Te Wairoa-Matapouri Dune Restoration & Monitoring Plan

2019-2027

'Restoring the Mauri of Matapouri'

Top photo: *Te Wairoa dunes looking out towards Matapouri Bay.* ***Bottom Photo:*** *Looking out towards Rangitapu Point & Matapouri Bay from Otito reserve. Photo Courtesy of Kayla Raines.*

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Site Description:

The Te Wairoa Estuary as it is known to locals and associated beach at Matapouri Bay is located within the Matapouri Township between Whale Bay in the North and Tutukaka in the South. The dune-land that is the focus of this plan is on hapū owned land (Rangiwhakaau) and Whangarei District council (WDC) reserve land. The local Landcare group, Matapouri Kaitiaki Project, has been working alongside the Northland Regional Council and local Tangata Whenua to restore this area. This is a seven year restoration strategy with multiple stakeholders and community interests involved such as the Ngunguru School which has been involved in the restoration work from the beginning.

There are three formal access ways and a number of informal access ways at the Te Wairoa Reserve, with Matapouri beach having a couple of formal access ways and a number of informal access ways. Previous year's restoration work done by WDC and the local Hapū has seen a vast improvement on the Matapouri beach front, however with every summer, masses of people come to the area, who have trampled all over the dune vegetation creating more work to be done.

The dunes have significant weed issues, especially at Te Wairoa dunes with exotic species, such as the South African ice plant which is the dominant plant species in the area. There are also other exotics present, such as Agapanthus, as detailed in Appendix 3. The native spinifex and pingao are well established in some places. However there have been a lot of weed control and native plantings that has happened over the last couple of years in the and around the dunes, the foredune area is looking healthy, but more planting and weed control is needed in the back dunes. Key sand binding species are critical in building a healthy dune to create a natural buffer against erosion and facilitating recovery from storm erosion. They also provide a special habitat for endangered and threatened wildlife species. The dunes are significantly impacted by horses, vehicles, and dogs, and it is critically important to restore and maintain a healthy natural dune ecosystem. Dune-lands have significantly been altered and affected by degradation over time, throughout Aotearoa (Bergin and Kimberley, 1999). They are the most common type of landform seen within New Zealand and hold special scientific importance. Our neighbor Ngunguru Sandspit – Pi Manu is a great example of a relatively- unaltered dune system, even though it is larger in comparison. It is an excellent habitat for endangered endemic wildlife.

This Restoration Plan will cover the fore dunes, mid dunes, and back dune areas within the Te Wairoa estuary, and strategically placed native plantings will be planted throughout the area. The restoration work will be done to re-establish the natural dune's function, stabilizing sand banks and mitigation against storm surges, plus provide critical habitat for endangered indigenous fauna and flora. The native planting will extend from the point of the first bridge, right around to the boat ramp and over the estuary on the sand spit Point, dependent on council funding and resource availability.

The "green area" on the Te Wairoa reserve, near the boat ramp will also be strategically planted with native plants and amenities installed to beautify and utilize the areas functionality for families, tourists, and locals. Post and batten and wire fencing will be installed- from the boat ramp access way, on the right-hand side of the entrance near the culvert, around the current dunes to the mean high tide mark, and towards the first bridge. Fencing will also be installed around the dunes on the sand spit point, extending out slightly to give plants a chance to establish and help reduce sand blow outs. Trees That Count is one organization that has agreed on funding 100 trees to be planted in the area, and both the NRC Environment Fund and the WDC Community Fund will be utilized in making this plan a reality.

Vision Statement:

The goal of this restoration plan is simple:

"In time the dunes and surrounding habitats will be returned to a functioning ecosystem with a community of native plants and wildlife representative of pre- European times, without threat of extinction. Where people will visit for recreation and appreciate the restored natural environment".

Below is a basic quote by (The Protected Natural Areas Programme. DOC, 2005) report, which states:

"Ensuring, as far as possible, the survival of all indigenous species of flora and fauna, both rare and commonplace, in their natural communities and habitats, and the preservation of representative examples of all classes of natural ecosystems and landscape, which in the aggregate originally gave New Zealand its own recognizable character".

Site Assessment:

The Matapouri beach is well known to be one of the most favored coastal recreational areas within the Whangarei District, due to its natural character, moderately sized beach, and sheltered water conditions. The seaward face of the dunes was once largely denuded of vegetation and as a result easterly winds had pushed sand off these faces and heavy pedestrian activity resulted in "blowouts". The vegetation on the dunes of the Matapouri beach front consisted of small, scattered pockets of indigenous sand binding species, and had a number of invading exotic grasses and low rhizomatous herbs previously. (LLA, 2008).

Since the dune restoration work was carried out a by WDC & community, where public access way entrances were improved, sand reinstatement work done and sand binding vegetation planted, the beach appears to have greatly improved. However, the ever-growing number of people visiting here every summer has once again displaced sand binding vegetation and undermined the community's efforts to make the dunes healthy. Not to mention the devasting damage the cyclone Gabriel has done. There are gaps to fill with sand binding plants and back dune planting to be done, as well as possible sites that need to be fenced off from the public.

Te Wairoa dunes are relatively small compared to other sites within Matapouri, the currently fenced area is approx. 9,440m^2 (just under 1 hectare). It is a lot wider than the dune along most of the ocean beach. The area is heavily denuded of native vegetation and needs substantial planting with indigenous plants.

There is a lot of cultural Māori history in Matapouri, and surrounding areas and a lot of the places people walk, and play are Wahi Tapu sites, some places are well known to individuals, other places not so much. More cultural awareness is "key"- for people to be able to respect and value this small coastal township and its special places.

There are also a number of endemic threatened and rare indigenous plant species known to frequent the surrounding Matapouri forest margins, adjacent to the duneland. Some populations are sparsely pocketed within Matapouri, and others are only located at a particular site. These include species such as *Fuchsia procumbens* (small coastal prostrating plant), *Cortaderia splendens* (local ToeToe), Tawapou (*Planchonella costata*), climbing Clematis (*Clematis cunninhamii*), Fireweed (*Senecio scaberulus*) and kotukutuku (*Fuchsia excorticaca*) (Bergin and Kimberley, 1999).

A hypothetical list of dune plants thought to have once been in the area is in Appendix 2. These would be appropriate to plant as part of this restoration work, if seeds can be locally-Eco sourced. However, there is an understanding that some plant species listed in the Appendix, would need to have a Department of Conservation Translocation Plan in place, e.g., *Atriplex hollowayi,* commonly known as Holloway's Crystalwort, which is Threatened – Nationally Critical (2012 NZTCS).

The Te Wairoa Estuary shown in Figure 1 below, has low numbers of several threatened fauna/bird species which use the estuary for feeding and breeding. The most threatened species due to lower population numbers are those of Australian bittern, fernbird, banded rail and pateke, the last of which are slowly recovering due to intensive pest control (Ecological Estuarine Area Assessment sheet Matapouri, and the latest NZTCS birds 2021). The Ecological significance of this estuary is moderate (NRC estuary sheet for regional plan), but local importance to some species should be considered when recognizing ongoing management in the future. A list of the species in this area is in Appendix 1.

Figure 1: Southern end of Matapouri beach, Te Wairoa Estuary Reserve, including the first bridge and the current boat ramp access point. Areas that are not included in the image are Shingles Bay (Pebbly Bay), Te Whahitapu stream area, rest of Matapouri Beach front, and Te Wairoa esplanade, (the actual boat ramp).

Threat analysis:

There are a few factors to consider, which need to be addressed /factored for the successful progression of this restoration plan and these include:

- Introduced exotic weed species
- Introduced pest animals – predators
- Climate change and sea level rise
- Lack of water for vegetation
- Grazing of native plants by rabbits
- Vandalism of native plants/structures by people or vehicles

Mitigating these factors will be a big part of this plan; however, a current predator control regime is in place within the dunes at Te Wairoa, for species such as rats, stoats, and mice. The Matapouri Kaitiaki Project is conducting a large-scale predator control regime within the surrounding bush areas within Matapouri. Due to lack of volunteers some of this mahi has been handed over in recent times to the Taiao team within Ngāti Wai, and Tutukaka Landcare Trust (TLC). An updated pest management plan will be available to view at a later stage, however Mana Whenua is working on their own pest management plan in conjunction with TLC and other appropriate organizations.

Public awareness is needed of the plight of our vulnerable NZ dotterel and other shorebirds and their vulnerability to household dogs and cats, which prey upon them as well as other native fauna. Public awareness is also needed of the plight of our vulnerable little blue penguin birds and their vulnerability to the household dog and cat. These issues will be raised through a sustained advocacy campaign. The essential messages will be for dogs and cats to be always kept under control in areas where our endemic wildlife reside. Cats should be kept inside from dusk till dawn and dogs should be always kept under control.

Rabbits pose a serious threat to newly planted vegetation and will need managing if populations become a problem. Possums could also be a problem to newly planted trees once they establish and a plan will need to be implemented in the future.

Introduced weed species at the different dune sites will need to be assessed on a stage-by-stage basis as each stage is planted out with native vegetation, and an ongoing management plan will need to be in place. Indigenous flora that is to be planted under this plan should ideally be planted in winter, once the ground has had a bit of rain and is easy to dig into. Plants will be able to cope better with climatic conditions, as the possibility of frequent rain forecasts will mean plant survivability will be more certain. In the summer months plants will need to be assessed and water might need to be provided in some instances. Selection of appropriate, drought tolerant, coastal species will reduce the risk of plants becoming too dry.

Grazing animals, such as horses, also pose a serious risk to the success of restoration within the reserve and more public awareness is needed here. Social media outlets should be used to get the message out to the local and wider members of the community. Vandalism is also another possible threat to the restoration plan as some individuals might damage plants or newly installed fences/signs, and local residents would need to be vigilant and report any suspicious activities to the appropriate authorities. These problems are not just local they are also problems at different sites around the motu (Te Mana O Te Taiao, 2020).

Goals

1. "*To halt further degradation of the natural environment and enhance the natural areas within Matapouri for indigenous fauna and flora" -Restoring the Mauri.*

2. *To serve as a recreational reserve and place for all to relax and unwind in, to provide natural buffers or vegetation for shading, serving also as an environment, where all can enjoy but also watch native biodiversity thrive*."

3. *To serve as a cultural gate way to the indigenous people and have purpose for the Mana whenua & Tangata Whenua, where everything in nature is used for purpose*.

4. "Poipoia te kakano Kia puawai"- *Nurture the seed and it will blossom.*

5. "Hapaitia Te ara tika pumau ai te rangatiratanga mo nga uri whakatipu"- *Foster the pathway of knowledge to strength, independence, and growth for future generations.*

Restoration Objectives

There is obviously a high interest within the Matapouri area in enhancing local biodiversity values. An all-encompassing vision is to bring about the sustained recovery of ecosystems in the Matapouri area and to ensure that there is a balance between retaining biodiversity values and achieving economic sustainability'.

Five objectives have been chosen- it is not an exhaustive list, and it should not be assumed that they totally reflect the vision of the wider community. There are clear opportunities to develop integrated projects on the ground with local iwi, which will ensure that protocols and procedures were acceptable to all concerned. They are summarized in Table 1 and elaborated below.

Table 1: Objectives of the Te Wairoa reserve and surrounding natural environment.

1.	*To hear and enjoy the morning chorus of bird song from bellbirds, kaka, tui, silvereyes, and other native birds. As well as enjoy the evening chorus from the North Island brown kiwi.*
2.	*To be able to enjoy the flowering spectacle of Pohutukawa trees and other key plant species.*
3.	*To return the dune-lands of Matapouri to a healthy and dynamic ecosystem where native biodiversity thrives. Attract an array of dune invertebrates and lizards by establishing a healthy plant community.*
4.	*To have fencing in place, either temporarily or permanent around the entire dune-land, to be able to protect native plants and native New Zealand Dotterel habitat, by 2021*
5.	*To have a thriving Pa harakeke for the community and hapū to utilize*
6	*To reintroduce indigenous endemic dune flora back into a dune ecosystem*

Objective 1: To hear and enjoy the morning chorus of bellbird, kaka, tui, silvereye and other native birds. As well as enjoy the evening chorus of the North Island brown kiwi.	
Explanation:	Bellbird numbers are increasing on the Tutukaka coast and will steadily increase if predator control continues and there are the key plant species available. Kiwi probably number less than 500 on the Tutukaka coast and are likely to be steadily increasing due to releasing of birds from overpopulated sites in Northland. If dogs are kept under control at all times and strong responsible dog ownership upheld, then numbers will only increase. Kiwi aversion training and advocacy is continued to be available to residences, then again numbers will increase.
Requirements:	Stop predators killing kiwi and other native birds.
Methods:	Control feral cats, mustelids, rodents, and possums using different trapping methods. Advocate for better control of domestic pet behavior.
Monitoring:	Call count indices carried out annually in June/July. Radiotelemetry will continue to be carried out by TLC (Tutukaka Landcare).
Other benefits:	Bellbirds, kaka, and other native wildlife will begin to breed successfully along the Tutukaka coast, especially with increased efforts of predator control. Nesting penguins, seabirds and shorebirds will also benefit and recover over time. Ripple effects may need to be addressed in sensitive areas.

Objective 2: The flowering spectacle of Pohutukawa is annual event and other key species have high levels of flowering and fruiting capabilities	
Explanation:	The forest canopy processes of flowering and fruiting are sensitive to possum browsing with species such as Pohutukawa, rata and kohekohe. The native kukupa (New Zealand pigeon) is a pivotal seed disperser of larger fruiting natives, such as puriri and is also susceptible to possum predation.
Requirements:	Possum indices need to be kept below 5% residual trap catch
Methods:	Possum control to <5% RTC has been in place in Otito Reserve and surrounding forests, for the last 8 years. Continued predator control efforts from TLC and MKP (Matapouri Kaitiaki Project) have maximized benefits and slowed-down possum reinvasion points and hotspots. Implement control of possums on private land adjacent to these areas by methods acceptable to landowners to maintain buffers, and reinvasion.
Monitoring:	Co-ordinate with hapū, DoC, and NRC Biosecurity staff (Possum Control)
Other Benefits:	NZ pigeon, kaka, and some other birds, lizards and insects benefit from improved food supply and reduce predation from possums. Seed dispersal improved and reduced light levels will limit certain weeds (See objective 3).

Objective 3: To have the dune-lands of Matapouri return to a healthy and dynamic ecosystem where native biodiversity thrives. Attracting native skinks, geckos, and invertebrates.	
Explanation:	The dune-lands within Matapouri have been fragmented, degraded over time, and increased vulnerability of these areas has reduced dispersal capabilities of indigenous plant and animal species. Dune-lands and their biota are under siege from the sea on one side and the effects of development on the other, e.g., grazing, building development and other vegetation clearance and pest encroachment. Consequently, the lush pingao-spinifex dominated dunes are now a shadow of their former glory, while characteristic dune fauna, such as the New Zealand dotterel and katipo spider, have declined historically.
Requirements:	Ensure controls on development are in place through WDC planning review processes, restore native vegetation, control weed and animal pests to low levels, monitor recovery of dune-lands and key indicator species.
Methods:	Determine areas that are a priority for restoration and evaluate the plant community required, e.g., fore-dune, mid-dune and back-dune habitats and species composition. Talk with landowners or council staff or consultants to determine whether rehabilitation is viable and if so, plan the approach e.g., eco-source plants, labor and follow-up management and monitoring. Work with WDC and NRC to achieve recognition for protection of values and better protection from development. Application of fertilizer to existing plants to encourage growth. Continue nursery approach/nursery crop development of native plants and planting regimes with genetic sourcing from nearby plants, appropriate for the area and identify opportunities for further expansion of planted areas. Control invasive weeds and browsing predators.
Monitoring:	Survival of plantings and habitat viability, e.g., establishment and growth of plantings, overall habitat health, plant pest levels, productivity of shorebirds. Using appropriate methodologies such as planting plans and shorebird surveys.
Other Benefits:	Increased dispersal and recolonization capabilities of plants and animals including fauna such as lizards, seabirds, and shorebirds to name a few. Protection of habitat, slowing blow outs and protection from flooding, reduced weeds, and predator invasion of surrounding habitat. Provide a restoration model for other areas.

Objective 4: To have fencing/signage in place around the entire dune-land, protecting native plants and native New Zealand dotterel habitat by 2024. Completed-Te Wairoa Dunes (2018-2020).	
Explanation:	Currently there is no fencing around the dune-lands and protection of native plants and native shorebirds is minimal. Predator control is in place by MKP, however more community input is needed to protect the flora and fauna. Advocacy of the plight of the shorebirds that call the dune-lands home is needed and fencing is required to keep people, and vehicles out.
Requirements:	Fencing is required around the dune-lands, whether permeant or temporary. Community input is needed to carry out the work needed in this area, such as fencing and planting.
Methods:	Relating to protecting planting and determining which areas will need permanent fencing (post batten and wire) and which areas need just temporary fencing (stake and tape). This will ensure that any restoration works undertaken will have adequate protection for native plantings, and native shorebird habitat and stop people from trampling any establishing plants.
Monitoring:	Regular checks of the area will be needed in order to notify council of any vandalism and areas that might need fixing.
Other Benefits:	Will allow native plants a chance to grow and provide habitat for native wildlife, also keeping out people and vehicles. Signage will bring awareness to community and community care for the area would be heightened.

Objective 5: To have a thriving Pa harakeke for the community and hapū to utilize	
Explanation:	Currently there is not that many varieties of harakeke for the community to easily utilize for cultural purposes. There needs to be a cultural element added to the community by appropriate use of the reserve. In Māori culture the Pa harakeke is a metaphor for family or whanau: 'Te rito o te harakeke' is the center shoot or growing point, likened to a child. The two shoots immediately either side of the rito are its parents 'or 'awhi rito'. Pa harakeke keeps cultural traditions and customs alive and ensuring environmental sustainability. "Hutia te rito o te harakeke, kei hea to komako e ko? If you pull out the center shoot of the flax plant, where will the bellbird sing? Local weavers will know which types of harakeke are best. Are you interested in weaving kete and mats, or using muka for cloak making? Do you want to make piupiu for kapa haka groups? Are there beginners or school children needing soft leaved bushes to practice with?
Requirements:	Pa harakeke is planting of selected varieties of harakeke (*Phormium* spp). Chosen for their muka (fibre) or raranga (weaving) plaiting qualities. Different species of flax will provide a resource that feeds culture. Harakeke is primarily used for *raranga* or weaving and is used to create things like baskets, *Whariki*-mats, clothes, art and *Wahakura*- a bed or cot for babies.
Methods:	Determine the site that would be ideal place for the Pa harakeke, determine which species would be suited to the area, as each species has a different purpose within Māori culture. Cultivate harakeke to ensure vigorous, healthy bushes that will provide high quality leaf material for weaving. Suitable varieties may be available through the network of weavers; another source is the Rene Orchinston collection, maintained by Manaaki Whenua at Lincoln. Keep an accurate record of the different varieties planted; it's important to preserve the integrity of their names and Whakapapa. Many harakeke looks quite similar and can easily be confused.
Monitoring:	Te Whanau of Rangiwhakaahu and community would care for the Pa harakeke and utilize the plant for cultural and other purposes. Frequent cultivation would see the bushes would be managed accordingly.
Other Benefits:	Strengthen tourism practices to provide future generations with security and comfort, both economically, culturally and increase biodiversity. Harakeke is also used for medicinal purposes; treating boils, burns, and can act as an antiseptic for cuts and internally for diarrhea. It also provides an excellent natural barrier instead of fencing in places.

Site-Specific Management Options

The section of dunes at Te Wairoa reserve has been divided into three areas shown in Figure. 2. The Management issues and description of the dune morphology and vegetation cover are provided for each area along with recommended site-specific management options.

Figure 2. The four zones identified at the Te Wairoa dune system, for restoration works to be done.

Mana whenua alongside Northland Regional Council, coastal care team and the local land care group have come up with a more detailed design as shown in Figure.3. The concept is to be aesthetically pleasing as well as functional and culturally appropriate.

Figure 3. The individual zones that are represented within each part of this restoration plan detailing native fore-dune, mid-dune and back-dune plants.

Area A – Boat ramp/Te Wairoa reserve (Figure 2 includes this zone)

Description

- Moderately sloping margin of small dune-land with dense cover of mainly spinifex and pingao plants. Near the boat ramp there are a few dense patches of jointed rush and spleenwort plants. There is one centrally located dense patch of exotic vegetation near the road edge and in the dunes, near the formal pedestrian access way.

Spinifex and pingao dominated foredune

Spinifex dominated foredune, transitioning into wiwi mid-dune (south of area)

Invasion of exotic grasses unnaturally consolidating the dune.

- There are a number of small blowouts in the vicinity of the formal pedestrian access ways leading from the reserve and entrance to the boat ramp. The reserve is primarily a large grass paddock with only a couple of shade trees and no fencing or natural barrier plantings (pictured below). Vehicles have access to the grass area, beach and the dune-lands, disturbing plants as well as native wildlife.

View of Te Wairoa reserve facing southward

Existing signage

Management options

- Install sand ladders (if this is feasible) on the two formal access ways through dunes onto beach, near wooden WDC sign and Pohutukawa tree.

- Remove exotic weed species over time, which is currently being done and needing to be continued. By control methods such as manual hand pulling and re-plant areas of fore-dunes, mid-dunes, and back-dunes slowly, with specific indigenous species such as pingao and spinifex. Back-dune planting should be done in winter and fertilized with slow-release tablets.

- The green space (reserve) should have 3 concrete picnic tables installed with the bases of those tables being made by locals to avert costs. Then pa harakeke (different flax plants, used for cultural purposes) is to be planted from the culvert near the multiagency sign right around by the power poles, allowing enough growth space, along the edge of the Matapouri Roadside for a natural barrier look. Different varieties of harakeke should be chosen here to consider views that may be affected.

- Wooden bollards installed near power source in the middle of the reserve, planting rengarenga lily and sand tussock on northern side of bollards to reduce vehicles on the green. Add mulch to help with moisture retention, A large commissioned wooden pou will be installed in the middle of the green, at a later date.

- Make a signage area with the existing bird signage as well as additional dune signage.

Area B - Te Wairoa Dunes/back of private dwellings (Figure 2 Includes this zone)

Description

This zone spans along from the front of the private homes, out onto the wide 'open green space' near the rock on the hill, around the front of the fore dunes and along the beach to the formal WDC wooden 'Te Wairoa reserve' sign.

- There are a number of informal tracks leading to the beach front, at the back of the private landowner's properties, where native plants have been removed which have created small blowouts. This has resulted in a lack of back dune, mid dune, and fore dune native plants.

- The entrance to the 'wide open green space' at the back of private landowners' properties has been extensively widened over time, creating a driveway to the area, as well as lack of vegetation (as seen below).

- The back dunes in this area are dominated by exotics, some of which are escapees from people's homes and will need to be removed. There are scattered patches of native species of plants throughout this dune section, mainly pingao and spinifex (pictured below).

View of access way leading down the southern end of reserve at the back of private homes

View of exotic plants, where back dune planting should be

Management options

- The main priority is to manually remove the exotic species of plants over time along the back dune area, near holiday homes, by way of manual digging and hand pulling.

- Post and batten fencing has been completed all around the described dune zone, up to the high tide mark, where necessary. The access way to the 'open green space' at the back of private landowner's properties will require fencing, so to allow the dune area to be extended and the grass area narrowed. Vehicles do not need access to this part of the reserve and are creating large uneven surfaces; it will need extensive back dune planting in this area.

- There is a large informal access way near the rock on the hill which is a culturally sensitive site (Wahi Tapu) to the local hapū. The fencing will be installed out onto the grass space past the rock by about 3-4 meters and go towards the formal access way on the right, where fencing will also be installed both sides of the stairs around the margin of vegetation (pictured below). The stairs are a bit of a hazard and are eroding away; perhaps a sand ladder would be a better option here. Vehicles have been driving over sensitive sites and gaining access to the beach via the wide blow out openings. Vehicles have also been driving over endangered dotterel nesting sites and tuatua spawning areas on the beach. Extensive, fore dune, mid dune and back dune planting is needed here at this site (pictured below).

Formal stair -access way to beach

Blow out damage caused by vehicles.

Area C-Southern part of dunes/First Bridge (Figure 2 includes this zone)

Description

This zone includes the open green space at the back of the private landowner's properties near the formal stair access way and the small margin of dunes around to the first bridge, where a second formal access way is located.

- The green space in this area is very exposed and there are no shade trees or back dune plants, with the area denuded of important native vegetation.

- A dense strip of exotic plants is present in this area, near the formal access way (small stairs), very few native sand binding plants are present (pictured below). These exotic species will need to be dug out and possibly a combination of hand cutting, and herbicide application will be required (see Appendix 4 for control methods). Extensive back dune and fore dune planting is needed here and also around towards the first bridge, where the dunes are denuded of native sand binding plants (pictured below).

Dense strip of exotic plants

Formal beach access way near the first bridge, Matapouri.

Management options

- Focus restoration efforts on the back dunes in one area initially, such as the most southern part of the back dunes, before moving northward (as resources allow). Removal of exotic plants will be slowly replaced with appropriate native species and the formal access way will be unblocked by digging out exotic species. Wooden bollards should be installed as well as a sand ladder at the formal access way point, to give public access onto beach without damaging dune plants (pictured below).

View of exotic plants blocking formal access way near the first bridge

- Moving northward in small stages, key native trees will be planted on the green space to provide shade, and gaps filled in the back dunes, and fore dunes with appropriate native species. Key back dune species include ngaio, ti kouka, harakeke, Pohutukawa and coastal five fingers, to name a few. Using planting regimes of 1-2m spacing the area will require less than 6000 plants, give, or take.

- At a later stage a concrete picnic table and BBQ will be installed on the green area, close to where the fencing will be near the rock on the hill. Once trees are well established here they will provide shade (pictured below).

View of 'open space' at southern part of Te Wairoa reserve

- A key part of the seven-year restoration strategy is to monitor the success of plant performance and implement timely maintenance, particularly weed control and perhaps even a water regime in summer months.

Area D - Matapouri beach front/Sand spit point/ Remaining Te Wairoa

Description

The zone for this plan spans from the last private landowner on the most southern point of the Matapouri beach right next to large mound of dune-land. This area is an important part of the dune-land and needs stabilizing to protect homeowners from storm surges as well as protecting endangered NZ dotterel and little blue penguin nesting sites (pictured below). This end of the sandspit is naturally unstable, but appropriate dune vegetation cover could help to reduce erosion, however there will always naturally be periods of erosion.

View of the sand spit point-Matapouri

Management options

- Focus on this area should be on the fencing, which should consist of a movable rope fence, due to tidal effects. Coming out about 2m, around the base of the dune and continuing right up to the high tide mark. This will ensure the area is not going to be disturbed by vehicles or boats that are capable of driving on the beach. People will need to go to appropriate access ways to gain entrance to the beach, but there will not be any guaranteed people will do this. Appropriate dune restoration signage will need to be installed and current temporary fencing of nesting bird sites moved, along with the signs depending on the nesting sites established within this area.

- A large number of indigenous dune plants need to be planted here; ideally once sand replenishment work is completed. But if this isn't possible then a 2m buffer zone of mid-dune plants should be used to create a bulk up of vegetation for the area. At the rear near the private dwelling at the top of the dune hill, a few back dune plants should be planted here. Mid-fore dune plants such as spinifex and pingao should be used as well as muehlenbeckia; a couple of little blue penguin boxes should also be placed here, once plants become more established.

Site-Specific Seven Year Restoration Plan

In developing the recommendations below (Table 2) we have considered the following site-specific factors:

- Recommended priorities for actions and resources are only provided in detail for years 1 and 2 and based on a budget of approximately $10,000 per year (WDC) to cover the cost of plants, any contractor's time, and other materials. Also bearing in mind the Northland Regional Council Environment Fund will provide certain resources needed as well.

- Only general guidelines are given for years 3-5 as this is dependent on actions undertaken and performance of restoration over the first two years.

- Plant numbers are based on a maximum of 500 plants to be planted comfortably within a single, winters morning session by a community group with 10-20 persons attending.

Table 2: Recommended priorities for actions and resources required for restoration of Te Wairoa Reserve dunes, Matapouri Beach front (Sand spit Point).

Area(s)	Year(s)	Actions	Resources required
A	**1 & 2**	Install sand ladder on formal and informal access way points. Install all wire post and batten fencing as well as wooden bollards in middle of green.	Community input, labour, basic fencing materials
A	**1 & 2**	Progressively eliminate ice plant and other exotic plants from dunes and replace with pingao & spinifex. (Limited broadcasting of fast release fertilizer along edges of colonies)	UREA, 1000 pingao plants, 1000 spinifex
A	**1 -3**	Progressively plant pa Harakeke as border and shade trees, as well as back dune plants.	1000 Harakeke plants (different Varieties), 2 Pohutukawa trees, 1000 back dune plants; mixture of coastal five finger, ngaio, ti kouka, taupata, Kowhai & Harakeke.
B	**1 & 2**	Initiate removal of the most vigorous weeds including Agapanthus.	Community input/ weed control
B	**1**	Install all wire post and batten fencing, closing off drivable entrance & making it a walking access only.	Community input, labor, basic fencing material
B	**1 & 2**	Plant up gaps left after removal of weeds and using native mid dune plants to fill in the gap, where informal paths have been made.	600 plants (pingao, spinifex & muehlenbeckia)
C	**1 & 2**	Install all wire post and batten fencing, blocking off informal access way over Wahi Tapu site.	Community input, labour, basic fencing materials
D	**1 & 2**	Install all wire post and batten fencing.	Community input, Council labour, basic fencing materials

Area(s)	Year(s)	Actions	Resources required
A	**2-3**	Install bases for concrete picnic tables.	Community input, Council labour, materials
A	**2-5**	Install commissioned pou	Community input, labour, materials
B	**2-3**	Fill gaps within the dunes with natives and plant back dunes.	Pingao, spinifex & muehlenbeckia (Mid-fore dunes). 2000 Harakeke plants, 2000 coastal five finger, 1000 ngaio, 800 ti kouka, 800 taupata, and 2 Kowhai.
B	**2-5**	Install base for concrete picnic table and install BBQ.	Community input, labour, materials
A, B, C	**1-5**	Plant shade trees and ensure all plantings are maintained, particularly regrowth of weeds, before extending plantings to new areas. Fill in bare areas. Fill in areas between successfully establishing clusters of natives.	Monitoring and maintence programme. Labour as required.
C	**2-3**	Extensive weed control on mid-fore dune area & replace with natives.	Community input / weed control and plant 2000 pingao, 2000 spinifex, 1000 muehlenbeckia .
C	**2-3**	Install bollards/ sand ladder (if necessary) and install dune restoration signage.	Community input, labour, materials
D	**1-5**	Install all wire post and batten fencing	Community input, labor, basic fencing material
D	**3-6**	Plant back dune plants, fore dune, mid dune plants. If possible after sand replenishment work is completed. Otherwise fill gaps where possible with native sand binding plants.	Pingao, spinifex , muehlenbeckia , Harakeke, coastal five finger & taupata
Main Beach	**1-7**	Fill in gaps along dunes with native plants. Temporary or permanent fencing of areas where needed. Install signage (Dune Restoration).	Community input, labour, mixture of dune plants; pingao, spinifex, muehlenbeckia and possibly taupata.
Te Wairoa Boat Ramp/Side bank	**1-7**	Extensive weed control is needed on entrance to boat ramp and native plants planted.	Community input, Labour, and materials

Conclusions

The Te Wairoa reserve and dune-land sites, all around Matapouri could become a flagship demonstration area along this coast of a restored coastal habitat. From native sand binders on the fore dune to a wide range of native back dune species established on the undulating semi-stable rear dune. This site could demonstrate the value of a realigned well-managed dune-land; promote a dune care ethic within the wider community through increased community awareness and participation.

Protection and enhancement of important coastal values which include natural character, coastal ecology and biodiversity, cultural values, recreational values and most importantly land scape amenity, and archaeological and scientific values.

Design and implement appropriate dune restoration and management works and you could have an actively managed restored dune ecosystem that could become an excellent environment, educational opportunity for the community or local schools. An information board placed at a vantage point along the access way would illustrate the main points of the restored dune system for visitors imploring the need to respect the vegetation cover and to keep to the formed access track provided.

In addition, signage will provide an illustration for the need to respect the native wildlife and respect the natural surroundings, as well as cultural significance to the local hapū. In turn the process of restoring ecosystems, individuals and society are re-establishing their relationship with the larger environments, they live in, depend upon, learn from, and which must be nurtured.

'Restoring the Mauri of Matapouri'

Appendix

Appendix 1 'Threatened and 'At risk' shorebird species present at Matapouri Estuary, with one exception (Ecological Estuarine Area Assessment sheet Matapouri)

Species Scientific Name	***Species Name/Maori***	***NZ threat classification***		***Significance for species***
Botaurus poiciloptilus	Australasian Bittern Matuku	Threatened	Nationally Critical	Locally important Breeding and feeding
Phalacrocorax varius	Pied shag Karuhiruhi	At Risk	Recovering	Local use for feeding
Egretta sacra sacra	Reef heron Matuku moana	Threatened	Nationally Endangered	Local use for feeding
Charadrius Obscurus aquilonius	Northern NZ Dotterel	Threatened	Nationally Increasing	Local use for feeding
Larus Novaehollandiae Scopulinus	Red-billed gull	At Risk	Declining	Local feeding
Hydroprogne caspia	Caspian tern	Threatened	Nationally Vulnerable	Local feeding
Himantopus himantopus leucopephalus	Pied stilt	Not Threatened		Local feeding
Bowdleria puctacta	Fernbird	At Risk	Declining	Locally important Breeding and feeding
Gallirallus phillippensis	Banded rail Moho pereru	At Risk	Declining	Locally important Breeding and feeding
Anas chlorotis (North Island)	Brown teal	Threatened	Nationally Increasing	Nationally important Breeding and feeding
Haematopus unicolor	Variable Oystercatcher Torea tai	At Risk	Recovering	Local feeding
Phalacrocorax carbo novaehollandiae	Black shag Kawau tuawhenua	At Risk	Relict	Local feeding
Phalacrocorax melanoleucos brevirostris	Little shag Kawau paka	At Risk	Relict	Local feeding
Phalacrocorax sulcirostris	Little black shag Kawau tui	At Risk	Naturally Uncommon	Local feeding

Appendix 2 List of hypothetical Indigenous plants where historically it was there habitat.

Species Scientific Name	***Species Name/Maori***	***NZ threat classification***		***Purpose***
Spinifex sericeus	Spinifex (Kowhangatara)	Not Threatened		Sand binder
Ficinia spiralis	Pingao	At Risk	At Risk - Declining	Sand binder
Poa billardierei	Sand tussock (Hinarepe)	At Risk	At Risk - Declining	Sand binder
Carex pumila	Sand sedge	At Risk	Declining	Sand binder
Coprosma acerosa	Sand Coprosma (Tātaraheke)	At Risk	Declining	Sand binder
Carex testacea	Speckled sedge	Not Threatened		Sand binder
Muehlenbeckia complexa	Wire vine (Pohuehue)	Not Threatened		Sand binder
Cordyline australis	Cabbage tree (Ti kouka)	Not Threatened		Back dune
Phormium tenax	Flax (Harakeke)	Not Threatened		Back dune/natural barrier
Kunzea linearis	Sand kanuka (Rawiri)	Threatened	Nationally Vulnerable	Back dune
Metrosideros excelsa	Pohutukawa	Threatened	Nationally Vulnerable	Back dune/shade tree
Pseudopanax lessonii	Coastal five finger (Houpara)	Not Threatened		Back dune/shade tree
Myoporum laetum	Ngaio	Not Threatened		Back dune
Leucopogon fasiculatus	Soft mingimingi	Not Threatened		Back dune
Vitex lucens	Puriri	Not Threatened		Back dune/shade tree
Leptospermum scoparium	Manuka	Not Threatened		Back dune
Planchonella costata	Tawapou	At Risk	Relict	Back dune
Cortaderia splendens	Toetoe (Endemic to Matapouri)	Not Threatened	Data deficient	Back dune

Appendix 3 List of Indigenous plants that are near extinction, serious decline, or range restricted, this list does not represent all of New Zealand's plants. Representative only. A few of these species could potentially be slowly re-established back into Matapouri.

Species Scientific Name	***Species Name/Maori***	***NZ threat classification***	
Atriplex hollowayi	Holloway's Crystalwort	Threatened	Nationally Critical
Euphorbia glauca	Shore spurge	At Risk	Declining
Pimelea aff. arenaria/Pimela villosa	Sand daphne, Toroheke	At Risk	Declining
Lepidium oleraceum	Cook's scurvy grass	Threatened	Nationally Endangered
Sicyos australis	NZ Cucumber Mawhai	At Risk	Declining
Senecio biserratus	Fireweed	Threatened	Serious decline
Senecio marotiri	Fireweed	Threatened	Range restricted
Senecio scaberulus	Fireweed	Threatened	Nationally critical
Tetragonia tetragoniodes	New Zealand spinach, Kohihi	At Risk	Nationally uncommon
Pomaderris hamiltonii/Pomaderris rugosa	Pale flowered kumerahou	At Risk	Nationally uncommon
Fuchsia procumbens	Creeping fuchsia	Nationally uncommon	Range restricted
Syzygium maire	Swamp maire	Threatened	Nationally Critical
Colensoa physalodies	Koru	Threatened	Nationally Vulnerable
Brachyglottis kirkii var. kirkii	Kirk's tree daisy Kohurangi	Threatened	Nationally Endangered
Hebe speciose	Hebe speciosa Titirangi	Threatened	Range restricted
Hibiscus trionum	NZ Hibiscus	Threatened	Serious decline
Tecomanthe speciosa	Tecomanthe, akapukaea	Threatened	Nationally Critical
Carmichaelia williamsii	William's broom	At Risk	Relict
Clianthus puniceus /C. maximus	Kaka Beak Kowhai ngutu kaka	Threatened	Nationally critical

Appendix-4

Introduced pest plant species within Te Wairoa dunes, this is not an exhaustive list. 'Why they are problem & method for removal'. Not all are in the 'National Pest Plant Accord' which lists the most invasive weeds within New Zealand. The list of invasive species here has been put together using best method of removal as advised by Weed buster's website.

Species Scientific Name	***Species Name***	***Why they are a problem…***	***Method for removal***	
Agapanthus precox	Agapanthus	Tolerate of a wide range of soil types and growing conditions, forming dense monocultures that excludes native plants.	**Physical control:** Removal of the bulb like base of the plant by hand is effective. A spade may be required for larger infestations.	**Herbicide Control:** Cut & stump treat with Vigilant gel or spray with 60ml triclopr (300g/L + 10L penetrant per 10L water
Zantedeschia aethiopica	Green goddess arum	Forms dense cover on the ground in open sites, shades out natives preventing native plants establishing. Tolerates a wide range of conditions and is drought-resistant, and all parts are poisonous.	**Physical control:** Dig out scattered plants (all year round); remove all pieces of root and dispose of them at refuse station. Regular checks of treated sites where necessary.	**Herbicide Control:** Cut & paint stumps: 1g metsulfuron-methyl (600/kg) per 1L water. Mulch the leaves and dispose. Weed wipe leaves with same herbicide mix.
Cortaderia selloana	Pampas grass/ Not to be confused with local native toetoe	Highly competitive and outcompetes native plants, forms dense stands and can rapidly colonize, spreading fast. Produces large quantities of seeds (up to 100,000 with one plant able to produce millions of seeds over 10-15 years).	**Physical control:** Dig or grub out seedlings or smaller plants, chainsaw small plants and remove sizeable plants by bulldozer. Compost or leave on site to rot down, burn any flower heads.	**Herbicide Control:** Spray Gallant (150ml/10L + crop oil) for most sites or glyphosate (100ml/10L + penetrant) for dense stands. Use a marker dye to avoid wastage & foaming agent to prevent spray drift.
Foeniculum vulgare	Fennel	It can regenerate by both seeds and roots, which often makes physical control methods ineffective & chemical control necessary once population is established.	**Physical control:** Grub individual plants ensuring the crown (first 15 centimeters of the root system is removed).	**Herbicide Control:** Over spray with 10ml glyphosate + penetrant per 1L water penetrant; or Tordon Gold at label rates, or Grazon at label rates.
Yucca filamentosa	Yucca or referred to as Adam's needle	Rapid growers with vast root systems, they outcompete natives. Dangerous to public as they have nasty spikes that can seriously injure. They can regenerate new sprouts where removal has occurred.	**Physical control:** Dig out with a spade or digger, make sure roots are dug out as well, and check periodically for young sprouts, removing them by hand.	**Herbicide Control:** Cut & paint stumps: 1g metsulfuron-methyl (600/kg) per 1L water. Ready to use herbicide is best. Alternatively drill and fill and pour herbicide into holes.

Brassica rapa ssp-sysvestis	Wild turnip/possibly Wild Radish	Competitive annual weed, capable of germinating any time of the year, displaces native plants. Used in agricultural sector and forms large bulbs and can become a problem if populations are large.	**Physical control:** Grub out or spade out individual plants ensuring the large bulb is dug out as well.	**Herbicide Control:** Over spray with 10ml glyphosate + penetrant per 1L water penetrant
Carpobrotus edulis	South African ice plant/hottentot-fig/pigface	It forms impenetrable mats to 50m in diameter and over 50cm deep, forming large mats and has an aggressive nature, taking over open sand. Displaces the native ice plant (Disphyma australe) and reduces soil ph and influences soil nutrients.	**Physical Control:** It is easy to pull out, ideally roll up like a mat and dispose of by burying or burning.	**Herbicide Control:** No need to control by herbicide method.
Agavoideae/Agave americana	Agaves/century plant	Tolerates extreme drought, wind, salt, high temperatures, poor soil and low fertility, recovers from damage and is not grazed by stock, is long lived and has no known parasites. New plants are formed via short rhizomes and succulent leaves re-sprout from fragments. Replaces vulnerable dune species, colonizes bare sand and is easily carried to new sites by ocean tides.	**Physical Control:** Dig out small plants and dispose of at refuse station. Burn or bury.	**Herbicide Control:** Stem inject (4-10 times), depending on size, use 5ml glyphosate (undiluted) and leave to rot. Cut and paint is another option, cutting to ground level and apply glyphosate (200ml/L) to stump and dispose at refuse station.
Nephrolepis cordifolia	Tubber ladder fern/Not to be confused with rare native ladder fern	Spreads spores, runners and tubers and forms dense, long-lived patches which are often large. Displaces native plants.	**Physical control:** Pull out, leave on site to rot down. Dispose of tubers and runners at a refuse station or bury/burn.	**Herbicide Control:** Spray with metsulfuron-methyl 600g/kg (1kg/10L). Leave sprayed sites 3-4months to allow herbicide to translocate to tubers before clearing or replanting.

Appendix-5

Dune-Invertebrates and lizards likely to be present, once a healthy ecosystem is established, this is not an exhaustive list.

Healthy dune ecosystems consist of an array of pollinators, seed dispersers, decomposers, herbivores, predators and of course prey. Dune invertebrates –referred to as 'bugs' such as flies, butterflies, spiders, sand hoppers, slaters, snails, and beetles living in the dunes.

Species Scientific Name	***Species Name/Maori***	**Biostatus**
Latrodectus atritus	Katipo spider	Serious decline
Lycaena sp. L. salustius	Common Copper butterfly & Coastal Copper	Endemic, native
Coccinellids leonina	Lady birds	Endemic, native
Pericoptus truncatus	Sand scarab beetle	
Zoriin. spp. Member of Cerembycidae family	Flower longhorns	Endemic native, associated with native flowering shurbs.
Melangyna novaezealandiae	Large hoverfly Ngaro paira	Endemic, resident
Leioproctus spp.	Native bees	Endemic, native
Aenetus virescens	Puriri moth Pepetuna	Endemic, resident
Liothula omnivoras	Common bag moth Pu a Raukatauri	Endemic, resident
Oligosoma aneum	Copper skink	Endemic, resident
Oligosoma smithi	Shore skink	Endemic, resident
Oligosoma moco	Moko skink	Endemic, resident
Dactylocnemis pacificus	Pacific gecko	Endemic, Native

Appendix 6 Different species of "Phormium & Carex" that could potentially be used for Pa harakeke within Te Wairoa reserve.

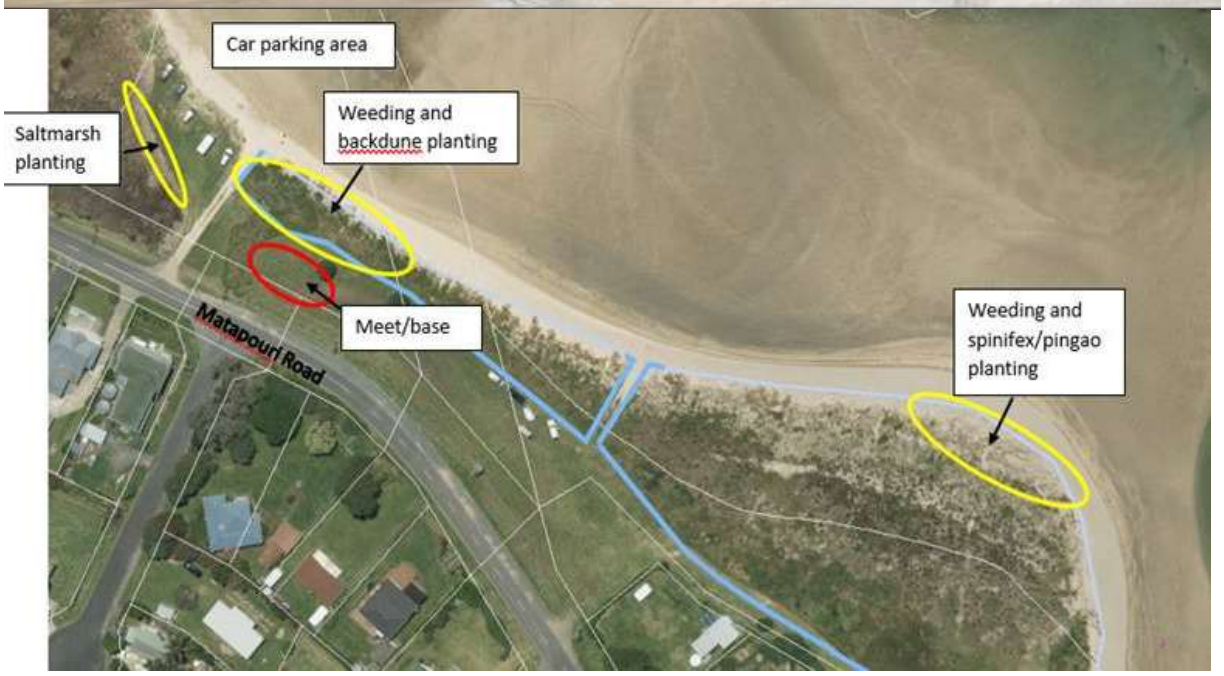
Species Scientific Name	***Common name:***	***Description/Color***
Phormium tenax	'Dark Delight'-cultivar	The 'dark delight' is Chocolate, Purple, and Black in color and has weeping foliage. Grows up to 1-1.5m in height and a spread of 1m. Tolerates very windy and coastal conditions.
Phormium tenax	'Sundowner'-cultivar	The 'Sundowner' is a cross between P.tenax and P. cookianum which originated by natural cross pollination by the native tui bird. Brightly striped foliage with long arching bronze-green leaves that have coral red streaks. Another evergreen that does well in coastal environments and adds dramatic high contrast color and texture.
Phormium tenax	'Yellow Wave'-cultivar	The 'Yellow Wave' has hues of color that range from pink-mix of olive green with sunset shades of shrimp and apricot. Reaches heights of up to 1.2m and a spread of 1.5m The flower spikes rise above the plant and bear twisted looking flowers, which birds are attracted to for the nectar. Coastal hardy and tolerates damp conditions.
Phormium tenax	'Green dwarf'-cultivar	The 'Green dwarf' is a dwarf New Zealand native flax, a form of P. cookianum which has bright green erect foliage. Can reach a height and spread of 0.8m. Evergreen that is hardy flax does well in coastal environments.

Table
Continued…

Carex trifida	'Rekohu sunrise'-Variegated	The 'Rekohu' is a variegated form of New Zealand, *Carex trifida* with Rekohu being the Maori name for the remote Chatham Islands. Forms large fountain shaped, evergreen clumps of broad leaves with gold margins; chestnut colored flower spikes appear in mid-summer.
Phormium cookianum	'Tri-color'-cultivar	The 'Tri-colour' is creamy yellow, green in colour and reaches heights of up to 1m and a spread of 1.2m. Salt tolerant and good in coastal environments.
Phormium cookianum	'Mayor Island'-cultivar	The "Mayor Island' is a cultivar of the native New Zealand mountain flax or Whahariki. This cultivar has drooping leaves, soft green with hint of yellow in color and does well in coastal sites. It reaches a height of up to 1m and a spread of 1m. Looks great contrasting against other mass plantings.
Phormium tenax	'Three Kings Island'-cultivar	The 'Three Kings island has slightly broader leaves with yellow edges. The flax plant can reach a height of 2m and spread 1.5m. Grows in clumps and does best in full sun, although very hardy, tolerates most soil conditions.
Phormium cookianum	'Dazzler'-cultivar	The 'Dazzler has Pink, Purple, and bronze margins of color, which form substantial clumps. Doesn't mind coastal conditions where it's windy and dry, but also frost hardy. Grows to a height of 1m and a spread of 1m, and great for cultural arts.
Phormium tenax	'Harakeke or korari'-Coastal/swamp	Indigenous to New Zealand and Norfolk Island. Leaves are numerous, arising from fan-like bases and dark green in color. Height of 1m and a spread of 1m.

Appendix 7 Map layout of Pa Harakeke, using different harakeke for different cultural elements. This layout and Map site location may be subject to change.

Appendix 8 Recent 2020-2023 photos of the work that has been carried out. Ngunguru School Earth Ed group has been helping with this restoration work by coming out each year to pull out weeds and replace them with native plants.



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How do sand dunes work?
Dune plants

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