



# LEITHFIELD BEACH: DUNE PLANTING CONCEPT PLAN

**Hurunui District Council**

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# 1 Introduction

The primary coastal hazard risk at Leithfield Beach is from inundation caused by storm surge and high rainfall and river flows during large storm events. During storm surge events wave run up can reach up into dunes where energy is dissipated.

One of the best natural defence mechanisms is the dune system. By protecting the dunes, the dunes are able to protect the settlement.

## 1.1 Purpose

This document sets out how a dune planting project could work at Leithfield Beach.

## 1.2 Existing environment

Leithfield Beach is a composite beach located at the northern end of Pegasus Bay. The beach varies between sand and gravel depending on the sea conditions. The beach is predominantly comprised of gravel upper beach ridges and a relatively flat sandy lower foreshore.

Leithfield Beach settlement has a coastal frontage of 1.5km and is orientated parallel to the coastline. The coastline is separated from the settlement by a series of vegetated backshore ridges which are approximately 6m above MSL in elevation and are a natural buffer and prevent waves from entering the settlement.

The sediment is coarse sand, sourced from nearby rivers and broken down by wave energy before being deposited at the beach. The dune area varies in width from 95m wide at the northern end of the settlement to 150m wide at the southern end.

The vegetation of the dunes is mostly exotic plant species. The foredune area is dominated by marram grass and the backdune consists of mature Pine trees where the ground is moist. Several native plants are present throughout the dune system including *Phormium tenax* (flax), Ngaio, *Meulenbeckia astonii*, *Meulenbeckia australis*, native *convulvulus*, *senecio*, taupata, cottonwood, cabbage trees, pōroporo and ake ake.

Throughout the dune system there are informal access tracks to the beach. Around these accessways the vegetation line in the foredune has shifted landward. Beach access tracks can concentrate wind and wave energy, causing funnelling into these areas and loss of vegetation. This is noticeable at the accessway adjacent to the community reserve and the accessway from the Leithfield Beach Holiday Park.



*Figure 1: Photograph of Leithfield Beach looking south*

## 2 Restoration Planting Plan

A site visit was undertaken with Jason Roberts who led the New Brighton dune planting. The information below is informed by that discussion.

### 2.1 The concept

The aim of restoration planting is to establish a more natural composition of native plants that enhances the environment and improves indigenous biodiversity. The dunes at Leithfield Beach can be protected and enhanced through restoration planting to strengthen the natural buffer between the beach and coastal settlement. Having the right plants in the dunes improves the dunes' ability to dissipate wave energy offering greater protection from coastal inundation.

At Leithfield Beach this involves identifying bare areas or areas where the current vegetation is not effective at dissipating wave energy and planting these with native species that are suited to coastal dunes. The undulating dunes have pockets of land that are protected from the heat and wind where juvenile plants have a greater chance of survival. Planting should focus on suitable areas first working small test patch increments to establish what works best in this environment. The initial plantings of a limited selection of hardy species would be interplanted with a wider range of plants that need protection from the elements to thrive.

The benefits of restoration planting will not be realised immediately. Restoration planting would need to occur over a number of years, focusing on areas with the greatest chance of success first. In the long-term smaller pockets of planting can be gradually extended and joined together as a process is established and resources become available. Full coverage of the dunes along the 1.5km frontage is a long-term goal that may take upwards of 20 years. The pace of progress is largely dictated by resources and community will. The main factors influencing progress will be funding, weather, and resources.

### 2.2 The process

Aerial footage of the dune system is beneficial to capture the current dune state and establish an understanding of potential target sites before further scoping is done. This footage will also be useful to map the progress over time. To begin, areas that offer more readily achievable gain are ideal initial test patches. Suitable planting sites are small patches of Marram grass in the dunes that are well sheltered from heat and wind, require minimal removal of larger tree species, and have good access and visibility to the community.

Based on a site walkover and aerial imagery several potential sites have been scoped and assigned priority based on their suitability as an initial test patch. A map of the proposed areas has been provided as appendix 1. Blue indicates priority areas which are suitable for initial test planting. Purple indicates secondary areas that present more challenges but would be sheltered locations to interlink into priority areas.

### 2.3 Opportunities

The community at Leithfield Beach has previously undertaken planting within the coastal environment. Most notably is the community planting project occurring to the north of the settlement in conjunction with the formation of a walking and cycling track linking the settlement to the existing Kowai River Walkway. There are also small pockets of exotic and native planting in concentrated areas around the boundary of some residential properties. These examples provide an opportunity to utilise existing community knowledge and resources to build on the work already done in the community.

The existence of informal walking and access tracks through the dunes provides good accessibility for the establishment and ongoing maintenance of potential planting sites. Having planting sites in places

with high foot traffic enables people to water and passively surveil juvenile plants. This track network could also be enhanced in the long term to continue on from the network north of the settlement.

The lack of a uniform ridgeline in the dune area also presents an opportunity to utilise the gullies throughout the dunes. These spaces are well protected from wind and have better moisture than those exposed areas on the foredunes. These gullies currently have nodes of Marram Grass that can be removed to make way for plants that are better suited to the coastal environment.

The trapping and maintenance of pest species may prevent plants being damaged. This would require additional resources to set traps and then have someone manage them continuously. From an initial site walk over the presence of pests throughout the dunes wasn't readily visible. If this is an issue after further investigation and monitoring, then trapping and other prevention methods can be explored.

There are ways to formalise accessways to the beach that may prevent scouring and loss of vegetation around the adjacent dunes, this may include realigning accessways to be adjacent to the prevailing wind or fencing off designated access points. This could be considered further into the project.



*Figure 2: Community planting on the Kowai Track*

## 2.4 Limitations

The sediment profile of Leithfield Beach is coarse sand and gravel which cannot be easily transported by the wind like finer grained sand. This means the introduction of native sand binding species such as spinifex will have limited effectiveness at trapping sediment and building up a sand dune to provide natural protection against inundation. For the same reason sand fences are unlikely to be effective.

The topography of the dune area consists of undulating ridges but lacks a uniform ridgeline to prevent the sea from reaching further inland. The gentle gradient of the dunes means any planting is likely to experience periodic wave wash which will affect plants that aren't resistant to saltwater intrusion.

The existing gullies in the dunes also create areas for salt water to pool. Along the foreshore the beach often has hollows or cusps, creating vulnerable spots where wave run up can concentrate into pockets of the dunes. This has caused vegetation that is not resistant to saltwater to die off.

Moisture and water availability is likely to be a limiting factor to vegetation growth. Vegetation on the foredune area is exposed to heat and wind, this is amplified by heat from the larger rocks on the beach being blown landward. On the contrary the existing pines on the back dune provide limited protection to both the dunes and the settlement and create shading that prevents other species from growing. Many of the larger trees would need to be removed if the area was to be planted with native species that are better suited to a coastal environment.

Storm surge only accounts part of the inundation hazard at Leithfield Beach with pluvial and fluvial flows being the dominant flooding source in most large events. Planting of the dunes can have benefits for dissipating wave energy from the sea but will not prevent flooding from rainfall and rivers.

### 3 Priority Areas

Priority areas have been identified based on:

- Ease of access
- Ground conditions
- Weather exposure.

#### 3.1 Priority Area One - North Leithfield Beach

The area inland of the carpark at the north end of the settlement would be a good test area because it is sheltered from wind and heat exposure, has good vehicle and pedestrian access, and already contains some introduced plantings that the new planting could be integrated into. The site would potentially require less work to prepare by placing mulch around those existing plants. This area would also interlink nicely into the planting work already being done on the Kowai Track.



Figure 3: Map of priority area one (left) and photograph of priority area one looking east (right).

#### 3.2 Priority Area Two - Central Leithfield Beach

This site is located adjacent to the beach access track off the Leithfield Beach Reserve. The reserve is well used by people accessing the beach and has good pedestrian access and visibility to passers-by. This area is well protected from wind and heat exposure in the foredune by the large pine trees surrounding it and will likely retain moisture well. The pine trees are well spaced to not cause shading so wouldn't need to be removed to make way for planting. Existing at this location is several large wharariki (mountain flax) plants.

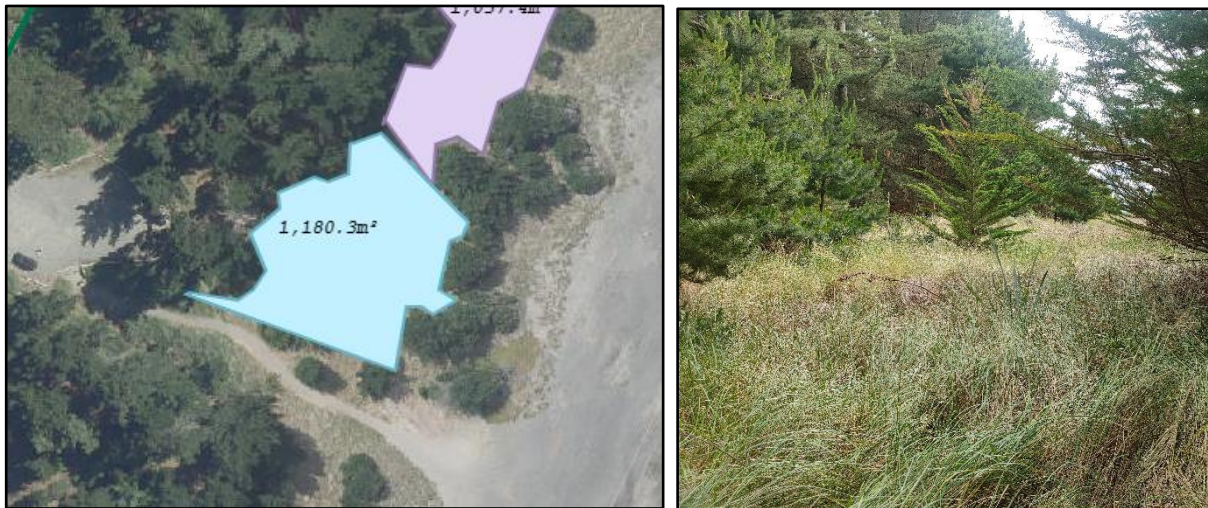


Figure 4: Map of priority area two (left) and photograph of priority area two looking north (right).

### 3.3 Priority Area Three - South Leithfield Beach

This area is significantly larger and has been included primarily based on review of aerial imagery. It wouldn't be proposed to plant this entire site as one test planting but could be progressively extended if initial smaller sections were successful.

The area is undulating which provides good, sheltered pockets for plants to thrive. It also includes several existing native plants. This is the largest area on the dune frontage with no pine trees which may be evidence this area has been subject to wave wash in the past and may be an area where wave wash would concentrate up the dunes. The south end of the settlement does have the widest section of the dune system creating a wider buffer between houses and the sea.



Figure 5: Map of priority area three (left) and photograph of priority area three looking east (right).

## 4 Preparation of planting sites

All sites will require the removal of existing invasive species in preparation of new planting, this is primarily Marram Grass however some sites will require the removal of larger pine trees, some of which are already dying due to saltwater intrusion. Existing areas of Marram Grass can be removed by mowing or spraying and may take several mows to die back. The removal of large pine trees will be more resource intensive and costly; it is preferable that these are only removed on an as needed basis.

Once the space has been cleared mulch is required to create a base for planting. This will enable plants to grow by providing nutrients that aren't found in sand, retaining moisture in the soil to keep heat off the plant roots, and suppressing weeds and other competing species.

#### 4.1 Test planting

Test planting should occur in winter to give plants the best chance of survival, this ensures they have adequate moisture and aren't exposed to hotter weather. Larger species will need 2m spacing to reduce overcrowding.

Planting days can either be by organised groups or local community volunteers. A range of jobs is important to cater to different interests and abilities. This can include preparation of plant guards, digging plant holes, placing plants etc.

#### 4.2 Plants

The figure below shows a vegetation sequence appropriate to Leithfield Beach.

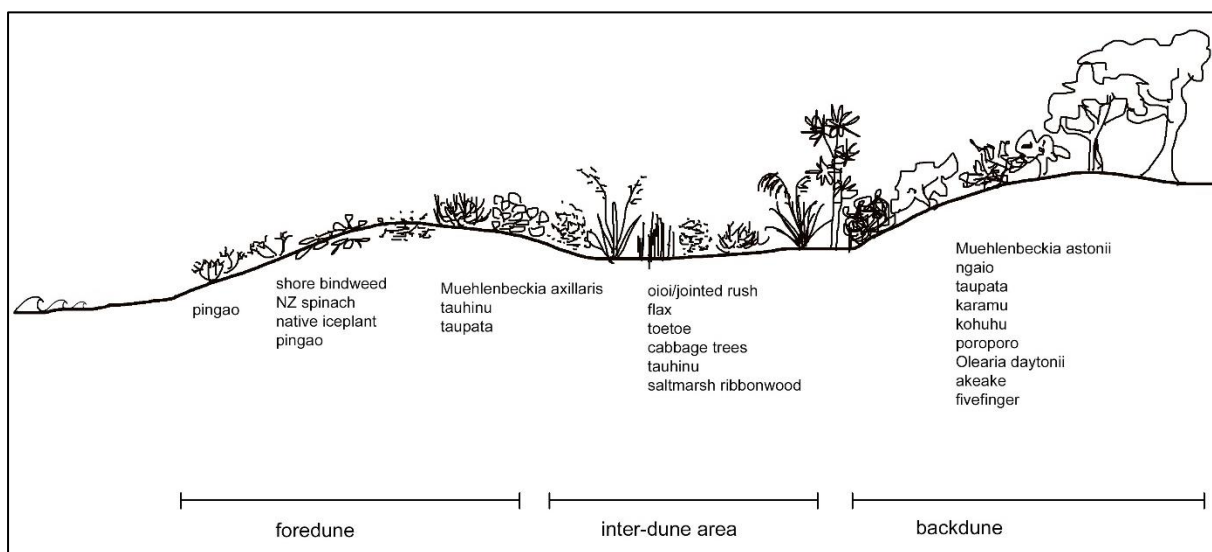


Figure 6: Dune vegetation sequence for Leithfield Beach

The table below shows the plant list for the dune area between the pines and the beach.



Common name	Botanical Name	Advantages
Plant first (easy to grow, easy to source, create protection for future plantings)		
flax	Phormium cookianum	Great bird food
ngaio	Myoporum laetum	Young plants are frost-tender, plant on raised sections
taupata	Coprosma repens	Great bird food, withstands salty conditions
karamu	Coprosma robusta	Great bird food
cabage trees	Cordyline australis	Good soil binding
salt-marsh ribbonwood	Plagianthus divariatus	Withstands salty conditions
cottonwood, tauhinu	Ozothamnus leptophyllus	
toetoe	Austroderia richardii	

Plants for later or as they become available		
Meulenbeckia astonii	Meulenbeckia astonii	Food for butterflies and birds
kohuhu	Pittosporum tenuifolium	
jointed rush/, oioi	Leptocarpus similis	Plant out in the open, in damper hollows
olearia daytonii	Olearia daytonii	
akeake	Dodonaea viscosa	
poroporo	Solanum laciniatum	
fivefinger	Pseudopanax arboreus	

The following plants are for the beach margins. They are “nice to haves.” They are great for biodiversity but won’t contribute as much to beach stabilisation as larger plants.

Common name	Botanical Name
shore bindweed	Calystegia soldanella
native spinach	Tetragonia tetragonioides
native iceplant, horokaka	Dysphema australe
pingao, golden sand sedge	Phicinia spiralis

A planting plan for each area would need to be drawn up, depending on resources and availability of plants, and the topographical features of the site. In line with best practice, eco-sourced plants (grown from seeds native to the local area) would be planted, where practical. Such plants will be the most well-adapted to local conditions and will contribute the most to native biodiversity, but as the nearby community already has a lot of non-local plants (native and exotic), it doesn’t make sense to be too strict about eco-sourcing at this site.

#### 4.3 Monitoring and Maintenance

Ongoing monitoring and maintenance will help us track the performance of the restoration planting and track changes in vegetation cover. Ongoing maintenance of planting sites will increase the chance of survival while monitoring will help us track the progress to learn what does and doesn’t work.

The survival rate of plants will depend on the weather pattern over the next two seasons and the amount of moisture available. Having readily accessible water for the community to visit the site and water plants will encourage plant growth and ease of access to water either on site or very close by will be vital. Other factors impacting the success are competition from weeds and grazing pest animals.

Passive surveillance by passers-by's will be the most effective maintenance. Having a highly trafficked site is an opportunity to encourage community buy in by having the people who use the beach every day taking responsibility of maintenance.

The Coastal Restoration Trust proposes community-based guidelines for how to assess and monitor the dunes. The relevant information is included as Appendix 2.

## 5 Logistics

The main components and possible sources and costs of these are listed below. The cost will vary with the scale of planting and for the purposes of this concept plan no quotes have been sought.

### 5.1 Plants

Plants will be sourced from whichever nursery has them available and from any locals who are keen to grow plants for the site. Well-grown plants raised in cardboard containers which can be planted with the seedlings, will give the plants the greatest chance of survival in these harsh conditions. Gough's nursery and Riverside Horticulture are local nurseries supplying good quality plants for restoration projects.

As there is a big demand for native plants for restoration projects at present, it may not be possible to acquire the full range without one or two year's notice. Plant orders need to go to the nursery with as much notice as possible, preferable two years. Planting a smaller range of plants based on whatever is available, is perfectly acceptable in the first season of planting.

Planting should commence in wintertime, as this is the time of year where there is more moisture, and the seedlings aren't in a growing phase so are less stressed by being planted.

### 5.2 Mesh guards

Plastic trellis cut to 1m lengths with bamboo stakes are effective mesh guards for preventing rabbits and other pests from getting to the plants. These can be cut and fitted to the size of the plants and secured on planting days. These are cost-effective materials that are easy to source and durable in a coastal environment.

These are stocked by local hardware and garden stores. A roll of plastic trellis measuring 5m x .9m costs \$15 - \$20. Bamboo stakes are also low cost, approximately \$5 - \$10 for 15 stakes.

### 5.3 Mulch

Woodchip or green waste mulch is needed to create a nutrient rich base where plants can establish. Mulch will need to be procured and placed sometime prior to planting. It's advised this is at least 100mm deep and it's expected a 1000m<sup>2</sup> area will require at least 100m<sup>3</sup> of mulch. This can be sourced from local landscape yards and prices vary between local suppliers. It's expected to cost approximately \$20 - \$30 per cubic metre.

Hurunui District Council sells mulch from the green waste collected at the Amberley Transfer station. This is processed and made available every 12 to 18 months. Due to the limited stock and long processing times material would need to be secured as soon as possible as it is likely to sell out by the time site preparations begin next year. Currently under the Council fees and charges green waste mulch costs \$16 per scoop.

## 5.4 Fertiliser tablets

Slow-release fertiliser tablets will help provide additional nutrients to plants and are stocked by local hardware and garden stores in bulk for minimal cost. A packet of 100 10g tablets costs approximately \$20 - \$30.

## 5.5 Water

Access to water will be essential for the ongoing maintenance of plants. This could be in the form of a water tank located nearby or smaller containers located on site. The cost of tanks will vary with size and is dependent on how much water the sites require. If the planting expands in future, it will be more cost effective to purchase a larger tank upfront that can service the entire area rather than a smaller tank which only holds enough water for the initial test sites and may require upgrading in future.

Water tank size	Approximate cost
500L – 750L	\$500-\$800
1000L - 2000L	\$1000 - \$1200
3000L – 5000L	\$1200 - \$1700

Prices sourced through the websites of local providers.

Alternatively, to avoid large expenditure in the short term the initial test patches could be serviced by smaller onsite containers that are regularly topped up and dropped back on site. Once the project is established and planting expands it may be viable to justify locating a tank close to the sites.

## 5.6 Services

The preparation of test sites will require someone to mow the sites twice and spread mulch. These services could be sourced by volunteers or professionals within the community or by Council contractors. These costs are highly variable depending on whether they're undertaken by professionals or volunteers and depend on the size of each planting area.

Some sites will also require the removal of large pine trees that do require professional services to fell. This is likely to be one of the largest costs to the project with felling costing over \$1,000 per tree.

# 6 Funding

The costs and possible funding avenues will influence the success of the project. Some funding options are explored below.

## 6.1 Hurunui District Council funding

The South Ward Committee has a contestable fund for improvements undertaken in Hurunui District Council reserves. While the location is not within a reserve it is adjacent to the Leithfield Beach Balance Reserves and Camping Ground that is Council owned. Given the project is community driven the committee may consider contributing.

## 6.2 Community funding

Some of the costs and procurement could be socialised amongst Leithfield Beach residents if there is sufficient interest. Below are ideas that would help promote community ownership of the project and get people invested in the outcome. In addition to these there may be members of the community who have resources and services available that they're willing to donate.

*Grow a plant* - Encouraging members of the community to grow a plant from seedlings in their own backyards for planting at test sites during the upcoming planting season. Purchasing seedlings will be

cheaper than purchasing established plants. Residents in the community may also have offcuts or existing plants they're willing to donate to the project.

*Buy a plant* – Selling the ownership of procured plants to community members for planting on site. Individuals or families can 'own a tree' within the project by paying towards the cost and then planting and maintaining that plant themselves. These could be given a tag to identify them to each person or family.

### 6.3 External funding

There are a number of public and private funds that could be applicable for this project including from Environment Canterbury and Department of Conservation. Many of these funds occur on a yearly basis and could fund stages of the work rather than the overall project. Some funds are specifically targeted at biodiversity work while others have broad criteria and are far-reaching in who/what they fund. Putting together applications for funding requires time and these applications need to be timed to secure funding prior to the winter planting season.

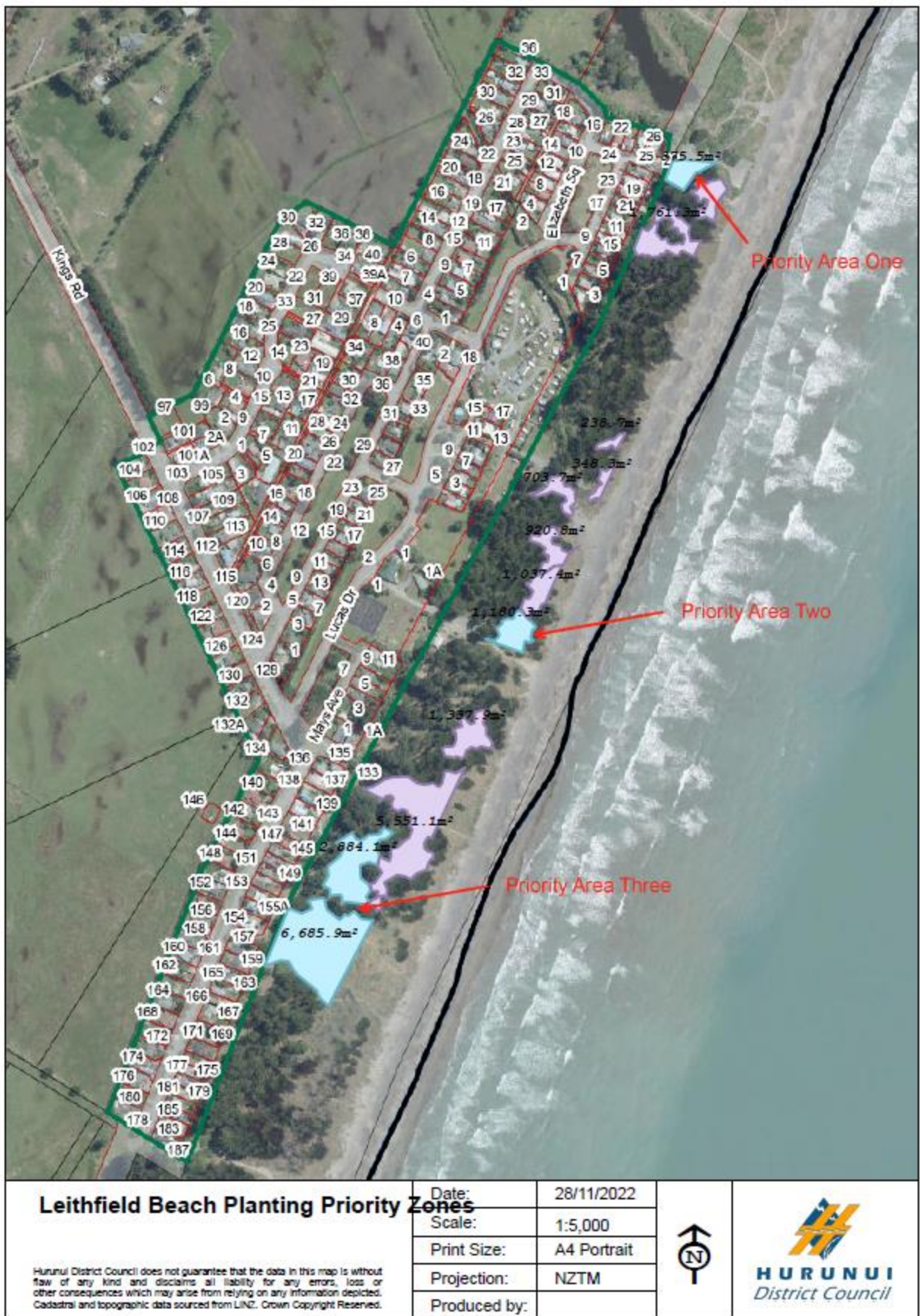
Sponsorship is another potential funding avenue. This could be from local businesses that would like to contribute financially or with resources and services. Planting requires resources and services that could be donated by willing businesses in return for publicity.



## 7 Next Steps

If the community would like to proceed with the project the next steps will be:

- To obtain up to date drone footage of the dunes to confirm the suitability of each test planting site and revisit any sites that may have been overlooked.
- Select a test planting area the community would like to proceed with.
- Secure a funding avenue to finance the test patch.
- Procure plants and mulch in preparation of the planting season.
- Prepare the site with mowing and mulching prior to planting, this can occur anytime up to a few weeks before.
- Plant test plants during Winter.
- Monitor plants from Winter onwards.
- Find further funding and procurement opportunity for new test patches for the next planting season.

# Appendix 1 – Map of Leithfield Beach



<b>Leithfield Beach Planting Priority Zones</b>  <small>Hurunui District Council does not guarantee that the data in this map is without flaw of any kind and disclaims all liability for any errors, loss or other consequences which may arise from relying on any information depicted. Cadastral and topographic data sourced from LINZ. Crown Copyright Reserved.</small>	Date:	28/11/2022	 
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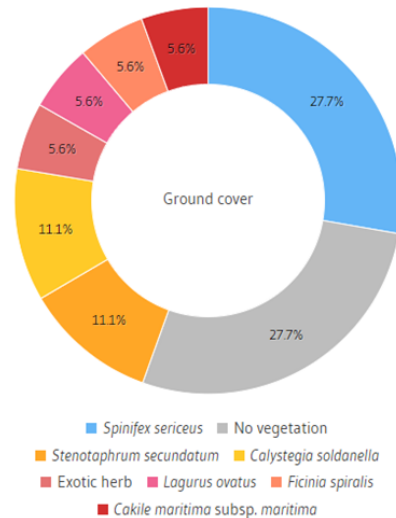
## Appendix 2 - Additional Monitoring information

<b>Assessment of vegetation cover and species composition - 'The stocktake'</b>	
What:	To create a baseline of what currently exists to measure future success against. This doesn't include tracking of changes in dune morphology or zonation because the profile of the Leithfield Beach dunes is unlikely to be affected by planting due to the coarse sand. Any changes in beach shape will also be recorded via the CoastSnap initiative.
Method:	Taking aerial photographs of the beach and fixed-point photographs of each section of the beach and its vegetation cover. Splitting the beach into sections and having fixed photo points will ensure consistency in monitoring across the long frontage and account for any variance in vegetation type.
<b>Monitoring the restoration program – Measuring change</b>	
What:	Monitoring the performance and success of the planting by measuring growth rates, survival, the presence of weeds and grazing by pest species. The methods and parameters for monitoring can be scaled to the project and its objective. This would be limited to vegetation monitoring and not dune form.
Method:	For a project of this scale the primary methods for gathering data could be: <ul style="list-style-type: none"><li>• Photographs from fixed photo points taken before and at regular intervals.</li><li>• A logbook documenting the site and any activities undertaken i.e site preparation, species planted, monitoring occurring.</li><li>• Census counts of all species in each testing site, including survival and growth. This intensive method would only be feasible for small testing sites.</li><li>• Transect sampling (Rapid point survey). A survey of 1m<sup>2</sup> patches within each planting site. This would be useful for larger sites and sites with small and diverse vegetation. Given the initial size of the test planting sites a census of the entire area will be more accurate with minimal additional effort. A transect survey method may be an efficient method once planting sites expand.</li></ul>
<b>The Database – Storage</b>	
What:	Having this information stored and secured for easy access and analysis. Having a record of the work and its impact may help secure external funding.
Method:	Internal Council databases where information is digitised in excel spreadsheets and documents that can be kept updated and made publicly available. Coastal Restoration Trust of New Zealand has a <a href="#">coastal monitoring database</a> for rapid point surveying. This would require survey information to be uploaded on the web regularly but does present raw data in a way that's user friendly. Below is an example of survey data from the Te Wairoa reserve in Matapouri, Northland.

## Ground cover

### By species

- *Spinifex sericeus* 27.8%
- *Stenotaphrum secundatum* 11.1%
- *Calystegia soldanella* 11.1%
- Exotic herb 5.6%
- *Lagurus ovatus* 5.6%
- *Ficinia spiralis* 5.6%
- *Cakile maritima* subsp. *maritima* 5.6%



### Native species

61.6% of samples with vegetation cover

### No vegetation

27.8% of total samples

## Vegetation height

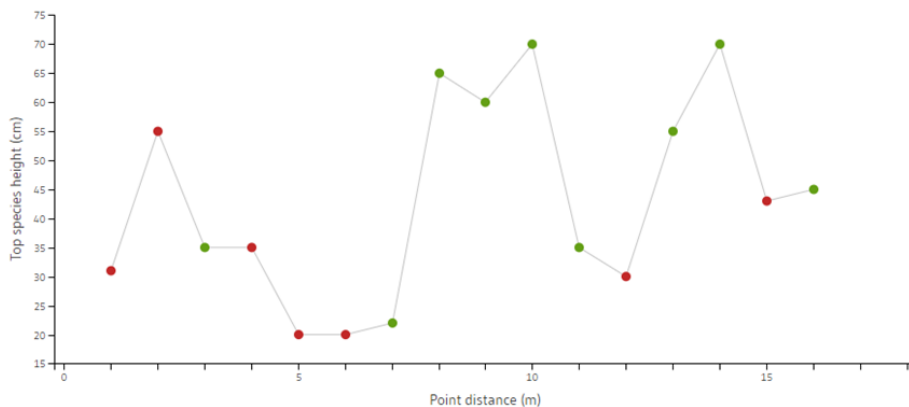


Figure 7. Survey data from a dune planting program at the Te Wairoa reserve in Matapouri, Northland available on the Coastal Restoration Trust [Coastal Monitoring Database](#).

## Analysis and interpretation of data – how are we doing?

**What:** Regular analysis of monitoring data to draw conclusions about the planting. This can quantify the progress of the project and provide information about what species are more likely to be successful at Leithfield Beach. This will enable us to make inferences about why planting has or hasn't worked and what can be done to improve our success in future. Additionally, having this information documented may support future funding applications for further planting.

**Method:** Visual and written analysis can be undertaken by Council staff or external technical experts. As depicted above, the Coastal Restoration Trust database summarises data into trends and graphs that can be used to draw conclusions.