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Significant Natural Areas (SNA) of the Waikato Region - Karst ecosystems

Methodologies for ranking of the top 58 Karst SNA sites for biodiversity management in the Waikato

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Abstract

Waikato Regional Council aims to prioritise natural areas in the Waikato region for biodiversity management. The main component of this assessment is setting up inventories by Biodiversity Vegetation, GIS mapping, using Waikato Regional Policy Statement (WRPS) criteria to identify Significant Natural Areas (SNA's) and prioritising SNA sites for biodiversity management. This process is required for Council to fulfil its obligations in relation to Section 6(c) of the Resource Management Act 1991 (RMA) to maintain and enhance biodiversity. Karst ecosystems can comprise of indigenous vegetation or habitats of indigenous fauna and flora that is nationally uncommon, or historically rare. In this context, the council wishes to provide the baseline information for karst ecological restoration and assist with further policy development.

This report outlines the methodological processes used to:

- An overview of information used for scoring the biotic values of karst ecosystems based on the WRPS ecological significance determination criteria (Table 11-A) ;
- A list of criteria and their definitions for assigning threats karst ecosystems face and management priority rankings, including how to apply these criteria and the relative importance (i.e. weight) of each criterion; and
- The results of applying this methodology to the previously determined 'Top 58' Karst ecosystems (SNAs) in the Waikato Region.

The assessment process considers only the ecological (i.e. biotic) values of the top 58 karst SNA. Karst systems will have a range of other values, such as landscape, geological, paleontological, archaeological and cultural values, which are not included in the scope of this assessment. The ecological criteria use in the ranking assessment are based on the WRPS criteria to identify Significant Natural Areas (SNA's) and management criteria (including threat and vulnerability factors)

From this process 58 sites were ranked in terms of their ecological value, the threats they face and the effort of management requirements to restore their values.

1 Introduction

1.1 Disclaimer

The "Top 58 Karst SNA Sites" 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 ecological management ranking of the top 58 karst significant natural areas (SNA) of the Waikato Region. It is subject to revision through consultation with appropriate sources. The Waikato Regional Council (the 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 a karst ecosystem area from the "Top 58 Karst SNA Sites" 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.

1.2 Purpose

The council has a legal requirement to protect karst ecosystems under section 6(c) of the Resource Management Act (RMA). The Waikato Regional Policy Statement (WRPS) requires that both regional and district plans identify and protect habitats of significant indigenous vegetation and habitats of significant indigenous fauna through a range of policies outlined in Section 11. Table 11-1 of the WRPS lists eleven criteria for determining the ecological significance of indigenous biodiversity in the region in order to map Significant Natural Areas (SNA).

Criterion 5, in particular specifically refers to indigenous vegetation or habitat that is nationally uncommon, or historically rare, including karst ecosystems[1]. The exposure drafts of the National Policy Statement on Indigenous Biodiversity (NPS-IB, 2018 & 2022) have also been used to inform the determination of thresholds for ecological significance for karst ecosystems. This is to ensure that when the NPS-IB is enacted the ranking system used for karst ecosystems in the Waikato region is aligned with the NPS-IB, particularly in relation to its objectives and policies and criteria/classifications for identifying significant indigenous vegetation and significant habitat of indigenous fauna.

The biodiversity strategy for New Zealand for the next twenty years (New Zealand Government 2020). This document supports the direction of WRC's karst prioritisation programme in that it lists a number of priority actions including:

- Review of the current biodiversity monitoring systems across central and regional government and iwi/hapū/whānau to enable to establish a system that aligns monitoring from community to national level; and
- Review the prioritisation system as carried out by DOC and regional councils, and roll out a coordinated national prioritisation system for ecosystem based management, as well as site and species-based management.

This assessment process considers only the ecological (i.e. biotic) values of the top 58 karst SNA. Karst systems will have a range of other values, such as landscape, geological, paleontological archaeological and cultural values, which are not included in the scope of this assessment.

[1] Terrestrial ecosystems that were rare before human colonisation of New Zealand often have highly specialised and diverse flora and fauna characterised by endemic and nationally rare species as defined by William et al (2007).

Karst is a topography formed from the dissolution of soluble rocks such as limestone, dolomite, and gypsum. Karst landscapes are characterized by distinctive surface features such as sinkholes, caverns, and underground rivers.

A surface karst ecosystem refers to the area of a karst landscape that is exposed to the atmosphere and is directly influenced by surface processes such as erosion, precipitation, and vegetation. Surface karst ecosystems are typically characterized by sinkholes, caves, and other topographic features that are formed by the dissolution of soluble rocks.

In contrast, a subsurface karst ecosystem refers to the area of a karst landscape that is located below the surface and is influenced by underground water flow and chemical processes. This includes underground rivers, caves, and other features that are formed by the dissolution of soluble rocks. Subsurface karst ecosystems are often home to unique and specialized species, many of which are adapted to the dark and often nutrient-poor environment of the underground. In the Waikato Region all karst is formed in limestone characterised by underground drainage and caves, and distinctive surface features such as dolines[2] and karren[3] outcrops. There are significant areas of 'pseudokarst' typically in tephra of the south Waikato where drainage is underground but not as a result of dissolution processes.

Many species dependant on cave habitats typical of karst systems have low reproductive potential and small, geographically isolated population sizes makes them vulnerable to extinction. Internationally, karst systems are under threat from activities such as deforestation, disturbance by agriculture, water use allocation changing hydrologically regimes, mining and tourism. Internationally, karst systems also of cultural significance and important features of almost one third of World Heritage Properties that have been listed for their natural importance (Monro, et al 2018). Therefore, karst specific management planning is required to conserve karst systems and their biodiversity.

In this context, the council wishes to develop a methodology that will allow it to prioritise potential biodiversity management efforts in karst areas[4] and provide the baseline information for karst ecological restoration and assist with further policy development – "*Methodologies for Ranking of the Top 58 Karst SNA Sites for Biodiversity Management in the Waikato*".

Large areas of remaining indigenous biodiversity and historically rare ecosystems within the Waikato region are in the stewardship of private landholders and iwi groups. Identifying and recognising the karst areas of high ecological value as SNAs provides opportunities for protection through council funding and assistance. Many private landowners and iwi groups recognise the value of these areas and are undertaking measures to protect and restore biodiversity (e.g., fencing and animal pest control). By prioritising the karst SNA sites of highest value and of the greatest need for conservation management action, both regional and district councils are able to focus resources to support willing landowners in undertaking ongoing protection and ecological restoration measures.

This report details the methodology developed by a collaborative process to rank the biotic values of karst ecosystems of the Waikato Region in terms of their value and management priorities. Specifically, it provides:

- An overview of information used for scoring the biotic values of karst ecosystems based on the WRPS ecological significance determination criteria (Table 11-A);

[2] A doline, also known as a sinkhole or sink, is a common landform found in karst topography. In karst systems, dolines are depressions or sinkholes in the ground that are typically formed by the dissolution of soluble rocks such as limestone, dolomite, or gypsum.

[3] a karren refers to a small-scale landform or surface feature that is created by the dissolution of limestone or other soluble rocks. Karrens are typically found on exposed limestone surfaces and are formed through the chemical weathering and erosion processes associated with karst topography

[4] Karst is a topography formed from the dissolution of soluble rocks such as limestone, dolomite, and gypsum. It is characterized by ravines, fissures and underground drainage systems with sinkholes and caves.

- A list of criteria and their definitions for assigning threats karst ecosystems face and management priority rankings, including how to apply these criteria and the relative importance (i.e., weight) of each criteria; and

- The results of applying this methodology to the previously determined 'Top 58' Karst ecosystems (SNAs) in the Waikato Region.

This ranking methodology report is the final phase of the council's ranking karst SNA for biotic values. It follows on from a baseline karst biotic values identification report (Clark et al. 2017), a literature review (Lewis, 2018), two technical workshops to refine scope and methodology, and a pilot report testing the robustness of the ranking methodology (Taylor-Smith et al 2020).

2 Methods

2.1 Framework for prioritising management potential of karst SNA

The WRPS ecological significance criteria recognises karst ecosystems as significant natural areas. This recognition, however, does not differentiate between the level of significance between the different karst SNA. The following sections outline criteria for assessing the value of each karst SNA, and how these criteria are applied to determine an overall ranking score for each SNA. It is important to recognise that the score for each criterion is the product of expert opinion expressed numerically. There is insufficient data and research to allow quantification of this ranking process. Therefore, expert opinion must be relied upon to rank the relative value of karst ecosystems.

We consider this a sufficiently developed methodology for the purposes that WRC wishes to apply it. This expert opinion will be tested through a collaborative review and workshop process, whereby the methodology and ranking will be tested by other karst and ecological experts. The numerical scoring systems is used to express the differentiation of value in a as fine-grained manner as possible by these experts.

This framework allows for the conversion of expert opinion into an overall site score that can be ranked against other sites; it should not be seen as being a quantitative scoring system, but rather a system to communicate expert opinion, often based on incomplete information and little data, into a readily understandable method of communicating ecological value, threats and management action priorities.

This assessment is the summation of a five-year process of determining a methodology to identity karst ecosystems in the Waikato region and developing a methodology through a collaborative process with technical experts and stakeholders. The process is detailed by Taylor-Smith et al (2020) and summarised in section 2.1 and 2.2 below. The methodology has been developed to:

- Describe a set of biotic ranking criteria specifically for karst ecosystems;
- Determine suitable thresholds and attributes for the application of each ranking criterion; and
- Assign weightings for each criterion; and
- Apply the ranking over the 58 sites determined to be karst ecosystems of highest value in the Waikato Region.

2.2 Process to determine ranking of karst values

Geologist B. Hayward developed a set of criteria to rank the abiotic values of karst (Hayward, 2018b) and mapped the 57 significant karst areas based on the information from Lewis' report (Hayward, 2018c). Hayward (2018a) reduced the number of karst SNA to 54 sites. Subsequent to this review, four more sites were added by the council, bringing the total to 58 karst sites (Figure 1 – Hayward 2019).

Clarkson et al. (2017) undertook a desktop inventory and significance assessment of karst landscapes in the Waikato region and identified a large number of karst SNA. Subsequently the council held a workshop on 14 July 2017 to discuss Waikato's karst ecosystems with key experts. The workshop involved discussion of the council's legal obligations to protect these ecosystems., Lewis (2018) undertook a further literature review for the council and reduced this number to 58 significant karst areas. A further workshop was held on 15 March 2018 to discuss the best approach for ranking the 58 karst SNA. A key outcome of this workshop was the decision to assess abiotic and biotic values separately.

Following this, the council commissioned Tonkin & Taylor Ltd (T+T), with assistance from Professor Bruce Clarkson (Waikato University), to develop a framework to rank the biotic values of karst in the Waikato region in terms of their value and management priorities (Taylor-Smith et al. 2020). As part of this work, T+T ground-truthed nine of these sites and used these sites to test the methodology.

Another council workshop was held on 25 October 2019 to showcase the results of the biotic assessment framework and to refine the methodology so that it could be developed into a system for prioritising the top 58 karst SNA sites. The workshop was attended by experts from various organisations including the council, DOC, the University of Waikato, University of Auckland, New Zealand Speleological Society and Geomarine Research and the council's staff members from Science and Policy, Interlacement Management and Tai Ranga Whenua Groups. The feedback from this workshop was incorporated into the abiotic ranking report (Taylor-Smith et al. 2020).

Subsequently, the council has engaged Bluewattle Ecology to refine the biotic ranking methodology. Changes have been made to the methodology based on further feedback from the 2019 workshop and discussion with the council. Data for each of the sites has been collated and the ranking methodology has been applied as a desktop exercise to each of the top 58 karst sites. The ranking methodology is described in the following sections.

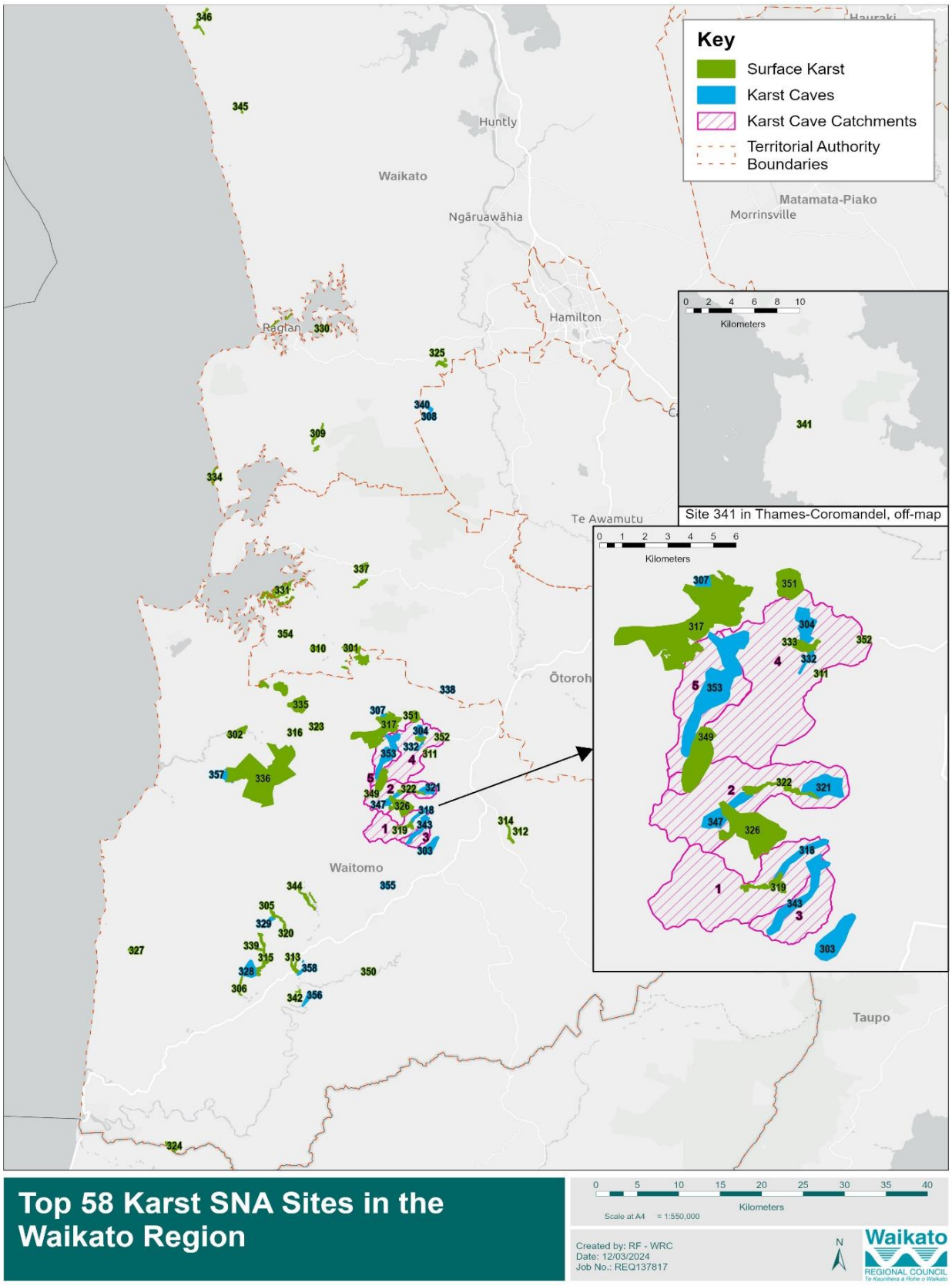

Figure 1: Location of top 58 karst sites assessed in this report as identified by Hayward (2019)

(NB: see Table 17 for ranking list, Appendix 1 for a detailed inventory of each site, and Appendix III for more detailed maps of the sites)

2.3 Guidelines for biotic criteria scoring and ranking method

2.3.1 Approach

WRC uses criteria outlined in Section 11A of the WRPS to determine significance of indigenous biodiversity in accordance with Section 6(c) of the RMA. For an area to be identified as significant it must meet one or more of the criteria listed in Section 11A. Of these criteria, criterion 5 describes habitats and ecosystems that are, and were prior to human settlement, nationally uncommon. As discussed in Section 1,2, this specifically relates to karst ecosystems where ecological characteristics are significant enough to meet the threshold test in terms of applying Section 6(c) of the RMA. However, other criteria may also be triggered and have been applied where appropriate.

When assessing ecological significance of indigenous ecosystems in New Zealand, matters such as sustainability, viability, buffering, threat and restoration management requirements should be part of the assessment process (Whaley et al 1995; Norton and Roper-Lindsay 2004). Maseyk and Gerbeaux (2015) consider these 'value' matters as secondary to the core significance assessment criteria; however, these aspects are useful for sound decision making and can be helpful for determining where a site ranks against other sites of similar habitat within a region.

In 2002, WRC produced guidelines that assists with the application of assessment criteria and the determination of relative importance (or value) of each SNA (i.e., international, national, regional or local significance; Waikato Regional Council and Wildland Consultants 2002). These guidelines are in the process of being revised for the Section 11A criteria in the current WRPS. It is understood that these guidelines have no legal status, but they are helpful in the assessment of SNAs, and have been applied in region wide assessments by the Waikato Regional Council (for example, (Kessels & Associates 2010).

There is, therefore, supporting literature and precedence to apply threshold tests for determining ecological significance and the relative value of SNAs where they are significant. The methodological approach outlined below is consistent with this literature and previously approaches adopted within the Waikato region (e.g., ranking of geothermal sites (Wildland Consultants Ltd 2014) and lake ecosystems (Wildland Consultants Ltd 2011)).
Criteria can be divided into those that assess ecological value (or importance), those that assess threats and those that assess management potential. The ecological criteria are based on those listed in Section 11A of the WRPS
The assessment methodology for karst ecosystems is based on the WRPS criteria but has been altered for karst systems because

- Subterranean species comprise mostly invertebrates. A large proportion of New Zealand's invertebrate species remain undescribed, with little known about their ecology. Hence, an assessment of subterranean karst ecosystems is based on a limited understanding of these systems; and
- The WRPS significance criteria are derived from assessment methodologies designed for more conventional ecosystems, and do not adequately cover the unique attributes of karst systems in some cases.

2.3.2 Determination of Thresholds and Scoring Attributes:

Expert judgement has been applied to assess each karst SNA against each criterion. For each criterion the SNA is assigned a value rank of either: low (score 1); medium (score 2); or high (score 3) as defined in Appendix I.

Thus the assessing ecologist needs to consider the following matters to determine when delineating the extent of a karst habitat used by indigenous species and identifying an indigenous vegetation area as an karst SNA:

i. Threshold determiner for rare species: Can the habitats of the Threatened or At Risk species be clearly delineated and regular usage be determined? Consider the pattern of distribution of the subject species, its key habitat and lifecycle requirements, including if habitat usage is regular, seasonal or occasional.

ii. Is the ecosystem integrity of the subject area sufficiently intact to delineate and define a recognisable karst ecosystem type comprising predominately of indigenous species? Matters to consider are vegetation cover composition and density at all structural tiers, the characteristic biophysical elements supporting that ecosystem type, the ecosystem's capacity to maintain its structural and functional processes, the proportion of exotic vegetation cover as opposed to indigenous vegetation cover, and if it contains a range of defining elements characteristic for its ecotype.

iii. Representativeness includes commonplace vegetation/habitats, which is where most indigenous biodiversity is present. It is not restricted to the best or most representative examples. It is not a measure of how well that vegetation or habitat is protected elsewhere in the ecological district. This can include secondary or regenerating vegetation that is recovering following natural or induced disturbance, provided indigenous species composition is typical of that type of vegetation. Representative indigenous fauna habitat can support the typical suite of indigenous animals that would occur in the present-day, regardless of the threat status of those species.

iv. Diversity has biological components, such as species/taxa, communities, and ecological variation. It also has physical components, such as geology, soils/substrate, aspect/exposure, and altitude characteristic of karsts systems. Pattern includes changes along environmental gradients, such as ecotones and sequences. Some communities or habitats are uniform, with naturally low species diversity; that attribute is assessed under the representativeness criterion.

v. Rarity includes ecosystems that are uncommon, and species that are threatened. Threatened and At Risk (including 'naturally uncommon') species at a national scale are listed in publications (for plants, mammals, birds, and reptiles) prepared and regularly updated by the Department of Conservation. Rarity at a regional or local scale is defined by published local lists or determined by professional opinion. Some species within the Myrtaceae family are relatively common in the Waikato Region (e.g. kānuka, mānuka) but are listed as Threatened or At Risk due to the threat posed by myrtle rust. If an area is identified only because of the presence of mānuka and kānuka, it should not trigger Criterion 3. However, if it qualifies as significant for any other reason, then it should be ranked as a Significant Natural Area. Two national frameworks are available for the assessment of rarity of terrestrial indigenous vegetation or ecosystems: Ecological Districts, as defined by McEwen (1987); and Land Environments, as defined by Leathwick et al (2003).

vi. Historically rare (or naturally uncommon) terrestrial ecosystems are defined and listed by Williams et al (2007a) and further defined by Wiser et al (2013), which includes karst ecosystems. These karst ecosystems, along with wetlands and sand dunes, are proposed as a priority for protection on private land by the Ministry for the Environment (2007a).

vii. Ecological Context is the extent to which the size, shape, and position of an area within the wider environment (land, freshwater or marine) contributes to the maintenance of indigenous biodiversity. Ecological context has two main attributes: the characteristics that help maintain indigenous biodiversity at the site (such as size, shape and configuration); and the contribution the site makes to protection of indigenous biodiversity in the wider landscape (such as by linking or buffering other sites, providing 'stepping stones' of habitat, or maintaining ecological and hydrological processes). Higher value is placed on sites that: have features (such as size, shape, configuration or buffering) that help maintain indigenous biodiversity at the site;

support large numbers of or provide important habitat for indigenous fauna; provide a buffer to or link between other significant areas; or play an important role in the biological/natural functioning of a freshwater or coastal/marine system. In the context of this ranking process, ecosystem function can be defined as the biological, geochemical and physical processes that take place within an ecosystem where that ecosystem retains ecological integrity allowing it to undertake its natural processes (de Groot *et al*. 2010). The ecological context of an area can be defined as:

"The extent to which the size, shape, and position of an area within the wider environment (land, fresh water or marine) contributes to the maintenance of indigenous biodiversity. Ecological context has two main attributes: the characteristics that help maintain indigenous biodiversity at the site (such as size, shape and configuration); and the contribution the site makes to protection of indigenous biodiversity in the wider landscape (such as by linking or buffering other sites, providing 'stepping stones' of habitat, or maintaining ecological and hydrological processes)." (NPSIB 2018)

The relevance of applying ecological function and ecological context to Section 11A is considered useful when developing qualifying thresholds. For example, should a remnant indigenous treeland over a karst area (as defined by Atkinson 1985) be in such a degraded and modified state that it may not have sufficient ecological integrity to still maintain its natural processes as an indigenous forest ecosystem.

xi. Distinctiveness includes distribution limits for indigenous vegetation types or ecosystems (as opposed to species), type localities, local endemism, relict distributions, and special ecological or scientific features. Distinctiveness of indigenous vegetation in each Land Environment has been assessed by Walker et al (2006) and Cieraad et al (2015). Land Environment data should be interpreted with caution. These are based on physical attributes which may not accurately reflect vegetation (or habitat) patterns at a local scale. Distinctiveness at a regional or local scale is defined by published local lists or determined by professional opinion.

2.4 Ecological Criteria

2.4.1 Ecological context

2.4.1.1 Representativeness (weighting = 2)

Representativeness is the extent to which the vegetation or habitat of indigenous fauna is typical or characteristic of the indigenous biodiversity of the ecological district or in the Waikato region. It considers only present-day indigenous vegetation and habitats, not historic biodiversity, and this distinguishes it from the "under-represented vegetation type" criterion (see Criterion 5). It can be applied to regenerating indigenous vegetation and indigenous vegetation with a modified structure and/or composition if the vegetation is typical of the area. In the context of this assessment, Representativeness can be defined as:

"the ecosystems or habitats that are typical and characteristic examples of the full range of the original or current natural diversity of ecosystem and habitat types in a district or in the region."

Representativeness is applicable to criterion 9 of the WRPS criteria. It requires reference to a baseline condition of that type (chosen as at 1840 – criterion 9). Criterion:

It is an area of karst habitat that is a representative example of its type, that is a representative example of its type because:

a Its structure, composition, and ecological processes are largely intact; and

b 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.

Table 1: Scoring methodology for representativeness

Value	Description	Score
High	A site is largely intact in its structure, composition, and ecological processes.	3
Medium	Some of the structures, composition, and ecological processes are intact, while others are degraded, but have the potential to recover.	2
Low	Very degraded and/or compromised by small size.	1

Definitions for value:

High:

- The habitat or indigenous vegetation is largely intact in its structure, composition, and ecological processes.
- There is no/very little evidence that threats such as erosion, animal and plant pests are having a detrimental effect on key elements of the ecosystem.
- Pest animals and plants may be present, but do not significantly degrade the karst character.

Medium:

- Some of the structures, composition, and ecological processes are intact, while others are degraded, but have the potential to recover, though this may take decades.
- Sites are degraded and/or small in size with better examples of similar habitat elsewhere.
- Natural processes are obviously modified and impacts from threats are evident.
- Pest animals and plants have modified a large portion of the site.

Low:

- Very degraded or the site is so small that ecological processes and structures are unlikely to be intact.
- Very little evidence remains of the original structure, composition, or ecological processes.
- The natural character of the site is severely affected by threats such as erosion, pest animal and plants.
- Recovery from this degradation may take decades.

Tools and references:

- Atkinson IAE 1985. Derivation of vegetation mapping units for an ecological survey of Tongariro National North Island, New Zealand. New Zealand Journal of Botany, 23(3): 361-378.
- Davis CM, Head N, Myers SC, Moore SH 2016. Department of Conservation guidelines for assessing significant ecological values. Publishing Team, Department of Conservation.
- De Groot RS, Alkemade R, Braat L, Willemen L 2010. Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. Ecological Complexity 6: 453-462.
- Roper-Lindsay J, Fuller SA, Hooson S, Sanders MD, Ussher GT 2018. Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems.

2.4.1.2 Size of karst area (weighting = 2)

Fragment size is an important driver for long-term viability of species, communities and ecosystems as well as the extent of diversity. Larger sites generally have greater diversity and long-term viability. Size is also used to ascertain the scale of potential enhancement and restoration works and can also reflect

the degree of the representativeness of the site. This size criterion is equivalent to criterion 7 of Section 11A of the WRPS.

Note that size of karst areas is often hard to define. The key issues are that (i) there is no obvious remote sensing method for karst and (ii) karst is often overlain by other lithologies, in the Waikato these are typically tephra or mudstones. Karst outcrops above ground are often overgrown by vegetation and so the true extent at the surface cannot be accurately determined, even by ground-truthing. The underground portions of a karst feature are often only partially explored and mapped so their extent is also often unable to be accurately determined.

Criterion:

It is an area of karst 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 only select the largest example of its type in the Waikato region, but consider also the suite of indigenous species present within that habitat type.

Table 2: Scoring methodology for size of karst area

Value	Description	Score
High	A large karst feature	3
Medium	A medium-sized feature	2
Low	A small karst feature	1

Definitions for value:

High:

- A large area of karst in the upper quartile for their type[5] that contains all or almost all indigenous species typical of that habitat type:
    - An extensive area of underground karst systems (>160 ha); or
    - A large area of surface karst features (>100 ha).

Medium:

- A medium-size area of karst that contains all or almost all indigenous species typical of that habitat type:
    - An underground system >20 ha to <160 ha; or
    - An area of karst features >20 ha to <100 ha.

Low:

- A very small area of karst in the lower quartile for their type:
    - Underground karst system (<20 ha); or
    - Aboveground karst feature (<20 ha); or
- A medium or large karst site (as define by the above sizes) that lacks all or almost all indigenous species typical of that habitat type.

Tools and references:

- Davis CM, Head N, Myers SC, Moore SH 2016. Department of Conservation guidelines for assessing significant ecological values. Publishing Team, Department of Conservation.
- Roper-Lindsay J, Fuller SA, Hooson S, Sanders MD, Ussher GT 2018. Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems.
- Whaley KJ, Clarkson BD, Leathwick JR 1995. Assessment of criteria used to determine 'significance' of natural areas in relation to Section 6(c) of the Resource Management Act (1991). Hamilton, Manaaki Whenua – Landcare Research.

[5] i.e. compared to all other surface karst or cave systems in the top 58 Waikato karst ecosystems.

2.4.1.3 Linkage and buffering (weighting = 2)

Spatial proximity between remnants and/or ecosystems determines the degree of migration, dispersal and the exchange of genetic material between sites. Therefore, proximity of karst SNA to other karst areas and indigenous ecosystems should be taken into consideration when determining ecological value. Contiguous indigenous habitats can also provide a buffer against external adverse effects from adjacent land e.g. forestry and farming. Criterion 11 of Section 11A of the WRPS assesses connectivity between ecosystems.

Expressions of karst morphology and unique biological values are a result of the distinctive hydrology and landforms, with features significantly influenced by the hydrological system within a catchment. Analysis of surface and sub-surface hydrological links are required to determine proximity between areas. However, data are often insufficient to determine the full extent of hydrological patterns and connections. Hence the degree of migration, dispersal and the exchange of genetic material between sites and the extent of indirect land use effects are difficult to estimate. Thus, in the absence of absolute certainty, expert judgment is required to determine the linkage and buffering value.

Criterion:

It is an area of karst 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 other site identified as significant from external adverse effects.

Table 3: Scoring methodology for linkage to and buffering of other natural areas

Value	Description	Score
High	Contiguous with other indigenous ecosystems	3
Medium	Some continuity with other indigenous ecosystems	2
Low	An isolated area of karst	1

Definitions for value:

High:

- The site is contiguous with other indigenous habitat; or
- The site is so large that adjacent areas on non-indigenous habitats will have limited impact on the majority of the ecosystem.

Medium:

- The site is contiguous with other indigenous habitats but only shares a very small proportion of its boundary with the other habitat(s); or
- There is some continuity with indigenous habitats that are present in the surrounding landscape.

Low:

- A karst site that is isolated from other indigenous ecosystems; or
- The site has little to no indigenous vegetation on site

Tools and references:

- Whaley KJ, Clarkson BD, Leathwick JR 1995. Assessment of criteria used to determine 'significance' of natural areas in relation to Section 6(c) of the Resource Management Act (1991). Hamilton, Manaaki Whenua – Landcare Research.
- Wildland Consultants Ltd 2019 (Draft). Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

2.4.1.4 Diversity and pattern (weighting = 2)

This criterion considers the full potential of indigenous biotic and abiotic factors, and natural processes functioning in sustainable communities, habitats and landscapes. Pattern relates to gradients such as biological succession, drainage, altitudinal, salinity, etc. that exist within a natural area. The diversity of floristic associations within each ecological unit, and species richness are also taken into account in order to achieve the goal of maintaining ecological integrity (Whaley *et al*., 1995). This criterion captures RPS significance criterion 10 and 11 and addresses patterns of diversity and continuity.

Criterion:
It is a karst SNA with a natural diversity of ecological units, ecosystems, species and physical features with a diversity of the following naturally uncommon karst ecosystem types (as defined by Mannaki Whenua Landcare Research (2021):

1. Cave entrances
2. Sinkholes
3. Caves and cracks
4. Cliffs, scarps and tors.

Table 4: Scoring methodology for diversity and pattern

Category	Description	Score
High	High diversity of ecological units, ecosystems, species and physical features.	3
Medium	Moderate diversity of ecological units, ecosystems, species and physical features.	2
Low	Low diversity of ecological units, ecosystems, species and physical features.	1

Definitions for value:

High:

- The SNA has high diversity of ecological units, ecosystems and species associated with karst ecosystems.
- The SNA comprises multiple types of karst ecosystem.

Medium:

- The SNA has moderate diversity of ecological units, ecosystems, species and physical features associated with karst ecosystems.
- The SNA comprises multiple types of karst ecosystem.

Low:

- The SNA has low diversity of ecological units, ecosystems, species and physical features associated with karst ecosystems.

Tools and references:

- Davis CM, Head N, Myers SC, Moore SH 2016. Department of Conservation guidelines for assessing significant ecological values. Publishing Team, Department of Conservation.
- Hayward BW 2019. Mapping Significant Natural Areas of the Waikato Region: karst ecosystems – updated methodology report. Prepared for Waikato Regional Council.
- Holdaway RJ, Wiser SK, Williams PA 2012. Status assessment of New Zealand's naturally uncommon ecosystems. Conservation Biology, 26(4): 619–629.
- Mannaki Whenua Landcare Research 2021. Naturally Uncommon Ecosystems. https://www.landcareresearch.co.nz/publications/naturally-uncommon-ecosystems/, accessed 7 June 2021.
- NPSIB Biodiversity Collaborative Group 2018. Report of the Biodiversity Collaborative Group incorporating The Biodiversity Collaborative Group's Draft National Policy Statement for Indigenous Biodiversity. Published in October 2018 by the Biodiversity (Land and Freshwater) Stakeholder Trust.
- Waikato Regional Council 2021. Karst management factsheet.
- Whaley KJ, Clarkson BD, Leathwick JR 1995. Assessment of criteria used to determine 'significance' of natural areas in relation to Section 6(c) of the Resource Management Act (1991). Hamilton, Manaaki Whenua – Landcare Research.
- Wildland Consultants Ltd 2019 (Draft). Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

2.4.1.5 Under-represented types (weighting 3)

As outlined in Section 1.2, a national priority is to protect indigenous vegetation and habitats associated with land environments that have 20 % or less remaining in indigenous cover. These vegetation units are currently being identified and quantified (Wildland Consultants Ltd, 2023) using Singers and Rogers (2014) vegetation typology descriptors. Determination of Under-Represented indigenous vegetation is applicable to criterion 4 of the WRPS criteria. It requires reference to an ecosystem type, and in application, is usually referenced to a baseline condition of that type (often chosen as at 1840), thus distinguishing it from "representativeness" which considers only present-day indigenous vegetation (see Section 2.4.1.1). Identification of areas that comprise 20 % or less indigenous cover remaining have been determined using the National Threatened Environment Classification (Walker et al. 2015) and regional application of Singers and Rogers (2014) classification of terrestrial ecosystems.

Criterion:

The karst SNA contains indigenous vegetation that is under-represented (20 % or less of its known or likely original extent remaining) within the ecological district.

Table 5: Scoring methodology for under-represented vegetation types

Value	Description	Score
High	Vegetation type is under-represented within the ecological district	3
Medium	Old growth vegetation	2
Low	Regenerating forest	1

Definitions for value:

High:

- 20 % or less of its known or likely original extent remaining based on biodiversity inventory data (Wildland Consultants Ltd, 2023).

Medium:

- Old growth vegetation, that may or may not have been logged, but is present at more than 20 % of its known or likely original extent (based on biodiversity inventory data), that is representative of its type.

Low:

- Induced regenerating forest or scrub that has been established in the last 50 years.

Tools and references:

- Singers NJD, Rogers GM 2014. A classification of New Zealand's terrestrial ecosystems. Science for Conservation 325. Wellington, Department of Conservation.
- Wildland Consultants Ltd 2019 (Draft). Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

2.4.1.6 Threatened species (weighting 1)

The presence of threatened species adds high value to natural areas (Whaley *et al*. 1995) and as such, the protection of threatened species is very important for biodiversity enhancement. Criterion 3 of Section 11A of the WRPS assesses rarity in terms of species (or taxon). Applying this criterion requires an understanding of matters such as the habitat utilisation and home range behaviour of the taxon of interest. It also requires an understanding of the reasons why the taxon was assigned its threat status. Habitat for mobile indigenous fauna species can be difficult to assess as these species may only utilise the site infrequently or as a vagrant. Also, the site may only be utilised by single individuals of a Threatened or At Risk species rather than by a population, and so an ecologist may deem that the site is not important habitat for the species and thus not significant.

Threatened species status are based on Robertson et al (2021) (birds), de Lange *et al*. (2018) (vascular plants), Burns *et al*. (2018) (amphibians), Hitchmough *et al*. (2021) (reptiles) and other updated lists provided by the Department of Conservation at nztcs.org.nz. There are also some regionally significant species and species at the limit of their natural range which need to be considered. References are subject to changes to the national Threatened classification system.

Karst ecosystems provide habitat for specialised flora and fauna species, but assessing and ranking of this criterion is difficult as the exact number of threatened species at any particular site is difficult to ascertain without undertaking carefully conducted field surveys. The most recent threatened species

reports should be used as DOC reassesses threat statuses periodically. Current threat statuses are available on the New Zealand Threat Classification System website.

As discussed in Section 0, because of the disparate data sets available concerning threatened and At Risk species within karst systems a low weighting has been applied to this criterion.

Criterion:
It is a karst SNA that includes vegetation or habitat for indigenous species or associations of indigenous species that are:

a Classed as Threatened or At Risk[6];

b Endemic to the Waikato region, or for which the Waikato is a major national stronghold; or

c At the limit of their natural range.

Table 6: Scoring methodology for threatened species

Value	Description	Score
High	At Risk/Threatened species and/or regional endemics/range-restricted species recorded as present	3
Medium	At Risk/Threatened species and/or regional endemics/range-restricted species are likely present	2
Low	At Risk/Threatened species and regional endemics/range-restricted species are unlikely to be present/ have not been recorded	1

Definitions for value:

High:

- At Risk/Threatened species have been recorded at this site; or
- Species are present which are endemic to the Waikato region, or for which the Waikato is a major national stronghold; or at the limit of their natural range.

Medium:

- At Risk/Threatened species are likely present at this site.
- Species are likely present which are endemic to the Waikato region, or for which the Waikato is a major national stronghold; or at the limit of their natural range.

Low:

- At Risk/Threatened species are unlikely to be present at this site.
- It is unlikely that species are present that are endemic to the Waikato region, or for which the Waikato is a major national stronghold; or at the limit of their natural range.

Tools and references:

- Atlas of the amphibians and reptiles of New Zealand (www.doc.govt.nz/our-work/reptiles-and-frogs-distribution/atlas/).

[6] A precautionary approach has been taken in the most recent New Zealand Threat Classification System lists for vascular plants and all Myrtaceae taxa have been classified as Threatened due to the recent arrival of myrtle rust in the country. However, some Myrtaceae taxa are relatively common in some areas, including mānuka, kānuka and certain climbing ratas (*Metrosideros perforata*, *M. fulgens* and *M. diffusa*). Therefore, as per the draft NPSIB (2018), these listed Myrtaceae species are not considered Threatened species for the purposes of scoring karst SNAs in this assessment. These species are, however, listed in the ranking spreadsheet (DOC#14322329).

- Bioweb – records of plant and animal distributions. Administered by DOC.
- eBird (ebird.org).
- iNaturalist (iNaturalist.org).
- New Zealand Threat Classification System website (nztcs.org.nz).
- New Zealand Plant Conservation Network (nzpcn.org.nz).
- NPSIB Biodiversity Collaborative Group 2018. Report of the Biodiversity Collaborative Group incorporating The Biodiversity Collaborative Group's Draft National Policy Statement for Indigenous Biodiversity. Published in October 2018 by the Biodiversity (Land and Freshwater) Stakeholder Trust.
- Overdyck E 2020. Nationally Threatened and regionally uncommon species of the Waikato Region. Waikato Regional Council Document #: 14986651.

Threatened species references:

- Andrew IG, Macfarlane RP, Johns PM, Hitchmough RA, Stringer IAN 2012. The conservation status of New Zealand Diptera. New Zealand Entomologist 35: 99–102
- Baker CS, Boren L, Childerhouse S, Constantine R, van Helden A, Lundquist D, Rayment W, Rolfe JR, 2019. Conservation status of New Zealand marine mammals, 2019. New Zealand Threat Classification Series 29, Wellington, Department of Conservation.
- Buckley T, Palma R, Johns P, Gleeson D, Heath A, Hitchmough R, Stringer I 2012. The conservation status of small or less well known groups of New Zealand terrestrial invertebrates. New Zealand Entomologist. 35 (2): 137-143.
- Burns RJ, Bell BD, Haigh A, Bishop P, Easton L, Wren S, Germano J, Hitchmough RA, Rolfe JR, Makan T 2018. Conservation status of New Zealand amphibians, 2017. New Zealand Threat Classification Series 25, Wellington, Department of Conservation.
- de Lange PJ, Jeremy R. Rolfe, JW Barkla, SP Courtney, PD Champion, LR Perrie, SM Beadel, KA Ford, I Breitwieser, I Schönberger, R Hindmarsh-Walls, PB Heenan, K Ladley 2018. Conservation status of New Zealand indigenous vascular plants, 2017. New Zealand Threat Classification Series 22, Wellington, Department of de Lange P, Blanchon D, Knight A, Elix J,Lucking R, Frogley K, Harris A, Cooper J, Rolfe J 2018. Conservation status of New Zealand indigenous lichens and lichenicolous fungi, 2018. New Zealand Threat Classification Series 27, Wellington, Department of Conservation.
- de Lange PJ, Glenny D, Frogley K, Renner MAM, von Konrat M, Engel JJ, Reeb C, Rolfe JR 2020. Conservation status of New Zealand hornworts and liverworts, 2020. New Zealand Threat Classification Series 31, Wellington, Department of Conservation
- Dunn NR, Allibone RM, Closs GP, Crow SK, David BO, Goodman JM, Griffiths M, Jack DC, Ling N, Waters JM, Rolfe JR 2018. Conservation status of New Zealand freshwater fishes, 2017. New Zealand Threat Classification Series 24. Wellington, Department of Conservation.
- Grainger N, Harding J, Drinan T, Collier K, Smith B, Death R, Makan T, Rolfe J 2018. Conservation status of New Zealand freshwater invertebrates, 2018. New Zealand Threat Classification Series 28, Wellington, Department of Conservation.
- Hitchmough, R.; Barr, B.; Knox, C.; Lettink, M.; Monks, J.; Pattreson, G.; Reardon, J.; van Winkel, D.;Rolfe, J.; Michel, P. 2021. Conservation status of New Zealand reptiles, 2021. New Zealand Threat Classification Series 35. Department of Conservation, Wellington. Hitchmough R. 2013. Summary of changes to the conservation status of taxa in the 2008-

11 New Zealand Threat Classification System listing cycle. Department of Conservation, Wellington. WRCDOCS # 2778343.

- Hitchmough R. 2002. New Zealand Threat Classification System lists. Department of Conservation, Wellington. WRCDOCS #3393685.
- Hoare RJB, Dugdale JS, Edwards ED, Gibbs GW, Patrick BH, Hitchmough RA, Rolfe JR 2015. Conservation status of New Zealand butterflies and moths (Lepidoptera). New Zealand Threat Classification Series 20, Wellington, Department of Conservation.
- Leschen RAB, Marris JWM, Emberson RM, Nunn J, Hitchmough RA, Stringer IAN 2012. The conservation status of New Zealand Coleoptera. New Zealand Entomologist 35(2): 91-98.
- Mahlfeld K, Brook FJ, Roscoe DJ, Hitchmough RA, Stringer IAN 2012. The conservation status of New Zealand terrestrial Gastropoda excluding Powelliphanta. New Zealand Entomologist 35: 103–109.
- Nelson WA, Neill K, D'Archino R, Rolfe JR 2019. Conservation status of New Zealand macroalgae, 2019. New Zealand Threat Classification Series 30, Wellington, Department of Conservation.
- O'Donnell CFJ, Borkin KM, Christie JE, Lloyd B, Parsons S, Hitchmough RA 2018. Conservation status of New Zealand bats, 2017. New Zealand Threat Classification Series 21, Wellington, Department of Conservation.
- Robertson, HA; Baird, KA; Elliot, GP; Hitchmough, RA; McArthur, NJ; Makan, TD; Miskelly, CM; O'Donnell, CFJ; Sagar, PM; Scofield, RP; Taylor, GA; Michel, P. 2021. Conservation Status of birds in Aotearoa New Zealand, 2021. New Zealand Threat Classification Series 36. Department of Conservation, Wellington, 43p.
- Sirvid PJ, Vink CJ, Wakelin MD, Fitzgerald BM, Hitchmough RA, Stringer IAN 2012. The conservation status of New Zealand Araneae. New Zealand Entomologist, 35(2): 85-90.
- Trewick S, Hitchmough R, Rolfe J, Stringer I 2018. Conservation status of New Zealand Onychophora ('peripatus' or velvet worm), 2018. New Zealand Threat Classification Series 26, Wellington, Department of Conservation.
- Trewick S, Johns P, Hitchmough R, Rolfe J, Stringer I 2016. Conservation status of New Zealand Orthoptera, 2014. New Zealand Threat Classification Series 16, Wellington, Department of Conservation.
- Wildland Consultants Ltd 2023. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato region | Waikato Regional Council, Waikato Regional Council Technical Report TR 2023/03.

For additional species groups, e.g. invertebrates, and to check for most recent updates please refer to DOC webpage, and see below:
http://www.doc.govt.nz/about-us/science-publications/series/new-zealand-threat-classification-series/

2.4.2 Criteria weighting

Each of the criteria have been weighted based on professional opinion and the rationale that some ecological or management attributes are of greater importance than other attributes. Weighting values range from 1 (low) to 3 (high), as defined in Appendix I.

A lower weighting has been applied to the threatened indigenous species criteria, even though they are a national priority for protection. The reason for this is that records and datasets of threatened species are often dated, unevenly distributed and based on survey methods with different detection efficiencies. The lower weighting will help to limit the bias associated with the uneven distribution of survey effort.

2.4.3 Scoring

This assessment process considers only the ecological (i.e. biotic) values of the top 58 karst SNA. Karst systems will have a range of other values, such as landscape, geological, paleological, archaeological and cultural values, which are not included in the scope of this assessment.

The score for each criterion is the product criterion value multiplied by weighting. The sum of the criterion scores is the site score for the prioritisation ranking. This framework allows for the conversion of expert opinion into an overall site score that can be ranked against other sites.

There are three broad categories of criteria as follows:

a) Ecological Value Criteria;
b) Threats criteria; and
c) Management Potential criteria.

It is important to note the following points about how the scoring is applied to each of the broad categories:

- Sites that score high on the ecological value criteria are sites that have a largely intact vegetation cover and provide habitat for indigenous species;

- Sites that score higher for the threats and management potential criteria indicate they require more input in management and protection; conversely sites that have a lower score are relatively well protected already and require less management/less monetary input;

- A higher total score indicates a high ecological value that is threatened and requires large management inputs; and

- Site assessments for ecological value and management priority are considered separately.

The following sections describe the 16 criteria and discuss the context and scope of their application. Based on these 16 criteria, the maximum karst site score is 105 and the minimum is 35.

2.4.4 Confidence levels

For each SNA, a confidence level is applied to each criterion depending on the degree of information available. These confidence levels are defined in Appendix I. Confidence levels range from 1 (low) to 3 (high). Confidence levels do not contribute to the overall score of a site.

Sites that have restricted public access (e.g. are located on private land) and as a result have little available information will have low confidence levels. In contrast, legally protected sites and/or well-researched sites will have higher confidence levels. Sites with lower confidence levels are higher priority for field surveys than those with higher confidence levels.

2.5 Threat and Management Potential Criteria

In this section

2.5.1 The key issues

The key issues are that (i) there is no obvious remote sensing method for karst and (ii) karst is often overlain by other lithologies, in the Waikato these are typically tephra or mudstones threat criteria
The following threat criteria assess the inherent vulnerability of a natural area to environmental change. Vulnerability of an ecosystem relates to its susceptibility to modification, and especially to any weakness in an ecosystem that allows for attack from diseases and/or pests. Many karst sites are well managed by landowners and are fenced from stock, with animal and plant pests controlled. However,

in some cases karst sites require immediate management action to prevent rapid decline of biodiversity values.

Note that threats may change with time, and it is difficult to quantify the future impacts of threats such as climate change, which may have a large impact on karst ecosystems, for example via change in hydrological regimes and how these changes may affect karst formations or degrade existing karst systems.

2.5.1.1 Vulnerability (weighting = 2)

Ecosystem vulnerability is a measure of ecosystem integrity[7]. Vulnerability of an ecosystem relates to its susceptibility to modification, and especially to any weakness in an ecosystem that allows for attack from diseases and/or pests.

Threats to karst ecosystems include:

- Sedimentation
- Pollution
- Indigenous vegetation clearance
- Pest plants
- Ground disturbance (e.g. clearing, fill dumping)
- Quarries
- Wastewater
- Refuse disposal
- Direct human disturbance (e.g. removal of cave structures)
- Pest animals
- pH change
- Hydrological change
- Eutrophication

Threats can have a range of impacts and may change with time. For example:

- vegetation clearance can result in sediment entering caves, influence cave food chains, affect cave and cave entrance micro-climates, affect speleothem growth rate and cave hydrology.
- dams and diversions can result in changes in water supply to karst ecosystems.
- high nutrient levels in water may encourage undesirable species to establish within the ecosystem.
- human activity within caves can increase CO2 within caves and dissolve limestone features, potentially altering habitat for karst fauna.

Criterion:

It is an area that is susceptible to modification or degradation from human and/or pest impacts.

Table 7: Scoring methodology for vulnerability

Value	Description	Score
High	At risk of permanent deterioration in the short-term from human induced threats such as adjacent landuse activities, vegetation clearance, ground disturbance and hydrological change	3
Medium	Area has the potential to deteriorate in the medium term from threats such as animal and plant pests and sedimentation from the surrounding catchment	2

[7] Ecological integrity can be defined as: "The ability of an ecosystem to support and maintain a community of organisms that has species composition, diversity, and functional organisation comparable to those of that ecosystem in its natural state." Reporting environmental outcomes in the context of ecological integrity is required from the council under the Environmental Reporting Act 2015.

Value	Description	Score
Low	Area is resilient to change, because it is a largely intact and self functioning ecosystems, largely protected from human induced threats, and/or actively managed to protect its values.	1

Definitions for value:

High:

- At risk of permanent deterioration in the short-term as a result of adverse effects from surrounding land use such as vegetation clearance, ground disturbance and hydrological change.

Medium:

- Area has the potential to deteriorate in the medium term as a result of low intensity threats such as intensive stock grazing, pest animal and plant invasion, e.g. pest plants are present along the margins and may spread further within the site.

Low:

- Area is more resilient to change because:
    - The area is of high ecological quality and is unlikely to be subject to modification. For example, the site is largely unmodified with low risk of human induced erosion issues and low levels of pest animals and plants; or
    - The area is of very low quality and it cannot be degraded any further under the current land use regime. In effect this means the area is unlikely to experience further deterioration other than complete removal or destruction due to a land use change (e.g. a change from farming to quarrying).

Tools and references:

- Bellingham P, Richardson S, Burge O, Wiser S, Fitzgerald N, Clarkson B, Collins K 2021. Standardised methods to report changes in the ecological integrity of sites managed by regional councils. Manaaki Whenua Landcare Research contract report prepared for Hawke's Bay Regional Council.
- Clarkson B, Cursey M, Denyer K 2018. Restoring Waikato's Indigenous Biodiversity: Ecological Priorities and Actions. Waikato Biodiversity Forum.
- Kenny JA, Hayward BW. Karst in stone: karst landscapes in New Zealand: a case for protection 2009. Geological Society of New Zealand.
- McGlone MS, McNutt K, Richardson SJ, Bellingham PJ, Wright EF 2020. Biodiversity monitoring, ecological integrity, and the design of the New Zealand Biodiversity Assessment Framework. New Zealand Journal of Ecology 44: 3411.
- Whaley KJ, Clarkson BD, Leathwick JR 1995. Assessment of criteria used to determine 'significance' of natural areas in relation to Section 6(c) of the Resource Management Act (1991). Hamilton, Manaaki Whenua – Landcare Research.
- Waikato Regional Council 2021. Management of Karst Landscapes in the Waikato. Factsheet April 2021.

2.5.1.2 Animal pest control (weighting = 3)

Introduced animal pests, including possums, mustelids, rats, feral cats, prey upon native birds, mammals (bats), fish, reptiles and invertebrates, as well as competing for their habitats. One of the most significant impact of animal pests is the removal of canopy foliage and canopy species seedlings and saplings of native vegetation communities, which, if left unchecked, may trigger complete canopy collapse and destruction of all structural tiers of a plant community (i.e., canopy, sub-canopy etc.).

Damage is not limited to leaves—fruit, seeds and seedlings of plants are also eaten. They have undoubtedly caused the localised reduction and complete local extinction of many native plant and animal species in the Waikato region. Browsing animal pests such as feral goats and pigs, and deer, can also be a significant issue in karst habitat. Excessive browsing of vegetation not only removes palatable plants from a native forest or wetland, browsing animal pests can spread weeds and diseases and open up native ecosystems allowing weeds to establish. Heavy browsing may accelerate soil erosion directly, or may damage the habitat of indigenous organisms causing localised population decline or extinction (e.g. pig rooting destroying habitat that supports ground-dwelling invertebrate communities). Three species of introduced social wasps are present in the Waikato region and are likely well established throughout all of the 58 top priority karst sites. These introduced wasp species are significant threat to native animals and their habitats.

Criterion:
Pest animals, including predators and herbivores, are controlled at this site.

Table 8: Scoring methodology for animal pest control

Value	Description	Score
High	No pest animal control is carried out at this site or it is unknown whether control is carried out.	3
Medium	Some control is carried out.	2
Low	Pest animal control is carried out at this site and/or plant pest distribution and abundance is minimal.	1

Definitions for value:

High:

- No pest animal control is carried out at this site; or
- It is unknown whether control is carried out.

Medium:

- Some pest control is carried out at this site but it does not cover the full suite of species and/or outcomes are not monitored.

Low:

- Pest animals are controlled at this site; and
- Targets are set and outcomes are monitored.

Tools and references:

- 2022-2032 Regional Pest Management Plan | Tūtohu Mahere Whakahaere Ā-Roheo Waikato Mō Ngā Kīrearea for the Waikato region
- Clarkson B, Cursey M, Denyer K 2018. Restoring Waikato's Indigenous Biodiversity: Ecological Priorities and Actions. Waikato Biodiversity Forum.
- Kenny JA, Hayward BW. Karst in stone: karst landscapes in New Zealand: a case for protection 2009. Geological Society of New Zealand.
- Waikato Regional Council 2021. Management of Karst Landscapes in the Waikato. Factsheet April 2021.
- Ecological restoration in the Waikato – Department of Conservation: https://www.doc.govt.nz/get-involved/run-a-project/restoration-advice/native-plant-restoration/local-planting-guides/ecological-restoration-in-the-waikato/
- Davis, M & Meurk, C. 2001. Protecting and restoring our natural heritage. A practical guide. Department of Conservation, Wellington.
- King, C.M. (Ed). 1990. The handbook of New Zealand mammals. Oxford University Press, Auckland.McGowan, R 2000: Plants for rongoa: Traditional Māori medicine. Hamilton Gullies. University of Waikato/Hamilton City Council Workshop, April 2000.

2.5.1.3 Plant pest and disease control (weighting = 3)

Pest plants affect the long-term survival of native plants and plant communities by smothering, shading or otherwise competing with native plants. Furthermore, plant pests can take over habitat required by native seedlings thus restricting regeneration. As plant pests spread around the world they reduce biodiversity and more and more places become increasingly alike. Plant pests threaten the ecological integrity of all terrestrial native vegetation communities within karst ecosystems.

Kauri dieback disease and Myrtle rust are the two most serious threats to native forest at the moment, and undoubtably other diseases will spread into karst ecosystems over time.

Criterion:
Pest plants are controlled at this site.

Table 9: Scoring methodology for plant pest control

Value	Description	Score
High	No pest plant control is carried out at this site or it is unknown whether control is carried out.	3
Medium	Some control is carried out.	2
Low	Pest plant control is carried out at this site and/or plant pest distribution and abundance is minimal	1

Definitions for value:

High:
- No pest plant control is carried out at this site; or
- It is unknown whether control is carried out.

Medium:
- Some pest plant control is carried out at this site but it does not cover the full suite of species and/or outcomes are not monitored; or
- Pest plants are unlikely to be present at the site.

Low:
- Pest plants are controlled at this site; and
- Targets are set and outcomes are monitored; or
- Pest plants are not present at the site.

Tools and references:

- 2022-2032 Regional Pest Management Plan | Tūtohu Mahere Whakahaere Ā-Roheo Waikato Mō Ngā Kīrearea for the Waikato region
- https://www.weedbusters.org.nz/
- Clarkson B, Cursey M, Denyer K 2018. Restoring Waikato's Indigenous Biodiversity: Ecological Priorities and Actions. Waikato Biodiversity Forum.
- Kenny JA, Hayward BW. Karst in stone: karst landscapes in New Zealand: a case for protection 2009. Geological Society of New Zealand.
- Waikato Regional Council 2021. Management of Karst Landscapes in the Waikato. Factsheet April 2021.
- Waikato Regional Council 2021. Regional Planting Guides: https://www.waikatoregion.govt.nz/environment/biodiversity/planting-guides/

- Ecological restoration in the Waikato – Department of Conservation: https://www.doc.govt.nz/get-involved/run-a-project/restoration-advice/native-plant-restoration/local-planting-guides/ecological-restoration-in-the-waikato/
- Davis, M & Meurk, C. 2001. Protecting and restoring our natural heritage. A practical guide. Department of Conservation, Wellington.
- Atkinson, I. A. E. 1994. Guidelines to the development and monitoring of ecological restoration programmes. Dept. of Conservation Wellington.
- Wiser S.K.; Allen R.B. 2006. What controls invasion of indigenous forests by alien plants? In: Allen RB, Lee WG ed. Biological Invasions in New Zealand. Ecological Studies 186. Berlin Heidelberg, Springer. Pp. 195–209.

2.5.1.4 Restoration planting criteria (weighting = 3)

Ecological restoration is the process of re-establishing a self-sustaining habitat or ecosystem similar to what is likely to have existed before human contact. The restoration could involve the reintroduction of native fauna and flora, and the eradication or control of pests. When reintroducing plant species, the aim should be:

- To restore to a site those genes and species which, if it were not for human intervention, might be expected to be naturally found there;
- To establish plants in the appropriate landscape, in a way that replicates natural dispersal patterns (this is especially important where species are planted in a natural setting and are intended, or have the potential, to naturally regenerate).

Ecological restoration is not usually a one-off activity. It may require a number of interventions over several years, or even decades, in order to restore natural patterns and processes.

Criterion:
Native vegetation cover has been lost at this site.

Table 10: Scoring methodology for restoration planting

Value	Description	Score
High	No restoration planting has been carried out at this site or it is unknown whether it has been carried out.	3
Medium	Some restoration planting.	2
Low	Restoration planting is not required	1

Definitions for value:

High:

- No restoration planting has been carried out at this site; or
- It is unknown whether restoration planting has been carried out.

Medium:

- Some restoration planting has been carried out at this site but it is limited to waterways only; and/or
- As much as half of the site is already vegetated with indigenous species.

Low:

- The site is fully vegetated with indigenous species (whether planted or naturally occurring).
- Extensive restoration planting is carried out at this site.

Tools and references:

- Clarkson B, Cursey M, Denyer K 2018. Restoring Waikato's Indigenous Biodiversity: Ecological Priorities and Actions. Waikato Biodiversity Forum.
- Kenny JA, Hayward BW. Karst in stone: karst landscapes in New Zealand: a case for protection 2009. Geological Society of New Zealand.
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- https://www.doc.govt.nz/get-involved/run-a-project/restoration-advice/native-plant-restoration/local-planting-guides/ecological-restoration-in-the-waikato/
- Waikato Regional Council 2021. Eregional Planting Guides: https://www.waikatoregion.govt.nz/environment/biodiversity/planting-guides/
- Ecological restoration in the Waikato – Department of Conservation: https://www.doc.govt.nz/get-involved/run-a-project/restoration-advice/native-plant-restoration/local-planting-guides/ecological-restoration-in-the-waikato/
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2.5.1.5 Fencing (weighting = 2)

Surrounding land use has a large impact on karst ecosystems and their catchments, particularly when karst systems are largely underground. The level of fencing and planting around sinkholes (dolines) and tomos provides protection from runoff/pollution of waterways downstream. It also prevents stock from entering the systems, which is beneficial to farmers and the ecosystems.

Criterion:
This site has inadequate fencing around its surface expression.

Table 11: Scoring methodology for fencing

Value	Description	Score
High	Unfenced or unknown	3
Medium	Partially fenced	2
Low	Fenced	1

Definitions for value:

High:

- This surface expression of this site is unfenced; or
- The fencing is inadequate to prevent stock access; or
- It is unknown whether the site is fenced.

Medium:

- The surface expression of this site is partially fenced, with some areas fully fenced but some areas unfenced or inadequately fenced.

Low:

- The surface expression of this site is securely fenced with a stock proof fence; or
- As a protected site, grazing or other rural landuse is not an issue.

Tools and references:

- Clarkson B, Cursey M, Denyer K 2018. Restoring Waikato's Indigenous Biodiversity: Ecological Priorities and Actions. Waikato Biodiversity Forum.
- Parkyn S, Collier K, Clapcott J, David B, Davies-Colley R, Matheson F, Quinn J, Shaw W 2010. The restoration indicator toolkit. NIWA, Hamilton, New Zealand.
- Waikato Regional Council 2016-2017. Oblique aerial imagery of the Waikato Region.

2.5.1.6 Legal protection (weighting = 2)

Legal protection of a karst SNA is considered a vital part of securing the long-terms benefits of enhancement and restoration management actions. Without legal protection, there is no guarantee that subsequent landowners will continue or maintain previous restoration measures (such as excluding cattle). Note that this criterion is equivalent to criterion 1 of Section 11A of the WRPS.

Criterion:
This site is currently unprotected 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.

Table 12: Scoring methodology for legal protection

Value	Description	Score
High	Unprotected	3
Medium	Partial protection	2
Low	Protected by DOC or QEII	1

Definitions for value:

High:

- It is unknown if this site is legally protected; or
- It is known that this site is not protected; or
- Less than a half of the site is protected by DOC or QEII; or
- Only part of the site is protected by Ngā Whenua Rāhui covenant.

Medium:

- At least half of the site is protected by DOC or QEII,; or
- The site is fully protected by a district council covenant/reserve/Ngā Whenua Rāhui.

Low:

- At least 75% of the site is legally protected by DOC or QEII specifically for the protection of biodiversity.

Tools and references:

- RACS_SOILCON_FENCE (fences associated with soil conservation programme)
- RACS_CLNSTRM_FENCE (fences associated with the cleanstream programme)
- RACS_PS_FENCE (fences associated with grazing licenses on WRC land)
- RACS_EXISTING_FENCING (fences already in place).
- LINZ Data Service. Protected Areas: Crown Property (data.linz.govt.nz/layer/53564-protected-areas/).
- Nga Whenua Rahui (doc.govt.nz/get-involved/funding/nga-whenua-rahui/)
- QEII Trust (qeiinationaltrust.org.nz/publications-and-resources/map-of-our-protected-land/).
- Roper-Lindsay J, Fuller SA, Hooson S, Sanders MD, Ussher GT 2018. Ecological impact assessment. EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems.
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2.5.2 Management Potential criteria

As discussed above, Whaley et al. (1995), consider it appropriate to assess threat and management states of a particular site in determination of ecological significance. These factors have therefore been incorporated into the ranking assessment methodology as 'Management Potential' criteria.

2.5.2.1 Restoration potential (weighting = 2)

The goal of restoration is to reinstate ecological integrity and create a self-sustaining, ecologically resilient environment. Restoration potential is the level of restoration achievable for a given amount of money (measured in dollars invested per hectare per year). Restoration activities can include stock control (fencing), pest animal and plant control, planting to create buffers and the creation of corridors to connect different areas to improve the ecological integrity of the site.

Criterion:
It is a site with high restoration potential, measured as the ecological integrity gained per dollars per hectare per year.

Table 13: Scoring methodology for restoration potential

Value	Description	Score
High	<$100/ha/year for a minimum of three years required to make significant improvements	3
Medium	$100/ha/year - $1000/ha/year for a minimum of three years required to make significant improvements	2
Low	> $1000/ha/year for a minimum of three years would be required to make significant improvements	1

Definitions for value:

High:

- Less than $100/ha/year for a minimum of three years would make significant habitat improvements and/or reduce threats to indigenous species.

Medium:

- Between $100 and $1000/ha/year for a minimum of three years would make significant improvements to a site.

Low:

- More than $1000/ha/year for a minimum of three years would be required to make significant improvements at a site.

Tools and references:

- Clarkson B, Cursey M, Denyer K 2018. Restoring Waikato's Indigenous Biodiversity: Ecological Priorities and Actions. Waikato Biodiversity Forum.
- Parkyn S, Collier K, Clapcott J, David B, Davies-Colley R, Matheson F, Quinn J, Shaw W 2010. The restoration indicator toolkit. NIWA, Hamilton, New Zealand.

2.5.2.2 LTP: Community Involvement (weighting = 2)

This criterion links objectives of the LTP (Long Term Plan). Community involvement can contribute greatly to the enhancement of biodiversity. Up to date ecosystem inventories are essential in ensuring resources are channelled to the best outcomes.

Criterion:
A community group is overseeing restoration activities at this site.

Table 14: Scoring methodology for community involvement

Value	Description	Score
High	A community group is involved in restoration activities.	3
Low	There is no community group involvement.	1

Definitions for value:

High:

- A community group is involved in restoration activities at this site or part of this site.

Low:

- There is no community group involvement at this site; or
- It is unknown whether there is community group involvement at this site.

2.5.2.3 LTP: Council Funding & Natural Heritage Partnership Programme (NHPP Support (weighting = 2)

This criterion identifies funding from the council or prioritisation by the council's Integrated Catchment Management service's team (ICM) for active management in the catchment of the karst SNA. It also takes into account Natural Heritage Partnership Programme (NHPP) grants.

Criterion:
The council provides funding or priority for funding through ICM's Prioritisation process. A community group or individual receives funding through the NHPP to undertake restoration activities at this site as per their funding agreement. Council supports community environmental projects through the Natural Heritage Partnership Programme (NHPP). This programme comprises three separate contestable funds: the Natural Heritage Fund (NHF); the Environmental Initiatives Fund (EIF); and the Small Scale Community Initiatives Fund (SSCIF).

Table 15: Scoring methodology for council ICM priority or NHPP funding criteria

Value	Description	Score
High	There is a high level of funding and management input from the council. A community group or individual receives funding through the NHPP to undertake restoration activities as per their funding agreement.	3
Medium	There is limited council funding and management input but it has been identified as a priority area for ICM or NHPP resource input.	2
Low	The site receives no council funding and/or management input, or it is	1

Value	Description	Score
	unknown whether the site receives funding and management input.	

Definitions for value:

High:

- There is a high level of funding and management input from the council.

Medium

- There is limited council funding and management input but it has been identified as a priority area for ICM or NNHPP resource inputs.

Low:

- The site receives no council funding and/or management input; or
- It is unknown whether the site receives council funding and management input.

Tools and references:

- ICM prioritisation records – accessed June 2021
- Waikatoregion.govt.nz/community/funding-and-scholarships/natural-heritage-fund/, accessed 28 May 2021.
- Waikato Regional Council 2021. Dataset: Number of on the ground projects on private land within the top 30% of priority ecosystems delivering biodiversity restoration
- Waikato Regional Council 2021. Dataset: Number of community groups and individuals funded through the NHPP that undertake restoration activities as per their funding agreement.
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- Waikato Biodiversity Forum 2010. Community Group Projects. https://www.waikatobiodiversity.org.nz/community-group-projects/

2.5.2.4 Non-Waikato Regional Council Resourced and Managed (weighting = 2)

This criterion assesses the level of funding or support from sources other than the council for conservation activities. These activities include, but are not limited to, pest animal and plant control, fencing, Threatened species protection and/or habitat restoration at a site. A higher score is applied to a site with little or no management or funding from sources other than the council[8].

Criterion:

It is a site that receives management and funding inputs from sources other than the council.

Table 16: Scoring methodology for non-council funding and management criteria

Value	Description	Score
High	There is a high level of funding and management input from central government or national trusts.	3

[6] For each criterion the SNA is assigned a value rank of either: low (score 1); medium (score 2); or high (score 3)

Value	Description	Score
Medium	There is limited funding and management input from one or two local sources.	2
Low	The site receives no funding and/or management input, or it is unknown whether the site receives funding and management input.	1

Definitions for value:

High:

- There is a high level of funding and management input from Iwi, mana whenua, central government or national trusts (e.g. Department of Conservation, QEII, Landcare Trust, Forest & Bird).

Medium:

- There is limited funding and management input from one or two local sources (i.e. local community groups, conservation organisations, or from the local district council).

Low:

- It is unknown if the site receives any funding and/or management input from sources other than the council; or
- The site receives no funding and/or management input.

Tools and references:

Ongoing communication with Iwi, mana whenua groups, key government agencies, stakeholders and community groups.

3 Results

3.1 Ranking summary

Table 17 summarises the results of the analysis of the 58 karst SNA, based on application of the methods detailed in section 2, using information obtained from existing databases and literature, consultation with key internal and external experts and ground–truthing of six sites.

The data and site specific analysis is detailed in an Excel spreadsheet held by the council – "Karst_SNA_Biotic_Ranking" master database which matches the spatial data and associated attribute table held by Council. It is expected that this ranking will alter as new information is obtained and new funding opportunities arise.

Table 17: Summary of ranking scores for the Top 58 SNA karst sites (highest to lowest)

Site number	Site name	Ecological value ranking (12-36)	Threat ranking (15-45)	Management Potential ranking (8-24)	Total Score
315	Mangaorongo Gorge and natural bridges	31	36	22	89
339	Ten Acre Tomo System	25	43	20	88
351	Waitomo Forest karst	31	41	16	88
327	Paparahia Cave	30	37	20	87

Site number	Site name	Ecological value ranking (12-36)	Threat ranking (15-45)	Management Potential ranking (8-24)	Total Score
331	Rakaunui coastal karst and ephemeral lakes	32	41	14	87
320	Mangawharawhara Stream natural bridges and gorge	27	41	18	86
344	Upper Mangaotaki Gorge bluffs	29	36	20	85
357	Kairimu Cave Systems	31	40	14	85
330	Raglan coastal karst	26	40	18	84
353	Waitomo Stream headwaters Cave System	24	41	18	83
304	Gardner's Gut Cave	27	38	18	83
313	Lower Mangaotaki Gorge bluffs	27	36	20	83
334	Taranaki Point coastal karst	30	41	12	83
358	King George Cavern and Sid's Surmise	22	40	20	82
325	Old Mountain Road karst	27	43	12	82
322	Mangawhitikau slit gorge and karst	26	45	10	81
317	Mangapohue-Hauturu Road polygonal karst	31	30	20	81
306	Gribbon Road bluffs	29	33	18	80
355	Broken Hill Cave	16	43	20	79
332	Ruakuri Cave	22	41	16	79
328	Pukeroa Cave System	17	43	18	78
302	Castle Craig bluffs	28	38	12	78
350	Wairere Falls cave and karst	16	45	16	77
345	Waikaretu karst and Nikau Cave	28	33	16	77
333	Ruakuri Natural Bridge and karst	31	26	20	77
356	Ecch Cave	14	42	20	76
314	Mangaokewa Gorge bluffs	31	21	24	76
303	Deception Cave	15	42	18	75
305	Grand Canyon Cave	18	37	20	75
337	Te Kauri Karst	29	26	20	75
324	Mohakatino karst	32	23	20	75
301	Awaroa rocky peaks and karst	33	28	14	75
352	Waitomo Glowworm Cave and resurgence karst	17	41	16	74
342	Totoro Gorge karst	19	39	16	74
343	Troopers Rd Cave System	16	41	16	73
321	Mangawhitikau Cave System	20	43	10	73
349	Waipuna polygonal karst	28	31	14	73
311	Lake Rotokawau	29	28	16	73
329	Puketiti Flower Cave	13	41	18	72
310	Lake Koraha and Matauratahi	29	26	16	71
338	Te Raumauku Maze Cave	17	45	8	70

Site number	Site name	Ecological value ranking (12-36)	Threat ranking (15-45)	Management Potential ranking (8-24)	Total Score
307	Hollow Hill Cave	27	31	12	70
323	Marokopa Natural Tunnel and Te Ana Kapiti Cave	31	27	12	70
318	Mangapu Cave System	18	41	10	69
312	Lake Rotokotuku	23	33	12	68
348	Waipuna Cave	24	30	14	68
335	Taumatatotara karst and dolines	33	21	14	68
336	Tawarau karst	33	21	14	68
308	Karamu Cave	16	43	8	67
354	Whenuapo karst	25	30	12	67
309	Lake Disappear and karst	15	41	10	66
346	Waikawau Valley karst	18	35	12	65
319	Mangapu Gorge and blind valley	28	25	12	65
326	Pakeho polygonal karst and autogenic aquifer	15	41	8	64
316	Mangapohue Natural Bridge	17	32	14	63
341	Torehina karst	22	31	10	63
340	Tomac Tomo	13	41	8	62
347	Waipapa Rd Cave System	13	41	8	62

4 Limitations and recommendations

This assessment process considers only the ecological (i.e. biotic) values of the top 58 karst SNA. Karst systems will have a range of other values, such as landscape, geological, paleological, archaeological and cultural values, which are not included in the scope of this assessment.

In addition, this methodological framework allows for the conversion of professional opinion into an overall site score that can be ranked against other sites. This score must be carefully interpreted as the score is largely based on interpretation of data by professional expert opinion, rather than quantitative data analysis. In most instances, assessments are desktop only with limited ground truthing. Further study and regular monitoring of karst ecosystems is required to provide more robust data and thus increased knowledge of karst biodiversity values and management needs, which in turn will lead to a more robust management prioritisation ranking of the top 58 karst SNA.

Nonetheless, the methodology described within this report is considered a sufficiently transparent and robust approach for council staff and landowners to apply to karst SNA. When applied in conjunction with site specific data from the karst SNA dataset, it will assist in the understanding of the relative biotic values of each karst SNA, the threats to and vulnerabilities of each, and hence provide for a strategic allocation of resources and management actions to protect, enhance and restore the biodiversity values of karst ecosystems from a regional perspective.

In this context, the council wishes to develop a methodology that will allow it to prioritise potential biodiversity management efforts in karst areas and provide the baseline information for karst ecological restoration and assist with further policy development. There are several limitations to the methodology presented in this report. Limitations and recommendations are as follows:

i. This methodology thus far treats subsurface karst and surface karst as two separate karst SNAs (e.g. Waipuna Cave site 348 and Waipuna Polygonal Karst site 349). However, surface and subsurface parts of karst systems are functionally connected. Drainage from the surface sinks and percolates underground later to flow through caves before reappearing in springs. The subterranean ecosystem depends completely on energy flows from the surface. Given that the purpose of management is to safeguard ecological and hydrological values, Paul Williams (The University of Auckland) recommends that the management of surface and subsurface features should be coordinated.

ii. Willingness of the landowner could be the primary constraint or incentive to undertaking biodiversity enhancement management. This may be further complicated when multiple landowners are involved in the management of a karst SNA. Landowner willingness will depend on factors such as management goals, council expectations and the degree of support available. Therefore, council staff will need to liaise with affected landowners on a case-by-case basis when applying the results from this methodology.

iii. Limited information is available for assessing threats and potential outcomes when evaluating management priority. We suggest that this data is reviewed annually and/or that an open-source dataset is shared within the council so it can be updated as more information becomes available on each site.

iv. Information on under-represented vegetation types is not always accurate and vegetation cannot always be easily categorised as a single type. For example, several subcategories of lowland puriri-broadleaved forest ('WF7' in Singers and Rogers et al 2014) exist in the Waikato region. These are effectively the same with minor regional differences in major canopy species. For the purposes of this assessment, these subcategories have been lumped together to calculate scores for under-represented vegetation types. In reality this has little effect on the outcome rankings for the karst ecosystem types, as the geo-morphological values are what

drives the overall unique biodiversity values of karst systems rather than above surface vegetation types.

v. For the purposes of this assessment, under-represented vegetation types have been assessed by ecological district. It is also possible to assess under-represented types of the region rather than districts, and this may have a small effect on the scoring.

vi. The presence or absence of nationally or regionally Threatened or At Risk species is a critical determiner in assessing the significance of a karst ecosystem and its habitats. There is a porosity of data for these At Risk, Threatened and regional rare species in the Waikato. It is recommended that council support regional research initiatives to improve our understanding of At Risk, Threatened and regionally rare species in the region. In addition, for future ranking assessment of karst systems, a differentiation between regionally rare, At Risk and Threatened species in the scoring methodology would likely better highlight the importance of these systems to these species and their habitats. This wasn't adopted ion this ranking assessment, because our knowledge of species usage, particularly for sub-surface habitat utilisation is very limited, and thus we undertook a conservative approach and assumed karst habitats for At Risk and regionally rare species was equally as important in the region as for Threatened species.

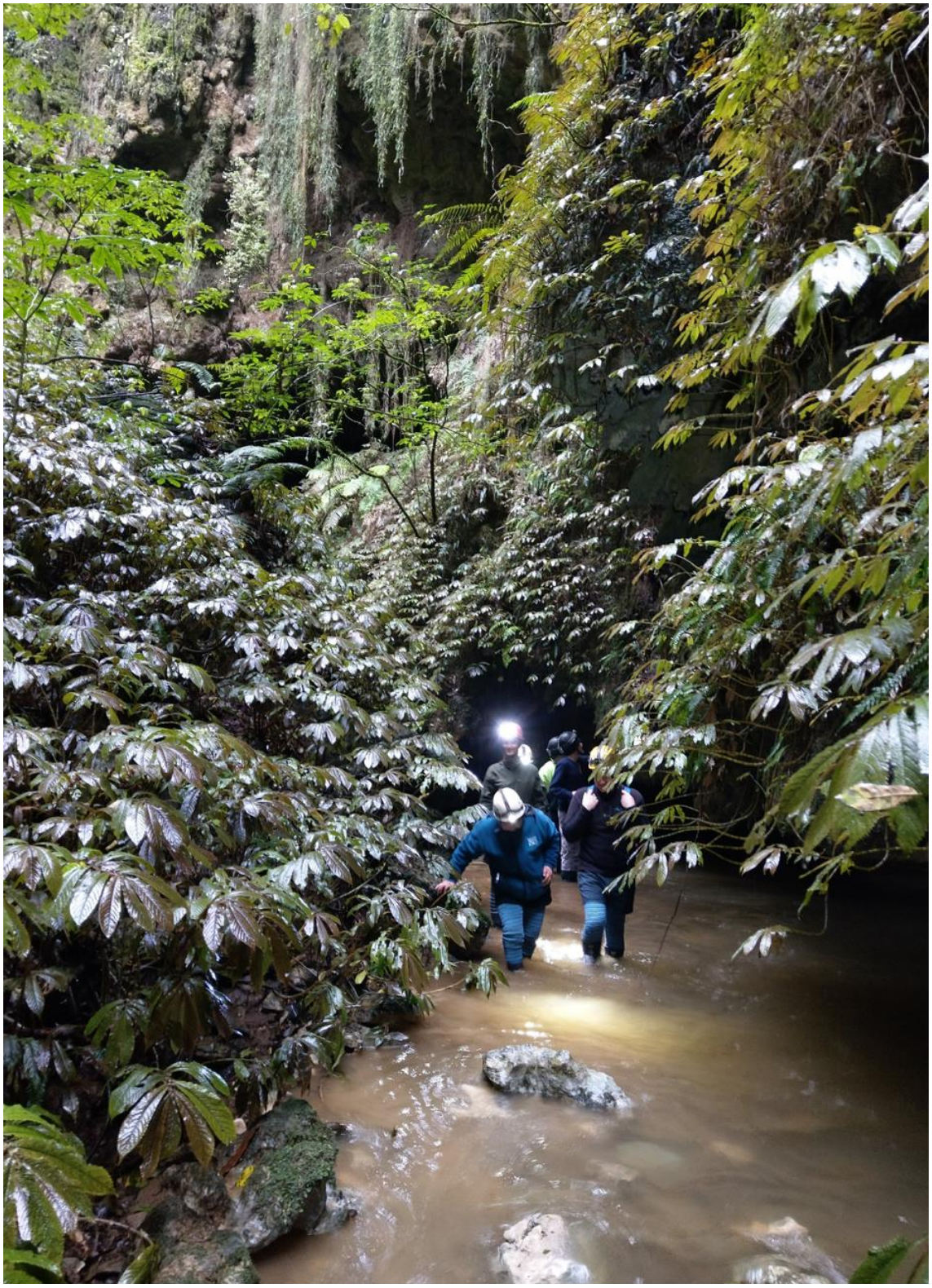

Figure 2: Exploring a 'Top 58 karst SNA' cave with intact native vegetation surrounding the entrance.

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NB – Note these references may not include those already cited in the body of this report.

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Appendix I: Detailed Inventory of Top 58 Karst SNA sites

A. Hierarchical classification system and priority ranking systems for karst SNA ranking and check list[9].

	Ecological Value Criteria											
Criteria	**Representativeness**		**Size**		**Linkage and buffering**		**Diversity and pattern**		**Under-represented vegetation types**		**Threatened species**	
Weighting		**2**		**2**		**2**		**2**		**3**		**1**
Scoring	Minimum Score	2	Minimum Score	2	Minimum Score	2	Minimum Score	2	Minimum Score	3	Minimum Score	1
	Medium Score	4	Medium Score	4	Medium Score	4	Medium Score	4	Medium Score	6	Medium Score	2
	Maximum Score	6	Maximum Score	6	Maximum Score	6	Maximum Score	6	Maximum Score	9	Maximum Score	3

	Threat Criteria											
Criteria	**Vulnerability**		**animal pest control**		**plant pest control**		**restoration planting**		**Fencing**		**Legal protection**	
Weighting		**2**		**3**		**3**		**3**		**2**		**2**
Scoring	Minimum Score	2	Minimum Score	3	Minimum Score	3	Minimum Score	3	Minimum Score	2	Minimum Score	2
	Medium Score	4	Medium Score	6	Medium Score	6	Medium Score	6	Medium Score	4	Medium Score	4
	Maximum Score	6	Maximum Score	9	Maximum Score	9	Maximum Score	9	Maximum Score	6	Maximum Score	6

	Management Potential Criteria							
Criteria	**Restoration potential**		**LTP: Community involvement**		**LTP: Funding support**		**Non-council funding**	
Weighting		**2**		**2**		**2**		**2**
Scoring	Minimum Score	2	Minimum Score	2	Minimum Score	2	Minimum Score	2
	Medium Score	4	Medium Score	4	Medium Score	4	Medium Score	4
	Maximum Score	6	Maximum Score	6	Maximum Score	6	Maximum Score	6

B. Definitions and factors to consider when applying a Confidence Level to the significance assessment of a site. Adapted from Wildland Consultants Ltd Draft report, 2019

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.

[9] For each criterion the SNA is assigned a value rank of either: low (score 1); medium (score 2); or high (score 3)"

Confidence level	Definition
	• 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.

C. Scoring sheets for top 58 karst SNA.

Site 301 Awaroa rocky peaks and karst

Site information.

Site Number	301	**Site Name**	Awaroa rocky peaks and karst	**Karst Type**	Surface	**Site Area (ha)**	214.569	**District**	Waitomo and Otorohanga
Ecological Region	Tainui	**Protection Status**	DOC (189.2ha) and unprotected	**Ecological District**	Kawhia	**Naturally Uncommon Ecosystem Types**	Caves and cracks; cliffs, scarps, and tors		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Karst - Top58 - Site Reports DM15802627, 16363769
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A surface karst site of a few separate areas, east of the Hauturu Road and Awaroa River, just north of Te Koraha Station. Based on aerial imagery, the vegetation (WF13, CDF4-1, MF7-2, VS5) and habitat of the surface is likely to be in relatively good condition and is well connected to a much larger portion of forest, which is likely to have multiple threatened biodiversity values.	3
2	Size	3	2	6	At 214.569 ha, this surface karst SNA is large compared to other surface karst in the top 58 karst SNA ecosystems.	3
3	Linkage and buffering	3	2	6	Each of the SNA units are entirely surrounded by indigenous vegetation. Most of the site (189.2ha) is part of Hauturu East Scenic Reserve or Hauturu East Conservation Area, which are well-connected to larger forested areas within the locality.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	3	2	6	The Awaroa rocky peaks and karst are a collection of limestone pinnacles, ranging from 460 m to 497 m a.s.l. In terms of naturally uncommon karst ecosystems, the site includes: caves and cracks; and cliffs, scarps and tors. The site comprises a range of indigenous vegetation types: WF13, CDF4-1, MF7-2, VS5.	3
5	Under-represented vegetation types (national priority)	2	3	6	Vegetation of the site has been mapped as a mix of Hall's totara-broadleaf forest, podocarp-tawa forest, manuka-kanuka and treefern-broadleaf scrub and this is supported by the imagery. N Area WF13 with exotic pasture in N; E Area CDF4-1, WF13 & MF7-2; Small Central N & S VS5-WF13 with small-leaved scrub on bluffs; S Area VS5-WF13 (small areas of exotic grassland on some bluffs-not mapped). None of the vegetation types present within this SNA exist within the Kawhia ED at less than 20% of their 1840 extent. However, much of this site appears to be old growth forest that is representative of its type.	2
6	Threatened species (national priority)	3	1	3	Flora known to occur on site: rātā (*Metrosideros colensoi*) (Nationally Vulnerable), red mistletoe/pikirangi (*Peraxilla tetrapetala*) (Declining), *Linum monogynum* (Declining) and awaroa hebe (*Veronica scopulorum*) (Declining). Flora likely to occur on site: carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable) and species of the Myrtaceae family (Threatened). Fauna likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical) and central lesser short-tailed bat (*Mystacina tuberculata rhyacobia*) (Declining).	3
Ecological value score				**33**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	The site is likely to be resilient to change because it is buffered from farmland by adjacent indigenous forest and conservation land. The usual suite of pest species are likely to be present, with goats and pigs in particular a big problem in the area. As a protected site, grazing or other rural land use is unlikely to be an issue.	3
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., goats, pigs, deer, possums, rats, and mustelids), with goats in particular a big problem in the area. Hares and rabbits may be an issue in areas bordering pasture. It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	2	3	6	A range of pest plant species may be present at this site, but it is unknown whether pest control is currently being undertaken. Most of the site is buffered from pest plants by adjacent forest.	1
10	Urgency: Restoration planting	1	3	3	The site is fully or nearly fully vegetated with indigenous species and so restoration planting is unlikely to be necessary.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
11	Fencing	2	2	4	Given that most of the site is protected, grazing or other rural land use is not an issue for the majority of the site. It is unknown whether areas on private land are fenced but records show it is unfenced.	2
12	Legal protection	1	2	2	Nearly 90% of the SNA is on DOC land (Awaroa Scenic Reserve, Hauturu East Conservation Area, Hauturu East Scenic Reserve).	3
Threat score				**28**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Goat control every five years and the establishment of possum and rat control in the form of bait stations would likely significantly reduce the threat to indigenous species.	2
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	2	2	4	No known WRC funding. ICM priority site.	2
16	Non-WRC funding	1	2	2	No known funding from other sources, however part of the site is public conservation land so it may receive some funding and inputs from DOC, but this is unknown.	1
Potential outcomes score				**14**		
Total Score for site 301				**75**		

Site 302 Castle Craig bluffs

Site information.

Site Number	302	Site Name	Castle Craig bluffs	Karst Type	Surface	Site Area (ha)	121.352	District	Waitomo
Ecological Region	King Country	Protection Status	DOC (50.43ha) and unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Caves and cracks; cliffs, scarps, and tors		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Karst - Top58 - Site Reports DM15802627, 16363769
- Rātā observed 2017 (sourced from GIS layer; iNaturalist_NatureWatch_data_Waitomo_DC); carmine rātā observation sourced from NZPCN; Myrtaceae observation via WRC database. Longfin eel observed 1987 (sourced from GIS layer; Fish Waitomo DC); bush falcon observed by R Barnes (sourced from GIS layer; Casual bird observations for Waitomo DC); redfin bully observed 1996 (sourced from GIS layer; Fish Waitomo DC).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A surface karst site of a single area, on the south and west side of the Marokopa River at Te Anga. Based on aerial imagery, fragmented broadleaf scrub with some manuka scrub is present in the southwest, with modified primary tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13) with areas of abundant nikau, tree ferns etc over the remainder of the area. Some lowland forest dominated by kahikatea and also freshwater herbfield is also likely in the parts of the site that are closer to the river. The vegetation and habitat of the surface is likely to be in relatively moderate condition and appears to be largely secondary forest from previous clearing events. The site is more-or-less connected to a much larger portion of forest, which is likely to have multiple threatened biodiversity values.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
2	Size	3	2	6	At 121.352 ha, this surface karst SNA is large compared to other top 58 karst SNA surface karst ecosystems.	3
3	Linkage and buffering	2	2	4	The site is mostly surrounded by pasture but is located within 1 km of Marokopa Falls Scenic Reserve and less than 3 km from Tawarau Karst (Site 336) which comprises more than 3000 ha of WF13 forest on both private and conservation land. Large areas of indigenous forest on private land are present to the north and south of the site.	3
4	Diversity and pattern	3	2	6	Ridge extending east from Castle Craig for 2 km with pinnacles and high bluffs. In terms of naturally uncommon karst ecosystems, the site includes: caves and cracks; and cliffs, scarps and tors. Contains WF13 forest, with some regenerating forest, lowland forest dominated by kahikatea, and potentially some freshwater herbfield.	3
5	Under-represented vegetation types (national priority)	2	3	6	In the Waitomo ED, 32.2% of WF13 is present and hence this vegetation type is not under-represented. Some areas of forest at this site appear to be old growth forest that is representative of its type.	3
6	Threatened species (national priority)	2	1	2	Significant fauna likely to occur on site: longfin eel (*Anguilla dieffenbachii*) (Declining), bush falcon/kārearea (*Falco novaeseelandiae* "bush") (Recovering) and redfin bully (*Gobiomorphus huttoni*) (Not Threatened but Regionally Uncommon). Significant flora likely to occur on site: rātā (*Metrosideros colensoi*) (Nationally Vulnerable), carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable), and species of the Myrtaceae family (Threatened).	3
Ecological value score				**28**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Part of the site is potentially open to land-clearing. The usual suite of pest species are likely to be present, with goats in particular a big problem in the area. In parts of the site that are protected, grazing or other rural land use is unlikely to be an issue. Some unprotected parts of the site are grazed.	2
8	Urgency: Animal pest control	3	3	9	Some pest species are likely to be present (e.g., goats, deer, pigs, hares, rabbits, possums, rats, and mustelids). It is unknown whether pest animal control is carried out at this site.	1
9	Urgency: Plant pest control	3	3	9	It is unknown whether pest plants are an issue at this site or whether pest plant control is being carried out.	1
10	Urgency: Restoration planting	2	3	6	It is unknown whether any restoration planting has been carried out at this site; however, much of the site is already vegetated with indigenous species.	1
11	Fencing	2	2	4	Part of the site is protected so grazing or other rural land use is not an issue for that part of the site. It is unknown whether parts of the site on private land are	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
					fenced to exclude stock, but part of the site is grazed. WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses.	
12	Legal protection	3	2	6	Part of the site (50.43 ha or 42%) falls within Ngahuinga Bluff Scenic Reserve, but the remainder fall on private land and has no official protection.	3
Threat score				**38**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Goat control every five years, the establishment of possum and rat control in the form of bait stations, and additional fencing or fencing upgrades would likely significantly improve habitats and reduce the threat to indigenous species.	2
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	2	2	4	No known WRC funding. ICM priority site.	2
16	Non-WRC funding	1	2	2	No known funding from other sources, however part of the site is public conservation land so it may receive some funding and inputs from DOC, but this is unknown.	1
Potential outcomes score				**12**		
Total score for site 302				**78**		

Site 303 Deception Cave

Site information

Site Number	303	**Site Name**	Deception Cave	**Karst Type**	Cave	**Site Area (ha)**	164.913	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	QEII (0.59ha) and unprotected	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Karst - Top58 - Site Reports DM15802627, 16363769
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A cave karst site of a single area, on the south and east side of Troopers Road at Whiroroa. Based on aerial imagery, vegetation of the site appears to be mostly exotic pasture with some scattered patches of forested vegetation in and surrounding the site. These patches have been variously mapped as MF7-3 tawa-pukatea-podocarp forest, broadleaf-treefern scrub and deciduous hardwoods and this is supported by the imagery. Modified wetland and riparian areas are present in the southwest. The vegetation and habitat of the surface appears to be in a relatively poor condition, dominated by exotic pasture, is not connected to other habitats and is likely to have only limited threatened biodiversity value.	2
2	Size	1	2	2	At 164.913 ha, this cave system is large compared to other top 58 karst SNA cave ecosystems; however, the site is highly degraded, lacking almost all indigenous species typical of its habitat type.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
3	Linkage and buffering	1	2	2	Very little indigenous vegetation is present on the site and in the surrounding landscape.	3
4	Diversity and pattern	2	2	4	One of the most extensive cave systems in the North Island. The site has moderate diversity of physical features with the following naturally uncommon karst ecosystems: caves and cracks; and cave entrances. The site contains small areas of forest and some modified wetlands.	2
5	Under-represented vegetation	1	3	3	Small areas of MF7 may be present, which is a vegetation type that is under-represented in the Waitomo ED. However, patches are likely too small to be considered representative.	2
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon). Significant fauna likely to occur on site: a species of beetle (*Neanops caecus*) (Naturally uncommon), a ground beetle *(Duvaliomimus* (*Mayotrechus*) *mayae mayorum*) (Naturally uncommon), a moth fly (*Psychoda zonata*) (conservation status unknown) and a fungus gnat (*Exechia hiemalis*) (conservation status unknown).	2
Ecological value score				**15**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	The main threats to this site are recreational cave use and future farm development. Other threats may include pest animal species, broadleaved agricultural weeds, exotic grasses, and uncontrolled grazing; however, current biodiversity values may be so low that these threats have negligible impact.	1
8	Urgency: Animal pest control	3	3	9	Pest animals (e.g., goats, pigs, deer, possums, rats, and mustelids) are likely present on site. It is unknown whether pest control is carried out for any of these species.	1
9	Urgency: Plant pest control	3	3	9	A range of pest plant species may be present at this site, but it is unknown whether pest plant control is currently being undertaken.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site. Most of the site is grazed and may be unsuitable for restoration planting; however, restoration planting of waterways and in fill planting amongst existing areas of indigenous vegetation may be possible.	1
11	Fencing	2.5	2	5	This site is mostly farmland with pockets of indigenous vegetation. This site has small amount of fencing associated with WRC's soil conservation programme (5%). It is not clear if the cave entrance(s) are fenced from stock.	1
12	Legal protection	3	2	6	A very small area of this SNA is QEII covenanted (0.59 ha), but most of the site is unprotected.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
Threat score				**42**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Although most of the site is farmland that would require extensive inputs for significant improvements, cave entrances could be significantly improved with a moderate amount of fencing, pest animal control and restoration planting.	1
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (~30% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	1	2	2	No known funding. A very small part of the site (<1 ha) is QEII covenanted, and so may have received some support from QEII to find some funding.	1
Potential outcomes score				**18**		
Total score for site 303				**75**		

Site 304 Gardner's Gut Cave

Site information

Site Number	304	Site Name	Gardner's Gut Cave	Karst Type	Cave	Site Area (ha)	96.548	District	Waitomo
Ecological Region	King Country	Protection Status	DOC (33.23ha) and unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Karst - Top58 - Site Reports DM15802627, 16363769
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- https://predatorfreenz.org/ruakuri-scenic-reserve/
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A moderately sized cave karst site of a single area that is a part of the Waitomo Caves complex. Aerial imagery shows that the surface vegetation is a combination of exotic pasture with some patches of forested vegetation in and surrounding the site. The southern half and western margin of the site is vegetated with tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13). Scattered WF13 forest-treeland fragments are present throughout the areas of pasture. The indigenous vegetation and habitat of the surface is in a relatively good condition and is well connected to a more extensive forest system within the district.	3
2	Size	2	2	4	At 96.548 ha, this cave system can be considered medium in size compared to other top 58 karst SNA cave ecosystems.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
3	Linkage and buffering	3	2	6	Aerial imagery shows that the site is partially native vegetation comprising broadleaved species-treefern scrub and WF13 that is in good condition and well-connected to larger forested areas within the locality. The site is closely associated with Ruakuri Natural Bridge and karst (karst SNA no. 333) and Ruakuri Cave (karst SNA no. 332), and a third of it is located beneath Ruakuri Caves & Bush Scenic Reserve.	3
4	Diversity and pattern	2	2	4	Gardner's Get is the longest cave in the North Island. In terms of naturally uncommon karst ecosystems, the site includes: cave entrances; caves and cracks. The site is vegetated with WF13 and broadleaf treefern scrub. Near the stream, kahikatea and matai are present with smaller trees and shrubs such as tree fuchsia, ramarama, kanono, and parataniwha. Upslope, tawa becomes prominent, often with mangeao. Podocarps are present on the ridges.	3
5	Under-represented vegetation	2	3	6	In the Waitomo ED, 32.2% of WF13 is present and hence this vegetation type is not under-represented. However, forest on this site appears to be old growth forest and is representative of its type.	3
6	Threatened species (national priority)	3	1	3	Known to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical), a species of ground beetle (*Duvaliomimus mayae* (*Trechinae*)) (conservation status unknown), and an unknown species of cave wētā. Likely to occur on site: torrentfish (*Cheimarrichthys fosteri*) (Declining).	3
Ecological value score				**27**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, recreational cave use, uncontrolled grazing, and future farm development.	2
8	Urgency: Animal pest control	2	3	6	Within the scenic reserve, possum and rat control is carried out by Discover Waitomo, in partnership with DOC. Other pest animals (including goats, pigs, deer, and mustelids) are likely to be an issue, but it is not known whether these animals are controlled.	2
9	Urgency: Plant pest control	3	3	9	It is unknown whether pest plants are an issue at this site or whether pest plant control is being carried out.	1
10	Urgency: Restoration planting	3	3	9	Part of the site is already fully vegetated with indigenous species. Some of this site is grazed and it is unknown how much of the site is suitable for restoration planting, or whether any restoration planting has been carried out in suitable areas.	1
11	Fencing	2	2	4	Grazing is not an issue for parts of the site within the scenic reserve. The northern two thirds of the site has some fencing associated with WRC's soil conservation programme - 35% fenced. Some of this northern area is farmland	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
					and so fencing to exclude stock is probably not a viable option for a large part of the site.	
12	Legal protection	3	2	6	Approximately one third of the site is DOC Scenic Reserve (Ruakuri Caves and Bush Scenic Reserve).	3
Threat criteria				**38**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Some fencing and restoration planting of patches of indigenous vegetation and waterways (if not already fenced) in the northern part of the site would improve habitat values. Some possum and rat control is carried out in Ruakuri Caves and Bush Scenic Reserve in the southern half of the site, but this could be extended to include ungulate and mustelid control.	2
14	LTCCP: Community involvement	3	2	6	Waitomo Catchment Trust (100% overlap).	2
15	LTCCP: Funding support	1	2	2	No known funding.	2
16	Non-WRC funding	3	2	6	Part of this site is within Ruakuri Caves and Bush Scenic Reserve, which is known to receive some funding from DOC for pest control. Given the vicinity of the site to Waitomo Glowworm Cave (a significant tourist destination), additional inputs from DOC are likely.	2
Potential outcomes score				**18**		
Total Score for site 304				**83**		

Site 305 Grand Canyon Cave

Site information

Site Number	305	Site Name	Grand Canyon Cave	Karst Type	Surface	Site Area (ha)	6.691	District	Waitomo
Ecological Region	King Country	Protection Status	DOC	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Karst - Top58 - Site Reports DM15802627, 16363769
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A small surface karst site of a single area on the south side of Haku Road at Mangaotaki. Vegetation of the surface is mostly exotic pasture with forested native vegetation at either end of the area. Oblique imagery shows broadleaved species scrub/forest (VS5), tawa, kamahi, podocarp forest (MF7) and matai, totara, kahikatea, broadleaved forest (MF3). Where the indigenous vegetation occurs, it is in moderate condition though exposed to impacts on the edges, and the southern patch is part of a larger area of native forest to the south. The Grand Canyon Cave is a roost site for long-tailed bats.	3
2	Size	1	2	2	At 6.691 ha in size, this site is small compared to other surface karst sites in the top 58.	3
3	Linkage and buffering	2	2	4	A small proportion of the site boundary is shared with Mangawharawhara gorge and natural bridges (Site 320), which is vegetated with MF7-3. These two sites are part of Grand Canyon Nature Reserve. The site is otherwise surrounded by pasture, but it is less than 3 km from Whareorino Conservation Area.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	A large horizontal dry passage in Oligocene limestone with entrances at either end. In terms of naturally uncommon karst ecosystems, the site includes: cave entrances; caves and cracks. Little vegetation diversity is likely to exist with only small areas of VS5, MF7 and MF3.	2
5	Under-represented vegetation	1	3	3	MF7 is underrepresented in the Waitomo ED; however, this site is very small and is not representative of its type.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon). Significant fauna known to occur on site: the site is a known roost site for long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical). Likely to occur on site: longfin eel (*Anguilla dieffenbachii*) (Declining).	3
Ecological value score				**18**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	3	2	6	The site is roosting habitat for bats which are vulnerable to predation. Pest animal species are likely to be present (e.g., hares, rabbits, possums, rats, and mustelids). Most of the surface is grazed but given that this is a nature reserve, and the cave entrances are fenced, the site is not vulnerable to farm development.	3
8	Urgency: Animal pest control	3	3	9	Pest animals are likely to be an issue at this site, but it is unknown whether pest control is carried out.	1
9	Urgency: Plant pest control	3	3	9	It is unknown whether pest plants are an issue at this site or whether pest plant control is being carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site. Much of the site is farmland and so fencing to exclude stock is probably not a viable option for most of the site.	1
11	Fencing	1	2	2	This is public conservation land but much of the site is grazed; however aerial imagery shows that the cave entrances are fenced from stock. WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses.	2
12	Legal protection	1	2	2	Most of this site is part of Grand Canyon Nature Reserve.	3
Threat criteria				**37**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Predator control and fence maintenance (if not already carried out) are likely to make significant improvements at this site.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	1	2	2	No known funding from other sources, however part of the site is public conservation land so it may receive some funding and inputs from DOC, but this is unknown.	1
Potential outcomes score				**20**		
Total Score for site 305				**75**		

Site 306 Gribbon Road bluffs

Site information

Site Number	306	Site Name	Gribbon Road bluffs	Karst Type	Surface	Site Area (ha)	24.446	District	Waitomo
Ecological Region	King Country	Protection Status	DOC (12.59 ha)	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cliffs, scarps and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Karst - Top58 - Site Reports DM15802627, 16363769
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Department of Conservation Pesticide Summary For the Region of: Waikato Valid as of: Tuesday, June 8, 2021
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A small surface karst site of a single area, north and east of Gribbon Road and the Awakino River at Mahoenui. Aerial imagery indicates that vegetation of the surface is all forested native vegetation. Oblique imagery shows broadleaved species scrub/forest (VS5), tawa, kamahi, podocarp forest (MF7) and matai, totara, kahikatea, broadleaved forest (MF3). This imagery also shows an area of exotic grassland on slopes below bluffs. The indigenous vegetation is in good condition and well connected to a larger, relatively intact patch of forest. The site is likely to be largely intact in its structure, composition, and ecological processes.	2
2	Size	2	2	4	At 24.446 ha, this site can be considered medium in size compared to other surface karst sites in the top 58.	3
3	Linkage and buffering	3	2	6	One edge of the northern half of the site is bounded by pasture, but most of the site is surrounded by indigenous forest, including parts of Mahoenui Scenic	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
					Reserve. Whareorino Conservation Area and surrounding indigenous forest is present less than 3 km to the west.	
4	Diversity and pattern	1	2	2	30-100 m high limestone cliffs extend uninterrupted for 2.5 km beneath native forest and scrub (MF7, MF3, VS5). This site has only a single type of naturally uncommon ecosystem: cliffs, scarps, and tors.	2
5	Under-represented vegetation	3	3	9	Oblique imagery shows broadleaved species scrub/forest (VS5), tawa, kamahi, podocarp forest (MF7) and matai, totara, kahikatea, broadleaved forest (MF3). This imagery also shows an area of exotic grassland on slopes below bluffs. MF7 is under-represented in the Waitomo ED.	2
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: Kirk's daisy/kohurangi (*Brachyglottis kirkii* var. *kirkii*) (Nationally Vulnerable), species of the Myrtaceae family (Threatened) and mānuka (*Leptospermum scoparium* var. *scoparium*) (Declining). Significant fauna likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical), shortjaw kokopu (*Galaxias postvectis*) (Nationally Vulnerable), longfin eel (*Anguilla dieffenbachii)* (Declining), inanga (*Galaxias maculatus*) (Declining), bush falcon/kārearea (*Falco novaeseelandiae* "bush") (Recovering), and redfin bully (*Gobiomorphus huttoni*) (Not Threatened but Regionally Uncommon).	2
Ecological value score				**29**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, uncontrolled grazing, and future farm development.	2
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats and mustelids). It is unknown whether pest control is currently being undertaken at this site. Some rat and possum control are being carried out in parts of the Mahoenui Scenic Reserve, which this site overlaps with, but not within this SNA.	2
9	Urgency: Plant pest control	3	3	9	It is unknown whether pest plants are an issue at this site or whether pest plant control is being carried out.	1
10	Urgency: Restoration planting	1	3	3	It is unknown whether any restoration planting has been carried out at this site; however, this site is nearly fully vegetated with indigenous species, and little restoration planting would be required.	1
11	Fencing	2	2	4	Grazing is not an issue for parts of the site that are conservation land. It is unknown whether areas on private land are fenced. WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
12	Legal protection	2	2	4	Half of the site is DOC Scenic Reserve (Mahoenui Scenic Reserve).	3
Threat criteria				**33**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Goat control every five years, the establishment of possum and rat control in the form of bait stations, and additional fencing or fencing upgrades would likely significantly improve habitats and reduce the threat to indigenous species.	2
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	1	2	2	No known funding from other sources, however part of the site is public conservation land so it may receive some funding and inputs from DOC, but this is unknown.	1
Potential outcomes score				**18**		
Total Score for site 306				**80**		

Site 307 Hollow Hill Cave

Site information

Site Number	307	Site Name	Hollow Hill Cave	Karst Type	Cave	Site Area (ha)	27.643	District	Waitomo
Ecological Region	King Country	Protection Status	DOC	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Karst - Top58 - Site Reports DM15802627, 16363769
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A cave karst site of a single area associated with the larger surface karst SNA 317 (Mangapohue-Hauturu Road polygonal karst), east of Hauturu Road, Waitomo. Vegetation of the surface is almost entirely forested native vegetation (WRAPS 2017). Oblique imagery shows modified primary WF13 with areas of exotic grassland on margins. A couple of small areas are dominated by exotic pasture. The indigenous vegetation is in good condition and well connected to a larger, relatively intact patch of forest.	3
2	Size	2	2	4	At 27.64 ha, this site is medium in size compared to other cave karst sites in the top 58 karst SNA.	3
3	Linkage and buffering	2	2	4	The site is bounded by a mix of pasture and indigenous vegetation. The site is contiguous with Mangapohue-Hauturu Road Polygonal karst (site 317) and less than 2 km from Taumatatotara East Conservation Area.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	Largest cave chamber in North Island with a large horizontal stream passage. In terms of naturally uncommon karst ecosystems, the site has: cave entrances; caves and cracks. The site is vegetated with indigenous WF13 forest.	2
5	Under-represented vegetation	2	3	6	Oblique imagery shows modified primary WF13 with areas of exotic grassland on margins. A couple of small areas are dominated by exotic pasture. This vegetation type is not under-represented in the Waitomo ED; however, forest on this site appears to be old growth forest and is representative of its type.	3
6	Threatened species (national priority)	3	1	3	Known to occur on site: a species of ground beetle (*Duvaliomimus* (*Mayotrechus*) *mayae mayorum*) (Naturally uncommon). Other notable species known to occur on site (conservation statuses unknown): a species of black fly (*Austrosimulium australense*), a chironomid midge (*Paucispinigera approximata*), six species of crane fly (*Dolichopeza Atropos*, *Gynoplistia concava*, *Gynoplistia tridactyla*, *Mischoderus annuliferus*, *Molophilus tenuistylus* and *Rhabdomastix* (*Sacandaga*) *brunneipennis*), a species of feather mosquito (*Harrisius pallidus*), a freshwater snail (*Gundlachia neozelandica*), two species of harvestman spider (*Hendea myersi cavernicola*, *Megalopsalis* sp.), a mayfly (*Zephlebia* sp.), two species of midge (*Anatopynia apicinella, Anatopynia debilis*), a millipede (*Schedotrigona* sp.) and a tangle-web spider (*Theridion* sp.). Likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical).	3
Ecological value score				**27**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses. The site is not at risk from grazing or uncontrolled development as it is conservation land.	3
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown whether pest control is carried out.	2
9	Urgency: Plant pest control	3	3	9	It is unknown whether pest plants are an issue at this site or whether control is carried out.	1
10	Urgency: Restoration planting	1	3	3	It is unknown whether any restoration planting has been carried out at this site, but the site is largely vegetated with indigenous species and little restoration planting is likely to be necessary.	2
11	Fencing	2	2	4	The site is public conservation land so grazing within areas of high biodiversity value is not an issue. Some of the site has some fencing associated with WRC's soil conservation programme (20%).	3
12	Legal protection	1	2	2	The site falls within Hollow Hill Scenic Reserve.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
Threat criteria				**31**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Five yearly control of goats and a network of bait stations to control possums and rats would significantly improve the habitat value of this site.	2
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	1	2	2	No known WRC funding.	2
16	Non-WRC funding	1	2	2	No known funding from other sources; however, the site is public conservation land so may receive some funding from DOC, but this is unknown.	1
Potential outcomes score				**12**		
Total Score for site 307				**70**		

Site 308 Karamu Cave

Site information

Site Number	308	Site Name	Karamu Cave	Karst Type	Cave	Site Area (ha)	29.264	District	Waipa
Ecological Region	Tainui	Protection Status	Unprotected	Ecological District	Raglan	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Karst - Top58 - Site Reports DM15802627, 16363769
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.
- Ground truthing form (within Taylor-Smith et al. 2020 listed above)

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A small cave karst site of a single area, just north of Fillery Road, Waitetuna. The site is dominated by exotic pasture, rushes, and exotic broadleaf herbs. A stand of kānuka is present on the eastern edge of the SNA. The occasional mature indigenous tree is present including māhoe, pukatea, *Griselinia littoralis*, mapou, kahikatea, wheki, nikau and heketara. Wetland areas in the valley to the east are vegetated with indigenous wetland vegetation including *Carex geminata*. Rocky outcrops, sinkholes and cracks in karst support some indigenous vegetation typical of a karst landscape including *Rhabdothamnus solandri*, *Peperomia urvilleana*, kawakawa, māhoe, *Veronica stricta*, hangehange, *Astelia solandri*, bamboo orchid and dozens of fern species. Caves and cracks are devoid of indigenous vegetation. Erosion is causing sediment to enter entrances.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
2	Size	1	2	2	At 29.264 ha, this site is medium in size compared to other karst caves in the top 58 karst sites; however, the site is highly degraded, lacking almost all indigenous species typical of its habitat type.	3
3	Linkage and buffering	1	2	2	The site is mostly pasture and is mostly surrounded by pasture.	3
4	Diversity and pattern	2	2	4	Karamu Cave is a long cave with 3 km of passages. The site has two naturally uncommon ecosystems: cave entrances; and caves and cracks. Wetlands are present.	3
5	Under-represented vegetation	1	3	3	The site is only sparsely vegetated with indigenous species.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: white rātā (*Metrosideros diffusa*); (Nationally Vulnerable), akatea (*Metrosideros perforata*) (Nationally Vulnerable) and kānuka (*Kunzea robusta*) (Nationally Vulnerable). Significant fauna known to occur on site: a species of springtail (*Spelaphourura petallata*) (conservation status unknown; however, this is the only known locality of this species).	2
Ecological value score				**16**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	3	2	6	The area is of very low quality, and it cannot be degraded any further under the current land use regime; however, further degradation is possible through caving. The cave entrance is very narrow and people entering the cave will damage the surrounding vegetation and cause erosion that will result in sediment entering the caves and cracks.	3
8	Urgency: Animal pest control	3	3	9	Wild pigs are present on site. Other pest species are likely present (e.g., hares, rabbits, possums, goats, rats, and mustelids). No pest control is carried out.	3
9	Urgency: Plant pest control	3	3	9	Pest plants are present but uncommon. Weeds include gorse, himalayan honeysuckle, tutsan, inkweed, pampas, barberry, and blackberry. It is unknown whether any pest plant control is carried out. Goats and pigs may control some of these weeds.	1
10	Urgency: Restoration planting	3	3	9	No restoration planting has been carried out. If cave entrances and waterways were fenced off, there would be ample opportunities for restoration planting within these areas.	3
11	Fencing	2	2	4	Cave entrances, cracks and waterways are unfenced. Downstream waterways are fenced off as of July 2021 but not all streams entering caves.	3
12	Legal protection	3	2	6	Unprotected.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
Threat criteria				**43**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	1	2	2	It is likely too difficult to fence outcrops, stream and wetland from stock, and the environmental gains from doing so is likely limited. Pest plants and animals are unlikely to cause much further degradation to the site.	3
14	LTCCP: Community involvement	1	2	2	No known community group involvement. However, Raglan Rock run caving trips at the site and so are likely invested in the future of the site.	2
15	LTCCP: Funding support	1	2	2	No known WRC funding. ICM priority funding.	2
16	Non-WRC funding	1	2	2	No funding from other sources.	3
Potential outcomes score				**8**		
Total Score for site 308				**67**		

Site 309 Lake Disappear and karst

Site information

Site Number	309	Site Name	Lake Disappear and karst	Karst Type	Surface	Site Area (ha)	53.599	District	Waikato
Ecological Region	Tainui	Protection Status	Unprotected	Ecological District	Kawhia	Naturally Uncommon Ecosystem Types	Sinkholes; cliffs, scarps, and towers.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Karst - Top58 - Site Reports DM15802627, 16363769
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A moderately sized surface karst site comprising four areas, just to the south-east of Bridal Veil Falls, Makomako. Aerial imagery shows that the surface vegetation is almost entirely exotic pasture. N Area covers Lake Disappear SNA - possibly some wetland species & scattered kahikatea around the margin in places; Central Area tomo with mostly exotic pasture and wetland area (incl. manuka); S Areas, exotic pasture, VS5-treeland. Lake Disappear itself is located along a degraded gully system, while the other areas are in paddocks on small scarps.	2
2	Size	1	2	2	At 53.599 ha, this site can be considered medium in size compared to other surface karst SNAs in the top 58 karst SNA. However, the site is almost entirely exotic pasture and likely lacks most indigenous species associated with the karst habitat type.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
3	Linkage and buffering	1	2	2	The site is mostly pasture and is mostly surrounded by pasture.	3
4	Diversity and pattern	2	2	4	Lake Disappear is the largest karst lake in New Zealand. The site has the following naturally uncommon ecosystems: sinkholes; cliffs, scarps, and tors. Wetlands are present.	2
5	Under-represented vegetation	1	3	3	WF13 is not under-represented in this region. Any old growth WF13 vegetation on site is likely too small and degraded to be representative of its type.	2
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: species of the Myrtaceae family (Threatened). Significant fauna likely to occur on site: blue duck/whio (*Hymenolaimus malacorhynchos*) (Nationally Vulnerable), longfin eel (*Anguilla dieffenbachii*) (Declining), New Zealand pipit (*Anthus novaeseelandiae novaeseelandiae*) (Declining), North Island kōkako (*Callaeas wilsoni*) (Recovering) and bush falcon/kārearea (*Falco novaeseelandiae* "bush") (Recovering).	2
Ecological value score				**15**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	1	2	2	The area is likely of very low quality and it likely cannot be degraded any further under the current land use regime.	2
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats, and mustelids). It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	Pest plants are likely to be a problem. It is unknown whether control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	3	2	6	WRC has no record of any fencing associated with soil conservation, clean streams, or grazing licenses. Aerial imagery suggests that at least parts of the site are unfenced and grazed.	1
12	Legal protection	3	2	6	The site is unprotected.	3
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
13	Restoration potential	1	2	2	Significant investment would be required to make improvements at this site. Extensive fencing and planting would be required to protect the lake, wetlands, outcrops, streams, and wetland from stock.	2
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	2	2	4	No known WRC funding. Part ICM priority site.	1
16	Non-WRC funding	1	2	2	No known funding from other sources.	1
Potential outcomes score				**10**		
Total Score for site 309				**66**		

Site 310 Lake Koraha and Matauratahi

Site information

Site Number	310	Site Name	Lake Koraha and Matauratahi	Karst Type	Surface	Site Area (ha)	43.059	District	Otorohanga
Ecological Region	Tainui	Protection Status	DOC (32.95ha) and unprotected	Ecological District	Kawhia	Naturally Uncommon Ecosystem Types	Sinkholes; cliffs, scarps, and towers.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A small surface karst site of a single area, encompassing Lake Koraha in Hauturu. Aerial and oblique imagery shows that the surface vegetation is WF13 (tawa-kohekohe-rewarewa-hinau-podocarp forest). The native vegetation of the site is in good condition and the site is well-connected to large expanses of native forest within the district.	3
2	Size	2	2	4	At 43.059 ha, this site can be considered medium in size compared to other surface karst SNA in the top 58 karst ecosystems.	3
3	Linkage and buffering	3	2	6	The site falls within Hauturu West Conservation area and is well-connected to large expanses of native forest within the district. A small section of the SNA borders farmland vegetated with exotic pasture species.	3
4	Diversity and pattern	2	2	4	This is a small karst lake with the following naturally uncommon ecosystems the site has: sinkholes; cliffs, scarps and tors. WF13 (tawa-kohekohe-rewarewa-hinau-podocarp) forest is present.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	2	3	6	WF13 is not under-represented in the Kawhia ED. However, forest on this site appears to be old growth forest and is representative of its type.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: swamp maire (*Syzygium maire*) (Nationally Critical), Kirk's daisy/kohurangi (*Brachyglottis kirkii* var. *kirkii*) (Nationally Vulnerable), carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable), a species of moss (*Drepandocladus aduncus*) (conservation status unknown) and an algae (*Nitella cristata*) (conservation status unknown). Likely to occur on site: species of the Myrtaceae family (Threatened) and awaroa hebe (*Veronica scopulorum*) (Declining). Significant fauna known to occur on site: North Island fernbird/mātātā (*Bowdleria punctata vealeae*) (Declining), spotless crake/pūweto (*Porzana tabuensis tabuensis*) (Declining), brown teal/pāteke (*Anas chlorotis*) (Recovering), and caddisflies (*Paroxyethira* sp.) (conservation status unknown). Likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical) and central lesser short-tailed bat (*Mystacina tuberculata rhyacobia*) (Declining).	3
Ecological value score				**29**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	This site is likely well-buffered from pest plants and other effects of farming. Pest animals are likely the key threat to biodiversity values at this site.	3
8	Urgency: Animal pest control	3	3	9	Pest animal species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown whether pest control is carried out.	2
9	Urgency: Plant pest control	2	3	6	Pest plants are unlikely to be a problem at this site as most of the site is well-buffered from farmland.	2
10	Urgency: Restoration planting	1	3	3	The site is entirely vegetated with indigenous forest and restoration planting does not appear to be required.	3
11	Fencing	1	2	2	The site is public conservation land so grazing and land use change is unlikely to be an issue.	3
12	Legal protection	1	2	2	Most of the site falls within Hauturu West Conservation area.	3
Threat criteria				**26**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
13	Restoration potential	3	2	6	This site would benefit from pest control, particularly rat and possum control in the form of bait station. Some ungulate control may be required.	2
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	2	2	4	No known WRC funding but part ICM funding.	2
16	Non-WRC funding	2	2	4	No known funding from other sources; however, the site is public conservation land so may receive some funding from DOC, but this is unknown.	1
Potential outcomes score				**16**		
Total Score for site 310				**71**		

Site 311 Lake Rotokawau

Site information

Site Number	311	Site Name	Lake Rotokawau	Karst Type	Surface	Site Area (ha)	2.345	District	Waitomo
Ecological Region	King Country	Protection Status	Unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Sinkholes		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A small surface karst site of a single area, encompassing Lake Rotokawau, south-west of Waitomo Caves. The native vegetation of the site (tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13) with a small ring of freshwater wetland) is in good condition and the site is well-connected to large expanses of native forest within the locality.	2
2	Size	1	2	2	At 2.345 ha in size, this site is small compared to other surface karst SNA in the top 58 karst ecosystems.	3
3	Linkage and buffering	3	2	6	The site is well-buffered by surrounding indigenous vegetation. The site is within 1 km of another surface karst SNA site (Site 333 Ruakuri Natural Bridge) which is also surrounded by WF13 and in good condition.	3
4	Diversity and pattern	2	2	4	This site is a small karst lake surrounded by regenerating forest. This site has low physical diversity with sinkholes being the only naturally uncommon ecosystem present. The site has WF13 vegetation and wetland habitats may be present, so the site can be considered moderately diverse.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	3	3	9	Vegetation of the surface is tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13) with a small ring of freshwater wetland. The freshwater wetland vegetation around the lake margin requires field validation (oblique imagery). WF13 is not under-represented in the Kawhia ED. However, forest on this site appears to be old growth forest and is representative of its type. Wetland vegetation is under-represented in the ED, but field validation of this vegetation type is required.	2
6	Threatened species (national priority)	2	1	2	Significant fauna likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical), longfin eel (*Anguilla dieffenbachii*) (Declining), torrentfish (*Cheimarrichthys fosteri*) (Declining), black mudfish (*Neochanna diversus*) (Declining), and bush falcon/kārearea (*Falco novaeseelandiae* "bush") (Recovering).	2
Ecological value score				**29**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include some pest animal species, but the site is relatively well buffered otherwise. Goats are likely to be an issue.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). Goats are an issue throughout Waitomo District. It is unknown whether pest control is carried out.	2
9	Urgency: Plant pest control	2	3	6	The site is unlikely to have a pest plant issue given the buffering provided by surrounding forest.	2
10	Urgency: Restoration planting	1	3	3	The site is entirely vegetated with indigenous forest and restoration planting does not appear to be required.	2
11	Fencing	2	2	4	Some of the site has some fencing associated with WRC's soil conservation programme (60%) and aerial imagery indicates that the site is fenced/not grazed.	2
12	Legal protection	1	2	2	Unprotected.	2
Threat criteria				**28**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Five yearly goat control and ongoing rat and possum control in the form of bait stations would significantly improve this site.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	3	2	6	Waitomo Catchment Trust (100% overlap).	3
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	1	2	2	No known funding from other sources.	1
Potential outcomes score				**16**		
Total Score for site 311				**73**		

Site 312 Lake Rotokotuku

Site information

Site Number	312	Site Name	Lake Rotokotuku	Karst Type	Surface	Site Area (ha)	7.172	District	Waitomo
Ecological Region	King Country	Protection Status	Unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Sinkholes		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A small surface karst site of a single area, encompassing Lake Rotokotuku, south-east of Te Kuiti, and approximately 1 km east of Mangaokewa Gorge Bluffs. Vegetation on this site is manuka-kanuka scrub and an area of wetland (WL Swamp mosaic) with shrubs (manuka, flax, cabbage tree, kahikatea) at the north-west end. The native vegetation of the site is in good condition and appears to be fenced, but the patch is isolated and surrounded on all sides by exotic pasture.	2
2	Size	1	2	2	At 7.172 ha in size, this site is small compared to other surface karst SNA sites in the top 58 karst ecosystems.	3
3	Linkage and buffering	1	2	2	The site is surrounded on all sides by exotic pasture.	3
4	Diversity and pattern	2	2	4	This site is a small karst lake. The site has low physical diversity with sinkholes being the only naturally uncommon ecosystem present. The site has WF13	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
					vegetation and wetland habitats may be present, so the site can be considered moderately diverse.	
5	Under-represented vegetation	3	3	9	Vegetation at this site is manuka-kanuka scrub, wetland (WL Swamp mosaic) with shrubs (manuka, flax, cabbage tree, kahikatea) at the NW end. Wetlands are under-represented in the Waitomo ED.	2
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: species of the Myrtaceae family (Threatened). Significant fauna known to occur on site: a species of snail (*Glyptophysa variabilis*) (Data deficient). Likely to occur on site: longfin eel (*Anguilla dieffenbachii*) (Declining).	2
Ecological value score				**23**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include some pest animal species, pest plants, uncontrolled grazing, and future farm development.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). Goats are common in the Waitomo district, but they are likely to visit this site only occasionally. It is unknown whether pest control is carried out.	2
9	Urgency: Plant pest control	3	3	9	It is unknown whether pest plants are a problem at this site or whether they are controlled.	1
10	Urgency: Restoration planting	1	3	3	The site is entirely vegetated with indigenous species and restoration planting does not appear to be required.	2
11	Fencing	1	2	2	The site is fully fenced with fencing associated with WRC's soil conservation programme.	3
12	Legal protection	3	2	6	The site is unprotected.	2
Threat criteria				**33**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	This site would benefit from rat and possum control using bait stations. Potentially some pest plant control may be required.	2
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
15	LTCCP: Funding support	1	2	2	No known WRC funding.	2
16	Non-WRC funding	1	2	2	No known funding from other sources.	1
Potential outcomes score				**12**		
Total Score for site 312				**68**		

Site 313 Lower Mangaotaki Gorge bluffs

Site information

Site Number	313	**Site Name**	Lower Mangaotaki Gorge bluffs	**Karst Type**	Surface	**Site Area (ha)**	47.175	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	DOC (29.39 ha) and unprotected	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Caves and cracks; cliffs, scarps, and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A moderately sized surface karst site on either side of State Highway 3 at Mahoenui. Oblique imagery shows broadleaved species scrub/forest (VS5), tawa, kamahi, podocarp forest (MF7) and matai, totara, kahikatea, broadleaved forest (MF3). The native vegetation of the site is in moderate to good condition and is more-or-less connected to other forested areas but has a large edge with exotic pasture on all sides.	2
2	Size	2	2	4	At 47.175 ha, the site is medium in size compared to other surface karst SNA in the top 58 karst ecosystems.	3
3	Linkage and buffering	2	2	4	The site has some connectivity to other forested areas but has a large edge with exotic pasture on all sides. The site is less than 5 km from multiple other surface karst sites (Site 315 Mangaorongo Gorge and natural bridges, Site 342 Totoro Gorge Karst, Site 320 Mangawharawhara gorge and natural bridges).	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	The Lower Mangaotaki Gorge bluffs are high limestone bluffs. The site has moderate physical diversity with the following naturally uncommon ecosystems: caves and cracks; cliffs, scarps, and tors. The site likely also has moderate floristic diversity with VS5, MF7 and MF3.	2
5	Under-represented vegetation	3	3	9	MF7 is under-represented in the Waitomo ED.	3
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: species of the Myrtaceae family (Threatened); Northland soft fern (*Christella dentata*) (Naturally Uncommon). Significant fauna likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical), lamprey (*Geotria australis*) (Nationally Vulnerable), longfin eel (*Anguilla dieffenbachii*) (Declining), mussel (*Echyridella menziesii*) (Declining), kōaro (*Galaxias brevipinnis*) (Declining), inanga (*Galaxias maculatus*) (Declining) and redfin bully (*Gobiomorphus huttoni*) (Not Threatened).	2
Ecological value score				**27**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include some pest animal species, broadleaved agricultural weeds, exotic grasses, uncontrolled grazing, and future farm development.	2
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats and mustelids), with goats a particular problem in the Waitomo District. It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	It is unknown whether pest plants are an issue or whether pest control is carried out.	1
10	Urgency: Restoration planting	2	3	6	It is unknown whether any restoration planting has been carried out at this site; however, the site is largely vegetated, and only small areas of planting would be needed.	1
11	Fencing	2	2	4	Grazing is not an issue for parts of the site that are conservation land. It is unknown whether areas on private land are fenced. WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses.	2
12	Legal protection	2	2	4	29.39 ha of the site (62%) is part of Mangaotaki Gorge Scenic Reserve.	3
Threat criteria				**36**		

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Goat control every five years and the establishment of possum and rat control in the form of bait stations would likely significantly reduce the threat to indigenous species.	2
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	1	2	2	No known funding from other sources; however, the site is public conservation land so may receive some funding from DOC, but this is unknown.	1
Potential outcomes score				**20**		
Total Score for site 313				**83**		

Site 314 Mangaokewa Gorge bluffs

Site information

Site Number	314	Site Name	Mangaokewa Gorge bluffs	Karst Type	Surface	Site Area (ha)	47.996	District	Waitomo
Ecological Region	King Country	Protection Status	DOC	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cliffs, scarps and tors		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Pesticide Summary For the Region of: Waikato Valid as of: Tuesday, June 8, 2021 4:42 PM
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	An extensive gorge south-east of Te Kuiti and less than 1 km from Lake Rotokotuku (Site 312). The site is moderately sized, but long and thin, surface karst site on the eastern side of the Mangaokewa Stream. Oblique imagery shows that the site is vegetated with tawa, kamahi, podocarp forest (MF7) and matai, totara, kahikatea, broadleaved forest (MF3), with areas of broadleaved species scrub/forest (VS5) and treefernland. The native vegetation of the site is in good condition.	2
2	Size	2	2	4	At 47.996 ha, the site is medium in size compared to other surface karst SNA.	3
3	Linkage and buffering	3	2	6	The site is located within Mangaokewa Gorge Scenic Reserve and is surrounded by indigenous vegetation - though in places this vegetation buffer separating the SNA from farmland is only about 10 m wide.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	This site is an extensive gorge with only one naturally uncommon ecosystem type: cliffs, scarps, and tors. Vegetation diversity is moderate with tawa, kamahi, podocarp forest (MF7); matai, totara, kahikatea, broadleaved forest (MF3); broadleaved species scrub/forest (VS5); and treefernland.	2
5	Under-represented vegetation	3	3	9	MF7 is under-represented in the Waitomo ED.	2
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: species of the Myrtaceae family (Threatened). Significant fauna likely to occur on site: longfin eel (*Anguilla dieffenbachii*) (Declining). Other threatened and at-risk species are present within the wider landscape and are likely to utilise this site.	2
Ecological value score				**31**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	1	2	2	Key threats are likely to include pest animal species only, as the site has buffering from other threats.	2
8	Urgency: Animal pest control	2	3	6	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids), with goats a particular problem in the Waitomo District. Rat and possum control has been carried out in the past: Diphacinone + Cholecalciferol (Double Tap), 0.05 g/kg + 0.6 g/kg, Bait stations 16 Aug 2020 - 31 Mar 2021.	3
9	Urgency: Plant pest control	2	3	6	The site is unlikely to have a pest plant issue given the buffering provided by surrounding forest.	2
10	Urgency: Restoration planting	1	3	3	The site is entirely vegetated with indigenous forest or regenerating indigenous vegetation and restoration planting does not appear to be required.	2
11	Fencing	1	2	2	Grazing is not an issue as the site is conservation land.	3
12	Legal protection	1	2	2	The site falls within Mangaokewa Gorge Scenic Reserve.	3
Threat criteria				**21**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Goats are a problem in the Waitomo District and this site would likely benefit from goat control. Rats and possums are already being controlled.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	3	2	6	Project Manu (90% overlap).	2
15	LTCCP: Funding support	3	2	6	Small Scale Community Initiatives funding (July 2019).	2
16	Non-WRC funding	3	2	6	No known funding, however, the site is public conservation land and DOC is carrying out pest control at this site.	3
Potential outcomes score				**24**		
Total Score for site 314				**76**		

Site 315 Mangaorongo Gorge and natural bridges

Site information

Site Number	315	**Site Name**	Mangaorongo Gorge and natural bridges	**Karst Type**	Surface	**Site Area (ha)**	144.758	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	DOC (97.9ha) and unprotected	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Caves and cracks; cliffs, scarps, and tors		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	The site is long, thin, and moderately sized. VS4/VS5 to MF7-3 throughout gorge, areas of exotic planting along parts of gorge edge/upper slopes. Small patches of treefern-manuka scrub. The native vegetation of the site is in good condition.	2
2	Size	3	2	6	At 144.758 ha in size, this site is large compared to other surface karst SNA in the top 58 karst SNA.	3
3	Linkage and buffering	2	2	4	Although the site is mostly surrounded by pasture, small areas of indigenous forest are contiguous with the site and Whareorino Conservation Area and surrounding indigenous forest is present ~5km to the west.	3
4	Diversity and pattern	2	2	4	The site is a deep limestone gorge and natural bridge along the Mangaorongo Stream at Mahoenui. In terms of naturally uncommon ecosystems, the site has: caves and cracks; cliffs, scarps, and tors. Vegetation is moderately diverse with VS4/VS5 to MF7-3.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	3	3	9	MF7 is under-represented in the Waitomo ED.	2
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: species of the Myrtaceae family (Threatened). Significant fauna likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical) and longfin eel (*Anguilla dieffenbachii*) (Declining).	2
Ecological value score				**31**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, uncontrolled grazing, and future farm development.	2
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats, and mustelids). It is unknown whether pest control is currently being undertaken at this site. Goats are a problem throughout the Waitomo District.	1
9	Urgency: Plant pest control	3	3	9	It is unknown whether the site has a pest plant issue or whether pest control is carried out.	1
10	Urgency: Restoration planting	2	3	6	It is unknown whether any restoration planting has been carried out at this site; however, the site is largely vegetated, and only small areas of planting would be needed.	1
11	Fencing	2	2	4	Grazing is not an issue for parts of the site that are conservation land. There is some WRC soil conservation fencing on this site 95%).	2
12	Legal protection	2	2	4	More than two-thirds of this site is part of Mangaorongo Scenic Reserve.	3
Threat criteria				**36**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	The site would likely benefit significantly from five yearly goat control and possum and rat control via the implementation of bait stations. Some fencing and/or fencing maintenance may also be required.	2
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	2	2	4	No known funding, however part of the site is public conservation land so may receive some funding from DOC	1
Potential outcomes score				**22**		
Total Score for site 315				**89**		

Site 316 Mangapohue Natural Bridge

Site information

Site Number	316	Site Name	Mangapohue Natural Bridge	Karst Type	Surface	Site Area (ha)	4.287	District	Waitomo
Ecological Region	King Country	Protection Status	DOC	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; cliffs, scarps and tors		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A small surface karst site at the Mangapohue Natural Bridge, on the northern side of the Te Anga Road at Te Anga. Vegetation of the site is manuka-kanuka scrub (VS3) on the eastern edge of the site, but the rest of the vegetation is regenerating secondary forest dominated by broadleaved species and podocarps (VS5, WF13). The native vegetation of the site is in moderate condition but is surrounded by adjacent grazing land.	3
2	Size	1	2	2	At 4.287 ha, this site is small compared to other surface karst SNA in the top 58 karst SNA.	3
3	Linkage and buffering	1	2	2	Indigenous forest is present in the wider landscape, but the site is very small and is surrounded by adjacent grazing land which makes the site very vulnerable to invasion by pest plants and animals.	3
4	Diversity and pattern	2	2	4	The site has a two-tiered natural bridge through limestone with speleothems on roof and sides. It has moderate vegetative and physical diversity. Naturally uncommon ecosystems present: cave entrances; cliffs, scarps, and tors. Vegetation is VS3, VS5, WF13.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	1	3	3	Vegetation types at this site are not under-represented in the Waitomo ED. The site is likely regenerating rather than old growth.	2
6	Threatened species (national priority)	2	1	2	Significant flora known to occur on site: rātā (*Metrosideros colensoi*) (Nationally Vulnerable). Likely to occur on site: woodrose (*Dactylanthus taylorii*) (Nationally Vulnerable), species of the Myrtaceae family (Threatened) and cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon). Significant fauna likely to occur on site: longfin eel (*Anguilla dieffenbachii*) (Declining) and bush falcon/kārearea (*Falco novaeseelandiae* "bush") (Recovering).	2
Ecological value score				**17**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaved agricultural weeds, and exotic grasses. The site is protected and, therefore, uncontrolled grazing and future farm development are unlikely to affect it. However, the site is very small and so vulnerable to invasion by pest plants and animals.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown if any pest animal control is carried out.	1
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue, but it is unknown whether pest plant control is being carried out.	1
10	Urgency: Restoration planting	2	3	6	It is unknown whether any restoration planting has been carried out at this site; however, the site is largely vegetated, and only small areas of planting would be needed.	2
11	Fencing	1	2	2	Grazing is not an issue as the site is conservation land.	3
12	Legal protection	1	2	2	The site falls within Mangapohue Natural Bridge Scenic Reserve.	3
Threat criteria				**32**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Goat control every five years and the establishment of possum and rat control in the form of bait stations would likely significantly reduce the threat to indigenous species.	1
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
15	LTCCP: Funding support	2	2	4	No known WRC funding. ICM priority site.	2
16	Non-WRC funding	1	2	2	No known funding, however, the site is public conservation land so may receive some funding from DOC, but this is unknown.	1
Potential outcomes score				**14**		
Total Score for site 316				**63**		

Site 317 Mangapohue-Hauturu Road polygonal karst

Site information

Site Number	317	**Site Name**	Mangapohue-Hauturu Road polygonal karst	**Karst Type**	Surface	**Site Area (ha)**	898.824	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	DOC (0.42 ha), QEII (278.05 ha) and unprotected.	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Sinkholes; caves and cracks; cliffs, scarps, and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A large surface karst site of a single area associated with the cave karst SNA 307 (Hollow Hill Cave), west of Hauturu Road, Waitomo. Vegetation of the surface is forested native vegetation, mostly tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13), exotic pasture and some patches of broadleaf-treefern scrub. The indigenous vegetation is in moderate condition.	3
2	Size	3	2	6	At 898.824 ha, the site is large compared to other surface karst SNA in the top 58 karst ecosystems.	3
3	Linkage and buffering	3	2	6	The site is large and well connected to a larger, relatively intact patch of forest within the district.	3
4	Diversity and pattern	3	2	6	The site is one of best examples of cockpit polygonal karst in New Zealand. The site has high physical diversity with the following naturally uncommon ecosystems: sinkholes; caves and cracks; cliffs, scarps, and tors. Vegetation has moderate diversity with WF13 and broadleaf-treefern scrub.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	2	3	6	WF13 is not under-represented in the Waitomo ED; however, the site is old growth forest.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: akatea (*Metrosideros perforata*) (Nationally Vulnerable) and cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon). Likely to occur on site: carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable) and species of the Myrtaceae family (Threatened).	3
Ecological value score				**31**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). Occasional cavers, school visits, trail run, scientific visits. These are strictly managed by the landowner.	3
8	Urgency: Animal pest control	3	3	9	Goats and pigs are common. Browsing of understorey vegetation observed throughout the site and goats were observed on pasture adjacent to the QEII block. Possums are present. Other pest species are likely present. It's unknown whether pest control is carried out.	3
9	Urgency: Plant pest control	2	3	6	Small areas of *Tradescantia fluminensis* and pampas are present within the QEII block. Other pest plants may be present.	3
10	Urgency: Restoration planting	1	3	3	Some restoration planting has been carried out at this site.	3
11	Fencing	2	2	4	The large QEII block is fenced to exclude stock. Some areas of stream are fenced. This equates to 25% of the feature.	3
12	Legal protection	2	2	4	Approximately 30% of the 898.82 ha site is formally protected, with most protected by QEII covenant (278.05 ha) and a small piece on public conservation land DOC (0.42 ha - a small edge of Hollow Hill Scenic Reserve). The protected areas are the high ecological value areas of indigenous forest, whereas the unprotected areas are farmland with patches of treeland and scrub.	3
Threat criteria				**30**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Control of goats, pigs, possums, and rats would significantly improve the biodiversity values at this site.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	3	2	6	Waitomo Catchment Trust (10-15%). Various researchers have an ongoing interest in the site.	3
15	LTCCP: Funding support	3	2	6	WRC has no record of the landowners receiving recent NHPP funding, but ICM has provided some funding and support in the past.	3
16	Non-WRC funding	2	2	4	No known funding but may have received some support from QEII to find some funding.	2
Potential outcomes score				**20**		
Total Score for site 317				**81**		

Site 318 Mangapu Cave System

Site information

Site Number	318	Site Name	Mangapu Cave System	Karst Type	Cave	Site Area (ha)	75.107	District	Waitomo
Ecological Region	King Country	Protection Status	Unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A moderately sized cave karst site, south of the Oparure Road – Troopers Road intersection, west of Te Kuiti. Vegetation of the surface is a mix of exotic pasture, exotic sburbland, broadleaved-treefern scrub and fernland. Exotic shrubland, VS5 and VS10 are present in the north-east, remnants of MF7-3 throughout remainder. The native vegetation of the site is in poor condition, is fragmented and surrounded by grazing land.	2
2	Size	2	2	4	At 75.107 ha, this site is moderate in size compared to other karst cave SNA in the top 58 karst ecosystems.	2
3	Linkage and buffering	1	2	2	The site is surrounded by grazed farmland. At its southern end, the SNA overlaps with Site 319 Mangapu Gorge, but this area of Site 318 appears to be pasture and treeland, and so provides little buffering or connectivity with Mangau Cave System. There is little indigenous vegetation in the wider landscape.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	The site has one of the largest underground rivers in North Island and moderate diversity in naturally uncommon ecosystems with: cave entrances; caves and cracks. Vegetation on site has moderate diversity with VS5, VS10 and MF7.	2
5	Under-represented vegetation	1	3	3	Remnants of MF7 are present which is an under-represented vegetation type in the Waitomo ED. However, the vegetation is unlikely to be in good enough condition to be representative of this vegetation type.	1
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: native verbena (*Teucridium parvifolium*) (Declining) and cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon). Significant fauna known to occur on site: black mudfish (*Neochanna diversus*) (Declining) and a species of moth (*Caloptilia* sp. "*Teucridium*") (Nationally Vulnerable) associated with the native verbena plant.	3
Ecological value score				**18**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, uncontrolled grazing, and future farm development.	2
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats, and mustelids), with goats a particular issue in the Waitomo District. It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	The site likely has a pest plant issue, but it is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	2	2	4	The site has some fencing associated with WRC's Clean Streams programme, but it is unclear whether the cave entrance is fenced. Much of the site is grazed farmland and will not be able to be fenced and restored. About 20% fenced	2
12	Legal protection	3	2	6	The site has no known legal protection.	2
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Fencing and planting of cave entrances, if not already in place, would significantly improve the habitat values of this site. Five yearly control of goats may be necessary as this site is in the Waitomo District, which has a goat	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
					problem. Control of possums and rats and any pest plants within areas of existing indigenous vegetation would also benefit this site.	
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	2
15	LTCCP: Funding support	1	2	2	No known WRC funding.	2
16	Non-WRC funding	1	2	2	No known funding from other sources.	1
Potential outcomes score				**10**		
Total Score for site 318				**69**		

Site 319 Mangapu Gorge and blind valley

Site information

Site Number	319	**Site Name**	Mangapu Gorge and blind valley	**Karst Type**	Surface	**Site Area (ha)**	44.862	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	Unprotected	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Cave entrances; sinkholes; caves and cracks; cliffs, scarps and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A moderately sized surface karst site comprising incised limestone gorges and hillslopes, that is associated with Mangapu Cave System (karst SNA no. 318), south of the Oparure Road – Troopers Road intersection, west of Te Kuiti. Aerial and oblique imagery show that vegetation of the surface has some exotic pasture but is mostly secondary tawa-pukatea-podocarp forest/treeland (MF7) with some broadleaved-treefern scrub (VS5), and this agrees with the vegetation mapping. The native vegetation of the site is in moderate condition.	3
2	Size	2	2	4	At 44.862 ha, the site is moderate in size compared to other surface karst in the top 58 karst SNA.	3
3	Linkage and buffering	1	2	2	The site has a large edge with the adjacent grazing land and is relatively isolated.	3
4	Diversity and pattern	3	2	6	A small gorge with best example of blind valley in region, this site has high diversity of naturally uncommon ecosystems with: cave entrances; sinkholes; caves and cracks; cliffs, scarps and tors.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	3	3	9	MF7 is under-represented in the Waitomo ED.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: native verbena (*Teucridium parvifolium*) (Declining). Likely to occur on site: species of the Myrtaceae family (Threatened) and cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon). Significant Fauna Known to occur on site: a species of moth (*Caloptilia* sp. "*Teucridium*") (Nationally Vulnerable) associated with the native verbena plant and black mudfish (*Neochanna diversus*) (Declining).	3
Ecological value score				**28**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	1	2	2	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, stock access and cave access. Some possum and rat control are undertaken, stock is generally excluded from the site and the owners are very pro-active in ensuring the karst features are not touched or disturbed by tourists.	3
8	Urgency: Animal pest control	2	3	6	Occasional possum control by the council. Owner reports occasional possum and rat control undertaken.	3
9	Urgency: Plant pest control	3	3	9	Barberry and cotoneaster are present in pasture areas but not in forested areas. It is unknown whether these weeds are controlled.	2
10	Urgency: Restoration planting	1	3	3	There are new plantings of indigenous shrubs and trees around some of the forest edge and retired paddock areas.	3
11	Fencing	2.5	2	5	The site has some fencing associated with WRC's soil conservation programme (10%). The site is mostly fenced although stock still have access through a track to get from one area to the next.	3
12	Legal protection		2	0		
Threat criteria				**25**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	This stand would greatly benefit with a co-ordinated and sustained possum and rat control programme with all landowners being involved.	3
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
15	LTCCP: Funding support	1	2	2	No known WRC funding.	2
16	Non-WRC funding	1	2	2	No known funding from other sources.	1
Potential outcomes score				**12**		
Total Score for site 319				**65**		

Site 320 Mangawharawhara Stream natural bridges and gorge

Site information

Site Number	320	**Site Name**	Mangawharawhara Stream natural bridges and gorge	**Karst Type**	Surface	**Site Area (ha)**	58.071	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	DOC (20.29 ha) and unprotected	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Cave entrances; caves and cracks; cliffs, scarps and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A moderately sized surface karst site south of Haku Road and adjoining the Grand Canyon Cave (karst SNA no. 305). Together these two sites make up Grand Canyon Nature Reserve. The site is a mix of exotic pasture and native forest and scrub. The native forest component is VS3-VS5-MF7-3, with areas of exotic grassland & scattered limestone boulders through central area. The native vegetation of the site is in moderate condition and has some connectivity but has a large edge with the adjacent grazing land.	2
2	Size	2	2	4	At 58.071 ha, this site is medium in size compared to other surface karst SNA in the top 58 karst SNA.	3
3	Linkage and buffering	2	2	4	This site is adjacent to Grand Canyon Cave (Site 305), which is predominantly grazed pasture with small areas of indigenous forest surrounding the cave entrances. The site is otherwise surrounded by pasture with some areas of indigenous vegetation to the south. Indigenous habitats are abundant in the wider landscape, with Whareorino Conservation Area <3km from the site.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	This site has three types of naturally uncommon karst ecosystem: cave entrances; caves and cracks; cliffs, scarps, and tors. The floristic communities within the VS3-VS5-MF7-3 vegetation on site is likely of limited diversity.	2
5	Under-represented vegetation	3	3	9	MF7 is present and is under-represented in the Waitomo ED.	2
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: species of the Myrtaceae family (Threatened). Significant fauna likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical) and longfin eel (Anguilla dieffenbachii) (Declining).	2
Ecological value score				**27**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, uncontrolled grazing, and future farm development.	2
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats and mustelids). Goats are a problem in the Waitomo District and may require control at this site. It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	Pest plants are likely to be an issue at this site, but it is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site. Some of the site appears to be grazed farmland and may not be suitable for restoration.	1
11	Fencing	2	2	4	Grazing is not an issue for parts of the site that are conservation land. The private land has some WRC soil conservation fencing – 50% of this area fenced.	2
12	Legal protection	3	2	6	Approximately one third of the land is public conservation land that is part of Grand Canyon Nature Reserve	2
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Habitats at this site may benefit from fencing and planting of margins, five yearly goat control and possum/rat bait stations.	1
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	1	2	2	No known funding, however part of the site is public conservation land so may receive some funding from DOC, but this is unknown.	1
Potential outcomes score				**18**		
Total Score for site 320				**86**		

Site 321 Mangawhitikau Cave System

Site information

Site Number	321	Site Name	Mangawhitikau Cave System	Karst Type	Cave	Site Area (ha)	140.877	District	Waitomo
Ecological Region	King Country	Protection Status	Unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	The site is west of Oparure and adjoining Mangawhitikau slit gorge & karst SNA site (karst SNA no. 322), the site is less than 5 km from other karst cave SNA (Waipapa Rd cave system Site 347, Mangapu Cave System Site 318, Troopers Road cave system Site 343). The site is mostly exotic pasture with small areas of remnant native forest of tawa-pukatea-podocarp forest (MF7-3) with some broadleaved-treefern scrub. The native vegetation of the site is in moderate condition but is fragmented and not connected to other patches of forest within the locality.	2
2	Size	2	2	4	At 140.877 ha, this site is medium in size compared to other karst cave SNA in the top 58 karst ecosystems.	2
3	Linkage and buffering	1	2	2	The site is mostly surrounded by exotic pasture, with some areas of regenerating indigenous vegetation. Little indigenous habitat is present in the wider landscape and the site is largely isolated.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	This cave system has moderate diversity in naturally uncommon ecosystems with: cave entrances; caves and cracks. Diversity in vegetation is likely to also be moderate with only regenerating scrub and small forest remnants.	2
5	Under-represented vegetation	1	3	3	MF7 is present, which is under-represented in the Waitomo ED. However, areas of this vegetation type are likely too small to be representative.	2
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon). Significant fauna known to occur on site: an amphipod crustacean (*Paraleptamphopus* sp. A) (conservation status unknown).	2
Ecological value score				**20**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	3	2	6	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, uncontrolled grazing, and future farm development.	2
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats, and mustelids). It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	The site likely has a pest plant issue, but it is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	2	2	4	The site has a small amount of WRC soil conservation fencing about 5% of boundary. Much of the site is productive farmland so is unsuitable for fencing and restoring. It is unclear whether cave entrances and cracks have been fenced from stock.	1
12	Legal protection	3	2	6	The site has no known legal protection.	2
Threat criteria				**43**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	The site may benefit from fencing and planting cave entrances and cracks in karst, if not already done, and maintaining any fences surrounding existing indigenous vegetation. Pest animal and plant control may also benefit the site.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	2
15	LTCCP: Funding support	1	2	2	No known WRC funding.	2
16	Non-WRC funding	1	2	2	No known funding from other sources.	1
Potential outcomes score				**10**		
Total Score for site 321				**73**		

Site 322 Mangawhitikau slit gorge and karst

Site information

Site Number	322	**Site Name**	Mangawhitikau slit gorge and karst	**Karst Type**	Surface	**Site Area (ha)**	53.548	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	DOC (18.45 ha) and unprotected	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Cave entrances; caves and cracks; cliffs, scarps and tors		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A moderately sized surface karst site, west of Oparure and adjoining Mangawhitikau cave system (karst SNA no. 321) to the east and Waipapa Rd cave system (karst SNA no. 347) to the west. The site is long and thin, mostly with patches of native forest interspersed with exotic pasture. VS5-MF7-3 with some areas of mixed native & exotic shrubland (with gorse) and exotic pasture and pine forestry. The native forest component is mapped as tawa-pukatea-podocarp forest, with some broadleaved-treefern scrub. The native vegetation of the site is in moderate condition but is fragmented and not connected to other patches of forest within the locality.	2
2	Size	2	2	4	At 53.548 ha, this site is medium in size compared to other surface karst SNA in the top 58 karst ecosystems.	3
3	Linkage and buffering	1	2	2	This site is largely surrounded by pasture, with some buffering by pine forest and regenerating scrub.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	This gorge has three types of naturally uncommon karst ecosystem: cave entrances; caves and cracks; cliffs, scarps, and tors. The floristic community on site is likely of limited diversity.	2
5	Under-represented vegetation	3	3	9	MF7 is present, which is under-represented in the Waitomo ED.	2
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: native verbena (*Teucridium parvifolium*) (Declining). Likely to occur on site: carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable), species of the Myrtaceae family (Threatened) and cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon). Significant fauna known to occur on site: longfin eel (*Anguilla dieffenbachii*) (Declining) and an amphipod crustacean (*Paraleptamphopus* sp. B) (conservation status unknown).	2
Ecological value score				**26**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	3	2	6	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, uncontrolled grazing, and future farm development.	1
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats, and mustelids). It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	The site likely has a pest plant issue, but it is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	3	2	6	Unfenced on private land but grazing is not an issue for parts of the site that are conservation land.	1
12	Legal protection	3	2	6	Approximately one third of the site is part of Koropupu Scenic Reserve	2
Threat criteria				**45**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Additional fencing and planting of gorge margins would likely improve habitat quality at this site. Pest animal control, particularly of rats and possums, would reduce the threat to indigenous species.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	1	2	2	No known WRC funding.	2
16	Non-WRC funding	1	2	2	No known funding, however part of the site is public conservation land so may receive some funding from DOC, but this is unknown.	1
Potential outcomes score				**10**		
Total Score for site 322				**81**		

Site 323 Marokopa Natural Tunnel and Te Ana Kapiti Cave

Site information

Site Number	323	**Site Name**	Marokopa Natural Tunnel and Te Ana Kapiti Cave	**Karst Type**	Surface	**Site Area (ha)**	39.458	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	DOC (30.36 ha), NWR (8.96 ha)	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Cave entrances; caves and cracks; cliffs, scarps and tors		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A moderately sized surface karst site on the north side of the Marokopa River and east of Piripiri. The site is almost entirely native forest with a minor north-eastern edge of exotic pasture. The native forest component is likely tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13). The forested area is in good condition and well connected to a much larger patch within the district.	3
2	Size	2	2	4	At 39.458 ha, this site is medium in size compared to other surface karst SNA in the top 58 karst ecosystems.	3
3	Linkage and buffering	3	2	6	The site is nearly entirely surrounded by indigenous forest.	3
4	Diversity and pattern	3	2	6	This natural tunnel and cave site has three types of naturally uncommon karst ecosystem: cave entrances; caves and cracks; cliffs, scarps, and tors. Diversity in vegetation is likely moderate.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	2	3	6	In the Waitomo ED, 32.2% of WF13 is present and hence this vegetation type is not under-represented. However, this forest appears to be old growth forest that is representative of its type.	2
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: woodrose (*Dactylanthus taylorii*) (Nationally Vulnerable), cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon), Lyall's spleenwort (*Asplenium lyallii)* (Not Threatened – Regionally Uncommon), and *Asplenium trichomanes* (Regionally Uncommon). Likely to occur on site: carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable) and species of the Myrtaceae family (Threatened). Significant fauna known to occur on site: long-tailed bats (*Chalinolobus tuberculatus*) (Nationally Critical), a chironomid midge (*Paucispinigera approximate*) (conservation status unknown) and a feather mosquito (*Harrisius pallidus*) (conservation status unknown). Likely to occur on site: bush falcon/kārearea (*Falco novaeseelandiae* "bush") (Recovering).	3
Ecological value score				**31**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	1	2	2	Key threats are likely to include pest animal species, broadleaved agricultural weeds, and exotic grasses.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids), with goats likely a major issue, as they are in much of the Waitomo District. It is unknown if any pest animal control is carried out.	1
9	Urgency: Plant pest control	2	3	6	The site is fairly buffered from farmland so is unlikely to have a serious pest plant issue.	1
10	Urgency: Restoration planting	2	3	6	It is unknown whether any restoration planting has been carried out at this site; however, the site is largely vegetated, and only small areas of planting would be needed.	2
11	Fencing	1	2	2	Grazing is not an issue for parts of the site that are conservation land. It is unknown whether areas on private land are fenced, but the private land is surrounded by indigenous forest and is not contiguous with farmland. WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses on this property.	3
12	Legal protection	1	2	2	30.36 ha is on public conservation land is part of Marakopa Natural Tunnel Scenic Reserve. The rest of the land is protected by a Nga Whenua Rahui covenant.	3
Threat criteria				**27**		

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Five yearly control of goats and possum/rat control using bait stations would significantly improve the habitat value of this site.	2
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	1	2	2	No known funding, however part of the site is public conservation land so may receive some funding from DOC, but this is unknown.	1
Potential outcomes score				**12**		
Total Score for site 323				**70**		

Site 324 Mohakatino karst

Site information

Site Number	324	**Site Name**	Mohakatino karst	**Karst Type**	Surface	**Site Area (ha)**	93.252	**District**	Waitomo and New Plymouth
Ecological Region	Taranaki	**Protection Status**	DOC (90.38 ha) and unprotected	**Ecological District**	North Taranaki	**Naturally Uncommon Ecosystem Types**	Sinkholes		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A moderately sized surface karst site along the southern edge of the Waitomo District, above the southern side of the Totara Stream and south of Mackford. The site is entirely native forest, in good condition and well connected to a large expanse of forest in all directions. The vegetation is tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13) in mosaic with scrub/shrubland (VS4/VS5) especially on steep/karst areas. The majority of the site is protected within the Mohakatino Conservation Area.	3
2	Size	2	2	4	At 93.252 ha, this site is medium in size compared to other surface karst SNA sites in the top 58 karst SNA.	3
3	Linkage and buffering	3	2	6	This site is located on the edge of Mohakatino Conservation Area and is completely surrounded by tawa-kohekohe-rewarewa-hinau-podocarp forest.	3
4	Diversity and pattern	2	2	4	This site has only a single naturally uncommon ecosystem type: sinkholes. Given its size, the site likely has moderate floristic diversity.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	3	3	9	WF13 is not under-represented in the North Taranaki ED. However, the vegetation is old growth forest that is representative of its type.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: *Brachyglottis turneri* (Nationally Endangered). Likely to occur on site: climbing rātā (*Metrosideros fulgens*) (Nationally Vulnerable), woodrose (*Dactylanthus taylorii*) (Nationally Vulnerable), and species of the Myrtaceae family (Threatened). Significant fauna known to occur on site: a book scorpion/false scorpion (*Tyrannochthoniella* sp.) (conservation status unknown). Likely to occur on site: longfin eel (*Anguilla dieffenbachii*) (Declining), inanga (*Galaxias maculatus*) (Declining) and redfin bully (*Gobiomorphus huttoni*) (Not Threatened).	3
Ecological value score				**32**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	1	2	2	Key threats are likely to include only pest animal species.	3
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). Goats are likely to be a problem at this site. It is unknown whether pest animal control is being carried out.	1
9	Urgency: Plant pest control	1	3	3	The site is unlikely to have a pest plant issue given the buffering provided by surrounding forest.	3
10	Urgency: Restoration planting	1	3	3	The site is entirely vegetated with indigenous forest or regenerating indigenous vegetation and restoration planting is not required.	3
11	Fencing	2	2	4	Grazing is not an issue for parts of the site that are conservation land. It is unknown whether areas on private land are fenced, but the private land is surrounded by indigenous forest and is not contiguous with farmland. WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses on this property.	3
12	Legal protection	1	2	2	Most of the site is public conservation land (Mohakatino Conservation Area).	3
Threat criteria				**23**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
13	Restoration potential	3	2	6	Five yearly goat control and rat/possum control using bait stations would significantly improve the habitat value of this site and decrease the threat to indigenous species.	3
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019). ICM priority site.	2
16	Non-WRC funding	1	2	2	No known funding, however part of the site is public conservation land so may receive some funding from DOC, but this is unknown.	1
Potential outcomes score				**20**		
Total Score for site 324				**75**		

Site 325 Old Mountain Road karst

Site information

Site Number	325	Site Name	Old Mountain Road karst	Karst Type	Surface	Site Area (ha)	54.239	District	Waikato
Ecological Region	Tainui	Protection Status	Unprotected	Ecological District	Raglan	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks; cliffs, scarps and tors		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A moderately sized surface karst site composed of several areas, north of the Old Mountain Road at Karamu. The area is mostly exotic pasture with some native forest. N Area, scattered to dense VS3-VS5; Central E Area scattered to dense VS3-VS5, small lake and modified WL area; S Area, WF13 & exotic pasture.	3
2	Size	2	2	4	At 54.239 ha, this site is medium size compared to other surface karst SNA.	3
3	Linkage and buffering	2	2	4	This site is mostly surrounded by pasture and pine forestry. Some small areas of indigenous vegetation bound the site. Some indigenous vegetation is present within the wider landscape (including Four Brother's Scenic Reserve and Karamu Walkway).	3
4	Diversity and pattern	2	2	4	This site has vegetated limestone bluffs and many small caves. In total it has three types of naturally uncommon karst ecosystem: cave entrances; caves and cracks; cliffs, scarps, and tors. Much of the site is pasture, but a lake and areas of wetland are also present.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	3	3	9	Under-represented ecosystem type (WF13) is present at this site.	3
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: kānuka (*Kunzea robusta*) (Nationally Vulnerable) and mānuka (*Leptospermum scoparium* var. *scoparium*) (Declining). Significant fauna likely to occur on site: long-tailed bats (*Chalinolobus tuberculatus*) (Nationally Critical) and bush falcon/karearea (*Falco novaeseelandiae* "bush") (Recovering).	2
Ecological value score				**27**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, and uncontrolled grazing.	1
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats, and mustelids). It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	Pest plants are likely an issue at this site but is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	3	2	6	WRC has no record of any fencing associated with soil conservation, clean streams, or grazing licenses. Aerial imagery suggests that at least parts of the site are unfenced and grazed. Much of the site is farmland that is likely unsuitable for retiring for biodiversity.	1
12	Legal protection	3	2	6	The site is unprotected.	3
Threat criteria				**43**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Wetland and stream margins may require fencing and planting. Some pest plant control may be required. Control of possums and rats using baits stations would decrease the threat to indigenous species.	1
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
15	LTCCP: Funding support	2	2	4	No known WRC funding. Part ICM priority site.	1
16	Non-WRC funding	1	2	2	No known funding from other sources.	1
Potential outcomes score				**12**		
Total Score for site 325				**82**		

Site 326 Pakeho polygonal karst and autogenic aquifer

Site information

Site Number	326	**Site Name**	Pakeho polygonal karst and autogenic aquifer	**Karst Type**	Surface	**Site Area (ha)**	346.100	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	DOC (0.61 ha) and unprotected	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Sinkholes; caves and cracks; cliffs, scarps and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A large surface karst site to the south and east of Waipapa Rd cave system (karst SNA no. 347), directly north of the Waipapa Road and Oparure Road intersection, west of Te Kuiti. The site is characterised by exotic grassland with scattered remnants of MF7-3 forest-treeland; however, these patches are fragmented and would have limited habitat value.	2
2	Size	1	2	2	This site is very large compared to other surface karst sites (346.1 ha); however, the site is highly degraded, lacking almost all indigenous species typical of its habitat type.	3
3	Linkage and buffering	1	2	2	The site has very little indigenous vegetation and is completely surrounded by pasture.	3
4	Diversity and pattern	2	2	4	The site has moderate to high diversity in naturally uncommon ecosystems (sinkholes; caves and cracks; cliffs, scarps, and tors), but the site has very little natural cover.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	1	3	3	The site has a small area of MF7 which is under-represented in the Waitomo ED; however, the site is very small.	2
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: rātā (*Metrosideros colensoi*) (Nationally Vulnerable), species of the Myrtaceae family (Threatened), native verbena (*Teucridium parvifolium*) (Declining) and cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon). Significant fauna likely to occur on site: longfin eels (*Anguilla dieffenbachii*) (Declining).	2
Ecological value score				**15**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	1	2	2	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, uncontrolled grazing, and future farm development. However, the site is very low quality and is unlikely to experience further deterioration.	2
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats and mustelids). It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	The site may have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site. Much of the site is productive farmland and so may be unsuitable for restoration planting.	1
11	Fencing	3	2	6	WRC has no record of any fencing associated with soil conservation, clean streams, or grazing licenses. Aerial imagery suggests that most of the site is grazed. It is unclear whether caves and cracks have been fenced.	2
12	Legal protection	3	2	6	A small part of this site is protected by DOC, but the site is largely unprotected.	3
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	1	2	2	This site would likely require extensive fencing and planting to improve the habitat values of this site.	1
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	1	2	2	No known funding from other sources.	1
Potential outcomes score				**8**		
Total Score for site 326				**64**		

Site 327 Paparahia Cave

Site information

Site Number	327	**Site Name**	Paparahia Cave	**Karst Type**	Surface	**Site Area (ha)**	38.454	**District**	Waitomo
Ecological Region	Tainui	**Protection Status**	Unprotected	**Ecological District**	Herangi	**Naturally Uncommon Ecosystem Types**	Cave entrances; sinkholes; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A moderately sized surface karst site on the west side of Manganui Road at Paparahia Station. The site is two-thirds good condition and well-connected tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13) with an eastern edge of pine forest and exotic pasture.	2
2	Size	2	2	4	At 38.454 ha, this site is medium in size compared to other surface karst SNA in the top 58 karst SNA.	3
3	Linkage and buffering	3	2	6	The site is bordered by indigenous vegetation, pine forest, and grazed pasture. It is contiguous with a large tract of forest that includes Hui komako Scenic Reserve.	3
4	Diversity and pattern	3	2	6	This site has moderate to high ecosystem diversity with the follow naturally uncommon ecosystems: cave entrances; sinkholes; caves and cracks. The site has indigenous forest vegetation and may also have wetland vegetation.	2
5	Under-represented vegetation	2	3	6	WF13 is not under-represented in the Herangi ED; however, this site is likely old growth forest.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: woodrose (*Dactylanthus taylorii*) (Nationally Vulnerable) and species of the Myrtaceae family (Threatened). Significant fauna likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical), shortjaw kokopu (*Galaxias postvectis*) (Nationally Vulnerable), lamprey (*Geotria australis*) (Nationally Vulnerable), longfin eel (*Anguilla dieffenbachii*) (Declining), torrentfish (*Cheimarrichthys fosteri*) (Declining), mussel (*Echyridella menziesii*) (Declining), giant kokopu (*Galaxias argenteus*) (Declining), kōaro (*Galaxias brevipinnis*) (Declining), bluegill bully (*Gobiomorphus hubbsi*) (Declining), Archey's frog (*Leiopelma archeyi*) (Declining), Hochstetter's frog (*Leiopelma hochstetteri sensu stricto*) (Declining), bush falcon/kārearea (*Falco novaeseelandiae* "bush") (Recovering) and redfin bully (*Gobiomorphus huttoni*) (Not Threatened).	3
Ecological value score				**30**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaved agricultural weeds, and exotic grasses. Goats are likely to be a significant issue at this site.	2
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats, and mustelids). Goats are likely to be a significant issue at this site. It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	2	3	6	It is unknown whether this site has a pest plant issue or whether pest control is carried out.	1
10	Urgency: Restoration planting	2	3	6	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	3	2	6	WRC has no record of any fencing associated with soil conservation, clean streams, or grazing licenses. At least part of the site is grazed.	2
12	Legal protection	3	2	6	Unprotected.	3
Threat criteria				**37**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Five-yearly control of goats and ongoing control of possums and rats using bait stations would greatly benefit this site.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (35-40% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	1	2	2	No known funding.	1
Potential outcomes score				**20**		
Total Score for site 327				**87**		

Site 328 Pukeroa Cave System

Site information

Site Number	328	Site Name	Pukeroa Cave System	Karst Type	Cave	Site Area (ha)	236.633	District	Waitomo
Ecological Region	King Country	Protection Status	DOC (0.91 ha) and Unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Threatened Species (DMU), Bat, and reptile in top 58 karst SNA sites of the Waikato April 2021
- Threatened species recording at the top 58 karst SNA sites,14322329
- Appendix III ,Threatened Species draft in top 58 karst SNA sites of the Waikato, word 18050151
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- SNA karst sites key attributes from Bruce Hayward,13091068
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A large cave karst site to the west of Mangaorongo Road, Mahoenui. The western area of the site may have been WF7-3, but are now pasture, plantation pines, small areas of VS5 scrub-shrubland possibly on karst. The site is characterised by exotic pasture and farmland with minor patches of native scrub and pine. The site would have limited surface habitat value but there may be some value for species that utilise caves.	3
2	Size	1	2	2	At 236.633 ha, this cave system is large compared to other top 58 karst SNA cave ecosystems. However, the site is highly degraded, with most of the site lacking almost all indigenous species typical of its habitat type.	3
3	Linkage and buffering	2	2	4	This site is contiguous with Mangaorongo Scenic Reserve (R17017), a nationally significant SNA. The reserve is predominantly lowland podocarp-hardwood	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
					forest (on steep hill slopes) but includes scrub and pasture. The reserve also includes extensive karst features, tomos and limestone outcrops. However, the site is degraded (it contains pasture and tracks). Better quality examples of the vegetation type are present elsewhere in the Waikato Region. It is not known if the species which are present in the reserve are also found in this site.	
4	Diversity and pattern	2	2	4	Diverse physical features found are found at this site (caves and multiple cave entrances, major streamway, waterfalls) and they may provide diverse habitats for cave fauna. Above ground, little diversity exists. In terms of naturally uncommon karst ecosystems, the site includes: caves and cracks; and cave entrances.	2
5	Under-represented vegetation	1	3	3	The site comprises exotic pasture, plantation pines and some small areas of scrub.	3
6	Threatened species (national priority)	2	1	2	Long-tailed bats (*Chalinolobus tuberculatus*) (Nationally Critical) are likely present and may utilise the site for foraging and roosting; however, it is no clear whether suitable roosting habitat exists at this site. Threatened species of the Myrtaceae family are likely present.	2
Ecological value score				**17**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, recreational cave use, uncontrolled grazing, and future farm development.	2
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats, and mustelids), but there is limited habitat available on site for indigenous species so the effects of pest animals may be limited. It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	It is unknown whether the site has a pest plant issue or whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site. Much of the site is productive farmland and may be unsuitable for retiring for biodiversity.	1
11	Fencing	3	2	6	This cave system has multiple entrances, and it is not clear if they are all fenced from stock. WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses.	1
12	Legal protection	3	2	6	A very small area of this SNA is DOC-owned (0.91ha) but most of the site is unprotected.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
Threat criteria				**43**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	1	2	2	This site would require extensive fencing and planting to significantly improve the habitat values for indigenous species.	2
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	2	2	4	No known funding, however part of the site is public conservation land so may receive some funding from DOC.	1
Potential outcomes score				**18**		
Total Score for site 328				**78**		

Site 329 Puketiti Flower Cave

Site information

Site Number	329	Site Name	Puketiti Flower Cave	Karst Type	Cave	Site Area (ha)	20.440	District	Waitomo
Ecological Region	King Country	Protection Status	Unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A small cave karst site south of Haku Road and associated with Grand Canyon Cave (karst SNA no. 305) and Mangawharawhara gorge and natural bridges (karst SNA no. 320). The site is entirely characterised by exotic pasture and farmland with scattered small-leaved shrubs and a small area of shrubland in the northwest and east. The site would have limited surface habitat value but there may be some value for species that utilise caves.	3
2	Size	1	2	2	At 20.44 ha, this site is medium in size compared to other surface karst SNA in the top 58 karst ecosystems; however, the site is highly degraded, lacking almost all indigenous species typical of its habitat type.	3
3	Linkage and buffering	1	2	2	The site has very little indigenous vegetation and is completely surrounded by pasture.	3
4	Diversity and pattern	1	2	2	This cave site has moderate diversity of naturally uncommon ecosystems: cave entrances; caves and cracks. The site has very little diversity in vegetation.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	1	3	3	The site is entirely characterised by exotic pasture and farmland with some shrubland.	3
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: species of the Myrtaceae family (Threatened). Significant fauna likely to occur on site: long-tailed bats (*Chalinolobus tuberculatus*) (Nationally Critical).	3
Ecological value score				**13**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	1	2	2	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, uncontrolled grazing, and future farm development. However, the site is very low quality and is unlikely to experience further deterioration.	3
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats, and mustelids). It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	The site may have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site. Most of the site is pasture that may be unsuitable for retiring for biodiversity.	1
11	Fencing	3	2	6	WRC has no record of any fencing associated with soil conservation, clean streams, or grazing licenses. The site is grazed. It is unclear whether the cave entrance is fenced.	2
12	Legal protection	3	2	6	Unprotected.	3
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Fencing and planting of wetlands, streams and cave entrances would be required to significantly improve biodiversity on this site.	1
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
16	Non-WRC funding	1	2	2	No known funding.	1
Potential outcomes score				**18**		
Total Score for site 329				**72**		

Site 330 Raglan coastal karst

Site information

Site Number	330	Site Name	Raglan coastal karst	Karst Type	Surface	Site Area (ha)	10.893	District	Waikato
Ecological Region	Tainui	Protection Status	DOC (0.6 ha), local authority (1.05 ha), unprotected	Ecological District	Raglan	Naturally Uncommon Ecosystem Types	Cave and cracks; cliffs, scarps and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A small surface karst site composed of several even smaller areas on the northern side of Raglan Harbour and one further up the Harbour to the east. These areas are confined to the foreshore of the harbour and mostly dominated by manuka-kanuka. E Areas (4) along harbour margin - include sea grass/sea grass herbfield areas with VS2-VS5, some gorse; Central E Area - modified WF13-small-leaved scrub with areas of estuarine vegetation along harbour margin - saltmarsh ribbonwood, sea meadow, rushland; E Area, upper harbour, unmapped mixed native & exotic shrubland with gorse & broadleaved shrubs, and areas of estuarine vegetation along harbour margin including sea meadow, mangroves & rushland.	3
2	Size	1	2	2	At 10.893 ha in size, this site is small compared to other surface karst sites in the top 58 karst ecosystems.	3
3	Linkage and buffering	1	2	2	The sites are surrounded by pasture and are isolated from other indigenous ecosystems.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	3	2	6	A small area of wetland habitat is present, providing habitat for indigenous flora and fauna species. Naturally uncommon cliffs, cracks are present. A range of coastal ecosystems are present.	2
5	Under-represented vegetation	3	3	9	Seagrass herbfields are under-represented in the Raglan ED.	2
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: koheriki (*Scandia rosifolia*) (Nationally Critical) and seagrass (*Zostera muelleri* subsp. *novazelandica*) (Declining). Likely to occur on site: species of the Myrtaceae family (Threatened). Significant fauna Known to occur on site: caspian tern/taranui (*Hydroprogne caspia*) (Nationally Vulnerable), North Island fernbird/mātātā (*Bowdleria punctata vealeae*) (Declining), variable oystercatcher (*Haematopus unicolor*) (Recovering), and royal spoonbill/kotuku (*Platalea regia*) (Naturally Uncommon).	3
Ecological value score				**26**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	3	2	6	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, and uncontrolled human access.	2
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, possums, rats and mustelids). It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	2.5	2	5	The site has a small amount of WRC soil conservation fencing (5%).	2
12	Legal protection	1	2	2	A small part of this site is protected by DOC and local authority but is largely unprotected.	2
Threat criteria				**40**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	These karst sites require fencing and planting to protect the biodiversity values of this SNA.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	3	2	6	Whaingaroa Harbour Care (100% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019) & ICM priority site.	2
16	Non-WRC funding	1	2	2	No known funding.	1
Potential outcomes score				**18**		
Total Score for site 330				**84**		

Site 331 Rakaunui coastal karst and ephemeral lakes

Site information

Site Number	331	**Site Name**	Rakaunui coastal karst and ephemeral lakes	**Karst Type**	Surface	**Site Area (ha)**	147.404	**District**	Otorohanga
Ecological Region	Tainui	**Protection Status**	DOC (37.49 ha) and unprotected	**Ecological District**	Kawhia	**Naturally Uncommon Ecosystem Types**	Cave entrances; sinkholes; caves and cracks; cliffs, scarps, and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A moderately sized surface karst site composed of twelve areas on the western shore of Kawhia Harbour. These areas, which range in size from small to large, are fragmented patches of native vegetation surrounded by farmland and exotic pasture. The coastal margin/inland vegetation ranges from gorse scrub to VS3-VS5 to WF13, with estuarine vegetation in parts variously including rushland, sea meadow, sea grass, saltmarsh ribbonwood etc. The patches have been mapped as a complex mix of broadleaved-treefern scrub, manuka-kanuka scrub, fernland, freshwater herbfield, gorse and broom and tawa-kohekohe-rewarewa-hinau-podocarp forest. Some parts of the site appear to be in good condition while others are likely degraded.	2
2	Size	3	2	6	At 147.404 ha, this can be considered large in size compared to other surface karst in the top 58 karst SNA.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
3	Linkage and buffering	2	2	4	The sites are mostly surrounded by grazed farmland, but some patches of indigenous vegetation border the site and large tracts of indigenous forest are present < 2 km to the south of the site.	3
4	Diversity and pattern	3	2	6	The site has the full suite of naturally uncommon karst ecosystems: cave entrances; sinkholes; caves and cracks; cliffs, scarps, and tors. The site also has coastal ecosystems, wetlands, and small lakes.	3
5	Under-represented vegetation	3	3	9	Under-represented ecosystem types (seagrass herbfield) are present.	2
6	Threatened species (national priority)	3	1	3	Significant flora likely to occur on site: koheriki (*Scandia rosifolia*) (Nationally Critical), carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable), *Leptinella tenella* (Nationally Vulnerable), species of the Myrtaceae family (Threatened), sea sedge (*Carex litorosa*) (Declining), blue grass (*Anthosachne kingiana* subsp. *multiflora*) (Declining) and *Thyridia repens* (Naturally Uncommon). Significant fauna known to occur on site: banded dotterel (*Charadrius bicinctus bicinctus*) (Nationally Vulnerable) and two species of crane fly (*Mischoderus annuliferus* and *Molophilus tenuistylus*) (conservation statuses unknown). Likely to occur on site: Australasian bittern/matuku (*Botaurus poiciloptilus*) (Nationally Critical), central lesser short-tailed bat (*Mystacina tuberculata rhyacobia*) (Declining) and royal spoonbill/kōtuku (*Platalea regia*) (Naturally Uncommon).	2
Ecological value score				**32**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses and uncontrolled grazing, and future farm development.	1
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats and mustelids). It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	2	2	4	Grazing is unlikely to be an issue in parts of the site that are public conservation land. Some fencing associated with WRC's soil conservation and Clean Streams programmes is present. Much of the site is grazed.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
12	Legal protection	3	2	6	Approximately one quarter of the site is part of Kawhia Harbour (Rakaunui) Scenic Reserve; however, most of the site is unprotected.	2
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	These karst sites require fencing, planting, and pest plant control to protect the biodiversity values of this SNA.	1
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	2	2	4	ICM priority site.	1
16	Non-WRC funding	2	2	4	No known funding, however part of the site is public conservation land so may receive some funding from DOC.	1
Potential outcomes score				**14**		
Total Score for site 331				**87**		

Site 332 Ruakuri Cave

Site information

Site Number	332	Site Name	Ruakuri Cave	Karst Type	Cave	Site Area (ha)	14.922	District	Waitomo
Ecological Region	King Country	Protection Status	DOC (0.65 ha) and unprotected.	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; sinkholes; caves and cracks; cliffs, scarps, and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A small cave karst site composed of a single area at Waitomo Caves, closely associated with Gardner's Gut Cave (karst SNA no. 304) and Ruakuri Natural Bridge and karst (karst SNA no. 333). The surface is a mix of exotic pasture and modified native vegetation which is in moderate condition and well connected to larger forest areas. Vegetation ranges from exotic pasture to exotic shrubland, VS5-mod WF13 and fernland i.e., bracken with other herbaceous species. Several threatened or significant species are known or are likely to occur at the site.	3
2	Size	1	2	2	At 14.922 ha, this site is small in size compared to other karst SNA in the top 58 karst ecosystems.	3
3	Linkage and buffering	3	2	6	The site is closely associated with Ruakuri Natural Bridge and karst (Site 333) and Gardner's Gut Cave (Site 304), and part of the site is within Ruakuri Caves & Bush Scenic Reserve. The modified native vegetation on site is well connected to larger forest areas to the north and south.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	The site has moderate diversity with indigenous forest and two naturally uncommon ecosystem types: cave entrances; and caves and cracks.	3
5	Under-represented vegetation	1	3	3	The site comprises regenerating indigenous vegetation.	3
6	Threatened species (national priority)	3	1	3	Significant flora likely to occur on site: species of the Myrtaceae family (Threatened). Significant fauna known to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical), a freshwater snail (*Potamopyrgus doci*) (Nationally Critical), torrentfish (*Cheimarrichthys fosteri*) (Declining) and a velvet worm (*Peripatoides novae-zealandiae*) (Not Threatened). Other notable species known to occur on site (conservation statuses unknown): a book scorpion (*Tyrannochthoniella* sp.), two species of seed shrimp (*Candona* sp. and *Scottia* sp.), a springtail (*Mesaphorura krausbaueri*) and an amphipod crustacean (*Paraleptamphopus* sp.).	3
Ecological value score				**22**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Major tourist cave. Key threats are likely to include pest animal species, urban weeds and garden escapes, exotic grasses, farm development, uncontrolled grazing, and uncontrolled human access.	3
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats, and mustelids). It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	2	2	4	The site is partially fenced. About 30% fenced.	3
12	Legal protection	3	2	6	A very small area of this site falls within Ruakuri Caves & Bush Scenic Reserve (0.65 ha), but most of the site is unprotected.	3
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
13	Restoration potential	3	2	6	Five yearly goat control and ongoing possum and rat control using bait stations would improve the habitat values of this site and decrease the threat to indigenous species.	1
14	LTCCP: Community involvement	3	2	6	Waitomo Catchment Trust (100% overlap).	2
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	1	2	2	No known funding from other sources.	1
Potential outcomes score				**16**		
Total Score for site 332				**79**		

Site 333 Ruakuri Natural Bridge and karst

Site information

Site Number	333	**Site Name**	Ruakuri Natural Bridge and karst	**Karst Type**	Surface	**Site Area (ha)**	39.816	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	DOC	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Caves and cracks; cave entrances; cliffs, scarps and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- SNA karst sites key attributes from Bruce Hayward,13091068
- Threatened Species (DMU), Bat, and reptile in top 58 karst SNA sites of the Waikato April 2021
- Threatened species recording at the top 58 karst SNA sites,14322329
- Appendix III ,Threatened Species draft in top 58 karst SNA sites of the Waikato, word 18050151
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- https://predatorfreenz.org/ruakuri-scenic-reserve/
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	The site is within Ruakuri Caves & Bush Scenic Reserve. The site is entirely native vegetation in good condition comprising broadleaved species-treefern scrub and tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13). The site is well-protected from edge effects. The site has a well-used DOC walkway and unmanaged human access may adversely impact biodiversity. Pest animal species are likely present but are unlikely to be significantly degrading the karst character.	3
2	Size	2	2	4	At 39.816 ha in size, this can be considered medium in size compared to other surface karst SNA in the top 58 karst SNA.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
3	Linkage and buffering	3	2	6	The site is closely associated with Gardner's Gut Cave (karst SNA no. 304) and Ruakuri Cave (karst SNA no. 332) and is within Ruakuri Caves & Bush Scenic Reserve. The site is entirely native vegetation comprising broadleaved species-treefern scrub and WF13. The vegetation is in good condition and well-connected to larger forested areas within the locality. The site is within 1 km of another surface karst SNA site (karst SNA no. 311 Lake Rotokawau) which is also surrounded by WF13 and in good condition.	3
4	Diversity and pattern	3	2	6	Ruakuri Natural Bridge is a spectacular 30 m high feature. Ruakuri Bush includes all the surrounding karst including limestone bluffs, cave entrances, arches, and karst areas as far downstream as the entrance to Aranui Cave, which is also included in this area. In terms of naturally uncommon karst ecosystems, the site includes: cave entrances; caves and cracks; and cliffs, scarps and tors. The site is vegetated with WF13 and broadleaf treefern scrub. Near the stream, kahikatea and matai are present with smaller trees and shrubs such as tree fuchsia, ramarama, kanono, and parataniwha. Upslope, tawa becomes prominent, often with mangeao. Podocarps are present on the ridges.	3
5	Under-represented vegetation	2	3	6	In the Waitomo ED, 32.2% of WF13 is present and hence this vegetation type is not under-represented. However, forest on this site appears to be old growth forest and is representative of its type.	3
6	Threatened species (national priority)	3	1	3	Various threatened, at-risk and regionally uncommon species are known to occur or are likely to occur at this site. Known to occur: *Astelia grandis*, Swamp astelia Regionally Uncommon; *Metrosideros diffusa*, White rata, Nationally Vulnerable; *Falco novaeseelandiae* "bush", karearea, Recovering; *Chalinolobus tuberculatus*, long-tailed bat, Nationally Critical. Likely to occur: *Metrosideros colensoi*, Rata, Nationally Vulnerable; *Metrosideros carminea*, Carmine rata, Nationally Vulnerable; *Ptisana salicina*, King fern Declining; *Anguilla dieffenbachii*, Longfin eel, Declining; *Cheimarrichthys fosteri*, torrentfish, Declining.	3
Ecological value score				**31**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	The vegetation on site is in good condition and the site is well-protected from edge effects. The site has a well-used DOC walkway and unmanaged human access may adversely impact biodiversity. Pest animal species are likely present but are unlikely to be significantly degrading the karst character.	3
8	Urgency: Animal pest control	2	3	6	Possum and rat control carried out by Discover Waitomo, in partnership with DOC. Goats may also be an issue at this site but it is unknown whether any goat control is occurring.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
9	Urgency: Plant pest control	3	3	9	It is unknown whether the site has a pest plant problem or whether pest plant control is carried out.	1
10	Urgency: Restoration planting	1	3	3	The site is already fully vegetated with indigenous species.	3
11	Fencing	1	2	2	Some of the site is a DOC Scenic Reserve. Private land is partially fenced covering approximately 60%	3
12	Legal protection	1	2	2	DOC Scenic Reserve.	3
Threat criteria				**26**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Five yearly goat control would significantly improve the biodiversity values at this site.	2
14	LTCCP: Community involvement	3	2	6	Waitomo Catchment Trust (100% overlap).	2
15	LTCCP: Funding support	1	2	2	No known WRC funding.	2
16	Non-WRC funding	3	2	6	Some funding from Discover Waitomo and from DOC.	2
Potential outcomes score				**20**		
Total Score for site 333				**77**		

Site 334 Taranaki Point coastal karst

Site information

Site Number	334	Site Name	Taranaki Point coastal karst	Karst Type	Surface	Site Area (ha)	27.590	District	Waikato
Ecological Region	Tainui	Protection Status	Unprotected	Ecological District	Kawhia	Naturally Uncommon Ecosystem Types	Caves and cracks; cliffs, scarps, and tors.		

Information used to Source the Karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- SNA karst sites key attributes from Bruce Hayward,13091068
- Threatened Species (DMU), Bat, and reptile in top 58 karst SNA sites of the Waikato April 2021
- Threatened species recording at the top 58 karst SNA sites,14322329
- Appendix III ,Threatened Species draft in top 58 karst SNA sites of the Waikato, word 18050151
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A surface karst site along the coastal cliffs of Taranaki Point. The site is a mix of exotic pasture and coastal native vegetation. The native vegetation is pohutukawa treeland-flaxland-rockland with broadleaved shrubs, although pohutukawa is rare in this part of the coast. Other vegetation communities present may include Ficinia nodosa-pohuehue sedge-vineland, kanuka-manuka scrub and shrubland, Spinifex grassland and cliff herb-shrub communities. Some of the structures, composition, and ecological processes may be intact, while others are likely to be degraded; however, from aerial imagery it is not possible to determine the level of understorey regeneration and pest invasion.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
2	Size	2	2	4	This site (27.59 ha) covers a significant length of 2 km of the western Waikato coastline and is medium in size compared to other surface karst SNA in the top 58 karst ecosystems.	3
3	Linkage and buffering	2	2	4	This site is mostly bounded by farmland, but it is contiguous with several other SNA sites including the large dune complex on the Aotea heads and Ruapuke Swamp.	3
4	Diversity and pattern	3	2	6	Limestone karst and pinnacles on exposed coast. Numerous limestone pinnacles and outcrops with variously developed fluting and solution features forms middle and lower cliffs and intertidal rocks. In a few places the limestone extends further inland into farmland. In terms of naturally uncommon karst ecosystems, the site includes: caves and cracks; and cliffs, scarps and tors. This SNA includes the CMA and likely includes a range of habitats for rare coastal plants (see 'Threatened species'). This site includes parts of some good examples of progressions from open coast to dune land, to wetland to forest as well as rocky coast to forest which are no longer common due to human development.	3
5	Under-represented vegetation	3	3	9	CL1, Pohutukawa treeland/flaxland/rockland. May also include rare coastal ecosystems.	2
6	Threatened species (national priority)	3	1	3	Plants known to occur on site: stalked adder's tongue (*Ophioglossum petiolatum*) (Nationally Critical). Plants likely to occur on site: koheriki (*Scandia rosifolia*) (Nationally Critical), blue grass (*Anthosachne kingiana* subsp. *multiflora*) (Declining) and species of the Myrtaceae family (Threatened). Fauna known to occur on site: caspian tern (*Hydroprogne caspia*) (Nationally Vulnerable), banded dotterel (*Charadrius bicinctus bicinctus*) (Nationally Vulnerable), red-billed gull (*Larus novaehollandiae*) (Declining), pied shag (*Phalacrocorax varius varius*) (Recovering), northern New Zealand dotterel (*Charadrius obscurus aquilonius*) (Recovering) and royal spoonbill/kōtuku (*Platalea regia*) (Naturally Uncommon).	3
Ecological value score				**30**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses and un-controlled grazing. Mass movement might also be a threat to current habitats, though this is a natural process.	2
8	Urgency: Animal pest control	3	3	9	The usual suite of pest species are likely to be present (e.g., hares, rabbits, goats, pigs, deer, possums, rats, and mustelids). It is unknown whether pest control is currently being undertaken at this site.	1
9	Urgency: Plant pest control	3	3	9	Pest plants are likely to be an issue at this site or whether pest plant control is carried out.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	2	2	4	Aerial imagery indicates that the site is mostly, if not fully, fenced. WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses.	2
12	Legal protection	3	2	6	Private land with no known legal protection.	2
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Fence maintenance, predator control and pest plant control, if required, may improve the indigenous habitats at this site.	1
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	1	2	2	No known funding from other sources.	1
Potential outcomes score				**12**		
Total Score for site 334				**83**		

Site 335 Taumatatotara karst and dolines

Site information

Site Number	335	**Site Name**	Taumatatotara karst and dolines	**Karst Type**	Surface	**Site Area (ha)**	519.224	**District**	Waitomo and Otorohanga
Ecological Region	Tainui	**Protection Status**	DOC (94.53 ha), NWR (315.31 ha) and unprotected.	**Ecological District**	Kawhia	**Naturally Uncommon Ecosystem Types**	Cave entrances; sinkholes; caves and cracks; cliffs, scarps, and tors.		

Information used to Source the Karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A large surface karst site of three discrete areas, west of Te Koraha. The site is well vegetated with good condition native vegetation and well connected to larger forested areas within the locality. Aerial and oblique imagery shows that the north-western area is vegetated with tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13), manuka scrub (VS4) and broadleaved species-treefern scrub (VS5). The central area is vegetated with VS5-WF13 and the south-eastern area with VS5-WF13.	3
2	Size	3	2	6	At 519.224 ha, this site is very large compared to other surface karst SNA in the top 58 karst ecosystems.	3
3	Linkage and buffering	3	2	6	Most of the site is surrounded by indigenous forest.	3
4	Diversity and pattern	3	2	6	The site has the full suite of naturally uncommon karst ecosystems: cave entrances; sinkholes; caves and cracks; cliffs, scarps, and tors.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	2	3	6	Indigenous vegetation types on site (WF13, VS4, VS5) are not under-represented in the Kawhia ED. However, forest on this site appears to be old growth forest and is representative of its type.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: swamp maire (*Syzygium maire*) (Nationally Critical); awaroa hebe (*Veronica scopulorum*) (Declining) and *Epilobium insulare* (Declining). Likely to occur on site: woodrose (*Dactylanthus taylorii*) (Nationally Vulnerable), rātā (*Metrosideros colensoi*) (Nationally Vulnerable), carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable), species of the Myrtaceae family (Threatened), cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon) and Lyall's spleenwort (*Asplenium lyallii*) (Not Threatened). Significant fauna known to occur on site (conservation statuses unknown): a fungus gnat (*Sciara* sp.), a moth fly (*Psychoda* sp.), a rootfeeding springtail (*Onychiurus novae-zelandiae*) and a springtail (*Pseudosinella spelunca*). Likely to occur on site: Australasian bittern/matuku (*Botaurus poiciloptilus*) (Nationally Critical), long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical), longfin eel (*Anguilla dieffenbachii*) (Declining), central lesser short-tailed bat (*Mystacina tuberculata rhyacobia*) (Declining), bush falcon/kārearea (*Falco novaeseelandiae* "bush") (Recovering) and redfin bully (*Gobiomorphus huttoni*) (Not Threatened).	3
Ecological value score				**33**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	1	2	2	Key threats are likely to include pest animal species only as the site is more-or-less buffered from farm edges.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown whether pest animal control is being carried out.	2
9	Urgency: Plant pest control	1	3	3	There is unlikely to be a pest plant issue through most of the site given the buffering provided by surrounding forest.	3
10	Urgency: Restoration planting	1	3	3	The site is nearly entirely vegetated with indigenous forest or regenerating indigenous vegetation and restoration planting is not required.	3
11	Fencing	1	2	2	Grazing is unlikely to be an issue for most of the site as it is surrounded by indigenous forest and/or is public conservation. WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses.	2
12	Legal protection	1	2	2	Most of the site is protected as part of Taumatatotara Conservation Area or by Nga Whenua Rahui covenant.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
Threat criteria				**21**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Five yearly control of goats and ongoing control of rats and possums using bait stations would significantly decrease the threat to indigenous species.	2
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	2	2	2	No known funding, however part of the site is public conservation land so may receive some funding from DOC.	1
Potential outcomes score				**14**		
Total Score for site 335				**68**		

Site 336 Tawarau karst

Site information

Site Number	336	Site Name	Tawarau karst	Karst Type	Surface	Site Area (ha)	3029.210	District	Waitomo
Ecological Region	King Country	Protection Status	DOC (2993.68 ha) and unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; sinkholes; caves and cracks; cliffs, scarps and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A large surface karst site, dissected by the Tawarau River, just south of Piripiri. The majority of the area is within DOC land (Tawarau Conservation Area, Puaroa Forest Scenic Reserve & Taumatatawhero Ecological Area). Aerial imagery shows that the site is well vegetated with good condition native vegetation and well connected to larger forested areas within the locality. The native vegetation is mostly mapped as tawa-kohekohe-rewarewa-hinau-podocarp forest, with smaller patches of manuka-kanuka scrub and broadleaved species-treefern scrub.	3
2	Size	3	2	6	At 3029.21 ha, this site is large compared to other surface karst in the top 58 karst SNA.	
3	Linkage and buffering	3	2	6	The site is so large that adjacent farmland will have limited impact on the majority of the ecosystem. The site is well connected to larger forested areas within the locality.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	3	2	6	The site has the full suite of naturally uncommon karst ecosystems: cave entrances; sinkholes; caves and cracks; cliffs, scarps, and tors.	3
5	Under-represented vegetation	2	3	6	Indigenous vegetation types on site (tawa-kohekohe-rewarewa-hinau-podocarp forest, with smaller patches of manuka-kanuka scrub and broadleaved species-treefern scrub) are not under-represented in the Waitomo ED. However, forest on this site appears to be old growth forest and is representative of its type.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: stalked adder's tongue (*Ophioglossum petiolatum*) (Nationally Critical), swamp maire (*Syzygium maire*) (Nationally Critical), woodrose (*Dactylanthus taylorii*) (Nationally Vulnerable), cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon), clematis (*Clematis quadribracteolata*) (Naturally Uncommon), *Caladenia bartletti* (Naturally Uncommon), swamp astelia (*Astelia grandis*) (Not Threatened –Regionally Uncommon) and *Olearia virgata* (Not Threatened). Likely to occur on site: rātā (*Metrosideros colensoi*) (Nationally Vulnerable), species of the Myrtaceae family (Threatened) and *Pseudopanax laetus* (Declining). Significant fauna known to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical), North Island brown kiwi (*Apteryx mantelli*) (Declining), bush falcon/kārearea (*Falco novaeseelandiae* "bush") (Recovering), North Island kokako (*Callaeas wilsoni*) (Recovering) and North Island kākā (*Nestor meridionalis*) (Recovering) and long-tailed cuckoo/koekoeā (*Eudynamys taitensis*) (Naturally Uncommon). Likely to occur on site: longfin eel (*Anguilla dieffenbachii*) (Declining), kōaro (*Galaxias brevipinnis*) (Declining), inanga (*Galaxias maculatus*) (Declining) and redfin bully (*Gobiomorphus huttoni*) (Not Threatened).	3
Ecological value score				**33**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	1	2	2	Key threats are likely to include pest animal species only as the site is large enough to sustain impacts from farm edges.	3
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown whether pest animal control is being carried out.	2
9	Urgency: Plant pest control	1	3	3	There is unlikely to be a pest plant issue through most of the site, but some pest plants may be present on the forest edges.	3
10	Urgency: Restoration planting	1	3	3	The site is nearly entirely vegetated with indigenous forest or regenerating indigenous vegetation and restoration planting is not required.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
11	Fencing	1	2	2	Grazing is unlikely to be an issue for most of the site as it is public conservation. WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses.	3
12	Legal protection	1	2	2	The majority of the area is within DOC land (Tawarau Conservation Area, Puaroa Forest Scenic Reserve & Taumatatawhero Ecological Area).	3
Threat criteria				**21**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Five yearly control of goats and ongoing control of rats and possums using bait stations would significantly decrease the threat to indigenous species.	2
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	2	2	4	No known WRC funding. Part ICM priority site.	1
16	Non-WRC funding	1	2	2	No known funding, however part of the site is public conservation land so may receive some funding from DOC, but this is unknown.	1
Potential outcomes score				**14**		
Total Score for site 336				**68**		

Site 337 Te Kauri Karst

Site information

Site Number	337	Site Name	Te Kauri Karst	Karst Type	Surface	Site Area (ha)	94.043	District	Otorohanga
Ecological Region	Tainui	Protection Status	DOC (88.79 ha) and unprotected	Ecological District	Kawhia	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks; cliffs, scarps and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- https://www.tekauri.org.nz/te-kauri-park-scenic-reserve/, accessed 16 June 2021.
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.
- Ground truthing form (within Taylor-Smith et al. 2020 listed above)

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A moderately sized surface karst site, either side of Kawhia Road at Hauturu. Aerial imagery shows that the site is well vegetated with good condition native vegetation and well connected to larger forested areas within the locality. The native vegetation is mapped as tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13), manuka-kanuka scrub and broadleaved species-treefern scrub (VS5) and aerial imagery broadly supports this. Oblique imagery shows that the northern area comprises VS5-WF13, the large Central Area VS5-WF13, the southwestern area VS2.1-WF13. Ground truthing found that the vegetation is dominated by tawa and interspersed with pukatea, rewarewa, totara, kamahi, and Tanekaha. The subcanopy and understorey includes: nikau, pigeonwood, lancewood, māhoe, mamaku, heketara, kānuka, rangiora, wheki, kawakawa, hangehange and Alseuosmia. Ground cover incudes *Rhabdothamnus solandri*, ground ferns and parataniwha. In some places the cliffs are densely vegetated and difficult to see. In other places the cliffs are bare. Exotic grasses and herbs are present.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
					In some areas the understorey is sparse, and grazing is apparent. The indigenous vegetation is generally in good condition.	
2	Size	2	2	4	At 94.043 ha, this site is medium in size compared to other surface karst in the top 58 karst SNA.	3
3	Linkage and buffering	3	2	6	Most of the site is completely buffered by indigenous forest.	3
4	Diversity and pattern	2	2	4	Forested bluffs and caves with the following naturally uncommon ecosystems: cave entrances; caves and cracks; cliffs, scarps, and tors.	3
5	Under-represented vegetation	2	3	6	WF13 is not under-represented in the Kawhia ED. The site is mostly old growth forest.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: dwarf mistletoe (*Korthalsella salicornioides*) (Nationally Critical), ramarama (*Lophomyrtus bullata*) (Nationally Critical), stalked adder's tongue (*Ophioglossum petiolatum*) (Nationally Critical), Australian cliff brake (*Pellaea falcata*) (Nationally Critical), *Schizaea dichotoma* (Nationally Critical), kohurangi/Kirk's daisy (*Brachyglottis kirkii* var. *kirkii*) (Nationally Vulnerable), woodrose (*Dactylanthus taylorii*) (Nationally Vulnerable), climbing rātā (*Metrosideros fulgens*) (Nationally Vulnerable), kauri (*Agathis australis*) (Nationally Vulnerable), white rātā (*Metrosideros diffusa*) (Nationally Vulnerable), akatea (*Metrosideros perforata*) (Nationally Vulnerable), *Leptinella tenella* (Nationally Vulnerable), carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable), northern rātā (*Metrosideros robusta*) (Nationally Vulnerable), *Pimelea tomentosa* (Nationally Vulnerable), *Rytidosperma buchananii* (Declining), *Deyeuxia quadriseta* (Declining), blue grass (*Anthosachne k*ingiana subsp. *multiflora*) (Declining), sedge (*Carex fascicularis*) (Declining), mānuka *(Leptospermum scoparium* var. *scoparium*) (Declining), *Pseudopanax laetus* (Declining), king fern (*Ptisana salicina)* (Declining), *Caladenia bartlettii* (Naturally Uncommon), *Crassula ruamahanga* (Naturally Uncommon), *Corunastylis nuda* (Naturally Uncommon), *Thyridia repens* (Naturally Uncommon), *Corybas hypogaeus* (Naturally Uncommon), *Lindsaea viridis* (Naturally Uncommon) and *Pittosporum huttonianum* (Naturally Uncommon). Significant fauna known to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical) and North Island brown kiwi (*Apteryx mantelli*) (Declining). Likely to occur on site: central lesser short-tailed bat (*Mystacina tuberculata rhyacobia*) (Declining).	3
Ecological value score				**29**		
B. THREAT CRITERIA RANKING						

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
7	Vulnerability	2	2	4	The site is vulnerable to the ongoing effects of pest animals, particularly goats and pigs.	3
8	Urgency: Animal pest control	2	3	6	The Te Kauri-Waikuku Trust monitors and controls pests in the reserve. More than 400 bait stations spaced over 20 km in the reserve control rats, possums, mice and stoats and other mustelids. It is unknown whether other pest animals are controlled. Goat and pig sign were observed during the site visit.	3
9	Urgency: Plant pest control	3	3	9	Pest plants present include: Selaginella, Cotoneaster, Fox glove, Mexican daisy, Pampas. It's unknown whether any pest plant control is carried out.	1
10	Urgency: Restoration planting	1	3	3	Restoration planting is not required as most of the site is vegetated with indigenous species.	3
11	Fencing	1	2	2	Most of the site is public conservation land and grazing is not an issue. A small area of this site is on private land, and it appears to be grazed.	3
12	Legal protection	1	2	2	Most of the site is public conservation land within Te Kauri Park Scenic Reserve.	3
Threat criteria				**26**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Pest animal control would significantly improve the biodiversity value of the site. Control of the small areas of pest plants would prevent further invasion and high future costs of pest plant control.	3
14	LTCCP: Community involvement	3	2	6	Te Kauri/Waikuku Restoration Project (approximately 50% overlap).	2
15	LTCCP: Funding support	2	2	4	No known WRC funding. But ICM priority site.	1
16	Non-WRC funding	3	2	6	No known funding. This site is mostly public conservation land, but it is unknown how much DOC invests in this site. The site has inputs from Te Kauri-Waikuku Trust, who request individuals to sponsor bait stations.	1
Potential outcomes score				**20**		
Total Score for site 337				**75**		

Site 338 Te Raumauku Maze Cave

Site information

Site Number	338	Site Name	Te Raumauku Maze Cave	Karst Type	Cave	Site Area (ha)	0.269	District	Otorohanga
Ecological Region	King Country	Protection Status	Unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A small cave karst site composed of a single area, near Te Raumauku Caves, towards the end of Te Raumauku Road, Waitomo. The surface is almost entirely exotic pasture with a small patch of modified native vegetation (VS5) which is likely to be in poor condition and is not connected to other forest areas.	3
2	Size	1	2	2	At 0.269 ha, this site is small compared to other karst cave SNA.	3
3	Linkage and buffering	2	2	4	This site is surrounded by pasture, with a small area, but it is only approximately 300 metres from an extensive area of indigenous vegetation that includes Te Raumauku Caves Scenic Reserve and Matakana Conservation Area	3
4	Diversity and pattern	2	2	4	Although the site is mostly exotic pasture, the site has two types of naturally uncommon ecosystem: cave entrances; caves and cracks	3
5	Under-represented vegetation	1	3	3	The site is almost entirely exotic pasture with a small patch of modified native vegetation.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: species of the Myrtaceae family (Threatened). Significant fauna likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical).	2
Ecological value score				**17**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	3	2	6	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses, grazing and on-going farm development. The site is highly degraded but could still be degraded further by the removal of indigenous vegetation surrounding the cave entrance.	1
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown whether pest animal control is being carried out.	1
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	3	2	6	Most of the site appears to be grazed. WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses.	1
12	Legal protection	3	2	6	Unprotected.	3
Threat criteria				**45**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	1	2	2	This site may require fencing and restoration planting to improve the indigenous habitat at this site.	1
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	1	2	2	No known funding.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
Potential outcomes score				**8**		
Total Score for site 338				**70**		

Site 339 Ten Acre Tomo System

Site information

Site Number	339	Site Name	Ten Acre Tomo System	Karst Type	Surface	Site Area (ha)	11.328	District	Waitomo
Ecological Region	King Country	Protection Status	Unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks; cliffs, scarps and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A small surface karst site, on the west side of Mangaorongo Stream, north of Mahoenui. The site is well vegetated with a mix of native scrub and forest, pine plantation and exotic pasture. The main collapse area is VS5-MF7-3.	2
2	Size	1	2	2	At 11.328 ha, this site is small in size compared to other surface karst in the top 58 karst SNA.	3
3	Linkage and buffering	2	2	4	The site is mostly surrounded by exotic pasture; however, it is contiguous with Mangaorongo Scenic Reserve, and extensive indigenous vegetation is present in the wider landscape, including Mahoenui Scenic Reserve ~3km to the west.	3
4	Diversity and pattern	2	2	4	The site has three types of naturally uncommon ecosystem: cave entrances; caves and cracks; and cliffs, scarps, and tors.	2
5	Under-represented vegetation	3	3	9	A small area of MF7 is likely present on site. This vegetation type is under-represented in the Waitomo ED.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: species of the Myrtaceae family (Threatened). Significant fauna likely to occur on site: longfin eel (*Anguilla dieffenbachii*) (Declining).	2
Ecological value score				**25**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses, un-controlled grazing, and on-going farm development.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown whether pest animal control is being carried out.	1
9	Urgency: Plant pest control	3	3	9	The site may have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	3	2	6	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. At least part of the site is grazed.	2
12	Legal protection	3	2	6	Unprotected.	3
Threat criteria				**43**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Five yearly control of goats and ongoing control of rats and possums using bait stations would significantly decrease the threat to indigenous species.	1
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	1	2	2	No known funding.	1
Potential outcomes score				**20**		

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
Total Score for site 339				**88**		

Site 340 Tomac Tomo

Site information

Site Number	340	Site Name	Tomac Tomo	Karst Type	Cave	Site Area (ha)	12.371	District	Waipa
Ecological Region	Tainui	Protection Status	Unprotected	Ecological District	Raglan	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A small cave karst site composed of a single area, at Karamu Caves, north of Fillery Road, Karamu. The surface is entirely exotic pasture, with visible limestone banding/outcrop sand (Oblique imagery; WRAPS 2017). It holds negligible habitat value for species that do not utilise caves. A few rare invertebrate cave specialists are known to occur at the site.	3
2	Size	1	2	2	At 12.371 ha, this site is small compared to other karst SNA cave systems.	3
3	Linkage and buffering	1	2	2	The site has no indigenous vegetation and is completely surrounded by pasture.	3
4	Diversity and pattern	1	2	2	Although the site is mostly exotic pasture, the site has two types of naturally uncommon ecosystem: cave entrances; caves and cracks. However, these are likely degraded with limited ecological value.	2
5	Under-represented vegetation	1	3	3	The site is entirely exotic pasture.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
6	Threatened species (national priority)	2	1	2	Notable species known to occur on site (conservation statuses unknown): a species of beetle (*Rhytisternus miser*), a mite (*Hypoaspis* (*Androlaelaps*) sp.) and a springtail *(Folsomia novae-zealandiae*).	2
Ecological value score				**13**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	1	2	2	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses, grazing and on-going farm development. However, this site is extremely degraded, and it is unlikely that much further degradation would be possible.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown whether pest animal control is being carried out.	2
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue. It is unknown whether pest control is carried out.	2
10	Urgency: Restoration planting	3	3	9	No restoration planting has been carried out at this site.	2
11	Fencing	3	2	6	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. The site is grazed.	2
12	Legal protection	3	2	6	Unprotected.	3
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	1	2	2	The environmental gains from fencing this site is likely limited. Pest plants and animals are unlikely to cause much further degradation to the site.	3
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	1	2	2	No known WRC funding. Part ICM priority site.	1
16	Non-WRC funding	1	2	2	No known funding.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
Potential outcomes score				**8**		
Total Score for site 340				**62**		

Site 341 Torehina karst

Site information

Site Number	341	Site Name	Torehina karst	Karst Type	Surface	Site Area (ha)	0.852	District	Thames-Coromandel
Ecological Region	Coromandel	Protection Status	Unprotected	Ecological District	Colville	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	Small surface karst site on the north side of Colville Road, about two kilometres east of Waitete Bay in the northern Coromandel Peninsula. Vegetation is mapped as manuka-kanuka and includes treefern and broadleaf scrub. SNA description: Te Kauae a Maui (TC090); the karst site is a small area in the southern part of the SNA; Kiwi unlikely to be present in this part of the SNA (proximity to Colville Road and local residences, and moderately disturbed native vegetation)	2
2	Size	1	2	2	At 0.852 ha, the site is small compared to other surface karst SNA.	3
3	Linkage and buffering	3	2	6	The site is adjacent to a road and a residential section, but it is otherwise surrounded by moderately disturbed indigenous vegetation.	3
4	Diversity and pattern	2	2	4	The site has two types of naturally uncommon ecosystem: cave entrances; caves and cracks. The likely has limited floristic diversity as it is regenerating vegetation.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	1	3	3	The site is regenerating indigenous vegetation (manuka-kanuka, treefern and broadleaf scrub).	2
6	Threatened species (national priority)	3	1	3	Significant flora likely to occur on site: kauri (*Agathis australis*) (Nationally Vulnerable) and species of the Myrtaceae family (Threatened). Significant fauna known to occur on site: silverfish species (conservation status unknown). Likely to occur on site: Archey's frog (*Leiopelma archeyi*) (Declining).	2
Ecological value score				**22**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Stoats and dogs threaten any kiwi that may venture into the site; weeds and potential development threats from houses in the area; goats and stock identified as a potential issue in key ecological site. Pigs may also be an issue.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). Pigs are likely to be an issue at this site. It is unknown whether pest animal control is being carried out.	2
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue. It is unknown whether pest control is carried out.	2
10	Urgency: Restoration planting	1	3	3	The site is nearly fully vegetated with regenerating indigenous vegetation and restoration planting is probably not necessary.	2
11	Fencing	3	2	6	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses.	2
12	Legal protection		2	0	Unprotected.	
Threat criteria				**31**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	This site likely requires significant pest plant and pest animal control (goats, pigs, rats, possums).	1
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
16	Non-WRC funding	1	2	2	No known funding.	1
Potential outcomes score				**10**		
Total Score for site 341				**63**		

Site 342 Totoro Gorge karst

Site information

Site Number	342	Site Name	Totoro Gorge karst	Karst Type	Surface	Site Area (ha)	24.836	District	Waitomo
Ecological Region	King Country	Protection Status	Unprotected and crown-owned land (hydro and road parcels)	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Caves and cracks; cliffs scarps and tors		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	An incised karst gorge near Totoro Road, west of Aria. The site is well vegetated with a mix of native scrub and forest which is in moderate condition. The native forest is mix of secondary and modified primary vegetation (VS5, MF7-3 etc). It has been mapped as tawa-pukatea-podocarp forest and broadleaved species-treefern scrub and the imagery broadly supports this.	2
2	Size	2	2	4	At 24.836 ha, this site is medium in size compared to other surface karst in the top 58 karst SNA.	3
3	Linkage and buffering	1	2	2	This site is mostly surrounded by pasture and is largely isolated from other areas of indigenous vegetation.	3
4	Diversity and pattern	2	2	4	This site has moderate diversity with two types of naturally uncommon ecosystem: caves and cracks; cliffs scarps, and tors.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	1	3	3	MF7-3 is under-represented in the Waitomo ED; however, the width of the riparian vegetation appears to be so narrow that it is unlikely to be representative of its type.	2
6	Threatened species (national priority)	2	1	2	Significant fauna likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus)* (Nationally Critical), longfin eel *(Anguilla dieffenbachii*) (Declining) and inanga (*Galaxias maculatus*) (Declining). This site is likely habitat for other threatened species, especially for freshwater fish.	2
Ecological value score				**19**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses, un-controlled grazing, and on-going farm development.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown whether pest animal control is being carried out.	2
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue. It is unknown whether pest control is carried out.	2
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	3	2	6	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. At least part of the site is grazed.	1
12	Legal protection	1	2	2	Although this site has no formal protection, most of this land falls crown-owned land in the form of 'road' and 'hydro' property parcels.	3
Threat criteria				**39**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	1	2	2	This site likely requires fencing and planting to increase the riparian widths in order to increase biodiversity values at this site. Control of rats and possums would also be beneficial to indigenous species.	1
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
16	Non-WRC funding	1	2	2	No known funding.	1
Potential outcomes score				**16**		
Total Score for site 342				**74**		

Site 343 Troopers Rd Cave System

Site information

Site Number	343	**Site Name**	Troopers Rd Cave System	**Karst Type**	Cave	**Site Area (ha)**	169.028	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	Unprotected	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A large cave karst site, west of the Whataroa Road – Troopers Road intersection, west of Te Kuiti. Vegetation of the surface is mostly exotic pasture with of remnant forest, areas of harvested pine and scattered exotic/native scrub-shrubland in the southwestern half. The native patches are mapped as broadleaved-treefern scrub and tawa-pukatea-podocarp forest, and this agrees with the aerial and oblique imagery. The native vegetation of the surface appears to be in poor condition, is fragmented and surrounded by grazing land.	3
2	Size	1	2	2	At 169.03 ha, this site is large compared to other karst caves in the top 58 karst SNA; however, the site is highly degraded, lacking almost all indigenous species typical of its habitat type.	2
3	Linkage and buffering	1	2	2	This site is surrounded by pasture and is isolated from other indigenous habitats.	3
4	Diversity and pattern	2	2	4	Two types of naturally uncommon karst ecosystem are present at this site: cave entrances; caves and cracks.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	1	3	3	Small patches of MF7 vegetation are present which are under-represented in the Waitomo ED; however, these patches are likely too small to be considered representative.	2
6	Threatened species (national priority)	3	1	3	Significant flora likely to occur on site: species of the Myrtaceae family (Threatened), native verbena (*Teucridium parvifolium*) (Declining) and cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon). Significant fauna known to occur on site: a species of beetle (*Neanops caecus*) (Naturally Uncommon), a ground beetle (*Duvaliomimus* (*Mayotrechus*) *mayae mayorum*) (Naturally Uncommon), a fungus gnat (*Exechia hiemalis*) (conservation status unknown) and a moth fly (*Psychoda zonata*) (conservation status unknown). Likely to occur on site: a species of moth (*Caloptilia* sp. "*Teucridium*") (Nationally Vulnerable) associated with the native verbena plant.	2
Ecological value score				**16**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	1	2	2	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, grazing, and future farm development. The site is highly modified and further degradation is unlikely.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown whether pest animal control is being carried out.	2
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue. It is unknown whether pest control is carried out.	2
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	3	2	6	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. This site appears to be grazed.	1
12	Legal protection	3	2	6	Unprotected.	
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	1	2	2	Extensive fencing and planting are likely required to improve biodiversity values at this site.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (5-10% overlap).	1
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	3
16	Non-WRC funding	1	2	2	No known funding.	1
Potential outcomes score				**16**		
Total Score for site 343				**73**		

Site 344 Upper Mangaotaki Gorge bluffs

Site information

Site Number	344	**Site Name**	Upper Mangaotaki Gorge bluffs	**Karst Type**	Surface	**Site Area (ha)**	75.04	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	DOC (30.31 ha), QEII (19.85 ha) and unprotected	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Caves and cracks; cliffs, scarps and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Pesticide Summary For the Region of: Waikato Valid as of: Tuesday, June 8, 2021 4:42 PM
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A moderately sized surface karst site consisting of high forested limestone bluffs either side of Mangaotaki Road and Mangaotaki River, west of Piopio. The site appears to be well vegetated with a mix of native, pine and deciduous forest. Oblique imagery shows that the eastern area is VS5-MF7-3 with some exotic pasture; the western area is VS5-MF7-3 forest to treeland, with areas of exotic pasture. Some parts of the site appear to be largely intact indigenous forest.	2
2	Size	2	2	4	At 75.040 ha, this site is medium in size compared to other top 58 surface karst SNA.	3
3	Linkage and buffering	2	2	4	Adjacent indigenous vegetation provides some buffering from the surrounding farmland, but some parts of the SNA are bordered by pasture. Indigenous forest is abundant in the wider landscape, including Whareorino Conservation area which is approximately 6 km to the west.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	The site has moderate diversity with the following naturally uncommon ecosystems: caves and cracks; cliffs, scarps, and tors. Vegetation is likely moderately diverse.	2
5	Under-represented vegetation	3	3	9	MF7 vegetation is present which is under-represented in the Waitomo ED.	2
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: species of the Myrtaceae family (Threatened). Significant fauna likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical) and longfin eel (*Anguilla dieffenbachii*) (Declining). Based on records within the broader locality, only two threatened or significant species are likely to occur at the site, however it seems this area would be more substantial and potential habitat for threatened biodiversity in the district.	2
Ecological value score				**29**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses, un-controlled grazing, and on-going farm development.	2
8	Urgency: Animal pest control	2	3	6	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). Pest control was carried out in 2018 using Cholecalciferol (Feracol) bait bags.	3
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	2	2	4	Grazing is unlikely to be an issue in parts of the site that are public conservation land. Some fencing associated with WRC's soil conservation and Clean Streams programmes is present (55%).	2
12	Legal protection	2	2	4	Two thirds of the site is protected conservation land (Mangaotaki Scenic Reserve) pr QEII covenanted.	3
Threat criteria				**36**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Five yearly goat control and possum/rat control using bait stations would likely significantly improve biodiversity values at this site.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	1
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	1	2	2	No known funding.	1
Potential outcomes score				**20**		
Total Score for site 344				**85**		

Site 345 Waikaretu karst and Nikau Cave

Site information

Site Number	345	**Site Name**	Waikaretu karst and Nikau Cave	**Karst Type**	Surface	**Site Area (ha)**	10.477	**District**	Waikato
Ecological Region	Tainui	**Protection Status**	QEII (6.18 ha) and unprotected	**Ecological District**	Raglan	**Naturally Uncommon Ecosystem Types**	Cave entrances; caves and cracks; cliffs, scarps and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.
- Ground truthing form (within Taylor-Smith et al. 2020 listed above)

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A few small, mostly forested, surface karst sites along the Waikaretu Valley Road just east of Waikaretu. Forested areas of the site have been mapped as WF13, Tawa, kohekohe, rewarewa, hinau, podocarp forest and aerial imagery supports this. Northern area (SNA Site No. 7240, QEII Covenant No. 5/03/142) exotic pasture with karst boulders etc in west with VS5-WF13 in east; central Area VS5-mod-primary WF13; southern area (SNA Site No. 8590, QEII Covenant No. 5/03/064) modified primary WF13. A site visit described the site as follows: Stream flowing through hillslope undulating country. Stream flows through an area of indigenous forest with small outcrops of surface karst. The eastern end of the identified Karst SNA is a waterfall over a calcareous cliff. Some wetland areas exist along the edges of the Karst SNA. Where no indigenous vegetation exists, vegetation comprises of grazed pasture with occasional outcrops of surface karst cliffs and scarps. A tomo or sinkhole exists between two forested areas at the eastern end of the Karst SNA. The southern side of the Karst SNA comprises a cave	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
					karst system of approximately a kilometre long. Indigenous vegetation covers either end of the cave, surrounded by grazed pasture. The forested areas are in good condition.	
2	Size	1	2	2	At 10.477 ha, this site is small compared to other surface karst in the top 58 karst SNA.	3
3	Linkage and buffering	1	2	2	The site is surrounded by pasture and little indigenous vegetation is present in the wider landscape.	3
4	Diversity and pattern	3	2	6	The site has moderate diversity with the following naturally uncommon karst ecosystems: cave entrances; caves and cracks; cliffs, scarps, and tors. The eastern end of the identified Karst SNA is a waterfall over a calcareous cliff. Some wetland areas exist along the edges of the Karst SNA. A sinkhole is also present.	3
5	Under-represented vegetation	3	3	9	WF13 is under-represented in the Raglan ED. Wetland habitat is also present.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: rātā (*Metrosideros colensoi*) (Nationally Vulnerable), carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable) and mānuka (*Leptospermum scoparium* var. *scoparium*) (Declining). Likely to occur on site: species of the Myrtaceae family. Significant fauna known to occur on site: a snail species (*Leptopyrgus manneringi*) (Nationally Critical), cave wētā (*Pallidoplectron turneri* or *Pachyrhamma waitomoense*) (conservation status unknown) and glowworms (*Arachnocampa luminosa*) (conservation status unknown).	3
Ecological value score				**28**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses, un-controlled grazing, and on-going farm development. The cave is visited by 3200 people each year and some erosion is present in the cave.	3
8	Urgency: Animal pest control	2	3	6	Pest control is carried out by the local community. It is unclear whether the full suite of pest species is controlled. Rat faeces was observed in the cave.	2
9	Urgency: Plant pest control	3	3	9	Pest plant species present include: blackberry, willow, pampas, prunus sp., wattle, pampas and tradescantia.	3
10	Urgency: Restoration planting	2	3	6	Restoration planting has been carried out within the QEII area, and along the stream.	3
11	Fencing	2	2	4	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. Stock is excluded from the QEII covenanted area. Cave entrances	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
					are vegetated with indigenous species and appear to be fenced. Parts of the wetland are unfenced and accessible to sheep.	
12	Legal protection	2	2	4	Approximately 59% of this site is protected by QEII covenant.	3
Threat criteria				**33**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	The site could benefit from rat control using bait stations and some pest plant control: minor plant pest issues can be improved by removing willow, pampas, Prunus from wetland margin. Wattle trees to be removed from tawa-kohekohe forest.	2
14	LTCCP: Community involvement	3	2	6	The ground truthing form states that the QEII sites are under conservation management by the local community. The landowners are very conscious of the ecological value of their land and have carried out extensive works to protect the site.	2
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	2	2	4	It is unknown whether this site receives non-WRC funding. Some of the site is QEII covenanted and QEII may have assisted landowners with finding funding for this site.	1
Potential outcomes score				**16**		
Total Score for site 345				**77**		

Site 346 Waikawau Valley karst

Site information

Site Number	346	Site Name	Waikawau Valley karst	Karst Type	Surface	Site Area (ha)	26.839	District	Waikato
Ecological Region	Tainui	Protection Status	Unprotected	Ecological District	Raglan	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks; cliffs, scarps, and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.
- Ground truthing form (within Taylor-Smith et al. 2020 listed above)

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A moderately sized surface karst site of a few separate areas, adjacent to and west of the Port Waikato - Waikerutu Road, in the Waikawau Valley north of Limestone Downs. Ground truthing has shown that this site is vegetated with tawa, kohekohe, titoki, puriri, karaka, mahoe, mangeao and kowhai (WF7-puriri forest). The northern most area of the four has more exotic pasture than the other three sites. The three southern areas are long and thin patches of modified WF7 forest or treeland surrounded by exotic pasture. They have limited resilience and habitat value.	3
2	Size	2	2	4	At 26.839 ha, this site is moderate in size compared to other surface karst in the top 58 karst SNA.	2
3	Linkage and buffering	1	2	2	This site comprises long narrow strips of indigenous vegetation surrounded by pasture. Indigenous forest is present in the wider landscape.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	The site has the following naturally uncommon ecosystems: cave entrances; caves and cracks; cliffs, scarps, and tors. Wetlands are present.	3
5	Under-represented vegetation	1	3	3	The indigenous vegetation on site is too degraded to be considered representative.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: white rātā (*Metrosideros diffusa*) (Nationally Vulnerable), akatea (*Metrosideros perforata*) (Nationally Vulnerable) and kānuka (*Kunzea robusta*) (Nationally Vulnerable). Significant fauna known to occur on site: a species of snail (*Potamopyrgus acus*) (Nationally Critical).	2
Ecological value score				**18**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	The site may be further degraded by ongoing grazing by stock and goats.	3
8	Urgency: Animal pest control	2	3	6	Goats, possums, rats, and rabbits are present. Rat and possum control in the form of bait stations carried out in some roadside areas.	3
9	Urgency: Plant pest control	2	3	6	Pampas is present. Other pest plant species are likely present.	2
10	Urgency: Restoration planting	3	3	9	No restoration planting has been carried out.	1
11	Fencing	2	2	4	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. The site is generally unfenced, but many areas are inaccessible to stock due to steep cliffs.	2
12	Legal protection	3	2	6	The site is unprotected.	3
Threat criteria				**35**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Five yearly goat control and infill planting of areas inaccessible to stock would prove the habitat value of the site.	3
14	LTCCP: Community involvement	1	2	2	No known community groups overseeing restoration activities.	1
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
16	Non-WRC funding	1	2	2	No known funding from any other sources.	1
Potential outcomes score				**12**		
Total Score for site 346				**65**		

Site 347 Waipapa Rd Cave System

Site information

Site Number	347	**Site Name**	Waipapa Rd Cave System	**Karst Type**	Cave	**Site Area (ha)**	120.541	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	Unprotected	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Cave entrance; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A moderately sized cave karst site with multiple caves with excellent speleothems. The site is located west of Oparure and adjoining Mangawhitikau slit gorge & karst (karst SNA no. 322) to the north-east and Pakeho polygonal karst (karst SNA no. 326) to the south and east. The site is characterised by exotic pasture and farmland with minor patches of fragmented native forest to treeland (MF7-3), exotic trees and a large area of pine forest to the south. The native vegetation of the site is in poor condition and fragmented, and overall, this cave karst site would have limited habitat value for non-cave species.	2
2	Size	1	2	2	At 120.541 ha, this site is medium in size compared to other cave karst in the top 58 karst ecosystems; however, the site is highly degraded, lacking almost all indigenous species typical of its habitat type.	2
3	Linkage and buffering	1	2	2	The site consists mostly of exotic pasture and pine forest, with very little indigenous vegetation. The site is mostly surrounded by farmland and pine forest.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	1	2	2	The site has little indigenous vegetation, but it has two types of naturally uncommon ecosystems: cave entrance and caves and cracks. It is likely that the cave entrances, and possibly the caves themselves, are degraded and so contribute little to the ecological diversity of the site.	2
5	Under-represented vegetation	1	3	3	This site has minor patches of fragmented native forest to treeland (MF7), a vegetation type that is under-represented in the Waitomo ED. The vegetation, however, is likely small and too degraded to have significant ecological value.	2
6	Threatened species (national priority)	2	1	2	Significant flora likely to occur on site: cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon). This species has been recorded from the broader locality, is considered likely to utilise the cave entrances.	2
Ecological value score				**13**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	1	2	2	Key threats are likely to include pest animal species, broadleaved agricultural weeds, exotic grasses, uncontrolled grazing, and future farm development. The site is likely highly degraded and unlikely to be further degraded under the current land use.	1
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown whether pest animal control is being carried out.	1
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	3	2	6	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. This site appears to be grazed. It is unknown whether caves and cracks are fenced from stock.	1
12	Legal protection	3	2	6	The site has no legal protection.	3
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	1	2	2	Extensive fencing and planting are likely required to improve biodiversity values at this site.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	1	2	2	No known funding.	1
Potential outcomes score				**8**		
Total Score for site 347				**62**		

Site 348 Waipuna Cave

Site information

Site Number	348	Site Name	Waipuna Cave	Karst Type	Cave	Site Area (ha)	66.166	District	Waitomo
Ecological Region	King Country	Protection Status	DOC (33.09 ha) and unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrance; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.
- Ground truthing form (within Taylor-Smith et al. 2020 listed above)

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A moderately sized cave karst site composed of a single area, east of Waipuna Road at Pomarangai and closely associated with Waitomo Stream headwaters cave system (karst SNA no. 353) and Waipuna polygonal karst (karst SNA no. 349). The surface is almost entirely mapped as broadleaved species scrub, forest mosaic and treefern scrub and the aerial imagery supports this. A site visit found that small areas at the north-western end are covered by pine plantation whereas the majority of the site is covered by regenerating native forest comprising largely mahoe, totara, pigeonwood, ponga. The native scrub mosaic is in moderate condition.	3
2	Size	2	2	4	At 66.166 ha, this site is moderate in size compared to other cave karst SNA in the top 58.	3
3	Linkage and buffering	3	2	6	The site is well connected to a larger forested area within the district.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	Major cave with forest above. In terms of naturally uncommon ecosystems the site has: cave entrances; caves and cracks. The vegetation is regenerating indigenous scrub and forest.	3
5	Under-represented vegetation	1	3	3	The site is regenerating indigenous vegetation.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon). Significant fauna known to occur on site: a ground beetle (*Duvaliomimus* (*Mayotrechus*) *mayae mayorum*) (Naturally Uncommon) and a velvet worm (*Peripatoides novae-zealandiae*) (Not Threatened). Other notable species known to occur on site (conservation statuses unknown): a species of beetle (*Prosphodrus waltoni*), a crane fly (*Limnophila tonnoiri*), three species of harvestman spider (*Hendea myersi cavernicola*, *Hendea* sp. and *Megalopsalis* sp.), a rove beetle (*Paraconosoma polita*), a fungus gnat (*Sciara* sp.), three species of springtail (*Ceratophysella armata, Pseudosinella spelunca* and *Tullbergia subantarctica*), a stonefly (*Nesoperla spiniger*), and a giant centipede (*Cormocephalus rubriceps*).	3
Ecological value score				**24**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species only as the site is well buffered from other issues. Some fence maintenance may be needed. The future felling of pine forest may result in further pest plant invasion. Caving is strictly managed by the landowner so is unlikely to be an issue.	3
8	Urgency: Animal pest control	2	3	6	Pest animals present include pig, goat, deer, wilding pine, magpie, peacocks, and turkey. Browsing of understorey vegetation observed throughout the site. Some pest control is undertaken at this site.	3
9	Urgency: Plant pest control	3	3	9	Wilding pine and other exotic weeds are emerging including: black berry, gorse, pampas, Mexican daisy. It is unknown whether pest plants are controlled.	2
10	Urgency: Restoration planting	1	3	3	The site is mostly vegetated with indigenous species so restoration planting is unlikely to be needed.	3
11	Fencing	2	2	4	The site has some WRC soil conservation fencing (15%). Stock from surrounding pasture occasionally enter the forest so the fencing may need some maintenance.	3
12	Legal protection	2	2	4	Half of the site falls within Waipuna Scenic Reserve.	3
Threat criteria				**30**		

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Fence maintenance and pest animal control (five yearly goat control and ongoing bait stations for possums and rats) would likely significantly improve this site. Pest plants will likely require attention in the future.	1
14	LTCCP: Community involvement	3	2	6	Waitomo Catchment Trust (50% overlap).	2
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	1	2	2	Half of the site is on DOC land but it is unknown if DOC provides any funding for this site.	1
Potential outcomes score				**14**		
Total Score for site 348				**68**		

Site 349 Waipuna polygonal karst

Site information

Site Number	349	Site Name	Waipuna polygonal karst	Karst Type	Surface	Site Area (ha)	246.186	District	Waitomo
Ecological Region	King Country	Protection Status	DOC (130.47 ha) and unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; sinkholes; caves and cracks; cliffs, scarps, and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
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- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.
- Ground truthing form (within Taylor-Smith et al. 2020 listed above)

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	A large surface karst site composed of a single area, east of Waipuna Road at Pomarangai and closely associated with Waitomo Stream headwaters cave system (karst SNA no. 353) and Waipuna Cave (karst SNA no. 348). Oblique and aerial imagery shows that the vegetation is primarily broadleaved species scrub and modified-primary to primary WF13 forest mosaic, with pockets of pine forest in the northeast. A site visit found that small areas at the north-western end are covered by pine plantation whereas the majority of the site is covered by regenerating native forest comprising largely mahoe, totara, pigeonwood, ponga. The native scrub mosaic is in moderate condition and well connected to a larger forested area within the district.	3
2	Size	3	2	6	At 246.186 ha, this site is large compared to other surface karst in the top 58 karst SNA.	3
3	Linkage and buffering	3	2	6	The site is well connected to a larger forested area within the district.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	3	2	6	One of best examples of forested temperate cockpit polygonal karst in New Zealand. The site has high diversity with all four naturally uncommon karst ecosystems: cave entrances; sinkholes; caves and cracks; cliffs, scarps, and tors.	3
5	Under-represented vegetation	1	3	3	The site is regenerating indigenous vegetation.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: mānuka *(Leptospermum scoparium* var. *scoparium*) (Declining) and cave spleenwort (*Asplenium cimmeriorum*) (Naturally Uncommon). Likely to occur on site: carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable), rātā (*Metrosideros colensoi*) (Nationally Vulnerable), species of the Myrtaceae family (Threatened) and native verbena (*Teucridium parvifolium*) (Declining). Significant fauna known to occur on site: whitehead/pōpokatea (*Mohoua albicilla*) (Declining), bush falcon/kārearea (*Falco novaeseelandiae* "bush") (Recovering), long-tailed cuckoo/koekoeā (*Eudynamys taitensis*) (Naturally Uncommon), pied tit (*Petroica macrocephala toitoi*) (Not Threatened), glowworms (*Arachnocampa luminosa*) (conservation status unknown) and cave wētā (*Pallidoplectron turneri* or *Pachyrhamma waitomoense*) (conservation status unknown). Likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical) and longfin eel (*Anguilla dieffenbachii*) (Declining).	3
Ecological value score				**28**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species only as the site is well buffered from other issues. Some fence maintenance may be needed. The future felling of pine forest may result in further pest plant invasion. Caving is strictly managed by the landowner so is unlikely to be an issue.	3
8	Urgency: Animal pest control	2	3	6	Pest animals present include pig, goat, deer, wilding pine, magpie, peacocks, and turkey. Browsing of understorey vegetation observed throughout the site. Some pest control is undertaken at this site.	3
9	Urgency: Plant pest control	3	3	9	Wilding pine and other exotic weeds are emerging including: black berry, gorse, pampas, Mexican daisy. It is unknown whether pest plants are controlled.	2
10	Urgency: Restoration planting	1	3	3	The site is mostly vegetated with indigenous species so restoration planting is unlikely to be needed.	3
11	Fencing	2.5	2	5	The site has some WRC soil conservation fencing (15%). Stock from surrounding pasture occasionally enter the forest so the fencing may need some maintenance.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
12	Legal protection	2	2	4	More than half of the site (~53%) falls within Waipuna Scenic Reserve.	3
Threat criteria				**31**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Fence maintenance and pest animal control (five yearly goat control and ongoing bait stations for possums and rats) would likely significantly improve this site. Pest plants will likely require attention in the future.	1
14	LTCCP: Community involvement	3	2	6	Waitomo Catchment Trust (50% overlap).	2
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	1	2	2	Half of the site is on DOC land, but it is unknown if DOC provides any funding for this site.	1
Potential outcomes score				**14**		
Total Score for site 349				**73**		

Site 350 Wairere Falls cave and karst

Site information

Site Number	350	Site Name	Wairere Falls cave and karst	Karst Type	Surface	Site Area (ha)	1.890	District	Waitomo
Ecological Region	King Country	Protection Status	Unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks; cliffs, scarps, and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	Small dry cave in small area of limestone bluffs and rocks, this site is a small surface karst site composed of a single area at Wairere Falls, along the Mokau River and Aria Road at Aria. The site appears to be almost entirely exotic pasture and shrubland with the occasional willow by the river, most of which has now been cleared.	1
2	Size	1	2	2	At 1.890 ha, this site is small compared to other surface karst in the top 58 karst SNA.	3
3	Linkage and buffering	1	2	2	The site is surrounded by pasture and has no connectivity with other surface karst SNA or indigenous forest.	3
4	Diversity and pattern	2	2	4	The site has little indigenous vegetation, but it has three types of naturally uncommon ecosystems: cave entrances; caves and cracks; cliffs, scarps, and tors. It is likely that ecosystems are degraded and so may contribute little to the ecological diversity of the site; however, some unique species are known to use these ecosystems.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
5	Under-represented vegetation	1	3	3	The site is almost entirely exotic pasture and shrubland with the occasional willow by the river, most of which has now been cleared.	
6	Threatened species (national priority)	3	1	3	Based on records both at the site and within the broader locality, several threatened or significant species are known or likely to occur at the site. Significant fauna known to occur on site: carabidae (*Neanops pritchardi*) (Nationally Critical), giant centipede (*Cormocephalus rubriceps*) (conservation status unknown) and a species of cave beetle (conservation status unknown). Likely to occur on site: lamprey (*Geotria australis*) (Nationally Vulnerable), longfin eel (*Anguilla dieffenbachii*) (Declining), torrentfish (*Cheimarrichthys fosteri*) (Declining) and mussel (*Echyridella menziesii*) (Declining).	3
Ecological value score				**16**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	3	2	6	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses, un-controlled grazing, and on-going farm development. The Mokau River is also managed at this location with a weir and adjacent installation, seemingly for hydropower. Unforeseen renovation or extension of this installation may impact on this karst SNA.	1
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown whether pest animal control is being carried out.	1
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	3	2	6	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. This site appears to be grazed.	1
12	Legal protection	3	2	6	The site has no legal protection.	3
Threat criteria				**45**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	1	2	2	Extensive fencing and planting are likely required to improve biodiversity values at this site.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	1	2	2	No known funding.	1
Potential outcomes score				**16**		
Total Score for site 350				**77**		

Site 351 Waitomo Forest karst

Site information

Site Number	351	Site Name	Waitomo Forest karst	Karst Type	Surface	Site Area (ha)	125.173	District	Waitomo
Ecological Region	King Country	Protection Status	DOC (14.45 ha) and unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	Forested dolines, blind valleys, and caves. A moderately sized surface karst site composed of a single area, close to the Te Araroa Trail at the end of Ngatapuwae Road, just to the north-west of Waitomo Caves. The site is perhaps 80 per cent good condition native vegetation which is well connected to a larger area of forest within the district. The native vegetation is mapped as tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13), manuka-kanuka scrub (VS3) and broadleaved species-treefern scrub (VS5) and the imagery supports this. Oblique imagery shows that vegetation includes VS5, VS5.1, VS5.2 and WF13, with exotic pasture in the west. A small portion of bush mapped as mixed exotic shrubland appears to be broadleaved species-treefern scrub with some pine.	3
2	Size	3	2	6	At 125.173 ha, this site is large compared to other surface karst in the top 58 karst SNA.	3
3	Linkage and buffering	3	2	6	The site is well connected to a larger area of forest (Matakana Conservation Area). Areas of indigenous vegetation within the site are adjacent to farmland.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	The site has naturally uncommon ecosystems (cave entrances; and caves and cracks) and indigenous forest that are likely to be in good condition.	3
5	Under-represented vegetation	2	3	6	Vegetation types that are under-represented in the Waitomo ED are not present on site, but much of the site appears to be old-growth forest.	3
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: *Asplenium trichomanes* (Not Threatened but regionally uncommon). Likely to occur on site: carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable), rātā (*Metrosideros colensoi*) (Nationally Vulnerable) and species of the Myrtaceae family (Threatened). Significant fauna likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical), longfin eel (*Anguilla dieffenbachii*) (Declining) and bush falcon/kārearea (*Falco novaeseelandiae* "bush") (Recovering).	3
Ecological value score				**31**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses, un-controlled grazing, and on-going farm development.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown whether pest animal control is being carried out.	1
9	Urgency: Plant pest control	3	3	9	It is unknown whether the site has a pest plant issue or whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	2	2	4	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. Parts of this site appear appears to be grazed. Grazing is unlikely to be an issue areas of public conservation land.	2
12	Legal protection	3	2	6	Fourteen of the 125 ha are on public conservation land (Matakana Conservation Area), but the rest of the site is unprotected.	3
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	The site would benefit from five-yearly goat control and ongoing rat/possum control using bait stations.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	3	2	6	Waitomo Catchment Trust (80% overlap).	2
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	1	2	2	No known funding, however part of the site is public conservation land so may receive some funding from DOC, but this is unknown.	1
Potential outcomes score				**16**		
Total Score for site 351				**88**		

Site 352 Waitomo Glowworm Cave and resurgence karst

Site information

Site Number	352	**Site Name**	Waitomo Glowworm Cave and resurgence karst	**Karst Type**	Surface	**Site Area (ha)**	2.490	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	DOC (0.4 ha) and unprotected	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Cave entrances; caves and cracks; and cliffs, scarps, and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	An internationally renowned tourist cave for its accessibility, glowworms, and speleothems, this site is a small surface karst site composed of a single area at Waitomo Caves on the south side of Waitomo Village Road. The site is a mix of good condition native vegetation, stands of deciduous trees and exotic pasture. Oblique imagery shows that the indigenous vegetation is tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13) and broadleaved species scrub/forest with planted deciduous exotic trees and exotic pasture in northeast.	2
2	Size	1	2	2	At 2.490 ha, this site is small compared to other surface karst SNA in the top 58 karst SNA.	3
3	Linkage and buffering	2	2	4	This site is mostly surrounded by pasture, with some indigenous vegetation present within the part of the site that is Waitomo Caves Scenic Reserve. The site is <2km from Ruakuri Caves (Sites 332, 333). Larger tracts of indigenous vegetation are present in the wider area within 5km of the site.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	The site has three types of naturally uncommon ecosystem: cave entrances; caves and cracks; and cliffs, scarps, and tors.	3
5	Under-represented vegetation	1	3	3	Oblique imagery shows that the indigenous vegetation is tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13) and broadleaved species scrub/forest with planted deciduous exotic trees and exotic pasture in northeast. Vegetation types that are under-represented in the Waitomo ED are not present on site.	3
6	Threatened species (national priority)	2	1	2	Significant flora known to occur on site: four species of moss (*Echinodium hispidum*, *Fissidens asplenioides*, *Breutelia pendula* and *Philonotis tenuis*) (conservation statuses unknown). Likely to occur on site: carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable), rātā (*Metrosideros colensoi)* (Nationally Vulnerable), species of the Myrtaceae family (Threatened), *Myriophyllum robustum* (Declining), king fern (*Ptisana salicina*) (Declining) and spleenwort (*Asplenium* aff. *trichomanes* (AK 168112 "hexaploid") (Not Threatened). Significant fauna notable species known to occur on site (conservation statuses unknown): a species of harvestman spider (*Hendea myersi cavernicola*), a rootfeeding springtail (*Onychiurus acicendelius*), a crane fly (*Aphrophila neozelandica*), a black fly (*Austrosimulium* sp.), a midge (*Anatopynia debilis*), three other species of springtail (*Lepidocyrtus cyaneus*, *Folosomia novaezealandiae* and *Ceratophysella armata*) and cave wētā. Likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical) and bush falcon/karearea (*Falco novaeseelandiae* "bush") (Recovering).	3
Ecological value score				**17**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, exotic plant species and garden escapes and un-managed human access.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). It is unknown whether pest animal control is being carried out.	1
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	2	2	4	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. Parts of this site appear appears to be grazed. Grazing is unlikely to be an issue areas of public conservation land.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
12	Legal protection	3	2	6	A small part of this site is protected by DOC (Waitomo Caves Scenic Reserve) but is largely unprotected.	3
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Removal of exotic trees and planting with indigenous species; predator control using bait stations.	1
14	LTCCP: Community involvement	3	2	6	Waitomo Catchment Trust (100% overlap).	2
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	2	2	4	No known funding, however, the site is a popular tourist destination and part of the site is public conservation land so may receive some funding from DOC.	2
Potential outcomes score				**16**		
Total Score for site 352				**74**		

Site 353 Waitomo Stream headwaters Cave System

Site information

Site Number	353	**Site Name**	Waitomo Stream headwaters Cave System	**Karst Type**	Cave	**Site Area (ha)**	497.558	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	QEII (47.04 ha) and unprotected	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Cave entrances; caves and cracks.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.
- Ground truthing form (within Taylor-Smith et al. 2020 listed above)

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	A large cave karst site composed of a single area, east of Waipuna Road at Pomarangai and closely associated with Waipuna polygonal karst (karst SNA no. 349) and Waipuna Cave (karst SNA no. 348). Aerial imagery shows that the surface is a complex mosaic of exotic pasture intermixed with patches of deciduous exotic trees, harvested forest areas, pine forest and native vegetation. The native vegetation is variously mapped as broadleaved species scrub (VS5), forest mosaic and treefern scrub, tawa-kohekohe-rewarewa-hinau-podocarp forest (WF13) and herbaceous freshwater vegetation and the aerial and oblique imagery supports this. A site visit found that the area is largely covered in pasture, grazed by stock. Small areas of indigenous vegetation in the centre and north of this site are protected under QEII covenants. The southern area used to be planted in pine but was felled 15 years ago. The native bush is in moderate to good condition. Some dieback and browse were observed during the site visit.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
2	Size	2	2	4	At 497.558 ha, this site is large compared to other karst SNA; however, the site is mostly pasture with only small areas of indigenous surface habitat.	3
3	Linkage and buffering	2	2	4	The site is mostly pasture and mostly surrounded by pasture, with small areas of indigenous vegetation bordering the site and present in the wider landscape.	3
4	Diversity and pattern	2	2	4	The site has the following naturally uncommon ecosystems: cave entrances; caves and cracks. Some indigenous vegetation is present, but it is small and likely of limited diversity. Wetlands are present.	3
5	Under-represented vegetation	1	3	3	Vegetation is WF13 and VS5. It is unclear whether the areas of indigenous forest are old growth or regenerating.	2
6	Threatened species (national priority)	3	1	3	Significant flora known to occur on site: mānuka (*Leptospermum scoparium*) (Declining). Significant fauna known to occur on site: whitehead/pōpokatea (*Mohoua albicilla*) (Declining), bush falcon/kārearea (*Falco novaeseelandiae* "bush") (Recovering), long-tailed cuckoo/koekoeā (*Eudynamys taitensis*) (Naturally Uncommon), pied tit (*Petroica macrocephala toitoi*) (Not Threatened), glowworms (*Arachnocampa luminosa*) (conservation status unknown) and cave wētā (*Pallidoplectron turneri* or *Pachyrhamma waitomoense*) (not threatened). Likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical). Immediately to the south, the Waipuna Cave system is well documented and several rare invertebrate cave specialists are known to occur and it is, therefore, likely that these species would occur in the Waitomo Stream headwaters cave system.	3
Ecological value score				**24**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses, grazing and on-going farm development. Streams/seeps/wetland appear to be unfenced and may deteriorate further. Cave systems exist in the northern parts of the site, apparently currently clogged up by sediment from surrounding erosion issues (TBC by landowner). Caving is strictly managed by the landowner.	3
8	Urgency: Animal pest control	3	3	9	Pests include goats, fallow deer, pigs, possums, magpie, peacocks, and turkey. Lots of browsing sign and faeces observed during site visit.	3
9	Urgency: Plant pest control	3	3	9	Wilding pine and other exotic weeds are emerging including: black berry, gorse, pampas, Mexican daisy. It is unknown whether pest plants are controlled.	2
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
11	Fencing	2	2	4	The site is partially fenced with WRC soil conservation fencing (55%). It is unclear whether all cave entrances are fenced. The QEII block is fenced.	1
12	Legal protection	3	2	6	Less than 10% of the site is protected by QEII covenant.	3
Threat criteria				**41**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	The site requires pest animal control using shooting and bait stations. It is unclear whether further fencing is required to exclude stock from wetlands and cave entrances.	1
14	LTCCP: Community involvement	3	2	6	Waitomo Catchment Trust (100% overlap).	2
15	LTCCP: Funding support	2	2	4	No known WRC funding. Part ICM priority site.	1
16	Non-WRC funding	2	2	4	Part of the site is protected by QEII covenant, so QEII have provided some assistance in finding funding.	1
Potential outcomes score				**18**		
Total Score for site 353				**83**		

Site 354 Whenuapo karst

Site information

Site Number	354	Site Name	Whenuapo karst	Karst Type	Surface	Site Area (ha)	10.593	District	Otorohanga
Ecological Region	Tainui	Protection Status	NWR (5.15 ha) and unprotected	Ecological District	Kawhia	Naturally Uncommon Ecosystem Types	Sinkholes; cliffs, scarps, and tors.		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).

- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	Small plateau of karst and perched ephemeral lake. The site composed of a single area in the upper reaches of the Mataimarino Stream catchment. The site is entirely good condition native vegetation which is well connected to a larger area of forest within the locality (LINZ 2018). The native vegetation is predominantly tawa-kohekohe-rewarewa-hinau-podocarp forest with broadleaved species scrub – forest mosaic in the northwest.	2
2	Size	1	2	2	At 10.593 ha, this site is small compared to other surface karst SNA in the top 58 karst SNA.	3
3	Linkage and buffering	3	2	6	The site is well-connected to a larger, relatively intact patch of forest. Most of the site is buffered from farmland and pine forestry.	3
4	Diversity and pattern	2	2	4	The site comprises indigenous forest and two types of naturally uncommon ecosystem: sinkholes; cliffs, scarps, and tors.	3
5	Under-represented vegetation	2	3	6	The native vegetation is predominantly tawa-kohekohe-rewarewa-hinau-podocarp forest with broadleaved species scrub – forest mosaic in the northwest. These types are not under-represented in the Waitomo ED, but parts of the site appear to be old-growth forest.	3
6	Threatened species (national priority)	1	1	1	Significant flora likely to occur on site: carmine rātā (*Metrosideros carminea*) (Nationally Vulnerable) and species of the Myrtaceae family (Threatened).	1
Ecological value score				**25**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	1	2	2	Key threats are likely to include pest animal species only as the site is well buffered from grazing and farm development.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). Goats are likely to be an issue. It is unknown whether pest animal control is being carried out.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
9	Urgency: Plant pest control	2	3	6	The site is mostly well-buffered and unlikely to have a pest plant issue.	1
10	Urgency: Restoration planting	1	3	3	It is unknown whether any restoration planting has been carried out at this site, but as the site is vegetated with indigenous forest, restoration planting may not be necessary.	2
11	Fencing	2	2	4	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. However, aerial imagery indicates that site is likely fenced.	1
12	Legal protection	3	2	6	Approximately half of this site is protected by Nga Whenua Rahui covenant.	2
Threat criteria				**30**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Five yearly goat control and possum/rat control using bait stations would likely significantly improve biodiversity values at this site.	1
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	1	2	2	No known WRC funding.	1
16	Non-WRC funding	1	2	2	No known funding.	1
Potential outcomes score				**12**		
Total Score for site 354				**67**		

Site 355 Broken Hill Cave

Site information

Site Number	355	Site Name	Broken Hill Cave	Karst Type	Cave	Site Area (ha)	27.226	District	Waitomo
Ecological Region	King Country	Protection Status	DOC (0.98 ha) and unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A moderately sized cave karst site of a single area, on the west side of Mangakowhai Road North of Piopio. Oblique imagery shows that vegetation of the site is mostly exotic grassland with a small area of shrubland-forest in centre (VS5 broadleaved shrubland - MF4 kahikatea forest possibly, with a wetland component and the occasional exotic deciduous trees) and a modified wetland area consisting of 2 dammed ponds (the southern one has a willow-dominated area to the north). The vegetation and habitat of the surface is in a relatively poor condition, dominated by exotic pasture, is not connected to other habitats and is likely to have only limited threatened biodiversity value.	2
2	Size	1	2	2	At 27.226 ha, this site is moderate in size compared to other cave SNA in the top 58 karst SNA; however, the site is highly degraded, lacking almost all indigenous species typical of its habitat type.	2
3	Linkage and buffering	1	2	2	The site is surrounded by pasture and little indigenous vegetation is present in the wider landscape.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	The site has two types of naturally uncommon ecosystem: cave entrances; caves and cracks; however, the site is highly degraded so the condition of these may be poor.	2
5	Under-represented vegetation	1	3	3	Vegetation of the site is mostly exotic grassland with a small area of shrubland-forest. No under-represented vegetation types are present.	2
6	Threatened species (national priority)	3	1	3	Significant fauna known to occur on site: a beetle species (*Neanops caecus*) (Naturally Uncommon) and a species of ground beetle (*Duvaliomimus* (*Mayotrechus*) *mayae mayorum*) (Naturally Uncommon). Likely to occur on site: black mudfish (*Neochanna diversus*) (Declining) and longfin eel (*Anguilla dieffenbachii*) (Declining).	2
Ecological value score				**16**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses, grazing and on-going farm development. The site has some indigenous vegetation with will deteriorate further with grazing. Streams/seeps/wetland appear to be unfenced.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, rats, and mustelids). It is unknown whether pest animal control is being carried out.	1
9	Urgency: Plant pest control	3	3	9	The site is likely to have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	3	2	6	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. The site is grazed. Streams/seeps/wetland appear to be unfenced. It is unknown whether the cave entrance is fenced.	2
12	Legal protection	3	2	6	A small fraction of the site is a local purpose reserve (Mangakowhai Road Cemetery), but most of the site is unprotected.	3
Threat criteria				**43**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	3	2	6	Fencing and planting of cave entrances, streams, seeps, wetlands, and areas of indigenous vegetation would be required to significantly improve this site.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	1	2	2	No known funding.	1
Potential outcomes score				**20**		
Total Score for site 355				**79**		

Site 356 Ecch Cave

Site information

Site Number	356	Site Name	Ecch Cave	Karst Type	Cave	Site Area (ha)	75.223	District	Waitomo
Ecological Region	King Country	Protection Status	Unprotected	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	1	2	2	A moderately sized cave karst site of a single area, along Torotoro Road west of Aria, next to Mokau River. Oblique imagery shows that the surface vegetation is predominantly exotic grassland with: scattered kahikatea treeland in parts; a small stand of pines in the northeast; an area of MF4 kahikatea-dominated forest-treeland with some riparian willow in the north centre; an area of primarily riparian exotic deciduous trees with scattered regenerating kahikatea along and east of Potaka Road; and a small area of riparian mixed native and exotic shrubland along the Mokau River in the south. Vegetation of the site is mostly exotic pasture with a small area of treeland. These patches have been variously mapped as MF7-3 tawa-pukatea-podocarp forest, broadleaf-treefern scrub and deciduous hardwoods and this is supported by aerial imagery. The vegetation and habitat of the surface appears to be in a relatively poor condition, dominated by exotic pasture, is not connected to other habitats and is likely to have only limited threatened biodiversity value.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
2	Size	1	2	2	At 75.223 ha, this site is moderate in size compared to other cave SNA in the top 58 karst SNA; however, the site is highly degraded, lacking almost all indigenous species typical of its habitat type.	3
3	Linkage and buffering	1	2	2	The site is surrounded by pasture and little indigenous vegetation is present in the wider landscape.	3
4	Diversity and pattern	1	2	2	The site has two types of naturally uncommon ecosystem: cave entrances; caves and cracks; however, the site is highly degraded so the condition of these may be poor.	2
5	Under-represented vegetation	1	3	3	Vegetation of the site is mostly exotic pasture with a small area of treeland.	3
6	Threatened species (national priority)	3	1	3	Significant fauna known to occur on site: a species of ground beetle (*Duvaliomimus* (*Mayotrechus*) *mayae mayorum*) (Naturally uncommon). Likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical).	2
Ecological value score				**14**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses, grazing and on-going farm development. Streams/seeps/wetland appear to be unfenced and may deteriorate further.	1
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, rats, and mustelids). It is unknown whether pest animal control is being carried out.	1
9	Urgency: Plant pest control	3	3	9	The site may have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	2.5	2	5	Some fencing associated with WRC's soil conservation and Clean Streams programmes is present on this site (5%) The site appears to be grazed. Streams/seeps/wetland appear to mostly be unfenced. It is unknown whether the cave entrance is fenced.	1
12	Legal protection	3	2	6	Unprotected.	3
Threat criteria				**42**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
13	Restoration potential	3	2	6	Fencing and planting of cave entrances, streams, seeps, wetlands, and areas of indigenous vegetation would be required to significantly improve this site.	1
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	1	2	2	No known funding.	1
Potential outcomes score				**20**		
Total Score for site 356				**76**		

Site 357 Kairimu Cave Systems

Site information

Site Number	357	Site Name	Kairimu Cave Systems	Karst Type	Cave	Site Area (ha)	241.220	District	Waitomo
Ecological Region	King Country	Protection Status	DOC (173.41 ha) and unprotected.	Ecological District	Waitomo	Naturally Uncommon Ecosystem Types	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Wildland Consultants Ltd 2019. Updated guidelines for determining areas of significant indigenous vegetation and habitats of indigenous fauna in the Waikato Region 15602008. Waikato Regional Council.

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	3	2	6	Many abiotically significant caves within a small area on the western edge of the Waitomo caves district. Two thirds of the area is good condition native vegetation under DOC reserve which is well connected to a larger area of forest within the district. Western quarter under steep private farmland, where the surface is a complex mosaic of exotic pasture intermixed with patches of deciduous exotic trees, harvested forest areas and native vegetation. Surface vegetation is WF13 over 3/4 of area, with VS4-VS5 along forest margins and in slopes/gullies in the western quarter (with significant recent erosion evident in aerial imagery) through areas of exotic grassland (oblique imagery).	2
2	Size	3	2	6	At 241.220 ha, this site is large compared to other cave SNA in the top 58 karst SNA.	3
3	Linkage and buffering	3	2	6	The site is well connected to larger forested areas within the locality and is closely associated with Tawarau Karst (Site 336). Parts of the site are bordered by farmland.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
4	Diversity and pattern	2	2	4	The site comprises indigenous forest and has two types of naturally uncommon ecosystem: cave entrances; caves and cracks.	2
5	Under-represented vegetation	2	3	6	Surface vegetation is WF13 over 3/4 of area, with VS4-VS5 along forest margins and in slopes/gullies. These vegetation types are not under-represented in the Waitomo ED; however, the vegetation is likely old growth forest.	2
6	Threatened species (national priority)	3	1	3	Significant flora likely to occur on site: woodrose (*Dactylanthus taylorii*) (Nationally Vulnerable). Significant fauna known to occur on site: bush falcon/kārearea (*Falco novaeseelandiae* "bush") (Recovering), a ground beetle (*Duvaliomimus* (*Mayotrechus*) *mayae mayorum*) (Naturally uncommon) and a species of beetle (*Neanops* sp.) (conservation status unknown).	2
Ecological value score				**31**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses, grazing, and on-going farm development.	2
8	Urgency: Animal pest control	3	3	9	Pest species are likely to be present (e.g., hares, rabbits, possums, pigs, goats, rats, and mustelids). Goats are likely an issue. It is unknown whether pest animal control is being carried out.	1
9	Urgency: Plant pest control	3	3	9	The site may have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	2.5	2	5	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. Part of the site is grazed. Grazing is unlikely to be an issue for parts of the site on public conservation land. It is unknown whether cave entrances and steams are fenced.	2
12	Legal protection	2	2	4	Approximately 72% of this site is on protected DOC land (Puaroa Forest Scenic Reserve).	3
Threat criteria				**40**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	Extensive fencing is likely required on areas of farmland to protect streams, seeps, wetlands, and caves. The large area of forest likely only needs pest animal control.	1

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
14	LTCCP: Community involvement	1	2	2	No known community group involvement.	1
15	LTCCP: Funding support	2	2	4	No known WRC funding. Part ICM priority site.	1
16	Non-WRC funding	2	2	4	No known funding, however part of the site is public conservation land so may receive some funding from DOC.	1
Potential outcomes score				**14**		
Total Score for site 357				**85**		

Site 358 King George Cavern and Sid's Surmise

Site information

Site Number	358	**Site Name**	King George Cavern and Sid's Surmise	**Karst Type**	Cave	**Site Area (ha)**	30.967	**District**	Waitomo
Ecological Region	King Country	**Protection Status**	DOC (3.26 ha) and unprotected	**Ecological District**	Waitomo	**Naturally Uncommon Ecosystem Types**	Cave entrances; caves and cracks		

Information used to source the karst SNA

- Taylor-Smith, B., Kessels, G., van der Zwan, W. 2020. Methodology for assessing and ranking the biotic values of karst sites in the Waikato Region. A Tonkin+Taylor Report Prepared for Waikato Regional Council. 207 pp. DN 15198758.
- SNA Masterdata top 58 biological assessment. (Excel spreadsheet) 2019, DN 14323863.
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Aerial oblique photo points: AERIAL_OBLIQUE_CAMERA_PTS_2016_2018
- WRAPS_2017
- Significant Natural Areas – Karst Data (WRC GIS layer: SNA_KARST_2018).
- Fencing information obtained from aerial imagery and WRC GIS layers: RACS_SOILCON_FENCE - Fences associated with soil conservation programme; RACS_CLNSTRM_FENCE - Fences associated with the clean stream programme; RACS_PC_FENCE - Fences associated with grazing licences on WRC land; RACS_EXISTING_FENCING - Fences already in place.
- Karst - Top58 - Site Reports DM15802627, 16363769
- Pesticide Summary For the Region of: Waikato Valid as of: Tuesday, June 8, 2021 4:42 PM

Check list for assessing karst top 58 SNA.

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
A. ECOLOGICAL CRITERIA RANKING						
1	Representativeness	2	2	4	Two small sized cave karst sites along SH3 northwest of Aria, next to Mokau River. Vegetation of the site is mostly exotic pasture with a small area of treeland with a small area protected under DOC reserve at the southern end of the SNA (Mangaotaki Gorge Scenic Reserve, SNA: R17021). Oblique and aerial imagery show that MF7 vegetation is present at the southern end of the SNA, with exotic grassland dominating through the central area, and kahikatea-dominated forest along the margins of the Papatane Stream in the north. The vegetation and habitat of most of the site is in a relatively poor condition, dominated by exotic pasture, where the forested area protected by a DOC reserve is in good condition and ranked as regionally significant. The cave system is not directly connected to other habitats and is likely to have only limited threatened biodiversity value.	2
2	Size	2	2	4	At 30.967 ha, this site is moderate in size compared to other cave SNA in the top 58 karst SNA.	2

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
3	Linkage and buffering	2	2	4	This site is mostly surrounded by pasture, but it is has some adjoined tracts of indigenous forest, including Mangaotaki Gorge Scenic Reserve and Lower Mangaotaki Gorge bluffs (Site 313).	2
4	Diversity and pattern	2	2	4	The site comprises indigenous forest and has two types of naturally uncommon ecosystem: cave entrances; caves and cracks.	2
5	Under-represented vegetation	1	3	3	MF7 vegetation, which is present at the southern end of the SNA, is under-represented in the Waitomo ED. However, the area of vegetation is likely too small or in too poor condition to be considered representative.	2
6	Threatened species (national priority)	3	1	3	Significant fauna known to occur on site: a species of ground beetle (*Duvaliomimus* (*Mayotrechus*) *mayae mayorum*) (Naturally uncommon). Likely to occur on site: long-tailed bat (*Chalinolobus tuberculatus*) (Nationally Critical), lamprey (*Geotria australis*) (Nationally Vulnerable), inanga (*Galaxias maculatus*) (Declining), longfin eel (*Anguilla dieffenbachii)* (Declining), mussel (*Echyridella menziesii*) (Declining), kōaro (*Galaxias brevipinnis*) (Declining) and redfin bully (*Gobiomorphus huttoni*) (Not Threatened).	2
Ecological value score				**22**		
B. THREAT CRITERIA RANKING						
7	Vulnerability	2	2	4	Key threats are likely to include pest animal species, broadleaf agricultural weeds, exotic pasture grasses, grazing and on-going farm development. The condition of indigenous vegetation has potential to deteriorate further due to grazing.	1
8	Urgency: Animal pest control	2	3	6	Pest species are likely to be present (e.g., hares, rabbits, possums, rats, and mustelids). Goats are likely also present. Pest control was carried out in some parts of the conservation land in 2018 using Cholecalciferol (Feracol) bait bags.	2
9	Urgency: Plant pest control	3	3	9	The site may have a pest plant issue. It is unknown whether pest control is carried out.	1
10	Urgency: Restoration planting	3	3	9	It is unknown whether any restoration planting has been carried out at this site.	1
11	Fencing	3	2	6	WRC has no record of fencing associated with soil conservation, clean streams, or grazing licenses. Most of the site is grazed, but grazing is unlikely to be an issue for the part of the site on public conservation land. It is unclear whether streams and wetlands are fenced.	1
12	Legal protection	3	2	6	Only a very small area of the site is on public conservation land (Mangaotaki Gorge Scenic Reserve), most of the site is unprotected.	3

Criterion number	Criteria	Rank	Weighting	Score (Rank x Weighting)	Comment/Justification	Confidence Level
Threat criteria				**40**		
C. POTENTIAL OUTCOMES CRITERIA RANKING						
13	Restoration potential	2	2	4	The site may require fencing and planting of streams, wetlands, and areas of indigenous vegetation. Ongoing pest control is likely also required.	1
14	LTCCP: Community involvement	3	2	6	King Country River Care Inc (100% overlap).	2
15	LTCCP: Funding support	3	2	6	Environmental Initiatives funding (July 2019).	2
16	Non-WRC funding	2	2	4	No known funding, however part of the site is public conservation land so may receive some funding from DOC.	1
Potential outcomes score				**20**		
Total Score for site 358				**82**		

Appendix II: Threatened Species List in Top 58 Karst SNA Sites

VASCULAR PLANTS

Table 18: Threatened or at risk indigenous plant species found within the top 58 karst SNA sites in Waikato as per de Lange *et al*. 2018[10]

Site Number	Site Name	Scientific Name	Common Name	Threat Status
301	Awaroa rocky peaks and karst	*Linum monogynum*		Declining
301	Awaroa rocky peaks and karst	*Metrosideros colensoi*	Rata	Nationally Vulnerable
301	Awaroa rocky peaks and karst	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
301	Awaroa rocky peaks and karst	*Veronica scopulorum*	Awaroa hebe	Declining
301	Awaroa rocky peaks and karst	*Peraxilla tetrapetala*	Red mistletoe, Pikirangi, Pirirangi, Pikiraki, Pirita	Declining
302	Castle Craig	*Metrosideros colensoi*	Rata	Nationally Vulnerable
302	Castle Craig	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
303	Deception cave	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
305	Grand Canyon Cave	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
306	Gribbon Road bluffs	*Leptospermum scoparium* var. *scoparium*	Manuka, Kahikatoa	Declining
306	Gribbon Road bluffs	*Brachyglottis kirkii* var. *kirkii*	Kohurangi, Kirk's daisy	Nationally Vulnerable
308	Karamu Cave	*Metrosideros diffusa*	White rata	Nationally Vulnerable
308	Karamu Cave	*Metrosideros perforata*	Akatea	Nationally Vulnerable
308	Karamu Cave	*Kunzea robusta*	Kanuka	Nationally Vulnerable
310	Lake Koraha and Matauratahi	*Veronica scopulorum*	Awaroa hebe	Declining
310	Lake Koraha and Matauratahi	*Syzygium maire*	Swamp maire, Maire tawake, Waiwaka	Nationally Critical
310	Lake Koraha and Matauratahi	*Brachyglottis kirkii* var. *kirkii*	Kohurangi, Kirk's daisy	Nationally Vulnerable
310	Lake Koraha and Matauratahi	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable

[10] Many surface karst SNA sites may have species present belonging to the Myrtaceae family which have not always been recorded. This includes manuka, kanuka, rata, *Lophomyrtus* and *Neomyrtus* species which were elevated to threatened conservation status in 2018 due solely to the threat of myrtle rust. Myrtaceae species previously considered threatened prior to the myrtle rust incursion are listed for all sites where they have been recorded as present.

Site Number	Site Name	Scientific Name	Common Name	Threat Status
313	Lower Mangaotaki Gorge bluffs	*Christella dentata*	Northland soft fern	Naturally Uncommon
316	Mangapohue Natural Bridge	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
316	Mangapohue Natural Bridge	*Metrosideros colensoi*	Rata	Nationally Vulnerable
316	Mangapohue Natural Bridge	*Dactylanthus taylorii*	Woodrose	Nationally Vulnerable
317	Mangapohue-Hauturu Road polygonal karst	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
317	Mangapohue-Hauturu Road polygonal karst	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
317	Mangapohue-Hauturu Road polygonal karst	*Metrosideros perforata*	Akatea	Nationally Vulnerable
318	Mangapu Cave System	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
318	Mangapu Cave System	*Teucridium parvifolium*	Native verbena	Declining
319	Mangapu Gorge and blind valley	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
319	Mangapu Gorge and blind valley	*Teucridium parvifolium*	Native verbena	Declining
319	Mangapu Gorge and blind valley	*Metrosideros fulgens*	Climbing rata	Nationally Vulnerable
319	Mangapu Gorge and blind valley	*Metrosideros diffusa*	White rata	Nationally Vulnerable
321	Mangawhitikau cave system	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
322	Mangawhitikau slit gorge & karst	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
322	Mangawhitikau slit gorge & karst	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
322	Mangawhitikau slit gorge & karst	*Teucridium parvifolium*	Native verbena	Declining
323	Marakopa River natural tunnel and Te Ana Kapiti Cave	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
323	Marakopa River natural tunnel and Te Ana Kapiti Cave	*Asplenium lyallii*	Lyall's spleenwort	Not Threatened
323	Marakopa River natural tunnel and Te Ana Kapiti Cave	*Asplenium trichomanes*	Spleenwort	Not Threatened
323	Marakopa River natural tunnel and Te Ana Kapiti Cave	*Dactylanthus taylorii*	Woodrose	Nationally Vulnerable
323	Marakopa River natural tunnel and Te Ana Kapiti Cave	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
324	Mohakatino karst	*Metrosideros fulgens*	Climbing rata	Nationally Vulnerable
324	Mohakatino karst	*Dactylanthus taylorii*	Woodrose	Nationally Vulnerable
324	Mohakatino karst	*Brachyglottis turneri*		Nationally Endangered
325	Old Mountain Road karst Rd	*Leptospermum scoparium* var. *scoparium*	Manuka, Kahikatoa	Declining
325	Old Mountain Road karst Rd	*Kunzea robusta*	Kanuka	Nationally Vulnerable

Site Number	Site Name	Scientific Name	Common Name	Threat Status
326	Pakeho polygonal karst	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
326	Pakeho polygonal karst	*Metrosideros colensoi*	Rata	Nationally Vulnerable
326	Pakeho polygonal karst	*Teucridium parvifolium*	Native verbena	Declining
327	Paparahia Cave	*Dactylanthus taylorii*	Woodrose	Nationally Vulnerable
330	Raglan coastal karst	*Zostera muelleri* subsp. *Novazelandica*	Seagrass, eelgrass, Nana, Zostera	Declining
330	Raglan coastal karst	*Scandia rosifolia*	Koheriki	Nationally Critical
331	Rakaunui coastal karst and ephemeral lakes	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
331	Rakaunui coastal karst and ephemeral lakes	*Leptinella tenella*		Nationally Vulnerable
331	Rakaunui coastal karst and ephemeral lakes	*Carex litorosa*	Sea sedge	Declining
331	Rakaunui coastal karst and ephemeral lakes	*Thyridia repens*		Naturally Uncommon
331	Rakaunui coastal karst and ephemeral lakes	*Scandia rosifolia*	Koheriki	Nationally Critical
331	Rakaunui coastal karst and ephemeral lakes	*Anthosachne kingiana* subsp. *multiflora*	Blue grass, Blue wheat grass	Declining
333	Ruakuri Natural Bridge and karst	*Metrosideros diffusa*	White rata	Nationally Vulnerable
333	Ruakuri Natural Bridge and karst	*Metrosideros colensoi*	Rata	Nationally Vulnerable
333	Ruakuri Natural Bridge and karst	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
333	Ruakuri Natural Bridge and karst	*Ptisana salicina*	King fern	Declining
333	Ruakuri Natural Bridge and karst	*Astelia grandis*	Swamp astelia	Not Threatened
334	Taranaki Point coastal karst	*Ophioglossum petiolatum*	Stalked adder's tongue	Nationally Critical
334	Taranaki Point coastal karst	*Anthosachne kingiana* subsp. *multiflora*	Blue grass, Blue wheat grass	Declining
334	Taranaki Point coastal karst	*Scandia rosifolia*	Koheriki	Nationally Critical
335	Taumatatotora karst and dolines	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
335	Taumatatotora karst and dolines	*Asplenium lyallii*	Lyall's spleenwort	Not Threatened
335	Taumatatotora karst and dolines	*Dactylanthus taylorii*	Woodrose	Nationally Vulnerable
335	Taumatatotora karst and dolines	*Metrosideros colensoi*	Rata	Nationally Vulnerable
335	Taumatatotora karst and dolines	*Veronica scopulorum*	Awaroa hebe	Declining
335	Taumatatotora karst and dolines	*Syzygium maire*	Swamp maire, Maire tawake, Waiwaka	Nationally Critical
335	Taumatatotora karst and dolines	*Epilobium insulare*		Declining

Site Number	Site Name	Scientific Name	Common Name	Threat Status
335	Taumatatotora karst and dolines	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
336	Tawarau karst	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
336	Tawarau karst	*Dactylanthus taylorii*	Woodrose	Nationally Vulnerable
336	Tawarau karst	*Metrosideros colensoi*	Rata	Nationally Vulnerable
336	Tawarau karst	*Clematis quadribracteolata*	Clematis	Naturally Uncommon
336	Tawarau karst	*Ophioglossum petiolatum*	Stalked adder's tongue	Nationally Critical
336	Tawarau karst	*Pseudopanax laetus*		Declining
336	Tawarau karst	*Olearia virgata*		Not Threatened
336	Tawarau karst	*Syzygium maire*	Swamp maire, Maire tawake, Waiwaka	Nationally Critical
336	Tawarau karst	*Caladenia bartlettii*		Naturally Uncommon
336	Tawarau karst	*Astelia grandis*	Swamp astelia	Not Threatened
337	Te Kauri karst	*Brachyglottis kirkii* var. *kirkii*	Kohurangi, Kirk's daisy	Nationally Vulnerable
337	Te Kauri karst	*Caladenia bartlettii*		Naturally Uncommon
337	Te Kauri karst	*Crassula ruamahanga*		Naturally Uncommon
337	Te Kauri karst	*Dactylanthus taylorii*	Woodrose	Nationally Vulnerable
337	Te Kauri karst	*Corunastylis nuda*		Naturally Uncommon
337	Te Kauri karst	*Rytidosperma buchananii*		Declining
337	Te Kauri karst	*Metrosideros fulgens*	Climbing rata	Nationally Vulnerable
337	Te Kauri karst	*Thyridia repens*		Naturally Uncommon
337	Te Kauri karst	*Agathis australis*	Kauri	Nationally Vulnerable
337	Te Kauri karst	*Metrosideros diffusa*	White rata	Nationally Vulnerable
337	Te Kauri karst	*Metrosideros perforata*	Akatea	Nationally Vulnerable
337	Te Kauri karst	*Deyeuxia quadriseta*		Declining
337	Te Kauri karst	*Anthosachne kingiana* subsp. *multiflora*	Blue grass, Blue wheat grass	Declining
337	Te Kauri karst	*Korthalsella salicornioides*	Dwarf mistletoe	Nationally Critical
337	Te Kauri karst	*Corybas hypogaeus*		Naturally Uncommon
337	Te Kauri karst	*Carex fascicularis*	Sedge	Declining
337	Te Kauri karst	*Senecio biserratus*		Declining
337	Te Kauri karst	*Ranunculus urvilleanus*		Declining
337	Te Kauri karst	*Leptinella tenella*		Nationally Vulnerable
337	Te Kauri karst	*Lindsaea viridis*		Naturally Uncommon
337	Te Kauri karst	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
337	Te Kauri karst	*Leptospermum scoparium* var. *scoparium*	Manuka, Kahikatoa	Declining
337	Te Kauri karst	*Lophomyrtus bullata*	Ramarama	Nationally Critical
337	Te Kauri karst	*Metrosideros robusta*	Northern rata	Nationally Vulnerable
337	Te Kauri karst	*Ophioglossum petiolatum*	Stalked adder's tongue	Nationally Critical

Site Number	Site Name	Scientific Name	Common Name	Threat Status
337	Te Kauri karst	*Pellaea falcata*	Australian cliff brake	Nationally Critical
337	Te Kauri karst	*Pimelea tomentosa*		Nationally Vulnerable
337	Te Kauri karst	*Pittosporum huttonianum*		Naturally Uncommon
337	Te Kauri karst	*Pseudopanax laetus*		Declining
337	Te Kauri karst	*Ptisana salicina*	King fern	Declining
337	Te Kauri karst	*Schizaea dichotoma*		Naturally Uncommon
341	Torehina karst	*Agathis australis*	Kauri	Nationally Vulnerable
343	Troopers Road cave system	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
343	Troopers Road cave system	*Teucridium parvifolium*	Native verbena	Declining
345	Waikaretu karst and Nikau Cave	*Metrosideros colensoi*	Rata	Nationally Vulnerable
345	Waikaretu karst and Nikau Cave	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
345	Waikaretu karst and Nikau Cave	*Leptospermum scoparium* var. *scoparium*	Manuka, Kahikatoa	Declining
346	Waikawau Valley karst	*Metrosideros diffusa*	White rata	Nationally Vulnerable
346	Waikawau Valley karst	*Metrosideros perforata*	Akatea	Nationally Vulnerable
346	Waikawau Valley karst	*Kunzea robusta*	Kanuka	Nationally Vulnerable
347	Waipapa Rd cave system	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
348	Waipuna Cave	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
349	Waipuna polygonal karst	*Asplenium cimmeriorum*	Cave spleenwort	Naturally Uncommon
349	Waipuna polygonal karst	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
349	Waipuna polygonal karst	*Metrosideros colensoi*	Rata	Nationally Vulnerable
349	Waipuna polygonal karst	*Teucridium parvifolium*	Native verbena	Declining
349	Waipuna polygonal karst	*Leptospermum scoparium* var. *scoparium*	Manuka, Kahikatoa	Declining
351	Waitomo Forest karst	*Asplenium trichomanes*	Spleenwort	Not Threatened
351	Waitomo Forest karst	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
351	Waitomo Forest karst	*Metrosideros colensoi*	Rata	Nationally Vulnerable
352	Waitomo Glowworm Cave and karst	*Asplenium aff. trichomanes* (AK 168112; *"hexaploid"*)	Spleenwort	Not Threatened
352	Waitomo Glowworm Cave and karst	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
352	Waitomo Glowworm Cave and karst	*Myriophyllum robustum*		Declining

Site Number	Site Name	Scientific Name	Common Name	Threat Status
352	Waitomo Glowworm Cave and karst	*Metrosideros colensoi*	Rata	Nationally Vulnerable
352	Waitomo Glowworm Cave and karst	*Ptisana salicina*	King fern	Declining
353	Waitomo Stream headwaters cave system	*Leptospermum scoparium* var. *scoparium*	Manuka, Kahikatoa	Declining
354	Whenuapo karst	*Metrosideros carminea*	Carmine rata	Nationally Vulnerable
357	Komrad Cave (Kairimu Cave Systems)	*Dactylanthus taylorii*	Woodrose	Nationally Vulnerable

BIRDS

Table 19: Threatened, at risk or not threatened notable indigenous bird species found within the top 58 karst SNA sites in Waikato as per Robertson *et al*. 2021[11]

Site Number	Site Name	Scientific Name	Common Name	Threat Status
302	Castle Craig	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing
306	Gribbon Road bluffs	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing
309	Lake Disappear and karst	*Anthus novaeseelandiae novaeseelandiae*	New Zealand pipit, pihoihoi, Richard's pipit	Declining
309	Lake Disappear and karst	*Callaeas wilsoni*	North Island Kokako, blue-wattled crow, kokako, hokako, honga, onga, honge, onge, pakara, werewere	Nationally Increasing
309	Lake Disappear and karst	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing
309	Lake Disappear and karst	*Hymenolaimus malacorhynchos*	Blue duck, Whio, mountain duck, blue mountain duck	Nationally Vulnerable
310	Lake Koraha and Matauratahi	*Anas chlorotis*	Brown teal, Pateke	Nationally Increasing
310	Lake Koraha and Matauratahi	*Bowdleria punctata vealeae*	North Island fernbird, Matata, Koroatito, Karoti, Matata, Koroatito, u-tick	Declining
310	Lake Koraha and Matauratahi	*Porzana tabuensis tabuensis*	Spotless Crake, Sooty rail, Puweto, Putoto	Declining
311	Lake Rotokawau	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing
316	Mangapohue Natural Bridge	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing
323	Marakopa River natural tunnel and Te Ana Kapiti Cave	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing
325	Old Mountain Road karst Rd	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing
327	Paparahia Cave	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing

[11] Threatened – Nationally Increasing is a new name and category for the former At Risk – Recovering A category (Robertson et al. 2021).

Site Number	Site Name	Scientific Name	Common Name	Threat Status
330	Raglan coastal karst	*Bowdleria punctata vealeae*	North Island fernbird, Matata, Koroatito, Karoti, Matata, Koroatito, u-tick	Declining
330	Raglan coastal karst	*Haematopus unicolor*	Variable oystercatcher, Black oystercatcher, Torea pango, Torea tai, Torea,	Recovering
330	Raglan coastal karst	*Hydroprogne caspia*	Caspian Tern, Taranui	Nationally Vulnerable
330	Raglan coastal karst	*Platalea regia*	Royal Spoonbill, Kotuku ngutupapa	Naturally Uncommon
331	Rakaunui coastal karst and ephemeral lakes	*Botaurus poiciloptilus*	Australasian bittern, Matuku Hurepo, Matuku Hurepo	Nationally Critical
331	Rakaunui coastal karst and ephemeral lakes	*Platalea regia*	Royal Spoonbill, Kotuku ngutupapa	Naturally Uncommon
331	Rakaunui coastal karst and ephemeral lakes	*Charadrius bicinctus bicinctus*	Banded dotterel, Double-banded plover, Tuturiwhatu, Pohowera	Declining
333	Ruakuri Natural Bridge and karst	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing
334	Taranaki Point coastal karst	*Hydroprogne caspia*	Caspian Tern, Taranui	Nationally Vulnerable
334	Taranaki Point coastal karst	*Larus novaehollandiae scopulinus*	Red-billed Gull	Declining
334	Taranaki Point coastal karst	*Phalacrocorax varius varius*	Pied Shag, Pied cormorant, Karuhiruhi, Karuhiruhi, Kawau, Yellow-faced cormorant. Large-pied shag	Recovering
334	Taranaki Point coastal karst	*Platalea regia*	Royal Spoonbill, Kotuku ngutupapa	Naturally Uncommon
334	Taranaki Point coastal karst	*Charadrius bicinctus bicinctus*	Banded dotterel, Double-banded plover, Tuturiwhatu, Pohowera	Declining
334	Taranaki Point coastal karst	*Charadrius obscurus aquilonius*	Northern New Zealand dotterel	Nationally Increasing
335	Taumatatotora karst and dolines	*Botaurus poiciloptilus*	Australasian bittern, Matuku Hurepo, Matuku Hurepo	Nationally Critical
335	Taumatatotora karst and dolines	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing
336	Tawarau karst	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing

Site Number	Site Name	Scientific Name	Common Name	Threat Status
336	Tawarau karst	*Eudynamys taitensis*	Long-tailed cuckoo, Koekoea, Kohoperoa, Long-tailed koel	Nationally Vulnerable
336	Tawarau karst	*Callaeas wilsoni*	North Island Kokako, Blue-wattled crow, Kokako, Hokako, Honga, onga, Honge, onge, Pakara, Werewere	Nationally Increasing
336	Tawarau karst	*Apteryx mantelli*	North Island brown kiwi	Not Threatened
336	Tawarau karst	*Nestor meridionalis*	North Island kaka, Bush parrot, Brown parrot, Kawkaw	Recovering
337	Te Kauri karst	*Apteryx mantelli*	North Island brown kiwi	Not Threatened
341	Torehina karst	*Apteryx mantelli*	North Island brown kiwi	Not Threatened
349	Waipuna polygonal karst	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing
349	Waipuna polygonal karst	*Petroica macrocephala toitoi*	Pied Tit	Not Threatened
349	Waipuna polygonal karst	*Mohoua albicilla*	Whitehead, Popokatea	Not Threatened
349	Waipuna polygonal karst	*Eudynamys taitensis*	Long-tailed cuckoo, Loekoea, Kohoperoa, Long-tailed koel	Nationally Vulnerable
351	Waitomo Forest karst	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing
352	Waitomo Glowworm Cave and karst	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing
353	Waitomo Stream headwaters cave system	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing
353	Waitomo Stream headwaters cave system	*Petroica macrocephala toitoi*	Pied Tit	Not Threatened
353	Waitomo Stream headwaters cave system	*Mohoua albicilla*	Whitehead, Popokatea	Not Threatened
353	Waitomo Stream headwaters cave system	*Eudynamys taitensis*	Long-tailed cuckoo, Loekoea, Kohoperoa, Long-tailed koel	Nationally Vulnerable
357	Komrad Cave (Kairimu Cave Systems)	*Falco novaeseelandiae* "bush"	Bush falcon, Karearea	Nationally Increasing

FRESHWATER FISH

Table 20: Threatened or at risk indigenous freshwater fish species found within the top 58 karst SNA sites in Waikato as per Dunn *et al*. 2018

Site Number	Site Name	Scientific Name	Common Name	Threat Status
302	Castle Craig	*Anguilla dieffenbachii*	Longfin eel	Declining
302	Castle Craig	*Gobiomorphus huttoni*	Redfin bully	Not Threatened
304	Gardners Gut Cave	*Cheimarrichthys fosteri*	Torrentfish	Declining
305	Grand Canyon Cave	*Anguilla dieffenbachii*	Longfin eel	Declining
306	Gribbon Road bluffs	*Anguilla dieffenbachii*	Longfin eel	Declining
306	Gribbon Road bluffs	*Galaxias maculatus*	Inanga	Declining
306	Gribbon Road bluffs	*Galaxias postvectis*	Shortjaw kokopu	Nationally Vulnerable
306	Gribbon Road bluffs	*Gobiomorphus huttoni*	Redfin bully	Not Threatened
309	Lake Disappear and karst	*Anguilla dieffenbachii*	Longfin eel	Declining
311	Lake Rotokawau	*Anguilla dieffenbachii*	Longfin eel	Declining
311	Lake Rotokawau	*Cheimarrichthys fosteri*	Torrentfish	Declining
311	Lake Rotokawau	*Neochanna diversus*	Black mudfish	Declining
312	Lake Rotokotuku	*Anguilla dieffenbachii*	Longfin eel	Declining
313	Lower Mangaotaki Gorge bluffs	*Anguilla dieffenbachii*	Longfin eel	Declining
313	Lower Mangaotaki Gorge bluffs	*Galaxias brevipinnis*	Koaro	Declining
313	Lower Mangaotaki Gorge bluffs	*Galaxias maculatus*	Inanga	Declining
313	Lower Mangaotaki Gorge bluffs	*Geotria australis*	Lamprey	Nationally Vulnerable
313	Lower Mangaotaki Gorge bluffs	*Gobiomorphus huttoni*	Redfin bully	Not Threatened
314	Mangaokewa Gorge bluffs	*Anguilla dieffenbachii*	Longfin eel	Declining
315	Mangaorongo Gorge and natural bridges	*Anguilla dieffenbachii*	Longfin eel	Declining
316	Mangapohue Natural Bridge	*Anguilla dieffenbachii*	Longfin eel	Declining
318	Mangapu Cave System	*Neochanna diversus*	Black mudfish	Declining
319	Mangapu Gorge and blind valley	*Neochanna diversus*	Black mudfish	Declining
320	Mangawharawhara gorge and natural bridges	*Anguilla dieffenbachii*	Longfin eel	Declining
322	Mangawhitikau slit gorge & karst	*Anguilla dieffenbachii*	Longfin eel	Declining
324	Mohakatino karst	*Anguilla dieffenbachii*	Longfin eel	Declining
324	Mohakatino karst	*Galaxias maculatus*	Inanga	Declining

Site Number	Site Name	Scientific Name	Common Name	Threat Status
324	Mohakatino karst	*Gobiomorphus huttoni*	Redfin bully	Not Threatened
326	Pakeho polygonal karst	*Anguilla dieffenbachii*	Longfin eel	Declining
327	Paparahia Cave	*Anguilla dieffenbachii*	Longfin eel	Declining
327	Paparahia Cave	*Cheimarrichthys fosteri*	Torrentfish	Declining
327	Paparahia Cave	*Galaxias argenteus*	Giant kokopu	Declining
327	Paparahia Cave	*Galaxias brevipinnis*	Koaro	Declining
327	Paparahia Cave	*Galaxias postvectis*	Shortjaw kokopu	Nationally Vulnerable
327	Paparahia Cave	*Geotria australis*	Lamprey	Nationally Vulnerable
327	Paparahia Cave	*Gobiomorphus hubbsi*	Bluegill bully	Declining
327	Paparahia Cave	*Gobiomorphus huttoni*	Redfin bully	Not Threatened
332	Ruakuri Cave	*Cheimarrichthys fosteri*	Torrentfish	Declining
333	Ruakuri Natural Bridge and karst	*Anguilla dieffenbachii*	Longfin eel	Declining
333	Ruakuri Natural Bridge and karst	*Cheimarrichthys fosteri*	Torrentfish	Declining
335	Taumatatotora karst and dolines	*Anguilla dieffenbachii*	Longfin eel	Declining
335	Taumatatotora karst and dolines	*Gobiomorphus huttoni*	Redfin bully	Not Threatened
336	Tawarau karst	*Anguilla dieffenbachii*	Longfin eel	Declining
336	Tawarau karst	*Galaxias brevipinnis*	Koaro	Declining
336	Tawarau karst	*Galaxias maculatus*	Inanga	Declining
336	Tawarau karst	*Gobiomorphus huttoni*	Redfin bully	Not Threatened
339	Ten Acre Tomo system	*Anguilla dieffenbachii*	Longfin eel	Declining
342	Totoro Gorge karst	*Anguilla dieffenbachii*	Longfin eel	Declining
342	Totoro Gorge karst	*Galaxias maculatus*	Inanga	Declining
344	Upper Mangotaki Gorge bluffs	*Anguilla dieffenbachii*	Longfin eel	Declining
349	Waipuna polygonal karst	*Anguilla dieffenbachii*	Longfin eel	Declining
350	Wairere Falls Cave and karst	*Anguilla dieffenbachii*	Longfin eel	Declining
350	Wairere Falls Cave and karst	*Cheimarrichthys fosteri*	Torrentfish	Declining

Site Number	Site Name	Scientific Name	Common Name	Threat Status
350	Wairere Falls Cave and karst	*Geotria australis*	Lamprey	Nationally Vulnerable
351	Waitomo Forest karst	*Anguilla dieffenbachii*	Longfin eel	Declining
355	Broken Hill Cave	*Neochanna diversus*	Black mudfish	Declining
355	Broken Hill Cave	*Anguilla dieffenbachii*	Longfin eel	Declining
358	King George Cavern and Sid's Surprise	*Galaxias maculatus*	Inanga	Declining
358	King George Cavern and Sid's Surprise	*Anguilla dieffenbachii*	Longfin eel	Declining
358	King George Cavern and Sid's Surprise	*Gobiomorphus huttoni*	Redfin bully	Not Threatened
358	King George Cavern and Sid's Surprise	*Galaxias brevipinnis*	Koaro	Declining
358	King George Cavern and Sid's Surprise	*Geotria australis*	Lamprey	Nationally Vulnerable

COLEOPTERA

Site Number	Site Name	Scientific Name	Common Name	Threat Status
303	Deception Cave	*Duvaliomimus (Mayotrechus) mayae mayorum*	Carabidae (Trechini)	Naturally Uncommon
304	Gardners Gut Cave	*Duvaliomimus mayae (Trechinae)*	Ground beetle	
307	Hollow Hill Cave	*Duvaliomimus (Mayotrechus) mayae mayorum*	Carabidae (Trechini)	Naturally Uncommon
343	Troopers Road cave system	*Neanops caecus*	Carabidae (Trechini)	Naturally Uncommon
343	Troopers Road cave system	*Duvaliomimus (Mayotrechus) mayae mayorum*	Carabidae (Trechini)	Naturally Uncommon
348	Waipuna Cave	*Duvaliomimus (Mayotrechus) mayae mayorum*	Carabidae (Trechini)	Naturally Uncommon
350	Wairere Falls Cave and karst	*Neanops pritchardi*	Carabidae (Trechini)	Nationally Critical
355	Broken Hill Cave	*Neanops caecus*	Carabidae (Trechini)	Naturally Uncommon
355	Broken Hill Cave	*Duvaliomimus (Mayotrechus) mayae mayorum*	Carabidae (Trechini)	Naturally Uncommon
356	Ecch Cave	*Duvaliomimus (Mayotrechus) mayae mayorum*	Carabidae (Trechini)	Naturally Uncommon
357	Komrad Cave (Kairimu Cave Systems)	*Duvaliomimus (Mayotrechus) mayae mayorum*	Carabidae (Trechini)	Naturally Uncommon
358	King George Cavern and Sid's Surprise	*Duvaliomimus (Mayotrechus) mayae mayorum*	Carabidae (Trechini)	Naturally Uncommon

Table 21: Threatened or at risk indigenous coleoptera species found within the top 58 karst SNA sites in Waikato as per Leschen *et al*. 2012

BATS

Table 22: Threatened or at risk indigenous bat species found within the top 58 karst SNA sites in Waikato as per O'Donnell *et al*. 2018

Site Number	Site Name	Scientific Name	Common Name	Threat Status
301	Awaroa rocky peaks and karst	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
301	Awaroa rocky peaks and karst	*Mystacina tuberculata rhyacobia*	Central lesser short-tailed bat	Declining
304	Gardners Gut Cave	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
305	Grand Canyon Cave	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
306	Gribbon Road bluffs	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
307	Hollow Hill Cave	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
310	Lake Koraha and Matauratahi	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
310	Lake Koraha and Matauratahi	*Mystacina tuberculata rhyacobia*	Central lesser short-tailed bat	Declining
311	Lake Rotokawau	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
313	Lower Mangaotaki Gorge bluffs	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
315	Mangaorongo Gorge and natural bridges	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
320	Mangawharawhara gorge and natural bridges	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
323	Marakopa River natural tunnel and Te Ana Kapiti Cave	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
325	Old Mountain Road karst Rd	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
327	Paparahia Cave	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
328	Pukeroa cave system	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
329	Puketiti Flower Cave	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
331	Rakaunui coastal karst and ephemeral lakes	*Mystacina tuberculata rhyacobia*	Central lesser short-tailed bat	Declining
332	Ruakuri Cave	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
333	Ruakuri Natural Bridge and karst	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
335	Taumatatotora karst and dolines	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
335	Taumatatotora karst and dolines	*Mystacina tuberculata rhyacobia*	Central lesser short-tailed bat	Declining
336	Tawarau karst	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical

Site Number	Site Name	Scientific Name	Common Name	Threat Status
337	Te Kauri karst	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
337	Te Kauri karst	*Mystacina tuberculata rhyacobia*	Central lesser short-tailed bat	Declining
338	Te Raumauku Maze Cave	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
342	Totoro Gorge karst	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
344	Upper Mangotaki Gorge bluffs	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
349	Waipuna polygonal karst	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
351	Waitomo Forest karst	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
352	Waitomo Glowworm Cave and karst	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
353	Waitomo Stream headwaters cave system	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
356	Ecch Cave	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical
358	King George Cavern and Sid's Surprise	*Chalinolobus tuberculatus*	Long-tailed bat	Nationally Critical

FRESHWATER INVERTEBRATES

Site Number	Site Name	Scientific Name	Common Name	Threat Status
312	Lake Rotokotuku	*Glyptophysa variabilis*	Snail	Data Deficient
313	Lower Mangaotaki Gorge bluffs	*Echyridella menziesii*	Mussel	Declining
321	Mangawhitikau cave system	*Paraleptamphopus* sp. A	An amphipod crustacean	Likely
322	Mangawhitikau slit gorge and karst	*Paraleptamphopus* sp. B	An amphipod crustacean	Likely
327	Paparahia Cave	*Echyridella menziesii*	Mussel	Declining
332	Ruakuri Cave	*Potamopyrgus doci*	Freshwater snail	Nationally Critical
345	Waikaretu karst and Nikau Cave	*Leptopyrgus manneringi*	Snail	Nationally Critical
346	Waikawau Valley karst	*Potamopyrgus acus*	Snail	Nationally Critical
350	Wairere Falls Cave and karst	*Echyridella menziesii*	Mussel	Declining
	Soda Spring, Wairomo Road, Aria	*Potamopyrgus troglodytes*	Freshwater snail	Nationally Critical
358	King George Cavern and Sid's Surprise	*Echyridella menziesii*	Mussel	Declining

Table 23: Threatened or at risk indigenous freshwater invertebrate species found within the top 58 karst SNA sites in Waikato as per Grainger *et al*. 2018[12]

[12] Some taxa have no conservation status allocated but are still included in this list as species of interest due to their indeterminate taxonomy or a lack of knowledge to allow threat classification to date.

AMPHIBIANS

Site Number	Site Name	Scientific Name	Common Name	Threat Status
327	Paparahia Cave	*Leiopelma archeyi*	Archey's Frog	Declining
327	Paparahia Cave	*Leiopelma hochstetteri sensu stricto*	Hochstetter's Frog	Declining
341	Torehina karst	*Leiopelma archeyi*	Archey's Frog	Declining

Table 24: Threatened or at risk indigenous amphibian species found within the top 58 karst SNA sites in Waikato as per Burns *et al*. 2018

LEPIDOPETRA

Site Number	Site Name	Scientific Name	Common Name	Threat Status
318	Mangapu Cave System	*Caloptilia* sp. *"Teucridium"*	Moth	Nationally Vulnerable
319	Mangapu Cave System	*Caloptilia* sp. *"Teucridium"*	Moth	Nationally Vulnerable
343	Troopers Road cave system	*Caloptilia* sp. *"Teucridium"*	Moth	Nationally Vulnerable

Table 25: Threatened or at risk indigenous lepidoptera species found within the top 58 karst SNA sites in Waikato as per Hoare *et al.* 2017

COLLEMBOLA

Site Number	Site Name	Scientific Name	Common Name	Threat Status
308	Karamu Cave	*Spelaphourua petallata*	A springtail	Likely
348	Waipuna Cave	*Pseudosinella spelunca*	A springtail	Likely
352	Waitomo Glowworm Cave and karst	*Onychiurus acicendelius*	A springtail	Likely

Table 26: Threatened or at risk indigenous collembola species found within the top 58 karst SNA sites in Waikato[13]

[13] Some taxa have no conservation status allocated but are still included in this list as species of interest due to their indeterminate taxonomy or a lack of knowledge to allow threat classification to date.

ARACHNID

Table 27: Threatened or at risk indigenous arachnid species found within the top 58 karst SNA sites in

Site Number	Site Name	Scientific Name	Common Name	Threat Status
307	Hollow Hill Cave	*Hendea myersi cavernicola*	A harvestman spider, daddy longlegs	Likely
324	Mohakatino karst	*Tyrannochthoniella* sp.	A book scorpion, false scorpion	Likely
332	Ruakuri Cave	*Tyrannochthoniella* sp.	A book scorpion, false scorpion	Likely
348	Waipuna Cave	*Hendea myersi cavernicola*	A harvestman spider, daddy longlegs	Likely
352	Waitomo Glowworm Cave and karst	*Hendea myersi cavernicola*	A harvestman spider, daddy longlegs	Likely
	Selenite Cave	*Uralbia (Zelandalbia) hopkinsi*	A mite	Likely

Waikato[14]

[14] Some taxa have no conservation status allocated but are still included in this list as species of interest due to their indeterminate taxonomy or a lack of knowledge to allow threat classification to date.

OTHER NOTABLE SPECIES

Table 28: Non-threatened and unknown threatened status species found within the top 58 karst SNA sites in Waikato[15]

Site Number	Site Name	Scientific Name	Common Name	Threat Status
303	Deception Cave	*Exechia hiemalis*	A fungus gnat	Unknown
303	Deception Cave	*Psychoda zonata*	A moth fly	Unknown
304	Gardners Gut Cave	Cave weta	Cave weta	Unknown
307	Hollow Hill Cave	*Austrosimulium australense*	A black fly	Unknown
307	Hollow Hill Cave	*Paucispinigera approximata*	A chironomid midge	Unknown
307	Hollow Hill Cave	*Dolichopeza Atropos*	A crane fly	Unknown
307	Hollow Hill Cave	*Gynoplistia concava*	A crane fly	Unknown
307	Hollow Hill Cave	*Gynoplistia tridactyla*	A crane fly	Unknown
307	Hollow Hill Cave	*Mischoderus annuliferus*	A crane fly	Unknown
307	Hollow Hill Cave	*Molophilus tenuistylus*	A crane fly	Unknown
307	Hollow Hill Cave	*Rhabdomastix (Sacandaga) brunneipennis*	A crane fly	Unknown
307	Hollow Hill Cave	*Harrisius pallidus*	A feather mosquito	Unknown
307	Hollow Hill Cave	*Gundlachia neozelandica*	A freshwater snail	Unknown
307	Hollow Hill Cave	*Megalopsalis* sp.	A harvestman spider, daddy longlegs	Unknown
307	Hollow Hill Cave	*Zephlebia* sp.	Mayfly	Unknown
307	Hollow Hill Cave	*Anatopynia apicinella*	A midge	Unknown
307	Hollow Hill Cave	*Anatopynia debilis*	A midge	Unknown
307	Hollow Hill Cave	*Schedotrigona* sp.	A millipede	Unknown
307	Hollow Hill Cave	*Theridion* sp.	A tangle-web spider	Unknown
310	Lake Koraha and Matauratahi	*Drepandocladus aduncus*	A moss	Unknown
310	Lake Koraha and Matauratahi	*Nitella cristata*	An algae	Unknown
310	Lake Koraha and Matauratahi	*Paroxyethira* sp.	Caddisfly	Unknown
319	Mangapu Gorge and blind valley	*Pallidoplectron turneri*	Cave weta	Not Threatened
319	Mangapu Gorge and blind valley	*Pachyrhamma waitomoense*	Cave weta	Not Threatened
319	Mangapu Gorge and blind valley	*Arachnocampa luminosa*	Glowworm	Unknown
323	Marakopa River natural tunnel and Te Ana Kapiti Cave	*Paucispinigera approximata*	A chironomid midge	Unknown
323	Marakopa River natural tunnel and Te Ana Kapiti Cave	*Harrisius pallidus*	A feather mosquito	Unknown

[15] Some taxa have no conservation status allocated but are still included in this list as species of interest due to their indeterminate taxonomy or a lack of knowledge to allow threat classification to date.

Site Number	Site Name	Scientific Name	Common Name	Threat Status
331	Rakaunui coastal karst and ephemeral lakes	*Mischoderus annuliferus*	A crane fly	Unknown
331	Rakaunui coastal karst and ephemeral lakes	*Molophilus tenuistylus*	A crane fly	Unknown
332	Ruakuri Cave	*Candona* sp.	A seed shrimp	Unknown
332	Ruakuri Cave	*Scottia* sp.	A seed shrimp	Unknown
332	Ruakuri Cave	*Mesaphorura krausbaueri*	A springtail	Unknown
332	Ruakuri Cave	*Peripatoides novae-zealandiae*	A velvet worm	Not Threatened
332	Ruakuri Cave	*Paraleptamphopus* sp.	An amphipod crustacean	Data deficient
335	Taumatatotora karst and dolines	*Sciara* sp.	A fungus gnat	Unknown
335	Taumatatotora karst and dolines	*Psychoda* sp.	A moth fly	Unknown
335	Taumatatotora karst and dolines	*Onychiurus novae-zelandiae*	A rootfeeding springtail	Unknown
340	Tomac Tomo	*Rhytisternus miser*	A beetle	Unknown
340	Tomac Tomo	*Hypoaspis (Androlaelaps)* sp.	A mite	Unknown
340	Tomac Tomo	*Folsomia novae-zealandiae*	A springtail	Unknown
341	Torehina karst	Silverfish species	Silverfish species	Unknown
343	Troopers Road cave system	*Exechia hiemalis*	A fungus gnat	Unknown
345	Waikaretu karst and Nikau Cave	*Pallidoplectron turneri* or *Pachyrhamma waitomoense*	Cave weta	Not threatened
345	Waikaretu karst and Nikau Cave	*Arachnocampa luminosa*	Glowworm	Unknown
348	Waipuna Cave	*Prosphodrus waltoni*	A beetle	Unknown
348	Waipuna Cave	*Limnophila tonnoiri*	A crane fly	Unknown
348	Waipuna Cave	*Hendea* sp.	A harvestman spider, daddy longlegs	Not Threatened
348	Waipuna Cave	*Megalopsalis* sp.	A harvestman spider, daddy longlegs	Unknown
348	Waipuna Cave	*Paraconosoma polita*	A rove beetle	Unknown
348	Waipuna Cave	*Sciara* sp.	A fungus gnat	Unknown
348	Waipuna Cave	*Ceratophysella armata*	A springtail	Unknown
348	Waipuna Cave	*Tullbergia subantarctica*	A springtail	Unknown
348	Waipuna Cave	*Nesoperla spiniger*	A stonefly	Unknown
348	Waipuna Cave	*Peripatoides novae-zealandiae*	A velvet worm	Not Threatened
348	Waipuna Cave	*Cormocephalus rubriceps*	Giant centipede	Unknown
350	Waipuna polygonal karst	*Arachnocampa luminosa*	Glowworm	Unknown
350	Waipuna polygonal karst	*Pallidoplectron turneri* or *Pachyrhamma waitomoense*	Cave weta	Not Threatened
350	Wairere Falls Cave and karst	*Cormocephalus rubriceps*	Giant centipede	Unknown

Site Number	Site Name	Scientific Name	Common Name	Threat Status
352	Waitomo Glowworm Cave and karst	*Aphrophila neozelandica*	A crane fly	Unknown
352	Waitomo Glowworm Cave and karst	*Austrosimulium* sp.	Black fly	Unknown
352	Waitomo Glowworm Cave and karst	*Echinodium hispidum*	A moss	Unknown
352	Waitomo Glowworm Cave and karst	*Fissidens asplenioides*	A moss	Unknown
352	Waitomo Glowworm Cave and karst	*Breutelia pendula*	A moss	Unknown
352	Waitomo Glowworm Cave and karst	*Philonotis tenuis*	A moss	Unknown
352	Waitomo Glowworm Cave and karst	*Anatopynia debilis*	A midge	Unknown
352	Waitomo Glowworm Cave and karst	*Scolypopa australis*	Passionvine hopper	Unknown
352	Waitomo Glowworm Cave and karst	*Lepidocyrtus cyaneus*	A springtail	Unknown
352	Waitomo Glowworm Cave and karst	*Folosomia novae-zealandiae*	A springtail	Unknown
352	Waitomo Glowworm Cave and karst	*Ceratophysella armata*	A springtail	Unknown
352	Waitomo Glowworm Cave and karst	Cave weta	Cave weta	Unknown
353	Waitomo Stream headwaters cave system	*Arachnocampa luminosa*	Glowworm	Unknown
353	Waitomo Stream headwaters cave system	*Pallidoplectron turneri* or *Pachyrhamma waitomoense*	Cave weta	Not Threatened
357	Komrad Cave (Kairimu Cave Systems)	*Neanops* sp.	A beetle	Unknown

Please note, all species lists were last updated and correct as of 03/08/2022.

Appendix III Top 58 Karst SNA Maps

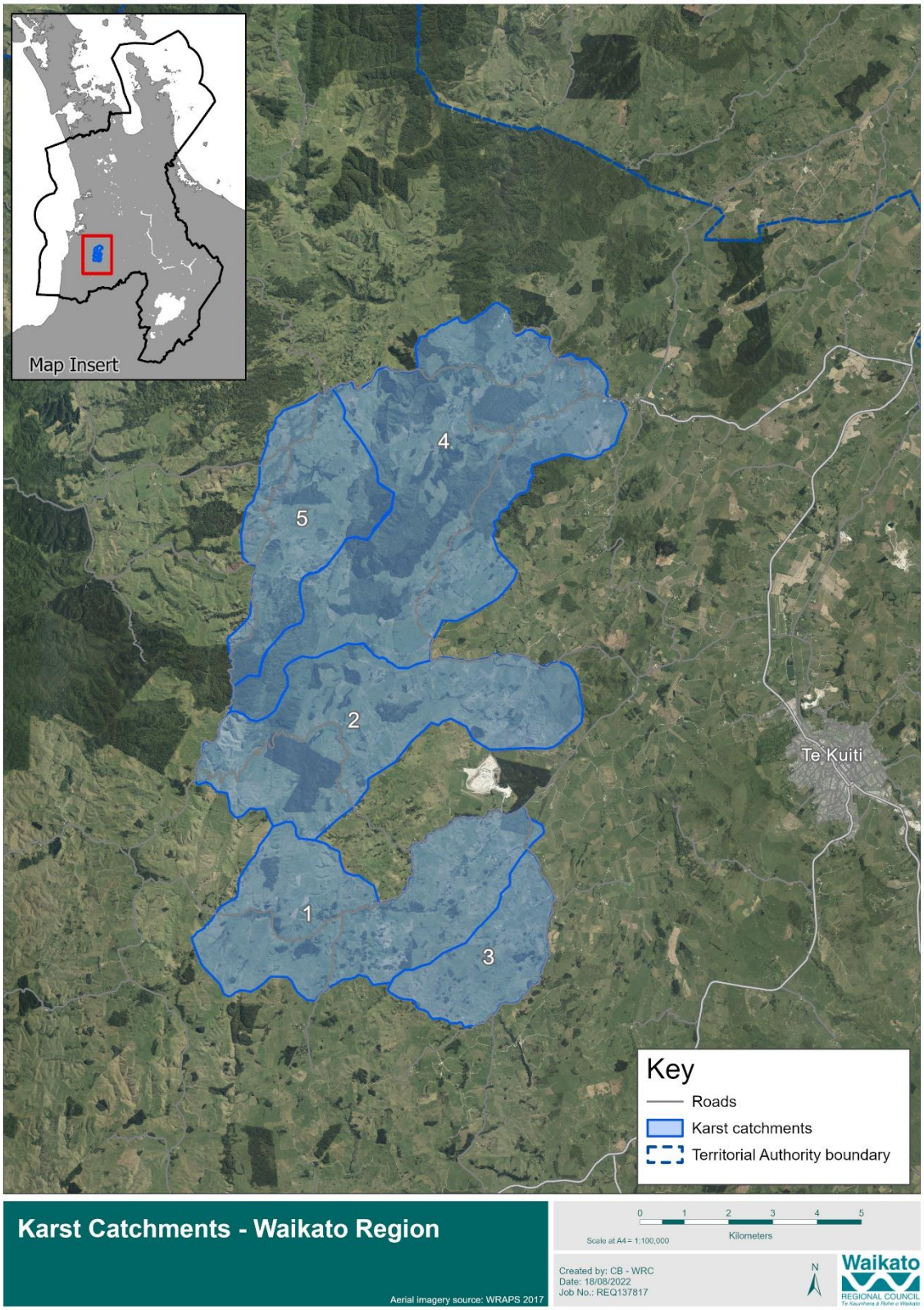

Figure 3: **Karst catchments in the Waitomo District.**

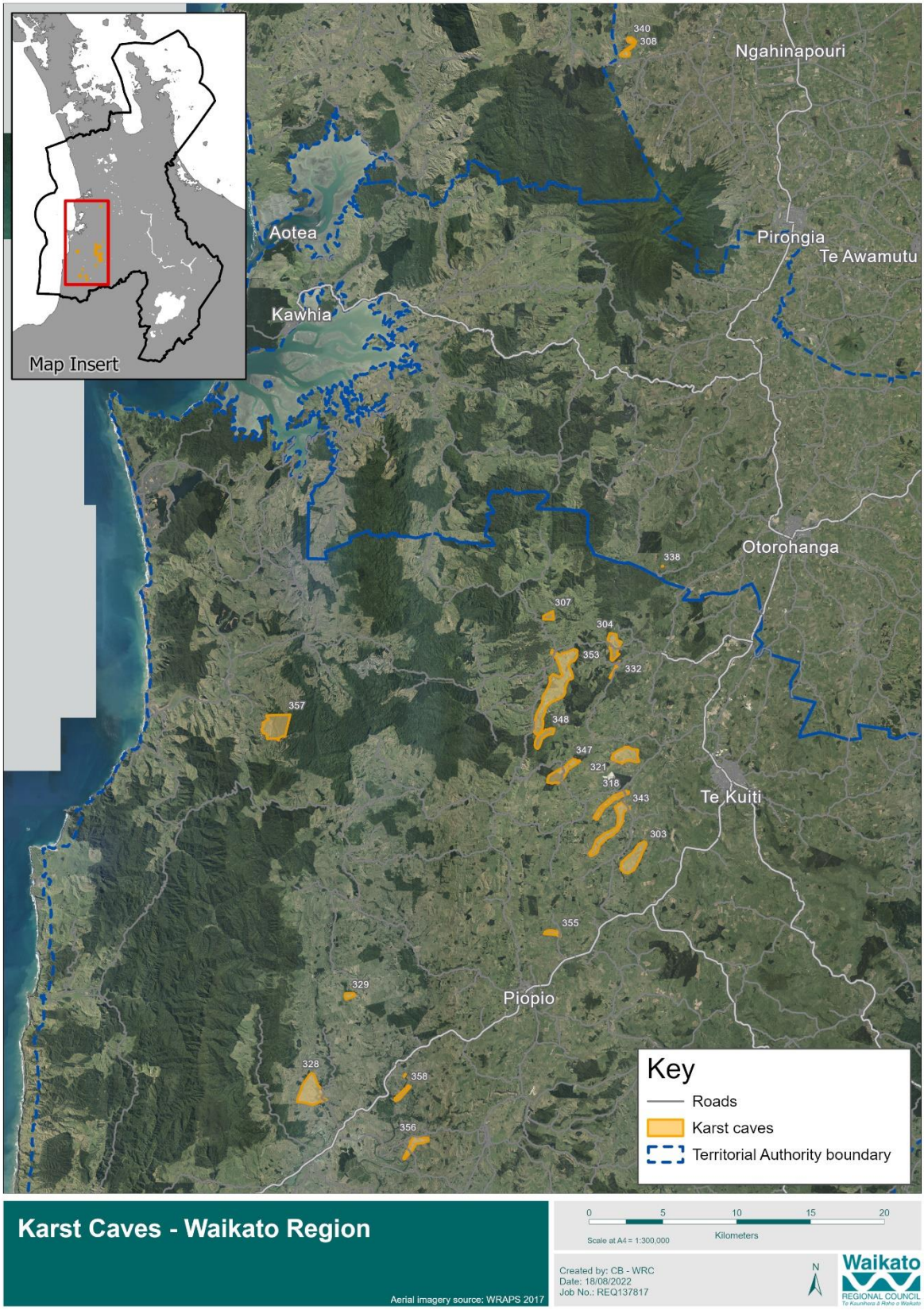

Figure 4: Karst caves in the Waitomo District.

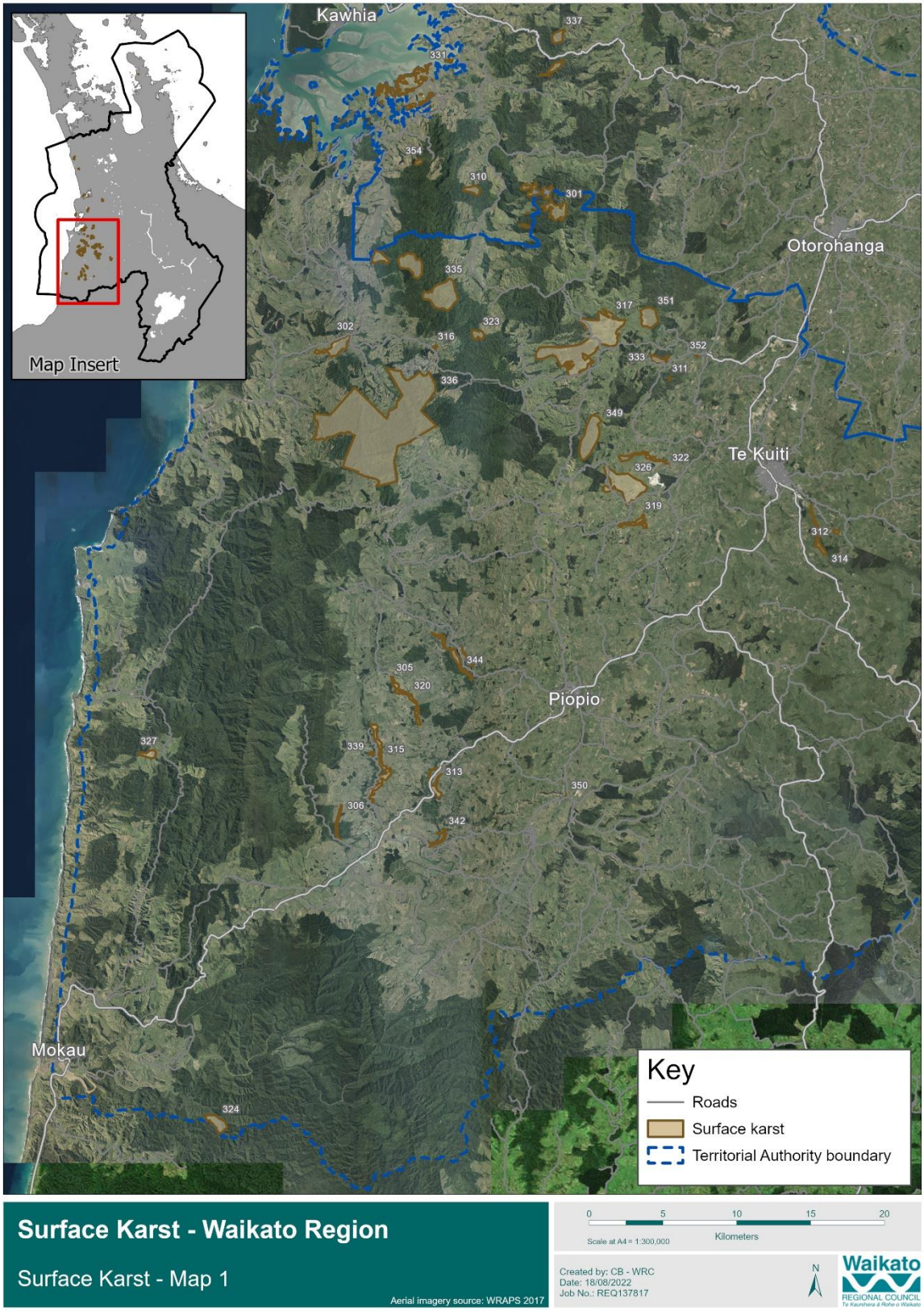

Figure 5: Surface karst (Map 1) in the Waitomo District.

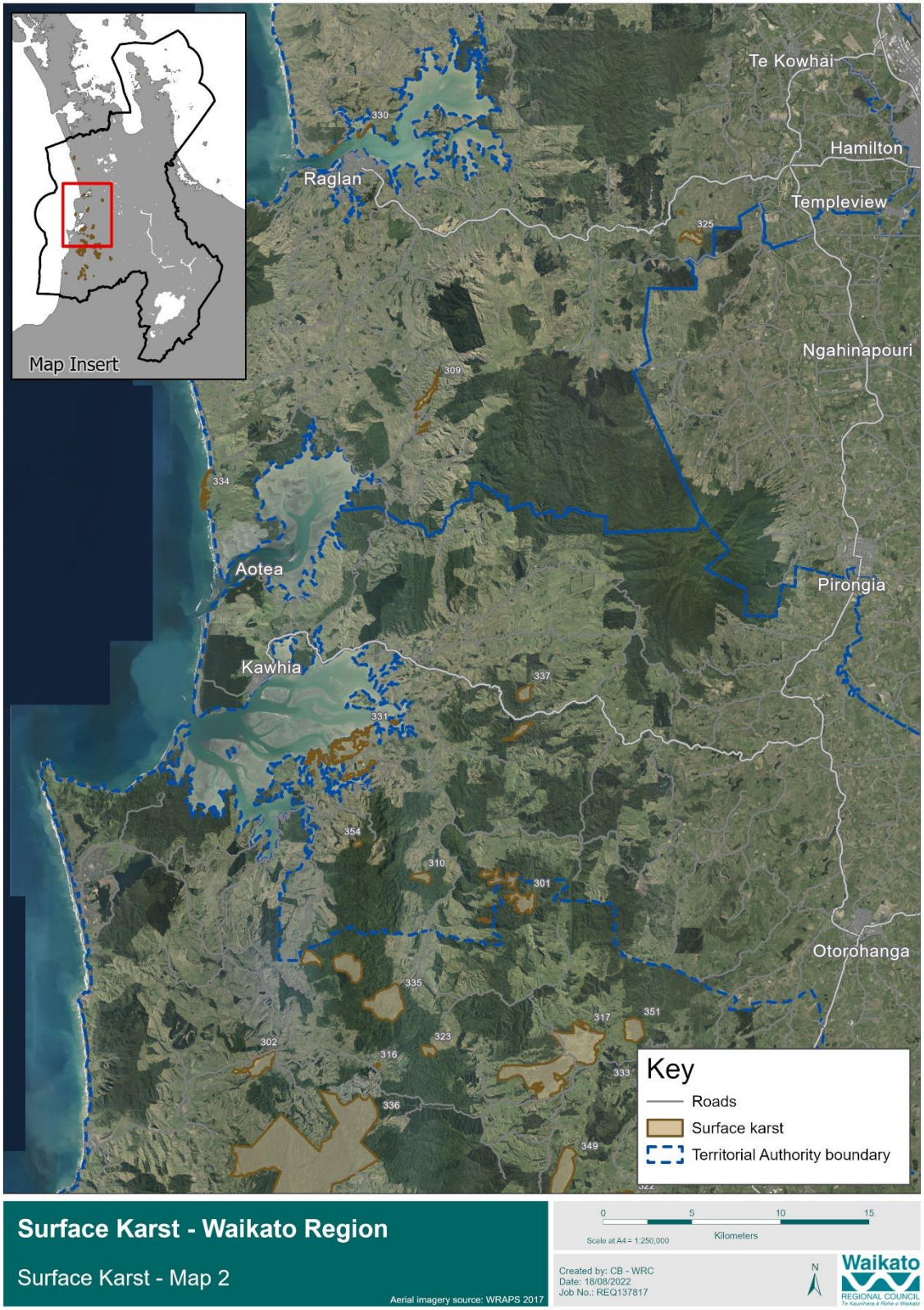

Figure 6: Surface karst (Map 2) in the Otorohanga District.

Figure 7: Surface karst (Map 3) in the Waikato District.

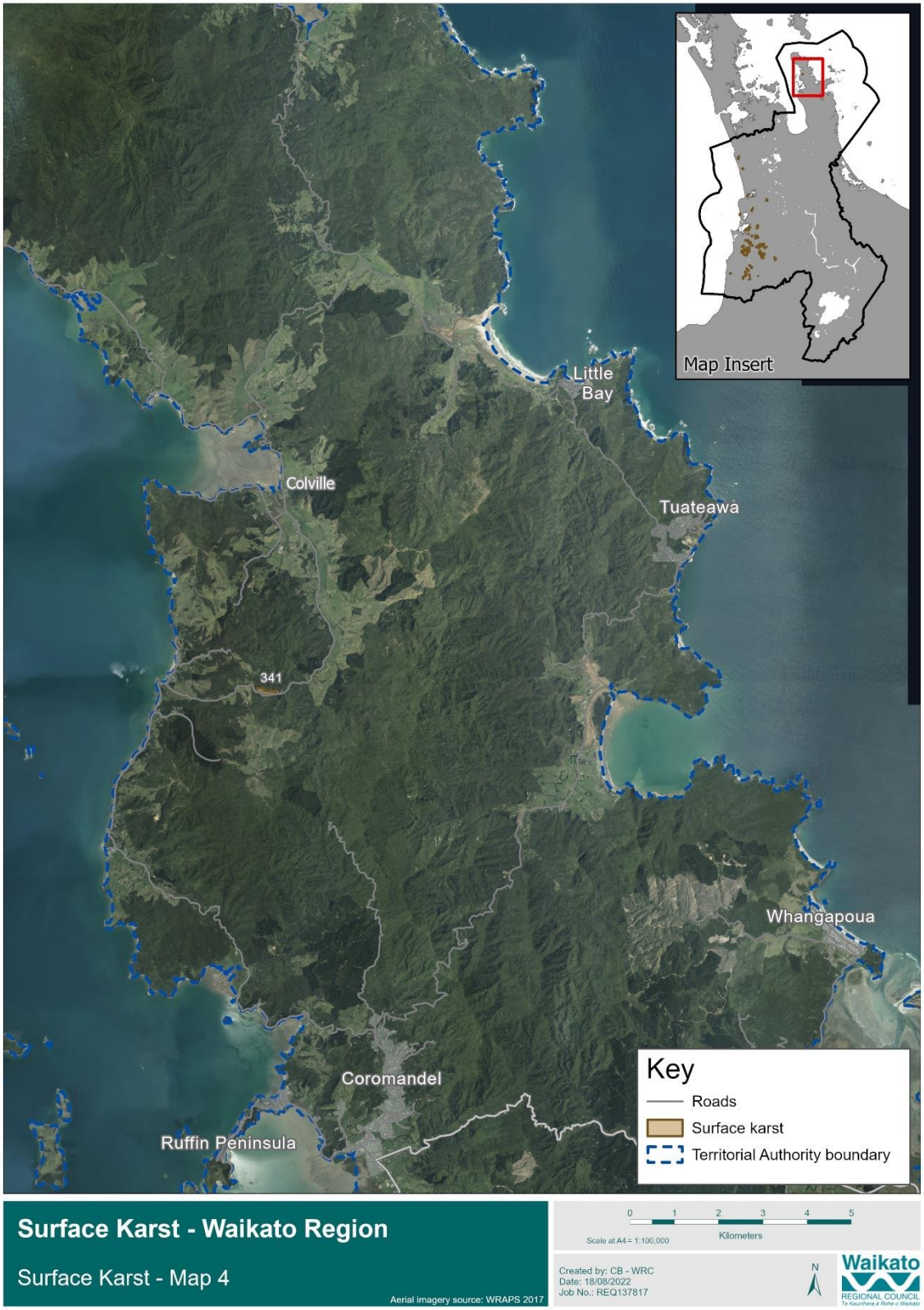

Figure 8: Surface karst (Map 4) in the Thames-Coromandel District.

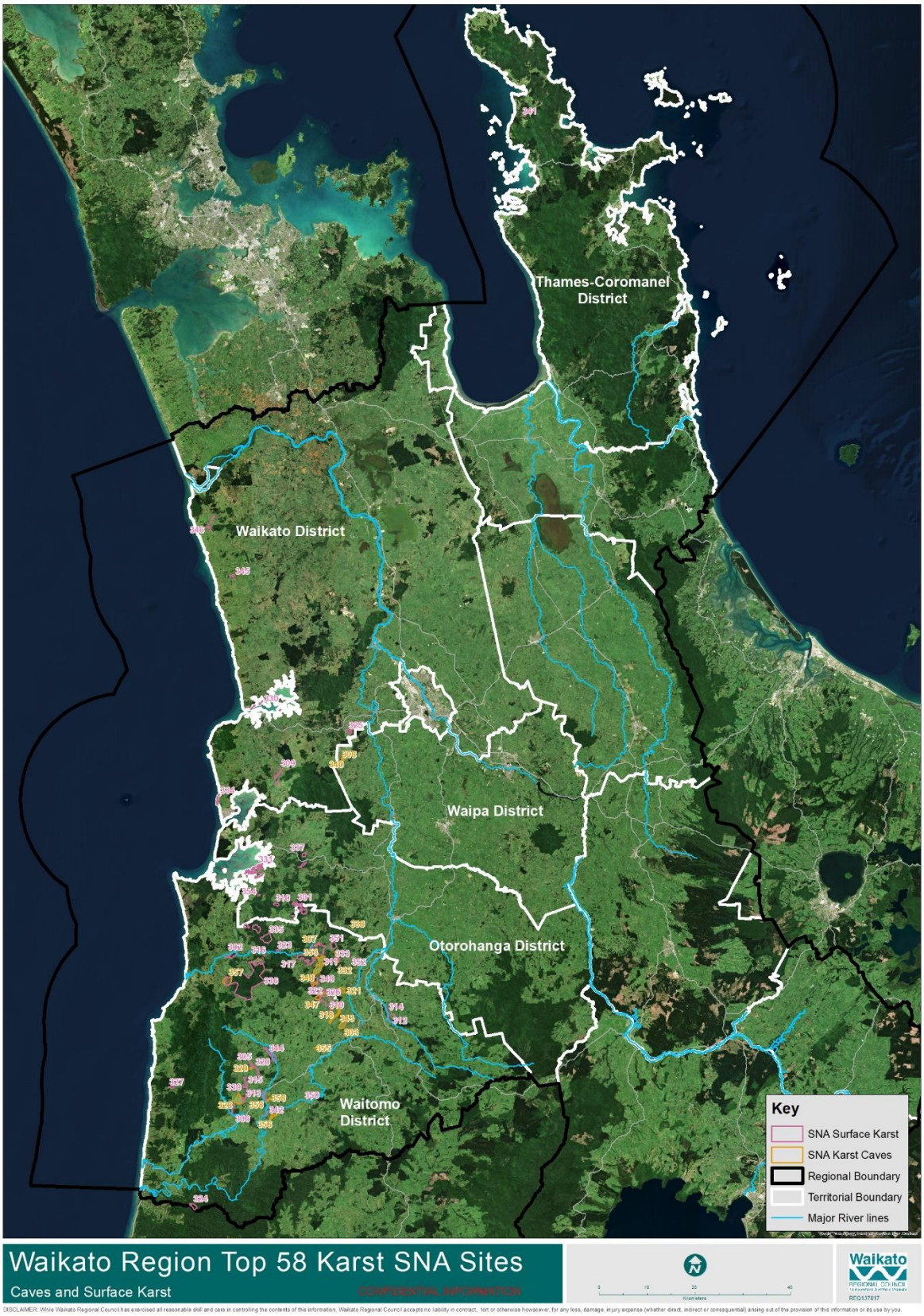

Figure 9: Location of top 58 karst SNA sites in the Waikato region.

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