Ecological Restoration Report for Kaiapoi East Residents Association

Introduction

Kaiapoi East Residents Association (KERA) is a group of local Kaiapoi residents who are passionate about their local parks and community wellbeing. The group approached the Greenspace Department for ecological advice following agreement from the Council that the group could create a pocket forest in an area to the south of Feldwick Drive, Kaiapoi. This area had previously been a residential area but was categorised as a red zone following the September 4th 2010 earthquake. Consequently, this area now includes an undulating landform as land settles, remnant garden plantings, debris in soil and compaction from previous roads and residences which were demolished.

The area is frequently used by the local community for recreational purposes and there have been discussions around the suitable use for the land. At a Council meeting on 19 April 2021, it was agreed that the group could plant up a 20 m strip adjacent to the existing buildings in order to create a pocket forest and enhance the biodiversity of the area (Council report: 210414059998 and meeting minutes: 210427066471; Figure 1).

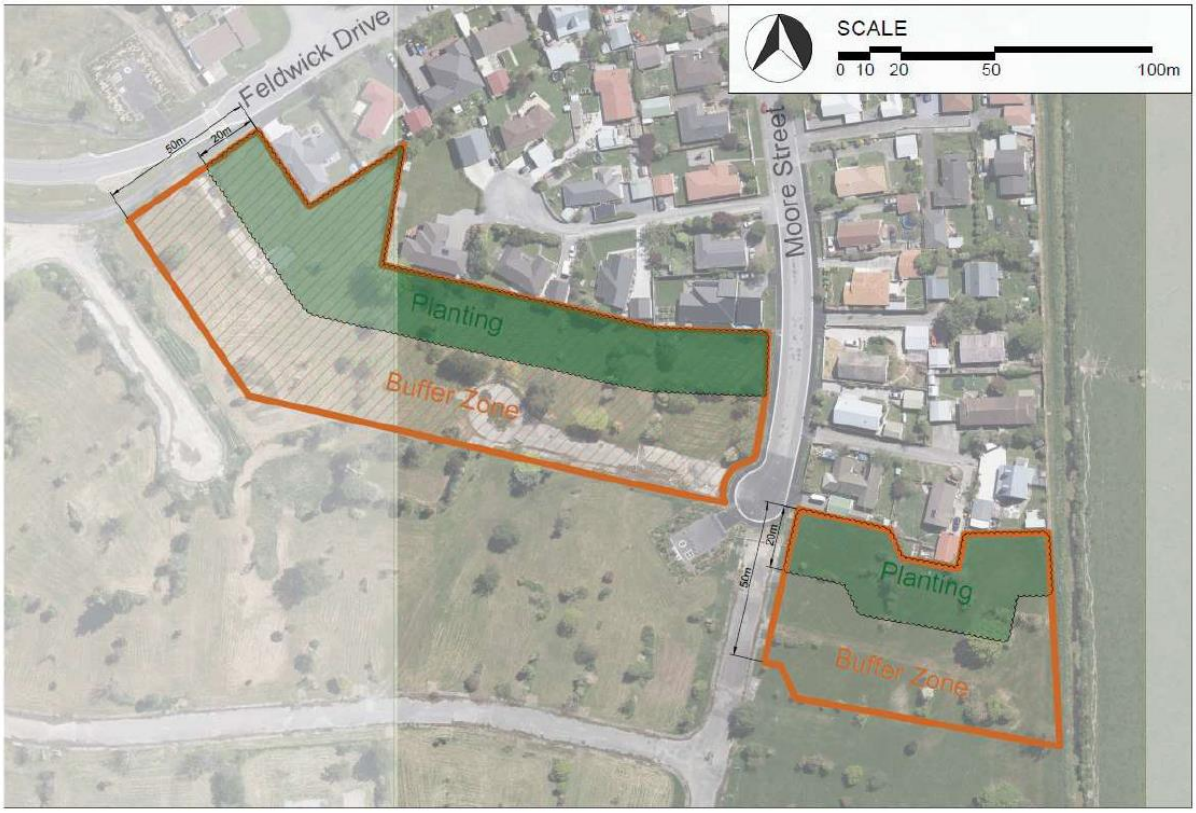

Figure 1. Except from the Council report denoting the agreed planting and buffer areas within the red zone.

The KERA group aim to restore the former residential area into a biodiverse rich green space, comparable to that which has been done in some of the surrounding areas. Whilst the group are biodiversity led, they also wish to have the area be a memorial to the houses, families and lives that were present in the area prior to the earthquake. Therefore, the objectives for the restoration scheme have been outlined as:

- A restoration plan, including a planting scheme, comprising **native** specimens which are local to the area with a good chance of **survival:**
- Establishment of plants without the use of **herbicides**;
- Maintenance of non-invasive and problematic exotic species which can be retained as specimen features to **honour** those who lived on the land prior to the earthquake;
- The creation of a peaceful **restoration** area which is safe for the whole community and has **community involvement**;
- Plants that will encourage safe gathering of **mahinga kai**;
- Plants attractive to **biodiversity** and particularly birds, pollinators and lizards; and
- Plants which are **low maintenance** once established.

The group has already spent a number of years collecting plants and planting up areas within the red-zoned land without the use of chemical herbicide and with no funding to date. Many of these plants have survived and, whilst the origin of the plants is not known from an eco-sourcing perspective, the work entailed to source, plant and protect them, has been commendable. In addition, the group has already started creating and implementing bird boxes in remaining trees, placing wooden discs to encourage native invertebrates and ensuring the removal of invasive species such as willow (*Salix spp*) from the wetland swale areas.

This report has been written to advise on the continued sustainable restoration of the area, encompassing all the objectives of the group, the wider community and for the biodiversity objectives for the District. This is intended to be an iterative document which can be revised as new information is gleaned from subsequent findings. It is intended to be a starting point from which discussions and actions can commence. It is noted that the group is also considering:

- Information from FENZ to ensure that the area is protected from accidental and deliberate fire damage;
- Information from a research study assessing the effects of inundation from projected sea level rise;

- Input from the Waimakariri Biodiversity Trust with regard to best practice for biodiversity enhancement, protection and maintenance.

Site Details

The site comprises an area of approx. 0.65 ha of red-zoned, previously residential greenspace. This area is currently a mixture of amenity grassland (maintained by the Council), previous garden plantings and restoration plantings achieved by the KERA group (Figure 2).

Figure 2. Aerial image (2022) of the land approved to be a pocket forest.

The site lies within the Low Plains ecological district which currently contains less than 10% indigenous native vegetation cover and therefore, restoration efforts in the district are important and notable (McEwan, 1987). The area is characterised by warm summer and cool winters with relatively low rainfall and strong nor westerly winds in autumn and spring (Macara, 2016). The site is located approximately 180 m north of the Kaiapoi River the 700 m northwest of the Waimakariri River. Since the earthquake and subsequent removal of damaged homes, the local residents have noticed that the area has become much more undulating and wet in certain areas.

The red zone area is divided between two main soil types (Figure 3). To the north, and in the planting areas, the soils are of the Gley Order, silt over clay. They are deep soils and poorly drained. Further south, the soils are Recent, comprised of sand and silt, moderately deep and well drained. However, the local variation in these soils, the anthropogenic effects and the repercussions from the earthquake may result in different soils being found at the site today.

Figure 3. Site Different soils mapped across the site (planting area shown in red oval), the blue areas showing the extent of the Gley soil (Manaaki Whenua, 2023).

Walkover Survey

Between July and August 2023, Bex Dollery visited the site to assess the species composition, landform and biodiversity present at the site. The area comprises large swathes of amenity grassland which is mown through a contract with WDC. Former residential plantings remain in the area and there is a mixture of exotic and native plant species. The area has a large open drain to the south (Feldwick Drain) and, further south, is traversed by swales through the site which reflect the drains from the former roads. Local residents have noticed an ongoing undulation of the land since the earthquake with additional wet areas, particularly through the autumn and winter months.

Areas of the site have received restoration plantings. The KERA group have been resourceful in collecting plant donations from the local area. However, some of these plant donations have been cultivars and garden specimens. The planting procedure for these plants has been to mow the area, plant the specimens marking them with a cane and placing a wool carpet weed mat to assist in weed maintenance directly around the plants.

Restoration Plan

The local community and the KERA group have noted that they would like to see the area used as a biodiverse area and amenity space. Below are recommendations of how the area could be enhanced to incorporate all of the objectives for the project (Figure 4).

Ecological Enhancements

It is recommended that the area is enhanced for invertebrates, lizards and birds. The planting will provide food for birds, lizards and invertebrates. The area has also already received some bird boxes. Further enhancements would be weta motels and wooden discs (round of wood at least 5 cm thick and 50 cm diameter placed onto bare soil) for invertebrate habitat and stone piles for lizard refugia. The wooden discs can be scattered throughout the area whilst the stone piles are best located along the edge of the planting in full sun. It is also recommended that annual bird surveys be undertaken along with a pest control program. This can be organised by KERA with the help of the Pest Free Waimakariri organisation (pestfreewaimakariri@gmail.com>).

Plant Selection

The plant suggestions below are intended as a guide. Due to some planting already being found within the area, the numbers may be reduced. However, the plant numbers provided will ensure that there is rapid canopy closure (Figure 4). It is recommended that all plants be purchased from reputable plant nurseries that practice ecosourcing to ensure plant survival and restore the area to an ecosystem comparable to what would have been found in the past.

It is noted that KERA have been gifted some plants (Table 1). Whilst these are native plants, some are garden varieties and will not have been ecosourced. In order not to waste the plants but to protect the areas which will be using ecosourced plants, it is recommended that these plants be planted together in the area adjacent to Feldwick Drive. This is an urban area where plant provenance may not such an issue due to the amount of non-native plants present in gardens. Further east, the area is adjacent to a drain and more natural vegetation, therefore, this area should be planted with ecosourced plants.

Figure 4. Planting areas adjacent to the fence (light green), main pocket forest (light orange), and edge planting (bright orange). The blue area represents the area containing the donated plants.

Table 1. Number of plants donated to KERA

Plant	**Amount**
Red Cabbage tree - *Cordyline australis* Purpurea (Red)	6
Cabbage Tree - *Cordyline australis*	10
Totara - *Podocarpus totara*	11
Red fountain – *Cordyline australis*	2
Dianella sp.	7
Tauhinu – *Ozothamnus leptophyllus*	34
Various varieties of Hebe (*Veronica sp*.)	64
Kowhai - *Sophora tetraptera*	2
Pittospororum sp.	80
Total	216

Low Stature Planting

As directed in the report to the Kaiapoi-Tuahiwi Community Board Meeting, the areas directly adjacent to the fencing to the north will be planted with low growing trees and shrubs so as not the cause problems of shading for the local residents. The plants chosen will also be those of low flammability to act partially as a green firebreak for the amenity area (Table 2).

Main Pocket Forest Planting

The pocket forest area will be planted with species which are also lower flammability where available but also those which produce biodiversity gain for the area providing habitat and food sources for a range of invertebrates, birds and lizards. It is recommended that the trees be randomly arranged (into natural type groupings) at a maximum of 1.5 m spacing to achieve the canopy coverage quickly (Table 2).

The species recommended constitute a range of growth forms in order to establish a pocket forest are the trees species which will grow to create conditions for lower growing plants in the future. It is recommended that after 5 years another restoration plan is created which includes plants such as shrubs, ferns, vines, grasses and herbs in order to create a full forest habitat (Table 2).

Edge Planting

Low growing species with scattered cabbage trees are recommended for the edge of the main pocket forest area to transition into the grassed area (Table 2).

Table 2. Suggested Species List

Common Name	Latin Name	Spacing (m)	No. of plants	
Adjacent to Feldwick Drive (0.03 ha)				
Variety of donated plants		1 – 1.5	216	Range of benefits but located adjacent to Feldwick Drive due to provenance not being known.
Adjacent to Fence Planting (0.22 ha)				
Harakeke, flax	*Phormium tenax*	1.5	300	Nectar for birds and habitat for invertebrates and lizards. Host plant for a range of endemic beetles, wasps, Hemiptera, moths, mites, flies and native thrips.
koromako	*Veronica salicifolia*	1.5	200	Erosion control, Shelter, rongoā, nectar.
Mikimiki	*Coprosma propinqua*	1.5	500	Berries and habitat for birds, invertebrates and lizards.
		Total	**1000**	
Main Pocket Forest Planting (0.35 ha)				
Mikimiki	*Coprosma propinqua*	1.5	200	As above
Karamū	*Coprosma robusta*	1.5	200	Used for rongoā, mahinga kai, fibre, cultural, invertebrates, birds, lizards.
Kohuhu	*Pittosporum tenuifolium*	1.5	400	Nectar (Insect), Fruit (Bird), Fruit (Lizard)
Kōwhai	*Sophora microphylla*	1.5	200	Used for rongoā, cultural, invertebrates, birds, lizards.
Tarata/lemonwood	*Pittosporum engeniodes*	1.5	400	Nectar (Insect), Fruit (Bird), Fruit (Lizard)
		Total	**1400**	
Edge planting (0.05 ha)				
Harakeke, flax	*Phormium tenax*	1.5	100	As above
koromako	*Veronica salicifolia*	1.5	100	Erosion control, Shelter, rongoā, nectar.
Tī kōuka, cabbage tree	*Cordyline australis*	Scattered	25	Rongoā, mahinga kai, cultural, pollinators, birds, invertebrate, lizards
Shrubby toroaro / Pohuehue	*Muehlenbeckia astonii*	scattered	25	Mahinga kai, lizards, invertebrates and birds.
		Total	**250**	
		Total Plants	**2650**	

<u>Restoration Costings</u>

It is anticipated that the area will be planted using volunteers from the community, reducing the restoration costs. Plant nurseries are detailed in Appendix 1 and advice can be gained from Waimakariri District Council Biodiversity team.

Where possible, items such as mulch will be donated, however, the full costings for materials are detailed in Table 3. It is recommended that funding is sought from a variety of sources detailed in

Appendix 2. Ecologists from the Waimakariri District Council Biodiversity team can assist in the completion of applications.

Restoration Costs

Restoration Costs have been removed from this document and are available upon request as the cost variances are constantly increasing/changing.

Restoration methodology

Site Preparation

It is noted that the KERA group do not wish to use chemical weed control on the site. Therefore, it is recommended the site be cleared by mowing or other mechanical method immediately prior to planting. Due to the lack of chemical control, additional manual maintenance may be required in the first 5 years.

If invasive, tall growing, woody weeds are present (such as gorse and broom), mechanical clearance can be undertaken. It would normally be recommended that stumps be painted with a systemic herbicide such as a high strength glyphosate. This "cut and paste" method would remove the need for a broad scale spray and could be considered by the KERA group.

Plant Introductions

- All plants will be sourced locally using specimens of local provenance where possible (see Appendix 1 for a list of local suppliers). It is recommended that the plants are small (possibly 1 year specimens and approx. 50 cm) to assist with survival.
- Where native plants naturally occur, these will be retained being identified and adequately protected during site preparation. Young specimens of plants will be used for planting to ensure maximum survival rates allowing the plants to adapt to their new environment and establish undisturbed root systems unless suggested otherwise by an appropriately qualified ecologist. For a closed canopy, it is recommended that plants are placed 1.5 m apart (approximately 2500 plants/ha).
- Planting should occur in late autumn/winter unless frosts are expected, and frost tender plants are used to allow plants to grow roots which will enable them to survive in the dry summer period.
- Where possible, planting will take place when the weather is most suitable (avoiding hot or windy days).

- Plants will benefit from having the collar buried up to 5 cm below the adjacent soil surface creating a hollow which surrounding water can drain into.
- Plants should be soaked in water and left to drain immediately prior to planting.
- A hole twice the size of the plant container be dug with soil loosened at the bottom.
- Retain as much soil around the roots from the pot as possible when removing from container and gently untangle fibrous roots where necessary. In general, no cutting or teasing of roots should occur as many native plants are sensitive to root disturbance.
- Place in hole and add soil, firming each layer and water thoroughly.
- In areas where soil quality is degraded, ensure nutrient supply and water retention by adding a scoop of good quality compost. Fertiliser tablets can be used but are not recommended for dry sites as they will not be broken down under the conditions of the soil.

Protection of plants

In almost all areas of Canterbury some form of plant protection is required. Research has shown that plant guards that are flexible and can be sculpted around the base of the plant to form a complete seal are the best. Examples are those of the Combiguards® which comprise a flexible, this plastic that can be sealed with stones or mulch around the outside. However, these must be removed when the plant has outgrown them. To combat this, a carboard tree can be used which does not need to be removed by hand and will naturally degrade. If this guard is used, a substantial weed mat is recommended to alleviate the trade-off for sealing the guard with the ground. If wind is allowed into the tree guard, soil and plant moisture will be impacted. Therefore, a good mulch or wool weed mat is recommended at the base of each planted specimen.

In this situation where minimal indigenous floral biodiversity already exists in the planting areas, and if financially viable, it is recommended that mulch of at least 10 cm depth is across the entire planting area. If possible, this should be done prior to planting to aid ease of spreading. If this is not financially viable, mulch can be spread around the base of each plant (outside of the plant guard to ensure no moisture transfer to the plant stem which could result in stem rot).

The mulch will assist in retention of soil moisture and temperature fluctuation and also provide further buffer against weed encroachment whilst the plants get established. Further weed management will be required before the plants reach canopy closure and outcompete adventive weeds.

Watering may be required in the first 2 years of planting during the summer period. It is ideal to water the plants inside the tree guards, not allowing the weeds outside to gain the benefit of soil moisture. However, this is labour intensive and where not feasible, wholescale watering should be undertaken.

Maintenance

The first 5 years are the most important whilst the plants establish a good root system and at this time, maintenance is important. This includes removing any weeds which growing within tree guards and tall weeds outside of tree guards. Some trees may enjoy the shelter afforded by weeds but most restoration plantings begin with pioneer species which require full light. Therefore, regular maintenance is required, especially in the growing seasons (spring and autumn for most weed species of drier habitats).

Maintenance is best undertaken manually through careful mowing and weed trimming. The tree guards afford some protection for the plants and act as indicators for where the desired plants are located.

The need for maintenance should lessen as the canopy expands and closes between planted trees and shrubs. However, maintenance of the area will almost always be required to remove exotic and invasive species which threaten the survival of the native plants. In addition, there may be understory plants that are desired once the canopy has closed and created enough shade and weed exclusion.