Belmont Regional Park

Cannons Creek Forest Restoration Plan

June 2013

Prepared by Greater Wellington Regional Council and Friends of Maara Roa

Quality for Life

greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

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Dedication

To Sylvia Jenkin, who first gathered together the Friends of Maara Roa,
for her ongoing contribution to the restoration of Cannons Creek forest.

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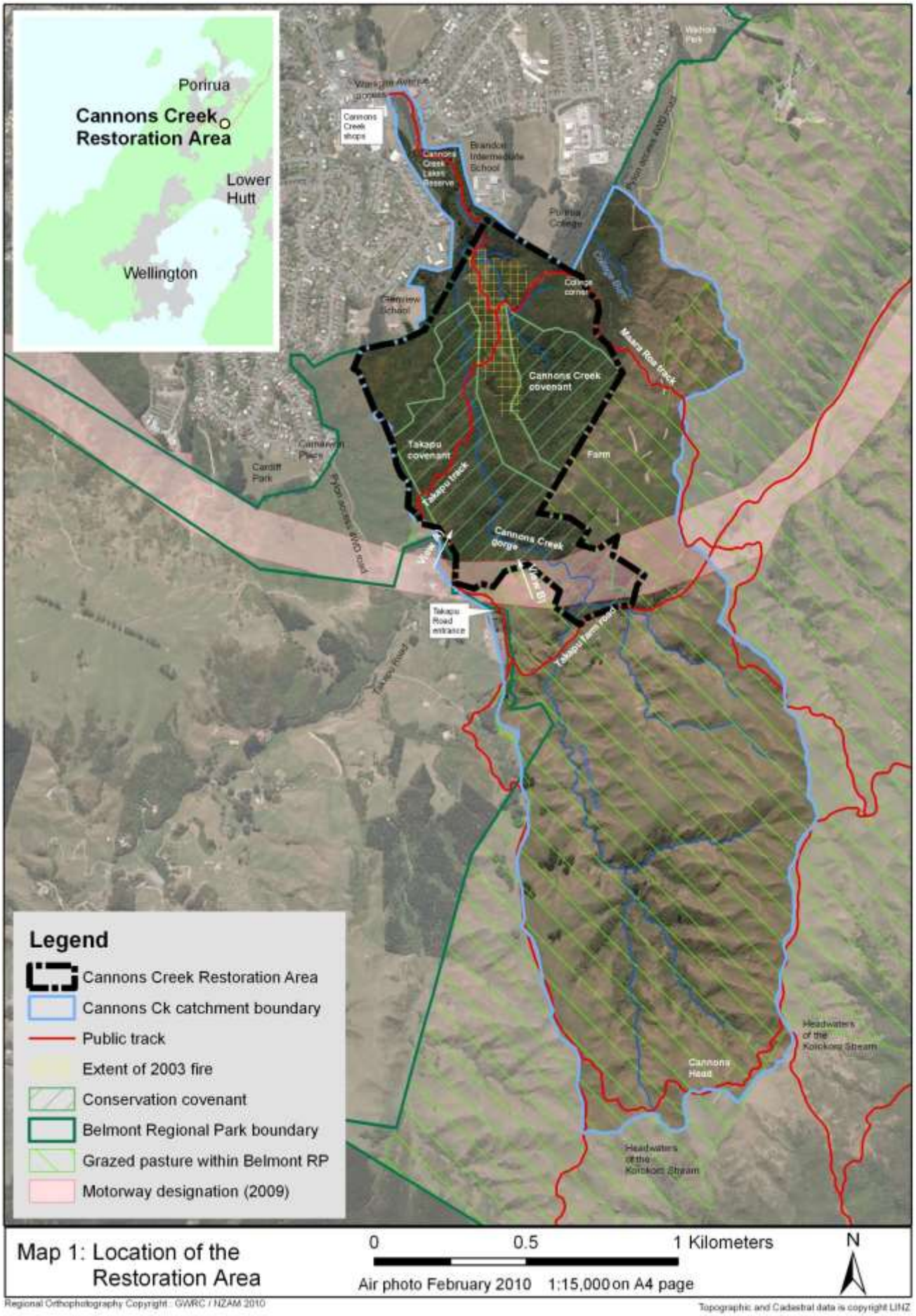
Porirua
Cannons Creek
Restoration Area
Lower
Hutt
Wellington
Cannons Creek covenant
Takapu covenant
Farm
Cannons Creek gorge
Takapu Road entrance
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Summary: Cannons Creek Forest Restoration Plan

1. Where is the restoration area

The restoration area is 67 hectares of regenerating native forest within Belmont Regional Park. It sits in the Cannons Creek valley between pastoral farmland, in the upper catchment, and the suburban community of Cannons Creek, part of Porirua city. (Map 1: Location map). About one hundred and fifty thousand people live within 10 kilometres drive to the area.

The main public access is from Cannons Creek shops through the Cannons Creek Lakes Reserve, a Porirua city local park. A second public entrance to Belmont Regional Park, from Takapu Road, on the western edge of the restoration area provides access to the area from Tawa and the other northern suburbs of Wellington city.

View A

View B

2. What is its history?

In 1988, the area was included as part of the newly formed Belmont Regional Park. At the time it was grazed as part of a pastoral farm. In 1992 two blocks of remnant and regenerating native bush making up 40.65 hectares of the area were fenced off from grazing and protected with conservation covenants. The rest of the area was mostly withdrawn from grazing shortly afterwards and the pasture was overgrown by gorse scrub. Native bush regenerating through the gorse scrub has accelerated from 2001 under the management of the Friends of Maara Roa.

Fires have caused major setbacks in the regeneration process. In the late 1980s a farm “burn off” got out of control and destroyed a considerable portion of remnant native bush. The remainder was protected, in 1992 as Cannons Creek covenant (11.4 hectares) with the best of the regenerating native bush included in the Takapu covenant (29.2 hectares). Then in 1997, a fire started by school children, in Cannons Lakes Reserve, burnt about 10 hectares of gorse and pasture from Porirua College up to the north and east sides of Cannons Creek covenant. Again, in March 2003, another fire also started by school children in Cannons Lakes Reserve, burnt a 6.5 hectare swathe up to Cannons Creek covenant and along its western side through gorse and native plantings set amongst sheltering gorse scrub (Fig 1).

The Friends of Maara Roa began implementing the original restoration plan in 2001 with revegetation plantings at the entrance to Belmont Regional Park from the Cannons Creek Lakes Reserve. Following the 2003 fire, the Friends of Maara Roa revised their revegetation strategy developing a "Green Firebreak Plan" to reduce future fire hazard in the burnt area. This focused their efforts on establishing fire resistant native bush at the easily accessed locations where fires have tended to start and spread from. For example, either side of public tracks passing through rank grass or gorse scrub. This involved spraying out the flush of gorse growth following the fire, clearing the burnt debris then planting quick growing shelter (tree lucerne) and colonising native broadleaf trees and shrubs to forestall the reestablishment of gorse scrub. This has been followed by enrichment planting with species needing shelter to establish. More recently they have been removing gorse that did re-establish and planting these cleared areas.

3. Why restore the area?

The Greater Wellington Regional Council Parks Network Plan, 2010, has proposed the creation of an ecological link between Porirua and Korokoro using the Cannons Creek catchment (Section 6.3.6). While the initial ecological value of the catchment was low when the Friends began restoration, as the forest regeneration continues over the coming 10 years the intrinsic ecological value of the area will rise rapidly. It is also proposed, separate from this restoration plan, to manage the upper catchment for reversion to native bush in the future.

Considerable 'human' value is being accrued to Wellington and Porirua from restoring the area to something like its original glory. This is not just from expanding the recreational potential and aesthetic appeal of the place but as a demonstration to the wider community of the significance we place on the value of our native environment.

4. How is the restoration being achieved?

Restoration is through managed regeneration of native forest from pasture. It relies on the presence of local remnants of native bush as seed sources and works through the succession of pasture by gorse scrub which is in turn overgrown by native trees and shrubs. It needs:

1. Very good pest management

    - Of introduced mammals (possums and rodents in this restoration area)

        - To improve the vigour and seed production of mature native plants by minimising introduced mammal browsing[1]

        - To minimise consumption of native seeds and browsing of native seedlings[2]

        - To encourage the presence of birds that spread the seeds of fruit bearing native plants.

    - Of introduced plants (exotic and native weeds)

        - To favour re-establishing indigenous flora through on-going removal of specific pest plants aimed at eliminating them or minimising their potential to infest the area.

2. Intensive fire hazard management

    - Where the public have access to areas of rank grassland and gorse scrub that develop in the early stages of succession

        - By creating "green firebreaks" of fire resistant native broadleaf bush either side of tracks to separate the public from highly flammable rank grassland and gorse scrub[3]

        - By avoiding planting flammable natives like manuka, kanuka, toe toe and cabbage trees beside public tracks and at other accessible places

        - By minimising public access to and tracks passing through or near extensive areas of high fire hazard

        - By encouraging a public presence along attractive tracks to provide oversight of and inhibit irresponsible behaviours.

[1] Plant vigour and flower production increase dramatically when introduced browsing mammals are eliminated, though this varies with plant species.
[2] Goats and larger grazing animals have already been eliminated, while possums are being kept at very low levels. Rodents are being controlled but numbers are not monitored.
[3] People have started the fires in the restoration area, while areas of rank grass and gorse scrub are particularly vulnerable due to the amount of highly flammable material present.

3. Strategic planting of nursery grown stock

   - To increase native plant diversity within existing scrub and native bush by limited planting of nursery grown stock of native forest species to act as future seed sources[4]

   - To quickly create green firebreaks by close planting of nursery grown colonising species[5]

5. Is recreation included?

Visitors can be a valuable source of moral and material support for restoration projects near population centres. Green firebreaks along tracks and enrichment planting into microsites for ecological purposes can encourage visitors in to the restoration area by improving views and track surrounds. Hence, it is worth considering recreational benefits when allocating restoration resources.

No capital funding is allocated for track development in the three years from June 2012. However, Greater Wellington Regional Council supports the Friends of Maara Roa, as an incorporated society, seeking funding for mutually agreed recreation infrastructure improvements.

If the proposed motorway development crossing Cannons Creek at the upper end of the restoration area proceeds, the tracks on both sides of the valley which pass through the restoration area will need to be realigned. This will be an opportunity to improve recreational use.

In the longer term, Greater Wellington Regional Council and Porirua City Council intend to better integrate recreational planning for the open space areas in the Eastern Porirua city suburbs and north western side of Belmont Regional Park. This will support recreational use of the restoration area by locals.

6. How is the restoration being funded?

Greater Wellington Regional Council is the primary funder, though the Friends gain occasional funding and support from other providers.

Greater Wellington Regional Council currently contributes $10,000 per year to the Friends of Maara Roa. This rate of funding is expected to continue for a further 3 years at least. With it they develop an annual programme of restoration works for approval by Greater Wellington Regional Council Parks Principal Ranger. The Friends also administer and implement this programme. On average about 5000 square metres of plantings are established along with excellent possum control, very good fire hazard management, and promotion of the area. This represents excellent value for money.

[4]The Friends also introduce desirable plants to areas unattractive to birds or too inaccessible for traditional planting by dropping in clay balls containing seeds and growing medium (see seedball technique (Human Birds programme))

[5] In more exposed locations than the restoration area, or when starting from pasture, establishment of shelter is a priority in addition to green firebreaks and increased diversity.

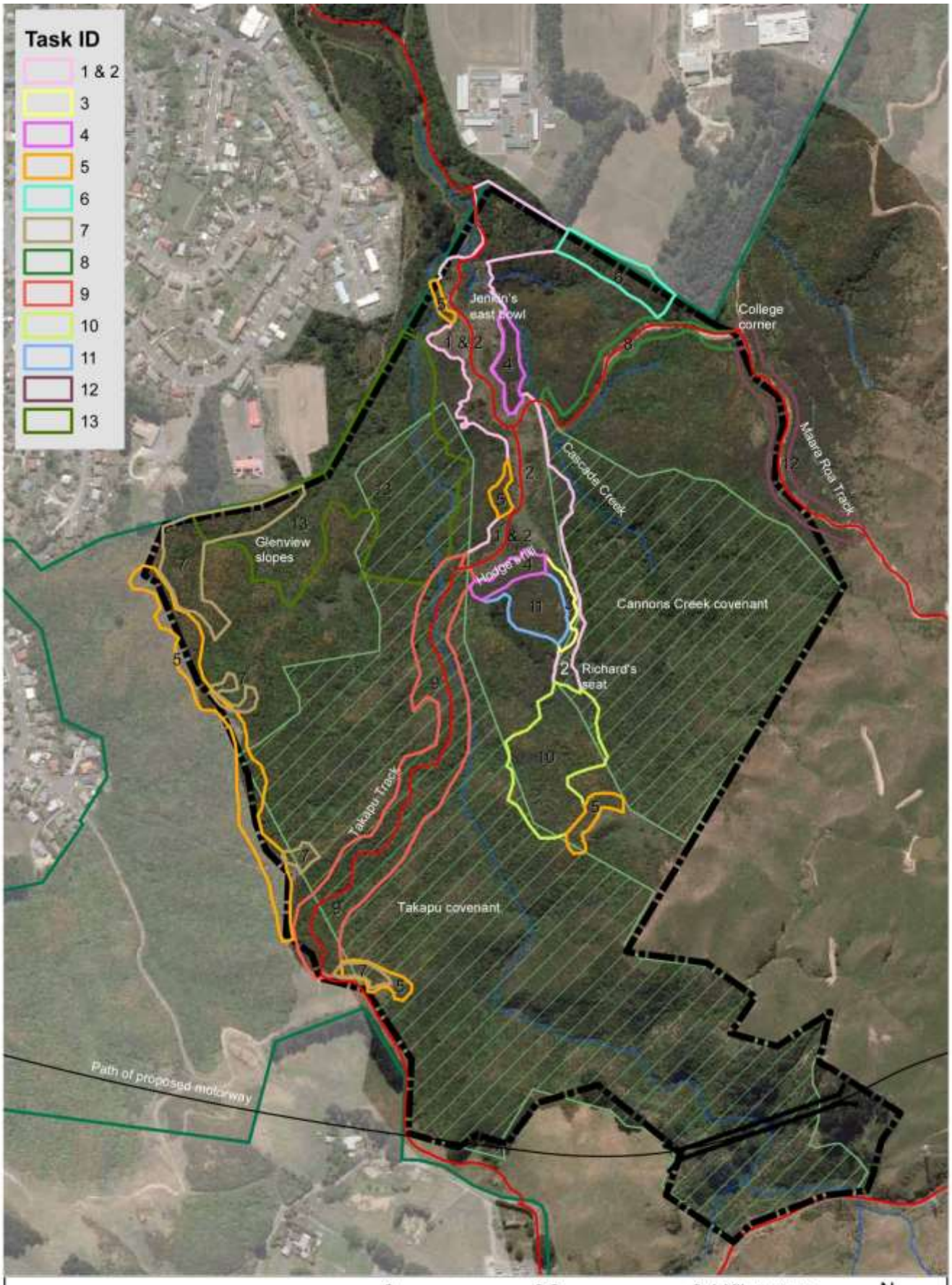
7. What's next?

The Friends of Maara Roa are successfully managing the complicated process of succession of personnel as older members step back from the physical labour and newer younger members step up to leadership roles. New roles for these younger members are also opening up as the green firebreaks the Friends have planted become established. Efforts to protect the restoration area will continue in the coming 10 years and may shift toward more targeted rodent control. Resources will shift towards enrichment planting to increase the plant diversity and resilience of the native ecosystem that evolves in the decades and centuries to come.

Year	Task ID	Task	Primary value gain
2013 to 2022		Continue bait station operation for control of possums and rodents	Ecological (improved plant vigour and seed production)
2013 to 2022		Continue plant pest control (primarily by GWRC staff or contractors)	Ecological (increased plant diversity)
2015 to 2016		Investigate establishment of a pest animal tracking station network	Ecological (knowledge of ground fauna present)

Continued on next page.

Year	Task ID	Task	Primary value gain
2013 to 2015	1	Continued weed (gorse) control, until canopy closure, within existing “Green firebreak” coloniser plantings on areas burnt in 2003. Primarily on “Hodges’ hill”	Ecological (improved establishment and reduced fire hazard)
2013 to 2016	2	Continued enrichment planting into light wells within coloniser plantings established since 2001	Ecological with Aesthetic
2013 to 2014	3	Increase width of green firebreak along west side of Cannons Creek covenant (up to Richard’s seat)	Ecological (reduced fire hazard and increased forest edge shelter)
2013 to 2014	4	Extend “Hodges’ hill” gorse clearance and planting up to the crest of the ridge Extend “Jenkin’s east bowl” gorse clearance and planting between track and Cascade Creek	Aesthetic with ecological (reduced fire hazard)
2013 to 2022	5	Annually, 'human bird' seeding and monitoring of results. (Locations may vary from those shown on the map)	Ecological (increased plant diversity)
2014 to 2016	6	Create a 30m wide green firebreak along the southern boundary of Porirua College by removing remnant gorse beside the playing field and in the scrub growth that followed the 1997 fire	Ecological (reduced fire hazard)
2015 to 2017	7	Create a 30m wide green firebreak along the BRP boundary with Atafu Tokelau Community Centre and Glenview School by removing remnant gorse. Reduce fire hazard along the ridgeline pylon/transmitter track by removing remnant gorse beside the track at gully heads and spurs.	Ecological (reduced fire hazard)
2014 to 2017	8	Create a green firebreak between “Cascade Creek” and “College corner” by clearing gorse from beside Maara Roa track and planting colonising natives.	Ecological (reduced fire hazard) Aesthetic (through increased appeal of the track surrounds)
2015 to 2022	9	Enrichment planting into light wells along Takapu Track starting from the junction with the Ridgeline pylon access track (dependant on quad bike transport of plants)	Aesthetic (by increased appeal of the track surround) Ecological (increased plant diversity)
2016 to 2022	10	Enrichment planting into light wells “above Richard’s seat”, if the area is made accessible to quad bike for transport of plants and tools	Ecological (increased plant diversity)
2017 to 2022	11	Enrichment planting into light wells in the scrub on the plateau south of above “Hodges’ hill”.	Ecological (increased plant diversity)
2017 to 2022	12	Extend planted “Green firebreak” up Maara Roa track from “College corner”, as resources allow.	Ecological (reduced fire hazard)
2019 to 2022	13	Begin enrichment planting into light wells on Glenview slopes, if the original farm access road up from Cannons Creek can be located and opened up for quad bike access.	Ecological (increased plant diversity)



Map 2: What next?

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Part 1: Review of Cannons Creek Forest Restoration

1. Introduction

Greater Wellington Regional Council, Parks department (henceforth GWRC) and Friends of Maara Roa (henceforth the Friends) have worked together to review the plan for restoration of the area presented in "Cannons Creek: Restoration and Development 2001". The area covered in the review broadly extends up Cannons Creek from Warspite Avenue and the Porirua City Council (henceforth PCC) Cannons Creek Lakes Reserve through to the headwaters of Cannons Creek in Belmont Regional Park (henceforth BRP) (refer to Map 1: Location Map). The Friend's current restoration focus is the middle reach of Cannons Creek[6].

The 67 hectares of the middle reach, between Cannons Creek Lakes Reserve and the Takapu farm road is being restored to native forest by the Friends of Maara Roa with assistance primarily from GWRC Parks. Maara Roa means 'long garden' in Maori and this refers to a local Maori legend of significance to the valley. Maraeroa Marae gave the Friends the name as taonga.

The area lies between suburban Porirua city, downstream, and Waitangirua's pastoral farming operation, upstream. Within it is a 10 hectare remnant of native bush with the balance being largely regenerating native bush and scrub. There is also a 2.5 hectare scenic reserve only one kilometre to the west which preserved a piece of the original mature lowland forest and which may act as a bird borne seed source. Unfortunately, the native flora within the restoration area has been severely disrupted by weed and animal pest invasion, by repetitive conversion between scrub and pasture and by fires. However, the native invertebrate stream ecology is in good condition[7] because grazing animals are excluded except for low intensity stocking in the headwaters, while downstream channelization has prevented stream colonisation by trout. The native plant regeneration is also already comparatively diverse given the diversity of seed sources and good control of pests over the past 10 years.

Following a destructive fire in 2003 the Friends have devoted considerable effort to fire hazard management through the creation of "green firebreaks" whereby highly flammable gorse scrub is removed, where the public have easy access to it, and replaced with quick establishing fire resistant shady native bush. To date there have been no further fires in the area. Their other restoration focus for the past 11 years has been on possum control[8] to improve bush vigour and seedling establishment which has been very successful. Also, GWRC Biodiversity department includes the area in their current plant pest control programme for BRP.

The restoration area has the potential to become a significant asset for the relatively undeveloped western portion of BRP. Accessible from both the Takapu Entrance, in Wellington City, and Cannons Creek Entrance, in Porirua

[6] The previous Plan included an additional area to the west of Cannons Creek proposed for a link road from Waihora gully to near the proposed Transmission Gully Motorway viaduct crossing Cannons Creek gorge. The proposed link road has been dropped from the motorway plan currently being consented and the area is being managed for reversion to native bush by the GWRC Park Ranger.
[7] Refer to Boffa Miskell report, 2009
[8] There is also secondary control of rats.

city, the valley's continued restoration can provide new recreational opportunities along with an experience of New Zealand's original natural environment for both nearby residents and regional visitors.

2. Context for the review

- A review after 10 years was signalled in the first Plan to identify changes in circumstances and consequent funding.

- Friends of Maara Roa are seeking continuing GWRC support and want a document to use to promote their vision for reforestation of the area and their role in seeing this through.

- The Parks Network Plan 2010 has signalled that Cannons Creek is intended as an ecological link (corridor) between Porirua and Korokoro, Lower Hutt city[9].

- Experience has shown that there is a significant need for management of fire hazard at local suburban edges. The on-going history of fires being lit in and around Cannons Creek was recorded in the first Plan but a strategy to manage this hazard was not proposed.

- PCC officers have asked for increased public access to Belmont Regional Park to encourage increased casual outdoor activity.

- PCC, following an ecological and landscape issues report and consultation on Cannons Creek Lakes Reserve in 2009, have stated an intention to "naturalise" the reserve[10].

- Local demographics are changing and individualised recreation in natural outdoor space seems to be rising. There is new nearby residential development in Grenada, Churton Park, east Tawa (Greenacres), Aotea, and Whitby, while 'outdoor pursuits' like mountain biking are increasing in popularity across the region.

- No recreational developments are currently programmed by GWRC for the catchment, but GWRC have built the Takapu track proposed in the first Plan and continue to maintain public tracks and structures in the area.

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[9] **Part 4 General management outcomes and policies**

4.1 Biodiversity and ecosystems

Outcomes

Outcome 1: Ecosystems of important ecological value are protected and cared for.

Outcome 2: Significant, degraded ecosystems and indigenous biodiversity are restored to a healthy functioning state.

Outcome 3: Ecological connections between natural areas and within catchments of regional parks and adjoining lands are enhanced.

[10] This has not yet been formally recorded in this or a park management document.

- If the proposed motorway and viaduct crossing of Cannons Creek is built[11], it will sever existing recreational links requiring these to be rerouted along new pathways.

- The motorway will also open up an extensive tract of landscape that few people in the region are aware of, let alone visit. The viaduct spanning the Cannons Creek gorge will be quite spectacular. The route through the Park combined with that through Horokiri Valley (Battle Hill Farm Forest Park) will effectively create a "green corridor" into Wellington.

3. Current land ownership and management

The middle catchment is included in a parcel of land bought by GWRC from the crown in 2005. The Department of Conservation retains ownership of the upper catchment with management responsibility vested with GWRC. GWRC manages all this area as part of Belmont Regional Park under the Parks Network Management Plan prepared in 2010. Two conservation covenants are registered on the land owned by GWRC within the middle reach of the creek totalling 40.5 hectares and it is around these that the Friends restoration efforts have been focussed. The 180 hectare upper catchment, above the Takapu Duck Creek farm road, is currently managed as grazed pasture as part of Waitangirua farm under a lease agreement with Landcorp Farming NZ, a Government SOE, which limits public access across the farm to designated paths. The grazed upper catchment will be more or less retired and managed for reversion to native vegetation as the park's sustainable farm management plan is implemented to create the ecological corridor proposed in the Park Network Plan.

Cannons Creek Lakes Reserve is owned and managed by PCC for casual recreation. The Friends have worked with PCC over 10 years on projects establishing native vegetation in the reserve and these passed to PCC maintenance in 2012.

Porirua City Council also owns a large land parcel on the west side of the restoration area which is largely covered with scrub and is managed by GWRC as part of BRP. The Friends undertake possum control within it in the portion adjacent to the restoration area.

4. History

Originally lowland forest covered the moist fertile slopes of the middle catchment. Emergent kahikatea, with emergent rimu and matai on the better drained slopes, would have been prominent while tawa, titoki, kohekohe and pukatea dominated the canopy.

The area is now immediately adjacent to residential eastern Porirua city and has been farmed since the original forest was cleared about 100 and more years ago. Over that period it has cycled between scrub and pasture depending on farm returns and on the fires that have periodically burnt out of control more or

[11] Resource consent was granted in 2012

less across it. These fires have been set as part of farm management and, more recently, by school children or unintentionally by nearby residents.

In 1991 two conservation covenants were agreed between the Department of Conservation and Landcorp Farming NZ Ltd, who managed the land as part of Waitangirua Farm, to protect, from pastoral farming, a 11.3 hectare remnant of tawa-kohekohe bush (the only such remnant left on the western side of Belmont Regional Park) and 29.2 hectares of the riparian slopes of Cannons Creek gorge which were reverting to native bush at that time. Fenced off, and ungrazed since 1992, these form the heart of the restoration area. The balance of the area was also removed from grazing shortly after.

The middle reach of the creek is now a mosaic of patches of native bush and scrub of widely varying age. There are also isolated native trees, which persisted through the periods of grazing, scattered through the scrub both inside and outside the conservation covenants. There has been marked native seedling regeneration and succession through the initially gorse dominated scrub since the cessation of grazing and more especially cessation of possum browsing with their on-going control since 2001. If fire can be kept out, the vegetation cover in the middle catchment will rapidly progress to native dominated bush in the coming few years.

The official opening of the restoration project was held on 9 and 10 June 2000, though planting by school children and other volunteers had been going on for some years before this within Cannons Creek Lakes Reserve. Also, the "Cannons Creek Valley Protection Group" had begun providing guided public walks in 1999 and acted as a steering and action group from September 1999 up to the formation of the Friends of Maara Roa (Inc.) in July 2000.

A useful summary of events and development in the Reserve and the Landcorp farm upstream, until 2001, is provided in the first restoration plan: "Cannons Creek: Restoration and Development 2001".

From 2001 to 2012, there have been a number of events that have or will effect restoration and development in the catchment:

2001

- Keep Porirua Beautiful and the Friends of Maara Roa invited the 5 nearest primary schools to "Adopt-A-Spot" each in the Cannons Creek Lakes Reserve, and with the support of PCC, have worked each year with plantings in the selected areas. This 10-year programme concluded in 2011 with a Celebration and giving of Mayoral awards to the schools

- The Friends started revegetation plantings with financial support from GWRC and using the first restoration plan as a guide

- Possum control was started by the Park Ranger.

2002

- The Friends took over possum control following cutting of bait station access lines and installation of 56 bait stations across the restoration area and adjacent area west of the catchment by GWRC Biodiversity department.

2003

- In March a fire burnt across 6.5 hectare of revegetation plantings, rank grass and gorse scrub from the southern edge of Cannons Creek Lakes Reserve upslope to and along the west side of the Cannons Creek Tawa-kohekohe bush remnant see (Map 1: Location map).

- The fire was started in some dead gorse by a 14 year old boy and two 13 year olds, at the boundary between Cannons Creek Lake Reserve and Belmont Regional Park (then part of Waitangirua Farm). Under a northerly wind it burnt upslope through unfenced rank grassland and gorse regrowth that followed a 1997 fire. It continued through the newly planted areas and natural regeneration to damage mature Tawa and kohekohe trees on the margins of the Cannons Creek Conservation Covenant). About 3000 trees planted in the preceding three years of restoration were lost as well as the natural regeneration in the burnt area.

The burnt western edge of the Cannons Creek covenant taken from Glenview School shortly after the 2003 fire

- In April the Friends adopted and began implementing their "green firebreaks" Plan[12]. This is the replacing of gorse and rank grass with fire resistant native vegetation where the risk of fires being started is high or where the consequences of damage by fire are high. (See Part 4 Regeneration).

- Porirua College[13] provided facilities for a "Trees for Survival" native plant nursery within the College walls. This nursery, mostly managed by volunteers from the Friends, has "grown-on" an average of 4000 to 5000 seedlings per year for planting out into the restoration area, as well as trees for the College and other school grounds.

- GWRC developed the Takapu Track crossing Cannons Creek and up to Takapu Road (Map 1)[14]. Provision of this track has led to increased recreational use of the area.

2004

- Kereru[15] are first noticed within the restoration area.

- In early 2004 a series of heavy rainfalls[16] and consequent floods deposited a wedge of coarse and fine sediment across the Cannons Creek valley floor up to about 400mm deep[17] at and upstream of the retention basin lakes in Cannons Creek Lakes Reserve. This sediment covered much of the wetland on the valley floor and partially filled in the upper lake in Cannons Lakes Reserve[18]. The debris came from erosion of the stream channel and some small "slips" into the stream and the retention basins performed as intended.

[12] Developed by John Hodges, a retired teacher who is a member of the Friends of Maara Roa and resident of Waitangirua. In earlier years he lead much of the volunteer planting efforts between Brandon School and Cannons Creek Lakes Reserve.
[13] Through Neil Bellingham, a staff member of the Science Department, and founding Committee member of the Friends
[14] It was formed by clearing an overgrown farm road and replacing its bridge across Cannons Creek with a pedestrian bridge able to accommodate a quad bike used for track maintenance. The official opening by Greater Wellington was held on Sunday 29th February 2004.
[15] Native wood pigeon. It feeds on native fruits and is a very effective disperser of their seeds as it will fly up to distances of about five kilometres between fruiting trees. Its large gape allows it to consume the large fruits of matai trees and so spread their seeds.
[16] Porirua City Council report this was about a 50 year or more event.
[17] photo was taken where the public path from Cannons Creek Lakes Reserve crosses Cannons Creek and rises into Belmont Regional Park.
[18] The coarse sediment came from upstream erosion of the stream channel and two slips on either side of the creek a little above the Takapu Track stream crossing.

Cannons Creek Lakes Reserve: overview of the flooded lower lake retention basin in 2004

The valley floor at the boundary between BRP and Cannons Creek Lakes Reserve. The mud of the original wetland ground surface is covered by 400mm of gravel deposited during the 2004 floods

December 2006 channel erosion was still evident almost 3 years after the flood

2005

- Ownership of the middle catchment passed from the Crown to Greater Wellington with Landcorp Farming NZ Ltd changing from land manager to pastoral leaseholder. While this land was already incorporated into BRP, the change in ownership has given GWRC control over how the area is managed

- Kereru were observed nesting deep in the Cannons Creek covenant. These birds had not been seen nesting in the Valley in living memory. Their nesting is a sign of the success of the possum control work.

2006

- GWRC formally adopted a policy to use eco-sourced native plant material where feasible. This confirmed practice by the Friends within the restoration area. Their commitment is to follow bio-diversity principles.

- A gorse and grass fire burnt across about eight hectares of farmland in the nearby Waihora gully. It was controlled when it threatened power lines and farm buildings.

2007

- GWRC adopted a region wide "Pest Management Strategy" for problem weeds and animal pests. This was used to allocate resources and set the baseline level of weed and pest control provided by GWRC in the restoration area.

- The abandoned farm road across College Burn, between the Waihora gully pylon road and the Maara Roa Track, in the restoration area, was modified to prevent motor bike and vehicle passage and vegetation control stopped. The risk of a fire being started along it seems to have been reduced as it is now no longer passable and it appears school children and other risky people are not entering the area.

2008

- The Friends, following concern about stream erosion below the Cannons Creek culvert under the Takapu Duck Creek farm road, obtained a pro bono report from Opus International regarding the volume and velocity of runoff in the upper catchment and the functioning of this culvert. Copies were given to GWRC and the Porirua Harbour and Catchment Strategy Planning group.

2009

- PCC initiated the "Porirua Stream Catchment study", including the Friends of Maara Roa in the consultations for what is now the Porirua Harbour and Catchment Strategy Plan, now to be actioned jointly by PCC, Wellington City Council and GWRC. This Plan includes all catchments on the western side of Belmont Regional Park and advocates for sediment control and ecological restoration within the catchments.

- PCC commissioned the "Cannons Creek Lakes Reserve Ecological and Landscape Issues and Options Report". Following receipt of the report and stakeholder consultation PCC stated their intention to manage the reserve towards a natural forested state.

- The government funded investigations to provide information to inform detailed design of the Transmission Gully motorway. NZTA have indicated there will be provision for public crossings of the motorway on either side of the Cannons Creek gorge under the viaduct crossing it. This will require substantial change to the alignment of the two public paths either side of Cannons Creek that currently provide access from Porirua city to the (Wellington city) Takapu Entrance into BRP and beyond.

- Triennial possum monitoring showed control is excellent.

2010

- GWRC adopted the "Parks Network Management Plan". This includes BRP. An ecological link is proposed extending upstream from Cannons Creek Lakes Reserve across to the Korokoro catchment, east of Cannons Head.
- In September the Friends, assisted by GWRC, held a public celebration of the 10th Year Anniversary of the Restoration Project. The Friends also symbolically handed over upkeep of the Kowhai Grove and their other plantings in Cannons Creek Lakes Reserve to PCC.
- GWRC commissioned a sustainable farm management plan which includes the grazed areas covered in this review. At the time of this review the Plan has not been adopted. It will primarily impact farm management upstream of the proposed motorway. These slopes and the slopes above the eastern conservation covenant may be more or less restored to native vegetation.

2011

- In 2011 Greater Wellington Regional Council adopted a "Biodiversity Strategy" which allocates resources according to regional biodiversity significance. Cannons Creek was not ranked as having high biodiversity significance. This may affect future Biodiversity department resourcing of plant and animal pest control associated with the restoration area.

2012

- In March resource consents were approved for motorway construction including the crossing of Cannons Creek.
- Porirua Harbour and Catchment Strategy and Action Plan were launched in April. Cannons Creek is a contributing catchment.
- Two whiteheads, (*Mohoua albicilla* is a small native bird), were photographed for the first time in the restoration area. Intensive possum and rat control has enabled small populations of resident and reintroduced native birds to recolonize the Wellington area[19].
- The possum control bait station network was inspected and brought to specification by GWRC contractors.
- Triennial possum monitoring showed control is excellent.
- The plant nursery was shifted to Aotea College.

5. The situation today

The Friends are very successfully managing the restoration of the area. GWRC provide the majority of funding and material support for the Friends revegetation programme along with some logistical support and technical advice. GWRC Biodiversity department undertakes work to control a variety of invasive plant pests and provide poison and some material support to the Friends for their animal pest control programme

The Honda tree fund, Keep Porirua Beautiful, Mana Grants Foundation, Hutt Mana Community Trust, Porirua Community Development Fund, Project Crimson and Forest and Bird Pauatahanui have also provided a variety of assistance to the Friends.

6. Friends of Maara Roa Outputs

Pictures from the Friends website

Bait station operation

Plant Nursery

[19] Miskelly C. Empson R. and Wright K. 2005. Forest birds recolonizing Wellington. *Notornis* 52: pp 21-26.

"Human birds"

Creating a
"green firebreak"

6.1 Publicity

The Friends maintain an attractive and informative website:

www.maararoa.wellington.net.nz

- To raise community awareness of the restoration project and its regional context
- To publicise events, to invite groups to help out and to recruit new members
- To provide information about their restoration methods.

The Friends report the web site is generating a lot of enquires. It is also linked to and active in www.**naturespace**.org.nz. This is the portal to ecological restoration groups throughout New Zealand. Other links to it are from GWRC, PCC, and Forest and Bird (Kapiti) websites.

The Friends promotional and restoration focussed activities occur about fortnightly, on average 23 annually, year-round, and are modestly scaled public and member events. GWRC assists with some public events like Arbor Day, and Honda tree-planting. Keep Porirua Beautiful has helped publicise the "Adopt-A-Spot" scheme.

The Friends also provide for corporate groups from Wellington businesses, community groups, churches, schools, and increasingly university groups visiting for study or to assist with planting and tree care. They also arrange "Guided Walks" on request, including two or three each year in the GWRC's Outdoor Programme of public events in the parks.

6.2 Animal pest control

The Friends animal pest control team service 54 bait stations within and beyond the restoration area. Possums are been kept at negligible levels.

6.3 Revegetation

Each year about 4000 to 5000 plants grown from seed collected from the Inland Wellington – Porirua ecological zone are purchased as growing on lines and nursery volunteers pot these on to planting out size (PB 3 and PB 5 grade). When available, further plants grown from locally sourced seed are purchased, or gifted, for planting out directly. Also small numbers of plants may be germinated from seed collected in the newly fruitful restoration area. The Friends are committed to the eco-sourcing of all seeds and seedlings, and do not accept inappropriate plants as donations. Ninety per cent of the nursery grown plants are colonisers that will establish in the open. The remainder are used for enrichment planting within areas of established coloniser plants and, to a lesser extent, within naturally regenerating bush.

In 2006, 2007 and 2009 the Kiwi Conservation Club (junior Forest and Bird) pioneered the "Human Birds Programme", by gathering seed, making clay based seedballs and throwing or batting them in to inaccessible areas. In 2010 this was enlarged to train 10 members of the Friends to use this restoration method, and through GWRC's Regional Outdoor Programme, 10 other adults from Tree Care groups also took the training course. A monitoring site was set up that year also.

Under the Green firebreaks Plan about 5000m^2 of gorse scrub has been cleared each year by supervised 'Corrections' community workers and a local community club (Porirua Canoe Kayak Club) with the latter also spraying to control regrowth. About two thirds of this area is planted by the Friends with wider assistance during various 'planting days'. The remainder is planted by the community workers.

6.4 The future

With the shift of the Friends' nursery to Aotea College the Friends will continue to be able to grow-on several thousand plants each year to PB3 and PB5 grades for planting out. They have been trialling growing plants from locally collected seeds and producing greater numbers of enrichment plants.

The site clearance and planting associated with the Friend's Green Firebreaks Plan created in response to the 2003 fire is programmed to be practically completed in winter 2013. The Friends immediate intention then is to increase enrichment planting within the area damaged by the 2003 fire.

Effort could also shift towards identifying more microsites for enrichment planting within the natural regeneration and along

Microsite planting

Miro seedling planted in natural light well within coloniser planting near "Richard's seat"

track sides outside of the 2003 fire extent. This will be constrained by the ability of the Friends to deliver plants and tools to such sites.

Given the number of nearby schools, the area upstream of the lakes up to and beyond the stile entrance to BRP will continue to be a place with a high risk of fires starting. There is also considerable flammable material along parts of the Restoration Area boundaries with Glenview Primary School, and Porirua College with an on-going risk of fires spreading from their grounds. The Brandon Intermediate boundary is now well vegetated and is a lower hazard. While planting by the Friends is creating the conditions to resist fire taking hold and spreading, management of fire hazard must remain a priority if reforestation is to be achieved. GWRC will assist by increasing their engagement with the local community, to encourage people to care about the place and not risk losing it to fire.

Part 2: Protection of the restoration area

1. Introduction

Pest control is mandated in the GWRC Parks Network Plan, 2010[20]. GWRC monitor and control pest animals and pest plants with support from other landowners, user groups and volunteers.

The GWRC pest management strategy guides the allocation of resources for control of animal and plant pests. Pest management encourages natural regeneration of native ecosystems. It also provides protection of the existing ecological value of the remnants of native bush and the more recent regeneration. The primary focus is on the control of exotic plant and mammal pests but there is also some control of native plant pests.

The area requires protection from animal pests, particularly browsing mammals to which native vegetation is not adapted. While controlling these to low levels encourages indigenous plant vigour and seedling establishment, many of these animal pests also prey directly on or compete with birds which are a crucial means for seed introduction and plant dispersal as the soil seed bank has been depleted through the prolonged period of farming, and repetitive fires.

The restoration area also requires protection from plant pests that are invading it and could overwhelm or displace the re-establishing indigenous flora. Those that can be eliminated or kept at low levels are considered here. Gorse is the major plant pest that cannot be controlled to low levels. It is managed as part of the regeneration process described in Part Three.

Fire is the third hazard with potential to cause significant harm to the restoration area. Measures to minimise the potential of a fire starting, taking hold and spreading are required. Porirua City Council, as the fire management authority, is responsible for controlling and putting out fires. Their focus is on minimising damage to property such as houses and power lines. Preservation of vegetation is only a secondary consideration.

2. Pest animal management

Grazing sheep, cattle and goats are no longer present within the restoration area and are excluded from it by stock fencing.

Rabbits and hares are prevalent in the area. These animals feed on the young seedling trees in the revegetation plantings as well as the natural regeneration occurring throughout the area. On advice, the Friends use hare protectors on all young seedlings. These are removed and re-used once the trees are sufficiently established.

[20] Part 4 General management outcomes and policies
4.1 Biodiversity and ecosystems
4.1.4 Pest plants and pest animals
Policies 14, 15, 16, 17, 18

Possums are the main animal pest targeted for control. Native plants are not adapted to possum browsing. Their browsing has a dramatic impact on both native plant vigour and the species composition of natural bush regeneration, favouring unpalatable and exotic species.

In 2009 and 2012 GWRC monitoring recorded possum Residual Trap Catch (RTC) rates of 0% in the Cannons Creek area (see boundaries in Map 1). This is an excellent result. The area will next be monitored in 2015.

Rats are a secondary target, but their numbers have not been monitored here.

Rats affect both native plants and native animals in regenerating ecosystems. Rats and smaller rodents are a major consumer of seed and new seedlings, and their presence will be inhibiting regeneration. Also native birds (and native insects) are not adapted to mammalian predators like rats. With the elimination of possum browse, all kinds of birds and other fauna will be colonising the regenerating bush. Removal of rats and smaller rodents makes it easier for native fauna to establish in the expanding bush ecosystem.

As a generalisation, fewer possums means more and healthier native bush, and less rodents means more native birds in that bush.

2.1 Possum and rat control using bait stations

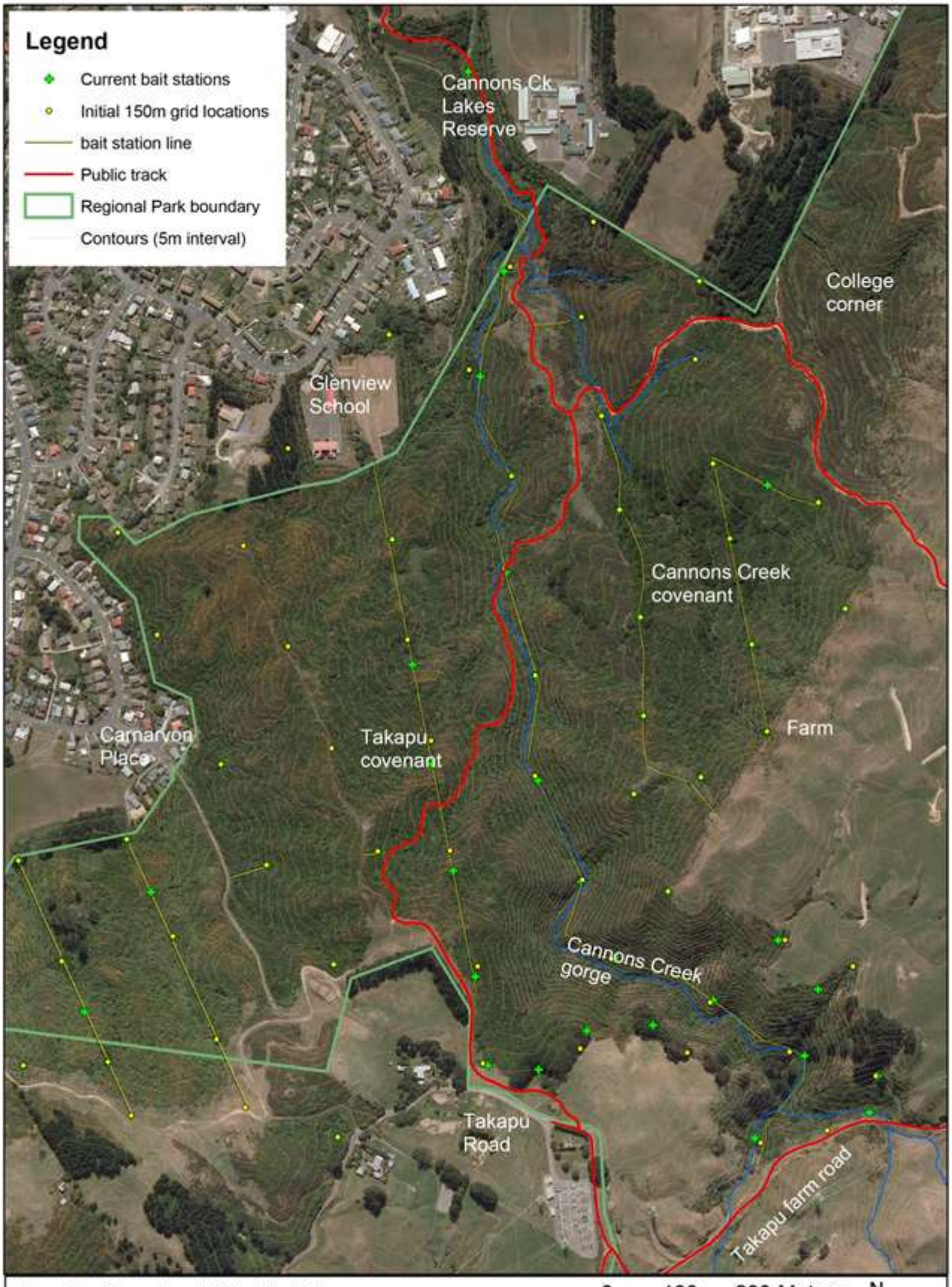
Pelifeed bait stations, roughly located at the intersections of a 150 metre grid, have been more or less distributed across and around the restoration area since 2001. The 150m spacing provides good control of possums when animal numbers are low. For rodent control, current guidelines suggest spacing at 50m intervals as this is the typical extent of an adult rat territory.

Currently 54 stations are maintained. Station spacing varies across the area (Map 3: Cereal pellet bait stations). Note one station beside the bottom lake is off this map. Stations are not currently maintained at grid points where bait take has been low[21]. The stations are inspected and refilled by volunteers every 2 to 3 months as advised by GWRC[22]. The frequency and amount of refill is adjusted based on on-going recording of bait station refill needs.

The anticoagulant poison, brodifacoum is used as a 0.02g/kg cereal pellet (brand name Pestoff Rodent Bait 20R). It effectively controls possums when their RTC is 5% or less. Brodifacoum is also an effective rodenticide. Rodent track monitoring elsewhere in the Regional Parks show rat tracking rates of 1 to 2% when brodifacoum is used in Pelifeed stations at the 150m grid bait station spacing.

Brodifacoum is not a controlled pesticide, so no licence is required to use it. It is generally safer than the controlled pesticides. The GWRC Biodiversity Advisor (Parks) provides instruction in safe operating procedures, as required.

[21] Typically in stands of pure gorse.
[22] Biodiversity Advisor (Parks)


Legend
Current bait stations
Initial 150m grid locations
bait station line
Public track
Regional Park boundary
Contours (5m interval)
Cannons Ck Lakes Reserve
College corner
Glenview School
Cannons Creek covenant
Carnarvon Place
Takapu covenant
Farm
Cannons Creek gorge
Takapu Road
Takapu farm road
Map 3: Cereal pellet bait stations as of June 2011
0 100 200 Meters
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Air photo February 2010
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2.2 Co-ordination and responsibilities

The operation of the animal pest control programme is a joint effort between the GWRC and the Friends. The GWRC point of contact is the Biodiversity Advisor (Parks) (or successor role). Within the Friends contact is through their nominated pest control "co-ordinator"

GWRC provide:

- The programme to work to
- Initial cutting of access lines through the bush and scrub
- 5 to 10 year follow up clearance of lines and upgrade of stations (done in 2011)
- Installed bait stations and bait (supplied by Biodiversity department)
- Consents and warning signs; bait station forms to record bait uptake and monitor station condition

Friends of Maara Roa:

- Train volunteers in bait station operation
- Check, refill and monitor stations 2 to 3 monthly as advised, with a bait station refill form completed and forwarded to the Biodiversity Advisor (Parks)
- Ensure the access to lines from public tracks is kept obscure from passers-by
- Undertake minor vegetation control to keep the lines passable

2.3 Future possibilities

Possum and rat control needs to be on-going because of the continual migration of animals into the area. No control of exotic birds, insects or lizards is anticipated.

The reliance on Brodifacoum and a predominantly 150m spacing of bait stations may encourage, over the years, the development of a poison wary population of pest animals, particularly rats. However, this is not apparent at this time.

50m station spacing is considered necessary to maintain rats at low numbers[23]. In the coming 10 years it may be appropriate to monitor rodent populations as a basis for deciding whether to increase station numbers to the 50m standard. This standard requires a substantial increase in resources devoted to control of mammal pests.

[23] 50m is the typical extent of an adult male territory

There is an established protocol for pest mammal monitoring using tracking stations. However, the extent of the restoration area is a little low for its direct application. Volunteers are already monitoring rodents this way in the Korokoro catchment.

With tracking station information decisions could be made to:

- Change poison
- More closely target rodents. They compete with birds for food, eat seed and seedlings, and predate nestlings, lizards and invertebrates. They also act as a food supply to support resident populations of mustelids and cats
- Target hedgehogs as these feed on the invertebrate fauna. However, the native land invertebrate community is likely to be impoverished given the pastoral history of the area and hedgehogs may act as a stabilising element in the hybrid ecosystem that is evolving
- Target top predators such as mustelids and cats. Their negative impact on native bird populations is well accepted but, as top predators, their removal from an ecosystem can have many unforeseen effects and needs to be done with care

3. Pest plant management

Management is required to reduce the current extent of plant pests within the restoration area, to minimise re-infestation (primarily from the adjacent residential area) and to identify and eliminate new weed species if they appear in the area.

The pest plants targeted are those weeds that have proven to inhibit or overwhelm natural regeneration by native plants indigenous to the area. It includes non-indigenous natives and could be extended to hybrid forms.

Most weeds are introduced by birds through their edible seeds but many are wind borne and others grow from dumped rubbish.

3.1 GWRC pest plant control

A BRP Plant Pest Plan is being implemented by GWRC staff. It concentrates on four main bush areas: Korokoro Valley, Speedy's Creek, Dry Creek and Cannons Creek.

The GWRC Weed Team surveyed the restoration area in 2008. Main tracks, streams, ridges and bait station line tracks were followed. Pest plant occurrences were mapped in GIS and have been updated annually following each inspection / control operation. It is likely that not all occurrences of pest plants are recorded, especially for the more dispersed plants.

Pest plant infestations are ranked according to urgency (site led approach) and practicality of control (weed led approach). The urgency score relates to the

impact of that pest plant on the biological values of the community it is present within. The practicality score assesses the practicality of control for each local population. Infestations are then allocated to one of three categories for GW Weed Team control:

Category 1:

- On-going control is directed at eliminating the pest from the location
- Remove mature plants, re-inspect and remove seedlings annually

Category 2:

- Monitor and control when resources are available
- Undertake control during Category 1 control operations, if the opportunity arises, otherwise, target for control when funding is available

Category 3:

No direct action because:

- There are no known control methods
- It is too widespread to be controlled at this stage (blackberry)
- They are very widespread and considered to have advantages as a nurse crop.(gorse, with broom on some ridges), except where high fire hazard necessitates control
- Not regarded as being invasive or damaging to native ecosystems

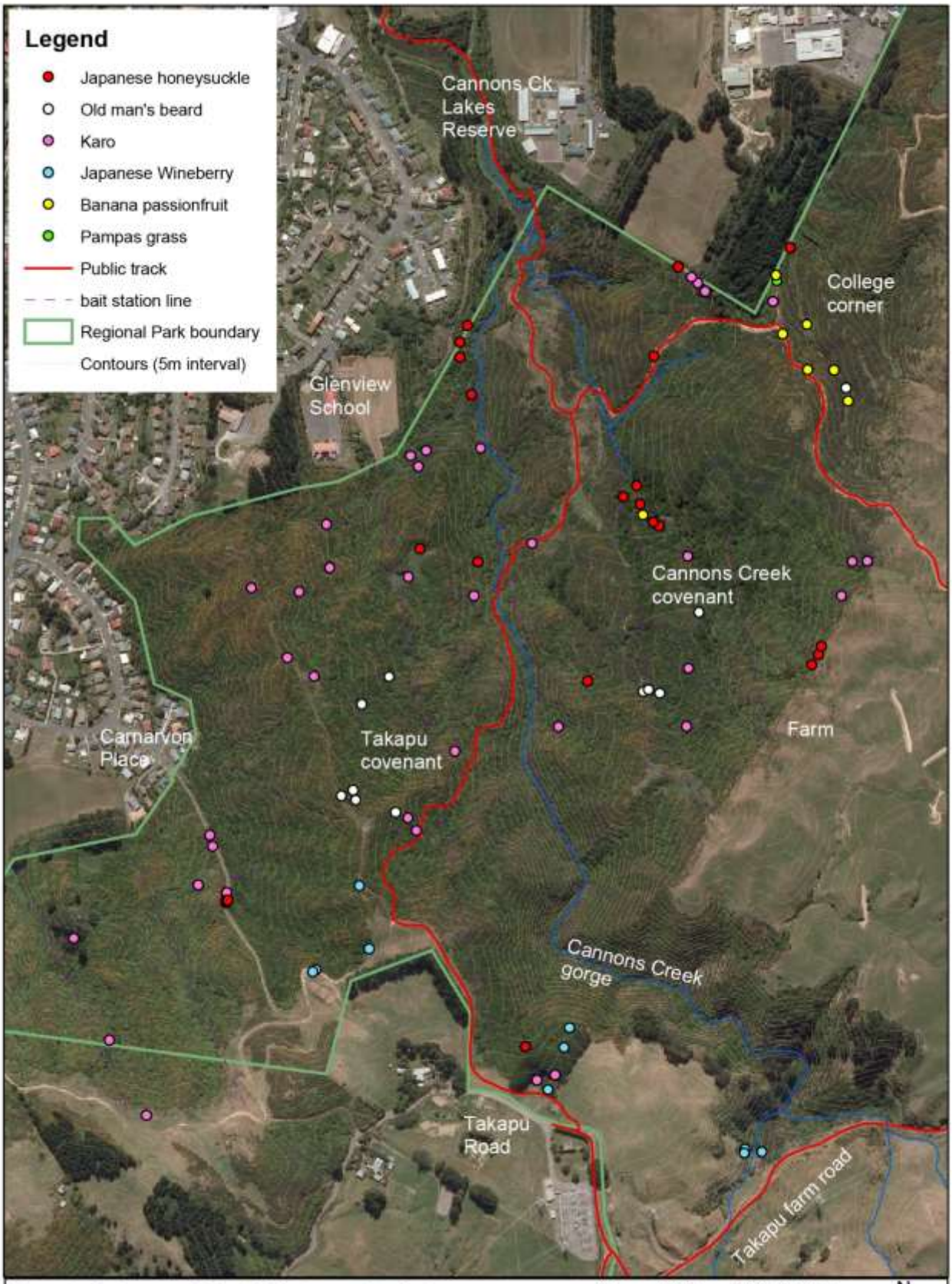
Gorse and blackberry are best managed through native re-generation eliminating /reoccupying the environmental niches these weeds currently occupy.

Plant pests controlled are shown on Map 4 and Map 5.

Cannons Creek

Species Name	Common Name	Comment	Urgency	Practicality	Category
Clematis vitalba	Old man's beard	Many large sites have been controlled	2.5	6	1
Cortaderia selloana	Pampas	1 plant, now eliminated	2.5	6	1
Lonicera japonica	Japanese honeysuckle	Some large infestations mainly in the north	2.5	6	1
Passiflora spp.	Banana Passionfruit	A minor but persistent problem in Cannons covenant & at College corner	2.5	6	1
Pittosporum crassifolium	Karo	Larger trees were easily spotted as they stood up above the surrounding bush. Many smaller karo have been found scattered through the understory	2.5	6	1
Rubus phoenicolasius	Japanese wineberry	Vine. 3 locations s in Takapu area	2.5	6	1
Berberis glaucocarpa	Barberry	2 mature plants found near public track. Seedlings may recur in area	2.5	6	2
Cotoneaster sp	Cotoneaster	Dispersed sites. Probably more present	2.5	6	2
Leycesteria formosa	Himalayan honeysuckle	Young plants but many dispersed sites (not yet well established in catchment)	2.0	6	2
Paraserianthes lophantha	Brush wattle	Has been removed from 3 sites	2.5	6	2
Erigeron karvinskianus	Mexican daisy		2.0	6	2
Tradescantia flumensis	Tradescantia	Localised patches (100m2)	2	3	2
Cytisus scoparius	Broom	Localised patches on dry ridges	2.0	6	3

Species Name	Common Name	Comment	Urgency	Practicality	Category
Rubus fruticosus	Blackberry	In patches mainly in valley bottoms	2.0	8	3
Phytolacca octandra	Inkweed	Local patches	1.0	4	3
Senecio glastifolius	Holly-leaved senecio	Local patches	1.0	4	3
Ulex europaeus	Gorse	Common throughout	1.0	4	3


Legend
Japanese honeysuckle
Old man's beard
Karo
Japanese Wineberry
Banana passionfruit
Pampas grass
Public track
bait station line
Regional Park boundary
Contours (5m interval)
Cannons Ck Lakes Reserve
College corner
Glenview School
Cannons Creek covenant
Carnarvon Place
Takapu covenant
Farm
Cannons Creek gorge
Takapu Road
Takapu farm road
Map 4: Category 1 Pest Plants controlled by GWRC from 2008 to June 2011
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Air photo February 2010 1:6,500 on A4 page
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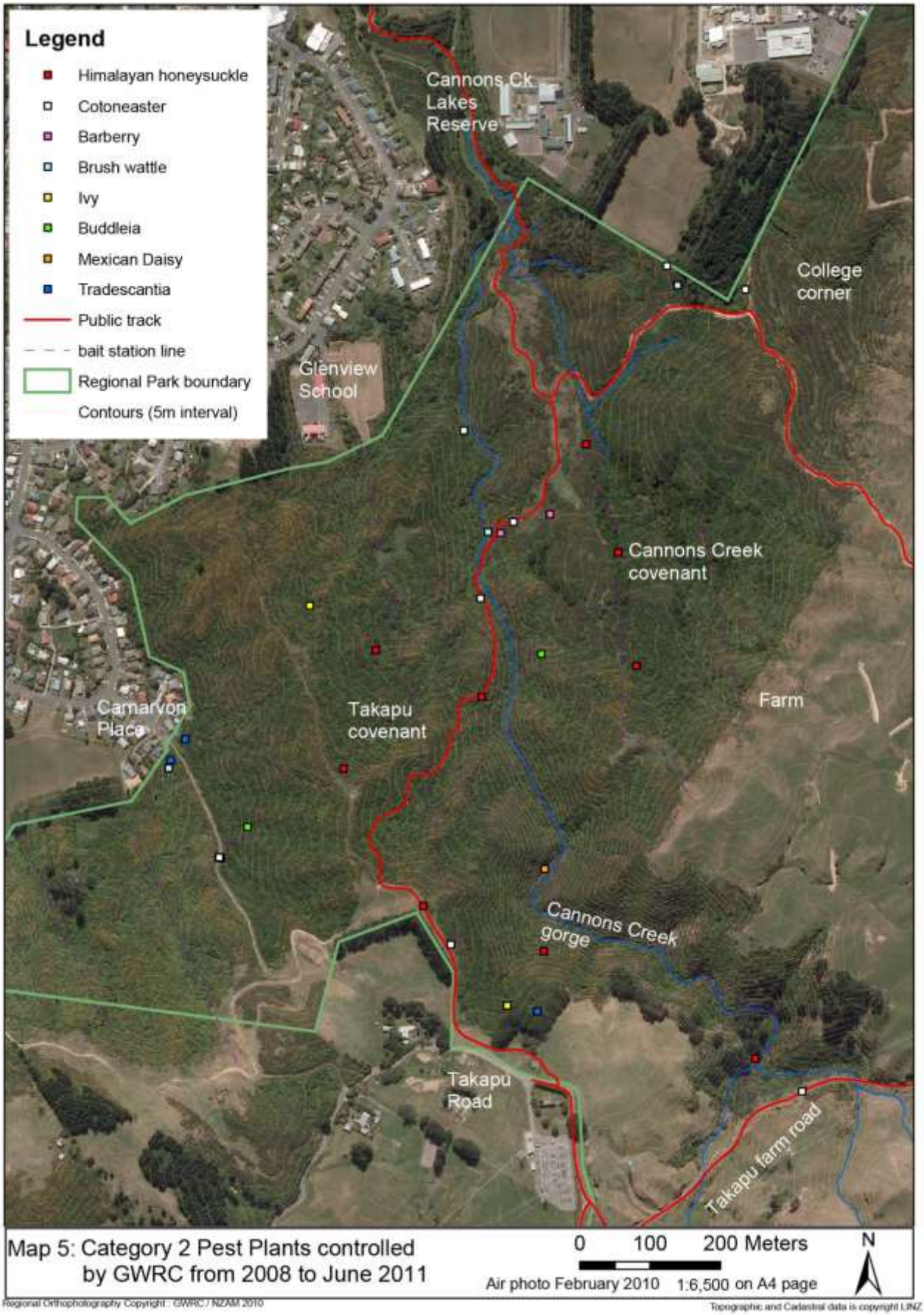
Legend
Himalayan honeysuckle
Cotoneaster
Barberry
Brush wattle
Ivy
Buddleia
Mexican Daisy
Tradescantia
Public track
bait station line
Regional Park boundary
Contours (5m interval)
Cannons Ck Lakes Reserve
College corner
Glenview School
Cannons Creek covenant
Farm
Carnarvon Place
Takapu covenant
Cannons Creek gorge
Takapu Road
Takapu farm road
Map 5: Category 2 Pest Plants controlled by GWRC from 2008 to June 2011
0 100 200 Meters
Air photo February 2010 1:6,500 on A4 page
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- Record and report to GWRC Biodiversity Advisor (Parks) locations of Category 1 and Category 2 pest plants they encounter during restoration works[24]

- Except, the Friends will control seedling pest plants in areas where they are doing on-going sprayed weed control to assist establishment of revegetation plantings

- If skills and resources are available, undertake an annual inspection for pest plants in the restoration area with reporting to the GWRC Biodiversity Advisor (Parks) prior to the GWRC weed team visit. This could focus on the portions of the restoration area not typically visited by the GWRC weed team[25].

3.3 Pest plant control in Cannons Creek Lakes Reserve

In the MOU between PCC and GWRC, which applies to the PCC's Cannons Creek Lakes Reserve, the 2 parties have agreed to cooperate on "joint pest and weed strategies."

GWRC will negotiate with PCC for the control of the Category 1 and 2 pest plants identified within the Cannons Creek Lakes area to the standard described above (Section 3.1)

In addition Convolvulus, *Calystegia silvatica*, ought to be treated as a Category 2 pest plant, and preferably eliminated from the reserve. It is a smothering herbaceous perennial vine that is difficult to control amongst broad leaved plants. It will hinder native regeneration in the reserve but it is not a current threat to BRP.

Convolvulus spreads vegetatively via its vigorous white fleshy rhizomes (roots) and will grow from small fragments of these. It infests the stream side flats and true left side of the reserve from the boundary with Belmont Regional Park downstream to the southern end of the northern lake. It probably established from garden waste dumped in the reserve.

4. Fire hazard management

Rainfall is sufficiently frequent that fires in the area have not been started by lightning strikes, arcing from power lines or spontaneous combustion of composting debris. Rather they are started by people either by accident or intentionally[26].

[24] Report, **by email**, to GWRC (Biodiversity Advisor to Parks) using an agreed standard subject line. This allows them to be automatically routed to a mailbox so they don't get lost amongst other business.

[25] Weed invasion may occur anywhere within the lower catchment. There is no advantage in treating catchment or urban boundaries separately.

[26] In addition to the three major destructive previously described, since the 1970's until PCC removed many pines from the Cannons Creek Lakes Reserve in 2000 and began to regularly clear dead dry debris and litter, fires in the Reserve were frequent throughout summer from November's Guy Fawkes Day onwards,. Also, some years ago a school rubbish fire lit by a teacher spread into the gorse behind Glenview School, while one which spread into the restoration area (right on Possum line E) from the Tokelau Hall, adjacent to the school, was lit by a crew cleaning up their grounds.

The most recent damaging fire, in March 2003, was started by 3 young local teenagers at the south (distal) end of Cannons Creek Lakes Reserve beside the streamside track there. It quickly spread up a dry slope of rank grass and gorse scrub extending up into BRP. Spread was probably aided by lines cleared through this scrub, with associated dead debris, for revegetation plantings being done by the Friends. It is regrettable that the Restoration Plan they were following did not give sufficient guidance on the management of fire hazard near residential areas.

It is a demonstration of the Friends resilience that they did not respond with despair at the loss of much of their revegetation plantings. They resolved to grow a buffer of fire resistant vegetation between "the public" and the areas of high fire risk (accessible gorse scrub) that develop in the early stages of restoration through managed regeneration

The "Green Firebreak" Plan the Friends came up with[27] identified two "firebreak strips" about 40 m wide to be planted in fire resistant native bush. The first traversed the slope above the BRP boundary extending from Brandon Intermediate School's southern boundary south west along the valley side to Cannons Creek streambed where the fire had been started and spread from. Note: the fire failed to establish in the regenerating native bush on the south east facing, Glenview School side, of Cannons Creek. The other planted strip straddled the track up to Cannons Creek covenant then continued along the western (burnt) edge of the covenant to the southern extent of the fire. It was located to protect the exposed north and western burnt edges of Cannons Creek covenant bush remnant.

4.1 Green firebreaks as part of fire hazard management

A hazard is dealt with by, first, attempting to eliminate it. If this can't be done, then by minimising it, and if all else fails, by isolating it. Preventing destructive fires here is largely managed by making it difficult to start fires by minimising flammable vegetation near track sides, and in publically accessible but rarely frequented spots, especially in Cannons Creek Lakes Reserve and near the three school boundaries. Fire spread is managed by partitioning/fragmenting areas of rank grassland and gorse scrub with fire resistant corridors of native bush.

The Friends and GWRC have developed the following fire hazard management approach

4.1.1 Role of Friends of Maara Roa

- Create planted "green firebreaks" (15 to 50m wide) of native broadleaf bush either side of public tracks and at other easily accessible places to shade out rank grass and gorse

- Avoid planting flammable natives like cabbage trees, toe toe, manuka and kanuka beside public tracks and at other easily accessible places

[27] Produced by John Hodges, a committee member and local resident and teacher who had some years previously initiated planting of the fire prone Cannons Creek Lakes Reserve bank below Brandon School.

4.1.2 Role of GWRC

- Minimise public tracks passing through or near extensive areas of highly flammable plant cover[28], particularly gorse scrub and former pasture that has become rank grassland

- Promote awareness of fire hazards and the consequences of fires in order to encourage public oversight and discourage accidental, irresponsible or malicious fire lighting

- Do vegetation trimming or mowing in spring or autumn so that dry dead debris does not collect alongside tracks

- Target resources to eliminating flammable material at easily accessible but 'out of the way' locations

4.2 Current and proposed green firebreaks

In addition to planted firebreaks, zones through gorse or other flammable scrub can be managed to increase the rate of succession to more fire resistant bush. The latter can be a little slower to establish but require much less resources.

Three green firebreaks are currently being established and four are proposed (Map 6).

4.2.1 Current green firebreaks

The "BRP entrance slope" (refer to Map 6) covers the area where the 1997 and 2003 fires were started. It includes some flammable plant material but now there is minimal open area and little reason for people to venture off track into it.

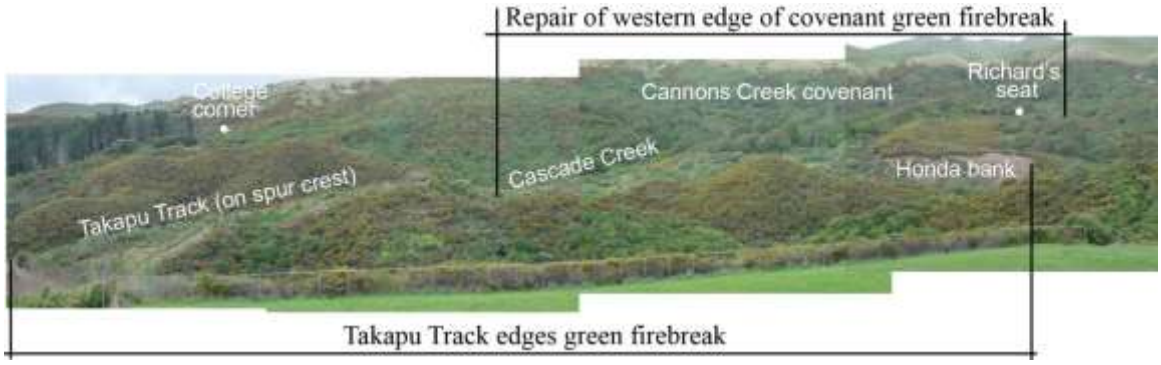
Planting to repair the western edge of the Cannons Creek covenant was begun immediately after the 2003 fire. Plant establishment has been quite variable depending on slope aspect and the amount of soil but the exposed edges of the covenant are well covered and trees burnt but not killed in the fire are growing well.

Planting of the Takapu Track edges began after the other two firebreaks. The firebreak follows a dry spur then traverses a north facing slope. Planting and care techniques[29] developed by the Friends have been critical to its successful establishment. Full canopy closure is 2 to 5 years away depending on the time since planting.

[28] Green Firebreaks take years to establish and suppress flammable vegetation like rank grass and gorse. The length of track through, and access points to, flammable vegetation needs to be kept in line with the level of resourcing available to minimise, or keep people away from, the rank grass and gorse during this vulnerable period. Access is best provided and promoted only once green firebreaks have been established. Then the track surrounds can be more appealing and the need for vegetation control is relatively reduced by the shaded environment.

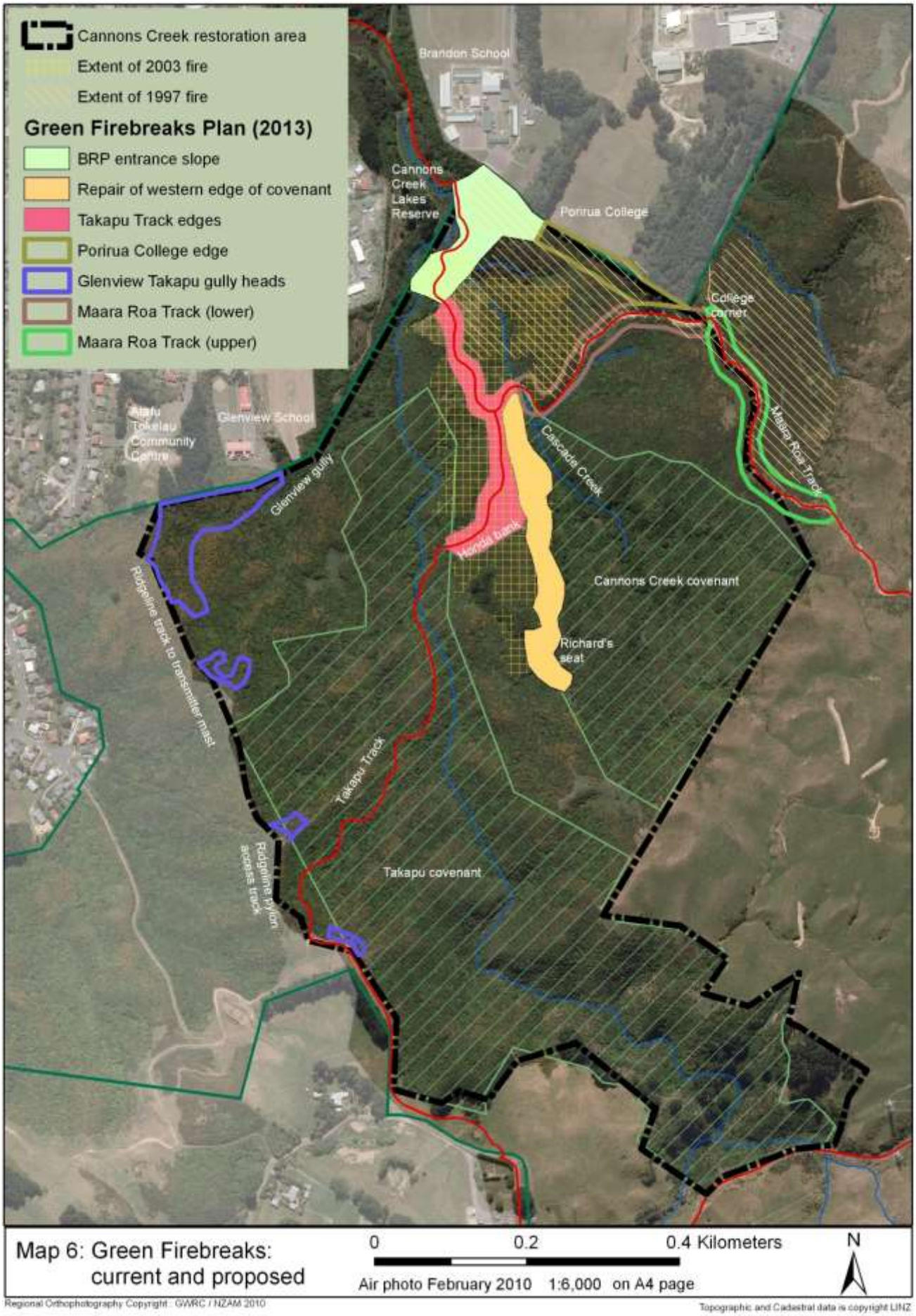
[29] Use of tree lucerne for quick shelter, use of well "hardened" plant stock, cardboard sheet mulch around each plant and plastic sleaves for hare protection and wind protection, along with ongoing herbicide control of gorse seedlings.

Two green firebreaks through eight year old gorse scrub



View, in July 2011, from Glenview School across the area burnt in 2003. The older one protects the western edge of Cannons Creek covenant. The second is either side of the Takapu Track. The most recent planting along it is on the "Honda bank" (renamed "Hodges' hill").

View in 2012 from the east end of Honda bank (renamed as "Hodges' hill") looking northwards along the green firebreak repair of the western edge of Cannons Creek covenant. Most of the planting in view is 5 to 6 years old with tree lucerne most apparent. This is used as a shelter plant on this north facing slope with colonising native shrubs planted amongst it. The first planting, on the right, did not include tree lucerne. This was along the burnt edge of the mature tawa within the covenant. The dead bush has been cleared from the edge and, while there was some dieback of the tawa, the trees had recovered by this time. Middle background hills show uncontrolled gorse growth following the 2003 fire. Brandon School is in the background.


Cannons Creek restoration area
Extent of 2003 fire
Extent of 1997 fire
Green Firebreaks Plan (2013)
BRP entrance slope
Repair of western edge of covenant
Takapu Track edges
Porirua College edge
Glenview Takapu gully heads
Maara Roa Track (lower)
Maara Roa Track (upper)
Brandon School
Cannons Creek Lakes Reserve
Porirua College
College corner
Maara Roa Track
Cascade Creek
Rondel bank
Cannons Creek covenant
Richard's seat
Takapu covenant
Glenview School
Aiga Tokelau Community Centre
Glenview gully
Ridgeline track to transmitter mast
Takapu Track
Ridgeline pylon access track
Map 6: Green Firebreaks: current and proposed
0
0.2
0.4 Kilometers
N
Air photo February 2010 1:6,000 on A4 page
Regional Orthophotography Copyright : GWRC / NZAM 2010
Topographic and Cadastral data is copyright LINZ

4.2.2 Proposed green firebreaks

The Porirua College edge consists of scrub which regrew following the 1997 fire. Native shrubs are now suppressing the gorse except along its northern, playing field, edge. A green firebreak could be created by removing gorse along this edge and cutting down the dispersed mature gorse within the bush for about 30m back from the edge. The latter might create light wells for enrichment planting.

The Restoration Area boundary with Atafu Tokelau Community Centre and the south edge of Glenview School is a pine and gorse dominated dry spur. The southern side is relatively moist with a cover of native shrubs beginning to suppress gorse. Cutting down remnant gorse within the shrubs will speed succession to more fire resistant bush. The Ridgeline track forming the western boundary of the Restoration Area is a similarly dry spur. Native shrubs are similarly suppressing gorse except on the dry spur crests and steep northerly gully heads along it. Strategic removal of gorse along the ridgeline will greatly reduce its fire hazard.

Takapu Covenant from Richard's seat, midday April 2011

The Ridgeline track is along the skyline. The left foreground lies between Takapu and Cannons Creek covenants and was last grazed in the early 1990's. Possums have been kept to negligible numbers since 2001.

The broadleaf bush across this view is at least 20 years old with that in the Takapu covenant being maybe 10 years older. Note the persistence of residual gorse on dry spurs and the absence of emergent trees.

Along the southern side of the lower Maara Roa Track is a damp gully of fire resistant bush. However, fire hazard will be reduced by enclosing the Track in

a green firebreak. The northern side of the lower track is dominated by gorse which would be best replaced for about 10m depth alongside the track with coloniser style native plantings. On the south side there is less gorse but it would be wise to replace this also. Bush established on the north side of "College corner" already provides some protection from fire in the Porirua College grounds.

Planting a green firebreak along the upper Maara Roa Track (upslope from College corner) will reduce the risk of a wild fire spreading from the north or east crossing into the Restoration Area. This part of the track is quite distant from the park entrance and it seems unlikely that fires will be deliberately lit along it. However, native plantings will increase the appeal of the track for visitors.

Part 3: Regeneration of native vegetation

1. Introduction

The 67 hectares encompassing the two conservation covenants and surrounding advanced regeneration in the restoration area make up a major part of the bush and scrub on the western slopes of Belmont Regional Park. The ecological value that is being created by the restoration of the area to native bush and, ultimately, forest, is a prime justification for the effort and resources being put in to it[30]. The Park Network Plan identifies Cannons Creek as a potential ecological link from Porirua to the Hutt Valley via Korokoro Valley, on the east side of Belmont Regional Park.

It will never be possible to regenerate the ecology of the original forest cover due to the extinctions that have occurred over the past 1000 years and the introductions of new plants and animals that cannot be excluded from the area. However, the intention is to restore the area to a complex functioning ecosystem that is dominated by native plants.

Cannons Creek Bush is within the Inland Wellington Porirua ecological domain.[31] This eco-domain is characterised by a complex hilly terrain with turbulent wind resulting in lots of microclimates. The clay rich soils are generally fertile and moisture-retentive. The five Wellington species of large emergent podocarps once dominated the forest in the valley, with Tawa as the major canopy species.

Landcare Research initially predicted natural climax vegetation for this area to be Rimu/Tawa-kamahi forest, with Rimu-Miro/kamahi-red beech-hard beech forest on the higher more exposed slopes. Their current prediction gives more weight to the fertile soils present. It suggests the native vegetation would be Kahikatea/Tawa-Titoki-Pukatea forest on sheltered moist slopes with Rimu-Kahikatea/Tawa-Kamahi-Mahoe-Kohekohe on the more exposed or less fertile steep slopes.

The previous restoration plan has a good description of the vegetation types currently present in the area, and worthwhile planting responses. The best form of intervention was determined as "supplementary enrichment planting to complement the natural succession process. Following the 2003 fire, green firebreaks of broadleaf colonising shrubs have also been planted, in part to repair the fire damage, but primarily to manage on-going fire hazard.

Restoration, beyond essential pest control, of the upper reaches of Cannons Creek gorge downstream of the Takapu Duck Creek farm road is best delayed until the proposed motorway viaduct over the gorge has been completed.

[30] Increased recreational value is also significant.
[31] Wellington Regional Native Plant Guide: Using your garden to sustain our native ecosystem**,** Wellington Regional Council, 1999.

2. Natural regeneration

Regeneration of the native forest is largely being achieved through the natural processes of plant succession by native bush growing over and shading out gorse which itself had established in grassland by overgrowing and shading out the grass. Gorse dominates this initial succession from grassland because it is a far more aggressive coloniser of pasture than native shrubs. Native seedlings grow under then through the gorse cover, especially as it matures and allows more light to penetrate to ground level.

Succession of native bush through gorse

Stage 1: Māhoe shrubs overgrowing and suppressing gorse (with yellow flowers) near the junction of Takapu Track with the Ridgeline pylon track. About 20 years after grazing stopped. The dominance of Māhoe, with its small fruits, is typical of the initial native bush succession in Wellington which seems driven more by fruit eating birds than wind blown seeds like kanuka or manuka.

Stage 2: Other plants slowly establish under the māhoe from spores and seeds blown in or brought by small fruit eating birds like silvereyes. This photo under the māhoe canopy near the top of Takapu Track shows the limited plant diversity about 20 years after grazing stopped. There is divaricating coprosma, on the left; some hounds tooth fern, and dead gorse in the background.

Stage 3: Species diversity slowly increases through the decades depending on local sources.

This is under older māhoe / kawakawa canopy lower in the Takapu covenant.

The seedlings under this bush canopy have germinated from wind-blown seeds and seeds introduced by birds.

The original native forest pattern largely reflected the close association between the numerous small fruited native trees and shrubs and the many birds such as tui, bellbird, kokako, kereru and stitchbird that ate the fruits and dispersed the seeds in their droppings. However, the absence of mature timber trees like kahikatea, rimu, matai and totara and the low numbers or absence of important seed dispersing birds like kereru and stitchbird mean the final pattern from the regeneration will differ significantly from the original.

Local seed sources

Damp gullies that harboured isolated remnants of bush within the grazed pasture have become important seeds sources particularly in Takapu covenant. Here a mature pigeonwood tree and nikau palm shelter abundant Nikau seedlings near the Takupu Track crossing of Cannons Creek.

Succession of gorse by broadleaf bush has been fastest and most effective within moist gullies and on shaded southerly slopes. The bush remnants within the two covenanted areas provide good seed sources of most forest floor and shrub species and a few canopy tree species, which are becoming dispersed through the gorse scrub. There are very few emergent forest tree species present in the restoration area[32]. They were removed by logging or have been killed by fires and animal browsing, leaving a tree canopy dominated by kohekohe and Tawa in the forest remnants. These have persisted due to their relative tolerance of animal browsing. Within their shelter a variety of other canopy and sub canopy native plants are present. The complexity of the sub canopy plant associations in the remnants will have increased dramatically with the exclusion of stock in the 1990's and control of possums since 2000, but the species composition is still limited because possums, rats and grazing animals ate out or killed many palatable species that were probably present.

If efforts to protect the restoration area continue, broadleaf bush will naturally succeed most of the gorse across it in the coming ten years. Creating "Green firebreaks" through intensive site specific management of the succession process to fragment gorse cover will reduce the risk of fire spreading into and through the area (refer to Part 2). Isolated pockets of gorse will remain on the drier slopes and hill crests. Most remaining gorse will be in the area burnt in 1997 and 2003, primarily on the ridge between Cascade Creek and Porirua College. Gorse may also predominate along the spur between Cannons Creek covenant and College Burn, which the Maara Roa track follows, because it has been grazed until recently (Map 1).

[32] Several mature totara and pukatea were recorded in the 2001 botanical survey of the 2 covenants within in the area. They are bigger than the tawa, but are not visible from a public track. One of the pukatea may be about 60 years old.

By encouraging seed production and birds, the protection of the restoration area (Part Two) contributes significantly to the speed with which the succession to bush occurs and to its plant diversity and ecological complexity. The broadleaf bush, which has naturally regenerated in most of the areas that were formally grazed, comprises colonising species such as māhoe, coprosmas, Kawakawa, olearias, hangehange, etc.

With the great reduction in numbers of many native birds due to rats and the extinction of others, silvereyes have become an important local disperser of seeds along with the introduced blackbird which is established in the restoration area. Unfortunately, exotic birds dispersing seed also tend to introduce weeds plants from the surrounding residential areas like japanese honeysuckle and barberry that also have small fruits.

Seedlings of forest canopy trees like Kohekohe and Pigeonwood are well dispersed across the natural regeneration and in time will emerge through the initial shrub canopy. However, there are problems with the development of a more diverse forest canopy. The large seeded Tawa, which once dominated the original forest canopy, will not spread beyond Cannons Creek covenant until kereru are present in larger numbers. The scarcity of Titoki and Hinau trees as a fruit source in the forest canopy in Cannons Creek covenant is limiting their spread by birds, while the palatability of the seeds to rats is limiting the development of self-sown seedlings. The lack of mature emergent tree species[33] in the covenants is preventing their reestablishment too, though kereru may introduce seed from the scenic reserve in Porirua Park, two kilometres to the west. Enrichment planting of these trees into microsites to provide future local seed sources will, once these have matured, speed up succession of the bush to forest and greatly enhance its potential ecological value. However, even with intervention, the regenerated native forest pattern is likely to be quite different from the original vegetation that grew in the catchment prior to European settlement.

3. Enrichment planting

3.1 Planting of nursery grown stock

Within the restoration area, where the regeneration is progressing beyond pure gorse scrub, there are sites where podocarps, tawa, hinau, nikau and northern rata, rewarewa, and pukatea, for example, can be re-established by planting instead of relying solely on bird (or wind for rata, rewarewa and pukatea) introduced seedlings successfully establishing. It can also be valuable to reintroduce sub canopy plants. Such plantings expand the limited species diversity of the regenerating bush and have potential to shorten the period for development of complex forest ecology by many tens of decades. For recommendations of enrichment plants refer to the Friends planting notes later in this Part and Appendix: Plant species list for Cannons Creek.

[33] Kahikatea, rimu, matai, totara, miro

Seeds should be sourced from remnants of native forest within about five kilometres of the restoration area as these plants are likely to have genetics adapted to the local conditions. However, there is considerable value in re-introducing plants to the restoration area that do not have local seed sources. Seed collected from more distant remnants is acceptable because of the relatively low biodiversity significance of the area, but do not use plants originating from outside the Wellington ecological region.

Do small scale plantings based on the best knowledge available with careful thought to adapt it to the local situation. Remember, the pattern of enrichment planting does not need to mimic a complex ecology. It is the seedlings produced from these plants that will create a new sustainable ecological pattern for the area. An example of the approach, for sub canopy planting, is outlined in "Recommendations for secondary planting under (planted) forest and shrub land canopies on Matiu-Somes Island, DOCDM-315270".

The absence or untoward rarity of a plant in the Restoration Area is a useful guide to the effort to expend on planting.

Some native plants can be difficult to source from nurseries or to grow from seed. However, as the intention is to establish these as seed sources contributing to future plant diversity it is important to persist. Good knowledge of the initial growing requirements and seedling distribution of each plant species at a given location is essential for success. Planting microsites for each species can then be identified and maintained. Especially, emergent species generally need more light than is provided under a closed canopy of planted native shrubs or regenerating bush. When planting these it is important to allocate resources to creating and maintaining light wells through the shrub cover. Ease of access to microsites is helpful but it is also important that they be distributed across the Restoration Area to facilitate future seed dispersal.

Detail of variations on the method are well covered in "Cannons Creek: Restoration and Development 2001" (the previous Plan), and in generic revegetation texts[34].

The best opportunities for enrichment planting into microsites are (refer to Map 2: What next?):

- Within the existing coloniser plantings established following the 2003 fire
- Into the scrub on the south side of the Porirua College playing field
- Into the scrub between Maara Roa Track and Cannons Creek covenant.
- Along the Takapu track on the true left of Cannons Creek below its junction with the Ridgeline pylon track
- South of "Richard's seat" on the high ground between the two covenants

[34] All species used should be grown from seed sourced from the Inland Wellington - Porirua ecological zone and have been recorded locally. Species choices are to be guided by the initial botanical survey included in the first restoration plan, by surveys of BRP, Porirua Trust Park, Porirua Scenic Reserve, and Judgeford Queen Elizabeth Covenant.

- On the plateau northwest of Richard's seat
- On the gully slopes south of Glenview School

The previous Plan advised, and this still applies, not to plant within the bush remnant in Cannons Creek covenant as species diversity was already high and natural regeneration processes would likely create a more sustainable ecosystem than planting.

Plant diversity along Cannons Creek upstream of the Takapu Track crossing is also high and enrichment planting may not be needed there.

3.2 Seedball technique: (the Human Bird Programme)

This is a method developed by Forest and Bird for introducing desirable seeds, in particular, to persistent or young stands of gorse scrub.

It involves three stages:

- Seed collection and preparation (cleaning, stratification etc.)
- Encapsulating the seed (balls of modelling clay wrapped round potting mix containing the seeds, and dried till firm)
- Distributing by throwing or batting the balls into target areas during winter or early spring

The technique has been applied at a number of sites in the restoration area (Map 2: What next?). If monitoring for seed germination and seedling establishment shows the method is useful its implementation should be expanded.

The Friends suggested seeds to use for steep slopes on valley sides use:

Alectryon excelsus
Aristotelia serrata
Beilschmedia tawa
Carpodetus serratus
Coprosma robusta
Cordyline australis
Dacrycarpus dacrydioides
Dysoxylum spectabile
Elaeocarpus dentatus
Fuchsia excorticata
Melicytus ramiflorus
Olearia rani
Podocarpus totara
Pseudopanax arboreus

For small areas with a thin grass cover surrounded by scrub the Friends suggest seeds of the following fast growing coloniser native species:

Coprosma robusta

Olearia solandri

Ozothamnus leptophyllus

Pittosporum tenuifolium

4. Green firebreak planting

This evolved out of the urgent need to deal with the flush of gorse seedling growth that followed burning, in 2003, of the scrub and bush through which the public track into BRP passes (refer to Map 1)[35]. The Friends Green Firebreak Plan[36] (ref to Part Two, section Fire Hazard Management) was produced to direct the Friends response

4.1 Creating a green firebreak through gorse

The approach involves four steps:

- Clearing of (burnt) gorse from the zone to be converted to green firebreak, followed by spraying of gorse seedlings and to prevent regrowth from stumps (fires induce a massive flush of gorse seed germination from the seed in the soil bank[37] so that gorse seedlings cover the ground like grass)

- Close planting of nursery grown colonising shrub species over the cleared slopes (Root trainer to PB5 size grades planted at about 1.3m spacing), including quick growing tree lucerne (at about five metre spacing to provide initial shelter and nutrients (like gorse it fixes nitrogen). Note, potash is left by burning but quickly leaches away. Adding a slow release fertiliser at planting assists quick establishment

- Spot spraying followed by monitoring and manual releasing, for up to three years, to prevent regrowth of gorse until sufficient canopy closure inhibits grass and gorse reestablishment

- Enrichment planting with species requiring shelter. This requires good plant knowledge as shelter and light needs vary significantly between species. Selective removal of plants is also helpful to promote diversity in the planted bush but can be emotionally difficult given the effort put into their establishment

[35] Planting in the season immediately following the fire was also done to re-establish a protective margin to the edges of the Cannons Creek bush remnant exposed by the fire.
[36] Developed by John Hodges. Refer to footnote 11
[37] In the years following the fire, as gorse re-established, initial labour input has shifted from spraying seedling growth to clearing established gorse plants

On-going (sprayed) herbicide control of gorse is critical. The approach is also reliant on having large numbers of nursery plants available and a ready supply of labour to clear, plant and monitor.

In the restoration area, by effectively eliminating the gorse scrub phase that follows burning, the approach reduces the time for bush to develop by up to about 25 years.

If such planting is done directly into pasture with no gorse present the reduction can be closer to 40 years. However, it is extremely resource intensive and so usually needs to be targeted to limited areas. Less labour intensive approaches are being developed based around selective herbicides, limited or minimal cultivation and direct seeding which may, in the future, provide more expansive revegetation options.

4.2 The Friends plant selection and planting notes[38]

All species being used are grown from seed sourced from the Inland Wellington – Porirua ecological zone and have been recorded locally (excluding tree lucerne). Species choices are guided by the initial botanical survey included in the first restoration plan, and by the BRP species lists referred to in the Parks Network Plan survey of BRP, and from Porirua Trust Park, Porirua Scenic Reserve, and Judgeford Queen Elizabeth Covenant.

Note: Planting should not be carried out within 20 metres of any boundary fence between the Restoration Area and farmland, due to the need for fence lines to be kept clear of vegetation for the purpose of maintenance. Spraying is often used for this purpose. Negotiate with farm management if need be.

- Initial shelter planting of tree lucerne (*Chamaecytisus palmemtsis*)
  Quick growing shade provider. Its primary purpose: to quickly provide shelter on exposed slopes for native coloniser plantings[39]

  (This is the only non-indigenous, non eco-sourced species recommended. It will normally be over-topped and die in 5–10 years; otherwise it should be cut out.)

  Plant 3 to 5 paces from each other, and 1 pace from other primary colonizing species. Plant on all areas newly cleared of gorse, and along track sides at least 1 pace from the track edge

- Tracksides: quick growing light demanding species to provide shade and suppress grass. Plant no further than 1 pace apart:

  Coprosma areolata
  Coprosma robusta
  Haloragis erecta
  Hebe stricta

[38] Compiled by Neil Bellingham of Friends of Maara Roa
[39] It also increases soil fertility by fixing nitrogen and the young shoots and flowers are a sought after food of kereru in early spring.

Olearia solandri
Ozothamnus leptophyllus
Pittosporum tenuifolium

- Hardy species that will grow on steep slopes and skeletal soils. Plant 1 pace apart:
  Coprosma robusta
  Dodonaea viscose
  Olearia solandri
  Ozothamnus leptophyllus
  Pittosporum tenuifolium

  These are appropriate to the 'Gutbuster track', the Sleeping Partners, and the knoll between the farm track and the Maara Roa (Cannons Creek) covenant

- Primary colonizing species which will quickly provide shade and ground cover, thus suppressing rank grass, and providing shelter for species that need protection from sun or wind. Plant 1 pace apart:

  Coprosma robusta
  Coprosma grandifolia
  Kunzea ericoides
  Melicytus ramiflorus
  Pittosporum eugenioides
  P. tenuifolium
  Pseudopanax arboreus
  Solanum aviculare

  These sites can also support emergent trees such as Podocarpus Totara, and Metrosideros robusta[40] and on deep soils, Dacrycarpus dacrydioides

- Species which will establish with some degree of shelter — usually planted one to three years after the Tree Lucerne and the primary colonizers. Some of these will be potential sub-canopy or canopy trees. Plant potential canopy trees at least 3 paces from each other:

  Aristotelia serrata
  Brachyglottis repanda
  Coprosma grandifolia
  Elaeocarpus dentatus
  Fuchsia excorticata
  Griselinia lucida
  Hedycarya arborea
  Knightia excelsa
  Macropiper excelsum
  Myrsine australis
  Prumnopitys ferruginea
  Pseudopanax crassifolius

[40] Not included in the BRP species list but recorded in the nearby Porirua Scenic Reserve.

Solanum aviculare

- Infill planting of emergent forest trees in canopy gaps and light wells. These need some light in the growing stages, but also must have protection from desiccating winds, and sometimes from frosts. Potential emergents should be planted 15 or more paces apart:

  Alectryon excelsus
  Beilschmedia Tawa
  Elaeocarpus dentatus
  Laurelia novae-zelandiae
  Podocarp spp

- Riparian planting — frequently flooded vegetation of valley floors and stream beds**:**
  Phormium tenax
  Carex secta

- Riparian planting — Banks and low slopes, occasionally flooded. Planting distances vary according to species and situation

  Coprosma robusta
  Cordyline australis
  Dacrycarpus dacrydioides
  Melicytus ramiflorus

Part 4: Monitoring

1. Introduction

Monitoring is undertaken to:

- Fine tune current restoration interventions such as pest control and planting survival
- Assess long term trends such as changes in animal species present and land cover
- Collect specialist information as a basis for changing restoration management approaches

2. Incidence of Category 1 plant pests and pest possums

GWRC annually to biennially inspect locations where Category 1 plant pests have been previously controlled (see Part Two). Now there are unlikely to be mature Category 1 plant pests on GWRC land and control is focused on removal of seedlings and young plants. Volunteers can assist with control by recording the location of any remaining mature Category 1 pest.

GWRC undertake a three yearly survey of possum numbers. The two surveys done while the Friends have been controlling possums show they are present in minimal numbers.

3. Survival of nursery grown plant stock

Monitoring plant survival rates, growth, levels of competition, time taken to achieve canopy closure, etc. all provides valuable information for future work and also helps refine subsequent plant management. The results from monitoring plantings need to be recorded systematically, the results evaluated and remedial action taken as necessary.

The Friends system for coloniser broadleaf plantings to establish green firebreaks is outlined in Part Three: Regeneration of native vegetation. There have been almost 10 years of refinements matching site conditions with plant selection and management during plant establishment.

Site specific methods for successful microsite enrichment plantings for forest succession, into light wells and under canopy, are being developed by the Friends. Each species tends to have quite specific and differing requirements for (sun) light, soil drainage, soil moisture, and wind shelter and frost protection.

4. Bird surveys

Monitoring of bird diversity and density in the area began in 2001 under the guidance of Dr Hugh Robertson of DOC. The technique used is a standard one followed by many voluntary restoration groups, known as the Five Minute Bird Count, established in New Zealand from 1975. Results of the first three surveys in 2001, 2006, and 2011, are held in the Friends' records as well as being forwarded to GWRC Environmental Science (Monitoring) section. The

intention is to increase the frequency of these surveys, subject to the assistance of professional staff or experienced ornithological society members.

The Friends members are also encouraged to report random sightings of specific native birds, with photos if possible.

5. Photopoints

Photopoints illustrating the qualitative changes that occur in vegetation cover can be a particularly effective way to illustrate the progress of a restoration project. View A) and View B) (refer to Map 1) show overviews of the Takapu and Cannons Creek covenants respectively. A photopoint in the Glenview School grounds (refer to Part 2, 4.2.1 Current green firebreaks) provides a good overview of the planting focussed regeneration through the years showing:

- The Green firebreaks planted following the 2003 fire
- The residual area burnt in 2003 and left to regrow gorse
- An area cut over by hand in the late 1980s between Glenview School and Takapu covenant (Glenview gully slopes)
- An area of hillside burnt in 1997on the west side of Cannons Covenant

GWRC can provide a protocol for the photography and a data format so that it could be combined with GWRC data for more general use. In BRP, GWRC already have two photo points in the vicinity of “Baked beans Bend”, in Korokoro Valley. These are to record qualitative changes in the mature native vegetation cover.

6. Specialist monitoring

6.1 Animal tracking

Animal tracking can record the presence of introduced pests like rodents and hedgehogs, the presence of native animals like lizards and skinks, and even the presence of invertebrate animals like weta and be used to assess their relative presence in the ecosystem. If appropriate, GWRC will provide basic information and logistic support to the Friends to initiate such monitoring.

No monitoring, apart from possums, is being done at present. As the presence of native animals and invertebrates is expected to rise with the shift towards native vegetation in the area, it could be appropriate to monitor more kinds of animals, particularly rodents and target their control more directly if they are considered to be problematic. Currently, rodents are not targeted except as bi-catch from the possum control operation.

6.2 Phenology

For some years Rangers and volunteers made monthly recordings of flowering and fruiting across the parks and forests. Both the abundance and timing of flowering and fruiting was recorded (Hanford, P, 2002, Native Forest

Monitoring. A guide for forest owners and managers. FRONZ). However, they have been largely discontinued because of the variability in results

6.3 Vegetation composition

A number of protocols for detailed recording of plant species at a location have been developed. A valuable record of forest regeneration can be collected if locations are resampled over many years. To do this transect sites were set up in the restoration area (as per Hanford, P, 2002, Native Forest Monitoring. A guide for forest owners and managers. FRONZ). However, the periodic work is laborious and it has proven difficult for volunteer organisations to build up the skill level and long term commitment required to obtain quantitative results. In particular, the progression of vegetation changes from pasture through gorse to native bush is now well accepted. To show this transition it is far easier to collect qualitative records from photopoints.

6.4 Predators

Though feral cats and mustelids are seen in the area, no attempt has been made to monitor their presence with a view to adding these species to the animal pest control plan. At this time, with no ground-nesting birds present, it is considered that they have a role in the controlling introduced animals like rats, mice, rabbits and hares.

Part 5: Recreation

1. Introduction

The recreational value that is being created by the restoration of the area to native bush and, ultimately, forest is a prime justification for the effort and resources being put in to it[41].

In particular, green firebreaks along tracks and enrichment planting into microsites for ecological purposes significantly improves the natural experience for people using tracks in the restoration area. The location and intensity of restoration efforts should be guided somewhat by such potential gains.

The Park Network Plan identifies Cannons Creek as the main entrance to Belmont Regional Park from suburban Porirua with its large population and the 3.5 kilometre park boundary alongside eastern Porirua city. Similarly, the Takapu Road end has a main entrance giving access for residents of the northern suburbs of Wellington City, where population is also increasing. This western side of Belmont Regional Park, bought by GWRC in 2005, has been managed for pastoral farming for decades with very limited public access. Currently, the facilities provided are fewer and of lesser standard than those at the main entrances from the Hutt City suburbs on the eastern side of the park.

The Park Network Plan recreation focus is on walking and biking as a way to encourage physical exercise while introducing or giving people access to the natural environment. The character of the existing bush remnants and restoration work being done by the Friends are a feasible destination and purpose to draw people into the area. The proposed motorway development also means that regional links will need to be reconsidered if it goes ahead.

In 2013 Greater Wellington Regional Council and PCC will begin developing an integrated recreational plan for the open space areas in the eastern Porirua city suburbs and north-western side of BRP. Recreational use of the restoration area will be included.

Usage was low when surveyed for a day in 2011. The next survey is programmed for 2016. Installation of a track counter near the lower stile would provide a useful baseline level for current recreational usage.

2. Role of the Friends of Maara Roa

GWRC is responsible for construction and upkeep of recreational assets such as paths and tracks and associated structures and signs. However, without the Friends the valley would be very different, and they will have significant input to public track planning. As an incorporated society they also have the ability to source funds apart from GWRC to implement planned developments.

It is the Friends preference to separate mountain bikers from walkers where tracks and paths are narrow, for example on the east side of Cannons Lakes

[41] The restoration is also justified as part of the creation of the ecological link from Porirua to Hutt valley via Korokoro catchment, proposed in the Park Network Plan

Reserve, or where bikers speeding becomes a danger to walkers, for example down the "Gutbuster" where the track drops steeply down to enter Cannons Creek Lakes Reserve. How GWRC and PCC manage bikers will be addressed in their recreational planning.

As frequent visitors, the Friends are able to act as 'eyes and ears' for the Park Ranger. Reports to the Park Ranger of the condition of tracks and structures, instances of vandalism or other misbehaviour, and suggestions for improvements are encouraged. An annual track check has been carried out by experienced walkers from the Friends, with a report and photos provided both for the Ranger and the Friends guides, prior to the summer hiking season.

As part of restoration area protection efforts, the Friends use and maintain non-public access lines to bait stations. As part of regeneration efforts they may also need non-public access lines to microsites for enrichment planting. Where possible these access lines should anticipate future public paths and tracks, especially where track formation is needed.

Appendix: Plant species list for Cannons Creek

Yellow highlight means the plant species is not in Mitcalf's 2003 Belmont list

Planting Style: C = coloniser, E = enrichment

Planting conditions: O = exposed, SS = some shelter or large lightwell, CS = close shelter or small lightwell, UC = under canopy

Common name, comments: * = Male and female sexes on different plants. Several individuals are needed to ensure fruiting

Month: N = nectar in flowers, F = fruit (eaten by birds)

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
Regenerating scrub/bush	E	SS	Titoki*	*Alectryon excelsus*					F	F	F	F	F				
Mature canopy or under canopy			Titoki*	*Alectryon excelsus*					F	F	F	F	F				
Regenerating scrub/bush	E	UC	Karapapa (requires always moist soil)	*Alseuosmia pusilla*	N	N	N	N	N	N			F	F	N	N	
Revegetation plantings	C	SS	Wineberry* , favoured possum food	*Aristotelia serrata*								F	F	F	F	F	
Regenerating scrub/bush	E	CS	Hutu* (small infrequent tree)	*Ascarina lucida*						F	F	F	F				
Regenerating scrub/bush			Fern , moist, fertile	*Asplenium bulbiferum*													
Climbers or epiphytes in canopy			Fern	*Asplenium flaccidum*													
Regenerating scrub/bush			Fern , tolerates light	*Asplenium oblongifolium*													
Climbers or epiphytes in canopy			Fern	*Asplenium polyodon*													
Climbers or epiphytes in canopy	E	CS	Fragrant astelia*	*Astelia fragrans*					N	N	F	F	F	F	F	F	
Climbers or epiphytes in canopy	E	SS	Kowharawhara / Astelia*	*Astelia solandri*	N,F	F	F	F	N,F	N,F	N,F	N,F	N,F	N,F	N,F	N,F	

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
Regenerating scrub/bush	E	SS	Tawa	*Beilschmiedia tawa*							F	F	F	F	F		
Mature canopy or under canopy			Tawa	*Beilschmiedia tawa*							F	F	F	F	F		
Regenerating scrub/bush			Fern , moist, shady	*Blechnum chambersii*													
Regenerating scrub/bush			Fern , moist, shady	*Blechnum discolor*													
Regenerating scrub/bush			Fern , shade, wet/streamside	*Blechnum filiforme*													
Regenerating scrub/bush			Fern , shade, wet/streamside	*Blechnum fluviatile*													
Regenerating scrub/bush			Fern , tolerates light	*Blechnum novae-zelandiae*													
Regenerating scrub/bush			Fern , moist, well-lit	*Blechnum penna-marina*													
Regenerating scrub/bush			Fern	*Blechnum procerum*													
Regenerating scrub/bush			Fern , deep shade	*Botrychium biforme*													
Regenerating scrub/bush	E	CS	Kirks daisy , (browsed out) also an epiphyte	*Brachyglottis kirkii*													Looks a bit like a pseudopanax. May have been present on cool moist slopes
Revegetation plantings	E	SS	Rangiora	*Brachyglottis repanda*													
Wetland			Cutty grass	*Carex geminata*													
Wetland				*Carex secta*													
Wetland				*Carex virgata*													
Revegetation plantings	E	SS	Native broom (browsed out, scrub and streamsides)	*Carmichaelia australis*					N	N	N	N	N	N			Mitcalf advises to reintroduce
Mature canopy or under canopy			Putaputaweta , spread by small birds and tolerant of possum browse	*Carpodetus serratus*		F	F	F	F	F	F	F	F				
Revegetation plantings	C	SS	Putaputaweta , spread by small birds and tolerant of possum browse	*Carpodetus serratus*		F	F	F	F	F	F	F	F				

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
Revegetation plantings	C	O	Tree lucerne , exotic	*Chamaecytisus palmemtsis*													Food for kereru, grows quickly in full sun and dry for shelter, N fixer, mistletoe host
Climbers or epiphytes in canopy	E	CS	Kahakaha / perching lily* (common epiphyte)	*Collospermum hastatum*	F	F	F				N	N	N	F	F	F	
Revegetation plantings	C	O	thin-leaved coprosma (divaricating grows in moist well drained)	*Coprosma areolata*	N									F	F	N	
Regenerating scrub/bush	E	SS	Stinkwood* (common)	*Coprosma foetidissima*	F										F	F	
Revegetation plantings	C	SS	Kanono*	*Coprosma grandifolia*	F	F							F	F	F	F	
Regenerating scrub/bush	C	SS	Kanono*	*Coprosma grandifolia*	F	F							F	F	F	F	
Regenerating scrub/bush	C	SS	Karamu*	*Coprosma lucida*								F	F	F	F		
Revegetation plantings	C	O	Mingimingi (soft)	*Coprosma propinqua*										F	F	F	
Regenerating scrub/bush	C	O	Mingimingi (soft)	*Coprosma propinqua*										F	F	F	
Revegetation plantings			Taupata* (coastal)	*Coprosma repens*							F	F	F				
Regenerating scrub/bush	C	O	Twiggy coprosma*	*Coprosma rhamnoides*									F	F	F		
Revegetation plantings	C	O	Twiggy coprosma*	*Coprosma rhamnoides*									F	F	F		
Revegetation plantings	C	O	Karamu*	*Coprosma robusta*	F	F	F						F	F	F	F	
Regenerating scrub/bush	E	SS	Round-leaved coprosma* (streamside)	*Coprosma rotundifolia*									F	F	F	F	
Revegetation plantings	E	SS	Round-leaved coprosma* (streamside)	*Coprosma rotundifolia*									F	F	F	F	
Revegetation plantings			Cabbage tree	*Cordyline australis*				N	N	N	N	F	F	F			
Regenerating	E	UC	Forest cabbage tree	*Cordyline banksii*						N	N	N	F	F	F		

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
scrub/bush																	
Mature canopy or under canopy			Forest cabbage tree	*Cordyline banksii*						N	N	N	F	F	F		
Revegetation plantings			Mountain cabbage tree	*Cordyline indivisa*							N	N	F	F	F	F	
Revegetation plantings	E	O	Tutu (browsed out)	*Coriaria arborea*						F	F	F	F	F	F		
Regenerating scrub/bush	E	O	Wire Netting Bush (common)	*Corokia cotoneaster*								F	F	F	F	F	
Revegetation plantings			Korokio	*Corokia cotoneaster*								F	F	F	F	F	
Revegetation plantings			Toe toe	*Austroderia toe toe*													Fire hazard
Regenerating scrub/bush			Karaka	*Corynocarpus laevigatus*									F	F	F		Avoid as not local
Mature canopy or under canopy			Karaka	*Corynocarpus laevigatus*								F	F	F	F	F	Avoid as not local
Regenerating scrub/bush			Fern	*Ctenopteris heterophylla*													
Regenerating scrub/bush			Tree Fern , streamside, shade	*Cyathea cunninghamii*													
Regenerating scrub/bush			Tree fern ,silver fern (tolerates dry sites)	*Cyathea dealbata*													
Regenerating scrub/bush			Tree Fern ,mamuku (moist)	*Cyathea medullaris*													
Regenerating scrub/bush			Tree fern ,shade	*Cyathea smithii*													
Regenerating scrub/bush	E	O	Mingimingi (soft)*	*Leucopgon fasciculatus*				F	F	F	F	F	F	F	F	F	Try on ridge crests and dry slopes. Requires control of gorse
Regenerating scrub/bush	E	O	Mingiminqi (prickly)*	*Leptecophylla juniperina*	F	F	F	F	F	F	F	F	F	F	F	F	Good to reintroduce but difficult to propagate. Dislikes shade
Revegetation plantings			Mingiminqi (prickly)* slow growing	*Leptecophylla juniperina*	F	F	F	F	F	F	F	F	F	F	F	F	Good to reintroduce but difficult to propagate
Wetland			Giant umbrella sedge	*Cyperus ustulatus*													
Future Emergent trees			Kahikatea* best in full sum and moist	*Dacrycarpus dacrydiodes*	F			F	F	F	F	F	F	F	F	F	
Regenerating scrub/bush	E	O	Kahikatea* best in full sum and moist	*Dacrycarpus dacrydiodes*	F			F	F	F	F	F	F	F	F	F	

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
Revegetation plantings	E	O	Kahikatea* best in full sum and moist	*Dacrycarpus dacrydiodes*	F			F	F	F	F	F	F	F	F	F	
Future Emergent trees			Rimu* ,sun and good drainage	*Dacrydium cupressinum*									F	F	F		
Regenerating scrub/bush	E	SS	Rimu* ,sun and good drainage	*Dacrydium cupressinum*									F	F	F		
Revegetation plantings	E	SS	Rimu* ,sun and good drainage	*Dacrydium cupressinum*									F	F	F		
Regenerating scrub/bush			NZ blueberry	*Dianella nigra*							F	F	F	F			
Regenerating scrub/bush			Tree fern ,shade	*Dicksonia fibrosa*													
Regenerating scrub/bush			Tree fern ,wheki (shade/light)	*Dicksonia squarrosa*													
Revegetation plantings	C	O	Ake ake, full sun dry exposed coastal	*Dodonaea viscosa*													Wind distributed
Mature canopy or under canopy			Kohekohe* , spread by small birds and tolerant of possum browse	*Dysoxylum spectabile*	N,F	N	F	F						N	N	N	Being well dispersed by birds. No need to plant
Regenerating scrub/bush	E	CS	Hinau , cool moist tolerant of possum browse	*Elaeocarpus dentatus*									F	F	F	F	
Mature canopy or under canopy			Hinau , cool moist tolerant of possum browse	*Elaeocarpus dentatus*									F	F	F	F	
Regenerating scrub/bush	E	UC	Pokaka ,cool moist shade	*Elaeocarpus hookerianus*						F	F	F	F	F	F		
Revegetation plantings			Whau (at seaside)	*Entelea arborescens*					N	N	N	N					Proabably wasn't present
Climbers or epiphytes in canopy	E	UC	Kiekie* (present in Cannons Ck)	*Freycinetia banksii*									F	F	F		
Regenerating scrub/bush	E	CS	Kotukutuku / tree fuchsia* , favoured possum food	*Fuchsia excorticata*			N	N	N	N,F	N,F	N,F	N,F	F	F	F	
Mature canopy or under canopy			Kotukutuku / tree fuchsia* , favoured possum food	*Fuchsia excorticata*			N	N	N	N,F	N,F	N,F	N,F	F	F	F	

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
Revegetation plantings	E	CS	Kotukutuku / tree fuchsia* , favoured possum food	*Fuchsia excorticata*			N	N	N	N,F	N,F	N,F	N,F	F	F	F	
Revegetation plantings	E	SS	Bush snowberry (moist, sun, rocky, fertile)	*Gaultheria antipoda*													
Regenerating scrub/bush			Hangehange, NZ privet	*Geniostoma ligustrifolium*													Being well dispersed by birds. No need to plant
Revegetation plantings	C	CS	Hangehange, NZ privet	*Geniostoma ligustrifolium*													
Mature canopy or under canopy			Broadleaf*	*Griselinia littoralis*	F	F	F								F	F	
Revegetation plantings	C	SS	Broadleaf*	*Griselinia littoralis*	F	F	F								F	F	
Climbers or epiphytes in canopy	C	SS	Puka, Shining Broadleaf*	*Griselinia lucida*	F	F				F	F	F	F	F	F	F	Plant in ground
Revegetation plantings	C	O	Toatoa, best in full sun, groundcover filler	*Haloragis erecta*													
Revegetation plantings	C	SS	Tree Koromiko (in scrub)	*Hebe parviflora*							N	N	N	N			
Revegetation plantings	C	O	Willow koromiko	*Hebe stricta*							N	N	N	N	N		
Regenerating scrub/bush	E	CS	Pigeonwood*	*Hedycarya arborea*	F	F	F	F	F	F	F	F	F	F	F	F	
Revegetation plantings	E	CS	Pigeonwood*	*Hedycarya arborea*	F	F	F	F	F	F	F	F	F	F	F	F	
Mature canopy or under canopy	E	CS	Pigeonwood*	*Hedycarya arborea*	F	F	F	F	F	F	F	F	F	F	F	F	Not a preferred fruit of kereru but eaten by many birds
Revegetation plantings	E	SS	Lacebark; Houhere	*Hoheria sextylosa*	N									N	N	N	fast pioneer tree for valley flats
Regenerating scrub/bush			Fern , moist, shady	*Hymenophyllum bivalve*													
Regenerating scrub/bush			Fern	*Hymenophyllum demissum*													
Regenerating scrub/bush			Fern	*Hymenophyllum dilatatum*													
Regenerating scrub/bush			Fern	*Hymenophyllum ferrugineum*													

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
Regenerating scrub/bush			Fern	*Hymenophyllum multifidum*													
Regenerating scrub/bush			Fern	*Hymenophyllum revolutum*													
Regenerating scrub/bush			Fern	*Hymenophyllum sanguinolentum*													
Regenerating scrub/bush			Fern	*Hymenophyllum scabrum*													
Regenerating scrub/bush			Fern	*Hypolepsis ambigua*													
Regenerating scrub/bush			Fern , moist, shady	*Hypolepsis rufobarbata*													
Climbers or epiphytes in canopy	E	SS	Mistletoe	*Ileostylus micranthus*					N	N	N	F	F	F	F		grows on a wide range of native (esp. P totara) and exotic host trees
Wetland				*Juncus gregiflorus*													
Wetland				*Juncus pallidus*													
Wetland				*Juncus sarophorus*													
Future Emergent trees			Rewarewa , sun and good drainage	*Knightia excelsa*					N	N	N	N					May be already present from wind blown seed sources.
Regenerating scrub/bush	E	UC	Rewarewa , sun and good drainage	*Knightia excelsa*					N	N	N	N					May be already present from wind blown seed sources.
Climbers or epiphytes in canopy	E	SS	Leafless mistletoe	*Korthalsella lindsayi*													Grows on kabuki, C propinqua scrub
Revegetation plantings	C	O	Kanuka	*Kunzea ericoides*					N	N	N	N					Fire prone
Regenerating scrub/bush			Fern , moist, shady	*Lastreopsis glabella*													
Regenerating scrub/bush			Fern , moist, shady	*Lastreopsis hispida*													
Regenerating scrub/bush			Fern , moist, shady	*Lastreopsis hymenophylloides*													
Regenerating scrub/bush			Fern , moist, shady	*Lastreopsis rufobarbata*													
Mature canopy or under canopy			Pukatea (swamp, gully)	*Laurelia novae-zelandiae*													
Revegetation plantings			Manuka	*Leptospermum scoparium*				N	N	N	N	N	N				Fire prone, plant where soil is depleted

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
Revegetation plantings			full sun	*Libertia grandiflora*													
Regenerating scrub/bush	E	SS	Ramarama ,prefers slopes	*Lophomyrtus bullata*						N	N	N,F	N,F	F	F		
Mature canopy or under canopy			Ramarama	*Lophomyrtus bullata*						N	N	N,F	N,F	F	F		
Regenerating scrub/bush	E	CS	Rohutu	*Lophomyrtus obcordata*							N	N	N	F	F	F	
Mature canopy or under canopy			Rohutu	*Lophomyrtus obcordata*							N	N	N	F	F	F	
Revegetation plantings	C	SS	Kawakawa*	*Macropiper excelsum*	F	F	F	F	F	F	F	F	F	F	F	F	
Regenerating scrub/bush	C	O	Divaricating small leaved shrub	*Melicope simplex*	F	F	F							N	N	F	May be present already
Regenerating scrub/bush	C	SS	Wharangi, coastal tree to 5m	*Melicope ternata*	F	F	F							N	N	F	Easily grown but probably wasn't present
Revegetation plantings	C	SS	Wharangi, coastal tree to 5m	*Melicope ternata*	F	F	F							N	N	F	Easily grown but probably wasn't present
Regenerating scrub/bush	E	O	Narrow leaved Mahoe* ,full light	*Melicytus lanceolatus*	N	F	F	F	F	F	F	F	F				
Mature canopy or under canopy			Narrow leaved Mahoe* ,full light	*Melicytus lanceolatus*	N	F	F	F	F	F	F	F	F				
Regenerating scrub/bush	C	O	Mahoe* , tolerant of possum browse	*Melicytus ramiflorus*	F								F	F	F	F	
Mature canopy or under canopy			Mahoe* , tolerant of possum browse	*Melicytus ramiflorus*	F								F	F	F	F	
Revegetation plantings	C	O	Mahoe* , tolerant of possum browse	*Melicytus ramiflorus*	F								F	F	F	F	
Climbers or epiphytes in canopy		CS	White rata vine	*Metrosideros diffusa*				N	N	N	N						
Climbers or epiphytes in canopy		UC	Red rata vines	*Metrosideros fulgens*									N	N	N	N	grows under canopy
Climbers or epiphytes in canopy		CS	Small-leaved rata	*Metrosideros perforata*							N	N	N				
Future Emergent trees			Northern rata , intolerant of possum browse	*Metrosideros robusta*						N	N	N					Plant into soil (don't treat as an epiphyte)

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
Regenerating scrub/bush	E	SS	Northern rata , intolerant of possum browse	*Metrosideros robusta*						N	N	N					Plant into soil (don't treat as an epiphyte)
Mature canopy or under canopy			Northern rata , intolerant of possum browse	*Metrosideros robusta*							N	N	N				
Revegetation plantings	E	SS	Northern rata , intolerant of possum browse	*Metrosideros robusta*						N	N	N					Plant into soil (don't treat as an epiphyte)
Future Emergent trees			Southern rata (rarely present)	*Metrosideros umbellata*						N	N	N	N	N			
Regenerating scrub/bush			Bush grass (moist shade)	*Microlaena avencea*													
Regenerating scrub/bush			Fern , shade or light	*Microsorum pustulatum*													
Regenerating scrub/bush			Mida* (rare in Wellington, small tree, root parasite)	*Mida salicifolia*						F	F	F	F	F			Present in Jacobson covenant
Revegetation plantings			Ngaio	*Myoporum laetum*		F	F			N	N		F	F	N	N	
Regenerating scrub/bush	C	SS	Mapou* , tolerant of possum browse	*Myrsine australis*					F	F	F	F	F	F	F	F	
Mature canopy or under canopy			Mapou* , tolerant of possum browse	*Myrsine australis*					F	F	F	F	F	F	F		
Revegetation plantings	C	SS	Mapou* , tolerant of possum browse	*Myrsine australis*						F	F	F	F	F	F	F	
Regenerating scrub/bush	E	SS	Toro* , favoured possum food (eaten out by possums)	*Myrsine salicina*				F	F	F	F	F	F	F	F	F	
Revegetation plantings	E	SS	Toro* , favoured possum food (eaten out by possums)	*Myrsine salicina*					F	F	F	F	F	F	F	F	
Regenerating scrub/bush	E	SS	Rohutu ,prefers moist soil tolerates sun	*Neomyrtus pedunculata*									F	F	F	F	
Mature canopy or under canopy			Rohutu ,prefers moist soil tolerates sun	*Neomyrtus pedunculata*									F	F	F	F	

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
Regenerating scrub/bush			Ground cover nertera	*Nertera depressa*								F	F	F	F	F	
Regenerating scrub/bush	E	CS	Black maire*	*Nestegis cunninghamii*					F	F	F	F	F	F	F		
Mature canopy or under canopy			Black maire*	*Nestegis cunninghamii*					F	F	F	F	F	F	F		
Regenerating scrub/bush	E	CS	White maire*	*Nestegis lanceolata*						F	F	F	F	F	F	F	
Mature canopy or under canopy			White maire*	*Nestegis lanceolata*						F	F	F	F	F	F	F	
NOT ON WEST SIDE OF BRP			Black beech	*Nothofagus solandri*													
NOT ON WEST SIDE OF BRP			Hard beech	*Nothofagus truncata*													
Revegetation plantings			Common trea daisy	*Olearia arborescens*						N	N	N					self introduced?
Revegetation plantings	C	O	Akiraho	*Olearia paniculata*									N	N	N	N	
Revegetation plantings			Heketara	*Olearia rani*			N	N	N								self introduced
Revegetation plantings	C	SS	Coastal tree daisy	*Olearia solandri*													
Revegetation plantings	C	O	Tauhinu	*Ozothamnus leptophyllus*													
Climbers or epiphytes in canopy	E	SS	Maori jasmine (bush edge climber)	*Parsonia heterophylla*													Probaby already present
Climbers or epiphytes in canopy			Kohia passion vine*	*Passiflora tetranda*	F	F	F							F	F	F	
Mature canopy or under canopy	C	UC	Kaikomako*	*Pennantia corymbosa*									F	F	F	F	Probably lost from covenant
Revegetation plantings	E	CS	Kaikomako*	*Pennantia corymbosa*									F	F	F	F	
Climbers or epiphytes in canopy			Red Mistletoe (live on beech trees, eaten out by possums)	*Peraxilla tetrapetala; P colensoi*					N	N	N	N	F	F			would not have been present on west side of BRP?
Revegetation plantings	C	O	Flax (mountain)	*Phormium cookianum*						N	N	N					
Wetland	C	O	Flax (lowland)	*Phormium tenax*						N	N	N					

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
Climbers or epiphytes in canopy	E	SS	tāwhiri karo (shrub grows on branches and rocks)	*Pittosporum cornifolium*													Mitcalf says to reintroduce
Revegetation plantings	C	O	Tarata*	*Pittosporum eugenoides*	F	F			N	N				F	F	F	
Regenerating scrub/bush	E	CS	Heart-leaved kohuhu, mostly found on east coast riverflats	*Pittosporum obcordatum*					N	N	F	F	F				Divaricating, may grow in CCLRes.
Revegetation plantings	C	SS	Kohuhu*	*Pittosporum tenuifolium*				N	N	N			F	F	F	F	
Regenerating scrub/bush			Fern , streamside moist shade	*Pneumatopteris pennigera*													
Revegetation plantings			Silver tussock, (full light, low fertility, tolerates dry)	*Poa cita*													
Mature canopy or under canopy			Hall's Totara* (at high elevation), intolerant of possum browse	*Podocarpus cunninghamii*											F	F	
Future Emergent trees			Totara*	*Podocarpus totara*	F	F					F	F	F	F	F	F	
Regenerating scrub/bush	E	SS	Totara*	*Podocarpus totara*	F	F					F	F	F	F	F	F	
Mature canopy or under canopy			Totara* ,	*Podocarpus totara*	F	F		F		F		F	F	F	F	F	
Revegetation plantings	E	SS	Totara*	*Podocarpus totara*	F	F					F	F	F	F	F	F	
Regenerating scrub/bush			Fern , moist, deep shady	*Polystichum silvaticum*													
Regenerating scrub/bush			Fern , shade or light moist	*Polystichum vestitum*													
Regenerating scrub/bush	E	CS	Miro* ,cool moist	*Prumnopitys ferruginea*	F	F	F	F						F	F	F	
Mature canopy or under canopy			Miro* ,cool moist	*Prumnopitys ferruginea*	F	F	F	F						F	F	F	
Revegetation plantings	E	CS	Miro* ,cool moist	*Prumnopitys ferruginea*	F	F	F	F						F	F	F	
Future Emergent trees			Matai* ,tolerant of dry	*Prumnopitys taxifolia*							F	F	F	F	F	F	

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
Regenerating scrub/bush	E	CS	Matai* ,tolerant of dry	*Prumnopitys taxifolia*							F	F	F	F	F	F	Divaricating for decade plus
Mature canopy or under canopy	E	UC	Matai* ,tolerant of dry	*Prumnopitys taxifolia*							F	F	F	F	F	F	Divaricating for decade plus
Revegetation plantings	E	CS	Matai* ,tolerant of dry	*Prumnopitys taxifolia*							F	F	F	F	F	F	Divaricating for decade plus
Regenerating scrub/bush	C	SS	Fivefinger*	*Pseudopanax arboreus*	F	N,F	N,F	N,F	F	F	F	F	F	F	F	F	
Mature canopy or under canopy			Fivefinger*	*Pseudopanax arboreus*	F	N,F	N,F	N,F	F	F	F	F	F	F	F	F	
Revegetation plantings	C	SS	Fivefinger*	*Pseudopanax arboreus*	F	N,F	N,F	N,F	F	F	F	F	F	F	F	F	
Mature canopy or under canopy			Mountain fivefinger* , favoured possum food (eaten out by possums)	*Pseudopanax colensoi*	N	N	N	N	N				F	F	F	N	Might have been present at high elevation
Regenerating scrub/bush	E	SS	Lancewood, Horoeka*	*Pseudopanax crassifolius*	F	F	F	F						F	F	F	
Revegetation plantings	E	SS	Lancewood, Horoeka*	*Pseudopanax crassifolius*	F	F	F	F						F	F	F	
Regenerating scrub/bush	E	UC	Hotopito / Pepper tree	*Pseudowintera axillaris*	F				F	F	F	F	F	F	F	F	
Regenerating scrub/bush	E	SS	Horopito / pepper tree (colorata prefers forest edge / more light)	*Pseudowintera colorata*	F	F					F	F	F	F	F	F	
Revegetation plantings			Horopito / pepper tree (colorata prefers forest edge / more light)	*Pseudowintera colorata*	F	F					F	F	F	F	F	F	
Regenerating scrub/bush			Fern , moist, shady	*Pteris macilenta*													
Regenerating scrub/bush			Fern , shade or light	*Pyrrosia eleagnifolia*													
Revegetation plantings			divaricating shrub	*Raukaua anomalus*									F	F	F	F	
Regenerating scrub/bush	E	UC	Raukawa* (was Pseudopanax) browsed out	*Raukaua edgerleyi*	F	F								F	F	F	Often starts as a epiphyte on tree fern

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
Mature canopy or under canopy			Raukawa* (was Pseudopanax) browsed out	*Raukaua edgerleyi*	F	F								F	F	F	May have been occasionally present
Revegetation plantings	E	CS	Raukawa* (was Pseudopanax)	*Raukaua edgerleyi*	F	F								F	F	F	
Regenerating scrub/bush	E	CS	Haumakaroa* (eaten out by possums) (was Pseudopanax)	*Raukaua simplex*	F	F	F									F	May have been present on cooler moist slopes
Mature canopy or under canopy			Haumakaroa* (was Pseudopanax), favoured possum food (eaten out by possums)	*Raukaua simplex*	F	F	F									F	May have been present on cooler moist slopes
Regenerating scrub/bush	E	UC	Taurepo, NZ gloxinia (present at Battle Hill, light shade)	*Rhabdothamnus solandri*	N	N	N	N	N	N	N	N	N	N	N	N	
Regenerating scrub/bush	E	UC	Nikau *	*Rhopalostylis sapida*							N,F	N,F	N,F	F	F	F	Plant on sides of moist gullies
Mature canopy or under canopy			Nikau *	*Rhopalostylis sapida*							N,F	N,F	N,F	F	F	F	
Climbers or epiphytes in canopy			Supplejack	*Ripogonum scandens*	F	F	F	F	F	F	F	F	F	F	F	F	
Regenerating scrub/bush			Fern , tolerates light	*Rumohra adiantiformis*													
Regenerating scrub/bush	E	CS	Pate (targeted by possums)	*Schefflera digitata*	F	F	F	F									
Revegetation plantings	C	SS		*Solanum aviculare*													
Regenerating scrub/bush	C	SS	Poroporo	*Solanum laciniatum*	F			N	N	N,F	N,F	N,F	N,F	N,F	N,F	F	
Revegetation plantings	C	O	Common kowhai ,full light	*Sophora microphylla*			N	N	N								
Mature canopy or under canopy			Milk tree* (deep fertile soil)	*Streblus banksii*									F	F	F		
Mature canopy or under canopy			Turepo* (seeds eaten out by rats)	*Streblus heterophyllus*						F	F	F	F	F			
Revegetation plantings	E	CS	Turepo* (seeds eaten out by rats)	*Streblus heterophyllus*						F	F	F	F	F			Plant on valley flats

Native Vegetation Type	Planting style	Planting Conditions	Common name, comments	Botanical names	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Added comment
Regenerating scrub/bush	E	SS	Swamp Maire ,wet full light	*Syzygium maire*	F	F	F				N,F	N,F	N,F	N,F	F	F	
Mature canopy or under canopy			Swamp Maire	*Syzygium maire*	F	F	F				N,F	N,F	N,F	N,F	F	F	
Regenerating scrub/bush			Fern , moist, shady	*Trichomanes reiforme*													
Mature canopy or under canopy			Kamahi (low fertility, browsed by possums)	*Weinmannia racemosa*					N	N	N	N					

The Greater Wellington Regional Council promotes **Quality for Life** by ensuring our environment is protected while meeting the economic, social and cultural needs of the community

Cover photo:
A mature miro, with tawa behind, in a fire-damaged part of Cannons Creek conservation covenant, protected by seven year-old green firebreak plantings

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