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Te Kaunihera ā Rohe o Waikato

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Waikato
REGIONAL COUNCIL
Te Kaunihera ā Rohe o Waikato

Significant Natural Areas of the Waikato District: Terrestrial and Wetland Ecosystems

KesselsEcology
SURVEY, ASSESSMENT AND RESTORATION

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The "Significant Natural Areas of the Waikato 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 assessment of SNA of terrestrial and wetland ecosystems of the Waikato District. It is subject to revision through consultation with the Waikato District Council or other appropriate sources. 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 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 Waikato 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.

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This SNA project relied heavily on the personal experience and knowledge of a number of key people, as well as institutional knowledge. As a consequence, a large number of people assisted with this project, including staff from Waikato District Council, Waikato Regional Council, the Department of Conservation and Waikato District landowners. Many thanks for your help and sharing of knowledge.

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Department of Conservation staff for sharing their knowledge, particularly for threatened species, and their review of the draft Master Dataset, GIS mapping, and report.

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ABSTRACT

Waikato Regional Council (the Council) has a strategic objective to identify and prioritise areas of indigenous flora and fauna habitats within the Waikato Region for biodiversity management. The Council identifies Significant Natural Areas (SNA) as areas that meet one or more criteria for significance in the Waikato Regional Policy Statement. Identification of SNA is an important step in managing the region's natural heritage, protecting threatened species from the risk of extinction, reconnecting fragmented ecosystems, and meeting the requirements of the Resource Management Act 1991.

The key objectives of this SNA project were to identify and assess the ecological significance of the remaining natural areas within the Waikato District, and to provide the Council and Waikato District Council with a foundation data set for prioritising biodiversity management. This report outlines the assessment of SNA in the Waikato District in order to prioritise biodiversity management opportunities in this largest of the territorial authorities to be studied. The study area includes assessment of SNA within ten mainland ecological districts which transect the Waikato District territorial boundary covering some 434,000 hectares. SNAs are given a significance ranking of "international, national, regional or local" by assessing against 11 criteria defined in chapter 11 of the previous Waikato Regional Policy Statement (these criteria are very similar to those found in the 2016 RPS). The Council's Biodiversity Vegetation (BIOVEG 2007) spatial data layer, was utilised to establish preliminary site boundaries. Orthorectified aerial photography and topographic spatial data were initial tools for refining vegetation coverage and types. Additional data sets were added to provide an ecological context and a basis for individual site assessments. A data set of threatened flora and fauna species was also used in the assessment of the significance of sites.

The study initially focussed on a largely desktop analysis. However, in collaboration with Waikato District Council, an extensive land owner consultation and feedback process, supplemented by targeted site visits, and community meetings, allowed for the further refinement of the data set and ranking of each affected SNA.

This study identified 698 sites, comprising an area of 71,312 ha (16.4%) of the Waikato District, as significant natural areas. Almost 47% of the area of SNA are legally protected under statute or covenant, 61,292 ha of the SNAs were comprised of indigenous vegetation, (85.9%) of the total area of SNA. This was primarily, regenerating podocarp-broadleaf forest and kanuka-manuka scrubland. Other less common vegetation types such as duneland and herbaceous wetland were also well represented. The remaining 14.1% contains areas of exotic vegetation, most of which, is dominated by "deciduous hardwoods", consisting of willow (Salix spp.) dominated wetland (eg Whangamarino). Notably, a large proportion of the intact freshwater and saline wetland vegetation types are unprotected. In addition, more modified and induced ecosystems, such as kanuka scrubland and willow wetlands, are mostly found on unprotected land, but nonetheless can provide important habitat for many threatened species, such as bittern, marsh crake, a variety of lizard species, long-tailed bats, black mudfish and giant kokopu. A total of 107 nationally threatened and at risk species (54 flora species and 53 fauna species) have been recorded as being present within the Waikato District.

There is considerable scope within the Waikato District for additions to the protected natural area network via protection of SNA on private land. The public consultation process revealed that the majority of landowners were very motivated to protect and restore SNA found on their land. However, while formal protection of natural areas is an ideal first step, the ongoing management of these SNA (including weed and animal pest control, fencing and restoration) is of primary concern. Due to the significant loss of vegetation and fragmented state of the remaining indigenous vegetation in most parts of the Waikato District, restoration of under-represented ecosystem types, and creating ecological linkages and corridors, should be a priority for addressing biodiversity loss.

For the purposes of prioritising the biodiversity management needs of the SNA the Waikato District was divided into four broad ecological management zones which require different management strategies in terms of enhancing biodiversity values found within them. Recommendations for restoration and management for the SNA found in each of these ecological management zones are provided.

EXECUTIVE SUMMARY

Project Brief

Waikato Regional Council (the Council) have a strategic objective to identify and prioritise areas of indigenous flora and fauna habitats within the Waikato Region for biodiversity management. Natural areas of terrestrial and wetland ecosystems are being identified, described and assessed for their ecological significance for each local territorial authority within the Waikato Region. As part of this project, Kessels Ecology was commissioned to undertake the assessment of significant natural areas (SNA) in the Waikato District, the largest of the territorial authorities to be studied. This report thus provides the background and summary of the baseline inventory and ranking of SNA of terrestrial and wetland ecosystems in the Waikato District. The report accompanies an SNA dataset that forms part of a comprehensive inventory of SNA throughout the Waikato Region. SNA of other ecosystem types (e.g. lake, stream, and riverine ecosystems) are being assessed as part of other projects and have been, or are being, published in separate reports and data sets. When complete, the full set of inventories will provide a regional context for biodiversity assets and priority sites for management and monitoring.

Summary of Methodology

The study area includes parts of ten mainland ecological districts (ED) within the Waikato District territorial boundary (i.e. Awhitu, Raglan, Hapuakohe, Hamilton, Hauraki, Hunua, Manukau, Meremere, Kawhia, and Maungatautari) covering some 434,000 hectares (ha). The parts of EDs that lie outside the Waikato territorial boundary are covered in previous SNA assessment studies (for example Waipa, Hauraki, Hamilton Council SNA studies). The EDs are subdivided based on geological, pedological, topographical and botanical features. Raglan, Meremere, Hunua, and Kawhia EDs make the largest contribution to the Waikato District, collectively representing approximately 71% (311,000 ha) of the total district (434,000 ha).

The "Provisional Significant Natural Areas of the Waikato 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, limited field surveys and feedback from a landowner consultation process led by the Waikato District Council (WDC). The data comprises an extensive, yet provisional, inventory and ranking of SNA of terrestrial and wetland ecosystems of the Waikato District. It is subject to revision through consultation with the Waikato District Council and other stakeholders.

The Council strongly advises that the data be used only in conjunction with subsequent additional field surveys, especially if the data will be used to help with decisions on resource consents, the development of district plan and regional plan policy. 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 ecological field survey. The absence of an existing natural terrestrial or wetland ecosystem area from the "Significant Natural Areas of the Waikato 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 on a case-by-case basis.

Information used for identifying, describing and assessing sites included all available biological data sets, past reports and inventories, key protected areas (e.g. Department of Conservation (DOC) data, Queen Elizabeth II (QEII) Trust Open Space covenants, Waikato District Council Conservation Lot covenants), Ecological District boundaries and flora/fauna species records. As part of this exercise, a data set of threatened flora and fauna species in the Waikato District was researched and prepared.

To determine whether a site was significant it was assessed against the 11 criteria defined in chapter 11 of the previous Waikato Regional Policy Statement (RPS). Generally, if a site met one

or more of these criteria, it was considered an SNA, and was then assessed to determine a level of significance, i.e. “International”, “National”, “Regional”, or “Local", as per guidelines developed by the Council (Waikato Regional Council Technical Report No. 2002/15) (Environment Waikato, 2002). Sites that were not found to be significant were classified into one of the following categories:

- “Likely” to be significant where the information available indicated the site has a high likelihood of meeting one or more of the 11 criteria, but this needs to be verified with more information, such as from field surveys;
- “Not significant” where, based on the information available, it was certain that the site did not meet any of the 11 criteria; or
- “Indeterminate” where there was insufficient information to determine if the site could meet any of the 11 criteria, or be classified in the “Likely” or “Not significant” categories. More information is needed for these sites, preferably from a field survey if possible.

Given this first part of the project was largely a desktop study, an attribute called "Confidence Level” was used to indicate the amount of confidence in the accuracy of the significance assessment of a site. This was dependent upon the accuracy and availability of information about the site. In general, where reports of the site existed, or the site was personally known to staff, the confidence level was considered “high”. Where the main vegetation type could be confidently determined, but other aspects such as health or species composition could not, the confidence level was considered “medium”. Where the main vegetation type could not be confidently determined (e.g. indigenous vs. exotic scrub), or where indigenous subcanopy tiers could reasonably be expected to be present under an exotic canopy (e.g. willow wetlands) confidence levels were generally considered “low”.

As part of the SNA assessment process, past records of threatened indigenous species were included. However, many species, such as NZ kaka and NZ falcon, are highly mobile and have large territories and vast home ranges. Other indigenous fauna species, such as many freshwater fish species and long-tailed bats, have very complex, vast and poorly understood habitat utilisation requirements, often involving marine and exotic habitats. It is often difficult to predict where these species may utilise suitable habitats throughout a year, so habitat utilisation is probably much broader than specific points in time and place such as the SNA recorded on this database.

The key outputs of this project are this report and a GIS-based data set of all sites assessed, including attributes for the following:

1. spatial information, ownership and protection status of each site;
2. descriptions of key vegetation, ecosystem and habitat types, as well as significant flora and fauna species;
3. assessments of the 11 criteria, level of significance and threats and opportunities for management (a complete list of attributes, including definitions, is provided in Appendix VI of this report); and
4. Land Environments of New Zealand (LENZ). This report summarises the data from the LENZ analysis for Waikato District.

Summary of Key Findings and Results

Nationally threatened environments within the Waikato District were identified using the Threatened Environment Classification developed by Landcare Research (LENZ). The first five categories are referred to as “threatened environments”, whereas category six is considered “not-threatened”. The majority of land in the Waikato District is categorised as “threatened” (78%), and only a small portion is considered “not-threatened” (22%). The majority of SNA (in ha) fall within category 6, indicating they have more than 30% indigenous cover and more than 20% has some form of protection. Following this, the largest area of significant SNA fall within the three highest threat categories, whereas categories 4 and 5 include the lowest area of SNA.

A total of 105 nationally threatened and at risk species (53 flora species and 52 fauna species) as defined by the Department of Conservation have been recorded as being present within the Waikato District.

As a consequence of this study, 1,599 potential sites were assessed totalling an area of 78,000 ha, with 698 sites identified as SNA (ranked locally significant or higher) comprising an area of 71,312 ha. Therefore, approximately 16.4% of the Waikato District consists of significant natural areas.

Eighty sites (19.0% of total SNA area) out of all sites assessed have been accredited a high confidence level. A total of 504 sites (66.6% of SNA area) were assessed with a medium confidence level, and a total of 1014 sites (14.4% of SNA area) had a low confidence level. Through the review and landowner consultation process the levels of confidence increased and a total of 108 changes were to the significance ranking, with the number of "Locally" and "Regionally" significant SNA increasing, and decreasing the number of "Likely" and "Indeterminate" SNA.

Some 46.7% of the area of SNA are legally protected under statute or covenant (excluding WDC covenants). This includes both private and public land. Public Conservation Land (PCL) administered by the Department of Conservation comprises approximately 32% (22,825 ha) of the total area identified as SNA (including SNA ranked as "likely", "indeterminate", and "not-significant"), which equates to 68.4% of the protected SNA in the Waikato District. Protected SNA owned by Waikato District Council include land protected as Marginal Strips, Stewardship Areas, Local Purpose Reserve, or as Recreation Reserve comprise 236 ha. For both PCL land and WDC owned land it is noted that while these areas are protected, this status may not guarantee adequate protection for biodiversity values.

Legally protected, privately owned SNA include 104 QEII National Trust Open Space covenants and 509 WDC Conservation Covenants. No spatial data was available for WDC conservation covenants, and therefore they were not included in the calculations above.

A vegetation analysis of the SNA of the Waikato District was conducted using the vegetation classes of the WRC BIOVEG 2007 database. A total area of 71,312 ha was assessed as being SNA, of which 61,292 ha is considered indigenous vegetation, which equates to 85.9% of the total area of SNA. The remaining 14.1% contains areas of exotic or uncertain vegetation, most of which, is dominated by "Deciduous hardwoods" (i.e. willow wetlands). Just over half (23,646 ha of 41,507 ha) of the mature indigenous forest (amalgamating the "Broadleaved Indigenous Hardwoods" and "Indigenous Forest" BIOVEG classes) remaining in the Waikato District are legally protected. These are primarily in Public Conservation Land (PCL) administered by DOC (14,636 ha) plus a large area of Auckland Council land in the Hunua Ranges (8,278 ha).

Of the 33,281 ha of protected SNA, 71% of the land is composed of indigenous forest, 4,350 ha or 13.1% is composed of "Manuka and or Kanuka", 2,253 ha (6.8%) is composed of "Herbaceous Freshwater Vegetation", 2,288 ha (6.9%) is "Deciduous Hardwoods", and 456 ha or 1.4% is "Sand Dune" vegetation. Other vegetation types present make up the remaining 0.9% of protected SNA.

Only 3,622 ha (5.1%) of the SNA area in the Waikato District contain remnant freshwater wetland vegetation (i.e. they have been identified as "Herbaceous Freshwater Vegetation" in the BIOVEG data), and 37.8% of these areas are found on unprotected land. A large proportion (97.7%) of the herbaceous saline vegetation is unprotected, as well as 99.2% of mangrove habitat.

Scrubland ecosystem such as "Manuka and or Kanuka" and "Deciduous Hardwoods" (primarily comprising of willow dominated wetlands) BIOVEG classes are primarily found on unprotected land, but can provide important habitat for many threatened fauna species, such as wetland bird species, lizards, bats, and threatened fish species such as black mudfish.

Conclusions and Recommendations

For the purposes of assessing the biodiversity management needs of the Waikato District, in consideration of its large size and distinct geographical landform patterns within it, the District was

divided into four broad ecological management zones, which because of their landform differences, often require different management strategies in terms of enhancing biodiversity values found within them. The ecological management zones are:

- Hill Country Ecological Management Zone;
- Waikato Floodplains Ecological Management Zone;
- Western Hill Country and Coast Ecological Management Zone; and
- Hamilton Basin Ecological Management Zone.

Through the landowner consultation process the following were identified as the main threats facing SNA in the Waikato District:

- vegetation clearance;
- stock intrusion into unfenced forest/shrubland/wetland areas;
- animal and plant pest degradation of all indigenous fauna and flora habitats; and
- degradation of the margins of estuarine wetlands and lakes by stock.

Essential components of the ongoing protection and ecological restoration of biodiversity values of SNA usually require enhancing indigenous populations of species through permanent stock exclusion, continuous weed and animal pest management, and carrying out enhancement planting. By applying these restoration measures over a number of scattered, but often ecologically linked SNA in the wider landscape, in particular when involving wetland and riparian margins, ongoing biodiversity management will enhance and restore ecological processes at a landscape scale.

This project is limited to the identification and assessment of areas of vegetation and habitats for indigenous fauna that are composed primarily of indigenous vegetation and are over 0.5 ha in size. It is acknowledged that significant habitats for indigenous fauna do exist outside of areas of indigenous vegetation (e.g. long-tailed bats in exotic tree stands; black mudfish populations in highly modified drains and willow wetlands). It is also important to bear in mind those wetlands and terrestrial remnants under 0.5 ha, which have not been mapped or assessed in this study. It should not be implied that as yet to be identified areas, even those under 0.5 ha or exotic vegetation providing habitat for threatened species, are not significant. In some cases, they may well be ecologically significant and trigger the RPS criteria. We recommend that the Council considers a future project to assess significant habitat for indigenous fauna in exotic vegetation. Also, it would add value to the database if the ecological significance of sites smaller than 0.5 ha or of sites that have not been previously identified are assessed as they come to light.

1 INTRODUCTION

This report provides a summary of the ecological value and significance of indigenous terrestrial and wetland habitats remaining in the Waikato District within a regional and national context. The SNA database will assist both the Council and WDC in their development of policies, incentives and rules in relation to their obligations under the Resource Management Act 1991 (RMA), primarily under section 6c, to protect significant habitats of indigenous fauna and flora. The Operative Waikato District Plan does not contain a schedule of SNA but stipulates that sites should be evaluated using the criteria contained in Chapter 11 of the Waikato Regional Policy Statement.

Based on the findings, recommendations are made on methods to maintain and protect existing SNA and indigenous biodiversity in various management zones. Those recommendations will also be given to WDC, who are currently in the process of a District Plan review process, in which they will take recommendations of this assessment into consideration.

This report provides a summary of the methods and results of the "desktop" exercise followed by an extensive review process. The "desktop" exercise was based on an extensive literature review, analyses of recent aerial photography, and existing in-house knowledge of the Waikato District. During the review stage, external parties, including DOC, provided invaluable information on many SNA. Also, WDC lead a landowner consultation process which resulted in large amounts of feedback in the form of phone calls, feedback forms, and consultation meetings. From all this feedback, 50 properties were visited, landowners consulted with directly, and a more in-depth assessment of the SNA on their property undertaken.

The data resulting from this project is held and maintained in an SNA database by the Council. It is important to recognise that the inventory produced for this study is an indicative and provisional data set of SNA in the Waikato District and it is expected to be updated periodically as new information becomes available. In particular, feedback from Waikato-Tainui, key stakeholders and data obtained from other assessments will provide valuable information which will be used to validate the data.

Indigenous terrestrial and freshwater wetland natural areas were assessed as part of this inventory. Lake, stream, marine, and riverine ecosystems were not specifically included in this assessment, although there were some overlaps with terrestrial and wetland ecosystems, e.g. riparian margins. Natural values along coastal margins were only assessed inland of the mean high water spring tide mark. Some comment on these other ecosystems outside of these parameters has been made where considered appropriate.

2 OBJECTIVES

The primary objectives of this project were to identify and assess the ecological significance of the remaining natural areas within the Waikato District, and to provide the Council and WDC with a foundation data set for prioritising biodiversity management needs. To help achieve these objectives, the Council has developed guidelines for assessing the ecological significance (Environment Waikato, 2002) of natural areas based on the 11 criteria defined in Chapter 11 of the operative Waikato Regional Policy Statement (RPS) (WRC, 2016). 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 3.4.2 below.

The key outputs of this project are this report and a GIS-based data set of all sites assessed, including attributes for the following:

1. spatial information, ownership and protection status of each site;

2. descriptions of key vegetation, ecosystem and habitat types, as well as significant flora and fauna species; and
3. assessment of the 11 criteria, level of significance and threats and opportunities for management (a complete list of attributes, including definitions, is provided in Appendix VI of this report).

3 METHODOLOGY

3.1 Introduction

The SNA site identification and significance assessments were initially carried out through a "desktop" exercise, with no detailed field work undertaken. The assessments were conducted using orthorectified[1] aerial photography, existing ecological information sourced from reports and databases, and the local knowledge of Kessels Ecology staff. The resulting data from this assessment are held and maintained by the Council and forms part of a database of SNA for the whole of the Waikato Region.

The desktop analysis project identified 1,599 potential SNA (made up of 16,987 polygons), covering an area of approximately 78,000 ha, which equates to approximately 18% of the district's land area.

The methodology for the desktop review process consisted of four stages: a literature review, GIS mapping and analysis, an assessment of the significance of sites, and quality control and review by Kessels and Waikato Regional Council staff, as well as DOC staff and Waikato District Council staff through an extensive landowner consultation process.

3.2 Literature Review

A review of available existing information was undertaken to determine the ecological characteristics of the Waikato District. All key documents, databases and maps were reviewed to enable a gap analysis to be undertaken of where further information was needed. This included searching both electronic and paper sources together with the personal observations of project staff and employees of other ecological organisations. A list of primary sources of information used for the literature review is provided in Appendix I.

3.3 GIS Mapping and Analysis

A baseline GIS database was provided by the Council, which was based on the Council's Biodiversity Vegetation (BIOVEG 2007) spatial data layer, which was utilised to establish preliminary site boundaries. Orthorectified aerial photography and Land Information New Zealand (LINZ) topographic spatial data were used as the key tools for establishing vegetation coverage and site location.

Additional data sets were added to provide an ecological context and a basis for individual site assessments. Key data sets included: territorial boundaries, legal protection boundaries (e.g. DOC, QEII, and district council covenants), Ecological District boundaries and animal pest control zones. A data set of threatened flora and fauna species was researched and prepared, and was used in the assessment of the significance of sites. Databases used included the New Zealand Freshwater Fish Database (NZFFDB), BioWeb (administered by DOC), and a subset of the Biodiversity Information Management System (BIMS) spatial data and accompanying reports.

An Excel spreadsheet (hereafter Master Data) was completed to collate site description and significance assessment information.

[1] Geometrically corrected so that the scale is uniform.

Guidelines for delineating sites were formulated by Waikato Regional Council staff and identified as “Specifications I: Spatial Data and GIS Processing” (Pages 22 - 29 of Doc # 2187824). These specifications formed the basis for the creation of the spatial data, the main elements of which are listed below:

3.3.1 Base Spatial Data

The foundation for defining the spatial extent of sites was primarily generated from the Council’s Biodiversity Vegetation (BIOVEG 2007) spatial data layer, and also included spatial data of land protected under statute or covenant (e.g. DOC Conservation Areas, WDC reserves, QEII Trust Open Space covenants, WDC Environmental Protection Lot covenants), and parcels under public administration, but not necessarily protected. Kessels Ecology reviewed and suggested revisions where applicable to the line work and classification of vegetation in the BIOVEG spatial data using the Waikato Regional Aerial Photography Syndicate 2012 (WRAPS 2012) layer.

3.3.2 Design Scale

The design scale of the SNA data is 1:10,000. For the purpose of producing this layer the data was not captured, edited or used at a scale greater than 1:5,000 (i.e. half of the design scale).

3.3.3 Minimum Mapping Unit (MMU)

For the purposes of this project the MMU was 0.5 ha per individual polygon, rounded to the nearest 0.1 ha. Areas of indigenous vegetation smaller than 0.5 ha were not mapped or assessed unless such areas were determined to have a significance level of at least "Regional" (see Section 3.4.2).

3.3.4 Grouping or Merging Polygons

An objective approach was applied for splitting, grouping and merging polygons where the Council used existing data sets (BioVeg for Ecosystem type, generalised dissimilarity modelling (GDM) class and River Environment Classification (REC) catchment database) to automatically split and group indigenous polygons into proposed Ecological Units (EU) before they are then split by protection type to derive DRAFT_SNA. The Council provided EU data to Kessels Ecology to review and edit early in the contract. Where the contractor elected to change the grouping of polygons as EU the following conditions had to be met or considered.

Mandatory Conditions: For two or more polygons to be grouped or merged as one EU, both of the following conditions must be met:

1. the polygons to be grouped should all consist of the same primary ecosystem type as described for the ECOSYSTEM_TYPE attribute in "Specifications 2: Attribute Data", (Pages 31 - 41 of Doc # 2187824) unless there is a clear and justifiable reason for grouping polygons consisting of different primary ecosystem types;
2. each of the individual (or isolated) polygons to be grouped should be 0.5 ha in area or greater, unless there is a clear and justifiable reason for including an individual polygon that is less than 0.5 ha (see MMU description in section 3.3.3 above).

Additional Factors: in addition to meeting both conditions above, the following factors were considered for grouping two or more polygons as one SNA:

- the polygons to be grouped should have a clear biogeographical and/or ecological relationship, e.g. the polygons to be grouped could all be in the same valley or watershed, or all be closely associated with a reserve or other protected SNA of the same primary ecosystem type;
- the polygons to be grouped should not be very different in size or shape, unless they are within a reasonable distance of each other (e.g. less than 1 km);
- if one or more of the polygons to be grouped could have a different significance level than the other polygons to be grouped (e.g. one of the polygons has a record for a threatened

species but the others do not), then it had to be considered whether the polygons should be assessed as two or more separate EU.

***NB**: EU that would probably meet different RPS criteria, but had the same significance level could be grouped, and all RPS criteria met by the different polygons in the EU were recorded* when the DRAFT_SNA data set was ready for recording attributes.

3.4 Significance Assessment and Level of Significance

The assessment of the significance of sites was undertaken, with relevant attributes completed in the Master Data spreadsheet. The site assessment also included a review of the site boundaries, with recommendations for changes made where appropriate.

Analysis of the indigenous vegetation and fauna characteristics of the Waikato District was undertaken with respect to the relevant provisions of the RMA and, in particular, the ecological significance assessment criteria of the Waikato RPS. The ecological significance of sites was initially assessed using the Council's guidelines for applying the 11 RPS criteria (Appendix II).

At the start of this project in 2012, the Waikato Regional Policy Statement, including the criteria for determining ecological significance, was under review. Consequentially, the new RPS and associated revised significance criteria became operative per 20 May 2016. There were some changes in the criteria, but the core criteria remained the same for the most part. Criteria 1 and 2 were changed to merge criterion 2 into criterion 1 and create 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 amended, changing the required percentage of under-represented indigenous vegetation, habitat or ecosystem types present in an ED, ER, or nationally from 10% to 20%. Appendix III outlines the previous RPS criteria used to assess the SNA for this project, and Appendix II presents the current RPS criteria.

The assessment framework is based on quantitative and qualitative parameters, described below, that were established to make prioritisation systematic and explicit in the justification of a baseline for biodiversity monitoring with community outcomes in the Waikato Region.

3.4.1 Descriptive Attributes

A number of descriptive fields were completed to provide background information relevant to each site. These fields include: a site name, a brief site description, the administration (i.e. tenure) and legal protection status, the broad ecosystem type, the ecological district(s) and bioclimatic zone(s) the site overlaps, the historic and current vegetation types (based on underlying spatial data) the site overlaps, and details of any significant flora/fauna species recorded from the site or considered likely to be present (more information on these and other attributes are described in Appendix VI of this report).

3.4.2 Significance Assessments

To determine whether a site was significant, it was assessed against the 11 significance criteria defined in Appendix 3 of the RPS. For each criterion, each site was assessed as either:

- meeting the criterion ("Yes");
- being likely to meet the criterion ("Likely");
- being uncertain as to whether the criterion was met or likely to be met due to inadequate information ("Indeterminate"); or
- not meeting the criterion ("No").

In line with the project specifications, the assessment of each criterion followed Table 1 of the criteria assessment guidelines (Environment Waikato and Wildland Consultants 2002) (Shown in Appendix II of this report), with the exception of criterion 3 for threatened and/or endemic species (see below).

If a site was found to be significant, then it was further assessed to determine a level of significance, i.e. "International", "National", "Regional", or "Local", following Table 2 of the Council's guidelines (Environment Waikato and Wildland Consultants 2002) (Shown in Appendix II of this report). Sites that were not found to be significant were classified into one of the following categories:

- "Likely" to be significant where the information available indicated the site has a high likelihood of meeting one or more of the 11 criteria, but this needs to be verified with more information, such as from field surveys;
- "Not significant" where, based on the information available, it was certain that the site did not meet any of the 11 criteria; or
- "Indeterminate" where there was insufficient information to determine if the site could meet any of the 11 criteria, or be classified in the "Likely" or "Not significant" categories. More information is needed for these sites, preferably from a field survey if possible.

Previous SNA assessments identified that changes to the significance assessment guidelines in relation to criterion 3, pertaining to threatened species (including At Risk and Threatened species), were required in order to provide a more robust and current assessment, particularly in light of recent changes in the national threat status classifications of some threatened species.

Threat status classifications were outlined in Townsend *et al.,* (2008), and since that publication, revisions of the threat status of New Zealand taxa have adopted this new system. Many taxa have now been reassessed using the new system and these new classification levels were adopted for this project. Assessment criteria were followed as described in the "Guidelines to apply Regional Criteria and Determine Level of Significance" report detailing further assessing threatened and/or endemic species.

A further interpretation was adopted for "Regional" significance to include habitat for fauna species in the threat categories "Nationally Critical", "Nationally Endangered", or "Nationally Vulnerable", where the association with the site is not considered sufficient to meet national significance. This interpretation brings non-regular habitat for these threatened fauna species in line with sites of lower significance for flora species of the same threat status that are incorporated in the requirements for "Regional" significance.

No current assessments are known to exist for regionally threatened, or regionally at risk species, within the Waikato Region. In the absence of these classifications, a precautionary approach was taken to attempt to capture data relating to species that could reasonably be considered as "regionally rare". The regional rarity of species was supported with literature references where available, and for species where such references were not available, the species was recorded in the data set as "regionally rare tbc" (tbc meaning "to be confirmed").

Where threatened species records are present in an SNA site, the polygon based nature of this project may give the impression that the threatened species may be present throughout the SNA. Some threatened species, however, may have limited home ranges or specific habitat requirements that may restrict them to certain areas of an SNA or only be present at certain times of the year. For example, a skink may only use rocky outcrops. Physical barriers to movement may also restrict species to a partial use of an SNA.

3.4.3 Community & Landowner Consultation Process

Waikato District Council sent out letters to all landowners who own land with potential SNA on their property. Over 4500 letters were sent out inviting people to provide feedback and information on the potential SNA on their property. Topics landowners could provide feedback on were:

- If the location of the natural area was identified correctly;
- What species or types of vegetation are present in the area identified;
- Information on current management; and
- How WDC could encourage the protection of SNA.

Landowners were invited to provide feedback by phone, submitting the feedback form they were sent, or by attending one of the many workshops WDC held in District Council offices in Raglan, Ngaruawahia, and Tuakau. Kessels Ecology staff attended those workshops together with the Council land managers and WDC staff.

Combining all means of feedback, information from 678 phone calls, information collated from 152 landowners collected at the workshop meetings, and 354 feedback forms. From this, approximately 50 sites were visited and a basic vegetation assessment undertaken, verifying the existing Master Data which mostly was based on a desktop assessment. For each (partial) SNA visited and ground-truthed, a short report was produced indicating any changes to the spatial dataset, as well as to the Master Data spreadsheet, including potential changes in ranking and significance.

All feedback information provided by WDC was incorporated into the Master Data spreadsheet and to the SNA spatial layer and changes made as and when required.

Additional to the workshops organised by WDC, two additional meetings were held with the Tamahere community to discuss in more detail any potential implications for the landowners adjacent to the Tamahere gully system.

3.4.3.1 Tamahere Gully System and Raglan Township

During the review process, it became clear that a more detailed review was required for the Tamahere gully system and Raglan Township as several SNA are highly intertwined with private properties, gardens and other usually intensive, land uses associated with residential and rural-residential land uses. It was therefore decided that the SNA in these areas should be checked in detail and redrawn excluding all buildings and other structures. Based on the feedback provided, repositioning of SNA boundaries were also made as required. Within the Tamahere gully system this included the gully floor which often includes a (ephemeral) stream and their riparian margins, including habitats sometimes dominated by exotic vegetation but which provided habitat or migration pathways for Threatened or At Risk indigenous species such as black mudfish, longfin eels, and long-tailed bats. In Raglan, this included incorporating the estuary margins, riparian margins along streams, and any bush/gully habitat. Figure 1 below depicts how the SNA around the Tamahere gully system was reviewed. A similar approach was taken for Raglan Township and the rest of the District.

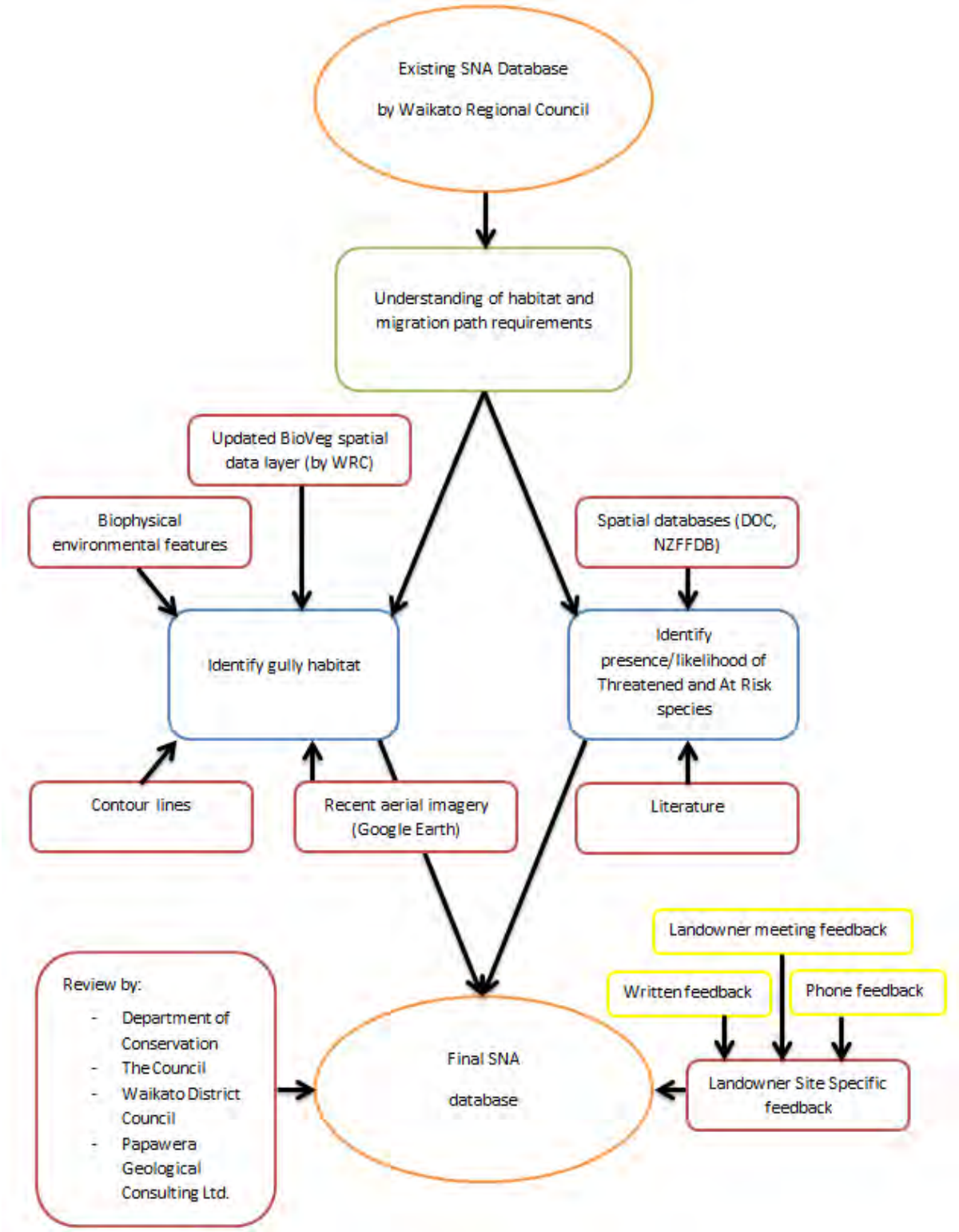


Figure 1. Decision flowchart on how landowner feedback and other information led to the updated SNA polygons.

4 ECOLOGICAL CHARACTER OF THE WAIKATO DISTRICT

4.1 General Overview

The Waikato District is the largest district within the Waikato Region, comprising a total area of 434,000 ha. Waikato District lies across three Ecological Regions (ERs) and ten Ecological Districts (EDs) (Tables 1 and 2 in Appendix VIII). Only Raglan and Meremere EDs are entirely contained within Waikato District. In the west, Tainui ER contains Raglan ED and Kawhia ED. In the north, Auckland ER contains Manukau ED, Hunua ED, and Awhitu ED. Waikato ER contains Hapuakohe ED, Meremere ED, Maungatautari ED, and Hamilton ED, and a very small part of Hauraki ED. With the size of Waikato District also comes the complexity and diversity of landcover, bioclimatic zones, geology and soils, vegetation, and associated habitats and ecosystems.

Waikato District is the largest District in the Waikato Region, and correspondingly has the highest number of SNA; for example Waipa DC covers a total area of 147,017 ha with 587 SNA covering an area some 10,914 ha (7.4%), where Waikato DC covers an area of 434,000 ha with 689 SNA covering an area of 71,312 ha (16.4%).

Large areas of indigenous forest and wetland once covered the district. Historically, the dominant forest species were typically kauri in the north, podocarp in central areas and a combination of rimu and tawa in the south. Variations were seen between coastal and inland areas. The major wetland areas were northeast of Hamilton and around the lower Waikato River. Large areas of rimu and tawa forest remain on the hill country and most of it is publicly owned and legally protected. Most of the internationally recognised Whangamarino Wetland is also legally protected. These areas and the lower Waikato lakes together form a semi-continuous band of indigenous habitats from the north-east (Miranda) to the south-west (Aotea Harbour). Outside of this band, indigenous vegetation and habitats have been significantly depleted and in some cases, only small remnants remain. Only a few of these remnants are formally protected (WDC, 2004).

The estimated 1840 vegetation cover of Waikato District was approximately 53.6% primary indigenous forest, 28.5% secondary forest and scrub, 0.2% duneland, and 15.8% wetlands. Franklin District, within Waikato Region, comprised an estimated 1840 vegetation of around 84.8% primary indigenous forest, 7.2% secondary forest and scrub, 0.6% duneland, and 5.9% wetlands (Leathwick *et al.,* 1995). These percentages are again based on the boundaries of the districts in 1995 and calculations are therefore not exact due to boundary adjustments; however these changes would only marginally change the results.

Table 1 below presents a breakdown of the main vegetation units found in each Ecological District within Waikato District, when it was last mapped in detail in 1995 by Landcare Research (Leathwick *et al.,* 1995). Leathwick *et al.* (1995) is the most relevant and detailed data available. As not all EDs are entirely within Waikato District and district boundaries have changed over time, data used may not be accurate for all EDs (i.e. Awhitu, Hunua, Franklin, and Manukau).

The data in Table 1 shows that indigenous vegetation, especially primary forest, wetland and duneland, is now highly under-represented within the Waikato District. Overall, only some 10.72% of the Waikato District still contains primary forest and wetland habitat (Leathwick *et al.,* 1995). This compares marginally with the other District Councils within New Zealand, ranking 24th across the 73 councils, highlighted by the fact that 1.4% of New Zealand's Nationally Threatened Vegetation units are within Waikato District (Walker *et al.,* 2005). Duneland was not included as a vegetation unit in Leathwick *et al*. (1995); therefore no comparison could be made against the remaining duneland habitat in Waikato District.

For the purposes of this report the Waikato District has been divided into four broad management zones based on key ecological features, which also require different management strategies in terms of enhancing biodiversity values found within them (see Figure 2) and in more detail in Appendix VII. These management zones are:

- Hill Country Management Zone;
- Waikato Floodplain Management Zone;
- Western Hill Country and Coastal Management Zone; and
- Hamilton Basin Management Zone.

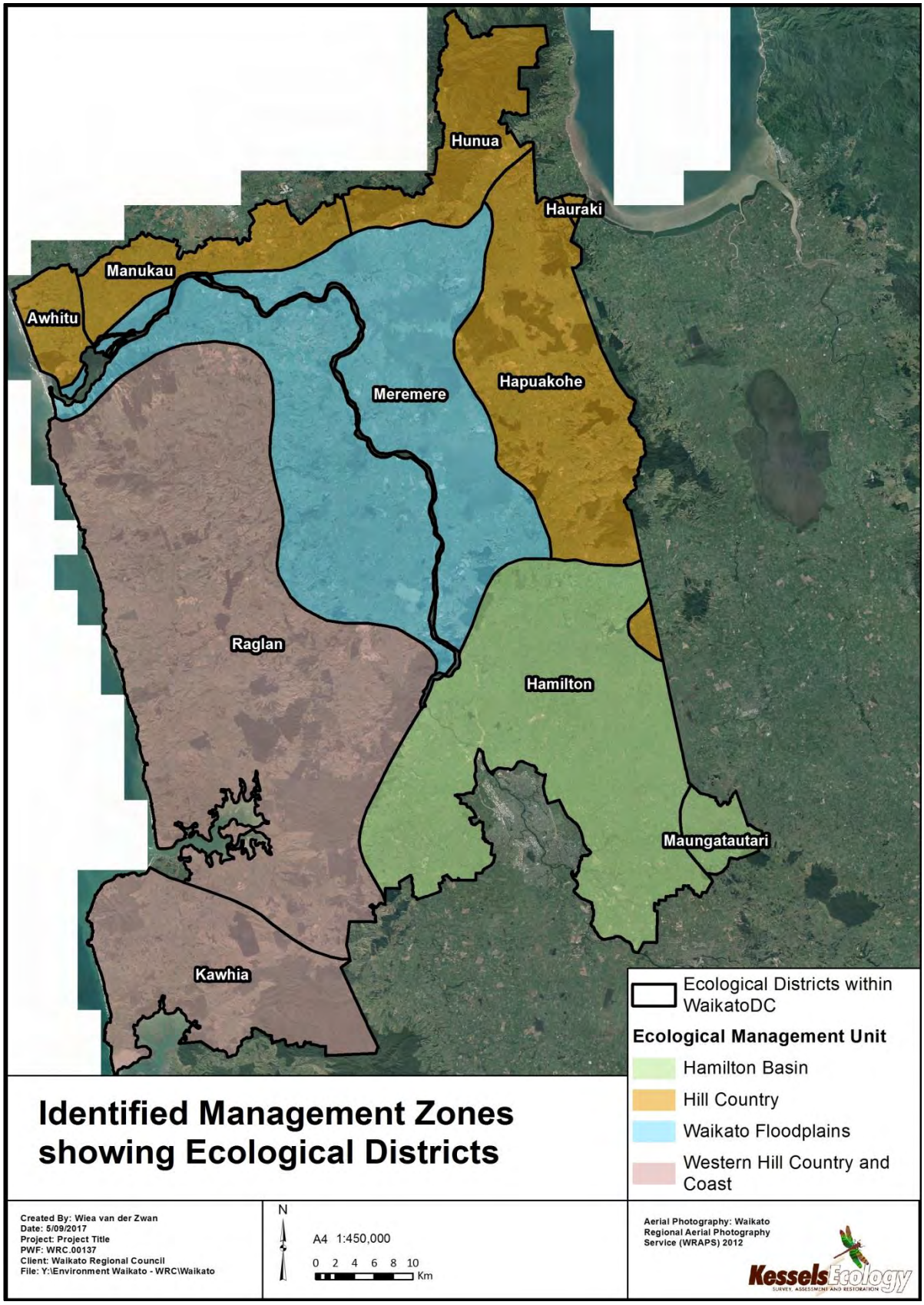


Figure 2. Identified Ecological Management Zones within Waikato District showing Ecological Districts per Management Zone.

Table 1. Breakdown of areas (ha) and percentage composition of vegetation units per Ecological District within the Waikato District (based on 1995 data collated by Leathwick *et al*., 1995). Red cells indicate where less than 20% of the vegetation present in 1840 remains, orange cells, where more than 20% but less than the original vegetation remains, and green indicates an increase in vegetation unit. Leathwick *et al*. (1995) does not contain data on the current extent of Duneland, and insufficient data is available to calculate the remaining extent of Duneland per ED.

	Raglan			Meremere			Hamilton			Kawhia			Maungatautari		
	1840	1994	Remnant	1840	1994	Remnant	1840	1994	Remnant	1840	1994	Remnant	1840	1994	Remnant
	ha	ha	%	ha	ha	%	ha	ha	%	ha	ha	%	ha	ha	%
Wetland	199	106	53.27%	24100	11977	49.70%	51676	631	1.22%		319			29	
Duneland	222	N/A	N/A	508	N/A	N/A				4425	N/A	N/A			
Primary forest	132061	4305	3.26%	32333	543	1.68%	18559	368	1.98%	122783	23516	19.15%	49567	4339	8.75%
Logged forest		8378			1173			572			14451			3191	
Primary and logged primary	132061	12683	9.60%	32333	1716	5.31%	18559	940	5.06%	122783	37967	30.92%	49567	7530	15.19%
	Hapuakohe			Awhitu			Manukau			Hunua			Hauraki		
	1840	1994	Remnant	1840	1994	Remnant	1840	1994	Remnant	1840	1994	Remnant	1840	1994	Remnant
	ha	ha	%	ha	ha	%	ha	ha	%	ha	ha	%	ha	ha	%
Wetland	519	170	32.76%				26	191	734.62%	46		0.00%	27766	11690	42.10%
Duneland				296	N/A	N/A									
Primary forest	53922	2931	5.44%	6793	10	0.15%	18170		0.00%	14208	1119	7.88%	29836	193	0.65%
Logged forest		3659			13			203			2192			200	
Primary and logged primary	53922	6590	12.22%	6793	23	0.34%	18170	203	1.12%	14208	3311	23.30%	29836	393	1.32%

4.2 Hill Country Ecological Management Zone (Awhitu, Hunua, Hapuakohe, Hauraki and Manukau EDs)

4.2.1 Overview & Landforms

The Hill Country Ecological Management Zone covers the northern and north-eastern margin of the Waikato District (Figure 2). It includes small areas of the Awhitu ED, Manukau ED and Hunua ED along the northern edge and a large part of Hapuakohe ED along the north-eastern edge of the district. Only a reasonably small area (441 ha) of this management zone reaches into the Hauraki ED coastal area at the Firth of Thames. As this is a considerably small area, the characteristics of the Hauraki ED are not described in this report.

The Hapuakohe ED covers the Hapuakohe Range and the Hangawera Hills. It comprises rolling hill country rising to a high point of 535 m on Maungakawa. The Hunua ED includes most of the Hunua Ranges and the Mangatawhiri Forest rising up to 688 m asl. Awhitu and Manukau EDs include comparatively low dune country within the Waikato District, which is north of the Waikato River mouth.

4.2.2 Bioclimatic Zones

The low Hapuakohe Range (535 m asl) in the submontane bioclimatic zone is the principal characteristic of the Hapuakohe ED. The surrounding land falls within the lowland zone. The submontane Hunua Range in Hunua ED reaches heights of up to 688 m asl. The topography of Awhitu and Manukau EDs includes low country with a maximum height of up to 300 m asl. The climate within the EDs of this management zone is characterised by warm and humid summers and mild winters. The Hunua ED is warmer and wetter than the nearby lower areas with annual rainfall rates between 1,400-2,300 mm. The annual rainfall rate in Hapuakohe ED is between 1,200 and 1,600 mm per annum. Rainfall rates in Awhitu ED are the lowest in this zone, i.e. usually around 1,100 mm per year, and the rainfall rate in Manukau ED is between 1,110-1,300 mm.

4.2.3 Geology and Soils

Sandstone and siltstones are the common underlying substrates within the Hapuakohe ED, with some andesitic volcanics and sediments and occasional coal seams. The soils are dominantly clay textured podzolised soils with impeded drainage. The Hunua ED also contains sandstone and siltstone substrates and has clayey soils with impeded drainage. Awhitu ED within the Waikato District is influenced by fluviatile and estuarine sediments with Holocene drifting dune sands in the south and Pliocene and Holocene fixed dune sands in the east. The soils are variable including sandy soils along the coast, basic volcanic ash soils on reasonably flat terrace land, and poorly drained loamy soils and sandy soils with interlayered peat on river flats and between dunes. The Manukau ED is characterised by central basalt which is fringed by sedimentary rocks and has a large variety of soils. Poorly drained, gleyed alluvial soils and peat deposits are the dominant soil types on the river flats and swamps, with small pockets of volcanic loam soils from basaltic lava and scoria scattered throughout the ecological district. Silty, generally well drained loam soils from old strongly-weathered volcanic ashes are dominant on the rolling and hilly land in the ecological district, while strongly leached and podzolised clayey soils, from strongly weathered sedimentary rocks, occur on the hilly and steep slopes (McEwen, 1987).

4.2.4 Vegetation

Within Hapuakohe ED, associations of kauri forest, especially kauri-podocarp-broadleaved and kauri-hard beech forest, were once dominant with lesser areas of rimu-tawa forest at higher altitudes and dense podocarp forest (mostly kahikatea) on the lower alluvial flood plains. To date, kauri-hard beech forest has a limited distribution within the Hapuakohe ED, restricted to the hills

and foothills of the ranges at the southern end of the ED. Major canopy species are kauri[2], hard beech and tanekaha, with canopy associates of rimu, tawa, and rewarewa. Kanuka forest, often grazed, is a feature of the eastern foothills of the ED, usually following stream gullies. Occasionally traces of semi-coastal forest are present, with large puriri emergent. Most of the kauri has been logged, but large stands of kauri rickers are common on suitable ridgelines, often in association with tanekaha.

The vegetation of the Hunua ED is described in McEwen (1987) as indigenous forest and fire induced manuka and hardwood scrubland with occasionally abundant kauri and scattered podocarp regeneration in the Hunua Ranges with much kauri and kauri-hard beech-tanekaha forest especially on the eastern and southern margins. Tawa-podocarp forest grows in the centre of the ranges and at higher altitudes while taraire, associated with puriri and rewarewa, is common at lower altitudes especially in the north and more localised towards the southern boundary. Kamahi is common in areas of kauri regeneration, but rare elsewhere.

The original vegetation cover in Awhitu ED is thought to have been mostly coastal podocarp/taraire-puriri-kohekohe forest with associations of kahikatea and totara. Kauri forest was locally common and is still present to date. Dune vegetation is still present along the coast in the west of the ED.

A characteristic of the vegetation of Manukau ED is the southernmost occurrence of taraire-puriri forest. Alluvial flats and terraces throughout the ED once supported extensive stands of kahikatea swamp forest, but these have largely been drained and converted to farmland.

4.2.5 Flora

The kauri-hard beech forests are uncommon and a feature of the Hapuakohe Range. Interestingly, puriri and puriri/(kohekohe-karaka) forest associations are found within a few gullies and within larger native forests tracts, with taraire also being present on occasion. Kauri was once more prevalent but has been severely reduced by logging. Nevertheless, occasional large kauri with trunk diameters greater than 1 metre occur in this zone. Other characteristic kauri forest species such as mamangi, kauri grass, and mairehau are present in these stands.

The most common forest type in the Hunua Ranges is tawa-podocarp forest where the main species is tawa with scattered emergent rimu, northern rata, kahikatea, totara and miro. Other species present are rewarewa, hinau, pukatea and occasionally taraire. Matai and kawaka are present but rare.

The nationally threatened king fern was observed at 6 sites of high conservation value in Manukau ED, and the regionally uncommon swamp maire was found at 2 sites in previous surveys contracted by Auckland Regional Council (Emmett *et al.,* 2000; Kessels and Riddell, 2002).

4.2.6 Fauna

Only a few decades ago, North Island kokako were present within the Hapuakohe Range, but these are very likely to be locally extinct now. NZ falcon may still roam this range and kereru are present. Long-tailed bats are likely to be more widespread and common than presently recorded and further surveys will most likely confirm this. Hochstetter's and Archey's frog, as well as common geckos (such as forest gecko and green gecko) may still be present and copper skink is likely to be widespread.

The Hunua Range was once home to a significant population of North Island kokako, which was reduced to only one remaining breeding pair by 1994. Since 1994, the Hunua kokako recovery project has increased the population to 55 breeding pairs. Other species benefitting from an intensive pest control programme in the area include species such as Hochstetter's frog, long-tailed

[2] In the text only common names for flora and fauna species are used where appropriate, for a full glossary of species named in the text, see Appendix X.

bats, North Island kaka, tomtits, and bellbirds, and the first North Island brown kiwi chicks have recently been released in the ranges.

Fernbird and banded rail were once abundant in Awhitu ED (McEwen, 1987) and some populations remain today (Kessels & Riddell, 2002). Awhitu ED was also known to have a very high diversity of small land snails in the 1980s (McEwen, 1987), which was thought to represent an overlap of the distribution limits of snail species endemic to Northland and Waikato.

4.2.7 Distinctive Ecosystem Types

The Hapuakohe and Hunua Ranges are the most distinctive and ecologically important ecosystem types within this management zone.

Within the Awhitu ED a series of dune lakes, many with associated wetland vegetation, are scattered along the length of the western dune hill country (Kessels & Riddell, 2002). These dune lakes support a diversity of wildlife including fernbirds, bitterns, banded rails, dabchicks, pukeko, black swans, shags and ducks.

4.3 Waikato Floodplains Ecological Management Zone (Meremere ED)

4.3.1 Overview & Landforms

The Waikato River is New Zealand's longest river and has its entire catchment in the Waikato Region starting at Lake Taupō, flowing 425 km before making its way out to sea at Port Waikato (Puuaha o Waikato). The river departed from a historic course some 19,000 years ago when the river abandoned its course through the Hinuera valley to enter the Hamilton Basin (McGraw, 2002).

The Waikato Floodplains Ecological Management Zone comprises of the Waikato River within a floodplain created by the river - essentially the Meremere ED. At the point where the Waikato River enters the sea, a vast delta comprises an extensive complex of willow wetlands, channels leading into intertidal estuarine wetlands and duneland of the Port Waikato sand spit. While the Waikato River dissects this zone, the floodplain is in essence an extensive, interconnected wetland system, containing many shallow lakes and wetlands. The zone is also characterised by small alluvial flat forest remnants and more notably, large lakes and wetlands, such as Lake Whangape, Opuatia Wetland, Lake Waikare, and including the internationally recognised Whangamarino Wetland.

4.3.2 Bioclimatic Zones

Almost the entire Waikato Floodplains Management Zone falls within the lowland bioclimatic zone. Only the very northern tip of the Hakarimata Range reaches into this zone in the south, which is classified as a submontane area, as well as the northern slopes of Putataka (354 m asl) near Port Waikato. Meremere ED is generally known to have warm and humid summers with persistent westerly winds and mild winters. The annual rainfall rates within the ED range from 1200-1400 mm p.a.

4.3.3 Geology and Soils

Geology of the Waikato Floodplains Zone comprises largely Holocene river and swamp deposits with some Pleistocene basalts near Pukekawa and Mercer, as well as Miocene to Oligocene calcareous sandstone and siltstone form elevated ridges, particularly in the south west. On its flattish and rolling slopes soils are mainly clayey textured but friable and well drained from old strongly weathered volcanic ash; more silty volcanic ash soils from younger, less weathered ashes prevail in the south. On the younger river flats and swamps poorly drained, gleyed alluvial and peaty soils occur. Weakly to moderately leached soils from sedimentary rocks dominate the small areas of hill country occurring in the zone while limited areas of reddish volcanic loam soils from basaltic lava and scoria are present in the north.

4.3.4 Vegetation

Historically, the terrestrial portion of the zone was dominated by kauri forest, dense podocarp forest, and wetland vegetation, with smaller areas of rimu-tawa forest on hill country. Today, land cover is dominated by intensive land use, and all indigenous ecosystems within the district are severely depleted. Indigenous vegetation is retained in less than 10% of the district, most of which is wetland or regenerating indigenous vegetation (Harding, 1997).

The former forest of the drier country is now reduced to very few small remnants and greatly modified, as is the former kahikatea forest around the wetlands. Sub-fossil kauri forest remains occur in swamps in the north of Meremere ED and kauri is still present in forest remnants today. Taraire is also common in remnants, especially near Onewhero, close to its southern limit in the west.

Significant vegetation change in the Waikato lowlands has been well documented by Newnham *et al*. (1989). They described a succession from sub-alpine shrublands and beech forest prior to 14,500 years ago, through matai and rimu forest, podocarp-broadleaved forest, predominance of kauri between 1000 and 3000 years ago, and subsequent anthropogenic clearance. It is thought that peat formation began around 10,000 years ago and the vegetation in the catchment may have included areas dominated by the restiad rushes giant wire rush and wire rush which are the key peat-forming species of the Waikato. Lower nutrient areas include manuka and tangle fern communities and kahikatea forest would likely have dominated in drier areas where flooding was less frequent.

4.3.5 Flora

The Whangamarino Wetland provides very important habitat in this management zone supporting several threatened plant species, such as the bladderworts *Utricularia delicatula* and *U. australis*, stout water milfoil, the fern *Cyclosorus interruptus*, bog clubmoss, as well as several orchid species, i.e. swamp helmet orchid, swamp greenhood (*Pterostylis palusoda*), and swamp leek orchid (Duggan *et al*., 2013). In the context of wetland habitats in Waikato District, the Whangamarino is rich is non-vascular flora such as moss and lichen species. Other threatened plants within Meremere ED include pingao at Port Waikato, king fern at Colebaker Scenic Reserve, and helmet orchid, swamp greenhood species (*Pterostylis micromega* and *P. palusoda*), and giant wire rush at Opuatia wetland (Browne & Campbell, 2005).

4.3.6 Fauna

McEwen (1987) reported the presence of at least 56 bird species in Whangamarino Wetland, including many Threatened and At Risk species, including the largest breeding population of Australasian bittern in New Zealand, high numbers of North Island fernbird and spotless crake, as well as marsh crake, brown teal (introduced), and New Zealand dabchick. A large population of banded rail was reported from Waikato River Heads (McEwen, 1987). Banded rail were commonly seen in the drier rush wetlands around Hamilton in the 1950s and were occasionally recorded in Whangamarino Wetland in the 1970s, but they were absent from these habitats by the 1980s, and are now absent inland (Bellingham, 2013).

The Threatened grey duck and New Zealand dabchick, and At Risk black shag, little black shag, and spotless crake are found throughout the larger wetlands and lakes in this zone.

Three lizard species have been recorded in the Hakarimata and Taupiri Ranges. Commonest of these is the copper skink which is widespread in the Waikato. Forest gecko has also recently been captured as part of the Huntly section of the Waikato Expressway as well as the Auckland green gecko from Hakarimata (pers obs). Two other gecko species (common gecko and pacific gecko) are widespread in the North Island and are also present in this zone (pers obs). Other species which may occur are ornate skink and possibly striped skink and speckled skink. Native frogs (*Leiopelma* spp.) have not been reported. Australian rainbow skink, or plague skink, are widespread throughout scrub and shrubland vegetation in this zone, as well as the majority of the Waikato

District. This species is highly likely a serious threat to copper skink and aggressively displacing coppers from suitable habitat where it occurs.

In addition, the Waikato Floodplains Zone provides habitat for a wide range of freshwater fish species including many Threatened and At Risk species such as giant kokopu, shortjaw kokopu, longfin eels, lamprey, and black mudfish. The zone provides spawning habitat for indigenous fish species, which have diverse spawning requirements ranging from vegetated stream and river margins, to wetlands, to tidal reaches of rivers. Habitat is also provided in the catchment for trout, an introduced sports fish.

Threatened long-tailed bats are also known to utilise a wide range of habitats in this ecological management zone.

4.3.7 Distinctive Ecosystem Types

At nearly 7,300 ha, the Whangamarino Wetland is the second largest wetland in the North Island and aside from the Waikato River itself, the most important and distinctive ecosystem type found in the Waikato Floodplains Zone. The wetland consists of palustrine swamp, fen, and peat bog east of Rangiriri. A 5,690 ha area of Whangamarino Wetland became formally recognised as a wetland of international importance under the Ramsar convention in 1989. Whangamarino supports a diverse range of indigenous flora and fauna including at least 19 Threatened or At Risk species. The wetland is habitat for the largest known breeding population of Australasian bittern (Duggan *et al*., 2013). In terms of fauna the bittern population is particularly significant, representing some 20% of the national total for this species. Other At Risk wetland birds include spotless and marsh crakes, and North Island fernbird. Black mudfish are common and widespread throughout the wetland, which is one of the main centres of population for this nationally At Risk species.

Although about a third of the wetland is classes as having a dominant willow cover, it is more diverse botanically than any other large lowland peatland in the North Island. Sixty per cent of its recorded 239 wetland plant species are indigenous, with several Threatened and At Risk species. These include the stout water milfoil and the only known location of the swamp helmet orchid.

4.4 Western Hill Country and Coast Ecological Management Zone (Raglan and Kawhia EDs)

4.4.1 Overview & Landforms

The Western Waikato Ecological Management Zone comprises most of the Raglan ED and the very northern part of the Kawhia ED (Figure 2).

The Raglan ED covers an area of 133,261 ha (Leathwick *et al*., 1995) and is located along the west coast from the Raglan Harbour north to the mouth of the Waikato River. Most of this ED sits within the Waikato District. Only a very small part of this ED (1,767 ha) in the south-eastern corner reaches into the Waipa District.

The Kawhia ED covers a total area of 128,370 ha with 36,792 ha of this falling within the south-western corner of the Waikato District. The Kawhia ED ranges from north of Mt. Karioi on the west coast near Raglan, down to the south of Kawhia Harbour. The boundary then curves up towards, and includes the eastern slopes of Mt Pirongia, up to the south-eastern boundary of the Raglan ED along Mt. Kokako and the Hakarimata Scenic Reserve. This ED is very diverse in terms of altitude and geology, and includes multiple threatened plant and animal species.

The west coast of the District comprises an extensive area of rugged country with many limestone outcrops, steep cliffs, and often steep country with small pockets of indigenous forest remaining in otherwise farmed land. This management zone includes several dune lakes such as lakes Otamatearoa, Parkinson, Puketi and Waitamoumou, which are small in size within small catchments (Dean-Speirs and Neilson, 2014). Many of these lakes retain aquatic plant communities and have high restoration potential (Dean-Speirs and Neilson, 2014).

As for the Waikato Hill Country, the West Coast remnant forest and wetland habitats play an important role in providing habitat for indigenous fauna as refugia amongst large areas of exotic vegetation, agricultural land, and residential areas. They serve as stepping stones between the large hill ranges, as well as sustaining a large variety of indigenous biodiversity.

4.4.2 Bioclimatic Zones

The Raglan ED falls within the semi-coastal and lowland bioclimatic zones. The western, coastal reaches of the Raglan ED is dominated by the prevailing westerly wind. This is evident in the growth of trees and scrub in exposed areas. Summers are usually warm and humid with regular periods of drought in February and March. Winters are often mild with winds tending west and north-west. Average annual rainfall at Raglan between 1984 and 2004 was 1,354 mm (Swales *et al*., 2005).

The western extent of the Kawhia ED falls within the coastal zone (within 1 km of the coast). Most of the ED falls within the lowland zone with Mt Karioi, Mt Pirongia and the southern ranges being within the submontane zone. The section of this ED that falls within the Waikato District is a mix of lowland and submontane zones, containing both Mt Karioi and the north-western corner of Mt. Pirongia. Summers are usually warm and humid with some periods of drought. Winters are often mild with annual rainfall ranging between 1,400 mm and 2,500 mm (McEwen, 1987) and a prevailing westerly wind.

4.4.3 Geology and Soils

The geology and soils within the Raglan ED are influenced largely by its proximity to the coast and the rich volcanic history. The lowland ranges of the area are dominated by marine siltstone, mudstone and conglomerate formed during the Jurassic era. Steeper bluffs found alongside valleys are formed from Miocene and Oligocene sandstone, siltstone and limestone. In the coastal, more estuarine regions, calcareous mudstone and muddy sandstones form the upper catchments of the Raglan harbour (Swales *et al*., 2005).

The soils of the Raglan ED consist mainly of Acidic Orthic Brown Soils and Typic Orthic Allophanic Soils (S-map Online - Landcare Research, 2017). A notable feature is the presence of the uncommon Dunmore soil type (DOC BioWeb, 2013).

Kawhia is well-known as a geological area of interest and has a long history of study. It was first noted by F. von Hochstetter in 1864 and since then has been analysed in terms of lithology, stratigraphy and paleontological content (Meesook & Grant-Mackie, 1995). Most of the area is broadly classified as Triassic and Jurassic rocks with notable features such as large areas of limestone, particularly inland, and layers of fossilised marine molluscs (Meesook & Grant-Mackie, 1995). These systems form when water channels and cuts through the limestone, forming an underground cave system (Williams *et al*., 2007).

Parts of the Kawhia ED were once volcanically active. Mt Karioi is an extinct basaltic and andesitic cone from the Pliocene age (Clayton-Greene & Wilson, 1985), and Mt. Pirongia, also an extinct volcano, is made up of mainly basalt and andesite (DOC, 2010) with yellow-brown loam and brown granular clay/loam forming the uppermost soil layers. A small deposit of coal is present on the north-western slopes of Pirongia, within the Waikato District boundary (DOC, 2010).

4.4.4 Vegetation

Historically, the Raglan ED was covered mostly in kauri-taraire-podocarp-broadleaved forest in the northwest, and kauri-podocarp-broadleaved forest dominated the northeast area. Rimu-tawa forest was characteristic in the southern reaches, with areas of rimu-taraire-tawa forest, and dense podocarp forest in low altitude alluvial sites, including stands of kahikatea in the flat, flood prone areas. In 1840, the area around Raglan was relatively isolated, so intensive deforestation did not occur in the area until 1879 when the first Waipa-Raglan road was completed (Swales *et al*., 2005). A summary of vegetation cover for the Raglan ED in 1995 (Leathwick *et al*., 1995) shows that only 13.3% of forest (primary, secondary and cutover), 53.3% of freshwater and wetland habitat remain

with only 0.1% being wetland. There has been an increase from the original extent of secondary scrub/shrubland to 2,280 ha, which is nearly three times (287.1%) the original cover.

The wider Kawhia ED has a few notable features, including relatively intact areas of native forest and the presence of montane flora on Mt. Karioi and Mt. Pirongia (Clayton-Greene & Wilson, 1985). Pirongia is the largest, continuous tract of indigenous vegetation in the Waikato Region and provides habitat for multiple threatened plants and animals. In 1840, 95% of this ED was covered in indigenous forest and 1% scrub. By 1995, there was a reduction of at least 63% of indigenous vegetation cover to 35% forest, 1% scrub and less than 1% wetland (Leathwick *et al*., 1995).

4.4.5 Flora

The Threatened king fern and thismia are present in the Raglan and Kawhia ED.

Threatened flora found within the Kawhia ED include *Pseudopanax laetus* (regionally rare), swamp maire (regionally rare), wood rose (Threatened - Nationally Vulnerable), kohurangi (At Risk - Declining) and thick-leaved kohukohu (At Risk - Declining).

4.4.6 Fauna

Threatened species that have been observed within the Raglan ED include the Nationally Vulnerable North Island long-tailed bat, and At Risk New Zealand bush falcon and North Island kaka. These three species are considered very mobile and often have wide feeding and home ranges.

A historic survey of sites within the Raglan ED that have notable wildlife values (Moynihan, 1986) showed the presence of bats, as well as Threatened and At Risk bird species such as spotless crake, North Island fernbird, banded rail, and Australasian bittern in and around the Raglan ED, but also Not Threatened species such as pied tomtit and bellbird.

Along the coastline anecdotal evidence suggest that petrels – including Threatened black petrel / *Taiko* and Cook's petrel / *Titi* were historically present at mid-to high altitudes on the slopes of Mt. Karioi, while grey faced petrel / *Oi* inhabited the lower altitudes.

A search of the New Zealand Freshwater Fish database (NZFFDB, 2014) showed the presence of a variety of fish species in catchments within the Raglan ED. Species present include common indigenous species such as shortfin eel, common bully, banded kokopu, and common smelt, and Cran's bully. Torrentfish, redfin bully, inanga, koaro, and longfin eel, all considered At Risk - Declining under recent threat classification (Goodman, 2014), as well as lamprey (Threatened - Nationally Vulnerable), are also found within the ED. Surveys carried out by Kessels Ecology in the northern part of the ED have also discovered the Not Threatened koura and the At Risk - Declining kakahi (Grainger *et al*., 2013).

The Kawhia ED is also known habitat for numerous threatened species. The key site for most of these species is Pirongia Forest Park, which within the Waikato District covers 1,500 ha of SNA and is contiguous with a further 15,000 ha situated within the Waipa District. It provides habitat for multiple threatened birds (Innes *et al*., 2003) and long-tailed bats (DOC BioWeb, 2013). Bats are known to have a wide feeding range and regularly move between roosting sites. They rely on both open areas and gullies for feeding as well as large, mature trees for roosting. It is likely that they are also utilising smaller stands of bush and gullies within the Waikato District.

Historical records show that the Threatened North Island kokako, North Island brown kiwi, blue duck, and rifleman were found in low numbers within Kawhia ED (DOC BioWeb, 2013). It is possible that some of these species are now locally extinct as kiwi were last observed in 1983, kokako in 1996 and blue duck in 1988 (DOC, 2010). Two Threatened bird species were reintroduced recently to Mount Pirongia; these include North Island robin in 2012/13 and North Island kokako in 2017 with more kokako expected to be translocated in 2018. Other Threatened and Uncommon birds found here include whitehead, North Island kaka, NZ bush falcon, long-tailed cuckoo, yellow-crowned parakeet, bellbird, and pied tomtit.

North Island kaka and NZ bush falcon are known to have large home ranges, so it is likely that they utilise smaller areas of bush and open country nearby for feeding. Falcon are a surprisingly common sight on the northern flanks of Pirongia Forest Park and also along the large western scrublands adjacent to Whāingaroa Harbour, likely utilising the extensive patchwork of indigenous forest and scrub vegetation running from the Hakarimata Range, including Mt Kokako forest for hunting and nesting. Common native species include tui, grey warbler, shining cuckoo, kereru, and the At Risk - Declining NZ pipit.

In terms of fish species present within Kawhia ED, the slopes of Pirongia and nearby streams have threatened koaro, longfin eel, lamprey, torrentfish, inanga, redfin bully and shortjaw kokopu (NZFFDB, 2014, Grainger *et al*., 2013). Common indigenous species include giant bully, common bully, Cran's bully, common smelt, banded kokopu and shortfin eel. Introduced species such as brown trout and rainbow trout are also present (NZFFDB, 2014).

4.4.7 Distinctive Ecosystem Types

This management zone comprises an extensive area of rugged country with many limestone outcrops, steep cliffs, and often steep country with small pockets of indigenous forest remaining in otherwise farmed land. It also includes several dune lakes such as Lakes Otamatearoa, Parkinson, Puketi and Waitamoumou. Some large areas of indigenous forest still remain in this zone, e.g. Mt Karioi in the south and Te Umukaraka Bush in the north. Whāingaroa Harbour and the coastal cliffs provide habitat for a range of flora and fauna species that are not found in the inland areas of the Waikato District.

4.5 Hamilton Basin Ecological Management Zone (Hamilton and Maungatautari EDs)

4.5.1 Overview & Landforms

The Hamilton Basin Ecological Management Zone contains the lowland area to the west, north, east and south-east of Hamilton City. This zone is defined by the Hamilton ED boundary to the west and north and the Waikato District boundary to the east and south. Approximately 50%, or 79,141 ha, of the Hamilton ED is situated within this management zone and the Waikato District. The total area of the Hamilton ED is 159,367 ha. A smaller part (4,901 ha) of this management zone (around Scotsman Valley, to the north-west of Te Miro) falls within Maungatautari ED, which covers a total area of 87,300 ha.

This zone is composed of four main landform units: hills, alluvial plains, gullies, and peatlands. In the past most of these areas were dominated by indigenous forest. Low rolling hills and the foothills of ranges at the edge of the zone are generally composed of late Quaternary parent material that used to be dominated by rimu/tawa forest and kauri-hard beech forest. On the more gentle sloping footslopes of the low rolling hills the main vegetation type supported by this landform was pukatea-kahikatea forest (Clarkson *et al.*, 2007).

Within the flatter landscape low mounds or ridges of alluvial plains emerge by moderately to well-drained alluvium from the Hinuera formation which predominantly supported mixed conifer-broadleaf forest. In shallow depressions or swales the alluvium has more silt and clay, and hence the less well drained soils that created the boggy areas that were dominated by kahikatea semi-swamp forests. In lower terraces beside the Waikato River the alluvium has more sand and gravel and is better drained. This well drained area suited totara-matai-kowhai forest types (Clarkson *et al.,* 2007).

Gullies are a feature of the Hamilton basin zone. It is estimated that these were formed about 15,000 years ago through a process called 'spring sapping'. As the Waikato River cut down into its banks, small streams were exposed which eroded steep-sided troughs that eventually became Hamilton's gully system. Gullies have two main land units: the steep gully sides, and the gully floor. On the sides, soil material is well-drained, generally from the Hinuera formation and once supported

totara-matai-kowhai forest. The gully floors are more poorly drained and were dominated by kahikatea-pukatea-swamp maire forest (Clarkson *et al*., 2007).

Peatlands include peat lakes (0.5%) and peat bogs (19.1%), all of which are generally very wet and poorly drained areas. These areas hosted a range of vegetation types including submerged vegetation, swamp forest, sedgelands, shrublands and restiad bogs (Clarkson *et al*., 2007).

Hamilton Basin contains several peat lakes, many of which are under threat from landuse, increased nutrient inputs, pest fish and drainage. Peat lakes are often shallow and have peat-stained water that is naturally acidic; conditions that support unique and ecologically significant species assemblages. Marginal wetlands surrounding peat lakes are also ecologically significant habitats that are often under threat from vegetation clearance and drainage. Examples include Lakes Rotokauri, Areare and Kaituna.

Contained within this management zone is also the Tamahere gully system, to the south-east of Hamilton City. This is a deeply cut gully system comprising the Mangaone, Mangaonua, and Mangaharakeke gullies. The gully vegetation comprises a mixture of indigenous and exotic vegetation. Despite the large portion of exotic vegetation, the gully system provides important habitat for indigenous fauna species.

4.5.2 Bioclimatic Zones

The part of the Hamilton ED within the Waikato District is entirely classified as lowland bioclimatic zone. It is characterised by warm summers with little wind and rain and periods of severe frosts in the cooler months. The annual mean temperature for the district is 14°C. Rainfall averages 1,100-1,400 mm with slightly higher rainfall near Pirongia.

The corner of the Maungatautari ED that falls within Waikato District is also classified as lowland bioclimatic zone. Summers are usually warm and humid with winters being mild. Average annual rainfall is usually between 1,200 mm and 1,400 mm.

4.5.3 Geology and Soils

The geological characteristics and soils in the Hamilton ED are largely influenced by the presence of the Waikato River. An understanding of these geological characteristics clearly show the significant influence of the river and associated vast peat domes which once dominated this zone but which is now largely highly productive farmland and the urban areas of Hamilton City (Figure 3).

The Hamilton basin is an alluvial plain with extensive deposits of silt, sand and gravel, Holocene peatlands, small lakes and wetlands (McEwen, 1987). Deposits from the central plateau were historically carried along the Waikato River and include Hinuera formation alluviums and pumiceous sediments, forming loamy soil in the southern reaches of the ED (outside the Waikato District). Other soil types include yellow-brown earths in the north east, central brown granular loams in the north-west and organic soil derived from peat bogs in the centre of the ED.

Yellow-brown earths, brown granular clay/loam and sandy loam are the main soil types of the Maungatautari ED within Waikato District (DOC, 2010).

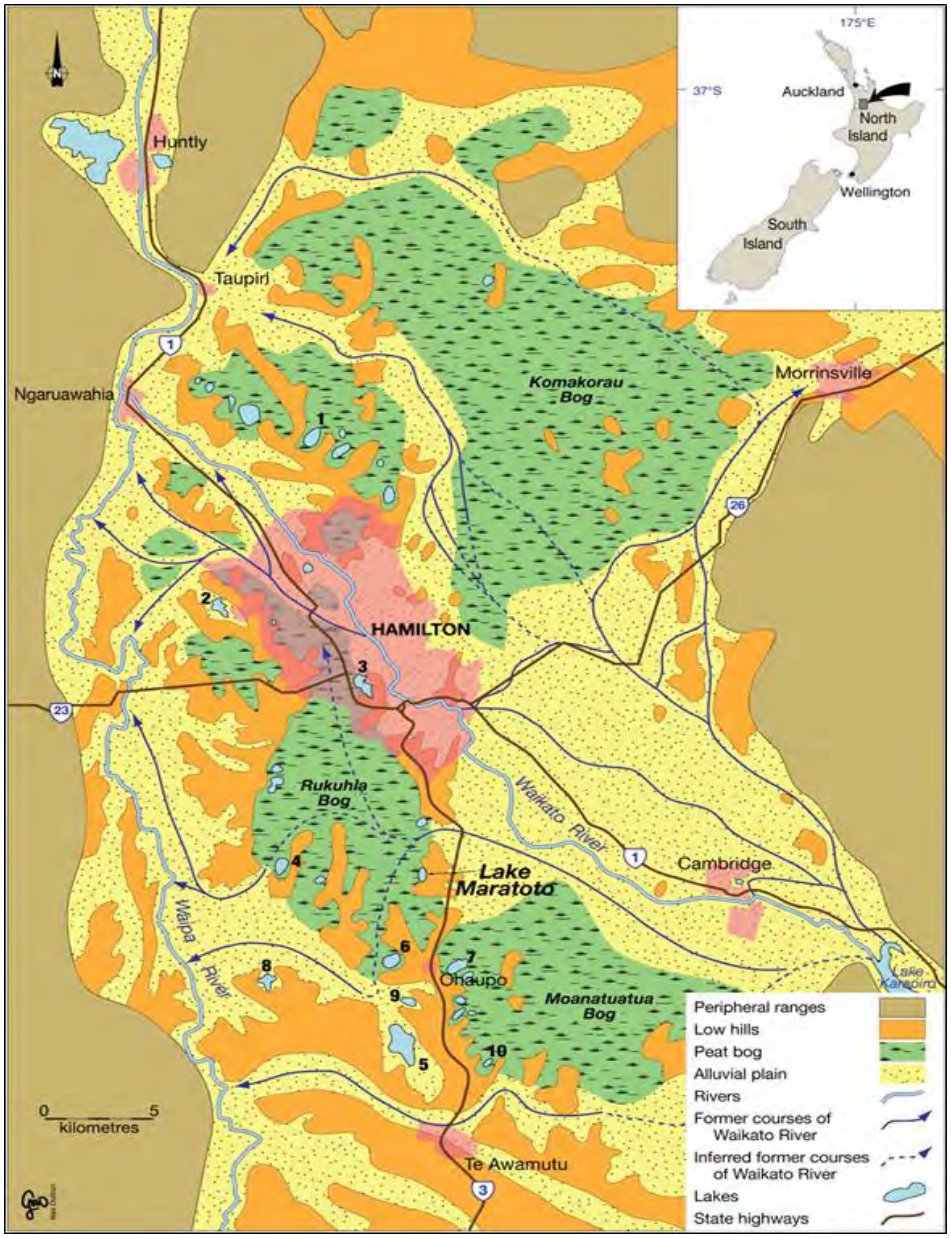


Figure 3. Landscape features of the Hamilton basin and the extent of peat bog soils. Figure by DJ Lowe (2010) after McCraw (2002).

4.5.4 Vegetation

Within this management zone only small areas of forest remain, many of which are remnant podocarp stands, often (historically) grazed extensively by stock. Although the ecological significance of the vegetation within these remnants is debatable in some cases, they do provide important stepping stones for indigenous fauna such as many birds and threatened long-tailed bats.

Evidence from soil core samples and pollen analysis suggest that historically, most of this area was once covered in conifer-broadleaf forest (Newnham *et al.*, 1989). On slightly elevated mounds and ridges rimu/tawa forest would have been typical, and kauri and hard beech forests would have been found in the northern extent of the Hamilton ED. Kahikatea semi-swamp forest would have been dominant in the wetter, low-lying areas of the Hamilton Basin, with extensive wetland and peat bog systems present (Clarkson *et al.,* 2001). The well drained terraces adjacent to the Waikato River, would once have sustained totara-matai-kowhai forest.

The Hamilton basin and surrounding area is thought to have been settled for about 1,000 years, with large areas of bush being cleared both pre and post-European settlement (Newnham *et al.*, 1989). Much of the area has been converted to farmed pasture and residential property with only a handful of original forest and wetland habitats remaining. Most of the remaining areas of indigenous vegetation are small and fragmented. A number of peat lakes and surrounding wetlands remain in the Hamilton Basin to date; however, these are severely modified by vegetation clearance and drainage.

Leathwick *et al.* (1995) calculated the decline in indigenous vegetation since 1840 and current percentage cover. Since 1840, the Hamilton ED has had a 97.8% reduction in indigenous vegetation. Percentage cover of indigenous vegetation in 1995 was about 1% forest and less than 1% scrub and wetland for the entire Hamilton ED.

In 1840, the Maungatautari ED was about 57% forest, 42% scrub and 1% wetland and other habitats. In 1995, forest cover decreased to only 9% cover, with scrub and wetlands at less than 1% cover. The total loss in indigenous vegetation was calculated at 89.5% or 77,886 ha within the ED (Leathwick *et al.*, 1995). The most significant area of vegetation of the Maungatautari ED within the Waikato District boundary includes the northern half of the Te Miro Scenic Reserve, which is habitat for threatened plant species.

4.5.5 Flora

A variety of threatened plant species are found within the Hamilton ED in wetland, peatland and forest remnants. Naturally Uncommon *Bulbophyllum tuberculatum*, is found in Pukemokemoke Reserve, as well as the At Risk - Declining stout water milfoil. Nationally Critical *Juncus holoschoenus* was recorded at Lake Rotokauri in 1990 (BioWeb, 2013). The Komakorau Peat Bog holds records the Relict giant wire rush.

4.5.6 Fauna

Multiple threatened species are found within the southern extent of the wider Hamilton ED. The Nationally Vulnerable long-tailed bat has been recorded all across the area, mainly in the west, near the foothills of Pirongia (DOC BioWeb, 2013), but also in the canopy of the riparian margins within the Tamahere gully system. Threatened lizard species include the Pacific gecko, Auckland green gecko, and speckled skink, which have been recorded near the western margins.

The Hamilton ED is also home to numerous threatened fish species as identified in Goodman *et al.* (2014). The NZFFDB indicates the presence of longfin eel, lamprey, inanga, giant kokopu, shortjaw kokopu, torrentfish and black mudfish, all classified as At Risk – Declining. The threatened koura is also found widely distributed around the district. Common freshwater species include Cran's bully, common bully, banded kokopu, and shortfin eel. Introduced species include brown trout, rudd, catfish, koi carp, goldfish, and gambusia. Grey mullet, considered a marine wanderer, is also found within the Hamilton ED.

The re-introduction of threatened fauna to the Maungatautari district since the establishment of the Maungatautari ecological island has made Maungatautari ED an important area for biodiversity. The Nationally Vulnerable long-tailed bat has been recorded widely within the south-western and north-western extent of the ED. This species is known to utilise bush fragments and gully systems and has wide home and feeding ranges. Bellbirds, which are regionally uncommon, are found in the Te Miro Scenic Reserve. Pied tomtit and North Island kaka have been recorded on Te Tapui in Matamata-Piako District. It may be possible that these birds traverse the Waikato District boundary and also utilise the bush remnant of Te Miro Reserve.

Common bush birds such as tui, kereru, grey warbler, shining cuckoo, fantail and kingfisher have been recorded all over the Hamilton Basin area, particularly within the larger areas of bush.

The numerous peat lakes and surrounding wetlands remaining in the Hamilton Basin Management Zone also provide habitat for a number of Threatened and At Risk bird species, such as brown teal, grey duck, Australasian bittern, North Island fernbird, banded dotterel, white heron, banded rail,

New Zealand pied oystercatcher, black billed gull, red billed gull, black shag, little black shag, royal spoonbill, New Zealand dabchick, marsh crake, spotless crake, and Caspian tern (Wildland Consultants, 2011).

4.5.7 Distinctive Ecosystem Types

The ecology of the Hamilton Basin is characterised by the Waikato River, extensive gully systems, peat lakes and remnant kahikatea stands. The riparian margins of the Waikato River and the gully systems, like the Tamahere gully system near Hamilton, form ecological corridors and valuable linkages for numerous threatened fauna species within this management zone. The peat lakes, such as Lakes Rotokauri, Areare and Kaituna, and small kahikatea forest remnants, such as Whewells Bush, stand out as vestiges of what once was an expansive and biodiverse wetland and forest ecosystem complex. Marginal wetlands surrounding the peat lakes are also ecologically significant habitats within this management zone.

5 THREATENED ENVIRONMENTS AND SPECIES OF THE WAIKATO DISTRICT

5.1 Extent of Nationally Threatened Environments within Waikato District

Nationally threatened environments within the Waikato District were identified using the Threatened Environment Classification developed by Landcare Research. Walker *et al*. (2015) proposed a threat classification for the remaining indigenous biodiversity in New Zealand's environments based on three components: how much indigenous cover remains within land environments, how much land is legally protected, and how past loss of indigenous cover and natural heritage protection are distributed across New Zealand's landscape. The Threatened Environment Classification 2012 combines Land Environments of New Zealand (LENZ; Leathwick *et al*., 2003), the land cover classes of the fourth Land Cover Database (LCDBv4.0) and the protected areas network, identifying legally protected areas for the purpose of natural heritage protection.

Maps of Threatened Environment Classification, prepared at LENZ Level IV (i.e. 500 land environments nationally), show land environments with various amounts of indigenous vegetation cover and legal protection. The aim of the Threatened Environment Classification is to protect indigenous vegetation associated with land environments (defined by Land Environments of New Zealand at Level IV) that have more than 70% of their former indigenous cover removed, and/or only a small portion of this land (less than 20%) is protected for natural heritage purposes. From a national level, Landcare Research have mapped New Zealand's most rare and threatened ecosystems. This national level information provides part of the biodiversity picture that is needed to inform resource management decisions at the regional and local level (MfE, 2015).

Based on the species–area relationships and fragmentation effect, six threat categories are identified (

Table 2 and Table 3). The first five categories are referred to as "threatened environments", whereas category six is considered "not-threatened". The majority of land in the Waikato District is categorised as "threatened" (78%), and only a small portion is considered "not-threatened" (22%). Table 3 shows that the majority of SNA (in ha) fall within category 6, indicating they have more than 30% indigenous cover and more than 20% has some form of protection. The remaining SNA fall largely within the three highest threat categories, while categories 4 and 5 cover the smallest area of SNA. The largest area of Nationally Significant SNA fall within category 6, which indicates that those areas have over 30% indigenous cover remaining and have over 20% legally protected.

Table 2. Summary of total land area for Threatened Environment Categories within the Waikato District.

Category	Category Criteria	Percentage of land in Waikato District	Area (ha) of land in Waikato District
1	<10% indigenous cover remaining	44.10%	191,448
2	10–20% indigenous cover remaining	25.55%	110,928
3	20–30% indigenous cover remaining	8.15%	35,387
4	>30% indigenous cover remaining and <10% legally protected	0.02%	107
5	>30% indigenous cover remaining and 10–20% legally protected	0.17%	717
6	>30% indigenous cover remaining and >20% legally protected	22.01%	95,577

Table 3. Matrix of Significant natural areas in each LENZ TEC category (in hectares) in the Waikato District for each SNA ranking score. Undetermined LENZ sites are located primarily along the Waikato River excluding many riparian SNA.

SNA Ranking	1	2	3	4	5	6	Undetermined	Total
International	2,735	3,510	4				0	**6,250**
National	1,555	2,121	3,003	7	325	24,148	92	**31,253**
Regional	2,588	3,837	1,093		53	9,717	246	**17,534**
Local	3,114	3,056	1,705	11	10	6,385	28	**14,309**
Likely	345	406	276		0	727		**1,755**
Indeterminate	570	724	577		1	1,195	4	**3,071**
Not Significant	398	404	233		5	767	5	**1,812**
TOTAL	**11,306**	**14,059**	**6,892**	**18**	**394**	**42,941**	**374**	**75,984**

5.2 At Risk, Threatened and Notable Species and Other Significant Features

A total of 105 nationally threatened and at risk species (53 flora species and 52 fauna species), as defined by the Department of Conservation, have been recorded as being present within the Waikato District defined by the Department of Conservation (e.g. Robertson *et al.,* 2017; Hitchmough *et al.*, 2016; O'Donnell *et al.,* 2012; de Lange *et al.,* 2013; Goodman *et al.,* 2014; Grainger *et al.*, 2014) as recorded in the BioWeb spatial dataset (administered by DOC), BIMS spatial dataset, and NZFFDB (administered by NIWA), and from records held by Kessels Ecology. These threatened species are listed in Table 4 to Table 9. Threat classification was determined using the New Zealand Threat Classification System manual (Townsend *et al.*, 2008) depicted in Figure 4.

The threat status of species is important and has had a significant bearing on the SNA assessment. The most up-to-date threat status rankings were used for this assessment (e.g. Robertson *et al.,* 2017; Hitchmough *et al.*, 2016; O'Donnell *et al.,* 2012; de Lange *et al.,* 2013; Goodman *et al.,* 2014;

Grainger *et al.*, 2014). However, the threat status rankings are reviewed every three to five years and a change in threat ranking can change the significance of an SNA dramatically. For example, the long-tailed bat, which is ranked at a Nationally Vulnerable threat status, means that an SNA where this species has been found and was considered to use the site on a regular basis was considered significant at a "National" level, regardless of whether any other records of threatened species were known for the site or any other of the 11 RPS criteria were met by the site. The determination of this will need to be done by an appropriately qualified ecologist.

Much of the data used for this analysis is more than ten years old and some animal (and plant) species may now be locally extinct. It is recommended that this data is used with caution, such that sites where data is older than twenty to thirty years should be re-surveyed to confirm if a threatened species is still present. For example, during the course of this analysis it was difficult to gauge the present extent and abundance of bittern and grey duck within the Waikato District since many of the records are now greater than fifteen years old. Because of this, for fauna species, only records of threatened species that were known to be resident and/or not greater than half the expected lifespan of a species were used in the assessment of SNA sites.

No Threatened or At Risk bryophytes, fungi, or macroalgae species are known in the Waikato District.

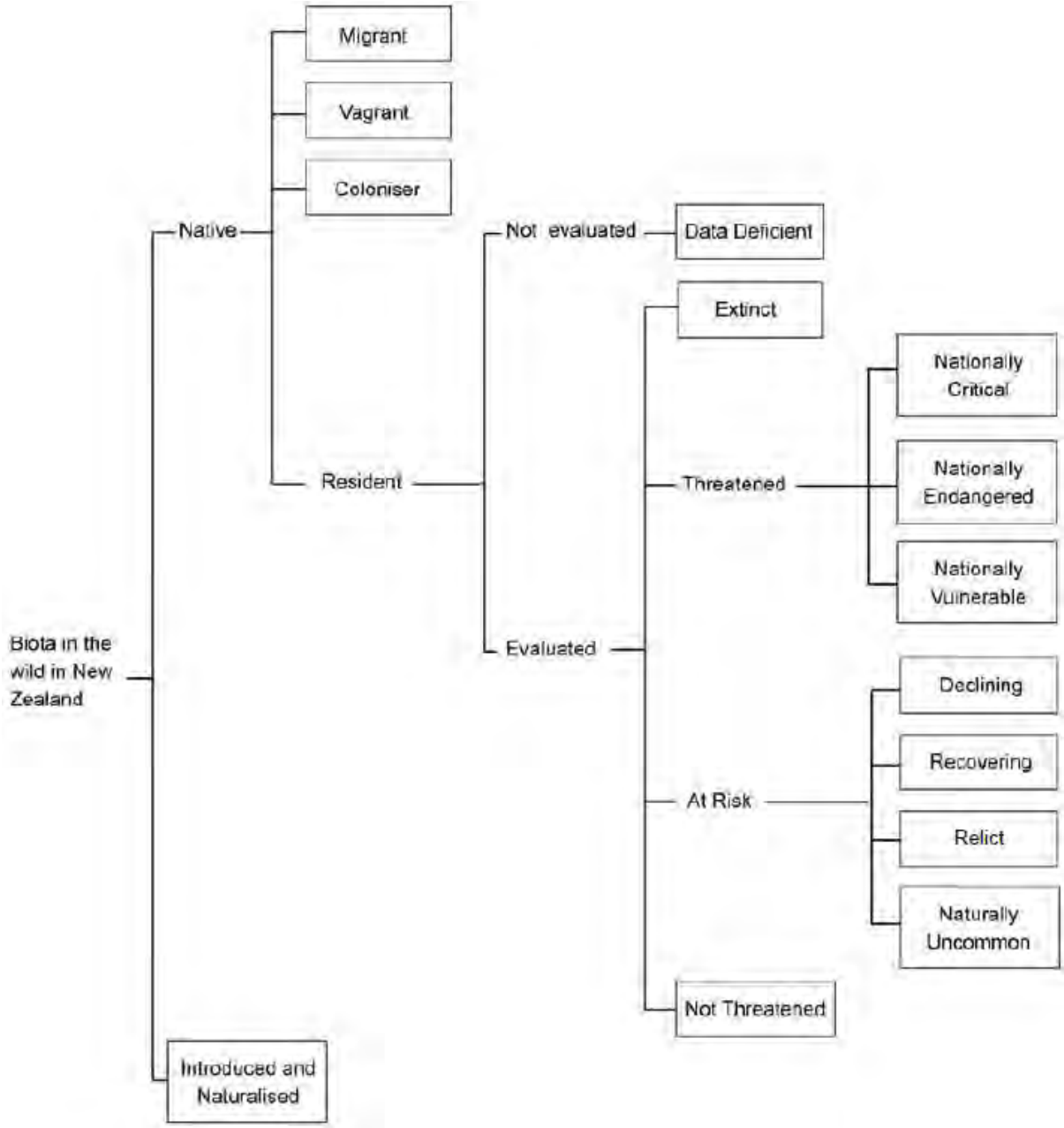


Figure 4. The categories of the New Zealand Threat Classification System describing threatened and at risk species, as used by Department of Conservation.

5.2.1 At Risk and Threatened Flora Species

5.2.1.1 Vascular plants

Within Waikato District, 53 nationally Threatened and At Risk vascular flora species have been recorded (Table 4). Threatened plant species are at risk of rapidly becoming locally extinct if a management regime changes or a new pest or disease strikes a local population. Threatened plants situated on privately owned, unprotected land are particularly vulnerable.

Table 4. Threat status of vascular plant species that have been recorded in the Waikato district (Names and threat status obtained from DOC BioWeb Threatened plant database 2013; and de Lange *et al*., 2013).

Species Name	Common/Māori Name	Threat status
Amphibromus fluitans	Water brome	Threatened – Nationally Vulnerable
Anemanthele lessoniana	Gossamer grass	Threatened – Nationally Vulnerable
Blechnum zeelandicum		At Risk – Naturally Uncommon
Botrychium australe	Parsley fern, patotara	At Risk – Naturally Uncommon
Brachyglottis myrianthos		At Risk – Naturally Uncommon
Bulbophyllum tuberculatum		At Risk – Naturally Uncommon
Carex cirrhosa	Curly sedge	Threatened – Nationally Vulnerable
Centipeda minima subsp. *minima*	Sneezeweed	Threatened – Nationally Vulnerable
Christella dentata[3]	Christella, Northland soft fern	At Risk – Naturally Uncommon
Corybas carsei	Swamp helmet orchid	Threatened – Nationally Critical
Corybas rotundifolius	Helmet orchid	At Risk – Naturally Uncommon
Cyclosorus interruptus		At Risk – Declining
Dactylanthus taylorii	Wood rose, pua o te reinga	Threatened – Nationally Vulnerable
Euphorbia glauca	Shore spurge, waiu-atua, sand milkweed	At Risk – Declining
Ficinia spiralis	Pingao	At Risk – Declining
Fimbristylis velata	Fimbristylis	At Risk – Naturally Uncommon
Gratiola concinna		Threatened – Nationally Vulnerable
Juncus holoschoenus var. *holoschoenus*		Threatened – Nationally Critical
Korthalsella salicornioides	Mistletoe, dwarf mistletoe, leafless mistletoe	At Risk – Naturally Uncommon
Lepidium oleraceum	Cooks scurvy grass, nau	Threatened – Nationally Endangered
Leptinella dispersa subsp. *rupestris*		Threatened – Nationally Critical
Libocedrus plumosa	New Zealand cedar, kawaka	At Risk – Naturally Uncommon
Lindsaea viridis		At Risk – Naturally Uncommon
Lycopodiella serpentina	Bog clubmoss	Threatened – Nationally Endangered
Myosotis spathulata		At Risk – Naturally Uncommon
Myriophyllum robustum	Stout water milfoil	At Risk – Declining
Notogrammitis rawlingsii	Rawlings strap fern	At Risk – Naturally Uncommon
Ophioglossum petiolatum	Stalked adder's tongue fern	Threatened – Nationally Critical

[3] In Waikato District there are two races of this taxon. The first race is primarily associated with geothermal sites in the North Island, the other race is naturally confined to Kaitaia and Raoul Island but is known to have naturalised in Hamilton city.

Pellaea falcata	Sickle fern	At Risk – Declining
Phylloglossum drummondii		Threatened – Nationally Critical
Pimelea villosa	Sand daphne, toroheke	At Risk – Declining
Pimelea tomentosa		Threatened – Nationally Vulnerable
Pittosporum kirkii	Kirks kohuhu	At Risk – Declining
Pomaderris hamiltonii	Pale-flowered kumarahou	At Risk – Naturally Uncommon
Pomaderris phylicifolia	Tauhinu	Threatened – Nationally Endangered
Prasophyllum hectorii	Swamp leek orchid	At Risk – Declining
Pseudopanax ferox	Fierce lancewood	At Risk – Naturally Uncommon
Pterostylis micromega	Swamp greenhood	Threatened – Nationally Endangered
Pterostylis paludosa	Swamp greenhood	At Risk – Declining
Pterostylis tasmanica	Plumed greenhood	Threatened – Nationally Vulnerable
Ptisana salicina	King fern, tawhiti para	At Risk – Declining
Rorippa divaricata	New Zealand water cress, matangaoa	Threatened – Nationally Vulnerable
Senecio scaberulus	Fireweed	Threatened – Nationally Critical
Sonchus kirkii	New Zealand sow thistle, Puha	At Risk – Declining
Spiranthes novae-zelandiae	Lady's tresses	Threatened – Nationally Vulnerable
Sporodanthus ferrugineus	Bamboo rush, giant wire rush	At Risk – Relict
Thelypteris confluens	Swamp fern	At Risk – Naturally Uncommon
Thismia rodwayi	Thismia	At Risk – Naturally Uncommon
Tupeia antarctica	White mistletoe, taapia	At Risk – Declining
Utricularia australis	Yellow bladderwort	Threatened – Nationally Critical
Utricularia delicatula	Bladderwort	At Risk – Relict
Veronica speciosa	Purple hebe, napuka	Threatened – Nationally Vulnerable
Zostera muelleri subsp. *novazelandica*	Seagrass	At Risk – Declining

5.2.2 At Risk and Threatened Fauna Species

As part of the SNA assessment process, past records of threatened indigenous fauna species were included. However, many species, such as NZ kaka and NZ falcon, are highly mobile and have large territories and vast home ranges. It is therefore difficult to predict where these species may utilise suitable habitats throughout a year, so habitat utilisation is probably much broader than specific points in time as shown on a static database.

Other species, such as the long-tailed bat, are regularly being discovered in new sites and habitats as ecological investigations for resource consents and/or scientific research are conducted in

conjunction with improved survey methods and technology. To this extent, the SNA database needs to be regularly updated to reflect this.

The following five tables list the Nationally Threatened and At Risk fauna species recorded in the Waikato District.

5.2.2.1 Freshwater invertebrates

One freshwater invertebrate has been recorded as At Risk - Declining in the Waikato District and one species has been listed as "Data deficient" (Table 5).

Table 5. Threat status of freshwater invertebrate species recorded in the Waikato District. (Names and threat status obtained from NZFFDB, Grainger *et al.*, 2014).

Species Name	Common/Māori Name	Threat status
Echyridella menziesii	Freshwater mussel, kākahi	At Risk – Declining
Austropeplea tomentosa	Freshwater snail	Data Deficient

5.2.2.2 Freshwater fish

Ten Threatened or At Risk freshwater fish species are recorded in the Waikato District.

Table 6. Threat status of freshwater vertebrate species recorded in Waikato District. (Names and threat status obtained from NZFFDB, Goodman *et al.*, 2014).

Species Name	Common/Māori Name	Threat status
Anguilla dieffenbachii	Longfin eel, tuna	At Risk – Declining
Cheimarrichthys fosteri	Torrentfish, piripiripohatu	At Risk – Declining
Galaxias argenteus	Giant kokopu, taiwharu	At Risk – Declining
Galaxias brevipinnis	Koaro	At Risk – Declining
Galaxias maculatus	Inanga, inaka	At Risk – Declining
Galaxias postvectis	Shortjaw kokopu	Threatened – Nationally Vulnerable
Geotria australis	Lamprey, kanakana	Threatened – Nationally Vulnerable
Gobiomorphus hubbsi	Bluegill bully	At Risk – Declining
Gobiomorphus huttoni	Redfin bully	At Risk – Declining
Neochanna diversus	Black mudfish	At Risk – Declining

5.2.2.3 Herpetofauna (Frogs & Reptiles)

Five Threatened or At Risk frog and reptile species are recorded in the Waikato District.

Table 7. Threat status of herpetofauna species recorded in Waikato District. (Names and threat status obtained from DOC BioWeb Herpetofauna Database 2013, BIMS, Hitchmough *et al.*, 2016).

Scientific name	Common/Māori name	Threat status
Dactylocnemis pacificus	Pacific gecko, teretere	At Risk – Relict

Leiopelma hochstetteri sensu stricto	Hochstetter's frog, pepeketua	At Risk – Declining
Mokopirirakau granulatus	Forest gecko, moko-piri-raʻkau	At Risk – Declining
Naultinus elegans elegans	Auckland green gecko, elegant gecko, kakariki	At Risk – Declining
Oligosoma infrapunctatum	Speckled skink	At Risk – Declining

5.2.2.4 Avifauna (Birds)

Thirty four Threatened or At Risk avifauna species are recorded in the Waikato District. Some are infrequent visitors, including some of the wading bird species such as wrybill, but also forest species such as North Island kaka and NZ falcon.

Table 8. Threat status of avifauna species recorded in Waikato District. (Names and threat status obtained from DOC BioWeb Casual Observations Database 2013, BIMS, Robertson *et al.*, 2017).

Scientific name	**Common/Māori name**	**Threat status**
Acanthisitta chloris granti	North Island rifleman, titiponamu	At Risk – Declining
Anarhynchus frontalis	Wrybill, ngutuparore	Threatened – Nationally Vulnerable
Anas chlorotis	Brown teal, pāteke	At Risk – Recovering
Anas superciliosa	Grey duck, pārera	Threatened – Nationally Critical
Anthus novaeseelandiae novaeseelandiae	New Zealand pipit, pīhoihoi	At Risk – Declining
Apteryx mantelli	North Island brown kiwi, kiwi	At Risk – Declining
Ardea modesta	White heron, kōtuku	Threatened – Nationally Critical
Botaurus poiciloptilus	Australasian bittern, matuku hūrepo	Threatened – Nationally Critical
Bowdleria punctata vealeae	North Island fernbird, mātātā	At Risk – Declining
Callaeas wilsoni	North Island kokako, kokako	At Risk – Recovering
Charadrius bicinctus bicinctus	Banded dotterel, tūturiwhatu	Threatened – Nationally Vulnerable
Charadrius obscurus aquilonius	Northern New Zealand dotterel, tūturiwhatu	At Risk – Recovering
Egretta sacra sacra	Reef heron, matuku moana	Threatened – Nationally Endangered
Eudynamys taitensis	Long-tailed cuckoo, koekoea	At Risk – Naturally Uncommon
Falco novaeseelandiae ferox	Bush falcon, karearea	At Risk – Recovering
Gallirallus philippensis assimilis	Banded rail, moho pererū	At Risk – Declining
Haematopus finschi	New Zealand pied oystercatcher, tōrea	At Risk – Declining
Haematopus unicolor	variable oystercatcher, tōrea pango	At Risk – Recovering
Himantopus novaezelandiae	Black stilt, kāki	Threatened – Nationally Critical
Hydroprogne caspia	Caspian tern, tarānui	Threatened – Nationally Vulnerable
Hymenolaimus malachorhynchos	Blue duck, whio	Threatened – Nationally Vulnerable

Larus bulleri	Black billed gull, tarāpuka	Threatened – Nationally Critical
Larus novaehollandiae scopulinus	Red billed gull, tarāpunga	At Risk – Declining
Limosa lapponica baueri	Eastern bar tailed godwit, kūaka	At Risk – Declining
Nestor meridionalis septentrionalis	North Island kaka, kākā	At Risk – Recovering
Phalacrocorax carbo novaehollandiae	Black shag, kawau	At Risk – Naturally Uncommon
Phalacrocorax sulcirostris	Little black shag, kawau tūi	At Risk – Naturally Uncommon
Phalacrocorax varius varius	Pied shag, karuhiruhi	At Risk – Recovering
Platalea regia	Royal spoonbill, kōtuku ngutupapa	At Risk – Naturally Uncommon
Poliocephalus rufopectus	New Zealand dabchick, waiwea	At Risk – Recovering
Porzana pusilla affinis	Marsh crake, koitareke	At Risk – Declining
Porzana tabuensis tabuensis	Spotless crake, pūweto	At Risk – Declining
Sterna striata aucklandorna	Southern white fronted tern, tara	Threatened – Nationally Vulnerable
Sterna striata striata	White fronted tern, tara	At Risk – Declining

5.2.2.5 Mammals

In the Waikato District only one threatened terrestrial mammal exists, the North Island long-tailed bat.

Table 9. Threat status of mammal species recorded in the Waikato District. (Names and threat status obtained from DOC BioWeb Casual Observations Database 2013, BIMS, O'Donnell *et al.*, 2012).

Species Name	**Common/Māori Name**	**Threat status**
Chalinolobus tuberculatus "North Island"	North Island long-tailed bat, pekapeka	Threatened – Nationally Vulnerable

5.2.3 Regionally Uncommon Species

No regionally uncommon species have been recorded in the databases researched.

6 RESULTS OF THE SIGNIFICANT NATURAL AREAS INVENTORY AND ASSESSMENT

6.1 Significant Natural Areas Inventory

A total of 1,599 potential sites (approximately 78,000 ha) were assessed, with 698 sites identified as SNA, comprising 71,312 ha. The Waikato District comprises a land area of approximately 434,000 ha. Therefore, approximately 16.4% of the district consists of significant natural areas (Figure 5). A summary of the SNA analysis for the Waikato District is provided below.

Of the 71,312 ha (represented by the 698 sites) identified as SNA, 6,269 ha (2 sites) was ranked as “Internationally” significant, 32,166 ha (20 sites) as “Nationally” significant, 18,396 ha (87 sites) as “Regionally” significant and 14,480 ha (589 sites) as “Locally” significant (Table 10 and Figure 6).

In addition to the 698 significant sites, a further 127 sites (1,761 ha) were considered to have a high likelihood of meeting one or more RPS criteria and were therefore classified as “likely to be significant”. A total of 348 sites (3,088 ha) remained with an “indeterminate” significance status, where it was impossible to determine even the likelihood that the site could meet one or more of the RPS criteria, because the vegetation appeared severely degraded and/or the information available was inadequate to discern the vegetation composition of the site. In order to determine whether the "indeterminate" and "likely" sites are significant, more information is needed from field surveys or other sources, if available. A further 426 sites (1,839 ha) were considered “not significant” as there were insufficient ecological values present to trigger any of the 11 assessment criteria (Table 10 and Figure 5, Figure 6, and Figure 7).

When the number of sites are tallied, the small number of very large “International” and “National” sites in relation to the more numerous but smaller sized “Regional” and “Local” sites suggests that larger remnants in the Waikato District are generally more biologically diverse and hence of greater ecological significance (Table 10 and Figure 7).

Eighty sites (19.0% of total SNA area) of all SNA assessed have been accredited a high confidence level (Table 11). These sites, however, include some of the larger areas, but also the SNA visited as part of the landowner consultation process where 50 properties were visited, each containing one or more SNA, as well as sites where sufficient landowner feedback was received. The majority of sites with a high confidence level are of local (35 sites) significance followed by 32 not significant sites. 504 sites (66.6% of SNA area) were assessed with a medium confidence level, the largest proportion of which was of local significance (243 sites). 1014 sites (14.4% of SNA area) had a low confidence level and about a third of those (311 sites) were assessed as being locally significant. Sites that were assessed as indeterminate or likely significant generally had a low confidence level, which indicates that these sites should have the highest priority for field surveys. Appendix V of this report provides definitions of the three confidence levels for the assessment of each site.

46.7% of the area of SNA, are protected under statute or QEII covenant (this excludes land protected by WDC covenants given no comprehensive data is available for these areas) (Table 14). For more detail on this matter, please refer to section 6.4 of this report.

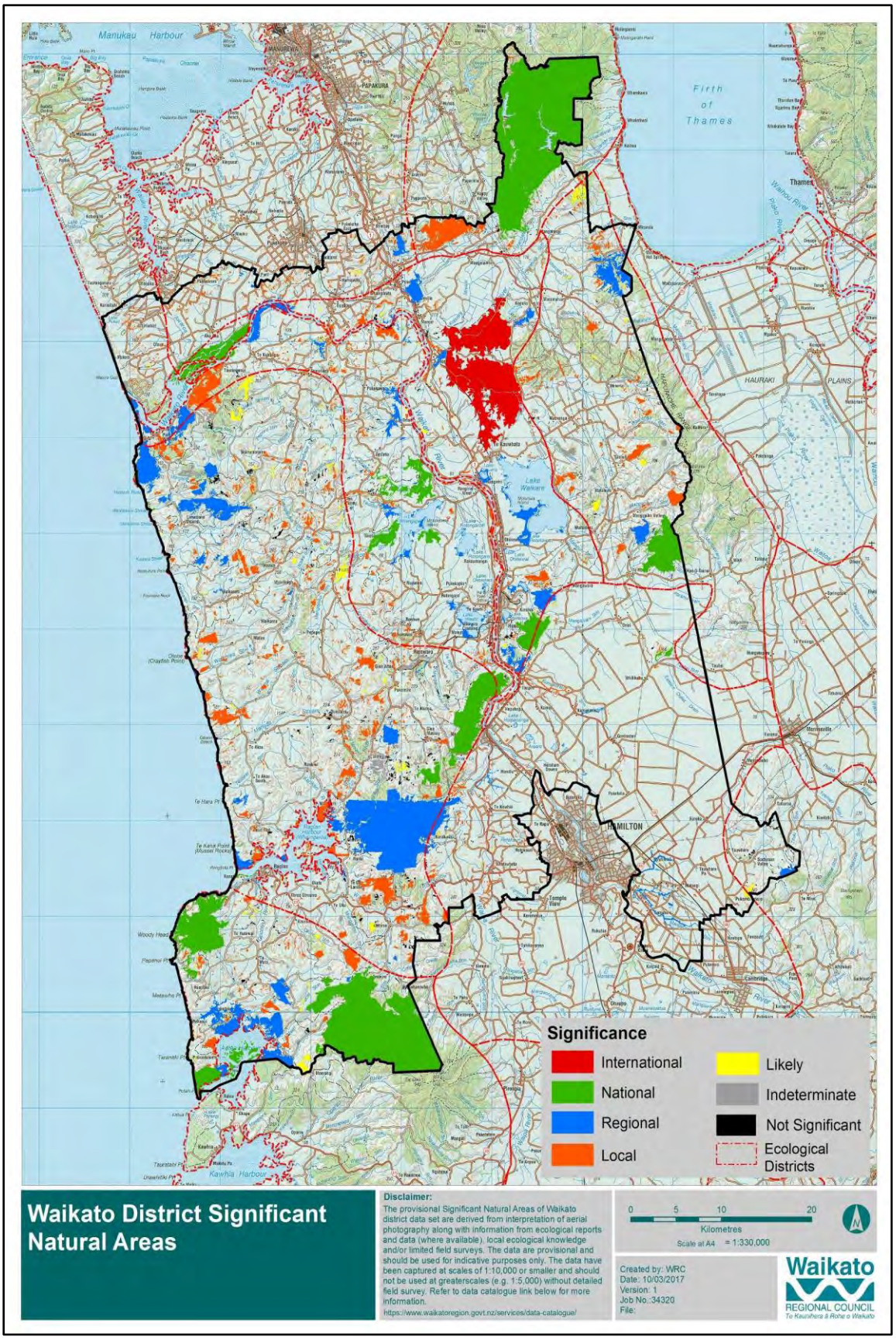


Figure 5. Significant Natural Areas of the Waikato District

Table 10. Summary, in total number and area (ha), of sites of terrestrial and wetland ecosystems assessed for significance in the Waikato District.

Significance Level	Number of Sites	Area (ha)	% of total SNA area assessed
International	2	6,269	8.0
National	20	32,166	41.2
Regional	87	18,396	23.6
Local	589	14,480	18.6
Subtotal for significant sites	**698**	**71,312**	**91.4**
Likely	127	1,761	2.3
Indeterminate	348	3,088	4.0
Not significant	426	1,839	2.4
TOTAL	**1599**	**78,000**	**100**

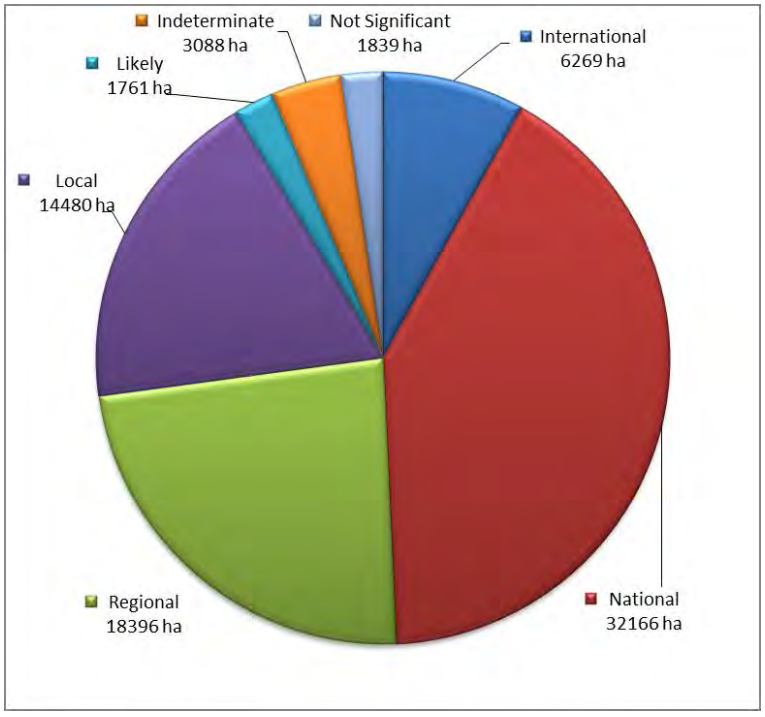


Figure 6. Distribution by area (hectares) of the relative significance of SNA assessed within the Waikato District.

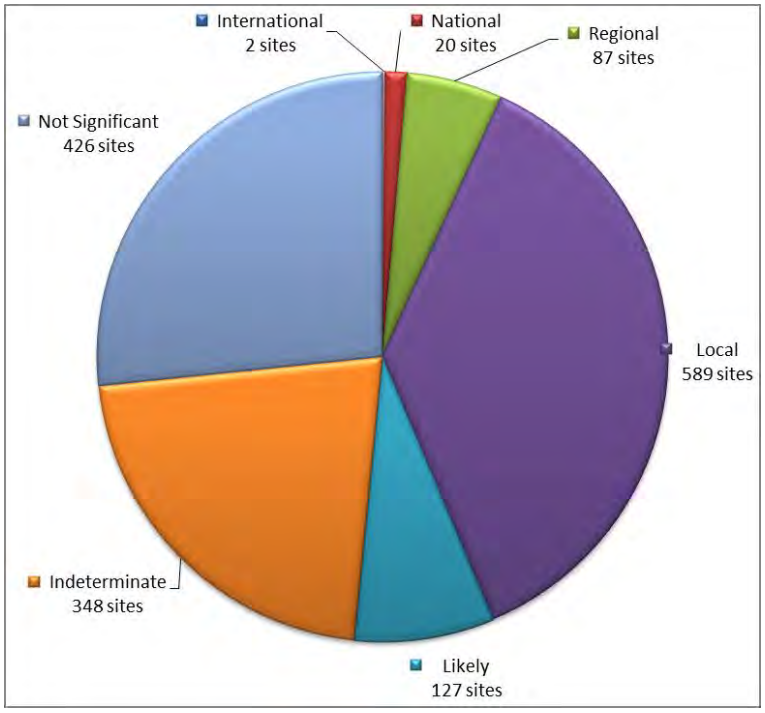


Figure 7. Distribution by number of sites of the relative significance of SNA assessed within the Waikato District.

The Department of Conservation administers approximately 32.0% (22,826 ha) of the total SNA assessment area (including SNA ranked as "likely", "indeterminate", and "not-significant"). This includes 43 small locally significant sites (covering a combined area of 423 ha) that are protected as DOC Marginal Strips, DOC Historic Reserves and DOC Recreation Reserves. While these areas are protected, this status may not guarantee adequate protection for biodiversity values (Table 12).

Protected, privately owned SNA equates 104 QEII National Trust Open Space covenants, covering an area of 1140 ha. Available spatial data shows that 299 ha of protected SNA are owned or administered by WDC and protected as Marginal Strips, Stewardship Areas, Local Purpose Reserve, or as Recreation Reserve. As for PCL administered by DOC and for WDC owned land may be protected, but this status may not guarantee adequate protection for biodiversity values (Table 12). While no spatial data was available for WDC conservation covenant areas, WDC communicated that a total of 509 WDC covenants exist and cover an area of over 1100 ha. Further investigation should be completed to allow for incorporation of this data into the SNA dataset and perform further data analysis.

The majority of SNA comprises terrestrial vegetation, approximately 30,000 ha, while many wetland SNA is composed of multiple ecosystems types or wetland alone (Table 13).

Table 11. Summary of confidence levels and relative significance, shown in number of sites and area (ha).

	High			Medium			Low		
Significance level	**Area (ha)**	**# sites**	**% of total SNA area**	**Area (ha)**	**# sites**	**% of total SNA area**	**Area (ha)**	**# sites**	**% of total SNA area**
International				6269	2	8.0			
National	12544	5	16.1	19577	14	25.1	45	1	0.1
Regional	1399	6	1.8	15831	57	20.3	1165	24	1.5
Local	660	35	0.9	8664	243	11.1	5156	311	6.6
Likely				443	32	0.6	1318	95	1.7
Indeterminate	32	2	0.04	961	84	1.2	2095	262	2.6
Not significant	146	32	0.2	219	72	0.3	1474	322	1.9
TOTAL	**14782**	**80**	**19.0**	**51965**	**504**	**66.6**	**11247**	**1014**	**14.4**

Table 12. Summary of protected SNA of the Waikato District by protection type and relative significance levels, shown in number of sites. (PCL = DOC Public Conservation Land, QEII = Queen Elizabeth National Trust, WRC = Waikato Regional Council, WDC = Waikato District Council, AC = Auckland Council)

Significance Level	**PCL land**		**QEII**		**WRC owned land**		**WDC owned land**		**AC owned land**	
	Area (ha)	**# sites**	**Area (ha)**	**# sites**	**Area (ha)**	**# sites**	**Area (ha)**	**# sites**	**Area (ha)**	**# sites**
International	4595	2	0	1	1.0	1	23	1		
National	15382	13	108	7			102	5	9187	1
Regional	2377	39	282	26			110	24		

Local	423	43	666	51	0.3	2	43	41	24	1
Likely	3	6	29	4			2	5		
Indeterminate	40	11	48	11	0.2	1	14	14		
Not Significant	5	6	7	4	2.1	1	5	6		
TOTAL	**22826**	**120**	**1140**	**104**	**3.6**	**5**	**299**	**96**	**9211**	**2**

Table 13. Summary of ecosystem types and relative significance levels, shown in number of sites and area (ha).

Significance Level	**Terrestrial vegetation**		**Wetland[4]**		**Coastal / sand dunes**		**Multiple[5]**		**Blank**	
	# sites	**Area (ha)**	**# sites**	**Area (ha)**	**# sites**	**Area (ha)**	**# sites**	**Area (ha)**	**# sites**	**Area (ha)**
International			1	1			1	6268		
National	4	12730	3	410	3	967	10	18059		
Regional	23	2455	8	158	3	720	53	15063		
Local	348	9672	68	481	23	188	150	4139		
Likely	62	1221	30	109	14	36	21	395		
Indeterminate	192	2188	78	203	17	24	60	671	1	0.5
Not Significant	379	1722	32	55	2	2	12	59	1	1.1
TOTAL	**1008**	**29988**	**220**	**1417**	**62**	**1937**	**307**	**44654**	**2**	**1.6**

[4] 'Wetland' includes ecosystems classified as 'Wetland - freshwater', 'Wetland - saline', and 'Exotic with wetland'.
[5] 'Multiple' refers to any site with a combination of terrestrial, wetland and coastal / sand dune ecosystems.

6.2 Vegetation Composition Analysis

A vegetation analysis of the SNA of the Waikato District was conducted using the vegetation classes of the WRC BIOVEG 2007 database. Table 14 shows that a total area of 71,312 ha was assessed as being SNA, of which 61,292 ha was considered indigenous vegetation, which equates to 85.9% of the total area of SNA. The remaining 14.1% contains areas of exotic or uncertain vegetation, most of which, is dominated by "Deciduous hardwoods".

When the data is analysed in terms of vegetation composition for legally protected areas identified as SNA (ranked as locally significant or higher), it becomes apparent that just over half (23,646 ha of 41,507 ha) of the mature indigenous forest remaining in the Waikato District are legally protected. These are primarily in Public Conservation Land (PCL) administered by DOC (14,636 ha) plus a large area of Auckland Council land in the Hunua Ranges (8,278 ha) (Table 14). This equates to 58.2% of the entire SNA area, and is quantified from the amalgamation of the "Broadleaved Indigenous Hardwoods" and "Indigenous Forest" BIOVEG classes. As much as 25% of the mature indigenous forest remaining in the Waikato District is not legally protected. These unprotected areas are often in a severely degraded and/or fragmented state. Of the 33,281 ha of protected SNA, 71% of the land is composed of indigenous forest, 4,350 ha (13.1%) is composed of "Manuka and or Kanuka", 2,253 ha (6.8%) is composed of "Herbaceous Freshwater Vegetation", 2,288 ha (6.9%) is "Deciduous Hardwoods", and 456 ha (1.4%) is "Sand Dune" vegetation. Other vegetation types listed in Table 14 make up the remaining 0.9% of protected SNA.

Only 3,622 ha (5.1%) of the SNA area in the Waikato District contain remnant freshwater wetland vegetation (i.e. they have been identified as "Herbaceous Freshwater Vegetation" in the BIOVEG data), and 37.8% of these areas are found on unprotected land. A large proportion (97.7%) of the herbaceous saline vegetation is unprotected, as well as, 99.2% of mangrove habitats (Table 14).

An analysis of the coastal vegetation types ("Flaxland", "Herbaceous Saline Vegetation", "Mangrove", Sand Dunes, and "Sand Dunes – Highly Modified") found that these types are primarily found on unprotected land. These coastal types combined add up to an area of 601 ha (0.8%) of the total area mapped as SNA. Those coastal habitats are important refugia for migrating bird species, but also important for many flora species.

Analysis of "Manuka and or Kanuka" and "Deciduous Hardwoods" (i.e. willow wetlands) BIOVEG classes found that these types are primarily on unprotected land. Expressed in area, 10,520 ha (14.8%) of the unprotected total area is mapped as "Manuka and or Kanuka" and 5,088 ha (7.1%) of the unprotected total area is mapped as "Deciduous Hardwoods". Scrubland ecosystems such as "Manuka and or Kanuka", as well as willow wetlands can provide important habitat for many threatened fauna species, such as wetland bird species, lizards, bats, and threatened fish species such as black mudfish.

The largest remaining wetland, Whangamarino wetland, is present in Meremere ED, comprising the largest area of internationally significant SNA in this ED. The largest remaining indigenous forest, the Hunua ranges covers a large area in Hunua ED, and large nationally significant SNA are present in Kawhia ED, comprising Mt. Karioi, part of Mt. Pirongia, and large areas of coastal SNA, but also the Hakarimata Scenic Reserve in the Raglan ED (Table 2 in Appendix VI). These large areas provide important habitat for many threatened flora and fauna species, including threatened orchids, and fauna species, such as birds and long-tailed bats.

Specific area calculations for SNA are not available for conservation covenants protected by WDC. Therefore, in the figures above, the area of land protected by WDC only includes WDC protected land in reserves and marginal strips. Furthermore, the total sums of protected and unprotected areas do not include the WDC conservation covenants (this may be over 1100 ha). The calculation of protected SNA in the Waikato District is therefore lower than the actual area and calculations of unprotected land are higher.

Table 14. Distributions (ha) of vegetation composition (as expressed in BioVeg classes[6]) of SNA (ranked as locally significant or higher) of the Waikato District and the areas and percentages of land that are protected by Department of Conservation as Public Conservation Land (PCL) , Queen Elizabeth II covenants (QEII), Waikato District Council owned land (WDC[7]), and Auckland Council owned land (AC).

Vegetation Type	SNA area (ha)	SNA area (%)	Protected areas (ha)[8]	Protected areas (%)	Unprotected areas (ha)[9]	Unprotected areas (%)	PCL land (ha)	PCL land (%)	QEII (ha)	QEII (%)	WDC owned land (ha)[10]	WDC owned land (%)	AC land (ha)	AC land (%)
Broadleaved Indigenous Hardwoods	2,786	3.9%	1,430	2.0%	1,355	1.9%	770	1.1%	71	0.1%	9	0.1%	581	0.8%
Fernland	218	0.3%	39	0.1%	179	0.3%	21	0.03%	18	0.02%				
Flaxland	47	0.1%	16	0.02%	31	0.04%	13	0.02%			4	0.01%		
Herbaceous Freshwater Vegetation	3,622	5.1%	2,253	3.2%	1,369	1.9%	2,219	3.1%	13	0.02%	20	0.03%		
Herbaceous Saline Vegetation	32	0.05%	1	0.00%	32	0.04%	0.1	0.00%			1	0.00%		
Indigenous Forest	38,722	54.3%	22,216	31.2%	16,506	23.1%	13,865	19.4%	603	0.8%	50	0.07%	7,698	10.8%
Mangrove	18	0.03%	0	0.00%	18	0.03%	0.1	0.00%						
Manuka and or Kanuka	14,870	20.9%	4,350	6.1%	10,520	14.8%	3,133	4.4%	284	0.4%	16	0.02%	917	1.3%
Sand Dunes	971	1.4%	455	0.6%	516	0.7%	438	0.6%	1	0.00%	17	0.02%		
Sand Dunes - Highly Modified	6	0.01%	1	0.00%	5	0.01%			1	0.00%	1	0.00%		
Sub-Total Indigenous Vegetation	**61,292**	**85.9%**	**30,762**	**43.1%**	**30,530**	**42.8%**	**20,459**	**28.7%**	**990**	**1.4%**	**117**	**0.16%**	**9,196**	**12.9%**
Deciduous Hardwoods	7,376	10.3%	2,288	3.2%	5,088	7.1%	2,151	3.0%	57	0.1%	79	0.11%		
Forest Harvested	5	0.01%	0	0.00%	5	0.01%	0.2	0.00%						
Gorse and Broom	130	0.2%	23	0.03%	107	0.2%	21	0.03%	0.3	0.00%	1	0.00%		
Mixed Exotic Shrubland	19	0.03%	3	0.00%	16	0.02%	2	0.00%			1	0.00%		
Other Exotic Forest	51	0.1%	6	0.01%	45	0.1%	4	0.01%			2	0.00%	0.1	0.00%
Pine Forest - Closed Canopy	107	0.2%	9	0.01%	98	0.1%	1	0.00%			0.4	0.00%	7	0.01%
Pine Forest - Open Canopy	12	0.0%	2	0.00%	10	0.01%	0.0		2	0.00%				
Uncertain	2,321	3.3%	189	0.3%	2,132	3.0%	138	0.2%	7	0.01%	36	0.05%	8	0.01%
Sub-Total Exotic and Uncertain Vegetation	**10,020**	**14.1%**	**2,519**	**3.5%**	**7,501**	**10.5%**	**2,318**	**3.3%**	**66**	**0.1%**	**119**	**0.17%**	**15**	**0.02%**
GRAND TOTAL	**71,312**	**100.0%**	**33,281**	**46.7%**	**38,031**	**53.3%**	**22,778**	**31.9%**	**1,056**	**1.5%**	**236**	**0.33%**	**9,211**	**12.9%**

[6] Derived from Waikato Regional Council Biodiversity Vegetation (BioVeg 2007) data dated 2007. Used under Creative Commons NZ 3.0.
[7] Some of Waikato District Council owned land is administered by DOC or protected by a QEII covenant.
[8] This includes sites with Protection Rank 1 - 5. Protected and unprotected area calculations do not include the areas for sites protected by conservation covenants administered by Waikato District Council
[9] This includes sites with Protection Rank o.
[10] WDC owned land does not include land protected by WDC covenants. No accurate data is available for WDC conservation covenants.

6.3 Landowner Consultation Results

A number of methods were used to engage with landowners who had potentially significant natural areas on their property, as detailed in section 3.4.3. Information was collated from 678 phone calls. Further, information from 152 landowners collected at the workshop meetings, and 354 feedback forms was also incorporated in the review process. In addition, detailed information was taken from the 50 site visits.

Feedback provided by landowners was largely positive in terms of appreciating the value of their natural feature and seeking ways and resources to manage them. Discussions often focussed on how to manage pest animals, pest plants, the status of grazing/fencing of the natural areas, as well as seeking information on how to manage the effects of surrounding land use. This information was added to the Master Dataset and changes made where and when appropriate.

A summary of the type of changes included into the base dataset included:

- removing, adding or altering the outline of an SNA boundary;
- changing the significance ranking of the SNA;
- adding information on animal pests, plant pests, fencing and grazing status;
- adding site specific information on flora and fauna species present; and
- adding information on other issues.

A total of 1023 changes were made to specific attributes cells in the spreadsheet Master Dataset as a consequence of the WDC initiated landowner consultation process, of which most were changes made to pest animal, pest plant, and stock issue columns.

Amendments and additions were made to 61 SNA site descriptions based on landowner feedback, mostly to SNA which are small or in remote places with little existing knowledge. Combining the feedback provided by DOC and private landowners/local communities, a total of 108 changes were made to the level of significance (Table 15) and 496 changes made to the level of confidence.

Generally, it was difficult to make changes to the significance ranking based only on verbal feedback received, but the number of “Locally” and “Regionally” significant SNA increased, where the number of “Likely” and “Indeterminate” SNA decreased. Overall, the confidence level of the SNA sites on which feedback was received increased, particularly when a visit was paid to a site, resulting to 496 changes in the level of confidence. An increase in confidence was particularly seen in the SNA ranked with medium or low confidence, increasing the number of high and medium confidence SNA. When a site was visited more detailed information was able to be gathered directly by the project ecologists and incorporated into the dataset.

Table 15. Total number of SNA sites assessed for significance in the Waikato District before and after consultation with DOC and private landowners/local communities.

	Number of Sites		
Significance	**Pre-consultation**	**Post-consultation**	**Difference**
A. Significance level allocated			
International	2	2	0
National	20	20	0
Regional	84	87	+3
Local	554	589	+34
B. No Significance level allocated			
Likely	142	127	-15
Indeterminate	387	348	-39
Not Significant	409	426	+17
Grand Total	**1598**[11]	**1599**	**108**

Table 16. Significance and confidence levels in the Waikato District before and after consultation with DOC and private landowners/local communities.

Significance level	**High**		**Medium**		**Low**		**Grand Total**	
	Number of Sites		**Number of Sites**		**Number of Sites**		**Number of Sites**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
International			2	2			2	2
National	5	5	13	14	2	1	20	20
Regional	4	6	41	57	39	24	84	87
Local	17	35	128	243	409	311	554	589
Likely			15	32	127	95	142	128
Indeterminate	1	2	40	84	346	261	387	359
Not Significant	21	32	49	72	339	322	409	414
Grand Total	**48**	**80**	**288**	**504**	**1262**	**1014**	**1598**[11]	**1599**

6.4 Limitations of the Assessment

As mentioned in section 3.4 above, ranking of the SNA was done using the proposed RPS criteria and the ranking has not been updated after the RPS criteria became operative on 20 May 2016. As described above, criteria 1 and 2 were changed to merge criterion 2 into criterion 1 and create criterion 2 to include the recognition of Coastal Marine Areas. Criterion 4 was amended, changing the required percentage of under-represented indigenous vegetation, habitat or ecosystem types present in an ED, ER, or nationally from 10% to 20%.

As part of this investigation, the change of criterion 1 has been incorporated into the Master Dataset, with only minor changes to the SNA ranking. Criterion 2 does not apply for terrestrial sites, thus would not make a difference in assessment. The change in criterion 4, increasing the percentage of under-represented indigenous vegetation, habitat, or ecosystem type from 10% to 20% will have some implications for the SNA ranking but it was decided during the course of the project to not update this at this stage, but will likely be updated in the future.

For example, based on Leathwick *et al.* (1995), remnant primary rimu-tawa forest in Kawhia District will, with the updated RPS criteria, comply with criterion 4, whereas it would not have complied using the previous set of RPS criteria. For logged forest types some vegetation types in different

[11] An additional SNA was identified during the review stage and added to the SNA Master Dataset.

EDs will make a difference in the significance assessment, but no major overall changes are expected.

After the initial desktop assessments were completed, a thorough review process was started, including an extensive landowner consultation process lead by WDC which included not only incorporating feedback into the Master Dataset, but also visiting SNA on 50 properties throughout the Waikato District (see above). This data will be added to and updated over time through activities such as further field surveys and community consultations. Every opportunity should be taken to add to or update information contained in this SNA dataset where new information becomes available.

The accuracy of the spatial boundaries of the sites in the data set is dependent on the data from which the boundaries are derived, with ground truthing being the ultimate method to ensure a high level of accuracy. Aerial photo base spatial analysis is limited by the date of the photo, the resolution of the photo and the ability of the assessor to determine the vegetation types presented. In general, the positional accuracy of aerial photography can be considered to be at worst within +/- 30m, which is the level of accuracy of the BIOVEG 2007 data, the primary source from which the majority of site boundaries were derived. This is generally not accurate enough for detailed management requirements of individual SNA.

An updated spatial dataset is now available for BIOVEG (BIOVEG 2012) with better boundary indication (line work). The Council decided that the more accurate line work of this dataset could not be incorporated at this stage of the project. It is expected that in a future review stage, the line work of the relevant SNA will be updated using more recent spatial data layers. Nonetheless, the extensive landowner consultation process did allow resolution of many spatial accuracy issues pertaining to the initial desktop assessment.

As one SNA site is likely to comprise more than one polygon due to the way the merging and grouping of polygons was set up, some limitations arose during assessment and analysis process of the SNA Master Dataset. Not all multi-polygon SNA would comprise a similar vegetation composition, nor would the protection status of many sites. Or vice versa, one large SNA site would be covered by multiple forms of protection, landforms, and vegetation types. In the site descriptions this was addressed as accurately as possible. This has created relatively minor anomalies in the statistics inventory, and thus these complications need to be kept in mind when reviewing the data.

This inventory includes mostly areas comprising indigenous terrestrial and freshwater wetland vegetation, but also areas with a mixture of exotic and indigenous vegetation which provide habitat for indigenous fauna species. As a consequence, it is important to recognise that just because an area is largely dominated by exotic vegetation does not necessarily mean it does not provide significant habitat values for indigenous fauna or flora species. These values may not be readily apparent when looking at maps or spatial data alone. For example, heavily degraded gullies, such as the Tamahere gully system, proved to be an issue during this assessment. As large areas of those gully systems contain many weed species and other exotic vegetation, the vegetation cover does not meet the significance criteria stated in the RPS. However, these gully systems do provide a unique and greatly valuable habitat for several threatened indigenous fauna species such as long-tailed bats, black mudfish, and longfin eels. In the SNA assessment, gully systems like the Tamahere gully system will meet criterion 11 in terms of the linkage and corridor function they provide.

Wetlands have been problematic to identify from the aerial photography and many will need to be field checked. In addition, there are likely to be some wetlands that have not been identified due to the limitations of identifying this ecosystem type in aerial photography, especially when they are situated within an already densely forested locality or underneath a willow canopy.

A limitation during the statistics inventory was the lack of spatial data for WDC conservation covenants. These protected sites could not be displayed by area in hectares due to the way WDC keeps their records, displaying WDC Covenants over the entire property, rather than for the actual covenanted area. Areas of protected land owned by WDC were however available for sites protected by local reserves and marginal strips. The WDC conservation covenant database shows that over 1100 ha is protected by covenants (measured over the entire property rather

than just the covenanted area) across 509 properties. The calculation of protected SNA in the Waikato District is therefore lower than the actual area and calculations of unprotected land are higher. For a more accurate and comprehensive evaluation of the SNA analyses in Waikato District, this should be further investigated. Additionally, monitoring of the covenants is important and would be required on an ongoing basis to ensure the ecological value of the covenants is sustained.

The key limitation in regard to incorporating landowner feedback to the Master Data was that many SNA cover land of multiple landowners, but landowners were only able to provide feedback on SNA on their own property. Information on an entire SNA could only be obtained if all the landowners involved engaged in the consultation process, which was often not the case. An additional constraint was that the spatial data was created in such a way that many SNA were grouped, often comprising natural features with different ecological features (i.e. grouping forest and wetland habitats in one SNA). Feedback on parts of a multipart SNA were incorporated as accurately as possible and changes to the SNA spatial data made accordingly.

7 CONCLUSIONS

This assessment provides data and an assessment of a diverse array of natural features within the Waikato District which will assist both the Council and WDC in their development of policies, incentives and rules in relation to their obligations of the Resource Management Act. In addition, the dataset and management recommendations can provide a guide to stakeholders and developers on strategic opportunities on how to protect and restore these significant natural areas.

This study area includes parts of ten mainland ED within the Waikato District territorial boundary covering some 434,000 ha. The "Provisional Significant Natural Areas of the Waikato 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, limited field surveys and feedback from a landowner consultation process led by the WDC.

To determine whether a site was significant it was assessed against the previous 11 criteria defined in chapter 11 of the previous Waikato RPS. Generally, if a site met one or more of these criteria, it was considered an SNA, and was then assessed to determine a level of significance, i.e. “International”, “National”, “Regional”, or “Local", as per guidelines developed by the Council. Sites that were not found to be significant were classified into one of the following categories: “Likely”, “Indeterminate”, or “Not Significant”. Given this first part of the project was largely a desktop study, an attribute called "Confidence Level” was used to indicate the amount of confidence in the accuracy of the significance assessment of a site. Following the review and landowner consultation stage, the confidence level increased considerably, with a total of 108 changes made to the significance ranking of SNA.

Nationally threatened environments within the Waikato District were identified using the Threatened Environment Classification developed by Landcare Research. The first five categories are referred to as “threatened environments”, whereas category six is considered “not-threatened”. The majority of land in the Waikato District is categorised as “threatened” (78%), and only a small portion is considered “not-threatened” (22%). The majority of significant SNA (in ha) fall within category 6 “Not Threatened”, indicating they have more than 30% indigenous cover and more than 20% has some form of protection. Following this, the largest area of significant SNA fall within the three categories with the highest threat categories, whereas categories 4 and 5 cover the lowest area of SNA.

A total of 105 nationally threatened and at risk species (53 flora species and 52 fauna species) as defined by the Department of Conservation have been recorded as being present within the Waikato District. The threat status of species is important and has had a significant bearing on the SNA assessment. For example, the long-tailed bat, which is ranked at a Nationally Vulnerable threat status, means that an SNA where this species has been found and was considered to

use the site on a regular basis was considered significant at a "National" level, regardless of whether any other records of threatened species were known for the site or any other of the 11 RPS criteria were met by the site. However, many species, such as NZ kaka and NZ falcon, are highly mobile and have large territories and vast home ranges. It is therefore difficult to predict where these species may utilise suitable habitats throughout a year, so habitat utilisation is probably much broader than specific points in time as shown on a static database.

As a consequence of this study, 1,599 potential sites were assessed, with 698 sites identified as SNA (ranked locally significant or higher), comprising an extent of 71,312 ha. Therefore, approximately 16.4% of the Waikato District consists of significant natural areas.

In addition to the 698 significant sites, 127 sites (1,761 ha) were considered to have a high likelihood of meeting one or more RPS criteria and were therefore classified as "likely to be significant". 348 sites (3,088 ha) remained with an "indeterminate" significance status, and a further 426 sites (1,839 ha) were considered "not significant" as there were insufficient ecological values present to trigger any of the 11 assessment criteria.

The small number of very large "International" and "National" sites in relation to the more numerous but smaller sized "Regional" and "Local" sites suggests that larger remnants in the Waikato District are generally more biologically diverse and hence of greater ecological significance.

Eighty sites (19.0% of total SNA area) of all SNA assessed have been accredited a high confidence level. A total of 504 sites (66.6% of SNA area) were assessed with a medium confidence level, and a total of 1014 sites (14.4% of SNA area) had a low confidence level. Sites that were assessed as indeterminate or likely significant generally had a low confidence level, which indicates that these sites should have the highest priority for field surveys. Through the review and landowner consultation process the levels of confidence increased and a total of 108 changes were to the significance ranking, with the number of "Locally" and "Regionally" significant SNA increasing, and decreasing the number of "Likely" and "Indeterminate" SNA. Overall, the confidence level of the SNA sites on which feedback was received increased, particularly when a visit was paid to a site, resulting to 496 changes in the level of confidence. An increase in confidence was particularly seen in the SNA ranked with medium or low confidence, increasing the number of high and medium confidence SNA

Some 46.7% of the area of SNA are legally protected under statute or covenant (excluding WDC covenants). This includes both private and public land. Public Conservation Land (PCL) owned or administered by the Department of Conservation comprises approximately 32% (22,825 ha) of the total area identified as SNA (including SNA ranked as "likely", "indeterminate", and "not-significant"), which equates to 68.4% of the protected SNA in the Waikato District. This includes 43 small locally significant sites that are gazetted as DOC Marginal Strips, DOC Historic Reserves and DOC Recreation Reserves. Protected SNA owned by Waikato District Council include land protected as Marginal Strips, Stewardship Areas, Local Purpose Reserve, or as Recreation Reserve comprise 236 ha. For both PCL land and WDC owned land it counts that while these areas are protected, this status may not guarantee adequate protection for biodiversity values.

Legally protected, privately owned SNA include 104 QEII National Trust Open Space covenants and 509 WDC Conservation Covenants. No spatial data was available for WDC conservation covenants, and therefore were not included in the calculations above.

A vegetation analysis of the SNA of the Waikato District was conducted using the vegetation classes of the WRC BIOVEG 2007 database. A total area of 71,312 ha was assessed as being SNA, of which 61,292 ha is considered indigenous vegetation, which equates to 85.9% of the total area of SNA. The remaining 14.1% contains areas of exotic or uncertain vegetation, most of which, is dominated by "Deciduous Hardwoods". A slight majority (23,646 ha of 41,507 ha) of the mature indigenous forest (amalgamating the "Broadleaved Indigenous Hardwoods" and "Indigenous Forest" BIOVEG classes) remaining in the Waikato District are legally protected. These are primarily in Public Conservation Land (PCL) administered by DOC (14,636 ha) plus a large area of Auckland Council land in the Hunua Ranges (8,278 ha).

Of the 33,281 ha of protected SNA, 71% of the land is composed of indigenous forest, 4,350 ha or 13.1% is composed of “Manuka and or Kanuka”, 2,253 ha (6.8%) is composed of “Herbaceous Freshwater Vegetation”, 2,288 ha (6.9%) is “Deciduous Hardwoods”, and 456 ha or 1.4% is “Sand Dune” vegetation. Other vegetation types present make up the remaining 0.9% of protected SNA.

Only 3,622 ha (5.1%) of the SNA area in the Waikato District contain remnant freshwater wetland vegetation (i.e. they have been identified as "Herbaceous Freshwater Vegetation" in the BIOVEG data), and 37.8% of these areas are found on unprotected land. 97.7% of the herbaceous saline vegetation is unprotected, as well as, 99.2% of mangrove habitats.

Scrubland ecosystems such as “Manuka and or Kanuka” and “Deciduous Hardwoods” (i.e. willow wetlands) BIOVEG classes are primarily found on unprotected land, but can provide important habitat for many threatened fauna species, such as wetland bird species, lizards, bats, and threatened fish species such as black mudfish.

The largest remaining wetland, Whangamarino wetland, is present in Meremere ED, comprising the largest area of internationally significant SNA in this ED. The largest remaining indigenous forest, the Hunua ranges covers a large area in Hunua ED, and large nationally significant SNA are present in Kawhia ED, comprising Mt. Karioi, part of Mt. Pirongia, and large areas of coastal SNA, but also the Hakarimata Scenic Reserve in the Raglan ED. These large areas provide important habitat for many threatened flora and fauna species, including threatened orchid species and fauna species such as birds and long-tailed bats.

Based on the findings of this SNA assessment, recommendations were made on methods to maintain and protect existing SNA and indigenous biodiversity in various management zones which are discussed in the following section.

Through the landowner consultation process led by WDC as part of the review stage, the following main threats facing identified SNA in the Waikato District are: vegetation clearance; stock intrusion into unfenced forest/shrubland/wetland areas; animal and plant pest degradation of all indigenous fauna and flora habitats; and degradation of the margins of estuarine wetlands and lakes by stock.

To ensure ongoing protection and ecological restoration of biodiversity values of SNA the following components are essential: enhancing indigenous populations of species through ongoing weed and animal pest management; stock exclusion; and carrying out enhancement planting. By applying these restoration objectives over a wide area, in particular when involving wetland and riparian margins, ongoing biodiversity management will enhance and restore ecological processes at a landscape scale.

8 RECOMMENDATIONS FOR MANAGEMENT OF SNA

For the purposes of assessing the biodiversity management needs of the Waikato District, the District was divided into four broad ecological management zones based on key ecological and landscape features, which also require different management strategies in terms of enhancing biodiversity values found within them. The management zones are more or less amalgamations of the base ecological district boundaries situated within the Waikato District, as described by McEwen (1987). The ecological management zones are:

- Hill Country Ecological Management Zone;
- Waikato Floodplains Ecological Management Zone;
- Western Hill Country and Coast Ecological Management Zone; and
- Hamilton Basin Ecological Management Zone.

The following sections outline restoration and management recommendations for the SNA found in each of these ecological management zones.

There is considerable scope within the Waikato District for additions to the protected natural area network via protection of SNA. However, while formal protection of natural areas is

recommended, the ongoing management of these areas (including weed and pest control, fencing and restoration) is of primary concern. WDC and the Council have funding available to landowners and community groups to assist restoration and habitat enhancement through financial support with fencing, planting, and undertaking weed and animal pest control. Due to the significant loss of vegetation and fragmented state of the remaining indigenous vegetation in most parts of the Waikato District, restoration of under-represented ecosystem types, and ecological linkages and corridors, is a priority.

The patterns of SNA throughout the District, follows the Waikato River, forming the edges of lakes or coastal margins and following major gullies and ranges highlights the importance of all remaining areas of non-pasture dominated vegetation, no matter how small and modified, either partly exotic dominated or completely indigenous, as habitats for indigenous flora and fauna and for the contribution they make to the maintenance of biodiversity through their ecological linkages, be that as stepping stones or corridors. Reserve design principles suggest that in order to maintain world biological diversity at least 10-20% of the original area of a landscape or habitat class should be protected (Kelly, 1980). For many lowland ecosystem types (e.g. kahikatea forest, freshwater wetlands) this is not possible as less than 10% of the original extent of those vegetation types in New Zealand now remains. Less than 10% of the land area of most of the district now remains in indigenous vegetation. Freshwater wetlands kahikatea floodplain forest have been reduced by over 98% from their former extent and the Hamilton Basin Ecological Management Zone, which indicates that most, if not all, remnants of remaining indigenous vegetation have some value for maintaining biological diversity. While SNA in this report have been selected for their ecological values (diversity, rarity, representativeness) and long term viability (their size, landscape context, level of weeds and pests, and ability to survive into the future) the selection of areas of high conservation value in this report does not mean that areas not identified as SNA do not contain ecological values or have potential to be restored.

This assessment and associated landowner consultation process strongly suggest that a major mechanism for protection of natural areas on private land in the Waikato District will continue to include the environmental lot subdivision provisions in the Waikato District Plan. A significant proportion of the SNA surveyed are still unprotected. Protection mechanisms and incentives for ecological restoration and ongoing management are in place in Waikato District. There is a need, however, for other mechanisms for encouraging voluntary protection and restoration that can complement subdivision provisions in the District Plan. The Council has a range of tools and processes being trialled as part of the Local Indigenous Biodiversity Strategy (LIBS) Pilot Project: “Source to the Sea” (WRC 2016), as well as the need for farm plans via the healthy rivers plan change.

A targeted approach for restoration for each of the ecological management zones is described below.

8.1 Hill Country Ecological Management Zone

This zone comprises an extensive area of hill country bush between Miranda and the Waikato River mouth, including the Hunua ranges. These ranges provide important habitat for many indigenous species and present a range of indigenous vegetation types such as rimu and tawa forest and podocarp forest.

The landscapes outside the significant areas of vegetation have been extensively modified by human activity. A number of areas of indigenous bush and wetland remnants have been protected in the past through incentive methods. However, these are limited in their ability to re-establish biodiversity and have contributed to an ad-hoc dispersal of countryside living in the rural and coastal areas. Next to increased pressure from expanding living areas, the forest areas are threatened by pest animals, stock intrusions, and pest plants.

A number of areas of indigenous bush and wetland remnants have been protected by covenants through incentive methods. However, these are limited in their ability to re-establish biodiversity.

The large ranges are largely protected, and it is recommended that management is focused on the smaller bush and wetland remnants scattered throughout the landscape. The remnant bush and wetland habitats play an important/vital role in providing habitat for indigenous fauna as refugia amongst large areas of exotic vegetation, agricultural land, and residential areas. They serve as stepping stones between the different large hill ranges, but may also sustain a large variety of indigenous biodiversity by themselves.

From the landowner feedback it is evident that the main reason those remnants still exist in the otherwise farmed land is that these pockets of indigenous vegetation are often situated in areas that are impractical or economically unviable to farm. Nonetheless, many of these areas are currently unfenced and used as shade and shelter for stock. As a consequence unprotected fragments hold very little understorey species and are further degraded by continual browsing of animal pests such as possums, goats, pigs and deer.

Key for these remnants is to minimise further stock and animal pest grazing and clearance of indigenous vegetation and habitat identified as SNA, and by encouraging the legal protection of these refugia and restoration of them, as well as inter-linking ecological corridors and stepping stones.

Remnant small gully wetlands and stream margins in this zone are equally important as refugia and stepping stones for indigenous fauna species, as well as serving as linkages and corridors between different water bodies.

8.2 Waikato Floodplains Ecological Management Ecological Zone

In this management zone many riparian margins have been lost from stream and river margins, and where present often comprise a mixture of indigenous and exotic vegetation. The river bank close to Hamilton city is often very steep, comprising a mixture of indigenous and exotic vegetation, whereas towards the downstream end of the Waikato River the banks are wide and willow- and alder comprise the main vegetation along the river. Among the riparian margins and wetlands however, many indigenous fauna exist, including threatened species.

The Whangamarino wetland retains good quality peat bog dominated by wire rush but swamp and fen habitat has been degraded by eutrophication and invasion by exotic plants. The wetland is mostly managed by DOC which spends considerable resources on threat management and restoration. Other parts of the wetland are owned by Fish & Game and managed for game bird hunting, or are privately owned.

The Waikato Floodplains zone contains several shallow lakes that lie within the Waikato District, such as lakes Waahi, Waikare, Whangape, Hakanoa and many more. The shallow lakes are often highly degraded and lack presence of macrophytes and many forms of indigenous life. Exotic fish and wind stir the bottom sediments, preventing the (re-)establishment of aquatic plants.

Historically, the most pervasive threat to the natural Waikato Floodplains Management Zone, including the extensive associated wetlands, was drainage and the spread of exotic trees and weeds, such as reed sweet grass, willow species, and alder. More recently, threats to aquatic life is caused by the presence of exotic pest fish, effects of surrounding land use, such as increased nutrient influx into water courses, invasion of new animal and plant pests, as well as expanding living zones.

Ecological linkages along Waipa and Waikato River will need to be enhanced in order to maintain and enhance biodiversity values within the floodplains. Restoration can be achieved by promoting restoration of riparian margins through fencing, planting, and undertaking targeted animal and plant pest control.

By identifying ecological corridors within the catchment, providing opportunities for these corridors to be restored and enhanced, biodiversity values throughout the catchment can be maintained and enhanced over time. Opportunities to encourage the protection and enhancement of the health and wellbeing of the Waikato River are to continue using the incentive rules that are currently in place; to provide opportunity for directed but limited levels of growth within rural areas.

8.3 Western Hill Country and Coast Ecological Management Zone

The west coast of the district comprises an extensive area of rugged country with many limestone outcrops, steep cliffs, and often steep country with small pockets of indigenous forest remaining in otherwise farmed land. The main issues in this zone are the ongoing degradation of existing forest remnants by stock intrusion, clearance of land for farming (often through aerial spraying), and intrusion of goats and deer which browse heavily on indigenous vegetation in many locations as well as the difficulty of fencing natural areas.

This management zone includes several dune lakes such as lakes Otamatearoa, Parkinson, Puketi and Waitamoumou, which are small in size within small catchments (Dean-Speirs and Neilson, 2014). Many of these lakes retain aquatic plant communities and have high restoration potential (Dean-Speirs and Neilson, 2014).

As for the Waikato hill country, the West Coast remnant forest and wetland habitats play an important role in providing habitat for indigenous fauna as refugia amongst large areas of exotic vegetation, agricultural land, and residential areas. They serve as stepping stones between the different large hill ranges, as well as sustaining a large variety of indigenous biodiversity.

Indigenous dominated scrub also has important intrinsic ecological values. It provides an ideal nurse crop in some sites for regenerating broadleaved and conifer species, which eventually become forest that supersedes the scrub as the major vegetation cover. In addition, it provides a habitat for a unique suite of species unsuited to forest environments such as sun orchids, greenhood orchids, and sundews, as well as several species of lizard.

From the landowner feedback it is evident that, like the hill country areas, the main reason these remnants still exist in the otherwise farmed land is that they are often situated in areas that are impractical or economically unviable to farm and are thus largely intact due to their location. Although many of these areas are currently unfenced, they often contain a remarkably diverse range of understorey species. Some of the forest remnants on flatter country are, however, highly degraded when unfenced and used for shade and shelter for stock. This part of the district is known to be a difficult area to manage ecologically, with the steep and erosion prone country making SNA extremely difficult to fence off from stock. The remnants of indigenous vegetation comprise podocarp species mixed with broadleaf species.

As the west coast country is so rugged and very difficult to fence, many landowners would appreciate assistance in fencing, restoration planting and animal pest control.

Residential zones along the West Coast, such as Raglan township, comprise numerous SNA intertwined with residential properties and their gardens. These features have great amenity value as well as providing indigenous fauna and flora habitats. Furthermore, it was noted during site visits in Raglan and based on communications with landowners, that weeds are a major issue in many coastal SNA (i.e. large areas of Council reserves, such as the Kaitoke walkway, are overgrown by exotic weeds).

Landowners in these areas would appreciate assistance in weed control, as well as providing knowledge replanting and ongoing maintenance techniques.

In this management zone, as throughout the Waikato District, voluntary groups undertake a range of restoration and pest control work. For example, since 2009 the Raglan community has been actively working together towards an integrated pest control program to re-establish Karioi as a seabird mountain. Currently they are implementing predator control to protect the remnant population of Oi (grey faced petrel) that still burrow around the shorelines of Karioi, while a wider programme of predator control to restore forest birds is being scaled up on the mountain each year. Oi are a “taonga species”, meaning they have special cultural significance to tangata whenua[12].

[12] https://karioimaunga.co.nz/what-we-do/

8.4 Hamilton Basin Ecological Management Zone

The Hamilton Basin is perhaps the most denuded management zone within the Waikato District. The Waikato River's riparian margins form corridors and a virtually continuous ecological linkage with deeply incised gully streams. While often highly modified and containing little indigenous vegetation, these gully systems provide important habitat for many terrestrial and freshwater species. Interspersed throughout the now highly managed urban and agricultural land, peat lakes and small forest remnants stand out as vestiges of what once was an expansive and biodiverse wetland and forest ecosystem complex.

Only small and scattered indigenous forest remnants exist in the Hamilton Basin, many of which are remnant podocarp stands, often (historically) grazed extensively by stock. Despite being small and modified these stands provide important habitat and stepping stones for many indigenous bird species and threatened long-tailed bats.

Hamilton Basin contains several peat lakes, many of which are under threat from landuse, increased nutrient inputs, pest fish and drainage. Peat lakes are often shallow and have peat-stained water that is naturally acidic, conditions that support unique and ecologically significant species assemblages. Marginal wetlands surrounding peat lakes are also ecologically significant habitats that are often under threat from vegetation clearance and drainage. Examples include lakes Rotokauri, Areare and Kaituna.

The Tamahere gully system complex, south-east of Hamilton city, is a deeply cut gully system comprising the Mangaone, Mangaonua, and Mangaharakeke gullies. The gully vegetation comprises a mixture of indigenous and exotic vegetation. Despite the large portion of exotic vegetation, the gully systems provide important habitat for many indigenous fauna species. Several threatened indigenous species are present, including black mudfish and longfin eels in the streams and wetlands, and long-tailed bats in the canopy of the riparian margins.

These gully systems are primarily threatened by the increasing pressure from surrounding land use, such as road construction and expanding residential areas. Vegetation clearance, introduction of cats and other domestic animals pose a threat to the existing indigenous habitat.

Restoration and enhancement of the gully system can be achieved by fencing, planting, and undertaking regular animal and plant pest control. Councils can assist the encouragement of protection and enhancement of the gully systems by providing advice and guidance to landowners and community groups that are restoring and enhancing gully habitats. In addition, promoting the identification of gully systems as being ecological significant and by providing incentives for landowners to legally protect these areas, may result in significant biodiversity benefits. For example, by providing resources and mechanism for restoration and by placing a monetary and market value on SNA, such as subdivision rights would, this would enhance protection of ecologically significant areas. In our experience, by creating a means to legally protect these areas, are likely to result in long-term significant biodiversity benefits which thus far, traditional land use valuations have not generally acknowledged.

8.5 Key Recommendations

Through the landowner consultation process led by WDC as part of the review stage, the following main threats facing identified SNA in the Waikato District are:

- vegetation clearance;
- stock intrusion into unfenced forest/shrubland/wetland areas;
- animal and plant pest degradation of all indigenous fauna and flora habitats; and
- degradation of the margins of estuarine wetlands and lakes by stock.

Essential components of the on-going protection and ecological restoration of biodiversity values of SNA require enhancing indigenous populations of species through ongoing weed and animal pest management, stock exclusion, and carrying out enhancement planting. By applying these restoration objectives over a wide area, in particular when involving wetland and riparian

margins, ongoing biodiversity management will enhance and restore ecological processes at a landscape scale.

The overwhelming feedback from landowners is that they are willing to undertake restoration. Many landowners are undertaking some form of informal non-legal protection and/or restoration management already with or without external support. The main constraints for landowners to fence, plant, and carry out plant and animal pest control is a lack of resources to implement restoration measures and knowledge on how to best carry out specific restoration measures.

There are many ecologically significant and large SNA found in the District, with an obvious desire by most landowners to carry out some form of biodiversity restoration who would greatly appreciate support in their efforts to do so. WDC and the Council have various funding options (e.g. WDC conservation fund or the Small Scale Community Initiatives Fund from the Council) set aside for ecological restoration and enhancement

The following is brief overview of the different community funds available:

- The **Environmental Initiatives Fund** provides one-off grants to community projects that directly enhance and/or benefit the environment or provide environmental education. www.waikatoregion.govt.nz/community/whats-happening/funding-and-scholarships/environmental-initiatives-fund
- The **Small Scale Community Initiatives Fund** supports volunteer community groups undertaking ecological restoration via animal and plant pest control and can provide small grants for plants, herbicide, pest control (including some contracted services) or monitoring gear. www.waikatoregion.govt.nz/community/whats-happening/funding-and-scholarships/natural-heritage-fund/
- The **Natural Heritage Fund** was established in 2005 to protect and manage, in perpetuity, special places of ecological significance. Key priorities include the preservation of access to waterways and the coast, as well as protection of biodiversity, heritage sites and landscapes of significance to the community. Natural heritage projects have very long term, inter-generational benefits. www.waikatoregion.govt.nz/community/whats-happening/funding-and-scholarships/natural-heritage-fund/
- **District and City councils** support voluntary protection measures and may offer some form of rates relief or other incentive for fencing costs and protection initiatives. Contact your local council for information.

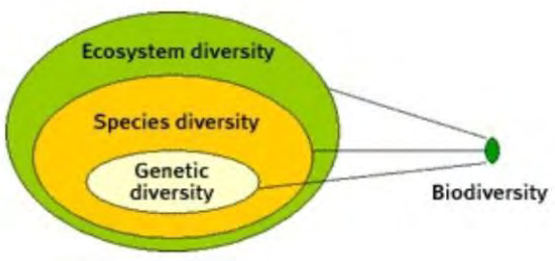
9 GLOSSARY

At risk: This means a species facing a longer-term risk of extinction in the wild (either because of severely reduced or naturally small population size or because the population is declining but buffered by either a large total population or a slow rate of decline) as identified in the New Zealand Threat Classification System lists.

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, for example, kahikatea forest likes to be seasonally flooded. The composition and abundance of species and communities in an ecosystem; and
- 'engines' that makes ecosystems work; e.g. the energy links which 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".

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; McEwen, 1987).

Ecosystems: Are 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: An endemic species is one that exists naturally in a particular environment or location (e.g. New Zealand), and does not exist naturally anywhere else.

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

Ground truthing: Undertaking a site visit of a natural feature to assess its ecological values, as well as to verify if what was found in literature and relevant databases is reflected on the ground.

Habitat: A habitat (which is Latin for "it inhabits") is 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 plant or animal species that occurs naturally without the assistance of humans in New Zealand. 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: 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 Waikato SNA is included in Appendix IV.

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© of RMA). Waikato Regional Council is identifying at the regional scale areas that meet one or more of the criteria in the operative Waikato Regional Policy Statement Appendix III as Significant Natural Areas.

Terrestrial ecosystems: Terrestrial ecosystems can be defined in the most general of 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 tussock land.

Threatened Species: A species faces a very high risk of extinction in the wild and includes nationally critical, nationally endangered and nationally vulnerable species as identified in the New Zealand Threat Classification System lists.

Threat Status: National Threat classification systems for ranking threatened species.

Unprotected: This means the site is on private and/or public land and/or water where there is no legal protection status. If it is unknown whether they are protected or not, then it "s "indeterminate"

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 native woody plants such as willows or manuka, and/or herbaceous plants such as sedges, rushes, raupo (*Typha)*, or mosses such as Sphagnum. "Willow wetlands" are wetland areas with a canopy dominated by exotic willows, but often contain native 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. Retrieved from http://www.doc.govt.nz/nature/biodiversity/nz-biodiversity-strategy-and-action-plan/new-zealand-biodiversity-strategy-2000-2020/

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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Grainger N, Collier K, Hitchmough R, Harding J, Smith B, Sutherland D 2014. Conservation status of New Zealand freshwater invertebrates, 2013. New Zealand Threat Classification Series 8. Department of Conservation, Wellington.

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APPENDIX I - KEY NATURAL AREAS DATA AND LITERATURE FOR THE WAIKATO DISTRICT

Waikato Regional Council
Resource Consents Applications Database (RUAMS)
Property Information (LAND)
Waikato Regional Coastal Plan
Areas of Significant Conservation Value (ASCV)
Beadel, S.M.; Shaw, W.B. 2000. Identification of significant natural areas in the Waikato Region using remote sensing and existing databases. Wildland Consultants Ltd Contract Report No. 340. Prepared for Waikato Regional Council. 103 pp.
Department of Conservation
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Waikato Conservancy Threatened Plant Database
BioWeb
Consents Database
Waikato Wetland Database WONI: Ausseil, A.; Gerbeaux, P.; Chadderton, W.L.; Stephens, T.; Brown, D.; Leathwick, J. 2008. Wetland ecosystems of national importance for biodiversity: Criteria, methods and candidate list of nationally important inland wetlands. Discussion document. Landcare Research Contract Report LC0707/158. Prepared for the Department of Conservation.
Directory of Wetlands in New Zealand
Biosites
Priorities Database

DOC Land Information

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Grainger, N.; Collier, K.; Hitchmough, R.; Harding, J.; Smith, B.; Sutherland, D. 2014: Conservation status of New Zealand freshwater invertebrates, 2013. New Zealand Threat Classification Series 8. Department of Conservation, Wellington. 28 p.

Hitchmough, R.; Barr, B.; Lettink, M.; Monks, J.; Reardon, J.; Tocher, M.; van Winkel, D.; Rolfe, J. 2016: Conservation status of New Zealand reptiles, 2015. New Zealand Threat Classification Series 17. Department of Conservation, Wellington. 14 p.

Newman, D.G.; Bell, B.D.; Bishop, P.J.; Burns, R.J.; Haigh, A.; Hitchmough, R.A. 2013: Conservation status of New Zealand frogs, 2013. New Zealand Threat Classification Series 5. Department of Conservation, Wellington. 10 p.

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Landcare Research

Fencing and animal pest control data collated by Landcare Research for FRST contract 'UOWX0609 – Forest Remnant Resilience'

Threatened Plants Database

National Vegetation Survey Database

Forest Research Institute Records on Protected Natural Areas

Land Environments New Zealand (LENZ)

Leathwick, J.R.; Clarkson, B.D.; Whaley, P.T. 1995. Vegetation of the Waikato Region: Current and Historical perspectives. Landcare Research contract report LC9596/022. Waikato Regional Council, Hamilton.

NIWA

New Zealand Freshwater Fish Database

Other

Nature Heritage Fund Applications (former Forest Heritage Fund (FHF))

Harding, M. 1997. Waikato Protection Strategy. A report to the Forest Heritage Fund Committee. Published by the Forest Heritage Fund, Wellington.

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QEII National Trust database (restrictions apply)

WDC Covenants database

WDC Reserves database

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

This appendix contains the following: Chapter 11 of the operative Waikato Regional Policy Statement (RPS) (WRC, 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 this project, the set of criteria for determining significance was in under review stage and became operative per 20 May 2016. 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 create 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 amended, changing the required percentage of under-represented indigenous vegetation, habitat or ecosystem types present in an ED, ER, or nationally from 10% to 20%. Appendix III below outlines the previous 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.

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

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, EW, NWR, QEII, TA.	Y / N / NS	What type of legally protected area is it? e.g. Scenic Reserve, National Park, QEII Covenant. _____ _____

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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[2]. Endemic to the Waikato Region, means currently only occurs naturally within the Waikato Region.	CE, CRI, DOC, EW	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 _____ _____

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[2] 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 EW. 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, EW, P	Y / N / NS	List under-represented vegetation/habitat type(s) and state whether rare at the national, regional, or ecological district scale? _____ _____ _____ _____

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	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
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 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.	CE, CRI, DOC, EW	Y / N / NS	Type of feature: _____ Area: Condition: _____

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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
6 It is wetland habitat for indigenous plant communities and/or indigenous fauna communities[2] 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[3]; 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. 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.	CE, CRI, DOC, EW, P Copies of Whaley *et al.* (1995) can be obtained from EW.	Y / N / NS	Type of wetland habitats/indigenous communities present: _____ _____ _____ _____ _____ Origins of wetland (natural, artificial): _____ _____ Area (ha): _____

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[2] Does not include exotic rush/pasture communities.

[3] 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
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, EW	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.* _____ _____

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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, EW, 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:	Fencing and pest control would be required for most mainland sites in the Region (irrespective of habitat type).	CE, CRI, DOC, EW, P	Y / N / NS	Rank the following factors High (H), Medium (M) or Low (L): • structural intactness ____ • ratio of indigenous:exotic species ____

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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
• 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.	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 will remain essentially as indigenous species and of 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 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.	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.		• 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 _____ 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. _____ _____ _____

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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, native dune vegetation through to coastal scrub or forest, lake margins or geothermal systems to native 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-native 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 (either by deliberate movement or dispersal of propagules such as seed or pollen). An exceptional, representative sequence will be one of the best examples of its type, taking into account its intactness, composition, and ecological processes. 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.	CE, CRI, DOC, EW, 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: _____ _____ _____ _____

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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 Col 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)
	INTERNATIONALLY SIGNIFICANT 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)**
	NATIONALLY SIGNIFICANT 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)**
	REGIONALLY SIGNIFICANT 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

A. RPS Criteria (see Table 1 above)	**B. FACTORS TO BE ASSESSED**	**C. NOTES**	**D. RESPONSE (Yes / No / Not Sure)**
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
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

A. RPS Criteria (see Table 1 above)	**B. FACTORS TO BE ASSESSED**	**C. NOTES**	**D. RESPONSE (Yes / No / Not Sure)**
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
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

Crit.	Reason for Significance*	Significance Levels*		
		International	National	Regional
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.

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 examples

APPENDIX III – 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.

APPENDIX IV - TYPES OF LEGAL PROTECTION IN THE WAIKATO DISTRICT

This appendix lists the possible legal mechanisms, or types of legal protection that have been applied to protect natural areas within the Waikato 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:

- Nature Reserve
- Scientific Reserve
- National Reserve / National Park
- Scenic Reserve
- Conservation Park
- Wilderness Area
- Ecological Area
- Sanctuary Area
- Watercourse Area
- Wildlife Management Reserve / Government Purpose Reserve (Wildlife Management)
- Wildlife Refuge / Government Purpose Reserve (Wildlife Refuge)
- Wildlife Reserve / Government Purpose Reserve (Wildlife Reserve)
- Wildlife Sanctuary / Government Purpose Reserve (Wildlife Sanctuary)
- QEII Open Space Covenant
- WDC Waikato and Franklin Sections, Conservation Covenants

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 were assessed “s "indeterminate" for RPS Criterion 1:

- Stewardship Area / Conservation Area
- Recreation Reserve
- Sanctuary Area
- Watercourse Area
- Historic Reserve
- Marginal Strip
- Local Purpose Reserve (Esplanade)

APPENDIX V - CONFIDENCE LEVELS FOR SIGNIFICANT NATURAL AREA ASSESSMENTS

The following table is adapted from Wildland Consultants Contract Report No. 1080 (DOC# 1396563). It lists the definitions and factors that are considered when applying a Confidence Level to the significance assessment of a site.

Confidence Level	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 level 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 level. · Sites that are contiguous with a site that has a high confidence level, 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. · Sites for which incomplete ecological information exists, and for which targeted surveys may result in records of threatened species. Sites with a medium confidence level 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 level have a high requirement for field survey.

APPENDIX VI – METADATA FOR THE "SIGNIFICANT NATURAL AREAS – "WAIKATO DISTRICT" DATA SET

1. Identification Information

Data Set Name:

Significant Natural Areas (SNA) – Waikato District

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 Waikato 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 (WRC) regional biodiversity management prioritisation, but is available for other Council projects. It may also be used by the Waikato 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_WAIKATO (<1599> single or aggregated features (sites))

SNA_WAIKATO_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. All layer attributes are recorded and stored in Oracle table SNA_WK_2007_ATTR.

Schema definition:

Attribute name	Attribute format	NULL attributes	External supply	Responsible 1=WRC 2=Ecologist
SITE_NUMBER	VARCHAR2(255 BYTE)	Not NULL	YES	2
PREVIOUS_KES_NUMBER	VARCHAR2(255 BYTE)	NULL allowed	YES	2
SITE_NAME	VARCHAR2(255 BYTE)	NULL allowed	YES	2
SITE_DESCRIPTION	VARCHAR2(4000 BYTE)	Not NULL	YES	2
ECOSYSTEM_TYPE	VARCHAR2(4000 BYTE)	Not NULL	YES	2
SIGNIFICANT_FLORA	VARCHAR2(4000 BYTE)	NULL allowed	NOT ALLOWED	2
LIKELY_FLORA	VARCHAR2(4000 BYTE)	NULL allowed	NOT ALLOWED	2
SIGNIFICANT_FAUNA	VARCHAR2(4000 BYTE)	NULL allowed	NOT ALLOWED	2
LIKELY_FAUNA	VARCHAR2(4000 BYTE)	NULL allowed	NOT ALLOWED	2
OTHER_FEATURES	VARCHAR2(4000 BYTE)	NULL allowed	NOT ALLOWED	2
ECOL_REASSESSMENT_REQUIRED	VARCHAR2(255 BYTE)	NULL allowed	YES	1,2
CRITERION_1	VARCHAR2(255 BYTE)	Not NULL	YES	2

CRITERION_2	VARCHAR2(255 BYTE)	Not NULL	YES	2
CRITERION_3	VARCHAR2(255 BYTE)	Not NULL	YES	2
CRITERION_4	VARCHAR2(255 BYTE)	Not NULL	YES	2
CRITERION_5	VARCHAR2(255 BYTE)	Not NULL	YES	2
CRITERION_6	VARCHAR2(255 BYTE)	Not NULL	YES	2
CRITERION_7	VARCHAR2(255 BYTE)	Not NULL	YES	2
CRITERION_8	VARCHAR2(255 BYTE)	Not NULL	YES	2
CRITERION_9	VARCHAR2(255 BYTE)	Not NULL	YES	2
CRITERION_10	VARCHAR2(255 BYTE)	Not NULL	YES	2
CRITERION_11	VARCHAR2(255 BYTE)	Not NULL	YES	2
CRITERIA_YES	VARCHAR2(255 BYTE)	NULL allowed	YES	1 (scripted)
CRITERIA_LIKELY	VARCHAR2(255 BYTE)	NULL allowed	YES	1 (scripted)
CRITERIA_INDETERMINATE	VARCHAR2(255 BYTE)	NULL allowed	YES	1 (scripted)
SIGNIFICANCE	VARCHAR2(255 BYTE)	Not NULL	YES	1 (scripted)
SIGNIFICANCE_JUSTIFICATION	VARCHAR2(4000 BYTE)	NULL allowed	YES	2
CONFIDENCE_LEVEL	VARCHAR2(255 BYTE)	Not NULL	YES	2
PEST_ANIMAL_ISSUE	VARCHAR2(255 BYTE)	NULL allowed	YES	2
PEST_PLANT_ISSUE	VARCHAR2(255 BYTE)	NULL allowed	YES	2
STOCK_ISSUE	VARCHAR2(255 BYTE)	NULL allowed	YES	2
DEVELOPMENT_ISSUE	VARCHAR2(255 BYTE)	NULL allowed	YES	2
OTHER_ISSUE	VARCHAR2(255 BYTE)	NULL allowed	YES	2
ISSUE_JUSTIFICATION	VARCHAR2(4000 BYTE)	NULL allowed	YES	2
BOUNDARY_SOURCE	VARCHAR2(255 BYTE)	NULL allowed	YES	2
BOUNDARY_CHANGE	VARCHAR2(255 BYTE)	NULL allowed	YES	2
VEG_CHANGE	VARCHAR2(255 BYTE)	Not NULL	YES	2
REFERENCES	VARCHAR2(4000 BYTE)	NULL allowed	YES	2
ASSESSMENT_NOTES	VARCHAR2(4000 BYTE)	NULL allowed	YES	2
ID	NUMBER(10,0)	Not NULL	YES	Autonumber

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 cannot be supplied to external parties without written permission from WRC first.

SITE_NUMBER[1] (Text, 9 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 (WK in the case for Waikato 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.

PREVIOUS_KES_NUMBER[1] (Text, 255 characters, can be NULL):

This attribute is usually only present if site numbers overlaps with a historic Key Ecological Site number.

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_1[2] (Text, 255 characters, cannot be NULL), short name = SITE_DESC1:
A summary of the geography, ecosystem(s) and/or primary type(s) of vegetation in a site. NB: for complex or mutli-part sites, or where there is chance of future re-splitting/grouping of blocks, avoid statements of quantities eg., avoid “A 41 ha forested block containing 3 streams, and 4 surrounding 1 ha stands”, instead put “A major forested site with minor satellites and notable streams”; 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 including the ecological, biogeographical, cultural and/or management relationship (if any) of a site to other sites (SNA or other) in the same Territorial Authority or the Waikato Region.

ECOSYSTEM_TYPE[2] (Text, 255, cannot 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 EWDOCS# 1690354.

- 'Indeterminate' = the ecosystem type(s) that comprise a site could not be determined from the data available.
- 'Island' = the site is composed of ecosystems on inshore or offshore islands;
- 'Multiple' = the site is composed of 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 is composed of coastal sand dune ecosystems;
- 'Shingle_Beach' = the site is composed of small areas of coastal beach habitat typically utilised by shorebirds for nesting;

- 'Terrestrial_Vegetation' = the site is composed of permanently or intermittently dry areas with emergent vegetation dominated by forest, scrub and/or shrubland, or tussock land;
- 'Wetland_Estuarine' = the site is composed primarily of 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 is composed primarily of 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 predominately indigenous understorey freshwater wetland vegetation (Beard, 2010).
  NB for the purpose of the SNA inventory, all text of this attribute must use underscore instead of a space, as this is important for automated checking and extractions that will come later. Use the pick-list provided in the Masterdata template (EWDOCS#2174023). Where there are more than one ecosystem type noted, the list must start with “Multiple” then a sequence of ecosystem types in order for largest to smallest area/expression, with terms separated by semicolon. Note that there underscores must be used (no spaces).

SIGNIFICANT_FLORA[2, 3] (Memo, 4000, Can be NULL), short name = SIG_FLORA:

A list of flora species known to occur within a site, that are classified, according to the New Zealand threat classification system manual (Townsend *et al.,* 2008), as ‘Threatened’ (including Nationally Critical, Nationally Endangered, Nationally Vulnerable), ‘At Risk’ (including Declining, Recovering, Relict, Naturally Uncommon) or ‘Data Deficient' (based on de Lange *et al.,* 2009 for vascular flora). Indigenous non-vascular flora not yet classified under the Townsend *et al.* (2008) system are listed with current classifications from the Molloy *et al.* (2002) system. This field may also include notable species or associations of flora known to occur at a site, in particular regionally threatened or regionally uncommon species. Species names generally consist of the common name (if known) followed by the Latin name and threat status in brackets, followed by a reference for the species record (if available), e.g. king fern (*Ptisana salicina* - Declining) - Teal (2008), swamp maire (*Syzygium maire* - Regionally uncommon) - DOC (2010), etc.

LIKELY_ FLORA[2, 3] (Memo, 4000, Can be NULL), short name = LIK_FLORA:

A list of flora species likely to occur within a site, that are classified, according to the New Zealand threat classification system (Townsend *et al.,* 2008), as ‘Threatened’ (including Nationally Critical, Nationally Endangered, Nationally Vulnerable), ‘At Risk’ (including Declining, Recovering, Relict, Naturally Uncommon) or ‘Data Deficient' (based on de Lange *et al.,* 2013 for vascular flora). Indigenous non-vascular flora not yet classified under the Townsend *et al*. (2008) system are listed with current classifications from the Molloy *et al.* (2002) system. This field may also include notable species or associations of flora likely to occur at a site, in particular regionally threatened or regionally uncommon species. See SIGNIFICANT_FLORA for examples.

SIGNIFICANT_FAUNA[2, 3] (Memo, 4000, Can be NULL), short name = SIG_FAUNA:

A list of fauna species known to occur within a site, that are classified, according to the New Zealand threat classification system (Townsend *et al.,* 2008), as ‘Threatened’ (including Nationally Critical, Nationally Endangered, Nationally Vulnerable), ‘At Risk’ (including Declining, Recovering, Relict, Naturally Uncommon) or ‘Data Deficient’. Indigenous fauna not yet classified under the Townsend *et al*. (2008) system are listed with current classifications from the Molloy *et al.* (2002) system. This field may also include notable

species or associations of fauna known to occur at a site, in particular regionally threatened or regionally uncommon species. Species names generally consist of the common name (if known) followed by the Latin name and threat status in brackets, followed by a reference for the species record (if available), e.g. North Island long-tailed bat (Chalinolobus tuberculatus - Nationally vulnerable) - DOC (2010), bellbird (Anthornis melanura melanura - Regionally uncommon tbc) - DOC (2010), etc.

LIKELY_ FAUNA[2, 3] (Memo, 4000, Can be NULL) short name = LIK_FAUNA:

A list of fauna species likely to occur within a site, that are classified, according to the New Zealand threat classification system (Townsend *et al.,* 2008), as 'Threatened' (including Nationally Critical, Nationally Endangered, Nationally Vulnerable), 'At Risk' (including Declining, Recovering, Relict, Naturally Uncommon) or 'Data Deficient'. Indigenous fauna not yet classified under the Townsend *et al*. (2008) system are listed with current classifications from the Molloy *et al.* (2002) system. This field may also include notable species or associations of fauna likely to occur at a site, in particular regionally threatened or regionally uncommon species. See SIGNIFICANT_FAUNA for examples.

OTHER_FEATURES[2, 3] (Memo, 4000, Can be NULL), short name = OTHER_FEAT:

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, Cannot be NULL):

The assessment of criterion 1 of the significance criteria in Appendix 3 of the Operative 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, Cannot be NULL):

The assessment of criterion 2 of the significance criteria in Appendix 3 of the Operative 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, Cannot be NULL):

The assessment of criterion 3 of the significance criteria in Appendix 3 of the Operative 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'.

***NB**: Further detail for the assessment of RPS significance criterion 3 is provided in Appendix 3 of these specifications.*

CRITERION_4[2] (Text, 255, Cannot be NULL):
The assessment of criterion 4 of the significance criteria in Appendix 3 of the Operative 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, Cannot be NULL):
The assessment of criterion 5 of the significance criteria in Appendix 3 of the Operative 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, Cannot be NULL):
The assessment of criterion 6 of the significance criteria in Appendix 3 of the Operative 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
- hydroelectric 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, Cannot be NULL):

The assessment of criterion 7 of the significance criteria in Appendix 3 of the Operative 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, Cannot be NULL):

The assessment of criterion 8 of the significance criteria in Appendix 3 of the Operative 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, Cannot be NULL), short name = CRIT_9:

The assessment of criterion 9 of the significance criteria in Appendix 3 of the Operative 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, Cannot be NULL), short name = CRIT_10:

The assessment of criterion 10 of the significance criteria in Appendix 3 of the Operative 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, Cannot be NULL), short name = CRIT_11:

The assessment of criterion 11 of the significance criteria in Appendix 3 of the Operative 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'.

SIGNIFICANCE[2] (Text, 255, Cannot be NULL), short name = SIGNIF:

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), short name = SIGNIF_JST:

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, Cannot be NULL), short name = CONF_LEVEL:

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 Wildland Consultants Ltd. Contract Report No. 1080 (DOC# 1396563). 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, Cannot be NULL), short name = ANIMAL_ISS:

This is used to indicate whether any pest animal (as defined in WRC 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, Cannot be NULL), short name = PLANT_ISS:

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

STOCK_ISSUE[2] (Text, 255, Cannot be NULL), short name = STOCK_ISS:

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, Cannot be NULL), short name = DEVEL_ISS:

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, Cannot be NULL), short name = OTHER_ISS:

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), short name = ISSUE_JUST:

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.

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

This is a list of citations, delimited by semi-colon, for the spatial data sets used to derive the boundary of a site (e.g. WRAPS (2007); BIOVEG (2007); DoC (2006), etc.). A bibliography of the data sets cited in this attribute is provided in either a separate document or MS Excel worksheet.

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.

ASSESSMENT_NOTES[2] (Memo, 4000, Can be NULL), short name = NOTES:

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, Cannot be NULL):

The unique identifier automatically assigned to the site. This is the primary key.

Key Words:

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

Resource:

Land, GIS

Data Set Ids:

1291.09@WAIKATOREGION.GOVT.NZ

DOCS# 2122957

Metadata Date:

21 March 2012

2. Contact Details

Contact Organisation:

Waikato Regional Council (WRC)

Contact Position:

Spatial Analyst - Biodiversity

Programme:

Spatial Information

Contact Address:

401 Grey St., Hamilton East. Ph.: (07) 859 0999, Fax: (07) 859 0998

Email: inforeq@waikatoregion.govt.nz

Supplier:

Kessels and Associates (trading as Kessels Ecology)

Contact Address:

134 Clyde street, Hamilton East. Ph.: (07) 856 0467

Email: info@kessels-ecology.co.nz

3. Spatial Information

Geographic Extent:

Various locations throughout the Waikato District of the Waikato Region, New Zealand.

Positional Accuracy:

The boundaries of the SNA_WAIKATO data set are derived from other data sets, which are listed in the "Related Information" section of this metadata. The positional accuracy of SNA_WAIKATO is thus dependent on the positional accuracy of these other data sets. The accumulated positional accuracy of SNA_WAIKATO 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 WRC agreed on the inclusion of these.

4. Data Acquisition History

Period and Frequency of Record:

The derivation of SNA_WAIKATO relied heavily on a "desktop" exercise using the 2007 WRAPS Aerial Photography (i.e. most sites were not inspected in the field). Therefore, it must 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 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. WRC provided contract specifications (DOCS# 2151941) and datasets were provided to Kessels and Associates Ltd. (trading as Kessels Ecology) (hereafter "Kessels Ecology") 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://data.waikatoregion.govt.nz:8080/ords/f?p=140:12:10804034289096::NO::P12_METADATA_ID:844) - for the Waikato District area.
- Extract of " GIS_PHOTOS.CURRENT_REGIONAL_PHOTOS" from the Aerial Photography - WRAPS 2012 - GIS Layer http://data.waikatoregion.govt.nz:8080/ords/f?p=140:12:0::NO::P12_METADATA_ID:300 - for the Waikato 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://data.waikatoregion.govt.nz:8080/ords/f?p=140:12:10804034289096::NO::P12_METADATA_ID:855 for the Waikato District area.
- Bioclimatic Zones - GIS Layer http://data.waikatoregion.govt.nz:8080/ords/f?p=140:12:10804034289096::NO::P12_METADATA_ID:81 for the Waikato District area.
- Extract of Biodiversity Vegetation (BIOVEG) - GIS Layer (2002) http://data.waikatoregion.govt.nz:8080/ords/f?p=140:12:10804034289096::NO::P12_METADATA_ID:866 for the Waikato District area (also Waikato and South Waikato Districts if needed).
- Extract of Biodiversity Vegetation (BIOVEG) - GIS Layer (2007) **http://data.waikatoregion.govt.nz:8080/ords/f?p=140:12:10804034289096::NO::P12_METADATA_ID:867** for the Waikato District area (also Otorohanga and Waipa Districts if needed).
- Extract of Biosecurity - Regional Animal Pest Control Areas - GIS Layer http://data.waikatoregion.govt.nz:8080/ords/f?p=140:12:10804034289096::NO::P12_METADATA_ID:876 for the Waikato District Area.
- Copy of the report: “Natural Heritage of Waikato 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://data.waikatoregion.govt.nz:8080/ords/f?p=140:12:10804034289096::NO::P12_METADATA_ID:1083 - for the Waikato District Area.
- Extract of "GIS_ALL.RACS_SOILCON_COMPARTMENT" and "GIS_ALL.RACS_SOILCON_FENCE" from the RACS Soil Conservation Assets GIS Layer

http://data.waikatoregion.govt.nz:8080/ords/f?p=140:12:10804034289096::NO::P12_METADATA_ID:1083 - for the Waikato District Area.

- Rivers SNA - GIS Layer (http://data.waikatoregion.govt.nz:8080/ords/f?p=140:12:10804034289096::NO::P12_METADATA_ID:1107 - 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 South Waikato, Thames-Coromandel, Waipa, Waikato and Waitomo Districts.
- Extract of the Draft "Significant Natural Areas - Karst Ecosystems" GIS Layer for the Waikato District Area. **Acknowledgement, Reference, and/or Copyright Notice**: "Derived from Waikato Regional Council Significant Natural Areas - Karst data, 2010. Copyright Reserved."
- Draft "Waikato Region Limestone Geology Likelihood" GIS Layer. **Acknowledgement, Reference, and/or Copyright Notice**: "Waikato Region Limestone Geology Likelihood features derived by Waikato Regional Council, 2009. Copyright Reserved."
- Bioclimatic Zones - GIS Layer
- Extract from the Legal Protection and Tenure GIS layer for Waikato District (**WRC Metadata Document Number 2119666)**

Data supplied by the New Zealand Archaeological Association (NZAA)

- Extract of Archaeological Sites GIS Layer - **WRC Metadata Document Number 881908**) for the Waikato 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 Waikato 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 - **WRC Metadata Document Number 1021377**) for the Waikato District Area.
- Extract of Ecological Regions and Districts - GIS Layer - **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).

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

- "GIS_ALL.CRS_PROPERTY_WAIKATO" from the Properties - GIS Layer - **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 - **WRC Metadata Document Number 915250** for the Waikato District area (also freely available from LINZ).
- Extract of "NZTopo Lakes", "NZTopo Ponds" and "NZTopo Rivers" from 2009 LINZ NZTopo data, for the Waikato District area. Relevant metadata - **WRC Metadata Document Number 885309**
- Extract of "GIS_ALL.GEOGRAPHIC_PLACE_NAME_EW" from the Geographic Place Names - GIS Layer - **WRC Metadata Document Number 881334** for the Waikato 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 Waikato District.

Data supplied by QEII National Trust

- Extract of QEII National Trust Covenants - GIS Layer - **WRC Metadata Document Number 881117** for the Waikato 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 - **WRC Metadata Document Number 883529** for the Waikato 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 **WRC Metadata Document Number 881411**) for the Waikato 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 - **WRC Metadata Document Number 871640** for the Waikato District.

Data supplied by the Waikato Biodiversity Forum

- Extract of Biodiversity Community Restoration Projects - GIS Layer - **WRC Metadata Document Number 992959** for the Waikato District area.

Data supplied by the Waikato District Council

- Extract of "GIS_ALL.DIST_PLAN_WPDC_RES" from the District Planning Zones GIS Layer - **WRC Metadata Document Number 1062713** for the Waikato District area.

Other data sets freely supplied under no license

- Subset of NZTOPO50 Topographic Maps (DOCS# 1562505) for Waikato District
- Subset of LANDCOVER_DATABASE2 (DOCS# 933628) for Waikato District
- Subset of Land Environments New Zealand (LENZ) (DOCS# 881554) for Waikato District

- Subset of DOC_NGA_WHENUA_RAHUI_COVENANT (DOCS# 1215463) for Waikato District
- Subset of ECOLOGICAL_DISTRICT (DOCS# 881153) for Waikato District
- Subset of BIOCLIMATIC_ZONE (DOCS# 1086812) for Waikato District
- Subset of "Vegetation Monitoring Plots" GIS data layer for the Waikato District (non-corporate, under development)
- Waikato District Ecological Sites GIS data, photos and documents sourced from Waikato District Council
- Subset of KEY_ECOLOGICAL_SITES (DOCS# 881987) for Waikato District
- Subset of DoC BIMS GIS data and accompanying reports for Waikato District
- Scanned copies of 1993 WRAPS for the Waikato District if required
- Subset of BIOSEC_TB_VECTOR_SECTOR (DOCS# 882824) for Waikato District
- Sites of Special Wildlife Interest (SSWI) for Waikato District
- Simplified version of CRS_PROPERTY_WAIKATO (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 Kessels Ecology for identifying, evaluating and creating the SNA_WAIKATO attribute and spatial data are provided in the following documents: Contract for Services: Inventory and ranking of significant natural areas of Waikato District (DOCS# 2273314), and Waikato Regional Council Technical Report 2012/2017: "Significant Natural Areas of the Waikato District: Terrestrial and Wetland Ecosystems" (DOCS# 10425482). 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 Waikato District.

2) Reviewed boundaries and classification (i.e. LCDB2_NAME attribute) of BIODIVERSITY VEGETATION_2007 (hereafter "bioveg") GIS data for Waikato District. Revised boundaries of bioveg polygons where boundaries were deemed inaccurate based on interpretation of 2012 WRAPS imagery, Google Earth imagery or LCDB2 data. Where existing classification was deemed inaccurate, Kessels Ecology revised this based on interpretation of 2012 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 WAIKATO 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) Waikato Regional 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_WAIKATO data set (hereafter "SNA") using the guidelines in Waikato Regional Council technical report TR2002/15 (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) Kessels Ecology incorporated a revised methodology of assessing the significance of SNA based on RPS Criterion 3, developed by Waikato Regional Council in consultation with Wildland Consultants Ltd, and based on newly released threat classification systems (Townsend *et al.,* 2008). For herpetofauna (Hitchmough *et al.,* 2016), for vascular plants (de Lange *et al.,* 2013), freshwater invertebrates (Graigner *et al.,* 2014), for freshwater vertebrates (Goodman *et al.,* 2014), for mammals (O’Donnell *et al.,* 2012), and for avifauna (Robertson *et al.,* 2017).

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 Waikato District (DOCS# 2273314).

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

11) Kessels Ecology revised and updated Bioveg and SNA data sets as deemed necessary in negotiations with the Waikato Regional Council.

12) The resulting spatial data was refined to remove geometry errors and to aggregate and dissolve polygons by site number.

13) Metadata was written by the Waikato Regional Council and the data was made corporate as GIS_ALL.SNA_WAIKATO.

14) The data and attribute tables was also provided to Waikato District Council and DOC - Waikato Conservancy for review at a later stage. The feedback from these organisations was also provided to Kessels Ecology.

15) A thorough review process was started by Waikato District Council, involving all landowners with SNA on their property. All feedback received by landowners was incorporates in an updated SNA dataset and attribute table. SNA on the properties of 50 landowners were visited and visually inspected and results used to update the SNA dataset and attribute tables.

16) A draft SNA report were provided to the Waikato Regional Council, DOC and Waikato District Council for review. The Waikato Regional Council proceeded to provide collated feedback with recommended changes to Kessels Ecology. This step was repeated a number of times until the outputs were deemed satisfactory by the Waikato Regional Council.

17) Kessels Ecology implemented any revisions required based on feedback from the peerreview, and also send documentation to correspond to each point raised by the peer review. The final report is yet to be made a full Council Technical Report for publishing.

Note: The provisional data is subject to feedback from DOC, Waikato District Council, relevant stakeholders and the general public. It is likely to change pending this feedback.

5. 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 Waikato District Council Reserve and Covenant data sets; whether vegetation is predominantly indigenous or exotic, was primarily based on the classification used in the Bioveg data set, which has been road side field-checked for approximately 10% of the dataset. However, many attributes were recorded based on expert ecological knowledge of the area by Kessels Ecology, with additional information from existing literature and reports.

The 11 criteria that the significance of sites was assessed against are found in appendix 3 of the WRC Regional Policy Statement (WRC, 2016). Kessels Ecology 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 Kessels Ecology 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 Kessels Ecology 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:

As at 2 February 2017 the provisional data is considered 99% complete, 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 further feedback, including that from Waikato District Council, DoC and/or other sources, including private landowners and field observations necessitate it.

Some attributes will be empty for some sites as 'Null' is a valid value for some fields.

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_WAIKATO data set is also subject to the limitations of the data sets it was derived from.

The data is considered a provisional inventory, ranking of SNA within Waikato District as at 2012. It is to be used in subsequent analyses and community consultation to help with validating and finalising the SNA of the Waikato 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 section 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 WRC 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.

6. Distribution Information

Data Form:

Digital GIS files (Oracle Spatial, MS Access (GeoMedia), Shapefiles, geodatabase files, 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:

All provisional spatial and attribute data are stored in Oracle Database. 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 Analyst in cooperation with an Ecologist will apply those changes to the data either in an ad hoc or bundled manner depending on the number of changes required.

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 WRC but appropriate Council

staff will decide whether or not to implement those changes at their own discretion. 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. Waikato 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 Waikato District as at 2012 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 Waikato District.

PLEASE NOTE THE DISCLAIMERS BELOW.

The first report to be derived directly from the data set will be the Kessels Ecology contract report, "Significant Natural Areas of the Waikato District: Terrestrial and Wetland Ecosystems".

Data Set Availability:

The data was initially available only to Waikato Regional Council and Kessels Ecology staff to be used strictly for internal purposes. The spatial data, the "Significant Natural Areas of the Waikato District" report, and a spreadsheet of all attribute and ranking data can be made available to Waikato 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 Waikato 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 Kessels Ecology 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 Waikato 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 Waikato 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 Waikato District. It may be subject to revision through consultation with the Waikato 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 Waikato 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.

7. Status Information

Data Status:

As at 2 February 2017, the provisional data is considered 99% complete, 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 Waikato 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.

8. Further Metadata Information

Metadata date:

26 May 2017

Related Information:

Boundary source data sets:

The following data sets were used for deriving the boundaries of the SNA_WAIKATO 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_WAIKATO (2010): "GIS_ALL.CRS_PARCEL_WAIKATO" 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)

Waikato DC Reserves (2011): Waikato 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)

WRAPS (2012): Aerial Photography - WRAPS 2012 - GIS Layer (metadata: DOCS# 1410510)

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

Updated system for evaluation of ecological significance in the Waikato Region based on Townsend *et al.,* 2008. DOCS# 1496182

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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 Waikato District (DOCS# 2273314).

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).

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WWW Links:

None.

Need More Help?

Email the Dataset Administrator:

inforeq@waikatoregion.govt.nz

APPENDIX VII - SIGNIFICANT NATURAL AREAS PER ECOLOGICAL MANAGEMENT ZONE

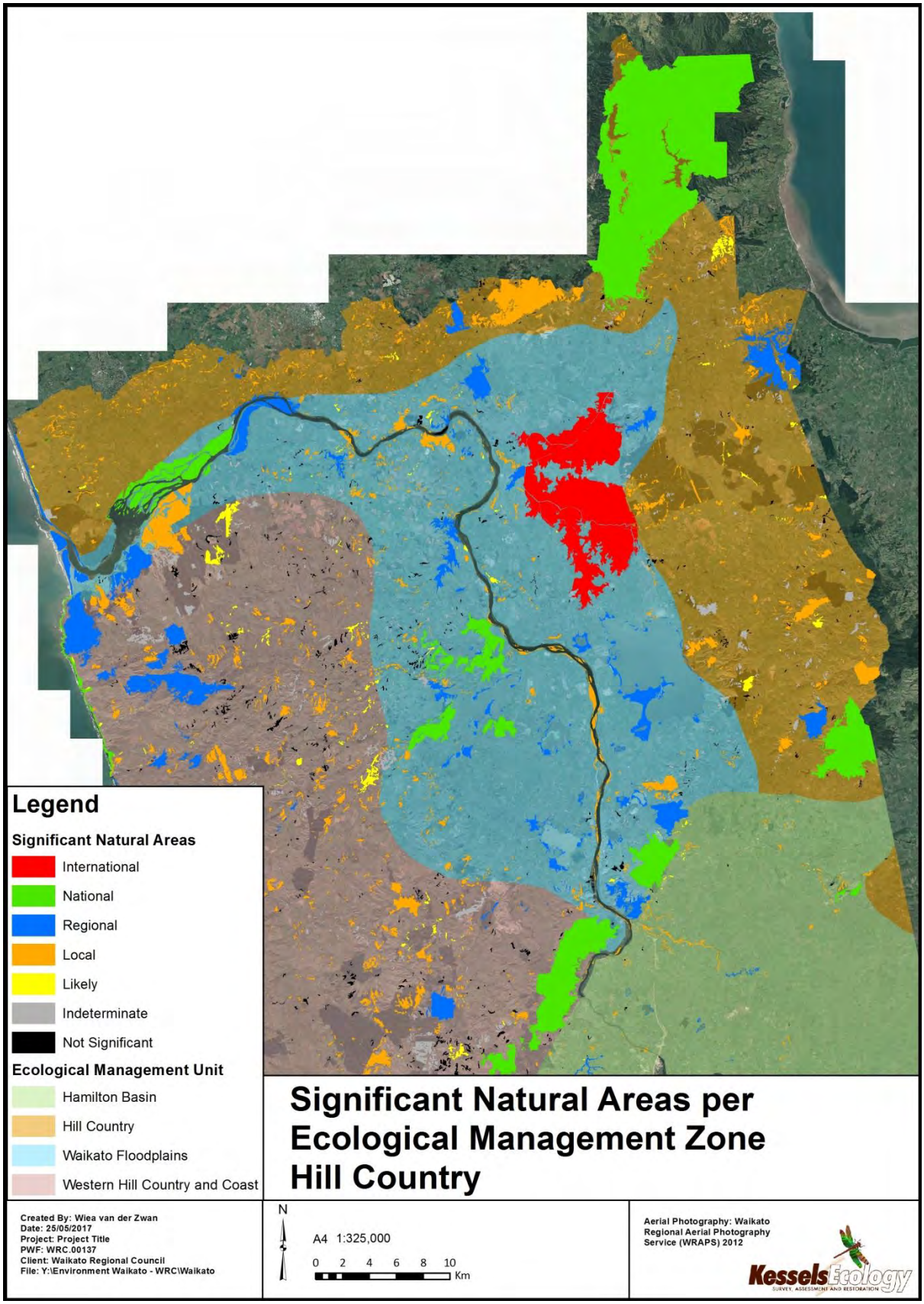

Figure 1. SNA in the Hill Country in the Waikato District.

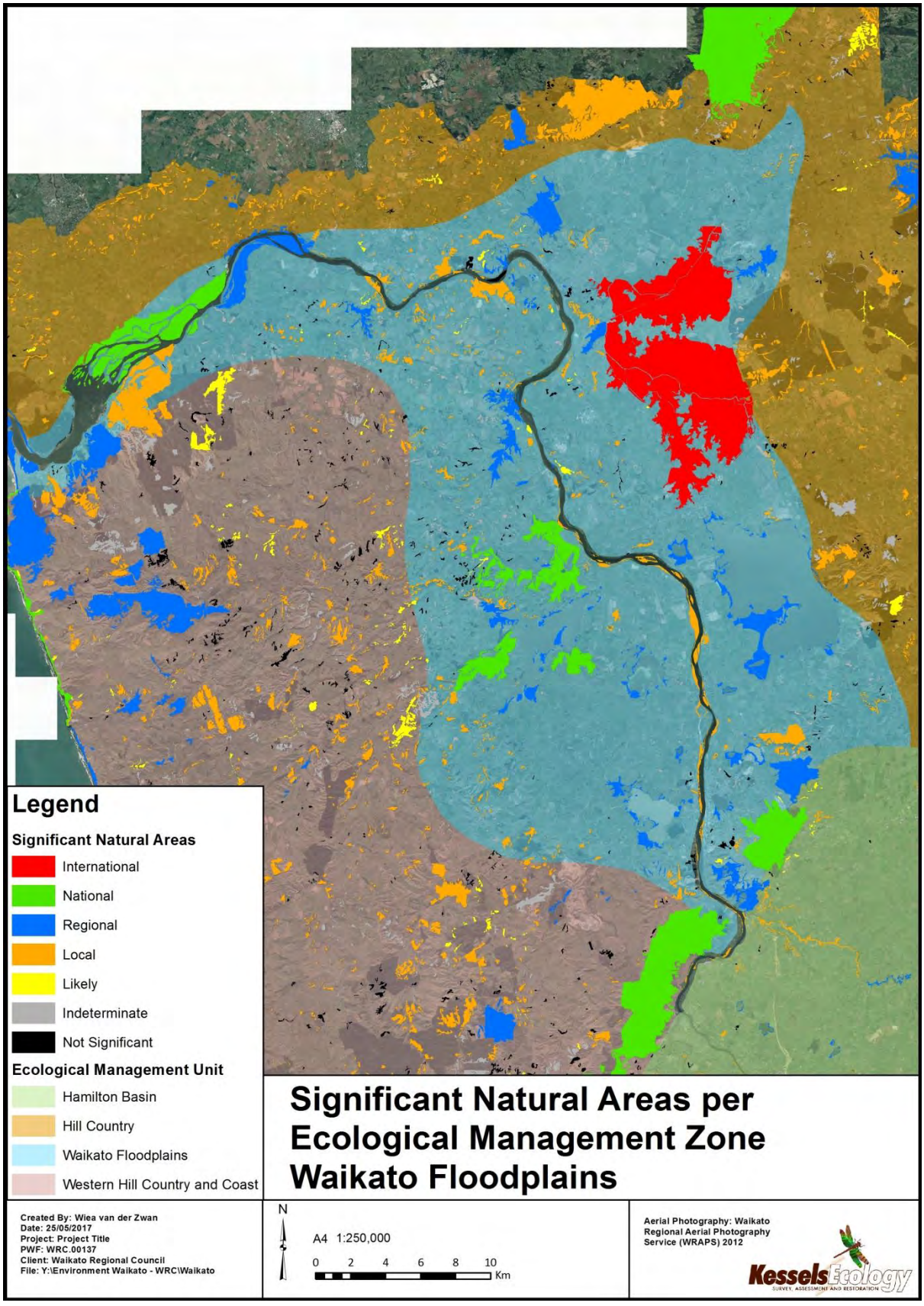

Figure 2. SNA on the Waikato Floodplains in the Waikato District.

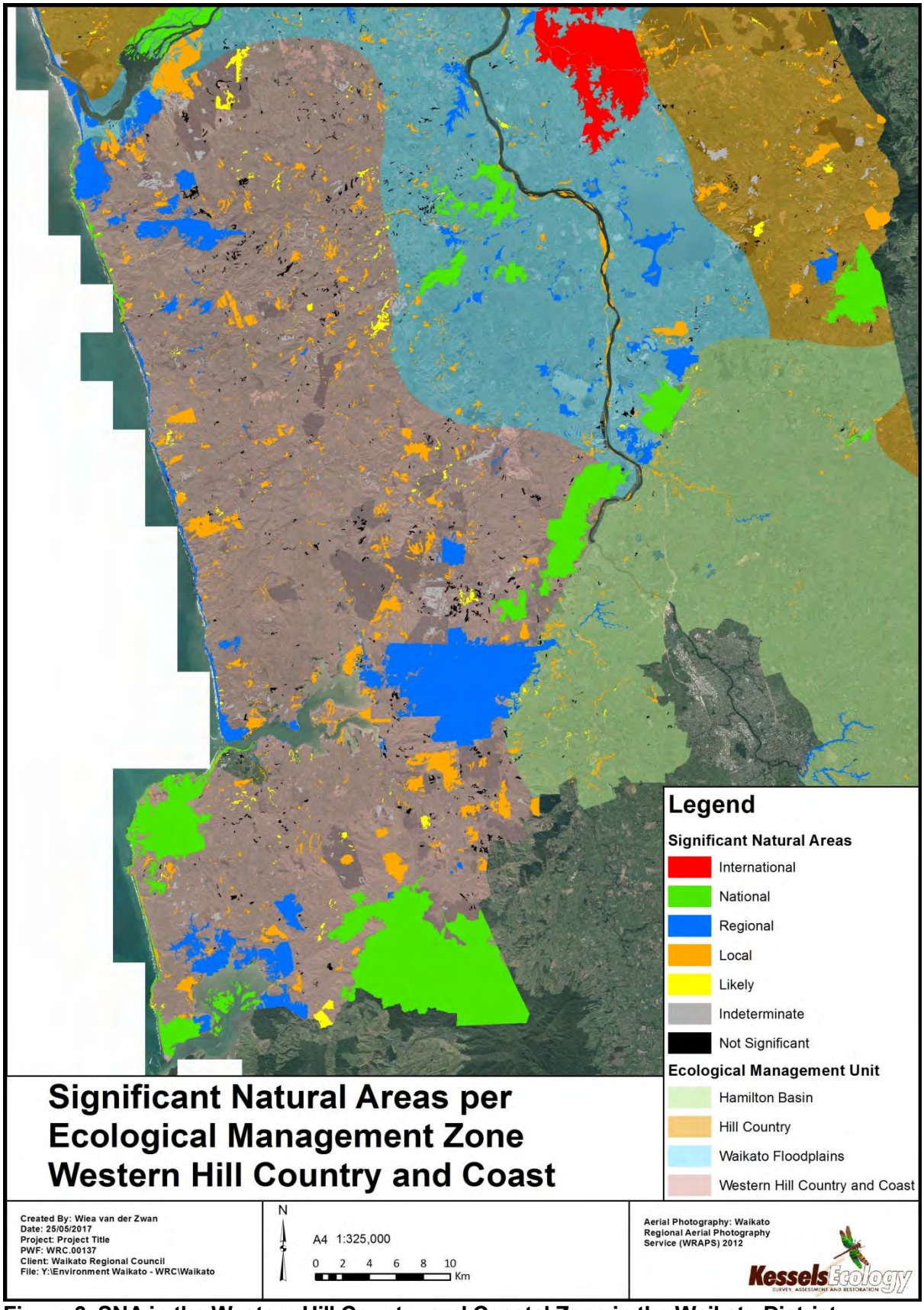

Figure 3. SNA in the Western Hill Country and Coastal Zone in the Waikato District.

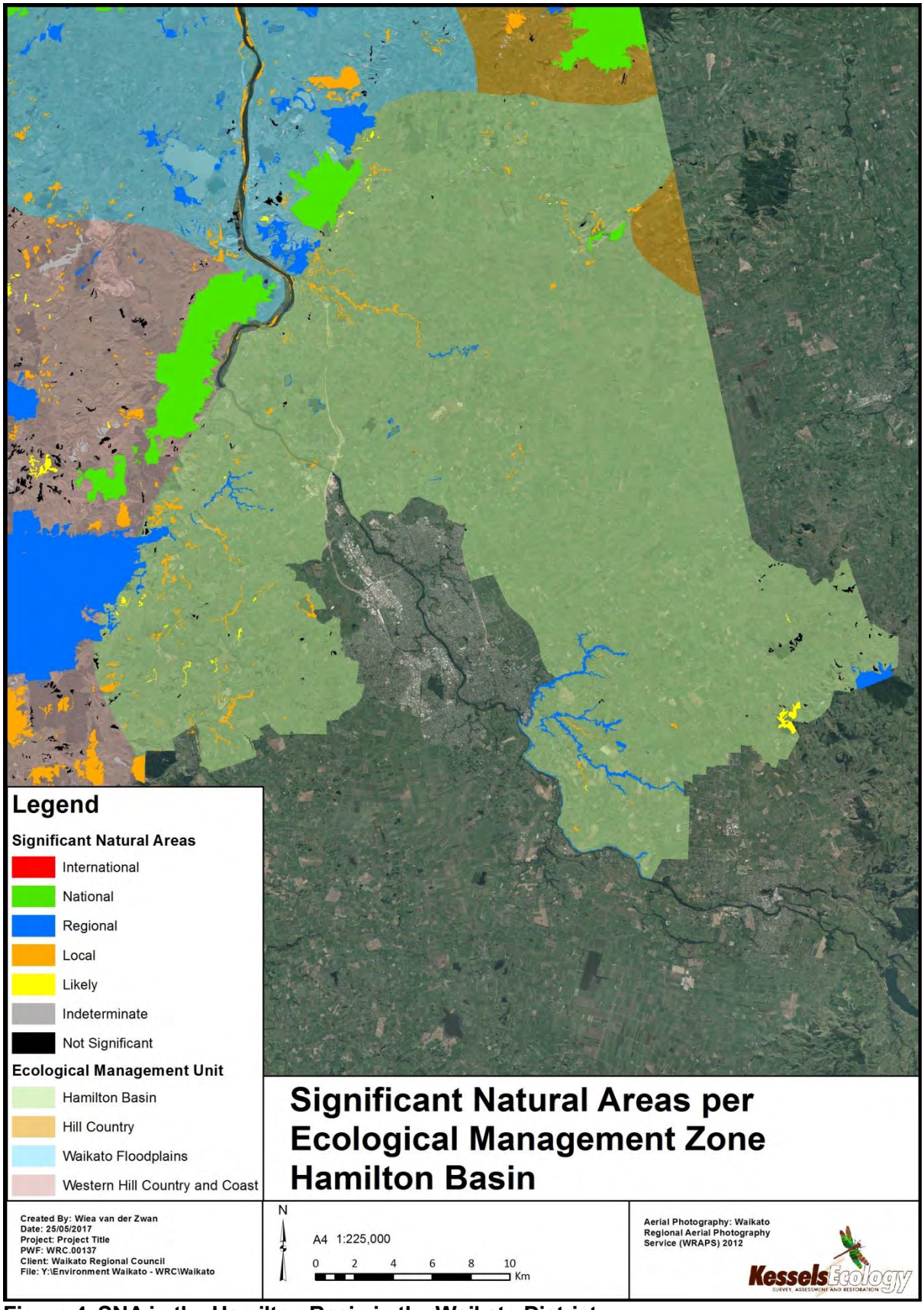

Figure 4. SNA in the Hamilton Basin in the Waikato District.

APPENDIX VIII - ECOLOGICAL DISTRICT STATISTICS

Distribution of the different Ecological Districts (EDs) within the Waikato District (Table 1). Only Raglan and Meremere EDs are entirely contained within Waikato District. In the west, Tainui ER contains Raglan ED and Kawhia ED. In the north, Auckland ER contains Manukau ED, Hunua ED, and Awhitu ED. Waikato ER contains Hapuakohe ED, Meremere ED, Maungatautari ED, and Hamilton ED, and a very small part of Hauraki ED.

Vegetation composition of indigenous vegetation per ED within the Waikato District pre-European time versus current status (Table 2). Most vegetation types, especially primary forest, wetland and duneland, is highly under-represented within the Waikato District. Overall only around 10.72% of the Waikato District still contains primary forest and wetland habitat (Leathwick *et al.,* 1995). This compares marginally with the other District Councils within New Zealand, ranking 24th across the 73 councils, highlighted by the fact that only 1.4% of New Zealand's Nationally Threatened Vegetation units are within Waikato District (Walker *et al.,* 2005).

Table 1. Areas of Ecological Districts (EDs) within the Waikato District (WDC).

Ecological Region	Ecological District	Total Area (ha) of ED	Area (ha) of ED Within WDC	% of ED Within WDC
Tainui	Raglan	132,439	130,416	98.5
Tainui	Kawhia	129,060	36,791	28.5
Auckland	Manukau	78,560	14,320	18.2
Auckland	Awhitu	28,764	6,500	22.6
Auckland	Hunua	67,920	19,498	28.7
Waikato	Hapuakohe	73,703	47,447	64.4
Waikato	Meremere	101,618	101,546	99.9
Waikato	Maungatautari	87,097	4,901	5.6
Waikato	Hamilton	159,344	79,141	49.7
Waikato	Hauraki	77,334	441	0.6

Table 2. Areas (ha) of ecologically significant sites and levels of relative significance in Waikato District tabulated by Ecological District (evaluated using the Waikato Regional Council criteria).

Ecological District	Significance Level				Likely to meet one or more WRC criteria (Likely)	Insufficient information to evaluate the criteria (Indeterminate)	Do not meet any WRC criteria (Not Significant)
	International	National	Regional	Local			
Awhitu		21.9	104.3	164.1	21.6	46.9	3.2
Hamilton		349.5	978.5	689.0	104.6	34.9	60.1
Hapuakohe	99.1	1464.4	1139.3	1558.7	321.3	664.9	130.5
Hauraki	0.3		8.6	6.5			2.5
Hunua		11929.8	12.7	1361.2	6.4	43.8	50.5
Kawhia		11836.4	2053.6	1001.9	278.3	189.7	113.1
Manukau		62.4	248.1	503.6	17.0	18.7	9.2
Maungatautari			127.2		41.9	7.6	71.2
Meremere	6169.2	3256.0	3748.7	2687.1	111.1	458.4	267.2
Raglan		2532.2	9403.8	6097.2	841.6	1579.5	1091.4
Areas Outside EDs	0.7	713.6	571.5	410.9	17.1	43.4	40.0
TOTAL	**6269.3**	**32166.4**	**18396.2**	**14480.1**	**1760.9**	**3087.8**	**1839.0**

APPENDIX IX – PHOTOS

Photo 1. Bridal Veil Falls, Raglan.

Photo 2. Riparian margins, saltmarsh, mudflats leading into the Raglan Harbour. (Wiea van der Zwan, Kessels Ecology).

Photo 3. Lower boundary of the Hakarimata ranges showing regenerating podocarp forest.

Photo 4. Podocarp-broadleaf indigenous forest remnant surrounded by farmland in Western Waikato. (Wiea van der Zwan, Kessels Ecology).

Photo 5. *Ficinia spiralis* at Port Waikato. (Wiea van der Zwan, Kessels Ecology).

Photo 6. Coastal Forest at Te Toto Gorge, Raglan. (Wiea van der Zwan, Kessels Ecology).

Photo 7. Westcoast Hillcountry. Limestone outcrops. (Wiea van der Zwan, Kessels Ecology).

Photo 8. Lake Rotokauri. (Wiea van der Zwan, Kessels Ecology).

Photo 9. Aotea Harbour. Australasian Pied Stilt (*Himantopus himantopus leucocephalus*) taking off, Royal Spoonbill, Kotuku (*Platalea regia*) wading, and Variable Oystercatcher, Torea (*Haematopus unicolour*) in the foreground (Adrienne Livingstone, Kessels Ecology).

Photo 10. Copper skink (*Oligosoma aeneum*). (Peter Langlands, Kessels Ecology).

Photo 10. Long tailed bat (*Chalinolobus tuberculatus (North Island)*), Fiordland (Hannah Mueller, Kessels Ecology).

Photo 11. Hochstetter's Frog (*Leiopelma hochstetteri sensu stricto*). (Wiea van der Zwan, Kessels Ecology).

Photo 13. Giant kokopu (*Galaxias argenteus*), Rotokauri Drain. (Jennifer Price, Kessels Ecology).

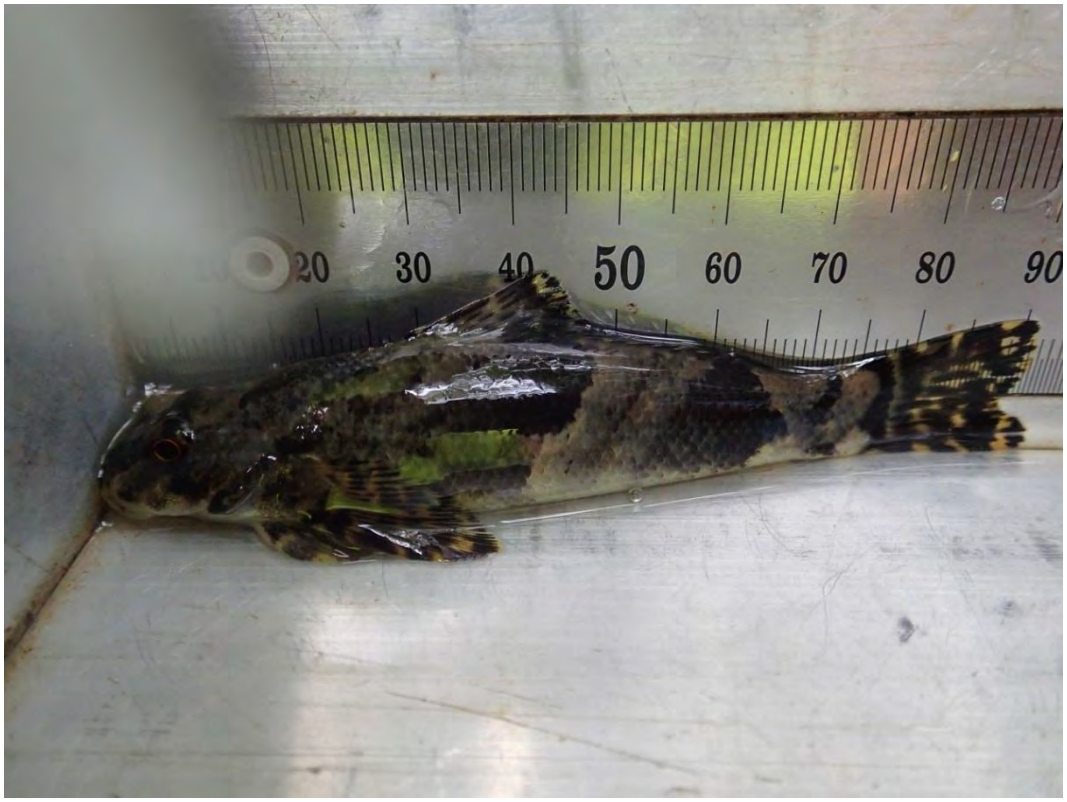

Photo 14. Torrentfish (*Cheimarrichthys fosteri*). (Jennifer Price, Kessels Ecology).

Photo 15. Koaro (*Galaxias brevipinnis*). (Jennifer Price, Kessels Ecology).

Photo 16. Black mudfish (*Neochanna diversus*), Rangiriri. (Jennifer Price, Kessels Ecology).

Photo 17. Wild goats along in the Western Waikato area. (Wiea van der Zwan, Kessels Ecology).

Photo 18. Rat encountered in an SNA along the Raglan Harbour. (Wiea van der Zwan, Kessels Ecology).

APPENDIX X – SPECIES GLOSSARY

Flora and fauna species used in the report text, listed here with common and scientific name. Both indigenous and exotic species are listed here. Threatened species are listed with their threat status in section 5 above.

Avifauna

Common name	Scientific name
Rifleman	*Acanthisitta chloris*
Brown teal	*Anas chlorotis*
Grey duck	*Anas superciliosa*
Bellbird	*Anthornis melanura melanura*
New Zealand pitpit	*Anthus novaeseelandiae novaeseelandiae*
North Island brown kiwi	*Apteryx mantelli*
White heron	*Ardea modesta*
Australasian bittern	*Botaurus poiciloptilus*
North Island fernbird	*Bowdleria punctata vealeae*
North Island kokako	*Callaeas wilsoni*
Banded dotterel	*Charadrius bicinctus bicinctus*
Shining cuckoo	*Chrysococcyx lucidus lucidus*
Yellow-crowned parakeet	*Cyanoramphus auriceps*
Black swan	*Cygnus atratus*
Long-tailed cuckoo	*Eudynamys taitensis*
New Zealand falcon	*Falco novaeseelandiae*
Banded rail	*Gallirallus philippensis assimilis*
Grey warbler	*Gerygone igata*
New Zealand pied oystercatcher	*Haematopus finschi*
Kereru	*Hemiphaga novaeseelandiae novaeseelandiae*
Pied stilt	*Himantopus himantopus leucocephalus*
Caspian tern	*Hydroprogne caspia*
Blue duck	*Hymenolaimus malachorhynchos*
Black billed gull	*Larus bulleri*
Red billed gull	*Larus novaehollandiae scopulinus*
Whitehead	*Mohoua albicilla*
New Zealand kaka	*Nestor meridionalis*
North Island kaka	*Nestor meridionalis septentrionalis*
Tomtit	*Petroica macrocephala*
Pied tomtit	*Petroica macrocephala toitoi*

Black shag	*Phalacrocorax carbo novaehollandiae*
Little black shag	*Phalacrocorax sulcirostris*
Royal spoonbill	*Platalea regia*
New Zealand dabchick	*Poliocephalus rufopectus*
Pukeko	*Porphyrio melanotus melanotus*
Marsh crake	*Porzana pusilla affinis*
Spotless crake	*Porzana tabuensis plumbea*
Black petrel, Taiko	*Procellaria parkinsoni*
Tui	*Prosthemadera novaeseelandiae novaeseelandiae'*
Cook's petrel, Titi	*Pterodroma cookii*
Grey faced petrel, Oi	*Pterodroma macroptera gouldi*
Fantail	*Rhipidura fuliginosa placabilis*
Kingfisher	*Todiramphus sanctus vagans*

Mammals

Common name	**Scientific name**
North Island long-tailed bat	*Chalinolobus tuberculatus*

Fish

Common name	**Scientific name**
Catfish	*Ameiurus nebulatus*
Shortfin eel	*Anguilla australis*
Longfin eels	*Anguilla dieffenbachii*
Goldfish	*Carassius auratus*
Torrentfish	*Cheimarrichthys fosteri*
Koi carp	*Cyprinus carpio*
Kakahi	*Echyridella menziesii*
Giant kokopu	*Galaxias argenteus*
Koaro	*Galaxias brevipinnis*
Banded kokopu	*Galaxias fasciatus*
Inanga	*Galaxias maculatus*
Shortjaw kokopu	*Galaxias postvectis*
Gambusia	*Gambusia affinis*
Lamprey	*Geotria australis'*
Cran's bully	*Gobiomorphus basalis*
Common bully	*Gobiomorphus cotidianus*

Redfin bully	*Gobiomorphus huttoni*
Grey mullet	*Mugil cephalus*
Black mudfish	*Neochanna diversus*
Rainbow trout	*Oncorhynchus mykiss*
Common smelt	*Retropinna retropinna*
Brown trout	*Salmo trutta*
Rudd	*Scardinius erythrophthalmus*

Invertebrates

Common name	**Scientific name**
Koura	*Paranephrops planifrons*

Frogs and lizards

Common name	**Scientific name**
’rchey's frog	*Leiopelma archeyi*
Auckland green gecko	*Naultinus elegans elegans*
Australian rainbow skink	*Lampropholis delicata*
Common gecko	*Woodworthia maculatus*
Copper skink	*Cyclodina aenea*
Forest gecko	*Mokopirirakau granulatus*
Green gecko	*Naultinus elegans*
Hochs’etter's frog	*Leiopelma hochstetteri*
Ornate skink	*Oligosoma ornatum*
Pacific gecko	*Dactylocnemis pacificus*
Speckled skink	*Oligosoma infrapunctatum*
Striped skink	*Oligosoma striatum*

Plants

Common name	**Scientific name**
Kauri	*Agathis australis*
Kauri grass	*Astelia trinervia*
Taraire	*Beilschmiedia tarairi*
Tawa	*Beilschmiedia tawa*
Kohurangi	*Brachyglottis kirkii*
	Bulbophyllum tuberculatum
Mamangi	*Coprosma arborea*

Swamp helmet orchid	*Corybas carsei*
Helmet orchid	*Corybas rotundifolius*
Karaka	*Corynocarpus laevigatus*
	Cyclosorus interruptus
Kahikatea	*Dacrycarpus dacrydioides*
Rimu	*Dacrydium cupressinum*
Wood rose	*Dactylanthus taylorii*
Sundews	*Drosera spp.*
Kohekohe	*Dysoxylum spectabile*
Wire rush	*Empodisma robustum*
Pingao	*Ficinia spiralis*
Hard beech	*Fuscospora truncata*
Tangle fern	*Gleichenia dicarpa*
Reed sweet grass	*Glyceria maxima*
	Juncus holoschoenus
Rewarewa	*Knightia excelsa*
Kanuka	*Kunzea ericoides*
Pukatea	*Laurelia novae-zelandiae*
Manuka	*Leptospermum scoparium*
Kawaka	*Libocedrus plumosa*
Bog clubmoss	*Lycopodiella serpentina*
Northern rata	*Metrosideros robusta*
Stout water milfoil	*Myriophyllum robustum*
Mairehau	*Phebalium nudum*
Tanekaha	*Phyllocladus trichomanoides*
Thick-leaved kohukohu	*Pittosporum kirkii*
Totara	*Podocarpus totara*
Swamp leek orchid	*Prasophyllum hectorii*
Miro	*Prumnopitys ferruginea*
Matai	*Prumnopitys taxifolia*
	Pseudopanax laetus
Swamp greenhood	*Pterostylis micromega*
Swamp greenhood	*Pterostylis paludosa*
Greenhood orchids	*Pterostylis spp.*
King fern	*Ptisana salicina*
Grey willow	*Salix cinerea*

Crack willow	*Salix fragilis*
Giant wire rush	*Sporadanthus ferrugineus*
	Sporadanthus spp
Swamp maire	*Syzygium maire*
Sun orchids	*Thelymitra spp.*
Thismia	*Thismia rodwayi*
Yellow bladderwort	*Utricularia australis*
Bladderwort	*Utricularia delicatula*
Puriri	*Vitex lucens*
Kamahi	*Weinmannia racemosa*