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CONSERVATION PLAN FOR MAUAO HISTORIC RESERVE 2015 - VOLUME 1

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CONSERVATION PLAN FOR MAUAO HISTORIC RESERVE 2015 - VOLUME 1

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EXECUTIVE SUMMARY

Mauao is a steep-sided rhyolitic lava dome rising *c.*231 m above sea level at the main entrance to Tauranga Harbour. It was inhabited for centuries by tangata whenua[1], who have articulated their connections with waiata, whakataukī, pūrākau, tikanga and tauparapara. Mauao is managed under a joint management arrangement that includes representatives from Ngāi Te Rangi, Ngāti Ranginui, Ngāti Pūkenga, Waitaha and Tauranga City Council.

> "The vision of the Mauao Trust, on behalf of the three iwi, seeks to give full expression to the relationship that the whānau, hapū, and iwi of Ngāi Te Rangi, Ngāti Ranginui and Ngāti Pūkenga have with their maunga tapu, maunga rongonui, Mauao" (Boffa Miskell Ltd 2014).

Mauao is a Historic Reserve. It comprises a unique volcanic landform in close proximity to the coast and is a regionally significant landscape feature. Visible surface archaeological features cover most of the summit and the southern slopes of Mauao. The archaeological landscape and associated cultural values of the reserve are of particular importance as are the reasons for the classification of the area as historic reserve. The archaeological sites within the reserve are a non-renewable resource, and they cannot be rebuilt or repaired if damaged or lost. The reserve is managed and conserved in a manner consistent with the cultural and spiritual values of tangata whenua.

Although heavily modified by human activity and related fires, Mauao also retains significant ecological values. These include an important remnant of coastal forest and mainland populations of ōi and kororā. There is considerable scope for ongoing active ecological restoration of Mauao. It has many similarities to some Bay of Plenty islands (c.f. Motuhorā - Whale Island) and it offers substantial opportunities for ecological restoration and nature conservation, in conjunction with ongoing high levels of public usage. The reserve is utilised by large numbers of visitors, estimated at one million per year, who traverse the base circuit track or climb to the summit. As such it is also a regionally important recreational asset and complements other local and regional reserves such as Pāpāmoa Hills Regional Park.

This plan updates the 2004 Conservation Plan and prescribes maintenance and remedial works to continue to assist in the conservation of the archaeological landscape in the Mauao Historic Reserve. This document can also be used as a resource for the development of a Reserve Management Plan for Mauao Historic Reserve. The purpose is to care for the archaeological features so that their meaning and importance is conserved and able to be appreciated and interpreted by present and future generations. It also sets out the management required to protect and enhance the significant ecological values currently and potentially present on Mauao. It is critical that the management of cultural values, archaeological heritage, ecological restoration, recreation, and other activities are addressed in an integrated manner.

[1] A glossary of māori names used in this Plan and their english translation is provided in Appendix 11.

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Reviewed and approved for release by:

Wildland Consultants Ltd

1. INTRODUCTION

Mauao Historic Reserve is a steep-sided rhyolitic lava dome rising 231.4 m above sea level at the main entrance to Tauranga Harbour. It is a prominent and iconic landscape feature. Tangata whenua inhabited Mauao for many centuries and it has very special significance to them. Evidence of Māori occupation is widespread on the summit and the southern slopes, and the archaeological landscape and associated cultural values are of particular importance.

Mauao is protected under the provisions set out in the Mauao Vesting Act 2008[1]. The Mauao Trust was established to assist in the management of the Historic Reserve for Ngāi Te Rangi, Ngāti Ranginui and Ngāti Pūkenga. Ngā Poutiriao o Mauao is a joint management committee that includes members of the Trust and appointed representatives from Tauranga City Council.

The archaeological features in the Reserve are archaeological sites, as defined in the Heritage New Zealand Pouhere Taonga Act (2014)[2], and protected under the provisions of the Act. It is unlawful to modify damage or destroy any archaeological site without prior authority from the Heritage New Zealand[3]. There are three relevant Māori heritage sites on Mauao listed under the Heritage New Zealand Pouhere Taonga Act 2014. Two of the recorded archaeological sites are Category II registered historic places under Section 23 of the Act - Kinonui Pā (#6403) and Pā (#6401); Mauao (#9423) is classified as a wāhi tapu. Other relevant registered sites include the terraces and midden associated with the Pā, the stone steps, and stone jetty.

Mauao also retains significant ecological values and there is considerable scope for ecological restoration. Protection of archaeological features and associated cultural values, protection and enhancement of landscape values, and the protection and restoration of ecological values need to be addressed in an integrated manner. This plan provides an integrated approach to these matters, recognising exceptional levels of ongoing visitor use that Mauao is subject to.

The reserve is a 'Conservation Zone' in the Tauranga City Plan. Permitted activities in this zone include provision and maintenance of public recreational facilities, informal recreational and leisure activities, and temporary activities and commercial uses.

Initial sections in this Conservation Plan address a vision for management, key resource issues, threats to significant values, and options for future management. This is then followed by sections on management implementation, monitoring, research, and a work plan and timeline. Background resource material, including goals,

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1 By deed dated 2 July 2007, the Mauao Trust was created empowering the trustees of the trust to hold the fee simple estate in Mauao Historic Reserve in trust for Ngāi Te Rangi, Ngāti Ranginui, and Ngāti Pūkenga (http://www.legislation.govt.nz/act/public/2008/0031/latest/DLM1037702.html). Management must also be consistent with the requirements of the Reserves Act (1977), which the Mauao Historic Reserve Vesting Act 2008 falls under.

2 The Heritage New Zealand Pouhere Taonga Act 2014 replaced the Historic Places Act 1993

3 Applications for modification can be made under the New Zealand Pouhere Taonga Act 2014. Relevant sections have been reproduced in Appendix 9.

objectives, and policies from the 1998 Management Plan and the 2004 Conservation Plan, are presented in a separate companion volume.

This conservation plan should be considered in conjunction with the following companion documents:

- Ecological Assessment of Mauao Historic Reserve (Wildlands 2015);
- Cultural Values Assessment of Mauao Historic Reserve (Boffa Miskell 2014);
- The 2014 archaeological survey report (Phillips 2014);
- Crime Prevention Through Environmental Design (CPTED) and Injury Prevention Through Environmental Design and Universal Access Assessment report (Boffa Miskell 2015);
- Mauao - Mount Maunganui Management Plan (Tauranga District Council 1998). Tauranga City Council, Ngāi Te Rangi, Ngāti Ranginui, Ngāti Pūkenga, and Waitaha are consulting with the wider community with the view to rewriting the Mauao Management Plan in the near future.
- Previous Conservation Plan (Wildland Consultants 2004).

This document can also be used as a resource for the development of a Reserve Management Plan for Mauao Historic Reserve.

2. VISION[1]

Mauao is a significant cultural, traditional, historical, and spiritual site of Ngāi Te Rangi, Ngāti Ranginui, and Ngāti Pūkenga. Waitaha also have an association with Mauao. Aspirations of iwi for Mauao Historic Reserve are detailed in the Cultural Values Assessment (Boffa Miskell 2014) and are reproduced below.

2.1 Vision of Mauao Trust

Kia toitū te mana o ngā iwi o Ngāi Te Rangi, Ngāti Ranginui me Ngāti Pūkenga me o rātou hapū i runga o Mauao.

The vision of the Mauao Trust, on behalf of the three iwi seeks to give full expression to the relationship that the whānau, hapū, and iwi of Ngāi Te Rangi, Ngāti Ranginui and Ngāti Pūkenga have with their maunga tapu, maunga rongonui, Mauao.

The Trust has set out a series of aspirational statements to give effect to the vision. The following sections provide some options for implementing these aspirations.

2.2 Mission of Mauao Trust

The Trust's mission is "*Kia whakatinanatia te mana motuhake me te tino rangatiratanga o Ngāi Te Rangi, Ngāti Ranginui, Ngāti Pūkenga me o rātou hapū ki*

[1] The vision and aspirations statements of the Mauao Trust reproduced here are somewhat different to what was presented in the 1998 Management Plan and the 2004 Conservation Plan. The goals, objectives, and policies in the 1998 and 2004 Plans are still considered to be relevant, and are provided in Volume 2 (Appendix 1 and 2) of this plan.

runga o Mauao" - To empower the people of Ngāi Te Rangi, Ngāti Ranginui and Ngāti Pūkenga to exercise full ownership rights and tino rangatiratanga over the Mauao Historic Reserve.

This mission is supported by four aspirations:

- The restoration and protection of the health and wellbeing of Mauao for our future generations;
- Recognition of special relationship iwi have with Mauao;
- To give expression to the relationship of iwi with Mauao;
- Ensuring cultural significance is recognised, provided for, preserved and protected.

The restoration and protection of the health and wellbeing of Mauao for our future generations

Te tiaki me te whakaora of Mauao mo ngā whakatupurangahou.

This aspiration seeks to enhance the natural qualities of the maunga, the strong stone structure, the native bush cloak, and the habitat for native fauna, including fish and shellfish at the coastal edge. This can be achieved through being sensitive to natural features such as outcrops, steep inclines, and rough coastal edges.

The restoring of the cloak of Mauao is a metaphor for the chiefly rangatira status of the maunga. In Tauranga traditions Mauao started out as an unknown hill in the great forest of Hautere. He looked up to the great Ōtānewainuku and beautiful Puwhenua. Mauao has the status of a chiefly mountain, a cloak of native bush will be consistent with the status of the maunga. Replanting much of the maunga with native plants and trees will enhance the mauri of the maunga. The enhanced habitat will attract birds and other native animals. Complemented by a pest management programme the maunga will provide a home for many species, some of whom are considered kaitiaki. The rich tapestry of flora and fauna may facilitate customary harvest by designated whānau (kaitiaki), a sign of mana and prestige for the iwi.

Whānau, hapū and iwi members should play a role in these programmes ensuring continuity of the relationships between people and the environment.

Recognition of special relationship iwi have with Mauao

Kia whakamana, whakahuatia te hononga o te iwi ki te maunga.

The recognition of the special relationship iwi have with Mauao has been somewhat provided for in the vesting of the maunga, establishment of the joint management board and the programme of ongoing activities.

The practical and meaningful expression of this recognition is somewhat based on facilitating opportunities to express the relationship, and supporting those activities. This can be as simple as identifying and providing for a range of ceremonies and events during the year, working with a range of iwi collectives associated with the

maunga, for example Te Maunga Mauao Mataitai Reserve (Iwi Committee), Tauranga Moana Kaumatua Forum and Tangata Whenua Collective.

Acknowledgement of the relationship iwi have with Mauao, spiritually, culturally, physically, and emotionally. Giving expression to the ownership and management rights that iwi of Tauranga have, providing for that in a practical and meaningful way.

To give expression to the relationship of iwi with Mauao

Ka puawai te hōhonu me te whai rawa o ngā kōrero me ngā āhutanga ā Mauao.

This aspiration seeks to make opportunities to collect, store, develop and share the memories, stories, traditions, associations and rich history of Mauao among iwi, council, visitors and the Tauranga community. This could be achieved through a dedicated archival, oral history and collection programme, publishing material online and in print, signage, interpretation and education programmes. There is a future generation theme to this aspiration.

There are opportunities to ensure iwi members can engage with their maunga both physically, mentally and spiritually.

Ensuring cultural significance is recognised, provided for, preserved, and protected

Ko Mauao he maunga tapu, kia tūpato.

This aspiration seeks to ensure integrity and respect is afforded to the maunga and iwi regarding all works and activities on the maunga. The maunga is sacred to iwi. There is a strong desire that there are places suitable for open public access and there are places where care and sensitivity is required, and sometimes constrained. These desires need to be articulated and provided for in management plans, annual programmes, staff manuals and training, and implemented on the ground through such things as signage, formal track networks, barriers, monitoring and enforcement.

3. CULTURAL VAUES

The following values statement has been reproduced from the Cultural Values Assessment (Boffa Miskell 2014).

"There are a number of values expressed by iwi that are relatively unchanged over the years. These are derived from traditional views of the Māori world and are influenced by the aspirations to revitalise and preserve core values and principles.

- Mauao is a foundation of identity and mana for Tauranga iwi.
- *Ko Mauao te maunga, Ko Tauranga te Moana* - immediately identifies Tauranga people in time and place.
- Mauao is a metaphor for the permanence of iwi and the intergenerational connection of people, place and time.
- *E papaki kau ana ngā tai ki Mauao* reflects the permanence of the mountain against the tides and natural forces of time.

- *Pororotai, Pororouru* - Mauao is a collection of special places, with a cloak of many colours, shades and form. *He wāhi tapu* - this is a sacred place.
- *Ka hoki koe ki tō maunga, kia purea ake nei i ngā hau o Tāwhirimatea* - Return to your mountain and be revived by the winds of Tāwhirimātea. Mauao is a source of healing and spiritual sustenance for whānau.

The core values underpinning the ongoing management of the maunga are:

Rangatiratanga - the ethic of chieftainship expressed in the ownership arrangement for the historic reserve; the appointment and anointing of elders to carry trusteeship of the maunga.

Mana - the recognition and provision for control and decision-making powers for the management of the maunga.

Kaitiaki - the practical expression of guardianship through dedicated people to look after the day to day activities on the maunga and respond to ceremonial, ritual and traditional activities.

Mauri - putting in place systems, processes and programmes to restore and enhance the life-giving force of the mountain, physically, spiritually and mentally."

(Boffa Miskell 2014)

4. HISTORIC HERITAGE DESCRIPTION AND SIGNIFICANCE

4.1 History

Tangata whenua inhabited Mauao for centuries and Ngāti Ranginui, Ngāi Te Rangi, Ngāti Pūkenga, and Waitaha all acknowledge the exceptional cultural importance of Mauao, and the ways in which Mauao provides significance to the lives of the individuals, whānau, and hapū of Tauranga Moana. These relationships are an integral part of the cultural whāriki of tangata whenua, are unique to tangata whenua and are not shared - and possibly not fully understood - by other sections of the community.

It is essential that the deep attachment that the tangata whenua of Tauranga Moana have with Mauao is understood and appreciated. Mauao is steeped in legend and occupies a central and very significant place in the tribal histories of the tangata whenua, and is one of the principal ways by which tribal identity and rohe is confirmed.

The cultural history of Mauao has been summarised in the cultural assessment report prepared for Ngā Poutiriao o Mauao. The cultural assessment is a foundation document that provides information to support this Conservation Plan.

4.2 Physical features

An inventory of the archaeological features within the reserve was prepared by Ken Phillips in 2003 (Phillips 2003). In 2014 an inspection and condition assessment of the archaeological features was undertaken (Phillips 2014). The following is a brief summary of the archaeological landscape provided in Phillips 2003.

4.3 Archaeological sites

Mauao Historic Reserve contains an extensive archaeological landscape that covers approximately 40 hectares - refer to Figure 1 (derived from Phillips 2014). There are approximately 800-1,000 visible surface archaeological features within the reserve. These surface features include the components of three pa, plus associated pits, terraces, platforms, house floors, and middens. The shell mounds in the reserve are the only known surviving examples of this type of archaeological feature within the Bay of Plenty.

It must be kept in mind that the surface archaeological features are interconnected by extensive buried archaeological deposits, and that Mauao represents a primarily intact archaeological landscape. The spaces between the surface archaeological features are highly likely to contain intact buried archaeological features.

There are also several archaeological features originating from the post contact or post European period[1]. Some of these features, such as the reputed 'military camp' and the stone steps require further archival and archaeological research before their origins, functions, and significance can be fully understood.

4.4 Assessment of historic values

Heritage New Zealand has a statutory role under the Heritage New Zealand Pouhere Taonga Act (2014) to identify places of heritage value, and it has statutory authority in relation to this matter.

The following sections include discussion about the values which collectively underpin the evaluation of significance. It is possible for elements of significance to conflict. For example, the archaeological significance of a place may be defined by its potential to contribute scientific information through invasive excavation. The archaeological significance may however be the antithesis of the cultural significance of a place. The apparent conflict between significance criteria does not however, detract from the contribution each criterion makes to the overall evaluation of heritage value.

4.5 Historical significance

Mauao Historic Reserve has regional historical significance. It is associated with key historical events and individuals and is an integral part of the traditional oral histories of Tauranga Moana. Ngāi Te Rangi, Ngāti Pūkenga, Ngāti Ranginui, and Waitaha all whakapapa to Mauao and articulate their connections within their waiata, whakataukī, pūrākau, tikanga and tauparapara.

[1] 'Post contact' or 'post European' means the archaeological features originate from the period after the arrival of Europeans in New Zealand.

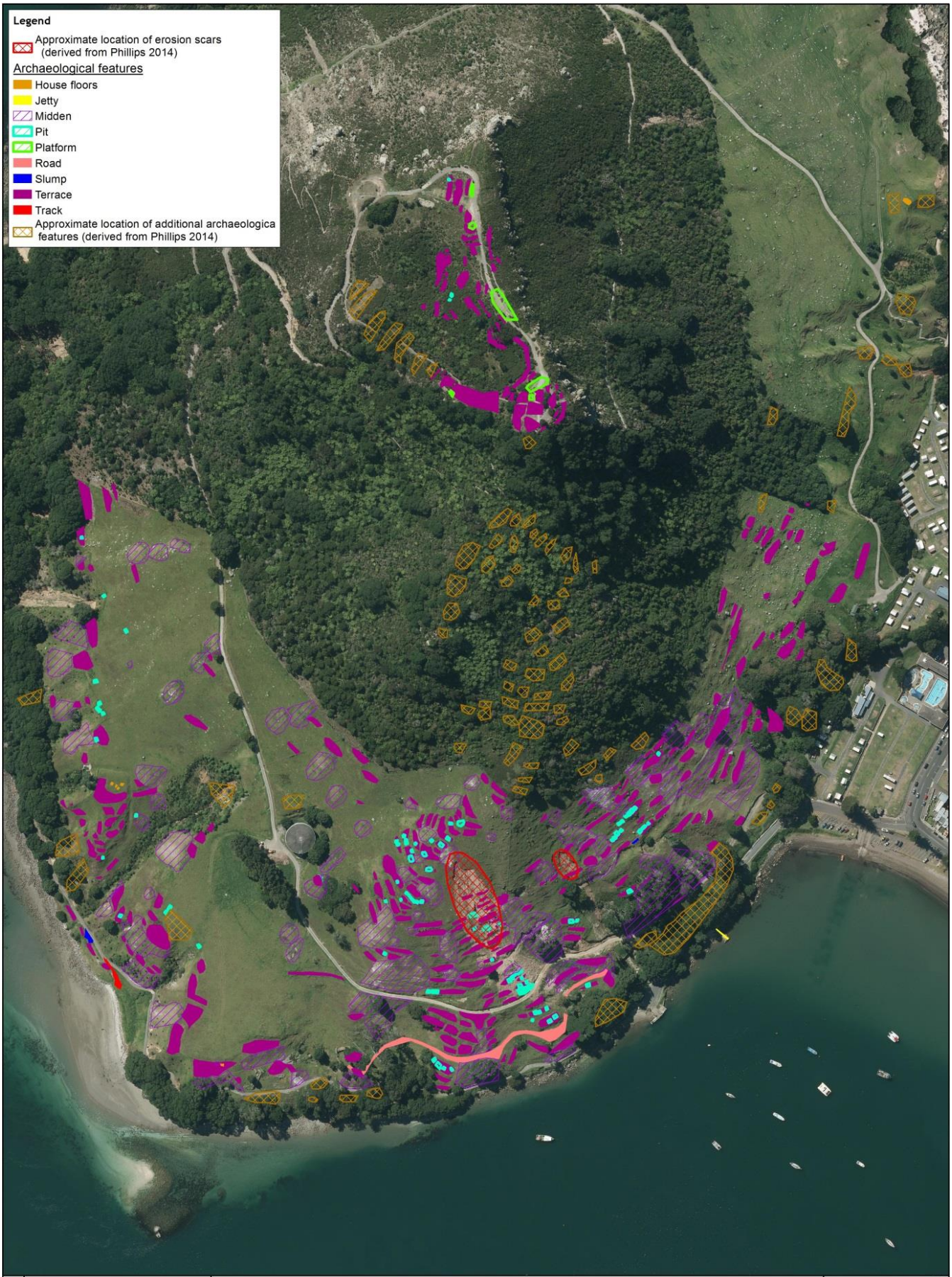

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Figure 1. Recorded archaeological features and significant erosion scars on Mauao Historic Reserve (from Phillips 2014)

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4.6 Archaeological significance

The archaeological and scientific significance of Mauao lies in its potential to contribute information to further the scientific understanding of the history of human occupation. Mauao is also significant as a physical monument of past human habitation. Mauao, as a very large open settlement complex, which also contains areas of fortification, has the potential to provide archaeological information relating to the history of both the Tauranga and wider Bay of Plenty region.

Mauao has national archaeological significance for its potential to contribute to the greater understanding of the development of human settlement patterns, the date and nature of early human settlement, the development of horticulture, and the form and function of large earthwork structures. The shell middens and shell mounds on Mauao are the largest surviving features of their type in the Bay of Plenty Region.

It is arguable that Mauao has international archaeological significance, particularly in relation to its potential to contribute to the wider understanding of the nature of human settlement within Polynesia. It is likely that many of the archaeological features have considerable antiquity, and occupation of Mauao probably spans the full period of human settlement in New Zealand. In particular, the distinct 'open space' features noted by Phillips on the western slopes (Phillips 2003) may provide considerable potential to contribute to the archaeological study of complex social, cultural and political structures.

There has been no systematic archaeological excavation undertaken at Mauao. It is likely that most of the remaining archaeological features are intact and have not suffered major stratigraphic disruption. This adds further to the overall archaeological significance of Mauao.

4.7 Cultural significance and values

Mauao has cultural, traditional, spiritual and social values closely associated with Ngāi Te Rangi, Ngāti Pūkenga, Ngāti Ranginui, and Waitaha. Archaeological features in the reserve must be conserved and managed in a manner consistent with the protection of these values. The cultural assessment completed for Ngā Poutiriao o Mauao identifies various issues and opportunities available.

5. THREATS TO ARCHAEOLOGICAL FEATURES

5.1 General

Threats to archaeological features within the Historic Reserve are principally related to natural processes, human activities, livestock grazing and management, rabbits (*Oryctolagus cuniculus*), information loss, and loss of reserve integrity and setting. Threats from natural processes are related to fire, erosion, and vegetation development. These processes inevitably interact and cannot be considered in isolation. Human impacts can be grouped as visitor impacts, machinery use, and management impacts.

There have been modifications to the physical evidence of past human occupation and use at Mauao. Modifications have occurred as a result of natural and human processes and the successive phases of occupation have undoubtedly resulted in the partial loss of physical features from earlier phases of occupation. Processes and actions which have resulted in the physical modification of features at Mauao include:

- Modification, destruction or loss of features due to overbuilding or landscape modification in subsequent occupation phases;
- Quarrying of midden;
- Access road formation;
- Water supply installations and management;
- Fencing and livestock management installations;
- Livestock grazing and trampling;
- Vegetation growth, tree root intrusion, and inappropriate plantings;
- Track formation;
- Installation of visitor facilities;
- Erosion and water run-off;
- Human foot traffic;
- Burrowing by rabbits.

Avoiding unwarranted and undesirable modification of archaeological features within the reserve is a major objective of this plan. Stabilisation of features and the avoidance of management actions which may result in the further loss of physical features and information are both key considerations.

5.2 Fire

The management of fire is relevant to and important for archaeology, ecological restoration, and all other activities on Mauao. Vegetation fire risk is influenced by a combination of climate, topography, vegetation, and ignition sources.

While a fire may not directly affect archaeological features, subsequent rainfall could damage those features by erosion. Alternatively, strong winds and extended fine weather following a fire is likely to lead to wind erosion. Machinery or firefighting tactics used in rural fire suppression, e.g. earthmoving machinery and fire line construction, can also damage archaeological features.

The risks and potential impacts of vegetation fires is relevant to all management on Mauao. Public safety, fire prevention, and pre-planning for fire control must be given a very high priority.

There has been a long history of fires on Mauao, and future fires are virtually inevitable. This is due to the combined influences of high public usage, light and highly flammable vegetation, free-draining soils[1], high summer temperatures, and dry coastal winds.

[1] The geology, soils, and landform units of Mauao have been described in the 2004 Conservation Plan and are presented in Appendix 3.

Flammable vegetation will always be a risk factor on Mauao, although this risk will reduce somewhat as the existing scrub and shrublands develop into secondary forest. There will be further reduction in fire risk as the existing grassland becomes more dominated by kikuyu (*Cenchrus clandestinum*) over time.

5.3 Erosion

Archaeological sites can be lost or eroded by natural erosion (e.g. along the coast) or through erosion triggered by human activities, such as track construction and maintenance. The southern slopes of Mauao, where most surface features are present, have been affected the most (see Figure 1). Stable slopes on the mid-slope pastoral areas appear to be increasingly affected and historical erosion events on the steep coastal escarpments and spring fed gullies have been less affected by erosion in the past decade. Sub-surface features have been exposed by erosion and slips on the southern slopes. Slip material has buried archaeological features lower down the slope (Phillips 2014).

Erosion on the southern slopes has been attributed to rainfall events but rabbit burrowing and stock tracking may also have been contributing factors.

5.4 Vegetation development

Vegetation, particularly large trees, can damage both surface and sub-surface archaeological features, destroying site information (Bowers 1998). Damage to archaeological features may be caused by root action as trees grow and the roots disrupt the stratigraphic relationship between soil horizons (layers). Damage to surface archaeological features also occurs as trees mature and disrupt the adjacent ground surface. If large trees topple as a result of windthrow further damage to archaeological features may be caused by the root plate being ripped from the ground, and the impact of the falling tree.

The low, dense grassland that covers most of the archaeological features on the southern and western slopes of Mauao provides ideal protection for surface and sub-surface archaeological features. Threats to the current vegetation cover include loss of that vegetation by fire, erosion, over-grazing, rabbit burrowing, or vegetation changes due to successional processes or weed invasion.

5.5 Visitor impacts

A high number of visitors utilise the reserve (approximately 3,500-4,000 per day in the summer months, and in total approximately one million visitors per year) and this is likely to continue to increase with local and regional population growth. Managed recreational use of the reserve is compatible with the conservation of archaeological sites, although many visitor activities have the potential to damage archaeological features. Damage can be caused by informal tracking, vandalism, excavation, bikes, and activities that concentrate large groups of people at specific points, e.g. sporting events, outdoor gatherings and school visits.

However Phillips (Phillips 2014) has indicated that pedestrian activity has had little impact on the archaeological landscape over the past decade. Public generally keep to the existing track and road network and there appears to be little evidence of adverse

effects from those that do traverse off track. Retirement of eroded track sections appeared to have controlled erosion at these sites and on the summit the public appear to keep to existing tracks and previously eroded areas. Ongoing maintenance and management will ensure there are further gains in control of visitor movement.

5.6 Machinery use

Machinery used in association with livestock management, fire control, the establishment and maintenance of tracks and roads, and the placement of interpretation panels and track markers have the ability to damage archaeological features.

Future infrastructure maintenance and construction may negatively affect the archaeological features of Mauao and should only be undertaken in consultation with Heritage New Zealand and monitored by an appropriate archaeological specialist. Archaeological monitoring of disturbed ground provides an opportunity for exposed archaeological features to be examined and researched.

5.7 Reserve management activities

The establishment of tracks, the placement of interpretation panels, track markers, the construction of fence lines and stiles, the placement of troughs for stock water, and inappropriate planting of trees may all inadvertently result in damage to surface or sub-surface archaeological features.

Fencing plans have been established, implemented and maintained under the guidance of Heritage New Zealand. Ongoing assessment, monitoring and revision of these with an approved archaeologist is important; particularly in relation to both stock management and the protection and preservation of archaeological features.

5.8 Grazing

Grazing of livestock, to maintain a protective grass cover on archaeological features, has the potential to seriously damage features through trampling and tracking. The risk to archaeological features posed by livestock grazing must be balanced carefully against the risk to archaeological features caused by a change in the existing vegetation cover.

Grazing (by sheep) is required to maintain the low pasture sward covering most of the archaeological features on the southern and western slopes of Mauao. It is currently the most suitable mechanism to maintain this part of the reserve in a vegetation cover that offers good protection to archaeological features while also providing for public viewing and appreciation of surface features. Management of grazing and associated fencing is a key requirement to stabilise features and reduce the rate of deterioration of archaeological sites on the southern and western slopes of Mauao. Some degree of ground damage due to stock trampling and tracking is always going to occur as a consequence of using grazing animals to maintain a pasture sward. This risk should be managed to restrict damage to areas where archaeological features are not affected.

Animal husbandry and welfare are also important issues. Livestock condition must be able to be maintained or improved. This is particularly important at Mauao due to the

high number of visitors to the reserve, the visibility of the livestock, and likely public concerns about animal welfare.

Damage to archaeological features can be reduced if livestock are managed carefully and monitored closely. Factors that must be considered when grazing livestock on archaeological features include:

- The age, number and species of animals used;
- Seasonal influences;
- The duration and timing of grazing;
- Placement of fences, gates, stiles, and water troughs;
- Animal behaviour (congregation of stock, trampling and tracking);
- Length of grazing rotations;
- Animal welfare and husbandry.

Phillips (2014) considers that stock management on Mauao has improved over the past decade and erosion from stock damage appears to be negligible. Fences protecting exposed middens may require relocation if stock tracking alongside fence are damaging archaeological features.

5.9 Rabbits

Grazing creates a habitat favourable for rabbits, which damage archaeological features by burrowing. The most significant damage to shell middens within the reserve is currently being caused by rabbit burrowing and scratching which breaks the pasture sward and exposes middens. Sheep then graze, camp, or track over these areas, causing further damage and loss of archaeological material. Rabbit damage is the most significant threat to archaeological features on Mauao, and implementation of a rigorous control strategy is urgent (Phillips 2014).

5.10 Information loss

The loss of archived information such as documents, photographs, and unrecorded oral history constitutes a threat to the sustainable management of archaeological features. This material provides a link with the past and is an integral component of the history of the area. Archaeological information can be lost due to ongoing erosion. As sites are eroded the integrity of the stratigraphic relationship of layers within the archaeological features is destroyed, and the opportunity to recover accurate information is lost.

The use of shell as a track aggregate has ceased. Originally shell from middens on Mauao was used to create tracks, and then shell was used from other sources in the region. The shell track aggregate became mixed with shell midden in the vicinity of the tracks. This means that the archaeological information normally able to be recovered from shell middens (by the use of techniques such as radio-carbon dating or the gathering of dietary information) is now unreliable in this part of the reserve.

5.11 Loss of reserve integrity

Intensive urban-based activities adjacent to the reserve may threaten its integrity and setting. Mauao is an historic reserve, yet it is likely that many visitors are unaware of the

historic and cultural values and significance of the place. There is significant potential to increase recognition of the historic and cultural values. Mauao could provide an outstanding example of ongoing recreational use managed compatibly with the protection of historic, cultural, and ecological values.

Methods to address threats to the integrity of the reserve setting and use are discussed in the landscape sections of this plan. Increased awareness of the values of the reserve will assist to preserve the integrity of those values. If reserve visitors are made aware of what is 'special' about the reserve, it is likely that most visitors will take greater care to ensure their actions do not threaten those values.

6. ARCHAEOLOGICAL SITE CONDITION REPORTING

Phillips (2003) undertook the first systematic archaeological survey of Mauao, identified current threats to the continued protection and preservation of the archaeological landscape, and provided general recommendations. The archaeological survey included GPS mapping of the most visible archaeological features within the reserve. This work provided the basis for an archaeological site inspection and condition assessment undertaken in 2014 (Phillips 2014).

Condition reporting for large earthwork structures that are principally archaeological sites is a technique that has been developed through work undertaken by Jones and Simpson (1995), and has been used mainly for conservation plans prepared for the Department of Conservation. The Department of Conservation has also produced guidelines for monitoring the condition of historic places, including archaeological sites (Walton 2003).

It has been found that systematic condition surveys identify factors causing deterioration of an archaeological site and leads directly to actions required to achieve stabilisation of site features. Condition reporting also documents rates of change and indicates methods appropriate to stabilise sites where detrimental changes are occurring.

6.1 Condition overview - November 2014

An archaeological inspection and condition assessment of Mauao Historic Reserve was undertaken in November 2014 (Phillips 2014). A summary statement by Phillips indicates that there have been isolated effects on archaeological features caused from erosion during severe weather events but rabbit damage is more prevalent since 2004 and is causing significant ongoing damage.

Protection and preservation of the archaeological features must also be directed by the cultural values of iwi associated with Mauao as described within the cultural values assessment (Boffa Miskell 2014).

Further detail from the Mauao archaeological inspection and condition report by Phillips (2014) is provided below:

- Erosion - Mid slopes pastoral areas on the southern side of Mauao, that have been stable for the previous 300 years, have suffered from rainfall erosion and slipping. Erosion has damaged or destroyed some surface archaeological features and has exposed a number of subsurface features.

- Pedestrian traffic - Increasing numbers of pedestrian using the track network appears to have had little negative impact on the archaeological features of Mauao. Retirement of the eroded summit track has been successful and the use of previously eroded tracks has not been exacerbated.

- Maintenance/infrastructure - Archaeological features exposed during the installation of a water main in 2010 were investigated and observations recorded. The water main was installed so that no visible surface sign remains.

- Stock management and fencing - Continued sheep grazing to maintain and enhance the archaeological landscape is encouraged. Stock movement along fence line causes minor damage to archaeological features and repositioning of some fences is recommended. Realignment of fence lines that currently intercept archaeological features should be discussed in association with appropriate stock and pasture management.

- Rabbits - Current control of rabbits is not reducing numbers on Mauao, and their impact on the archaeological features on Mauao is considered to be significant. A renewed emphasis on a pest management strategy and implementation is recommended.

7. LANDSCAPE CONTEXT AND MANAGEMENT

Key concepts for the landscape management of Mauao are discussed in this section, including the management of recreational pressure, management of exotic trees, enhancement of indigenous vegetation, management of existing amenity services, and the broad landscape context, which is an essential precursor to further work on landscape protection and enhancement. Future management needs to incorporate all of the identified landscape management issues, along with any others which may assist in the appropriate management of Mauao as a significant archaeological site and recreational destination for residents and visitors to Mount Maunganui.

7.1 Landscape context

When viewed from almost all directions, the junction between the higher slopes of Mauao covered with indigenous vegetation and the lower pastoral slopes occurs at a similar height - around the 80-100 m contour. This flat line in the landscape creates an artificial line in an otherwise natural contrast to the adjacent built up area. A terrain model of Mauao (refer to Figure 2) shows the land cover (based on 2015 Google Earth aerial photographs), the location of archaeological features, and adjoining features.

Data Acknowledgment

Image sourced from Google Earth, 2015 DigitalGlobe
Imagery date 15/04/2015

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Figure 2. Terrain, landcover and archaeological features on Mauao

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Scale: not to scale
Date: 30/07/2015
Cartographer: s 7(2)(a) - Privacy
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Remnants of indigenous vegetation tend to find more protection, and therefore have more resilience, in valleys and gullies than on the slopes of hills. When viewed in a broad context, a landscape with indigenous remnants in gully and valley systems appears more natural. At a local scale, indigenous vegetation remnants also have a greater level of resilience in conjunction with water courses. This is partly due to the often sheltered nature of water courses and the general lack of suitability for long-term sustainability of pasture. The identification of areas in the partially sheltered valleys, gullies and water courses on Mauao will highlight sites which are suitable for indigenous vegetation establishment. An obvious constraint to the establishment of vegetation in these areas is the presence of archaeological features. By partitioning off small areas of gullies and water courses adjacent to the existing indigenous vegetation indigenous vegetation establishment can occur on these sites, leading to a higher level of naturalness and aesthetic coherence in the landscape.

7.2 Management context

As a landscape feature, Mauao is undoubtedly outstanding when assessed in the context of Resource Management Act (1991). Various criteria, listed below, provide a benchmark for the assessment of landscape within the context of the Act:

- Natural science factors - the geological, topographical, ecological, and dynamic components of the landscape;
- Aesthetic values - including memorability and naturalness;
- Expressiveness (legibility) - how obviously the landscape demonstrates the formative processes leading to it;
- Transient values - occasional presence of wildlife; or its values at certain times of the day or of the year;
- Whether the values are shared and recognised;
- Value(s) to tangata whenua;
- Historical associations.

Many of these criteria are clearly met and have high values on Mauao. It is simply a matter of the relative value of each criterion. In this particular case, though, it is clearly the protection and maintenance of values associated with the archaeological and landscape features which are of primary concern, in tandem with actual and potential ecological values.

The strong contrast between Mauao and the adjacent heavily built up residential and business areas highlight the discrete landform unit as being both outstanding and appropriately well buffered from the adjacent urban centre.

Sound landscape management principles can help to protect existing archaeological features and indigenous vegetation on Mauao. Control of the very high levels of foot traffic on Mauao will be integral to the protection and enhancement of Mauao for ongoing use and appreciation by high numbers of visitors each month.

7.3 Recreational pressure

An estimated one million visitors to Mauao each year is a clear indication of its popularity as a recreation resource within close proximity to a heavily built up urban area. The pressures associated with this level of use may damage archaeological features that cannot be repaired or replaced. Identification of key pedestrian routes within the reserve have meant that sensitive areas are generally protected from unnecessary damage and visitors are channelled to sites better suited to high levels of foot traffic. Overall Phillips (2014) suggests that the effects on archaeological features from the high level of pedestrian use appear to be negligible.

If additional formal tracks are developed archaeological features could be protected using timber boardwalks to span fragile areas, or geotextile membranes could be used, overlaid with aggregate paths. These techniques may reduce the visibility of some features, but they provide for ongoing channelling of foot traffic, reducing impacts on archaeological features. The nature and extent of the archaeological features will be a key determinant in the protection of those features from any future development and damage. Each new site should be assessed based on specialist archaeological advice, and appropriate landscape management solutions developed. Ongoing track review and monitoring to ensure appropriate track use is important.

Impacts on archaeological features on the summit caused by high visitation numbers can be minimised by the use of imported track materials and the building up of an artificial track surface, rather than cutting into the existing ground surface.

7.4 Exotic tree management

The current Management Plan (Tauranga City Council 1998[1]) for Mauao provides a clear intent to protect and enhance the natural character of the reserve. In the context of the Resource Management Act (1991), indigenous plants and fauna are considered to have a higher level of natural character than exotic equivalents. Historically, exotic vegetation has been used on Mauao for screening existing amenities, for erosion control, and for shelter. Exotic trees may be a faster solution for landscape screening in some situations, however a key management objective is to maintain and enhance the natural character of the reserve and the phasing out of exotic trees and replacement with suitable native species is clearly appropriate. This approach can be used in conjunction with other methods to reduce the prominence of existing amenities, e.g. painting the existing infrastructure to colours more appropriately landscape sensitive.

By continuing to phase out exotic trees[2] and replace them with indigenous species, the natural character and indigenous restoration efforts will be enhanced. Reducing competition from weed species is an essential prerequisite for the restoration of indigenous vegetation.

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[1] Tauranga City Council, Ngāi Te Rangi, Ngāti Ranginui, Ngāti Pūkenga, and Waitaha are consulting with the wider community with the view to rewriting the Mauao Management Plan in the near future.

[2] Consultation may be required to determine the historic significance of any old exotic specimen trees.

Where large exotic trees are removed and replaced with potentially large indigenous specimens; the replacement tree should be planted in the immediate vicinity of the former tree's root plate. This will reduce the probability of new disturbance to intact archaeological deposits, because new tree root action will be concentrated in the area already disturbed by the growth of the previous tree.

7.5 Indigenous vegetation management

Establishment of indigenous vegetation can assist in the achievement of many of the management objectives for Mauao. Enhancement of natural character is an obvious benefit from the establishment of further indigenous vegetation. Other benefits which aren't so obvious, but are also relevant, include:

- The control of pedestrian traffic (use of prescribed Crime Prevention Through Environmental Design (CPTED) planting in appropriate places will also reduce any perceived fear or perceived incidences of crime on the maunga);
- The re-establishment of a natural vegetation edge for existing areas of native vegetation;
- The stabilisation of erosion-prone slopes;
- The screening and enhancement of existing amenities, wāhi tapu, and other important sites;
- Support the intent of tangata whenua to enhance the mauri of the maunga.

7.6 Other landscape management issues

Although the stockyards are outside the Mauao Historic Reserve cadastral boundary consideration should be given to screening this area from the public below to provide an increased perception of the naturalness of the maunga.

8. VEGETATION

8.1 Pre-human

Prior to human occupation Mauao would have been covered almost entirely with coastal forest dominated by pōhutukawa (*Metrosideros excelsa*), pūriri (*Vitex lucens*), karaka (*Corynocarpus laevigatus*), ngaio (*Myoporum laetum*), houpara (*Pittosporum crassifolium*), and kānuka (*Kunzea robusta*), and shrubs or small trees of karo (*Pittosporum crassifolium*), houpara, māpou (*Myrsine australis*), whau (*Entelea arborescens*), and nikau (*Rhopalostylis sapida*). There are also likely to have been local occurrences of rimu (*Dacrydium cupressinum*), northern rātā (*Metrosideros robusta*), tawa (*Beilschmiedia tawa*), hīnau (*Elaeocarpus dentatus*), rewarewa (*Knightia excelsa*), mangeao (*Litsea calicaris*), and kamahi (*Weinmannia racemosa*). Specialist species, such as *Euphorbia glauca*, would have been present on bluffs, beaches, coastal rocks and seepages.

8.2 Human-induced change

People lived on Mauao for many centuries and they had a dramatic effect on the vegetation:

"The most elaborate fortified sites in the region were at Maunganui, Mangatawa and on the hills at Pāpāmoa. Maunganui, an isolated mount protected by the sea on all sides except the narrow sandy isthmus to the east, was an ideal site for a large fortified village. The main village was on the south side and the remnants of extensive terracing and numerous middens testify to its long occupation."

(Stokes 1980)

Fire will have been an important factor in the ecology of Mauao since human occupation and there may have been occasional natural fires prior to human arrival. Natural vegetation is rarely static but the frequency of post-human arrival fire has had negative impacts on both vegetation and fauna. The original vegetation will have been cleared at an early stage, and fire would have been used repeatedly to keep Mauao relatively open. Pre-European vegetation was mapped as "fern and mānuka (*Leptospermum scoparium*) scrub" (Stokes 1980). A large fire was reported in November 1842 (Cunningham and Musgrave 1989) and an 1858 illustration shows the southern and western slopes devoid of heavy vegetation (Plate 1 in Wildland Consultants 1999). Oblique photographs of the eastern slopes of Mauao in 1929, 1940s, and 1960 are also presented in Wildland Consultants (1999). In 1929 the vegetation was low but by the 1940s pines were well established and were very prominent by 1960.

From analysis of aerial photographs from 1943 to 1999 it is evident that fire has affected the vegetation of parts of Mauao at reasonably regular intervals over the last 60 or so years. Evidence of most recent fire-related vegetation change is confined to the northern flanks of Mauao, with a different extent affected within the same general area by each episode. Most of the indigenous-dominant vegetation on the southern and western slopes has not been affected by fire since 1943, probably reflecting the slightly damper environment on these slopes and the lower flammability of the more advanced vegetation successions. In the 1943 aerial photograph earlier successional vegetation is evident over a reasonably large area (Wildland Consultants 1999). There is no evidence of fire between 1943 and 1959, as shown by a large increase in the numbers of pines (*Pinus* sp.) in the vicinity of the summit and in the area affected by fire prior to 1943.

From interpretation of aerial photographs taken in 1977 it appears that between 1959 and 1977 only a restricted area on the upper northern slopes was affected by fire. However, Cunningham and Musgrave (1989) noted that "fires in the mid-1960s were particularly severe" and that the road to the summit was constructed in the late 1960s to provide vehicle access for firefighting.

The 1996 aerial photograph shows evidence of an earlier major fire and this is supported by an article in the Bay of Plenty Times Supplement (26 May 1987) which documents a planting expedition in response to a "disastrous fire early this year". The area affected by this fire was still clearly evident on the 1996 aerial photograph, with a large area of gorse (*Ulex europaeus*)-dominant vegetation. There was a major fire in

December 1997 which burnt nearly all of the gorse-dominant vegetation and also some vegetation that was not burnt in 1987.

From comparison of the 1943 and 1999 vegetation maps it is apparent that there have been significant changes to the vegetation over the last 56 years. Major changes are summarised below:

- Much of the scrub on the western and southern slopes in 1943 has developed into treefernland, treeland, and forest.
- The area of pasture has diminished.
- Exotic treeland is no longer present on upper slopes.
- The restricted area of pōhutukawa treeland and forest present along the western slopes in 1943 has developed into a larger area of indigenous forest.
- The extent of pōhutukawa treeland on the coastal margin has increased.

Recent fires on Mauao, with the notable exception of the two most recent ones, appear to have occurred at 10-15 year intervals (pre-1943, mid-1960s, 1987, 1997, 2003), and have all occurred in the same general area; on the northern slopes. The January 2003 fire destroyed an extensive area of vegetation on the northern slopes.

8.3 Present day vegetation

Vegetation and habitats on Mauao comprise a mosaic of vegetation types including regenerating forest, scrub, shrubland, and grazed pasture, with small pockets of remnant indigenous vegetation (predominantly large, old pōhutukawa). Sixteen broad vegetation and habitat types were identified and mapped in November 2014 (see Figure 3, derived from Wildland Consultants 2015) and are listed below. Full descriptions of each type are presented in Appendix 4, a list of vascular plant species recorded on Mauao is presented in Appendix 5 and a glossary of plant names in Appendix 10.

1. Pōhutukawa forest (8.0 ha)
2. Pōhutukawa/māhoe-mamaku-hangehange forest (12.7 ha)
3. Mānuka-(Spanish heath)-(whararikí) shrubland (6.3 ha)
4. Mixed exotic-indigenous scrub and shrubland (2.8 ha)
5. Māhoe forest and scrub (2.8 ha)
6. Pōhutukawa-mixed indigenous species forest, treeland, and scrub (3.8 ha)
7. Planted indigenous species forest/treeland/scrub/shrubland (4.8 ha)
8. Pōhutukawa treeland (2.7 ha)
9. Mixed indigenous species scrub (1.8 ha)
10. Mixed exotic and indigenous species forest and treeland (2.4 ha)
11. Rocky bluffs (1.0 ha)
12. Close-cropped grassland and paths (0.8 ha)
13. Rocky promontory (0.2 ha)
14. (Wīwī)/bracken-pōhuehue-cocksfoot shrub-grassland (0.1 ha)
15. Shallow gully (<0.1 ha)
16. Pasture (26.1 ha)

8.4 Vegetation succession

In 1999 large dead gorse was present in the understorey of many of the secondary indigenous vegetation types indicating that over time an indigenous canopy has developed through the gorse. It is also evident that a range of indigenous species have established within stands of gorse. If fire can be prevented, natural regeneration and succession will proceed relatively rapidly on sites without domestic stock. The relatively rapid rate of this succession is indicated by the significant degree of change between 1943 and 1999. A key element for the successful revegetation of Mauao is to allow and encourage this naturally rapid rate of vegetation development. Pōhutukawa should continue to be a prominent element on Mauao and it is a key component in the planting schedules provided below.

8.5 Grazing

It is not clear when grazing of domestic stock was first undertaken on Mauao but it was most likely early last century or even the later part of the 1800s. An undated manuscript held in the Tauranga Library ("Taina" - Visions of Boyhood) relates to early childhood and notes that "mānuka clad its upper slopes, with many magnificent pōhutukawa and karaka in groves, or clinging above the rocky shores". It also records an observation of a "boundary rider whose job was to keep the cattle that grazed the Mount from straying".

A 1930 photograph in Cunningham and Musgrave (1989) appears to show low vegetation only over the eastern slopes, and pasture was present on the lower slopes in the early 1930s (W.T. Davies pers. comm. 2004). At that time the 'scrub line' was apparently similar to the present day, and rabbits were abundant in the grassland.

8.6 Tracks and planting

The summit track was built in 1898 (Bellamy 1982) and there has been a long history of planting, extending back to the 1880s (Cunningham and Musgrave 1989) and the early 1900s (Bellamy 1982). Apparently many of the 1880 plantings were destroyed by fire (Cunningham and Musgrave 1989). These later authors also note that there were regular Arbor Day excursions from Tauranga in the late 1880s to plant trees, including one led by a J.C. Adams who also took scouts to the summit and had them use catapults to scatter karaka berries in all directions!

8.7 Flora

The flora of Mauao includes at least 345 species, of which 165 are indigenous and 180 are adventive (Appendix 5). Of the 165 indigenous species recorded from Mauao, three are considered to be Threatened or At Risk nationally (de Lange *et al.* 2013): Holloway's crystalwort (*Atriplex hollowayi*) (Threatened-Nationally Critical), *Pimelea tomentosa* (Threatened-Nationally Vulnerable), and native spinach (*Tetragonia tetragonioides*) (At Risk-Naturally Uncommon). Only one of these was seen during the 2014 survey - native spinach was observed on the southern sandy

Legend

Project area boundary

Vegetation and habitat types

1a-c. Pōhutukawa forest

2. Pōhutukawa/māhoe-mamaku-hangehange forest

3. Mānuka-(Spanish heath)-(whararikī) shrubland

4. Mixed exotic-indigenous scrub and shrubland

5. Māhoe forest and scrub

6. Pōhutukawa-mixed indigenous species forest, treeland, and scrub

7a-g. Planted indigenous species forest/scrub/ treeland/shrubland

8. Pōhutukawa treeland

9. Mixed indigenous species scrub

10a-d. Mixed exotic and indigenous species forest and treeland

11. Rocky bluffs

12. Close-cropped grassland and paths

13. Rocky promontory

14. (Wīwī)/bracken-pōhuehue-cocksfoot shrub-grassland

15. Shallow gully

16. Pasture

N

Data Acknowledgment

Maps contain data sourced from LINZ
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Imagery sourced from BOPLASS Ltd 2011

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Figure 3. Vegetation and habitat types on Mauao, November 2014

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Scale: 1:4,000
Date: 29/07/2015
Cartographer:
Format: A3

beach beneath pōhutukawa. *Pimelea tomentosa* was not seen during the current survey and was last reported from Mauao in 2004. The record of Holloway's crystalwort (Beadel *et al*. 2009) is a historic record, and this species is not currently present.

Several species that are regionally uncommon in the Bay of Plenty Region (as per Beadel 2009) are present on Mauao. *Astelia banksii* is present on the western and northern lower slopes beneath pōhutukawa forest. *Lepidosperma laterale* is present within indigenous forest and scrub on the southern slopes of Mauao. This species is near its southern limit, and is found at only two other sites in the Bay of Plenty Region (Wildland Consultants 2008). *Oxalis rubens* is present on the eastern, coastal fringe of Mauao beneath pōhutukawa treeland. *Psilotum nudum* is present on the rock bluffs on the north-western side of Mauao, which is one of the few known coastal occurrences of this species in the Bay of Plenty (Wildland Consultants 2008). *Tetraria capillaris* is present on the margins of secondary scrub on the northern upper slopes of Mauao. *Zoysia pauciflora* is present just above the small saltmarsh herbfields on the rocky margins on the north-eastern side of Mauao.

Mangemange *(Lygodium articulatum*), whilst not regionally uncommon, is of very limited distribution in Tauranga Ecological District and is only known to be present in the District on Mauao.

Of the 180 adventive species, five are historical records that have not been observed on Mauao since 1984 (Wilcox and Ecroyd 1984) and some or all of these five species may no longer be present. The large range of species reflects the wide range of habitats present, ranging from rocky foreshore, to gentle hill slopes, to cliffs. Exotic species also occur widely in most of these habitats, in part due to the history of disturbance on Mauao, and also the close proximity to an urban centre. Twenty-five species present are listed in the Bay of Plenty Regional Pest Management Plan, and a further 30 are considered environmental weeds that should be controlled for indigenous biodiversity values. The distribution, abundance, and priority status for control of these species on Mauao is described in greater detail below.

8.8 Environmental weeds

Fifty-four adventive plant species considered to be environmental weeds have been recorded on Mauao. Nineteen of these species are listed in the Bay of Plenty Regional Pest Management Plan (Bay of Plenty Regional Council 2011) (Table 1 and mapped in Figure 4). Two species, buddleia (*Buddleja davidii*) and Khasia berry (*Cotoneaster simonsii*), have not been recorded since 1984 (Wilcox and Ecroyd 1984) and are unlikely to still be present.

Table 1: Environmental weeds recorded on Mauao, their status in the Bay of Plenty Regional Pest Management Plan, and relative priorities for control[1].

Key: * Distribution mapped on Figure 4.

Scientific Name	Common Name	RPMP Status	Priority for Control
Acacia mearnsii	Black wattle*		High
Ailanthus altissima	Tree of heaven*	Restricted pest	High
Arctotheca calendula	Cape daisy*		High
Asparagus asparagoides	Smilax*	Restricted pest	High
Asparagus scandens	Climbing asparagus*	Restricted pest	High
Chrysanthemoides monilifera	Boneseed*	Containment pest	High
Cortaderia jubata	Purple pampas	Restricted pest	High
Cortaderia selloana	Pampas*	Restricted pest	High
Cotoneaster glaucophyllus	Cotoneaster*		High
Crataegus monogyna	Hawthorn*		High
Eriobotrya japonica	Loquat*		High
Delairea odorata	German ivy		High
Dipogon lignosus	Mile-a-minute	Restricted pest	High
Euyonomus japonicus	Japanese spindleberry*	Restricted pest	High
Gomphocarpus fruticosus	Swan plant*		High
Hakea sericea	Prickly hakea		High
Hedera helix	Ivy		High
Hedychium gardnerianum	Kahili ginger*	Containment pest	High
Ligustrum lucidum	Tree privet*	Restricted pest	High
Ligustrum sinense	Chinese privet*	Restricted pest	High
Lonicera japonica	Japanese honeysuckle*	Restricted pest	High
Lycium ferocissimum	Boxthorn*		High
Metrosideros excelsa × *M. kermadecensis*	Põhutukawa × Kermadec põhutukawa*		High
Paraserianthes lophantha	Brush wattle*		High
Passiflora edulis	Black passionfruit		High
Phoenix canariensis	Phoenix palm*		High
Pinus pinaster	Maritime pine	Restricted pest	High
Pinus radiata	Radiata pine*	Restricted pest	High
Pinus species	Wilding pine*	Restricted pest	High
Rhanmus alternus	Italian evergreen buckthorn*		High
Senecio angulatus	Cape ivy		High
Solanum mauritianum	Woolly nightshade*	Containment pest	High
Trachycarpus fortunei	Chinese windmill palm*	Restricted pest	High
Tradescantia fluminensis	Tradescantia	Restricted pest	High
Acacia dealbata	Silver wattle		Medium
Berberis glaucocarpa	Barberry		Medium
Erica lustianica	Spanish heath*		Medium
Hakea salicifolia	Willow-leaved hakea		Medium
Rosa rubiginosa	Sweet briar*		Medium
Rubus fruticosus	Blackberry*		Medium
Acer pseudoplatanus	Sycamore maple		Low
Alnus glutinosa	Common alder		Low
Chamaecytisus palmensis	Tree lucerne		Low
Cornus capitata	Strawberry dogwood*		Low
Erigeron karvinskianus	Mexican daisy*		Low
Lupinus arboreus	Lupin		Low
Miscanthus nepalensis	Himalaya fairy grass		Low
Nerium oleander	Oleander		Low
Quercus robur	English oak*		Low
Roldana petasitis	Velvet groundsel		Low
Solanum marginatum	White-edged nightshade		Low
Teline monspessulana	Montpellier broom*		Low
Ulex europaeus	Gorse*	Containment pest	Low
Yucca gloriosa	Yucca*		Low

[1] Priorities for control are further discussed in Section 10.5.1 of this Plan.

Figure 4. Weed distribution on Mauao, November 2014

8.9 Previous vegetation restoration/enhancement projects

Since the early 20th century there have been numerous attempts to beautify or enhance Mauao by the clearing of "weed" species and the planting of other exotic species. Plantings of hawthorn (*Crataegus monogyna*), several pine species (*Pinus* spp.), sycamore (*Acer pseudoplatanus*), eucalyptus (*Eucalyptus* sp.), and poplar (*Populus* spp.) have also occurred, although the purpose of most of these plantings is not known (Tauranga District Council 1998). Over the past 120 years there also have been attempts to restore the native vegetation on Mauao, and this has included planting of tōtara (*Podocarpus totara*), ngaio, kauri (*Agathis australis*) (probably not found naturally on Mauao), and pōhutukawa, scattering of karaka berries as well as planting them, and distribution of seed of a variety of species (Wildland Consultants 1999).

The regular occurrence of major fires on Mauao has kept large areas of the northern and eastern slopes open, or covered in a low scrub that has been dominated by gorse (Wilcox and Ecroyd 1984) and pampas (*Cortaderia selloana*) (Wildland Consultants 1999). The prevalence of these two species is due to their ability to spread highly viable seed rapidly, and their tolerance of extremely dry conditions. Over recent years attempts have been made to clear and restore some of the areas dominated by gorse and pampas, by herbicide treatment of both species and planting the area with natives such as mānuka and kānuka, along with a variety of other shrub species.

Possums (*Trichosurus vulpecula*) and rabbits are the greatest mammalian threats to indigenous vegetation. Possums damage the crowns and young shoots of established trees, especially vulnerable species such as pōhutukawa, as well as browsing seedlings and saplings. Possum numbers on Mauao are low (Wildland Consultants 2015). Rabbits graze seedlings of any palatable species, especially in open areas and are very common on Mauao (Wildland Consultants 2015).

8.10 Future vegetation management

Vegetation management must be integrated with other key uses of the reserve, such as protection of archaeological features, protection of wāhi tapu, restoration of areas damaged by fire, landscape management, visitor management, and fauna management. Key issues are:

- Protection and/or enhancement of wāhi tapu sites using indigenous plantings to either restrict public access to selected areas, or, to increase public awareness.
- Protection of existing areas of indigenous vegetation, while recognising that some local management of vegetation development may be required to protect significant archaeological features.
- Re-establishment of indigenous vegetation on areas recently damaged by fire, without creating increased fire risk.
- Creation of a linked margin of pōhutukawa-dominant forest around the base of Mauao.

- Localised planting to 'soften' existing straight vegetation boundaries that cut across the mid-slopes of Mauao.
- Retention of pasture in key areas of archaeological landscape.
- The staged removal of planted and wilding exotic trees.
- An ongoing need for the control of a diverse suite of invasive environmental weeds.
- The need for ongoing monitoring of vegetation extent and condition, and weeds.
- The need for ongoing review of vegetation management.

9. FAUNA

9.1 Avifauna

Mauao supports a wide range of terrestrial and coastal birds (Appendix 7). There are three groups of bird species that utilise the site:

- Seabirds that roost and/or breed on Mauao, e.g. kororā (northern blue penguin; *Eudyptula minor iredalei*), ōi (grey-faced petrel; *Pterodroma macroptera gouldi*) and pied shag (*Phalcrocorax varius varius*).
- Land and bush birds that reside on Mauao, e.g. spur-winged plover (*Vanellus miles*) and North Island fantail (piwakawaka; *Rhipidura fuliginosa placabilis*).
- Seasonal or irregular visitors, e.g. shining cuckoo (pipiwhauraroa *Chrysococcyx lucidus*), pihoihoi (New Zealand pipit; *Anthus novaeseelandiae*), reef heron (*Egretta sacra sacra*), and kārearea (New Zealand falcon; *Falco novaeseelandiae*).

Mauao is important for two seabird species that breed here - kororā and ōi. The following describes the local populations.

<u>Kororā (blue penguin)</u>

Kororā are classified as At Risk-Declining (Robertson *et al.* 2013). Three key sites are present within the Tauranga area: Mauao, Moturiki (Leisure Island), and Motuotau (Rabbit Island). These sites are thought to support *c.*300 pairs, *c.*100 pairs, and *c.*200 pairs respectively (Dave Richards, pers. comm., in Sievwright 2014). Seventy-four occupied burrows were found on Mauao during a Masters research programme in 2012-2013 (Sievwright 2014). The distribution of kororā is relatively continuous around Mauao and burrows are primarily within *c.*10 m or so of Mean High Water Spring (MHWS). However, some burrows are present in the forest and grasslands of the lower slopes, and were possibly originally constructed by rabbits (Winter 2000).

Ōi (grey-faced petrel)

Ōi are classified as Not Threatened (Robertson *et al.* 2013). However, colonies of burrowing petrels are very rare on the New Zealand mainland due to the presence of mammalian predators. As such, the presence of ōi on Mauao is ecologically significant. Colonies are also present on Motuotau (Jones *et al.* 2011) and Motuhorā (Whale Island), with the population on Motuhorā estimated to number *c*.95,000 pairs in 2003 (Imber *et al*. 2003). On Mauao, ōi burrows are found on the lower slopes in areas of pōhutukawa forest/treeland with some burrows occurring in grazed pasture. The colony has approximately 200 pairs of birds.

Other Bird Species

A further 11 indigenous and 13 introduced bird species were recorded during the 2014 field survey of Mauao (Wildland Consultants 2015). A pied shag (*Phalacrocorax varius varius*; Threatened-Nationally Vulnerable) colony (up to ten nests; Cuming 2008 in Beca 2014) is present in pōhutukawa forest near the base track on the north-western side. No other At Risk or Threatened bird species were recorded during the 2014 survey.

Terrestrial indigenous bird species recorded on Mauao are all relatively common, regionally and nationally, and are all species that are able to survive in the presence of introduced mammalian predators. Nevertheless, relative breeding success would improve if a more effective mammal pest control was to be undertaken across relevant habitats.

9.2 Reptiles

Information on reptile populations on Mauao is sparse and herpetofauna have not been formally surveyed. Shore skinks have been recorded from Mauao, but are present at low abundance (Wildland Consultants 2008). A copper skink (*Oligosoma aeneum*) was caught on Motuotau (*c*.1.5 km to the east) in 2012 (Mauao Wildlife Trust, http://mauaowildlife.org/wildlife/reptiles.html) and this species could also be present on Mauao. Areas of kānuka may support geckos (*Hoplodactylus* spp. or *Nautilinus* spp.) and other skink species may be present along the shoreline or within areas of indigenous vegetation.

9.3 Indigenous mammals

The only indigenous mammal species that occurs regularly at Mauao is the New Zealand fur seal (*Arctocephalus forsteri*; not threatened) and increasing numbers of seals are using Mauao as a haul-out site (Wildland Consultants 2008).

9.4 Management options for fauna

Avifauna

Mauao has the potential to support a much larger population of burrowing seabirds than it does at present. The ōi population is likely to be significantly restricted by predation by rats, mustelids, and cats, and possibly disturbance by people. On islands

where rats have been eradicated, the ōi population has increased significantly. A site the size of Mauao has the potential to support several thousand breeding pairs, assuming that most of the habitat available is suitable for burrowing.

In addition to ōi, adjacent islands support Pycroft's petrel (*Pterodroma pycrofti*; At Risk-Recovering[1]), fluttering shearwater (*Puffinus gavia*; At Risk-Relict), North Island little shearwater (*Puffinus assimilis haurakiensis*; At Risk-Recovering), northern diving petrel (*Pelecanoides urinatrix urinatrix*; At Risk-Relict), New Zealand white-faced storm petrel (*Pelagodroma marina maoriana*; At Risk-Relict), and flesh-footed shearwater (*Puffinus carneipus*; Threatened-Nationally Vulnerable). Several of these species have been successfully attracted and/or translocated to protected mainland sites. In time, such species could be considered for re-establishment or introduction on Mauao (several may well have been present in the past). Introductions need not be prohibitively expensive (e.g. translocations), but can use comparatively cheap techniques such as acoustic attraction (although these are not always successful). However, it would not be advisable to attempt this until mammal pest control has been successful and increases in the existing ōi population demonstrated.

Likewise, Mauao may be able to support an increased number of kororā pairs with sustained mammal pest control, particularly if the availability of suitable breeding habitat is increased through planting.

However, management of the existing seabird population at Mauao is the highest priority for avifauna. This will need to involve intensive pest mammal control and monitoring of the kororā and ōi population numbers and productivity. Observed, sustained, increases in breeding pairs of ōi and associated low indexes of mammalian predators should be considered to be indicative of successful management and, at this point, translocations or attraction of other seabird species can be considered.

Herpetofauna

It is suggested that a suitably-qualified herpetologist is engaged to undertake a thorough herpetological survey of Mauao, as the presence of indigenous reptile species may need to be addressed in future management.

10. MANAGEMENT IMPLEMENTATION

10.1 Cultural values

An assessment of cultural values has been undertaken (Boffa Miskell 2014)[2]. The values and aspirations of tangata whenua are clearly outlined and supported by a summary of oral and documented whakapapa, history and tribal relationships. Numerous issues and opportunities for the cultural values management of Mauao have been discussed and presented. Some of the issues have been reiterated within this document but ongoing consultation with Tauranga City Council and Heritage

[1] All bird species have been classified as per Robertson *et al*. 2013.
[2] Tangata whenua issues described in the 1998 Management Plan are presented in Appendix 8.

New Zealand will be required so as to achieve appropriate outcomes. Appendix 1 of the assessment report details the specific matters, and these are summarised below:

Significant Cultural Value Issues

i. The lack of cultural interpretation and elements that expresses the special relationship between tangata whenua and Mauao.

ii. Natural erosion and the effects of high visitation on physical elements of pā and occupation areas.

iii. The lack of detailed understanding of the settlement pattern and traditional ways of life on Mauao.

iv. The poor condition of sacred springs.

v. The lack of a coherent and enforceable position on acceptability or unacceptability of commercial activities.

vi. Balancing tension between open space, pasture, and native vegetation.

vii. Iwi wish for the removal of infrastructure (water reservoir, trig).

viii. Proactive management of depositories of human remains to prevent accidental discovery and fossicking.

Significant Cultural Value Opportunities

ix. Coherent, consistent, effective and meaningful interpretation and signage across the maunga.

x. Opportunities to restore the *korowai o Mauao* through conservation programmes and planting projects.

xi. Specific projects to enhance the rangatiratanga, mana, kaitiaki and mauri of Mauao and including iwi education.

xii. Conducting archaeological and other research to better understand the former settlement pattern and lifestyle of the ancestors who resided at Mauao.

10.2 Archaeological management standards

The following management standards should be applied in the reserve, to ensure the ongoing protection, conservation, and appreciation of this very significant cultural landscape.

10.2.1 Legal requirements

All management and conservation work must comply with the requirements of the Heritage New Zealand Pouhere Taonga Act (2014). It is unlawful to modify, damage or destroy any archaeological sites without prior authority from Heritage New Zealand. Management must also be consistent with the requirements of the Reserves Act (1977), which the Mauao Historic Reserve Vesting Act 2008 falls under.

Ngā Poutiriao o Mauao should pursue registration of the entire Mauao Historic Reserve as an historic area through the provisions of the Heritage New Zealand Pouhere Taonga

Act (2014), in recognition of the significance of the cultural and archaeological landscape. Some of the archaeological sites within the reserve are currently registered under the Act as Category II historic places (places of historical or cultural heritage significance or value). Ngā Poutiriao o Mauao should continue to pursue the upgrading of the registration status of these sites to Category I (places of special or outstanding historical or cultural heritage significance or value), to reflect the particularly high significance of Mauao in terms of both historic and cultural values.

The recognition of Mauao Historic Reserve as a World Heritage Site for its significant archaeological, cultural, and historic values has been investigated and it does not meet the specific criterion. However this should be revisited as qualification criteria may change overtime.

10.2.2 Standards of conservation

The international organisation which develops cultural heritage conservation policies is ICOMOS, the International Council on Monuments and Sites. All conservation work in the Mauao Historic Reserve should be guided by a plan consistent with the principles of the ICOMOS New Zealand Charter for the Conservation of Places of Cultural Heritage Value (ICOMOS New Zealand Charter 2010).

10.2.3 Specialist advice

Planning for conservation work should be based on adequate and reliable information being first obtained and critically analysed. Specific projects and work within the reserve will require input from people with specialist skills. Skills or knowledge of particular relevance include: tangata whenua, archaeology, conservation of historic stone structures, agricultural and livestock management, archival research, visitor management, interpretation, structural engineering, rural fire management, plant ecology (including in-depth knowledge of invasive weeds), and fauna ecology (including ecological restoration).

10.2.4 Intervention

All reserve management activities (including grazing) should be undertaken to ensure the minimum possible intervention with archaeological features, as they presently exist. Increasing levels of intervention are defined by ICOMOS as: (i) preservation, through stabilisation, maintenance, or repair; (ii) restoration, through reassembly, reinstatement, or removal; (iii) reconstruction; and (iv) adaptation.

Any new elements that are introduced into the ground subsurface, such as new fence post holes, should continue to be clearly identified to avoid future confusion with earlier archaeological features. The use of a marker layer, such as fine gravel, should be used to distinguish features such as farm fences. Fine gravel should be placed in fence post holes, prior to infilling, when fences are removed. Geotextile or fine gravel should also be used as a base marker layer when material is imported to build up track surfaces. The introduction of additional material to the reserve should only occur after assessment and approval by Ngā Poutiriao o Mauao and Heritage New Zealand.

10.2.5 Approved uses

Mauao is a Historic Reserve, open for public visits. The uses approved for historic reserves, under the provisions of the Reserves Act 1977 (which the Mauao Vesting Act 2008 sits under), include passive recreation and educational visits. Any potential change to approved uses should be reviewed in the light of changed impacts and financial viability, and may require changes to this plan.

10.2.6 Documentation of work

All management work undertaken on Mauao, except for minor general maintenance, should be documented with notes and photographs, and records should continue to be retained on Tauranga City Council files (or other appropriate archival facility). A document bank should hold information relating to the conservation and management of the reserve.

10.3 Specifications for archaeological sites

Any management of the cultural and archaeological landscape within the reserve will require prior consent from the Heritage New Zealand under the provisions of the Heritage New Zealand Pouhere Taonga Act (2014). The outline of this work has been discussed with the Bay of Plenty regional archaeologist for Heritage New Zealand during the preparation of the 2004 Conservation Plan (Wildland Consultants 2004) and updated for this report.

1. Continue to revise the fencing when and where appropriate ensuring that the archaeological features are not compromised by livestock grazing.

2. Continue to establish appropriate indigenous vegetation in selected areas to stabilise archaeological features where grazing is not an appropriate site management practice.

3. Continue to upgrade tracks on Mauao. Track maintenance should align strongly with the CPTED principles defined for Mauao Historic Reserve (Boffa Miskell 2015). Tangata whenua have indicated a marae atea and other enhancements would be appropriate at Te Taumata o Mauao to reflect its significant wāhi tapu status (Boffa Miskell 2014). The redesigning of the trig, to one that reflects the cultural significance of the site should also be considered.

In addition, the following work is required which will not need prior Heritage New Zealand consent unless ground disturbance is necessary.

4. Continue to remove trees planted on archaeological features within the grazed parts of the reserve.

5. Continue to remove trees on the southern slopes of Mauao which are causing damage to intact archaeological features. This should be carried out following the advice of an archaeologist.

6. Continue to trim and/or remove tree saplings, from the area of the stone-faced landing platform associated with the iron jetty on the southern margin of Mauao. This should be carried out following archaeological advice.

7. Implementation of a robust strategy to control rabbits, as they continue to cause significant damage to archaeological features. Regular effective, ongoing rabbit control is essential to ensure that disturbance to archaeological material caused by burrowing activity is minimised.

Regular maintenance and revision of water run-off systems, tracks, and fencing will minimise the risk of accidental damage to archaeological features. The primary function of regular maintenance is to ensure early identification and remedying of problems. Any ground disturbance as a result of regular maintenance will require an authority from Heritage New Zealand.

10.3.1 Vegetation management to protect archaeological features

1. Trees planted on archaeological features and the large trees well established on archaeological features should continue to be removed to prevent further loss of archaeological information. Large trees will need to be removed in a staged fashion.

2. The ongoing selected removal of indigenous trees on archaeological features within the area of regenerating vegetation on the southern slopes of Mauao is also required, to prevent the loss of currently intact archaeological material. Tree species that are vulnerable to windthrow, or have a growth habit that is particularly disruptive to the ground surface (e.g. rewarewa and māhoe (*Melicytus ramiflorus*)) need to be removed as they become established on archaeological features. The position of particular trees and the potential for root development and expansion are the key points of concern for site stability. Archaeological features in this part of the reserve should be regularly inspected by an archaeologist with vegetation and site management expertise, so that undesirable saplings can be identified and removed.

3. Periodic trimming and/or removal of saplings will continue to be required adjacent to the stone-faced landing platform associated with the iron jetty on the southern margin of Mauao, in order to conserve this historic feature. This work should be undertaken with advice from a suitably experienced archaeologist and could be completed in conjunction with archaeological inspections of indigenous vegetation on the southern slopes of Mauao.

4. It is appropriate to establish vegetation other than grazed pasture on archaeological features in parts of the reserve where continued livestock grazing is not desirable for archaeological site protection or other reserve management purposes. In these areas, continued grazing is having a detrimental effect on slope stability and is contributing to the loss of archaeological sites. While establishment of a vegetation cover other than grazed pasture may lead to some loss of archaeological information, on the whole that loss will be less than that caused by ongoing erosion.

The areas to be retired from grazing include the escarpment (that is subject to erosion) adjacent to the base track on the eastern, western, and southern sides of Mauao and the seaward side of the base track. Any retirement of grazing on the southern side of Mauao will require consultation with Heritage New Zealand. Pōhuehue (*Muehlenbeckia complexa*) or meadow rice grass (*Microlaena stipoides*) are suitable plant species to establish on these sites, to stabilise and protect the archaeological features. The planting of scattered pōhutukawa where visible archaeological features are absent would assist to establish a vegetation cover that will reduce weed invasion over time. Ongoing periodic weed control will be required in the interim for areas retired from livestock grazing.

10.3.2 Visitor management

Members of the community that regularly use the tracks on the maunga have a sense of ownership to the site. Overall any effects on the archaeological surface features from visitor use during the past 10 years appear to be negligible which can be attributed to the methods implemented during the ongoing maintenance and enhancement of the existing track network (Phillips 2014). Local users feel a connection with the area and treat the area as part of their 'backyard'. In the past, the Park Ranger has often been informed of maintenance, vandalism and occasionally untoward behaviour by members of the pubic. Whilst there is no longer a resident Park Ranger, a "Parks Asset Coordinator - Mauao" position based at Tauranga City Council has been developed to look after the reserve. The Parks Asset Coordinator could further nurture the relationship the public has with the reserve by developing the following:

1. Visitor numbers have been monitored and are estimated at one million per year. An informal survey showed that mothers with prams, and over 60s, are the most frequent visitors to the area. A more formal user survey to determine why people visit the reserve - is it for the outdoor experience, physical exercise, views obtained from the site, archaeological features, or perhaps a combination of these experiences - would help to guide future reserve management and interpretation.

2. Tracks should be clearly defined, well maintained, and signposted following the CPTED assessment guidelines specifically detailed for Mauao (Boffa Miskell 2015). This will ensure that informal tracking does not increase and the public feel safe and comfortable while using track network. Track hardening, the use of artificial surfaces and the selected use of board walks are all options worth considering as visitor numbers continue to increase.

3. Although a large amount of work has been undertaken to arrest damage to archaeological and ecological features and channel visitor flow on the summit of Mauao, further attention is required where the public continues to access various dangerous and culturally sensitive 'viewing platforms'. Tracking issues should be resolved using the defined CPTED guidelines while incorporating aspirations of tangata whenua for this significant wāhi tapu (as outlined in Boffa Miskell 2014). Restoration, CPTED and enhancement planting should utilise large-sized (potentially PB8 or larger) plants to minimise access to restricted areas on the summit.

4. Use of the tracks by cyclists should continue to be restricted. Biking - or any other non-authorised vehicle use - on the maunga would be detrimental to archaeological features (e.g. shell middens) and dangerous for other users.

5. Tangata whenua could provide guided walks for large groups. This would enhance visitor experiences, draw attention to the reserves historic and cultural status, and reduce the risk of accidental damage to archaeological features. A programme of guided walks would also provide a valuable learning experience for visiting groups.

6. The Mauao Management Plan stipulates that no long-term commercial activities are allowed on the maunga and short-term one-off commercial activities would be considered by Council (Tauranga City Council 1998). There could possibly be a discussion around granting 'concessions' for those that apply. Concessions would formalise the current informal use of the maunga for commercial purposes (e.g. guided tours for cruise ship clients and running events). Any financial gains received could be put towards funding specific projects on Mauao.

10.3.3 Machinery

1. No earthmoving machinery, or machinery likely to cause ground disturbance during normal operation, should be used in the reserve without prior approval from Heritage New Zealand and Ngā Poutiriao o Mauao. This must also include emergency situations such as firefighting.

2. The 4WD access track is maintained regularly, and the use of machinery for this purpose should continue to be supervised closely. If any ground disturbance is likely to occur in any area that is not already clearly part of the established 4WD track - for example, the establishment of additional culverts - the proposed work should be discussed with Heritage New Zealand to determine if an Authority to Modify is required.

10.3.4 Reserve management activities

1. Archaeological advice should be sought prior to any management activities being undertaken in the reserve likely to cause ground disturbance, to ensure that archaeological features are not at risk.

2. The maintenance of vehicle access to the summit needs to be assessed carefully in relation to impacts on archaeological features. Run-off from the road and the subsequent translocation of archaeological material will always be a potential issue.

3. Water needs to be diverted off tracks at regular intervals. The existing culvert spacing on the 4WD access track is adequate, but will need to be revised if there is any future localised channelling and erosion of archaeological features. Reduction of the velocity ensures that run-off is dissipated over the ground surface, thus preventing channelling. The track should be monitored closely, to ensure that scouring has not occurred after significant weather events.

10.3.5 Grazing

1. The key to minimising damage to archaeological features from grazing livestock is to graze each area lightly for short durations. Modification of fence lines, reducing stock numbers and shorter grazing rotations has proven to alleviate damage issues.

2. Slope stability and archaeological preservation in grazed areas should be closely monitoring and any adjustments to stock management made accordingly. The ongoing implementation of a well-managed rotational grazing programme will continue to result in a reduction of erosion because sheep will not be tracking and camping in particular areas for extended periods of time. Regular breaks from grazing will ensure that the pasture sward has time to establish over exposed archaeological features. In this instance, kikuyu grass is a desirable species as it will establish a robust ground cover that persists during dry conditions. Periodic topdressing with fertiliser will also assist with the maintenance of the pasture sward.

3. Heritage New Zealand has reviewed the fence lines and are happy with the current design. Any localised tracking when found should be addressed under consultation with farm management and an appropriate archaeological supervisor to ensure that all fences continue to be effective for both stock control and archaeological feature management.

4. Any fence posts that are removed should be marked in the ground with a layer of fine gravel placed in the fence post holes prior to them being backfilled. This will ensure that these fence post holes are not confused with earlier archaeological features if future archaeological investigations are undertaken.

5. The short pasture sward has created a habitat favourable for rabbits, with related damage to middens as a result of burrowing. Rabbit numbers in the reserve continue to be high. If rabbit numbers are not reduced damage to archaeological features will continue to accelerate.

6. Ongoing monitoring of the livestock management regime will be required in order to constantly assess its effectiveness.

10.3.6 Information management

1. All relevant documents should continue to be stored in the Tauranga City Council's information database. This will help to combat the loss of information associated with the history and management of Mauao.

10.4 Integrity of setting and landscape management

10.4.1 Overall management theme

Mauao Historic Reserve is a culturally significant wāhi tapu and a dramatic landscape feature on the margin of a large urban population. There is currently no 'sense of arrival', particularly at the western entrance. Much could be done to improve both reserve entrances to reflect the cultural and landscape significance of the area. Intensive

urban activities adjacent to the reserve pose potential risks to the archaeological features, due to the likelihood of inappropriate activities occurring in the reserve. The creation of a buffer or gateway between the reserve and the adjacent urban landscape is desirable. Given the significance of the cultural and archaeological features, a redesigned reserve entrance is justified. A suitably qualified landscape architect should prepare a carefully designed entrance, which draws in the appropriate design elements of the reserve and the relationship of tangata whenua to the land.

It is critical for a landscape as high profile and significant as Mauao, that coherency and consistence is established and maintained in high quality landscape detailing around the tracks and recreation areas. High profile sites, such as the summit and the walking tracks, require standardised facilities, a robust brand, including design details, and materials (a logo or 'brand' could possibly be generated specifically for Mauao). The brand should be developed in conjunction with tangata whenua (Boffa Miskell 2014), so that appropriate signals are sent to visitors about the history and significance of the area. The brand should be both natural and solid to allow for the appropriate image and landscape detailing, necessary for such a significant and popular area. Creating and implementing a 'package' that includes promoting the cultural values, archaeological heritage, ecological restoration and recreational features of Mauao Historic Reserve will continue to encourage visitor use and information sharing. High standards of maintenance of facilities and signs give an impression of care of the reserve and provide a sense of safety for users. Future facility, planting and walking track development should also align with CPTED principles (further discussed below).

Visitor facilities should maximise the quality of the visitor experience while avoiding any adverse impacts on archaeological features. Existing tracks and other recreational facilities, such as seats and signs, are showing very high levels of wear and degradation. Provision and maintenance of appropriate facilities is imperative to the protection of Mauao.

Vegetation can be used to manage key areas of significance on the summit of Mauao. The planting and use of indigenous grasses will provide non-destructive vegetation cover to some of the more prominent archaeological sites. Low profile indigenous grasses (including meadow rice grass) can offer an appropriate cover to some sites, such as the 'amphitheatre' areas adjacent to the main lookout. Plantings of tree and shrub species can be used to control pedestrian traffic.

10.4.2 Tracks

Track surfaces on Mauao are currently maintained using crushed rhyolite. It has good wearing properties and is a suitable natural material for track surfaces.

10.4.3 Look-out edges

Past fires opened up the main lookout area and the edges of many tracks to very steep drops below. Previous vegetation cover was effective in keeping pedestrians back from the edge, but the lack of vegetation now presents a hazard to pedestrians on the summit, and a risk for the reserve managers. The presence of archaeological sites means that heavy fencing, typically associated with steep-edged lookouts, is

inappropriate, given the potential damage which would be caused by the placement of posts.

Natural rocks can be inter-planted, or grouped together, to provide an effective pedestrian barrier, without compromising the views which have been opened up on the summit. Tree planting should punctuate the sweeping views to provide some shelter for visitors to the summit. Large plant sizes should be used at the summit to reduce incremental damage to surrounding vegetation as this is a high use area.

10.4.4 Seating

As with the pedestrian control techniques, seating should be natural, low key, and should not use footings which may result in damage to archaeological sites. The seats should be placed appropriately to allow for resting places in the shade on the summit, and on other tracks on Mauao. A consistent theme, or brand, for seating, fencing, and pedestrian control is crucial to the overall landscape concept for Mauao.

10.4.5 CPTED

A Crime Prevention Through Environmental Design (CPTED) audit of Mauao was undertaken for Tauranga City Council (Boffa Miskell 2015). The assessment used four key principles and seven qualities that characterise well defined safe place from the National Guidelines for CPTED (Ministry for Justice 2005) to underpin the audit. The aim of CPTED is to use environmental design to produce behavioural effects that will reduce the incidence and fear of crime; the following has been reproduced from Boffa Miskell (2015).

Four key principles considered within CPTED are:

1. **Surveillance:** people are present and can see what is going on;
2. **Access management:** methods are used to attract people and vehicles to some places and restrict them from others;
3. **Territorial reinforcement:** clear boundaries encourage community 'ownership' of the space; and
4. **Quality environments:** good quality well maintained spaces that attract people and support surveillance.

Seven qualities that characterise well defined safe places are:

1. **Access:** Safe Movement and Connections. Places with well-defined routes, spaces and entrances that provide for convenient and safe movement without compromising security.
2. **Surveillance and Sightlines**: See and be seen. Places where public spaces are overlooked, and clear sightlines and good lighting provide maximum visibility.
3. **Layout:** Clear and Logical Orientation. Places laid out to maximise safety and help with orientation and way finding.

4. **Activity Mix:** Eyes on the Street. Promoting a compatible mix of uses and increased use of public space.

5. **Sense of Ownership:** Showing a space is cared for. Places that promote a sense of ownership, respect, territorial responsibility and community.

6. **Quality Environments**: Well designed, managed and maintained environment. Spaces designed with management and maintenance in mind to discourage crime and promote community safety in the present and future.

7. **Physical Protection**: Inclusion of well-designed security features and elements such as security cameras and physical barriers.

A number of site specific findings and recommendations are included in the assessment but general guidelines include (derived from Boffa Miskell 2015):

- Crown-lifting of trees and trimming of shrubs on the edge of tracks where it hinders sightlines.
- Relocate and update information signs to clearly indicate track routes and distance from entry and exit points.
- Increase vegetation along track margins with low growing plant species to prevent users from straying from the track and accessing dangerous vantage points.
- Keep tracks and facilities well maintained to convey a sense of ownership and deter vandalism.
- Installation of seating to provide rest and passive surveillance of the track.
- Upgrading some informal tracking to formalise escape routes.

Plant species that can be used in CPTED managed areas (for under-planting or as an informal/soft edge treatment to tracks and edges with steep sides) are listed in Table 3 below.

10.4.6 Other facilities

Establish screen planting (of pōhutukawa) adjacent to the stock yards[1].

10.5 Environmental weeds

10.5.1 Environmental weed distribution, abundance, and priorities for control

Thirty-five of the environmental weed species listed in Table 1 have been mapped (see Figure 4) to show their distribution and abundance on Mauao. A summary of their priority for control is also presented in Table 1 and further discussed below.

[1] The stock yards are outside the cadastral boundary of Mauao Historic Reserve but screen planting here would align with the overall restoration and enahncment of the naturalness of Mauao.

Pampas (*Cortaderia selloana*), Spanish heath (*Erica lusitanica*), Japanese honeysuckle (*Lonicera japonica*), climbing asparagus (*Asparagus scandens*), and Mexican daisy (*Erigeron karvinskianus*) are widespread throughout indigenous vegetation and habitats. Pampas is common in open habitats (bluffs and landslides), but is also found at lower density within scrub and shrubland habitats. Pampas is a high priority for control due to its ability to spread thousands of viable seeds over great distances, its wide environmental tolerances, its potential fire risk, and tendency to form large, dense patches that exclude indigenous species. Spanish heath is also widespread and forms part of the dominant vegetation on the northern mid and upper slopes of Mauao; it is found in the same kind of habitats as pampas and is common on track margins. It is a lower priority for control than pampas as it is readily overtopped and shaded out by woody indigenous species as vegetation succession progresses.

Japanese honeysuckle is locally common in most vegetation/habitats throughout the Reserve. Scattered individuals are present within rank grassland habitat beside the base track on the southern and eastern sides of Mauao, and on the margins of tracks throughout the Reserve. Larger patches of Japanese honeysuckle are locally common at the transition between scrub/shrubland habitats and forested areas, particularly on the southern and western mid-slopes. Japanese honeysuckle is a high priority for control because it is shade tolerant and has the capacity to smother canopy species, preventing the growth and regeneration of indigenous species.

Climbing asparagus is locally common on track margins throughout the Reserve. It is a high priority for control because it is shade tolerant and has the capacity to smother canopy species, preventing the growth and regeneration of indigenous species.

Mexican daisy is locally common on track margins on the southern side of Mauao. It is a high priority for control because of its ability to form dense mats of ground cover which smothers and kills indigenous vegetation, creating habitat for other invasive weed species such as climbing vines. Mexican daisy is also a prolific seeder, with seeds that are able to spread long distances through wind dispersal.

Blackberry (*Rubus fruticosus*) is locally common within short stature vegetation on the southern mid-slopes of Mauao, and at lower density within short stature vegetation in other parts of the park. Blackberry is a moderate priority for control because it can grow to form dense patches that exclude indigenous species.

Gorse is present at low densities within short stature vegetation and on track margins on the northern, western, and southern midslopes. Although gorse is readily overtopped and shaded out by taller-growing indigenous species as vegetation succession progresses, it is a moderate priority for control because it also produces many, long-lived seeds which enable it to persist in an area over many decades. Scattered gorse shrubs are also present within grazed pasture on Mauao, but plants in these habitats are controlled regularly.

Chinese privet (*Ligustrum sinense*), hawthorn (*Crataegus monogyna*), woolly nightshade (*Solanum mauritianum*), and cotoneaster (*Cotoneaster glaucophyllus*) are generally present at low densities throughout the Reserve, although isolated patches with higher densities of these species are also present. Chinese privet and hawthorn

are scattered to locally common within scrub and forest habitats on the south-western mid to upper slopes. In particular, there is a small area of dense Chinese privet and several hawthorn trees near the mid-slope fence line on the southern side of the Reserve. Chinese privet is a high priority for control because it is a shade-tolerant shrub that is capable of forming dense, monospecific stands that exclude all other vegetation. Hawthorn is a high priority for control because it has wide environmental tolerances and can form dense thickets, blocking access, crowding out other plant species, and preventing desirable seedlings from establishing. Individual plants of woolly nightshade and cotoneaster are scattered throughout forest and scrub habitats on the south-western and western sides of Mauao. Cotoneaster is often present within short stature vegetation on track margins. Cotoneaster is a high priority for control because it is long-lived, has wide environmental tolerances, and can form dense thickets which crowd out other plant species, and prevents desirable seedlings from establishing. Woolly nightshade is a high priority for control because it can quickly establish large groups of plants, which can out-compete and crowd out other desirable species.

Boneseed (*Chrysanthemoides monilifera subsp. monilifera*), boxthorn (*Lycium ferocissimum*), and swan plant (*Gomphocarpus fruticosus*) are present at low densities in open habitats on the northern and north-western mid-to-upper slopes of Mauao. Occasional individuals of boneseed were observed within open habitats around the midslope track on the northern and north-western side of Mauao. Other plants are likely to be present within this habitat but surveillance and control is undertaken for this species on a regular basis. Boneseed is a high priority for control because it can spread quickly to form dense cover that shades out desirable species; it also produces copious seeds every year, which can remain dormant for up to 10 years. Occasional boxthorn plants were observed during the field survey. Boxthorn is capable of forming dense, long-lived stands which exclude desirable species and has wide environmental tolerances. Boxthorn is a high priority for control on Mauao due to its limited current distribution. Swan plants are locally common alongside the midslope track beneath the bluffs on the northern side of Mauao; a few other plants were also observed in open habitats on the western midslopes. Swan plant is a high priority for control because it has the capacity to form dense thickets that exclude desirable species.

Black wattle (*Acacia mearnsii*) and brush wattle (*Paraserianthes lophantha*) were observed at low densities within open habitats on the mid - to lower slopes on the western side of Mauao in 2014. These species are likely to be present elsewhere and are a high priority for control as they are currently at low densities and have the capacity to spread and establish quickly within low stature vegetation.

Loquat (*Eriobotrya japonica*), tree privet (*Ligustrum lucidum*), Italian evergreen buckthorn (*Rhamnus alaternus*), Japanese spindleberry (*Euonymus japonicus*), smilax (*Asparagus asparagoides*), and Kahili ginger (*Hedychium gardnerianum*) are present at low densities in isolated areas of Mauao. Tree privet, Italian evergreen buckthorn, Japanese spindleberry are a high priority for control because they are capable of rapid spread and forming dense stands that exclude indigenous species. Smilax is a high priority for control because it is shade-tolerant and has the capacity to smother canopy species preventing the growth and regeneration of indigenous species. Bridal Creeper Rust (*Puccinia myrsiphylli*) has been released to combat smilax in Australia. It has

self-introduced to New Zealand and is now locally common in the North Island. The rust affects the stems, shoots, leaves and fruit and is often severe, completely defoliated and killing the plant prematurely (Harman *et al*. 2008). Kahili ginger distribution is concentrated within short-stature vegetation northwest of the summit. It is a high priority for control because it produces massive branching rhizomes, which form a dense layer up to a metre thick, which other plant species cannot penetrate. Above ground, wild ginger shades and smothers indigenous species. It may permanently displace uncommon plant species or specialised plant communities.

A few saplings and seedlings of maritime pine (*Pinus pinaster*), radiata pine (*Pinus radiata*), and other wilding pine species were observed within forest and scrub habitats. These plants should be controlled as a high priority before they mature and produce viable seed, which is capable of spreading widely within the reserve. Two very large radiata pine trees are present beside the base track on the northern side of Mauao. These trees may be difficult to control safely due to their proximity to the track.

Hybrids between pōhutukawa and Kermadec pōhutukawa (*Metrosideros excelsa* × *M. kermadecensis*) have been planted at several sites on Mauao. These plants should be removed, as a high priority, as they are highly likely to hybridise with pōhutukawa and therefore threaten the ecological integrity of pōhutukawa on Mauao.

Chinese windmill palm (*Trachycarpus fortunei*), phoenix palm (*Phoenix canariensis*), tree of heaven (*Ailanthus altissima*), and English oak (*Quercus robur*) are present at low abundances at isolated sites on Mauao. Several mature English oak trees are present near the boundary with the motor camp require removal. Removal of these trees should be undertaken as nearby plantings of indigenous species mature. Elsewhere, English oak should be controlled, as a low priority, where it is present within habitats dominated by indigenous species. Chinese windmill palm and phoenix palm are locally common within mixed exotic-indigenous vegetation near the south-eastern boundary of the reserve. Chinese windmill palm is also present within short-stature vegetation on the south-eastern midslopes of the reserve. Chinese windmill palm is a high priority for control because it is fast growing, has wide environmental tolerances, produces copious seeds, and has the capacity to invade indigenous plant communities. Phoenix palm is a moderate priority for control. It has not been observed within indigenous vegetation and habitats on Mauao, but, if it were to become established, it can replace indigenous trees and inhibit regeneration by producing an impenetrable, long-lived sub-canopy of saplings and seedlings.

Sweet briar (*Rosa rubiginosa*) is present as isolated individuals within short stature vegetation on the south-western mid-slopes of Mauao. It is likely to be present in other areas, but at low density. It is a moderate priority for control.

Two species were only found at single locations: cape daisy (*Arctotheca calendula*) and yucca (*Yucca gloriosa*) were each only observed at one locality during the 2014 field survey. Cape daisy is a high priority for control because it is currently confined to one area. Cape daisy is known to smother other plants growing near it, and therefore may reduce habitat for indigenous species, such as ground orchids and herbaceous species, that grow in open environments. However, Cape daisy may be more extensive on Mauao and if this is the case then it may be too extensive to control

effectively. Yucca was found in one locality during the field survey; it does not pose a significant risk to indigenous biodiversity values, but it is not a suitable species in this environment and should be removed.

The provenance of the kauri saplings planted near the summit of Mauao is currently unknown and, due to this, these plants should be removed, as a medium level priority. If any future planting of this species is desired, it should be ensured that the plants are eco-sourced from natural populations in either the Tauranga or Ōtānewainuku Ecological Districts.

Other Environmental Pest Plants

Purple pampas (*Cortaderia jubata*), ivy (*Hedera helix*), willow-leaved hakea (*Hakea salicifolia*), prickly hakea (*Hakea sericea*), black passionfruit (*Passiflora edulis*), tree lucerne (*Chamaecytisus palmensis*), lupin (*Lupinus arboreus*), Himalaya fairy grass (*Miscanthus nepalensis*), mile-a-minute (*Dipogon lignosus*), and white-edged nightshade (*Solanum marginatum*) were not observed within the project area during the field survey in 2014. Purple pampas was mapped with pampas in 1997, so it is not possible to confirm whether this species is still present at the locations where it was observed in 1997. However extensive pampas control has been undertaken on Mauao since 1997 and it is therefore possible that this species is no longer present within the Reserve. The location and extent of ivy mapped in 1997 was outside the boundaries of the project area in 2014 and this species may therefore still be present in the area mapped in 1997. A single plant of prickly hakea was present below the summit in 1997 and 2004; this plant may have been controlled as it was not seen in 2014. A single plant of white-edged nightshade was observed on the edge of indigenous vegetation on the eastern side of Mauao in 1997; this plant was not observed in 2014 and may have been controlled. A single infestation of mile-a-minute was recorded in 1997 near the boundary with the motor camp on the eastern lower slopes; this species was not recorded in this area in 2014 and may have been controlled. German ivy (*Delairea odorata*) and velvet groundsel (*Roldana petasitis*) were observed during field survey in 2014, but these species are located outside the 2014 project area and have therefore not been mapped in this report.

Surveillance for the other environmental pest plant species listed in Table 1, but not mentioned above or mapped in Figure 4, should be undertaken during the course of other weed control work. If found, they should be controlled based to the priorities listed in Table 2.

Comparison With 1997 Inventory

The distribution and abundance of forty-six pest plant species was mapped in 1997 (Wildland Consultants 1997). In 2014, the distribution and abundance of each pest plant species observed during field work was compared with the mapped extent of that species in 1997 and notes were made on differences or similarities between the extent mapped between years. Significant pest plant control has been undertaken on Mauao since pest plant distribution and abundance was last mapped in 1997 (Wildland Consultants 1997) and pest plant control is ongoing. In particular, the extent and abundance of pampas (*Cortaderia* species), wilding pines, blackberry, gorse, boneseed, hawthorn, woolly nightshade, and smilax have reduced significantly

since 1997 (see Table 2 below). Pampas, boneseed, and woolly nightshade are currently the priority for control on Mauao, and regular surveillance and control of these species, along with gorse and thistles, is undertaken (M. Ray, Tauranga City Council, pers. comm. 2014). Other pest plant species are controlled on an ad hoc basis as weeds are identified by Tauranga City Council staff and contractors, by the public, or by Bay of Plenty Regional Council staff and contractors (M. Ray, Tauranga City Council, pers. comm. 2014).

Table 2: Comparison of mapped environmental pest plant distribution and extent between 1997 and 2014.

Common Name	Comparison Between 1997 and 2014	Notes
Barberry	Increased in extent	Not widespread.
Black passionfruit	Not known	Not mapped in 1997.
Black wattle	Not known	Not mapped in 1997.
Blackberry	Reduced in extent	Significant reduction.
Boneseed	Reduced in extent	Significant reduction.
Boxthorn	Increased in extent	Minor.
Brush wattle	Similar in extent	Mapped with silver wattle.
Cape daisy	Not known	Not mapped in 1997.
Cape ivy	Not known	Not mapped in 1997.
Chinese privet	Increased in extent	Minor.
Chinese windmill palm	Similar in extent	Additional plant(s) found in indigenous vegetation in 2014.
Climbing asparagus	Reduced in extent	Significant reduction.
Common alder	Not known	Not mapped in 1997.
Cotoneaster	Increased in extent	
English oak	Not known	Not mapped in 1997.
German ivy	Reduced in extent	Same location, reduced density.
Gorse	Reduced in extent	Significant reduction.
Hawthorn	Reduced in extent	Significant reduction.
Himalaya fairy grass	Reduced in extent	Not observed in 2014.
Italian evergreen buckthorn	Increased in extent	Minor. Recorded at different locations in 2014.
Ivy	Not known	1997 extent was outside project area.
Japanese honeysuckle	Reduced in extent	Significant reduction.
Japanese spindleberry	Similar in extent	Recorded at different locations in 2014.
Kahili ginger	Similar in extent	
Loquat	Not known	Not mapped in 1997.
Lupin	Not known	Not mapped in 1997.
Maritime pine	Reduced in extent	Significant reduction.
Mexican daisy	Increased in extent	Significant increase.
Mile-a-minute	Not known	Not observed in 2014.
Montpellier broom	Not known	Not mapped in 1997.
Oleander	Not known	Not mapped in 1997.
Pampas	Reduced in extent	Significant reduction.
Phoenix palm	Similar in extent	
Pōhutukawa × Kermadec pōhutukawa	Not known	Not mapped in 1997.
Prickly hakea	Not known	Not observed in 2014.
Purple pampas	Reduced in extent	Not observed in 2014. Presume significant reduction.

Common Name	Comparison Between 1997 and 2014	Notes
Radiata pine	Reduced in extent	Significant reduction.
Silver wattle	Reduced in extent	Not observed in 2014.
Smilax	Reduced in extent	Significant reduction.
Spanish heath	Not known	Not mapped in 1997.
Strawberry dogwood	Not known	Not mapped in 1997.
Swan plant	Not known	Not mapped in 1997.
Sweet briar	Not known	Not mapped in 1997.
Tall fescue	Not known	Not mapped in 1997.
Tradescantia	Similar in extent	
Tree lucerne	Not known	Not mapped in 1997.
Tree of heaven	Reduced in extent	Significant reduction.
Tree privet	Increased in extent	Minor. Recorded at different locations in 2014.
Velvet groundsel	Similar in extent	Outside project boundary.
White-edged nightshade	Reduced in extent	Not observed in 2014.
Wilding pine	Reduced in extent	Significant reduction.
Willow-leaved hakea	Not known	Not mapped in 1997.
Woolly nightshade	Reduced in extent	Significant reduction.
Yucca	Not known	Not mapped in 1997.

10.6 Pest mammal control

Overall, pest mammal control programmes currently in place on Mauao are making some reductions in the populations of pest mammal species present. However, some areas have been identified where alterations to control regimes may improve protection of indigenous biodiversity as discussed below (reproduced from Wildland Consultants 2015). Implementation of the regimes described below will provide added benefits for lizards, invertebrates, small birds, and possibly small seabirds if control of large predators and possums is also effective. Control of hedgehogs and mice to low levels would provide additional benefits for invertebrate fauna.

Control of browsing pests should be undertaken prior to planting, each season, in order to ensure low numbers of rabbits, possums, and hares. Rabbits could be controlled to low numbers by using a combination of poisoning, trapping, and dogging.

Pest animal control should be undertaken in conjunction with Bay of Plenty Regional Council pest control officers.

10.6.1 Rabbit

Rabbit numbers continue to be very high. Currently a regime of poison pulses and night-shooting (between mid-February and mid-December) reduces population levels but this strategy requires revision. Reinvasion of rabbits from the beach, Pilot Bay and the local Mount Maunganui residential area is ongoing and a strategy to control rabbit populations may need to include a wider area than just the maunga. Construction of a rabbit-proof fence across the neck of the peninsula could also be considered as a means to mitigate the influence of rabbits on indigenous ecological and archaeological values (further discussed below).

10.6.2 Rodent

Diphacinone baits in bait stations currently used are an effective method of reducing rodent numbers. However, more bait stations are needed to maximise control efficacy. A 50 m grid of stations through the forest, scrub, and shrubland areas and around any non-forest/scrub/shrubland areas of ecological interest, such as the petrel colony and any areas where indigenous lizards may be found will provide more effective rodent control than a less regular bait station distribution. Three pulses of bait a year should be a minimum and it would be highly beneficial to monitor rodent numbers using tracking tunnels before and after each poison pulse, to quantify the success of control operations. It may be advisable to fill bait stations three or four times during a pulse to allow mice access to bait after rat numbers have been reduced. Extra bait station fills should be undertaken around two weeks following the first fill. Rat populations should be indexed at least twice a year, including immediately prior to the first period of control each year in June-July.

10.6.3 Mustelid

Mustelids are elusive and it is unusual for a member of the public to see any animals, however they are highly likely to be present in moderate numbers on the maunga. Currently the trapping regime includes the use of a small number of permanently placed, with some temporary, DOC200 traps. Mustelids are very wary of new objects and changes in their environment, and traps that have never caught stoats, or have not caught stoats in a long time, can suddenly begin to catch stoats. Therefore, the regular moving of existing traps is not ideal. It is suggested that the mustelid trapping regime is revised and the number of DOC200 traps on Mauao is increased allowing traps to be left in place permanently. Use of more than one bait or lure is beneficial as individual mammals may have different bait or lure preferences. Any baiting regime however should be consistent between the DOC200 traps.

10.6.4 Possum

Possum control should be pulsed throughout the year aimed at suppressing possum numbers to below 5% residual trap catch (or bait take) at all times. Management should be adaptive, utilizing the most cost-effective and environmentally acceptable methods available. Depending on baseline possum levels, numbers could be depressed initially by poisoning. Alternatively, trapping pulses could be implemented.

10.6.5 Domestic animal control

Control of feral cats in areas where domestic cats may be present is difficult and has the potential to be a public relations 'problem'. Cat owners living close to Mauao should be contacted to discuss the risks cats pose to indigenous fauna, and methods of responsible cat ownership. If cats are sighted on Mauao, live traps should be used to catch the cats and, if they are not claimed, they should be destroyed.

Dogs are not permitted on Mauao, but are still occasionally a problem, especially for penguins and other ground-nesting birds. Rangers and volunteers working on Mauao should be vigilant and ready to take steps to remove any dogs.

10.6.6 Buffer zone

With water on three sides and residential property on the other, the geography of Mauao means that reinvasion by some pest species are likely to be slower than in other mainland sites. Several pulses of intensive pest mammal control on Mauao coupled with a permanently-maintained grid of bait stations and traps along the narrow neck of landing between Mauao and the "mainland", including controlling rabbits on the dunes, may lead to local eradications of some pest mammal species and a substantial, sustained reduction in numbers of others. Rat and stoat control should be considered for areas of Matakana Island adjacent to Mauao, to limit re-invasion of Mauao by animals swimming across the Tauranga Entrance.

10.6.7 Predator-proof fence

Installation of a fence to exclude the reinvasion of rabbits and other pest animals into Mauao Historic Reserve should be considered. Fence installation would work in conjunction with pest animal control strategies on the maunga. Removal of pest animals will not only protect the archaeological features but will also improve indigenous fauna habitat, vegetation condition, increase success rates of planting, and protect the cultural values of the area. Subject to position and height, a fence could be potentially intrusive, restrict people movement, be structural-looking, and could impact on the natural character of the area, but the benefits to the cultural, archaeological, and ecological values of the site within the fence boundaries would be considerable.

Any potential fence alignments would need to be determined in consultation with Heritage New Zealand, but relatively little ground disturbance would be required for installation at the base of the maunga, and could follow existing fence lines across the 'neck' of the peninsula. Although Mauao accommodates high visitor numbers 24 hours a day the installation of a pest-proof fence would not restrict exit and entry into the area as entry/exit gates could be positioned roughly at their current locations. Vehicle access could also be accommodated.

There are three obvious options for pest-exclusion fences at Mauao:

- A rabbit-proof fence 1.3 m tall.
- A fence to exclude rabbits, possums, hedgehogs, rodents, and mustelids, also 1.3 m tall.
- A fence to exclude all of the above plus cats (and dogs), which would be 2 m tall.

The costs of these three options vary considerably, with a rabbit fence being the lowest cost and lowest impact option, and may be able to be largely based on modification of existing fences. A fence to exclude the full suite of pest species (i.e. two meters tall) would require a clear zone of about four meters, and a benched fence line track would also be required. However, a pest-proof fence that does not exclude cats (1.3 m tall) may only need 2-3 metres of clearance outside of the fence. Any cats inside the fence could be relatively easily controlled using other methods. Both of the latter options would restrict the reinvasion of rodents, mustelids, rabbits, possums and hedgehogs. Once pests have been removed or

reduced to very low numbers, potential reinvasion sites will require active management, e.g. at the sea ends of the fence and from Matakana Island. This type of pest animal management is currently being undertaken successfully at other sites such as Shakespear Regional Park, north of Auckland.

10.7 Interpretation

Currently there is a lack of interpretation information expressing the special relationship between tangata whenua and Mauao (Boffa Miskell 2014). Interpretation panel information that is available is out of date. Site specific panels would improve visitor appreciation and understanding of the area. They should highlight the outstanding cultural heritage features and significant ecological values of the reserve, as well as drawing attention to any cultural restrictions (e.g. eating while on pa sites) and safety issues. Tangata whenua have recognised the need for explanatory panels for the reserve gateway and interpretation panels or pouwhenua to identify special places and landmarks (Boffa Miskell 2014).

The cultural values assessment (Boffa Miskell 2014) provides guidance and suggestions for various sites on the maunga. Allocation of funding and implementation of these should be a high priority.

An updated self-guiding pamphlet on the historic, cultural and ecological values of the area would also be useful for visitors.

10.8 Publicity

Appropriate publicity opportunities, in local and national media, should continue to be utilised to heighten public awareness and appreciation of the significance of the Mauao cultural values, archaeological heritage ecological restoration and recreation values. The creation of online tools and consistently updating various social media platforms would:

- Keep locals and visitors informed of news and events of the Reserve.
- Educate users on the values of the site.
- Let visitors know what the Reserve has to offer.
- Promote visitor activities.
- Track interest in the reserve and potentially find out why people visit.
- Visually advertise and promote the beauty of the area.

Although high visitor numbers present could pose a potential threat to archaeological features in the reserve, appropriate management of those visitors minimise that threat. High visitor use of the reserve presents an opportunity to increase awareness of historic heritage values. Media coverage should be sought for all conservation works (cultural, archaeological and ecological) carried out in the reserve.

10.9 Fire

The reserve is in the Western Bay Moana Rural Fire District and there is a requirement to have an approved fire plan by 1 October each year.

The primary fire management objective for rural fire authorities is to minimise risk of fire while retaining sufficient resources to rapidly extinguish any outbreak of fire that does occur. Fire management on Mauao needs to focus on fire prevention, pre-planning for fire control, and public safety. The risk of fire can be reduced considerably through the implementation of a well-publicised active fire prevention programme. This programme should include:

1. Establishment of a year round total fire ban (including cigarettes).

2. Regular assessment of fire risk using established Rural Fire Authority standard FDR ratings.

3. Establishment of a standard rural fire rating sign that show the current level of fire risk: extreme, high, moderate, or low.

4. Radio and newspaper advertising of fire risk, to educate reserve users about fire prevention measures, fire risk, and public safety issues. Publicity should increase as the risk increases.

5. Visits to local schools, community groups (e.g. Lions, Rotary) and user groups (e.g. running clubs) to publicise the risk.

6. Analysis of the causes of previous fires (e.g. arson, camp fires) can help determine where prevention activities should be focused.

7. Maintain a high level of fire suppression readiness.

8. Reduce levels of management activities and public access as the fire risk rises. A total ban on public access should be considered during periods of extreme fire risk (this has been used in similar situations but should only be a last resort, in very extreme situations).

9. Remove highly flammable vegetation - in particular dead pampas - from the sides of all tracks (i.e. where visible and easily accessible to track users).

Pre-planning for fire suppression can significantly reduce the potential spread of fire. It focuses on early detection, initial fire attack procedures, pre-arranged fire control strategies, call out procedures, and training of firefighting personnel. Pre-planning should include the following elements:

1. Establishment of a network of observers and publicised fire reporting procedures. Observers can include residents with clear views of Mauao, boaties, aero clubs, and regular users.

2. Close liaison with other fire management agencies, e.g. New Zealand Fire Service and the Department of Conservation. Joint training exercises should be undertaken on Mauao, to ensure that initial attack, in the event of a real fire, is both rapid and effective.

3. Regular (at least annual) training of Tauranga City Council staff that are involved with the management of Mauao and volunteers in fire control strategies, undertaken to industry standards.

4. Fire control strategies and fire plan should be reviewed annually. Public safety should be addressed specifically in the fire plan and action plan for Mauao. Priority must be given to the evacuation of reserve users immediately following the outbreak of fire.

5. Water supplies for firefighting should be reviewed. Supplies should be strategically placed to allow aerial access, ready vehicle access, and safety of firefighting personnel.

The greatest fire risk is associated with areas of early successional scrub on the northern slopes. Planting on Mauao should avoid the use of flammable species such as mānuka. This is very suitable for revegetation but other species are less likely to carry fire; e.g. karamu and ngaio. Reducing the fuel loadings of vegetation can significantly reduce the intensity of a fire, thus making it easier to control and reducing the risk of it spreading. Reduction of fuel loadings at Mauao can be achieved by using appropriate species during planting programmes in combination with maintaining a short pasture sward where grazing is to be continued.

10.10 Revegetation guidelines

Mauao Historic Reserve has been divided into nine broad Management Units which are shown in Figure 5. These are generally based on weed control and revegetation priorities.

Key factors in the successful establishment of indigenous vegetation on Mauao are:

- Species selection.
- Site preparation.
- Planting techniques.
- Maintenance of plantings.
- Ongoing weed control.

10.10.1 Species selection

Plant species have been selected that would occur naturally on the types of sites present on Mauao. The overall aim of the revegetation/restoration work is a fundamental factor when selecting plant species. Pōhutukawa is a key element on Mauao (and along the Bay of Plenty coast in general) and should continue to be a key species on Mauao. Another particularly important consideration is the relative flammability of species (some species planted prior to 2003 are considered to be highly flammable and this has been an important consideration when selecting species since the 2003 fire). A list of species and their relative flammability is provided in Appendix 6. Other issues considered include the overall appearance of the mountain and requirements for low maintenance.

A preliminary plant schedule is presented below in Section 10.10.2, but suites of species should be selected to suit individual sites. A full list of plant species potentially suitable for inclusion in plantings on Mauao is presented in Appendix 6. All plants should be sourced from Tauranga or local Bay of Plenty genetic stock, and should generally be grown from seed.

Most species will need to be grown in PB2 or PB3 planter bags. However, root trainer stock would be suitable for some species (e.g. tī kōuka (*Cordyline australis*), whahariki (*Phormium cookianum*), koromiko (*Hebe stricta*), and karamu (*Coprosma robusta*)), however where cover is required to quickly establish (e.g. track margins) it would be appropriate to use PB stock for these species as well, up to PB8 where size of the plants would provide an immediate cover or barrier. Plant stock should be ordered one to three years prior to planting to allow suppliers adequate time to source seed and grow stock. Early orders can sometimes also attract lower prices.[1]

10.10.2 Species schedules

Various complements of indigenous species are suggested for planting in each of the management units, as set out below in Table 3. In addition plant species that are recommended for areas (including track margins) under CPTED management are listed. An expanded list of species suitable for planting on Mauao is presented in Appendix 6.

Table 3: Plant species recommendations for each Management Unit and CPTED managed areas.

Species	Management Unit									CPTED Sites[3]
	1	2	3	4	5	6	7	8	9	
Asplenium oblongifolium	2									1
Astelia banksii	1									2
Carmichaelia williamsii			1							
Coastal māhoe (*Melicytus novae-zelandiae*)		1	2		1		1		2	
Houpara (*Pseudopanax lessonii*)		1	1		1	1	2		1	
Karamu (*Coprosma robusta*)		1	1				2		1	
karaka (*Corynocarpus laevigatus*)			1							
Karo (*Pittosporum crassifolium*)		1	1			1	1		1	
Kiokio (*Blechnum novae-zelandiae*)	1									1
Koromiko *(Hebe stricta* var. *stricta)*	1		1			1	1			1
Meadow rice grass (*Microlaena stipoides*)	1		1							1
Ngaio (*Myoporum laetum*)		1	1		1	1	1		1	
Olearia pachyphylla			2							
Pōhuehue (*Muehlenbeckia complexa*)				1		2				
Pōhutukawa (*Metrosideros excelsa*)	1	2	1	1	1	1	1	1	1	
Pūriri (*Vitex lucens*)		1					1		1	
Tauhinu (*Pomaderris amoena*)	1									1
Taupata (*Coprosma repens*)	1	1	1		1	1	2		1	
Whahariki (*Phormium cookianum*)	1	1	1			1	2		1	1
Whau (*Entelea arborescens*)		1					1		1	

Key
1. These species should comprise the bulk of the plantings.
2. To be used in low numbers.
3. To be used as under planting or alongside tracks where low-growth plant species are required (in CPTED managed situations).

[1] Most root trainer stock will be easily obtained the October prior to planting, but some species may require a longer lead-in time, e.g. up to two years.

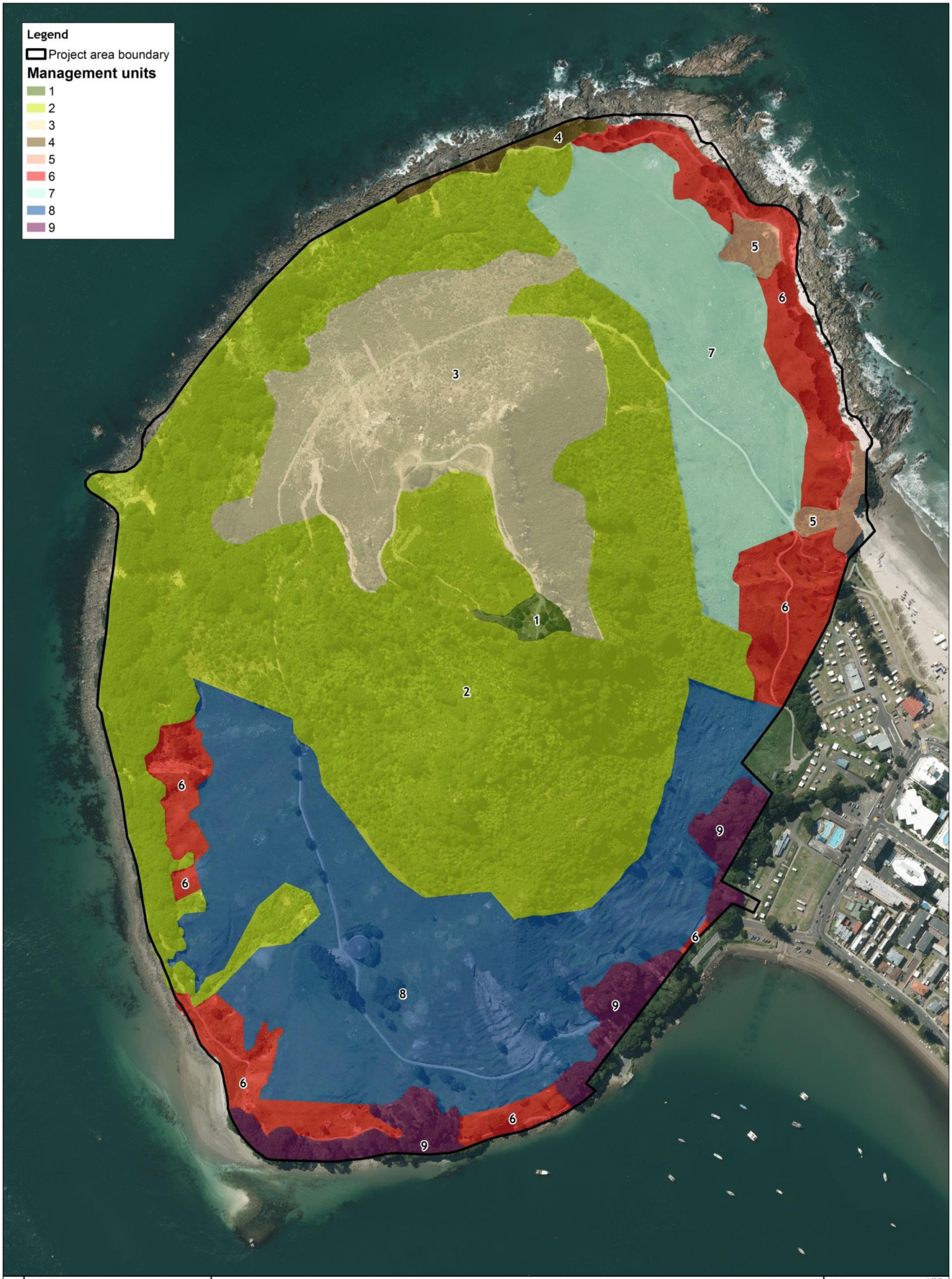

Figure 5. Proposed management units, 2015

The restoration area includes opportunities for cultural plantings and options for cultural plantings should be considered when planning the restoration of individual areas.

10.10.3 Site preparation for planting

Pasture/Exotic Grasses and Herbs

Planting sites that are pasture, or where exotic grasses and herbs have established following tree felling, clearance of debris, or spraying of weeds will require spot-spraying or blanket spraying with herbicide prior to planting.

During planting, individual planting sites with a dense grass/herb cover should be screefed (i.e. remove plant material and roots from an area about 0.35 m in diameter), plants should then be planted in the centre of these cleared micro-sites.

Areas with Exotic Trees[1]

Priorities for site preparation in these areas are listed below:

- Fell large exotic trees and mulch or remove debris.
- Cut all other small exotic trees and shrubs (remove debris), and swab stumps with herbicide.
- Knapsack spray or cut, and stump swab other weeds as appropriate (e.g. tradescantia). This will need to be undertaken more than once, in the summer months, with approximately 8-12 weeks between herbicide applications.
- Blanket spray 2-3 weeks prior to planting.

10.10.4 Plant spacings

Plant spacings when using PB stock should be *c.*1.5 m, and *c.*1.2 m for root trainer stock. This will ensure that canopy closure is achieved relatively quickly and reduce opportunities for weed establishment. Pōhutukawa should be planted at 8-10 m spacings.

10.10.5 Timing

Planting should be undertaken in the winter, preferably in early winter (e.g. May) to allow plants to become well established before summer.

10.10.6 Maintenance

Plantings will need to be released from all weed competition two or three times during the first year following planting, and 1-2 times in the following two or three years until plants have become established. Only aggressive woody weeds (e.g. gorse,

[1] For example within Management Unit 9.

blackberry, and pampas) will need further control until canopy closure is achieved. Some parts of the planting sites may be able to be left unreleased after 18 months if plants are well established.

Plants that die in the first year should be replaced (by infill planting), particularly where their absence would allow growth of aggressive weeds.

This management approach should be maintained for successive new plantings over the next 5-6 years, and then assessed to determine if it is appropriate and modified to correct any inadequacies.

10.11 Management of threatened and local plant species

The flora of Mauao reflects the diverse character of the habitats present. The distribution and relative abundance of various species will change as vegetation succession proceeds. It is also likely that more indigenous species will continue to establish naturally (weed species as well).

If track construction or other development is considered in, or near, habitats where *Psilotum nudum, Lepidosperma laterale*, mangemange, and *Tetraria capillaris* occur, these species should first be located and protected. All sites potentially affected should be inspected prior to any future track construction or re-alignment, to determine if any populations of threatened or local species are present.

One of the *Psilotum nudum* populations occurs in an area used for recreational climbing. The population on the climbing site should be monitored. If *Psilotum nudum* becomes threatened by increased climbing activity it may become necessary to survey other parts of Mauao to ensure that the species is secure. The cliffs have also been affected by fire and are somewhat unstable. This may also pose a risk for *Psilotum* and other cliff species.

Several nationally threatened or local species that occur naturally in coastal areas in the Bay of Plenty Region may have been present previously on Mauao and consideration could be given to the establishment of locally-sourced populations. Potentially suitable species and the appropriate habitats for establishment are listed below. Small scale planting trials should be considered, as the causal factors of decline may still be operating and hence re-establishment may not be successful. Any plantings should be monitored.

<u>Beaches</u>

Poa billardierei (hinarepe, sand tussock)
Ficinia spiralis (pingao)
Euphorbia glauca (Waiu-o-Kahakura)
Lepidium oleraceum (Nau, Cook's scurvey grass)
Pimelea villosa (sand daphne)
Tetragonia tetragonioides (New Zealand spinach)

Shrubland and Secondary Forest

Pimelea tomentosa
Olearia pachyphylla
Carmichaelia williamsii

Forest

Marrattia salicina (para; king fern)
Nestegis apetala (coastal maire)
Pisonia brunoniana (parapara)

11. MONITORING

11.1 Archaeological features

A condition monitoring programme should continue for the archaeological features within the reserve. Comprehensive monitoring is required in order to:

- Monitor the effectiveness of the grazing regime - to regularly review the grazing regime to maintain the pasture sward without causing damage to archaeological features. Monitoring should include fence lines, gates, and water troughs, and should be carried out at pre-determined intervals. For example, it would be useful to monitor the site following heavy rainfall or during prolonged dry spells, when ground damage from livestock is most likely to occur.

- Monitor whether visitors or other reserve management activities are having detrimental impacts - simple regular walk-through surveys can be used to monitor impacts of visitors and other management activities. The checklist of effects to be monitored should include graffiti/vandalism, damage to archaeological features by vehicles used in site management, damage caused by track and/or road maintenance and water run-off, damage caused by informal tracking, deterioration or damage to structures, and safety issues related to structures or reserve features. The checklist should include recording of the remedial actions required and the person responsible for them. In addition to these surveys, informal monitoring should be undertaken during any site visit or after specific management actions.

- Detect short and long term changes in vegetation that may lead to detrimental impacts on archaeological features.

11.2 Vegetation

- A series of photopoints should be established to monitor vegetation change on Mauao. These should include views of all side slopes and of the main vegetation/habitat types. Photographs should be taken at regular intervals, say every 1-3 years.

- It is also recommended that long term monitoring be established to check for new weed infestations and to monitor the rate of spread, or otherwise, of current infestations.

- A series of permanent vegetation monitoring plots should also be established and remeasured every 3-5 years.

- Foliar Browse Index (FBI) should be used to assess possum impacts on vulnerable species, e.g. pōhutukawa.

- It is important that plantings are monitored regularly, to determine survival of different species and relative growth rates, and other trends.

11.3 Fauna

The following monitoring should be implemented for key pest species and selected indigenous species:

- Annual possum monitoring using standard repeatable approaches (e.g. residual trap catch using ethically-certified leg hold traps, or bait take using wax blocks). The small size of Mauao would favour the latter method. Subsequently outcome monitoring of sensitive tree species (e.g. pōhutukawa and māhoe) should be undertaken annually (c.f. Payton *et al.* 1999).

- Rat monitoring should be undertaken at least biannually including in the early part of the seabird breeding season (June/July) and in summer. Either tracking tunnels could be used or wax blocks (c.f. Handford 2000).

- Mustelids and cats are not easily indexed, particularly in small areas. Operational monitoring should comprise a comparison of inter-year trap catch, a database of sightings compared between years, and assessment of breeding success and causes of failure of seabird species (see below), If mustelids and/or cats persist, use predator dogs to gauge the extent of the problem, and potentially to hunt and/or kill pest animals.

- Seabird monitoring - annual monitoring initially (and then every three years) of burrow occupancy and breeding success of kororā and ōi. Compare annual results with past studies (e.g. Jervis and Davies 2000 and H. Clifford pers. comm. 2014). OSNZ monitoring should be maintained. For dead birds, determine likely cause(s) of death by examining the scene for sign, including searching for predator bite marks and scats.

- Fur seal numbers - undertake regular counts of haul-out areas at set times of the year to determine trends in numbers. Monitoring of human behaviour around these sites is also recommended.

- Visiting birds - keep a database of threatened species visiting the reserve, e.g. kārearea and North Island kākā (*Nestor meridionalis*).

- Lizard diversity and abundance - an initial survey is needed to determine diversity of species present, from which a monitoring programme can be derived.

11.4 Human use

A visitor survey should be undertaken to establish the types and patterns of visitor use. A survey could include the following elements: background research, development of a field survey, field survey, and data analysis. A field survey could be undertaken using personnel positioned at key locations in the reserve. Surveys could be repeated at five-yearly intervals.

12. RESEARCH

The need for further research in the following areas became apparent during the preparation of the conservation plan in 2004 (Wildland Consultants 2004):

- Archaeological research to determine whether buried archaeological features are present within the grazed portion of the reserve on the eastern slopes of Mauao.
- Archival and archaeological research to determine the nature and origin of the archaeological features associated with the stone steps.
- Conservation advice[1] and assessment of the stone steps and stone jetty in order to determine what conservation treatment is required and/or appropriate. It is possible that the stone structures have been so heavily modified by 'repairs' carried out in the past that there is little or no original fabric remaining.

13. MANAGEMENT UNITS

Mauao has been subdivided into nine management units (refer to Figure 5) and management guidelines are provided below to underpin future management in each unit. Potential planting sites have been identified, to increase the area of indigenous vegetation. This would provide a larger area of habitat for indigenous plants and animals, and support tangata whenua aspirations for Mauao.

A simple objective and set of key issues has been identified for each management unit. Management Units 1, 7, and 8, about 50 percent of Unit 9, and the southern slopes of Unit 2 are to be managed primarily for the protection of cultural heritage landscape. While the majority of Unit 2, and Units 3, 4, 5, 6, and 9 are to be managed primarily for ecological restoration. Note that the southern slopes of Unit 2 are to be retained in indigenous vegetation and that further archaeological investigation is required in Unit 8.

[1] Advice should be sought from a specialist formally qualified in the conservation of historic stone structures. It is important that an appropriate person is identified because this is a highly specialised area.

Management Unit 1

Protect archaeological values and views while supporting a high level of public visitation to the summit.

- Review and implement ideas from the cultural values assessment with regards to the summit.
- Continue to revegetate track margins with low growing plant species to prevent users from straying from the track and accessing dangerous vantage points.
- Use PB8 size plants where appropriate to quickly establish cover and deter visitors from dangerous vantage points.
- Maintain permanent control of mustelids and cats, and pulsed control of possums and rats.

Management Unit 2

To be retained in indigenous vegetation. Manage indigenous vegetation on the southern slopes where it is protecting archaeological features.

- Maintain indigenous vegetation cover.
- Regular maintenance and manipulation of vegetation will be required to protect archaeological features.
- Selective control of invasive weeds.
- Local planting (mainly pōhutukawa) where required.
- Maintain permanent control of mustelids and cats and pulsed control of possums and rats.
- Remove lemonwood and replace with appropriate indigenous species.

Management Unit 3

The long term aim for this area is to establish pōhutukawa forest; the short term aim is to reduce pest plant cover and establish a vegetation cover that is relatively resistant to fire.

- This area was burnt in 1997 and January 2003. Parts were planted in June 2003.
- Many of the plants that were burnt continue to grow, particularly near the margins of the fire scar. Whaririki has been planted adjacent to tracks, along with lesser amounts of taupata and ngaio. Other species suitable for planting are pōhutukawa, karaka, karamu, houpara, koromiko, coastal māhoe, and karo. Several of these species are suitable for planting in root trainers, which leads to cost savings in plant stock and planting cost - whaririki, karamu, and koromiko. It may be advisable to continue to use PB stock adjacent to tracks where the

establishment of a dense fire resistant cover within as short a time as possible is desirable. A list of species and relative flammability is provided in Appendix 5.

- Control invasive pest plant species such as boneseed and pampas.
- Control radiata pine, brush wattle, boxthorn, gorse and swan plant as a secondary priority.
- Maintain permanent control of mustelids and cats and pulsed control of possums and rats.

Management Unit 4

The long-term goal is to re-establish a continuous canopy cover of pōhutukawa along the coastline.

- This area currently comprises pōhutukawa trees in declining health on the northern side of the base track.
- Plant pōhutukawa at intervals between existing trees along the coast line. Trees may require some sort of shelter (e.g. an informal stone enclosure) to provide suitable establishment sites and protect them from public interference.
- Control exotic grass species, and plant pōhuehue and rice meadow grass in between pōhutukawa trees.
- Maintain permanent control of mustelids and cats, and pulsed control of possums and rats.

Management Unit 5

Continue to establish indigenous forest and connect the corridor of pōhutukawa around the base of Mauao (linking with Management Unit 6).

- This area currently comprises pōhutukawa with indigenous plantings.
- Continue to establish a continuous strip of pōhutukawa-dominant forest. In between planted and existing pōhutukawa add ngaio, houpara, karamu, whararikī, and taupata.
- Release and maintain revegetation plantings.
- Maintain permanent control of mustelids and cats and pulsed control of possums and rats.

Management Unit 6

Retain grazed pasture in the short term, undertake further archaeological investigation and, subject to results from that investigation, either retain as pasture or plant with indigenous trees and shrubs.

Re-establish a corridor of pōhutukawa linking up with existing forested remnants around the base of Mauao (Management Unit 5).

- Parts of this area are currently grazed pasture.
- The coastal margins of this unit include a discontinuous fringe of scattered pōhutukawa over exotic grasses. Continue to establish a continuous strip of pōhutukawa-dominant forest (linking with Management Unit 5). In between planted and existing pōhutukawa add ngaio, houpara, karamu, whararikī, and taupata.
- Consider planting the grassed area in the future, particularly the steeper slopes, to re-establish indigenous vegetation. Prior archaeological research would be required in order to determine if this area contains buried archaeological features. If this area is part of the archaeological landscape it should remain in grazed pasture.
- This area also contains some evidence of shell middens and is likely to contain buried archaeological features. Planting is required to stabilise the eroding escarpment. Planting will require prior consent from Heritage New Zealand.
- The long term aim could be to re-establish tall forest, dominated by pōhutukawa; the short term aim is to re-establish vegetation cover which is relatively fire resistant. Pōhutukawa, taupata, koromiko, ngaio, karamu, whararikī, karo, and houpara should form the bulk of the plantings.
- Ensure invasive pest plant species such as boneseed and pampas are controlled if grazing is removed.
- Remove Kermadec pōhutukawa (*Metrosideros kermadecensis*) and replace with pōhutukawa (*Metrosideros excelsa*) or other appropriate indigenous species.
- Remove rabbits (potentially erect rabbit-proof fences and eradicate rabbits) and maintain permanent control of mustelids and cats and pulsed control of possums and rats.

<u>Management Unit 7</u>

Continue to revegetate the pasture where Heritage New Zealand has confirmed indigenous revegetation is appropriate, but maintain areas in grazed pasture as required to protect archaeological features.

Create canopy closure in areas that have already been planted by infill planting to prevent pest plant species establishment. Long term aim is to develop pōhutukawa forest (subject to the results of further archaeological investigation).

- Control all pest plants within the restoration plantings.
- Undertake or encourage archaeological research to determine if the area contains cultivated soils or buried archaeological features. This research will determine whether it is necessary to maintain this area in grazing.

- Establish scattered plantings of pōhutukawa if this is determined to be appropriate following archaeological investigation.
- The long term aim could be to re-establish tall forest, dominated by pōhutukawa; the short term aim is to re-establish vegetation cover which is relatively fire resistant. Pōhutukawa, taupata, koromiko, ngaio, karamu, whararikі, karo, and houpara should form the bulk of the plantings.
- Remove rabbits (potentially erect rabbit-proof fences and eradicate rabbits) and maintain permanent control of mustelids and cats and pulsed control of possums and rats.

Management Unit 8

To be maintained in grazed pasture where it is required to protect archaeological features.

- Reduce pest plant species distribution and abundance.
- Selective removal of exotic trees.
- Paint water reservoir.
- Remove poplar trees from the southern side of the water reservoir once the indigenous species planted underneath are established.
- Control rabbits (or erect rabbit-proof fences and eradicate rabbits) and maintain permanent control of mustelids and cats and maintain permanent control of mustelids and cats and pulsed control of possums and rats.

Management Unit 9

Exotic trees occur throughout this unit, interspersed with indigenous trees, and the aim is to re-establish pōhutukawa-dominant forest.

- This unit comprises a mixture of karaka, and pōhutukawa, which should be maintained, and exotic trees.
- The long term aim for this area should be to fell and remove the exotic trees, and control pest plant species growing beneath the trees.
- Plant to re-establish tall forest of pōhutukawa, karaka, and pūriri. Plantings should include pōhutukawa, karaka, houpara, ngaio, karo, taupata, whararikі, koromiko, karamu, tī kōuka, and coastal māhoe, with lesser amounts of whau. Pūriri can be planted in sheltered areas.
- Planting in this area will require the prior consent of the Heritage New Zealand as it is highly likely to contain buried archaeological features.
- Maintain permanent control of mustelids and cats and pulsed control of possums and rats.

14. WORK PLAN AND TIMING

A work plan with generalised timelines has been identified and is presented below. Note: It will be necessary to obtain quotes from potential suppliers for the tasks listed below.

Table 4: Selected tasks for management and conservation of Mauao, and their relative timing.

Tasks	Timing
ARCHAEOLOGY	
Ongoing informal archaeological inspections:	
• Continue to assess and revise fencing and grazing regimes to determine if there are any new negative impacts.	Weekly/monthly basis.
• Monitor tree saplings that may require trimming/removal from the area of the stone-faced landing platform associated with the iron jetty on the southern margin.	Weekly/monthly basis.
• Address the above.	As required.
Continue formal archaeological inspection and condition assessments by appropriate professional.	As required (for specific events) or at 10 yearly intervals to assess long-term effects.
Obtain archaeological advice prior to any management activities being undertaken in the reserve likely to cause ground disturbance, to ensure that archaeological features are not at risk.	As required.
Consult with archaeologist and Ngā Poutiriao o Mauao about further enhancement of the summit and associated open spaces and track network (e.g. trig replacement, construction of a marae atea, interpretation and other facilities).	Prior to any further work.
Consider further archaeological research in particular in MUs 6, 7, 8 and potentially the southern side of MU2.	
Consult with Heritage New Zealand with regards to the revegetation of MU6 and 7.	
ECOLOGICAL ADVICE	
Obtain advice re specific activities and review specific ecological restoration activities with an experienced restoration ecologist.	As required.
PLANTING	
Ecological advice: • Finalise plant schedules (include infill and blanking plants). • Confer with appropriate professionals with regard to yearly planting programmes.	 Yearly - January/February. Yearly - January/February.
Order plants.	Yearly for following year.
Site preparation (generally only covers spot spray immediately prior to planting; other weed control/site preparation covered under weed control).	April.
Monitor and maintain current restoration plantings.	February/March and November/December.
Planting and plant layout (1.5 m spacings for smaller PBs (PB3 and PB4); 10 m Spacing for pōhutukawa; and 1.2 m spacings for root trainer stock).	May or August/September.
Maintenance of plantings (for three years following planting).	February/March and November/December.
Small-scale plantings of nationally threatened and local plant species - plants and maintenance.	August/September.
Infill planting (site preparation, plants, and planting).	As per above.
Continue to plant pōhutukawa around the base track, particularly in MU4 and 6.	May or August/September.
Plant ngaio, houpara, karamu, whaririki and taupata in between pōhutukawa in MU5 and 6.	May or August/September.
Restoration planting in MU6 (under consultation with Heritage New Zealand.	May or August/September.
Continue revegetation programme in MU7.	May or August/September.

Tasks	Timing
Restoration and enhancement planting in MU9.	May or August/September.
Enhancement planting where appropriate around sites of cultural value (e.g. around puna).	May or August/September , as required.
Use culturally significant plant species in plant species selections.	As required.
Use plants to restrict access to culturally sensitive areas.	As required.
PEST ANIMAL CONTROL	
Review rabbit control programme.	Yearly.
Implement rabbit control.	Year round.
Review mustelid control programme.	Yearly.
Implement mustelid programme.	Year round.
Continue to control cats.	Year round.
Review possum control programme.	Yearly.
Possum control.	Year round.
Review rat control programme.	Yearly.
Implement rat control.	Year round.
Keep data of trap catches (mustelid, cat, rat and possum where appropriate).	Year round.
Continue to exclude all dogs.	Year round.
INDIGENOUS FAUNA	
Prevent human disturbance at seal haul-out areas.	Year round.
Undertake a lizard diversity and abundance survey.	As soon as possible.
FIRE	
Review fire plan.	Yearly.
Maintain a year round total fire ban (including cigarettes).	24/7.
Assessment of fire risk.	Weekly .
Radio and newspaper advertising of fire risk, to educate reserve users about fire prevention measures, fire risk, and public safety issues. Publicity should increase as the risk increases.	Ongoing.
Visits to local schools, community groups (e.g. Lions, Rotary) and user groups (e.g. running clubs) to publicise the risk.	Ongoing.
Maintain a high level of fire suppression readiness.	Ongoing.
Reduce levels of management activities and public access as the fire risk rises. A total ban on public access should be considered during periods of extreme fire risk (this has been used in similar situations but should only be a last resort, in extreme situations.)	As required.
Regular training of Tauranga City Council staff and volunteers in fire control strategies, undertaken to industry standards.	Yearly.
Continue the network of observers, 'phoning tree', and publicised fire reporting procedures. Observers can include residents with clear views of Mauao, boaties, aero clubs, and regular users.	Ongoing.
Close liaison with other fire management agencies, e.g. New Zealand Fire Service and the Department of Conservation. Joint training exercises should be undertaken on Mauao, to ensure that initial attack, in the event of a real fire, is both rapid and effective.	Ongoing.
Control pampas and remove any dry vegetative material, particularly near tracks or easily accessible sites.	As soon as possible and then as required.
REMOVAL OF TREES	
Consult with Heritage New Zealand if there will be any ground disturbance as a result of tree removal.	As required.
Continue to remove trees planted on archaeological features within grazed sections of the reserve.	As required.
Remove exotic trees in MU9.	Ongoing[1].
WEED CONTROL	
Control and follow-up control of environmental pest plants in all Management Units.	Six monthly.
Control weeds and release restoration plantings in MU7.	Six monthly until established.
Targeted control of pampas adjacent to tracks (and subsequent removal of dead vegetation).	Six monthly.
Control of weeds in MU3 - boneseed, pampas, radiata pine, brush wattle, boxthorn, gorse and swan plant.	Six monthly until established.

[1] Consultation may be required to determine whether any of the large, mature, exotic specimen trees are of historic significance.

Tasks	Timing
Remove silver poplar around the water reservoir once an indigenous understorey is established.	As required.
Ongoing weed control in sites where pōhuehue planted.	Six monthly.
LANDSCAPE	
Landscape brand development for Mauao.	Consultation, design and implementation over a 1-8 year timeframe.
Develop gateways and formal entrances.	Consultation, design and implementation over a 1-8 year timeframe.
Interpretation panels for sites of significance within the reserve that can be accessed by the general public.	Consultation, design and implementation over a 1-8 year timeframe.
Remove any old or damaged facilities (e.g. seating).	As required.
Consult with Tauranga City Council and establish screen planting (pōhutukawa) adjacent to stock yards (outside of Mauao Historic Reserve boundaries but fits in with the overall look sought within the reserve).	As soon as possible.
GRAZING/STOCK MANAGEMENT	
Monitoring of livestock management regime.	Weekly/monthly basis.
Monitor any changes to archaeological features.	Weekly/monthly basis.
Inspect fences to identify general maintenance requirements regularly as part of management, e.g. fortnightly and after storm events.	Weekly/monthly basis.
Regular maintenance of fences.	Ongoing.
Continue grazing regime to protect archaeological features.	Ongoing.
Gates between paddocks should be closed when not in use for stock movement.	Ongoing.
INFORMATION MANAGEMENT	
Continue to store and save all records information associated with the history and management of Mauao.	Ongoing.
Record work undertaken under each of the actions in this work plan as it is undertaken, and summarise it annually.	Ongoing.
CPTED MANAGEMENT	
Crown lift trees and trim shrubs on the edge of tracks where they restrict sightlines.	As required.
Relocate and update information signs to clearly indicate: track routes, distance from entry and exit points and grade of walk.	Consultation, design and implementation over a 1-8 year timeframe.
Plant low growing species on the track margins to prevent users from deviating from route (preferred plant species are listed in Table 3).	May or August/September.
Plant low growing plant species as an alternative to fencing to remove access to dangerous vantage points and wāhi tapu (preferred plant species are listed in Table 3).	May or August/September.
Keep tracks, seating and facilities well maintained.	Ongoing.
Install more seating.	As required.
Formalise informal tracking.	As required.
VISITOR/PEOPLE MANAGEMENT	
Undertake monitoring and visitor surveys to determine:	
• visitor activities;	Ongoing.
• seasonal patterns of use;	Six monthly.
• assess why people are visiting the reserve - is it for the outdoor experience, physical exercise, views obtained from the site, archaeological features, or perhaps a combination of these experiences.	Once and then 3-5 yearly.
Develop visitor management programme based on above surveys.	Yearly revision.
Implement above.	As soon as possible.
Interpretation panels and pamphlets (update pamphlets regularly).	As required.
Consider enforcing a concession based fee for companies that use Mauao for commercial gain (e.g. tour groups and sporting events).	Under consultation.
Continue to limit the installation of memorials in the Reserve.	Ongoing.

Tasks	Timing
MONITORING	
Archaeology	
Archaeological inspections to assess - livestock management regime; - visitor impacts; and - short and long term changes in impact of vegetation.	Weekly/monthly basis.
Fauna	
Annual possum monitoring.	Yearly.
Rat monitoring.	Bi-annually.
Mustelid and cat monitoring.	Yearly (comparison of inter-year trap catch).
Seabird monitoring.	Yearly (and then every three years).
Fur seal monitoring.	Yearly.
Lizard monitoring.	Initial survey and then as prescribed.
Establish database to record threatened fauna species visiting the reserve.	Ongoing.
Maintain database.	Ongoing.
Annual reporting on pest animal control.	Yearly.
Vegetation	
Establish and measure permanent photopoints (*c*.30).	Now (and then remeasure 1-3 years).
Establish and measure permanent vegetation plots.	Now.
Remeasure permanent vegetation plots.	Three to five yearly.
Foliar Browse Index (FBI) points/plots.	Now.
Monitor plantings (to determine survival of different species and relative growth rates and threatened plantings).	Ongoing.
RESEARCH	
Undertake or encourage archaeological research to determine if MUs 6 and 7 contain cultivated soils or buried archaeological. features. (This research will determine whether it is necessary to maintain this area of grazing or whether parts or all can be planted.)	2016.
Archival and archaeological research (to determine the nature and origin of the archaeological features associated with the stone steps).	Ongoing.
Archaeological research to better understand past inhabitants way of life.	2016.
ROAD, TRACKS, WATER RUN-OFF, VEHICLE ACCESS	
Monitor water run-off management from summit access road, reservoir, and all other tracks and implement maintenance when required.	Ongoing.
Ensure the use of machinery during maintenance of the 4WD access track is closely supervised. (If any ground disturbance is likely to occur in any area that is not already clearly part of the established 4WD track - for example, the establishment of additional culverts - the proposed work should be discussed with Heritage New Zealand in order to determine if an Authority to Modify is required.)	Ongoing.
Regularly inspect tracks to identify general maintenance requirements as part of management.	Fortnightly, and after storm events.
Inspect water run-off systems to identify general maintenance requirements regularly as part of management.	Fortnightly, and after storm events.
Track maintenance - use crushed rhyolite surfacing - ongoing (ensure that shell aggregate is not used).	Ongoing.
Track definition.	Ongoing.
Continue to restrict vehicle use of the summit track.	Ongoing.
PUBLIC USE	
Encourage tangata whenua to provide guided walks for large groups.	
Continue to encourage public use while increasing awareness of cultural, archaeological, ecological and landscapes values on the site through the following (as discussed above): - Interpretation panels. - A high level of maintenance. - Increased public involvement (for example pest control, litter	Ongoing.

Tasks	Timing
control and planting). - CPTED management. - Marketing.	
MANAGEMENT PLAN	
Review Conservation Plans.	Every 10 years, or sooner if required.
Review Management Plan.	Under current consultation.

15. REVIEW OF CONSERVATION PLAN

Ongoing consultation with all relevant parties is imperative during the implementation of this plan. Any management proposals not currently within the scope of this plan will require a change to the plan before the proposals proceed. Changes in management or standards should be discussed and agreed, in writing, by Ngā Poutiriao o Mauao and Heritage New Zealand. This plan should be reviewed by 2025, or sooner if required.

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s 7(2)(f)(ii) and s 7(2)(f)(ii) Tauranga City Council) provided project liaison and important discussion with regards to the day to day operations on the maunga.

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