



Hororata Farm

Biodiversity Management Plan



This plan has been designed to meet and exceed the relevant industry assurance standards and district and regional council regulations in place at the time of preparation

Please note: All family and farm names in this plan have been anonymised for the purpose of this pilot project.

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Prepared by Becky Clements, September 2022

Introduction

Hororata Farm is a 395 ha sheep and beef breeding, but predominantly beef finishing, unit on the Canterbury Plains. The farm is fully irrigated by 11 center pivots, after an extreme windstorm in 2013 removed most trees from the property, presenting the opportunity to re-design the farm fences. This has allowed Hororata Farm to run four times as much stock compared to when they were a dryland farm and currently run 18 stock units per hectare. Hororata Farm is a highly productive farm recognised for the premium beef they produce. Livestock are overwintered on a mix of kale and fodder beet. The farm is self-contained, growing enough feed to sustain all stock throughout the winter without needing to buy in surplus feed. The Central Plains Water Scheme headrace intersects the farm.

Biodiversity Vision Statement

In 20 years' time our farm will be an outstanding example of bringing back native biodiversity to the Canterbury Plains. Native habitat patches will be re-established that will help bring mobile native bird species such as korimako and tūī back to the area as well as contributing aesthetic value to the farm. The laneway will feel like a forest corridor with plantings on either side providing habitat for many native species as well as shelter for stock.

Stock take of Biodiversity Assets

The predominant vegetation found on Hororata Farm is exotic pasture grasses such as clovers and ryegrass. Kale and fodder beet are grown as winter feed for stock. There are few remaining woody plants on the farm as a wind storm in 2013 removed almost all tall vegetation. There are two small native plantings that contain a mixture of harakeke, pittosporums, and coprosma species.

Native birds seen on the property:

- Pīwakawaka (Fantail)
- Korimako (Bellbird)
- Poaka (Pied stilts)
- Matuku moana (White faced heron)
- Pohowera (Banded dotterel)
- Kārearea (New Zealand falcon)
- Ruru (Morepork)
- Kōtare (Sacred Kingfisher)



Red admiral butterfly



Yellow admiral butterfly

There is abundant insect life beneath the irrigators and both yellow and red admiral butterflies are seen throughout the farm.

The average annual rainfall here is 900 – 950 ml and the farm is predisposed to strong wind events, which leads to high evapotranspiration levels. The soils on Hororata Farm are predominantly stony, free-draining Lismore typical to the Canterbury Plains. Current predator control methods on this farm are shooting for hares and feral cats as well as trapping for possums and cats. Rodents are baited for around farm buildings during the winter.

Before human arrival, the Canterbury Plains were covered in a mosaic of shrubland and forest, with closed forest in wetter areas (damp soils and closer to the foothills), more open forest across the drier areas, and shrubland where it is driest (e.g. shallow stony soils). However, there is almost no biodiversity remaining today as the native vegetation was cleared by early Polynesian settlers with fire. European

settlers then cleared the remaining areas of shrubland for farming and forestry when they arrived. There now remain only a few small pockets of remnant native forest on the Canterbury Plains, the closest of which to Hororata Farm is Lords Bush, past Springfield. For these reasons, restoration projects such as this one being undertaken at Hororata Farm are highly important to bringing back native biodiversity to the Canterbury Plains.

Mahinga Kai Values

Mahinga kai is about the value of natural resources – our birds, plants, fish, and other animals and resources that sustain life, including the life of people. Mahinga kai encompasses the management and collection of natural resources important to the cultural traditions of Ngāi Tahu. It is a culturally important practice as it connects people with the land, allows for customary traditions to be passed down through generations, and provides a vital food source. Mahinga kai includes access to healthy kai, and sustainably doing this, with our future generations in mind. Mahinga kai refers to numerous species and inter-relationships rather than something specific. It includes things such as species, natural habitats, materials and practices used for harvesting food, and places where food or resources are, or were, gathered.

The recognition of mahinga kai values does not imply any obligation on the landowner, but this concept is used within the Freshwater Management National Policy Statement as one of the indicators of freshwater quality.

Assessment of Biodiversity Assets

Hororata Farm presents a clean slate with ample opportunities to enhance indigenous biodiversity in the landscape. With enthusiastic owners and funding avenues, there are many opportunities to create biodiversity assets on the farm. The only waterway found on Hororata Farm is the Central Plains Water Scheme headrace that bisects the farm, which is not available for restoration because of its role as an irrigation race.

Risks to Biodiversity

The main risks to native biodiversity identified at Hororata Farm are from pest animals such as feral cats, hares, possums, mustelids and low pressure from feral pigs and deer. Dehydration of native seedlings is also a risk as high winds and low rainfall may result in low survivability of plantings if they are not irrigated.



Hares damage native vegetation and can cause mortality within plantings.



Feral cats pose a large threat to native biodiversity as they predate upon lizards, insects and bird species.



Stoats often catch large numbers of animals and cache them in their burrows.



Possums can strip a tree of foliage within one night. They also predate upon bird eggs and young chicks.

Biodiversity Action Plan

This work plan outlines the tasks that will be necessary for achieving high quality biodiversity management outcomes at Hororata Farm that addresses the long-term vision for the property. The plan is written as a 5-year calendar so that biodiversity management actions can be easily scheduled into the working year with a draft budget included for anticipated costs.

This calendar should be reviewed and updated annually alongside your normal farm management planning so that you have the flexibility to carry out the work when you have the capability and make changes in the face of unexpected events. Costs are written as estimates only.

Goal 1: Plant pugging corner by Pivot #9															
Action	Location	2022	2023	2024	2025	2026	2027		2022	2023	2024	2025	2026	2027	
Source seedlings	Local nursery	September							\$8,160						Source 1,360 seedlings (seedlings required for goals 1-3). Cost \$2-\$30 ea. Average of \$6 each= \$8,160 for goals 1-3.
Fence restoration site	Cornery by Pivot #9	November							\$240						\$6/m= \$240. Try to buy materials out of peak fencing time.
Source plant guards	Online store	September							\$2,720						Plant guards and stakes range between \$1.20- \$2.80ea, average of \$2 (total for goals 1-3). A range of different plant guards are available from https://www.advancelandscape.co.nz/shop/Plant-establishment.html .
Prepare sites for planting	Cornery by Pivot #9	December							\$464						Estimated average spray contractor price for herbicide weed releasing 242 seedlings @ \$2/stem.
Undertake plantings	Cornery by Pivot #9		Jan-Feb												Plant 242 seedlings at this site . An average of 5 minutes to plant each seedling will require 20 hours of work with 1 staff member (\$ value not included in this table).
Maintenance of plantings	Cornery by Pivot #9			Jan-Feb							\$464				Release spraying around plant guards @ \$2/stem.
							Total:		\$11,604	\$0	\$464	\$0	\$0	\$0	Total cost over 5 years:
															\$12,068
Goal 2: Plant strip by Pivot #7															
Action	Location	2022	2023	2024	2025	2026	2027		2022	2023	2024	2025	2026	2027	
Fence restoration site	Strip by Pivot #7	November							\$1,932						\$6/m= \$1,932. 322m required.
Source plant guards	Online store	September													See goal 1.
Prepare sites for planting	Strip by Pivot #7	December							\$826						Estimated average spray contractor price for herbicide weed releasing 413 seedlings @ \$2/stem.
Undertake plantings	Strip by Pivot #7		Jan-Feb												Plant 413 seedlings at this site .
Maintenance of plantings	Strip by Pivot #7			Jan-Feb							\$826				Release spraying around plant guards @ \$2/stem.
							Total:		\$2,758	\$0	\$826	\$0	\$0	\$0	Total cost over 5 years:
															\$3,584
Goal 3: Plant strip by Pivot #4															
Action	Location	2022	2023	2024	2025	2026	2027		2022	2023	2024	2025	2026	2027	
Fence restoration site	Strip by Pivot #4	November							\$1,722						\$6/m= \$1,722. 287 m required.
Source plant guards	Online store	September													See goal 1.
Prepare sites for planting	Strip by Pivot #4	December							\$1,500						Estimated average spray contractor price for herbicide weed releasing 750 seedlings @ \$2/stem.
Undertake plantings	Strip by Pivot #4		Jan-Feb												Plant 750 seedlings at this site .
Maintenance of plantings	Strip by Pivot #4			Jan-Feb							\$1,500				Release spraying around plant guards @ \$2/stem.
							Total:		\$3,222	\$0	\$1,500	\$0	\$0	\$0	Total cost over 5 years:
															\$4,722
Goal 4: Plant strip by Pivot #6															
Action	Location	2022	2023	2024	2025	2026	2027		2022	2023	2024	2025	2026	2027	
Source seedlings	Local nursery	May							\$10,500						Source 1,750 seedlings at an average of \$6= \$10,500
Fence restoration site	Strip by Pivot #6	April							\$3,912						\$6/m= \$3,912. 652 m required.
Source plant guards	Online store	April							\$3,500						Plant guards and stakes range between \$1.20- \$2.80ea, average of \$2.
Prepare sites for planting	Strip by Pivot #6		AUGUST						\$3,500						Estimated average spray contractor price for herbicide weed releasing 1,750 seedlings @ \$2/stem.
Undertake plantings	Strip by Pivot #6		Sept-Dec												Plant 1,750 seedlings at this site .
Maintenance of plantings	Strip by Pivot #6			October							\$3,500				Release spraying around plant guards @ \$2/stem.
							Total:		\$0	\$21,412	\$3,500	\$0	\$0	\$0	Total cost over 5 years:
															\$24,912
Goal 5: Plant dry corner by Pivot #1															
Action	Location	2022	2023	2024	2025	2026	2027		2022	2023	2024	2025	2026	2027	
Source seedlings	Local nursery		May								\$26,340				Source 4,300 seedlings at an average of \$6= \$26,340
Fence restoration site	Dry corner by Pivot #1		April								\$750				\$6/m= \$750. 125 m required.
Source plant guards	Online store		April								\$8,780				Plant guards and stakes range between \$1.20- \$2.80ea, average of \$2.
Prepare sites for planting	Dry corner by Pivot #1			AUGUST							\$8,780				Estimated average spray contractor price for herbicide weed releasing 4,300 seedlings @ \$2/stem.
Undertake plantings	Dry corner by Pivot #1			Sept-Dec											Plant 4,300 seedlings at this site .
Maintenance of plantings	Dry corner by Pivot #1				October							\$8,780			Release spraying around plant guards @ \$2/stem.
							Total:		\$0	\$0	\$44,660	\$8,780	\$0	\$0	Total cost over 5 years:
															\$53,440

Goal 6: Plant corner by Pivot #6														
Action	Location	2022	2023	2024	2025	2026	2027	2022	2023	2024	2025	2026	2027	
Source seedlings	Local nursery				May						\$39,000			Source 6,500 seedlings at an average of \$6 each = \$39,000
Fence restoration site	Corner by Pivot #6				April						\$1,170			\$6/m = \$1,170. 195 m required.
Source plant guards	Online store				April						\$13,000			Plant guards and stakes range between \$1.20 - \$280 ea, average of \$2.
Prepares sites for planting	Corner by Pivot #6				August						\$13,000			Estimated average spray contractor price for herbicide weed releasing 6,500 seedlings @ \$2/stem.
Undertake plantings	Corner by Pivot #6				Sept-Dec									Plant 6,500 seedlings at this site.
Maintenance of plantings	Corner by Pivot #6					October						\$13,000		Release spraying around plant guards @ \$2/stem.
							Total:		\$0	\$0	\$66,170	\$13,000	\$0	Total cost over 5 years: \$79,170
Goal 7: Plant corner by Pivot #2														
Action	Location	2022	2023	2024	2025	2026	2027	2022	2023	2024	2025	2026	2027	
Source seedlings	Local nursery					May						\$6,300		Source 1,050 seedlings at an average of \$6 = \$6,300
Fence restoration site	Corner by Pivot #2					April						\$900		\$6/m = \$900. 150 m required.
Source plant guards	Online store					April						\$2,100		Plant guards and stakes range between \$1.20 - \$280 ea, average of \$2.
Prepares sites for planting	Corner by Pivot #2					August						\$2,100		Estimated average spray contractor price for herbicide weed releasing 1,050 seedlings @ \$2/stem.
Undertake plantings	Corner by Pivot #2					Sept-Dec								Plant 1,050 seedlings at this site.
Maintenance of plantings	Corner by Pivot #2						October						\$2,100	Release spraying around plant guards @ \$2/stem.
							Total:	\$0	\$0	\$0	\$0	\$11,400	\$2,100	Total cost over 5 years: \$13,500
Goal 8: Continue mammalian predator control														
Action	Location	2022	2023	2024	2025	2026	2027	2022	2023	2024	2025	2026	2027	
Purchase Timms cat traps	Farmlands	October						\$413						Timms traps are available from Farmlands for \$82.50 each. Purchase 5 or the amount that fits within your budget.
Purchase DOC250, A24 traps.	Online store	September						\$9,513						DOC250 = \$119 ea (x 72). A24 = \$ 189 ea (x5).
Continue mustelid/rat control.	Whole farm	On-going	On-going	On-going	On-going	On-going	On-going	\$400	\$400	\$400	\$400	\$400	\$400	Estimated costs of rabbit meat/lure and maintenance of trapping network.
Continue shooting for rabbits, possums and cats	Whole farm	On-going	On-going	On-going	On-going	On-going	On-going	\$300	\$300	\$300	\$300	\$300	\$300	Estimated costs of ammunition for control. Potential to use rabbit meat from rabbit control on the farm.
Feral deer and pig control	Whole farm	On-going	On-going	On-going	On-going	On-going	On-going	\$300	\$300	\$300	\$300	\$300	\$300	Estimated costs of ammunition for control.
							Total:	\$10,926	\$1,000	\$1,000	\$1,000	\$1,000	\$1,000	Total cost over 5 years: \$15,926
Goal 9: Establish biodiversity monitoring														
Action	Location	2022	2023	2024	2025	2026	2027	2022	2023	2024	2025	2026	2027	
Establish automated acoustic bird monitoring		October						\$498	\$79	\$79	\$79	\$79	\$79	1 recorder @ \$419 and annual cloud storage @ \$79. Install earlier if plantings are made before then.
Establish photo point monitoring		December												Establish 2 photopoint locations at each habitat patch as they are planted. Approx. 1 2 hours of work required to take initial photos and mark locations
Repeat photo point monitoring			December	December	December	December	December							
							Total:	\$498	\$79	\$79	\$79	\$79	\$79	Total cost over 5 years: \$893
Goal 10: Annual management plan review														
Action	Location	2022	2023	2024	2025	2026	2027	2022	2023	2024	2025	2026	2027	
Undertake annual review of biodiversity management plan	Office	July	July	July	July	July	July	\$0	\$0	\$0	\$0	\$0	\$0	Half day reading management plan, ticking off completed actions and scheduling actions for the year ahead. Do this in conjunction with farm business planning.
							Total:							Total cost over 5 years: \$0
														Total cost of biodiversity management actions for 5 years: \$208,225

Biodiversity Action Plan

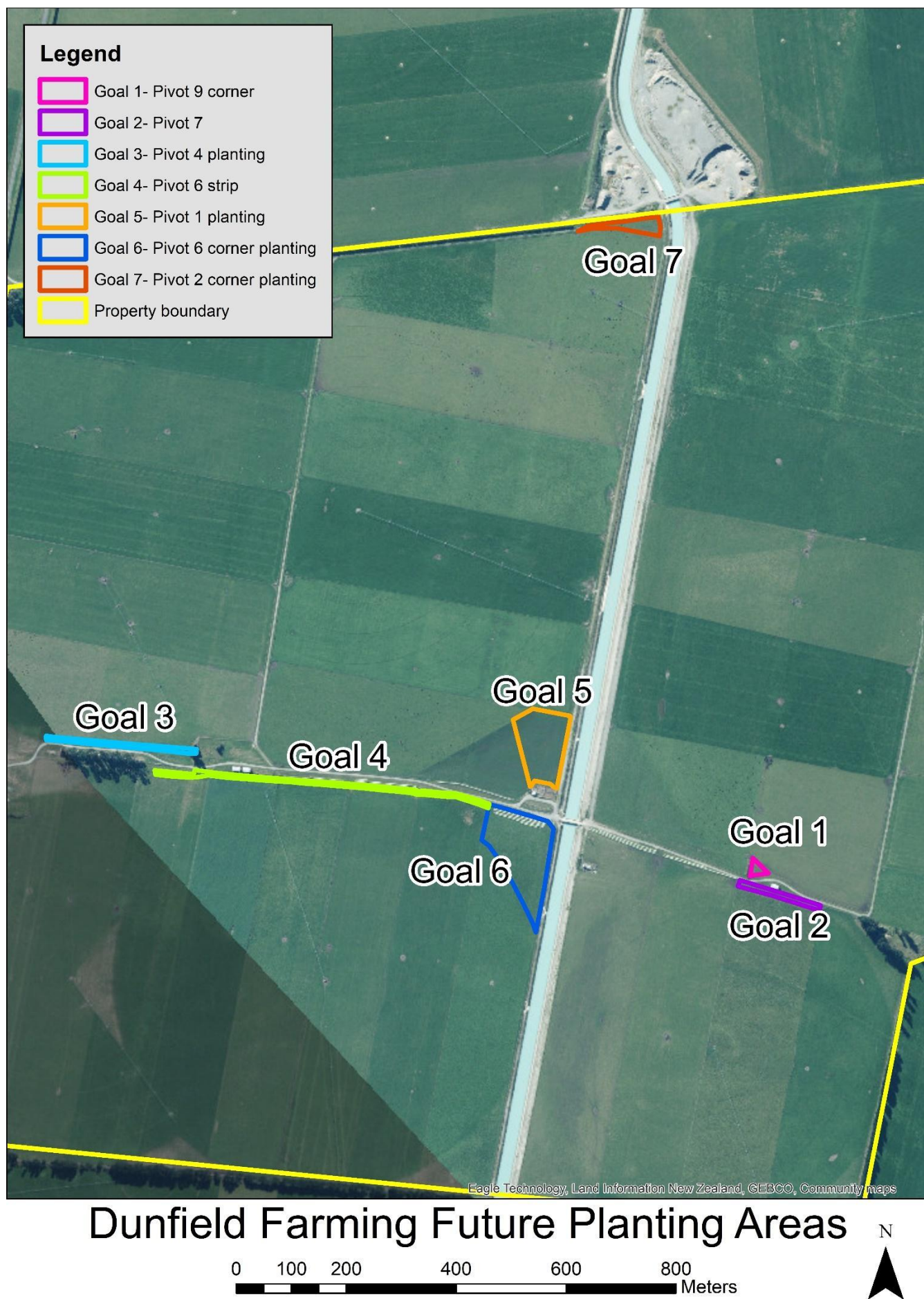
Given that this farm has a baseline of very little biodiversity on the property, or in the surrounding landscape, the aim of this plan is to restore native vegetation as habitat for native fauna. The free-draining soils, high winds and lack of irrigation to most of the native plantings will however be limiting. Habitat patches that receive spray drift or the irrigator arm passes over will do best. It is possible to see every unproductive area and non-irrigated areas planted in natives with low shelter belts of native species providing stock shelter.

In order to realize the 20-year biodiversity vision for Hororata Farm, the below goals need to be met. The benefits to indigenous biodiversity will be similar for Goals 1 – 7 (planting of various habitat patches on the farm). These provide habitat and food resources for various native birds and insect species through planting appropriate native plants. These habitat patches will provide ‘stepping-stones’ for mobile native species such as korimako and fantails to move through the landscape. Many native bird species avoid flying for long distances (>few hundred meters) over open spaces. Habitat patches therefore provide important connectivity within the landscape. Almost all native vegetation has been removed from the Canterbury Plains since human settlement. Projects like this one therefore play a vital role in bringing back biodiversity to the plains. A detailed planting plan is attached on page 32.

Goals 1 – 7 are in order of priority as indicated by the owners. The benefits of Goals 1 – 7 for the farm business will include shade and shelter for stock, habitat for pollinations, improved soil health, aesthetic values and customers linking their products to the positive impact that farm has on native biodiversity.

Actions required for Goals 1 – 7 are:

- Fence required area.
- Source planting material from local nursery or by eco-sourcing and producing own seedlings.
- Plant following best practice methods (Appendix 2) using species supplied in the planting list on page 32.
- Maintain plantings following best practice methods (Appendix 2).



Goal 1 – Fence and plant small pugging corner by Pivot #9.

This goal aims to fence and plant with natives the small area prone to pugging by Pivot #9. Map on page 16.

Area: 0.05 ha.

Length of fencing required: 40 m.

Number of seedlings required: 242

Goal 2 – Fence and plant strip by Pivot #7

This goal aims to establish a planting of native species to provide habitat for native fauna by pivot #7 on this property.

Area: 0.093 ha (6 m wide, 155 m long)

Length of fencing required: 322 m

Number of seedlings required: 413

Goal 3 - Fence and plant strip by pivot #4

This goal will help create a native corridor down the laneway through a strip planting in the paddock by pivot #4. Map on page 19.

Area: 0.17 ha (6 m wide, 275 m long)

Length of fencing required: 287 m.

Number of seedlings required: 750

Goal 4 – Fence and plant strip by Pivot #6

A strip planting is to be made along the laneway, next to pivot #6. Fence on the inside of the paddock, making the strip as wide as possible within the limits of the pivot wheels. 6 m should be the minimal width of the strip, this would make the planting 4 plants wide at 1.5 m spacings. Map on page 17.

Area: 0.36 ha (6 m wide, 610 m long)

Length of fencing required: 610 m.

Number of seedlings required: 1,599

Goal 5 – Fence and plant large dry corner by Pivot #1

This goal aims to plant the dry corner by the cattle yards and pivot #1. The entire dry area is about 2.5 ha. The long term (>5 years) is to plant the whole area with natives as an area that size would provide sufficient area for breeding pairs of native bird species. Preparation for planting will be coincided with cultivation of the paddock after cropping. Map on page 18.

Area: 1 ha.

Length of fencing required: 125 m.

Number of seedlings required: 4,390

Goal 6: Fence and plant corner by Pivot #6

This large dry corner in between the water canal and pivot 6 is to be planted in an assemblage of native species. Map on page 20.

Area: 1.5 ha

Length of fencing required: 195 m.

Number of seedlings required: 6,500

Goal 7: Fence and plant corner by Pivot #2

This goal aims to plant the dry corner next to the water canal and pivot #2. Map on page 22.

Area: 0.23 ha.

Length of fencing required: 150 m.

Number of seedlings required: 1,022

Goal 8: Continue predator control and install mustelid trapping network.

Hares and possums are already controlled at Hororata Farm through shooting and trapping. This should be continued and increased when numbers are higher. There are moderately high numbers of feral cats present in the area, these are controlled through live capture trapping and shooting which should be

continued but increased by purchasing Timms kill traps. There a low number of wild pigs and deer that come through the property, these are controlled when necessary.

When trapping for mustelids (stoats, weasels, ferrets), traps should be placed along fence lines where they will not be disturbed by stock or humans. The DOC 250 kill trap is recommended if ferret control is needed. The DOC250 also catches stoats, rats and hedgehogs. I suggest placing traps every 100 m along the farm tracks. The general rule of thumb is 2 devices for every hectare. A24 traps are a good option for around farm buildings. Map of proposed trap lines on page 23. Further methods for predator control are attached in Appendix 3.

Actions

- Trap for mustelids, possums and feral cats following best practice methods.
- Continue shooting hares.
- Continue to shoot wild pigs and deer when necessary.

Benefits to biodiversity

Predator control is one of the most important actions to take to improve native biodiversity. Possums, rabbits, hares, wild pigs and deer all damage palatable native plants and will need to be controlled for restoration plantings to thrive. Cats and mustelids (stoats, weasels and ferrets) all predate upon native bird and lizard fauna and can be extremely damaging to biodiversity.

Effect on farm business

Controlling pests on farm will not only help increase native biodiversity, but will also benefit the farm business as a proportion of winter crops is lost to wild deer every year and possums and pigs are TB vectors.

Goal 9 - Biodiversity Monitoring

This goal aims to establish a biodiversity management plan for Hororata Farm. All records collected through the below monitoring actions must be kept for at least 5 years although it is recommended that you keep them in perpetuity as their value will be in the long term (including for future generations).

Actions

Establish automated acoustic bird monitoring: One acoustic bird recorder should be purchased from the Cacophony Project (<https://www.2040.co.nz/collections/cacophonometer-bird-monitoring>) and

installed by the homestead. Installing a bird recorder now will provide baseline data and show improvement in bird abundance after biodiversity management actions are completed. If there is cellphone coverage where the recorders are located and a monthly cellular data package is purchased, data will be automatically uploaded to the cloud. If there is no coverage, recorders will need to be checked regularly to back up data, this will need to be done every 3-12 months depending on the storage capacity option chosen. At this stage, the AI can only identify ruru/morepork, and groups all other bird species into "generic bird call." However, it is expected that within the next 3-5 years the AI will be advanced enough to identify all common bird species in Aotearoa. This will allow for records stored on the Cloud to be reanalysed and you will receive a much more detailed record of the birds that you have been recording.

Establish photo point monitoring: The simplest way to monitor change in your native vegetation (as a proxy for biodiversity generally) over time is to install a photo-point monitoring network. This entails taking photos from the exact same location, in the exact same direction at the same time every year. The photos should show an area of land where you expect to see a change in vegetation over time. At Hororata Farm, take two pictures from different viewpoints of each planting annually. Store these images where they will be easy to recover.

Benefits to biodiversity

Understanding what species are on the property and how their presence is changing as a result of management actions will influence future decisions on how to manage these species to further increase biodiversity on your property.

Effect on farm business

Monitoring changes in biodiversity on farm is likely to become important as local and international customers are increasingly looking to source products from farms that operate to environmentally high standards and this is likely to become important as new regulations come into effect. It is important to have a record of any biodiversity enhancement conducted on your property.

Goal 10 - Review of Biodiversity Plan

It is important that this biodiversity plan isn't just a one-off exercise and that it is reviewed regularly and the results from monitoring are used to guide future management. While the whole biodiversity plan will have a substantial review every 5 years, annual reviews and updates to the 5-year operational plan are

considered essential and should be undertaken. An annual review is also important because this plan is designed to be able to meet the needs of regulators and market auditors.

Actions

Review this biodiversity plan at the same time as setting the overall farm work programme and budget for the next year. This review will include:

- Summarising the results of monitoring information from the past year.
- Undertaking a review of biodiversity management achievements against what we have proposed and assess why the management actions did or did not work.
- Undertake forward planning for both the next year and the next five-year period, which will include updating the operational plan.

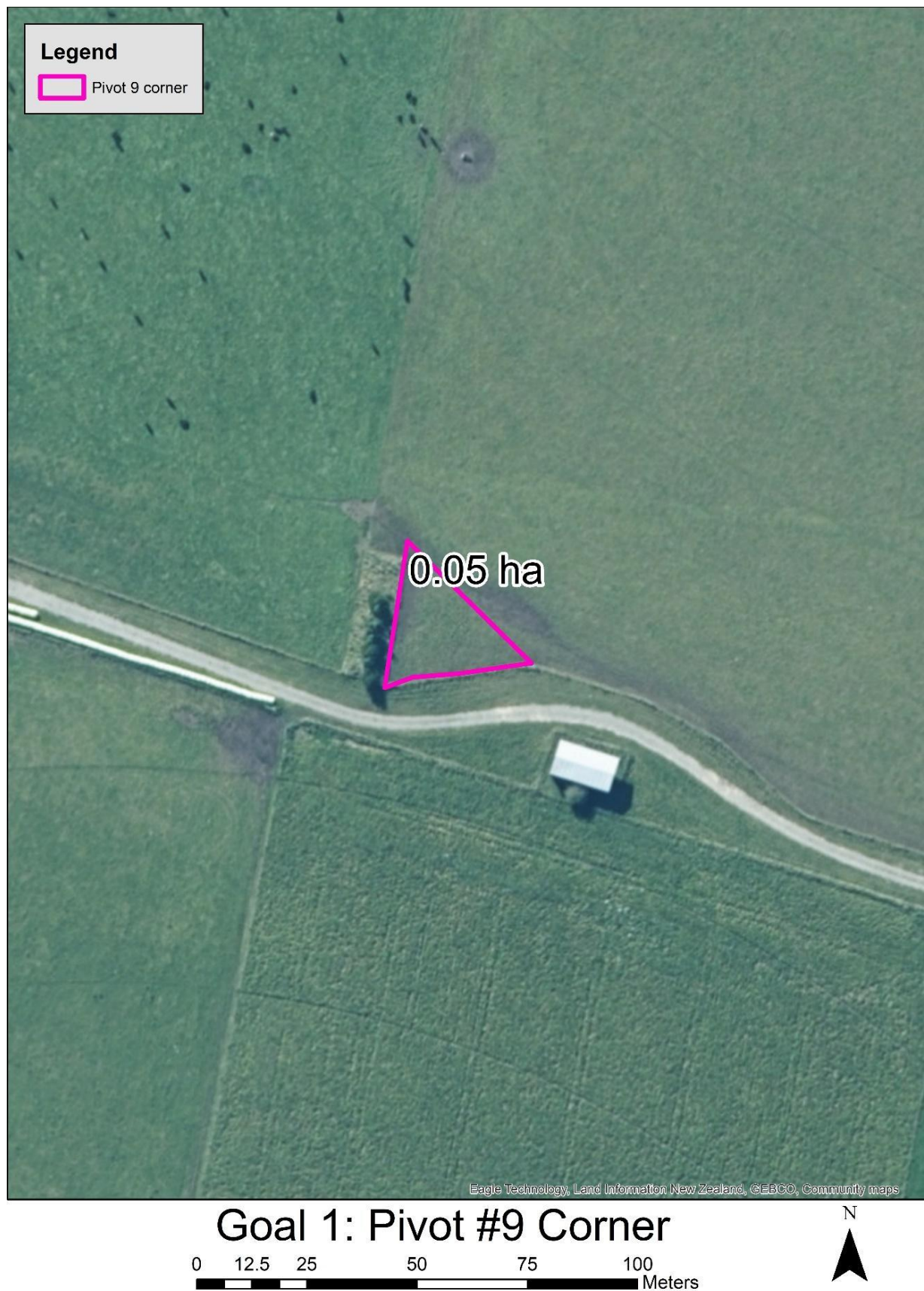
Benefits to biodiversity

Having a structured approach to planning biodiversity restoration work will increase the likelihood of biodiversity management actions being undertaken.

Effect on farm business

Having records of biodiversity work undertaken and results of monitoring meets FAP+ requirements and may become important to comply with future regulations.

Biodiversity Goals Maps:





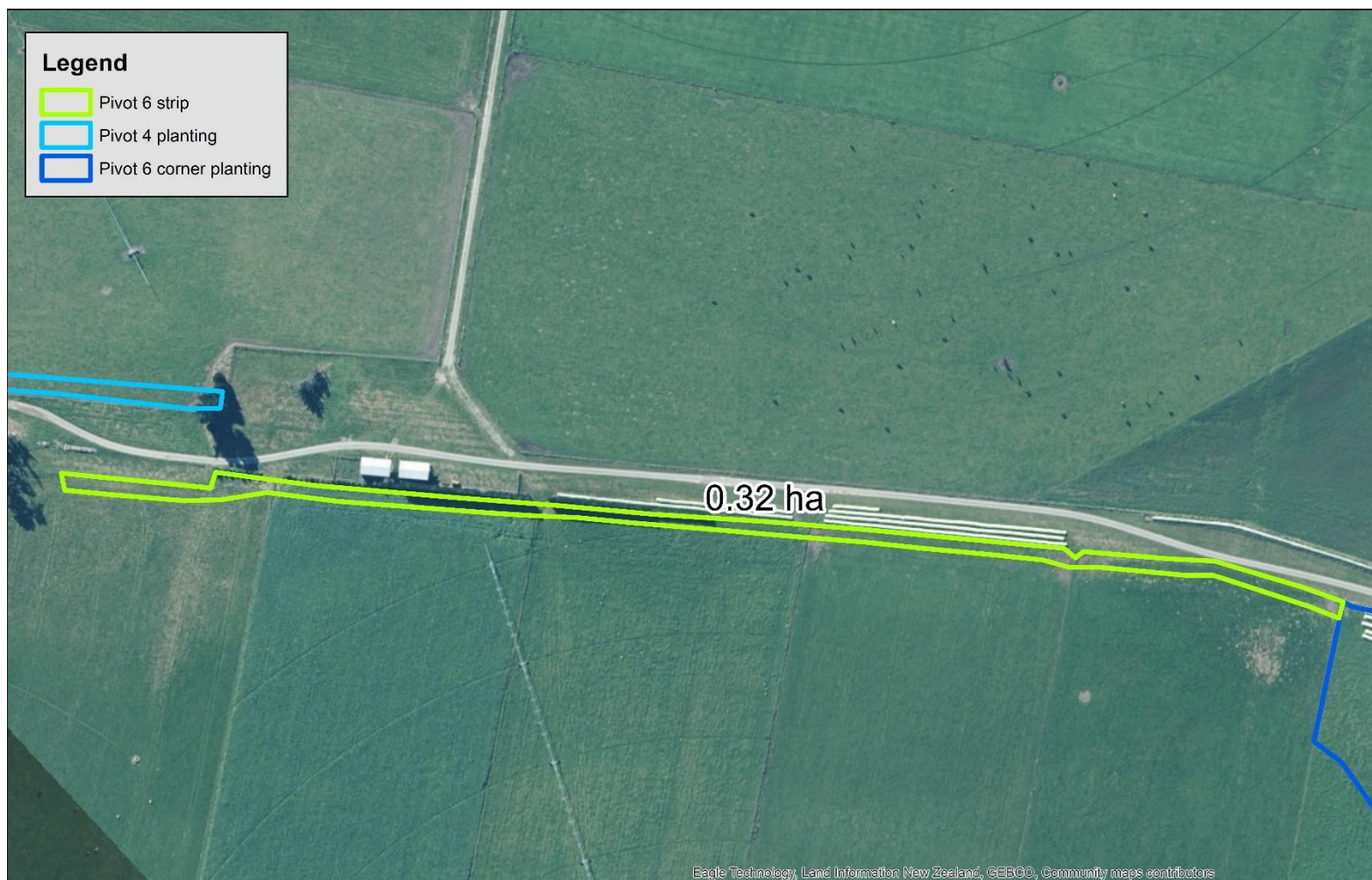
Goal 2: Strip planting by Pivot #7



Goal 3: Strip planting by Pivot #4

0 12.5 25 50 75 100 Meters





Goal 4: Strip planting by Pivot #6

0 25 50 100 150 200 Meters





Goal 5: Corner planting by Pivot #1

0 12.5 25 50 75 100 Meters





Goal 6: Corner planting by Pivot #6

0 12.5 25 50 75 100 Meters





Goal 7: Corner Planting by Pivot #2

0 12.5 25 50 75 100 Meters





Proposed Trap Lines

0 125 250 500 750 1,000
Meters



Appendix 1: Eco-sourcing

Eco-sourcing benefits native biodiversity by using seeds from plants that naturally occur in the area. They therefore will be genetically adapted to the conditions and more likely to survive. Getting seedlings that have been grown from seed is much better than plants that have been propagated from cuttings as cuttings will mean each plant is genetically identical and the population will therefore not be robust against the risk of disease and adverse weather. Genetic diversity within a population is needed for survival. When eco-sourcing seeds, you should collect them from a variety of different plants as well as slightly different times in the season.

Resources on propagation of natives and a calendar for seed collection can be found on DOC's website:

<https://www.doc.govt.nz/get-involved/run-a-project/restoration-advice/native-plant-restoration/ecosource-seeds/>

Basic guide to setting up a native nursery:

https://www.whitebaitconnection.co.nz/images/wbc/resources/HK_Resources/He_Kkano_How_to_set_up_a_native_plant_nursery.pdf

Manuka¹:

They have seed capsules from September to May but you can often find capsules most of the year. When the flower petal falls off and a brown capsule remains, collect the capsules before they split open and place them in a paper bag to open and release the seeds. Leave in a dry/warm place for two days, then look at the very bottom of the bag to find the seeds. They look like red eyelashes.

Harakeke¹:

Harakeke have flowers from September to November and have seeds from November to March. You may notice old empty stalks from past years. Pick the whole 'pod' off the harakeke stalk and it put straight into a bag or container. Gently open the pod and let the shiny black seeds fall out.

Māhoe¹:

Māhoe have really sweet smelling, tiny green/white flowers, sometimes coming straight from the trunk. From December to April you might find dark purple berries. Collect the purple berries (some think they look like 'mini-microphones'). Squash them between your fingers, wash in a sieve to get rid of the excess flesh and find the seeds inside.

Ti kōuka¹:

Tī kōuka have berries from December to March. The berries are white with blue speckles. Often you will only find one bunch of berries per 'head' of leaves. Each berry may contain 1-10 seeds inside. Get in quick! Kererū love to eat these berries. Gently squash them between your fingers, wash in a sieve to get rid of flesh and find the little black seeds inside.

Kōwhai¹:

Kōwhai have very small leaves, actually called 'leaflets'. Sometimes you can find kererū eating the new leaves. Kōwhai have seeds from October to May. Seed pods can be picked when the long strands of cases are dry and brown. There is one seed inside each 'bubble'. Kōwhai seeds have a hard yellow shell that needs to be broken in order for germination to start. Ask an adult to cut an end off with scissors or rub the seed on sandpaper until you can see the pale inside. Caution! Kōwhai seeds can be toxic so keep them away from young children.

Karamū¹:

You can collect the berries from March to July. The plant will often have berries of all colours, from green to orange, in each bunch. If the flowers are pollinated they will turn into a berry. You can pick the berries when they are bright orange. Wash and sieve the berries to expose two white, hard seeds.

Pureri (*Carex secta* and *C. virgata*)²:

These two species of sedge are commonly found in wetlands, both growing in open sunlight or light shade in wet soil, tolerating water to a depth of 300 to 400 mm. The roots of *Carex secta* can form a trunk-like structure, making the individual plant up to 2 metres tall. The seeds are borne on long spikes – upright in *Carex virgata* and more pendulous in *C. secta*. Seeds ripen in late summer and are dispersed by floating on water. Be careful when stripping seeds from the seed head as leaf margins can be sharp. Sow on firm seed raising mix and cover lightly with mix. Germination can be a few weeks in warmer temperatures but slower in winter.

1: Retrieved on 17/06/22 from:

https://www.whitebaitconnection.co.nz/images/wbc/resources/HK_Resources/He_K%C4%81kano_Seed_Collecting_Guide_1.pdf

2: Retrieved on 17/06/22 from:
<https://www.doc.govt.nz/get-involved/run-a-project/restoration-advice/native-plant-restoration/ecosource-seeds/collecion-and-propagation-guide-grasses/>

Appendix 2: Planting Instructions

Site preparation:

Spot spray 2-6 weeks prior to planting to ensure that weed competition is effectively reduced and any herbicide residue has dissipated. Ensure the areas sprayed are at least 1 m in diameter. Spraying in a snaking motion, rather than circling, reduces spray overlap. Plant seedlings in the ground during spring time when the frost risk is less. Alternatively, plant under shelter or after earlier plantings have established sufficient cover. Exact timing of planting will depend on weather conditions and the result of initial spot spraying. Avoid planting on hot, windy days.

Sourcing plant material:

It is important to source locally appropriate plants and these may already be available commercially or a nursery will need to be contracted to collect seed and propagate them. Nurseries often need a year in advance to prepare the plants.

If purchasing hardened seedlings from a nursery, be sure to ask whether they treat their native seedlings with a **mycorrhizal inoculation**. It will be important to ensure that seedlings are able to develop healthy populations of mycorrhizal fungi in their roots prior to planting out. These symbiotic fungi help plants to take up nutrients and water more effectively and can make a significant difference in seedling survival rate when planted into a stressful environment.

Plant guards and weed mats:

Using plant guards helps to suppress weeds around the seedlings and make it easier to find and maintain the seedlings afterwards. They help protect against frosts and drying out in exposed sites. Guards can also help to protect against rabbit and hare browse. Guards should be used in combination with matting, as the weeds that grow up inside the plant guard can compete with the native seedling and are difficult to remove. Plant guards and mats are, however, optional as they do add a significant cost to the restoration project. Plants guards have been found to be more important than weed mats for the survival of seedlings.

At Hororata Farm, reducing soil temperature and retaining soil moisture during summer will be the most important challenge to overcome. Mulching around seedlings can combat this, as well as keeping weeds down and can be used as an alternative to weed mats. Use organic material if possible, as it breaks down to supply nutrients to the soil. These mulches will need renewing over time to maintain effective weed control. Sheep dags are also a good option for around seedlings.

See planting techniques for Natives technical guide by Tanes Tree Trust:

https://www.tanestrees.org.nz/site/assets/files/1069/8_1_planting_techniques_for_natives-1.pdf

Find options for weed mats and plant guards at Advance Landscape Ltd:

<https://www.advancelandscape.co.nz/shop/Plant+Establishment.html>

At each of the areas planted at Hororata Farm, 60% of the species should be pioneering species, indicated by a 1 on the planting list. This is to ensure adequate shelter for later successional species.

Planting maintenance:

Maintenance of plantings is the most important step for a successful planting. The seedlings should be release sprayed 12 months after planting and as necessary in the following 3 years. Irrigation will greatly help the seedlings survive and competition from weeds should be kept to a minimum.

Maintenance of plantings will need to be carried out every year, this includes release spraying, control of regrowth of woody weeds and re-mulching around seedlings if required.

Appendix 3: Predator control methods

The combined length of the property boundary and farm lanes that may be used as trapping lines is 14.45 km. DOC250 traps should be placed along tracks for ease of maintenance. Depending on your goal for predator control at Hororata Farm, traps could be placed every 100 m (requiring 144 traps) or every 200 m (72 traps).

A24 traps for rats, mice and stoats can be placed around farm buildings:

<https://goodnature.co.nz/collections/a24-rat-stoat-trap-kits>

Purchase DOC250 traps at:

<https://www.connovation.co.nz/products/doc250-trap-range?variant=34016629686411>

As there is little habitat for rats, possums and mustelids nearby, individuals found on the property will mostly just be moving through the landscape. These pests usually move along features in the landscape such as fences rather than through the middle of paddocks therefore traplines should be set along fence lines. This also makes it easier to check and re-bait traps. As the habitat patches on Hororata Farm become established, this will create potential habitat for predators. Predator control efforts may therefore need to be increased in the future.

Lures: Whole raw egg may be used as a long-lasting lure for mustelids. Fresh rabbit meat is also a good lure for mustelids but needs to be replaced frequently. Visual lures should be used for possums such as white corflute or white metal cards and hazing using flour and icing sugar. Automatic lure dispensers (Motolure) from Zero Invasive Predators is a good option for a long-lasting lure that attracts possums, rats and stoats: <https://zip.org.nz/products-list/motolure>

Brief explanation of predator control options for farms:

<https://predatorfreenz.org/toolkits/trapping-baiting-toolkit/farms/>

Cribox will deter stock from licking and chewing trap boxes:

<https://www.summitsaddlery.co.nz/products/cribox-hydrophane?variant=7715405758511>

Appendix 4: Photo point monitoring technique.

Regular repetition of photographs under the same seasonal conditions will be the best way to monitor growth of the native plantings. Early summer (November-December) is the best time to photograph native vegetation after the flush of growth in spring but before vegetation starts to die back in mid-summer. Installing a waratah is a good way to mark the location of where to take the photos from.

Aligning the frame of repeated photos is key. It is recommended that you take copies of the original photos out with you when taking follow-up photos to ensure that you are pointing the camera in the same direction (consider using a compass bearing) and showing the same trees year on year. Relying on your memory to aim and frame the picture correctly usually produces poor results.



Landscape photo-point showing change in vegetation cover on a retired sheep and beef farm over 13-years (2005 left, 2018 right). Note the increase in shrub cover on the hill side in the top right and restoration plantings below this, and the changes to the two ponds and especially expansion of raupō on the left-hand pond.



Close-up photo-point showing rapid re-growth of mahoe under a kānuka canopy over three years with grazing animal retirement. Note background trees for reference.

Appendix 5: Opportunities & Constraints

Intrinsic opportunities and constraints to protect and enhance indigenous biodiversity at Hororata Farm.

Opportunities: The opportunities to enhance indigenous biodiversity at Hororata Farm are outlined in the goals in this plan. There are many areas throughout the farm that are able to be retired and planted in native species to create habitat patches.

Constraints: Although there are small numbers of possums found on the property, their presence here and in the wider habitat threaten biodiversity values as they are capable of stripping native trees of foliage and predate on bird eggs and chicks. Feral cats pose a huge threat to native wildlife, including birds and lizards. Although in low numbers, wild pigs and deer will also damage native plantings.

There is never enough time when running a busy farm business to do everything. This is something that all farms face with the many demands on people's time, not only for day-to-day farm work, but also in meeting the ever-increasing regulatory demands being imposed by Councils.

Extrinsic opportunities & constraints to protect & enhance indigenous biodiversity

Opportunities: The opportunity to collaborate with neighbouring properties and irrigation scheme members on management actions such as pest control. Central Plains Water have funding available for indigenous biodiversity enhancement projects.

Market demand: There is a growing demand from markets, both domestic and international, for farm products sourced from properties that undertake proactive environmental management, including for native biodiversity conservation.

Carbon sequestration: Under the potential He Waka Eke Noa carbon credits scheme, plantings of indigenous vegetation 0.23 ha or larger will be eligible to be part of the scheme. This has not been guaranteed yet as the policy is still being finalized. There are going to be opportunities for farmers in the Voluntary Carbon Market.

Constraints:

Conducting pest control on your property will only protect your land so far if the neighbouring properties do not control predators such as possums, mustelids, rats and pigs. Incursions to your property will continue to occur if predators are not controlled at landscape scale. This therefore ties in with the opportunities as there is a need to collaborate with neighbouring properties to control animal pests.

Plantings list

Hororata Farming Planting Plan		Total Area (ha)	Proportion	Stems per hectare		Approximate stem spacing 1.5 m x 1.5 m
		3.45	1	4444		
Planting order	Species	Botanical name	Proportion	Number of Seedlings	Mature height	Specifics
1	Harakeke (Flax)	<i>Phormium tenax</i>	0.02	307	3 m	Tolerant of permanently wet soil. Shelter for tree seedlings. Plant where it will get water from pivots.
1	Ti kōuka (Cabbage tree)	<i>Cordyline australis</i>	0.05	767	10 m	Important habitat for birds and invertebrates. Shelter for tree seedlings. Plant where no pruning is needed.
1	Mingimingi	<i>Coprosma propinqua</i>	0.05	767	5 m	Very hardy shelter shrub.
1	Karamū	<i>Coprosma robusta</i>	0.02	307	5 m	Fast growing early successional species. Versatile but not suited for the driest sites. Frost tender when young.
1	Thin-leaved coprosma	<i>Coprosma areolata</i>	0.04	613	3 m	Hardy species that attracts birds and lizards. Grows well in moist soils but can tolerate dry.
1	Coprosma virescens	<i>Coprosma virescens</i>	0.05	767	3 m	Fast growing species that is drought and wind tolerant.
1	Korokio (corokia)	<i>Corokia cotoneaster</i>	0.05	767	3 m	Very hardy to drought, wind and cold.
1	Kānuka	<i>Kunzea robusta</i>	0.05	767	8 m	Dryer areas only. Fast growing main canopy species
1	Tussock grass	<i>Carex comans</i>	0.03	460	0.5 m	Fast growing tussock grass that is very hardy and require good drainage. Plant at edges of plantings.
1	Porcupine shrub	<i>Melicytus alpinus</i>	0.01	153	0.8 m	Suits rocky soils in full sun, though it will grow on any well-drained soil.
1	Canterbury Plains tree daisy	<i>Olearia adenocarpa</i>	0.02	307	1.5 m	Requires well drained, dry soil and full sun. Is a rare and threatened plant and worth planting for this reason alone.
1	Scented tree	<i>Olearia</i>	0.02	307	3 m	Suits dry to moist soil. Very hardy plant.

	daisy	<i>odorata</i>				
1	Mountain akeake	<i>Olearia avicennifolia</i>	0.02	307	4 m	Suits dry to moist soils and tolerates exposure.
1	Cottonwood / Tauhinu	<i>Ozothamnu s leptophylla</i>	0.01	153	2 m	Suits dry to moist soil. Fast growing hardy shrub.
1	Koromiko	<i>Hebe salicifolia</i>	0.03	460	2 m	Suits dry to moist soils. Good shelter plant for seedlings.
1	NZ native broom	<i>Carmichaeli a australis</i>	0.01	153	3 m	Needs full sun and tolerates dry to moist soil.
1	Desert broom	<i>Carmichaeli a petriei</i>	0.01	153	1.5 m	Needs full sun and dry, well drained soil.
2	Mountain lacebark	<i>Hoheria lyalii</i>	0.02	307	8 m	Prefers moist soil, tolerant of shade.
1	South Island Toe Toe	<i>Austroderia richardii</i>	0.02	307	2 m	Tolerates wet and dry soil. Good for under pivots.
1	Hard tussock	<i>Festuca novae-zelan diae</i>	0.01	153	0.7 m	Prefers moist to dry soil. Hardy species for exposed sites. Plant at edges.
1	Blue tussock	<i>Poa colensoi</i>	0.01	153	0.7 m	Prefers dry soil and full sun. Plant at edges.
1	Silver tussock	<i>Poa cita</i>	0.01	153	0.7 m	Suits dry to moist soils. Hardy species. Plant at edges.
1 or 2	Tarata	<i>Pittosporum eugenioides</i>	0.02	307	12 m	Fast growing main canopy species. Tolerant of some shade and dry. Frost tender when young.
1	Kōhūhū	<i>Pittosporum tenuifolium</i>	0.03	460	6 m	Early successional species. Hardy. Will grown in any site. Susceptible to myrtle rust.
1	Rōhutu	<i>Lophomyrtu s obcordata</i>	0.03	460	5 m	Requires dry or moist soil.
1	Kāpuka (Broadleaf)	<i>Griselinea littoralis</i>	0.01	153	6 m	Canopy species. Relatively tolerant of harsh temperatures but may struggle to establish. Very palatable to stock
1	Narrow-leaved	<i>Hoheria</i>	0.04	613	6 m	Fast growing main canopy species. Similar to lowland ribbonwood but

	lacebark	<i>angustifolia</i>				more dry tolerant. May not respond well to pruning.
1	Shrubby tororaro	<i>Muehlenbeckia astonii</i>	0.04	613	2 m	Deciduous species that is hardy, tolerating dry conditions. Attracts insects and lizards.
1	Kōwhai	<i>Sophora microphylla</i>	0.05	767	8 m	Suitable for dry areas. Needs full sun. May struggle if pruned.
1	Dwarf kowhai	<i>Sophora prostrata</i>	0.05	767	2 m	Hardy species that does well on exposed, cold, dry sites.
1 or 2	Horoeka (Lancewood)	<i>Pseudopanax crassifolius</i>	0.02	307	12 m	Wind resistant. Frost tender when young. Plant where pruning will not be required.
1	Fierce lancewood	<i>Pseudopanax ferox</i>	0.02	307	8 m	Slow-growing. Hardier and more drought tolerant than <i>P. crassifolius</i> .
2	Māpou (red matipo)	<i>Myrsine australis</i>	0.04	613	5 m	Frost tender when young. Requires full sun or part shade.
2	Putaputāwētā (Marbleleaf)	<i>Carpodetus serratus</i>	0.01	153	10 m	Sub-canopy species that requires shelter trees to grow well. Plant where it will get watered from pivot.
1	Mānatu (Lowland Ribbonwood)	<i>Plagianthus regius</i>	0.04	613	12 m	Fast growing main canopy species. Tolerates wet and some shade and dry. Shelter for tree seedlings. May struggle if pruned.
2	Tōtara	<i>Podocarpus totara</i>	0.04	613	15 m	Emergent and main canopy component for dryer areas. Requires shelter plants around seedlings. Somewhat browse resistant. Cannot be pruned.
	Total no. seedlings			15332		