



# FLOCKHILL

## Biodiversity Management Plan

“It is that range of biodiversity that we must care for - the whole thing - rather than just one or two stars.”

— Sir David Attenborough



## Introduction

The purpose of this Biodiversity Management Plan (BMP) is to align the vision of FLOCKHILL with what we know about biodiversity and how we manage it. As well as helping the farm, and facilitating better enjoyment of natural values, it will support the lodge to become a key focal point for people to experience the rich history and ongoing story of integration of people and nature on FLOCKHILL. The BMP recognizes the various beneficial actions which already occur and integrates them with biodiversity goals, while ensuring optimal return for effort for further action to improve the environment.

In pre-European times, the high country was a fundamental element in seasonal food gathering patterns, with families and hapū undertaking seasonal migrations to high country areas to gather weka and other Mahika Kai. It is important that these connections are recognised through a holistic approach to management, sharing of knowledge and accountability with Kaitiaki Rūnaka as appropriate, and correct representations through signage or other communications.

The environment of FLOCKHILL has been significantly altered since the arrival of humans around 800 years ago. At this time, the vegetation of FLOCKHILL consisted entirely of beech forest with grasslands, scrublands or mire in alpine areas, and open riverbeds and small areas of valley floor. The dry climate makes this forest somewhat vulnerable to fire, and the presence of people, both pre and post-European settlement has resulted in fires, creating the tussock grassland dominated high-country landscape with which we are familiar.

FLOCKHILL Station was originally part of the Craigieburn run, originally established by Joseph Hawdon in 1865, which extended from Broken River

to Lake Pearson, and from Waimakariri River to the Craigieburn Range. Craigieburn was owned and managed by various parties until 1917 when it was divided into what are now FLOCKHILL and Craigieburn Stations. Both FLOCKHILL and Craigieburn are pastoral leases on land owned by the University of Canterbury. The name 'Flock Hill' refers to the scattered limestone formations on the ridge to the north of Cave Stream which resemble a flock of sheep.

The land environment of FLOCKHILL has changed significantly over the past generation. The end of agricultural subsidies in the 1980s resulted in greatly reduced fertilizer use, which was in followed in turn by infestations of hieracium, which devastated tussock grasslands and greatly degraded productive and ecological value. Carrying capacity reduced from 20,000 to 5,000 stock units (sheep equivalents), much natural value was lost, and around 1/3 of the farm (4000 ha) became infested with wilding pines.

Richard and Anna Hill, the current managers, became involved in FLOCKHILL in 2004. They initially leased the station before becoming managers when it was acquired by Flock Hill Holdings in 2015. Since 2015 significant effort has gone into protecting ecological values (primarily through ecological fencing of Vagabonds, Blackwater, and other wetlands and waterbodies), removing wilding pines, renovating hieracium infested grassland, and developing the lodge. Around 1,000 ha of the property is now in improved pasture or lucerne carrying 7,000 stock units, with the balance in tussock grassland, wetlands, and native scrub or regenerating forest. Much of this work has been undertaken to comply with Overseas Investment Office conditions<sup>1</sup>.

Prepared by James Lambie and Michael Bennett, October 2021

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<sup>1</sup>Overseas Investment Office Notice of Decision: Case 200920041







## Vision and Management Objectives

A 100 year-vision has been written to reflect the unique environment of FLOCKHILL which transcends lifetimes, and what we intend to leave behind for future generations to enjoy. This is supported by a 10-year vision to anchor our response to current challenges and opportunities for biodiversity in the short term.

### 10 Year Vision

Environmental outcomes are overwhelmingly better than if we were not here and cultural and biophysical values on FLOCKHILL are widely recognized as exceptional.

FLOCKHILL Station and Lodge operations are in harmony, both in a business sense, and in terms of the environment on which they depend on and influence. Both businesses perform at a top level. Lodge guests are fully exposed to the integration of nature and human use which takes place on FLOCKHILL, and consistently report their experiences as life changing.

The exceptional harmony with nature and farming/human use which takes place on FLOCKHILL is widely known and recognized and drives very positive outcomes both directly for the Lodge and indirectly in terms of how FLOCKHILL and other high-country farms are perceived socially in New Zealand and intern100 Year Vision

Human uses are completely integrated with natural and heritage values, despite significant the challenges of climate change and political and economic disruption.

Streams, wetlands, tussock-lands, and native forest are in full health and sustain a rich variety and abundance of bird, lizard, and invertebrate species and successive native plant communities continue to be actively managed

and sustained. Pest plant and animal species, including hieracium are eliminated. FLOCKHILL and associated high country properties have pride of place as a key part of the rich biological and research heritage of the University of Canterbury. It is an exemplar of integration of natural farming system and a rich 250-year tradition of New Zealand High Country Farming, and over 1000 years of customary use by Tangata whenua.

### 10 Year Biodiversity Goals

The following biodiversity goals support our vision and are the basis of the management program developed through this plan:

Goal 1. Maintain indigenous dominance of wetland systems.

Goals 2. Maintain the currently excellent water quality and health of lakes and streams.

Goal 3. Elevated areas (Broken Hill/Constitution Hill, Nomans Land, parts of Tarnmoor) continue their current trajectory of a very slow change from tussock country to mixed Matagouri, native shrubland habitat and eventually alpine totara and black beech.

Goal 4. Maintain or improve rare plant and animal communities in Limestone areas.

Goal 5. Forest and scrubland communities are in a good state of ecological health and display a natural successional trajectory.

Goal 6. Cats, possums, pigs, deer, and wasps are managed to very low levels, and restoration has increased food resources to the point that native birds have become more abundant than any time the past generation.







## The History and Values of FLOCKHILL<sup>2</sup>

Over the last few million years the central South Island landmass has undergone a major episode of mountain building. Ancient (Mesozoic) marine sediments (sandstone and mudstone) were thrust upwards, creating a highland crisscrossed with giant faults, which was in turn eroded by water and ice ages to shape mountain ranges and valleys. The last glaciation 75,000 to 14,000 years ago shaped most of the high-country landscape we see today.

At the time of the arrival of Polynesian settlers, around 1300 AD, the landscape was more heavily forested than it is today. Unfortunately, this forest is vulnerable to fire in dryer parts of the high country (which includes FLOCKHILL), and increased incidence of fire, combined with further burning to clear land for grazing following European arrival in the 1850s, has created the wide expanses of tussock grassland, woody scrubland, and forest remnants which we are familiar with today.

The primary aim of pastoralists was meat and wool production. Most of the high country, including the eastern part of the Waimakariri Valley was grazed from the valley floor to the mountaintops. Known as 'runs', each farm had a homestead base (the station) with houses, yards, and shearing sheds. Much of the farm work was done on horse-back, with heavy loads moved by bullock wagons.

By the late 19<sup>th</sup> century, wire fencing bounded and subdivided the runs and cattle became more common. This style of farming persisted relatively unchanged until after the Second World War. The past 50 years have seen major changes in the high-country way of life. Persistently low wool prices have led farmers to explore other options such as tourism, deer farming, or (on FLOCKHILL) growing of lucerne to displace hieracium infested pasture, better utilize moisture, and make the most of a short grazing season.

## Vegetation on FLOCKHILL Today

FLOCKHILL includes 7650 hectares of moderate to high biodiversity value native bush, scrub and extensively grazed tussock land, mixed native and exotic grasslands, wetlands, limestone rock and scree habitat. The beech forest which once covered the landscape is now confined to the gully heads of Broken Hill, Nomans Land and the Broken River escarpments. The main indigenous vegetation and other habitat types of interest for maintaining the indigenous biological diversity on FLOCKHILL are: Beech forest, which is by far the most abundant mature forest type on FLOCKHILL. The two beech species (Black and Mountain Beech) both host a scale insect which exudes honeydew, which in turn supports the distinctive black mold which covers the bark of these trees.

Broadleaved shrublands of koromiko, kohuhu, and others of the glossy-leaved indigenous shrubs and trees represent habitats that are in a secondary state of advancement toward the original forest and shrubland cover types. Matagouri dominated shrubland, which is abundant on uncultivated floodplains and hillsides, often associated with many other species of divaricating or tangle shrub species. Matagouri can grow to small tree size and can reach 200 years old. It may form impenetrable, dense thickets. At the other extreme it is often just a low shrub dotted through grassland.

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<sup>2</sup> Adapted from Winterbourn M. et.al. (2008) The Natural History of Canterbury. University of Canterbury Press







Other mixed indigenous shrubland with high proportions of kanuka and/or manuka. Kanuka and manuka spread quickly from windblown seeds and often recolonizes areas very quickly, forming almost pure stands, after fire. The mixed indigenous shrublands will revert to beech forest over about 20-50 years if seeds or seed sources are present. Limestone rock and talus, which supports a distinctive and rare set of plants and animals adapted to the high fertility and dry environment of these areas.

Wetlands, which are inhabited by distinctive communities of plants adapted to wet conditions. They are often found on valley floors, or on hill sides, where water accumulates or seeps out of the ground. Many of these areas are dominated by Red Tussock, a tall tussock which can grow over 1.5 m tall and has a wide variety of habitat tolerances. Large areas of mixed, predominantly indigenous, vegetation consisting of short tussock and hard tussock grasslands interspersed with small herbs, shrubs, and exotic pastoral species inhabit open low-level areas not regularly cultivated. These areas are maintained by fire and grazing and would be replaced by scrub otherwise. Snow tussock occupies more elevated areas (around the timberline). Sometimes snow tussocks are so dense that they exclude other species, but they are usually associated with herbs and small shrubs. Areas of mixed indigenous and exotic grassland where the short and hard tussock grasslands that are interspersed with exotic pastoral species and hieracium, are maintained by grazing only. These areas retain a modest proportion of indigenous grassland diversity.

Areas of mixed indigenous and exotic shrubland vegetation, where the active control of exotic shrubs such as broom and gorse coupled with low grazing pressure is actively promoting reversion of the landscape into mixed indigenous shrubland. Areas of predominantly exotic vegetation, consisting of gorse and broom with willows and pines that have been retired from grazing present opportunity for biodiversity enhancement through passive (watch and wait) or active (re-planting) restoration of areas back to the original indigenous habitat types found on FLOCKHILL Station.

The biodiversity values of the farm blocks, including their current state of health and how they are influenced by farm activities or introduced pests are mapped and described in Appendix 5. Stocktake of Biodiversity Assets. The blocks described are: 1. Broken Hill and Constitution Hill 2. The Constitution / Milliken's and FLOCKHILL Stream 3. MPI to the Battlefield including FLOCKHILL, the Limestones, Cave Stream and Rocks Flat 4. Flockburn 5. The Ram Paddock, Home Blocks and Winding Stream 6. Nomans Land 7. Vagabonds Inn, the Air Strip and Avoca (including Slovens Stream) 8. Pig Gully (including Rosa Swamp) 9. Tarnmoor 10. The Weaning, Middle, and Waimakariri blocks. Management blocks and biodiversity assets have been mapped at scales suited to informing the high-level biodiversity management actions developed in this plan.







## Effects of Introduced Species

Unfortunately, the arrival of people coincided with the introduction of several harmful mammalian species (rats, cats, possums, hedgehogs, stoats, ferrets, deer, goats, pigs) which have had devastating effects on native wildlife. While the geographic isolation of New Zealand means the assemblage of plant flora is unique with a set of native species which are found nowhere else, it also means they have not evolved to cope with mammalian predators or herbivores. Many species of birds and reptiles have become extinct, with most of the rest threatened or in decline. Almost all native forests in New Zealand are degraded by excessive browsing. Pest plants and fire are also serious threats; problems with hieracium, sweet briar, and wilding pines are particularly severe on FLOCKHILL.

## Values of Importance to Māori

The High Country is a very important area for Te Rūnaka o Ngai Tahu. In pre-European times, it was a fundamental element in seasonal food gathering patterns, with families and hapu undertaking seasonal migrations to high country areas to gather mahika kai. It is therefore important that the Vision of FLOCKHILL, and plans or actions that give effect to it reflect the values and aspirations of Ngai Tūāhuriri as Kaitiaki Rūnaka of the upper Waimakariri basin. To this end, genuine efforts will be made to recognise alignments and adapt work programmes to better manage the environment in a holistic way. Kaitiaki Rūnaka will be made welcome and invited to share knowledge or critique whether suitable progress is being made, and any

signage, publications, or other communications related to FLOCKHILL must be correct in their representation on Māori cultural values.

Of particular importance is Ōpōrea (Lake Pearson) which is located on the western boundary of the property. Ōpōrea has been recorded as a kāinga nohoanga, kāinga mahika kai and kāinga tūturu<sup>3</sup>. Among the foods gathered here were tuna (eel), koukoupā (giant kōkōpu), panako, kōareare (edible rhizome of raupō/bulrush), pūtakitaki (paradise duck), pāpera (grey duck) and pākura (pūkeko/swamp hen). Other lakes on the property would also have been an important source of mahika kai<sup>4</sup>.

Wilding pines pose a particular threat to the High Country, and to FLOCKHILL, and if uncontrolled will remove almost all natural values, which will also greatly degrade cultural values and any possibility of maintaining cultural traditions or activities connected to the area. Over the past few years, a massive effort has been undertaken to better manage wilding pines on the property. A key benefit of maintaining the property in its current use, will be long term management of wilding pines.

Finally, we are aware that overseas investment and purchase of land has potential to detract from the relationship of tāngata whenua with ancestral lands, water, sites, wāhi tapu and other taonga<sup>5</sup>. A key role of this plan is to prevent this from happening, and over time, to enable building of relationships and appropriate knowledge so that opportunities to manage the environment and recognise Kaitiaki Rūnaka in more appropriate ways are not overlooked.

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<sup>3</sup> 1879 Smith-Nairn Royal Commission of Inquiry into the Ngāi Tahu land claims, interviews with Ngāi Tūāhuriri kaumatua.

<sup>4</sup> Ngai Tahu Cultural Atlas [online] <https://www.kahurumanu.co.nz/atlas>

<sup>5</sup> Mahaanui Iwi Management Plan. Ngāi Tūāhuriri Rūnanga, Te Hapū o Ngāti Wheke (Rāpaki), Te Rūnanga o Koukourāra, Ōnuku Rūnanga, Wairewa Rūnanga, Te Taumutu Rūnanga







## Threats and Opportunities for Biodiversity

A number of attributes of FLOCKHILL present opportunities for biodiversity conservation, while some other factors are important constraints that need to be addressed through management. Opportunities and constraints help to determine what is achievable, and are described in terms of those that are intrinsic (of the property) and extrinsic (external to the property).

### Intrinsic Opportunities

Factors associated with the property which are opportunities for biodiversity conservation include:

**Fences:** After several years of work, most biodiversity assets and wetlands are now permanently fenced. Unfenced areas are either subject to little human influence or will be addressed through planned work. Within mapped areas, streams and wetlands are largely inaccessible to cattle due to fences, vegetation barriers or because they are only passing through at the time of mustering. Several wetlands are already fenced (Winding Stream, many of the larger tarns of the Waimakariri Block, Air strip, Middle Block, and the Vagabonds) or are in good health with nil or very little grazing because of the kind of block they are in (e.g., all the wetlands on Tarnmoor and the Constitution). Cattle exclusion from Rosa Swamp is planned as of winter 2021. Alternative water supplies could help further reduce cattle access to streams in more remote parts of the station (Tarnmoor, and the Weaning, Middle, most of the Waimakariri Block. Most of the hill country is only lightly grazed: The hill country areas of FLOCKHILL are lightly grazed with sheep, and very few cattle (20 to 30 cattle across about 1000 hectares). This helps sustain values by reducing weed infestation, and is not prohibiting natural regeneration toward shrubland. Moderate grazing also minimises rank grass which reduces fire risk, moisture competition with natives, and rodent predation of lizards (important around rocky tors and limestone areas). It is particularly helpful in areas subject to infestation by wilding pines, and in limestone country where exotic grasses will compete with or suppress native species.

**Existing high quality biodiversity assets:** There are areas of moderate to high biodiversity right across FLOCKHILL, and within these areas the impact of human use is relatively low. Most wetlands are relatively free of willows: Willows have a

devastating effect on natural values across much of the high country, but aside from Slovens Stream are not a major feature of wetlands on FLOCKHILL.

### Extrinsic Opportunities

Factors operating beyond the property can also present for biodiversity conservation.

**Willing and committed owners and farm team:** The owners and the farm team are very interested in the environmental values of FLOCKHILL and improving alignments between farming and nature. An enormous effort is already expended in weed control, and the station fully resources culls and deer and pigs for production reason.

**Integration with the lodge:** There is great potential for the BMP to support improved integration between what happens on the station and the lodge.

**Public Access:** Public access is an opportunity to showcase the values of FLOCKHILL and our environmental work. It can also be a constraint if it results in wildlife poaching.

**Connection to community:** FLOCKHILL is well staffed and closely connected to the wider community, which helps hugely with building relationships with agencies and Mana Whenua. Connection to the community also facilitates community conservation efforts (e.g., managing geese), and voluntary control of pigs and deer.







## Intrinsic Constraints

There are also aspects of the property that constrain progress and need to be built into our management. For each of these constraints, we also list current management responses. In particular profiling and celebrating the biodiversity of FLOCKHILL and how we are managing it. Invasive environmental weeds. Invasive weeds are the most harmful threat to native values on FLOCKHILL because they destroy habitat values and because they are costly to remove once they become established. The priority weeds are wilding pines, hieracium, and sweet briar. Various other weed issues are identified as well. The conservation benefits of keeping areas under control, and lack of resources to achieve control in other ways, are a key reason why continued low intensity farming is the best long term management option for the environment of FLOCKHILL.

Wilding Pines. Wilding pines, especially *Pinus nigra* and *Pinus contorta* now cover extensive areas of almost all high-country catchments and were the focus of a recent massive (4000 ha) control effort on FLOCKHILL. Constant vigilance and ongoing light grazing are required to prevent re-infestation, especially in elevated parts of the farm (where there is a lack of competition) and fertile limestone areas which are particularly vulnerable. Priority should also be placed on keeping areas which have been clean up until now free of wilding pines (e.g., Tarnmoor, and the Weaning, Middle, and Waimakariri blocks). Douglass Fir (*Pseudotsuga menziesii*) is particularly undesirable because, as well as having a windblown seed and being able to grow at high altitudes, it is shade tolerant and therefore able to grow under and eventually replace mature native forest. Hieracium. *Pilosella officinarum* (Hieracium or Mouse-ear hawkweed) deserves special mention. This plant began to quickly spread and dominate huge areas of high-country grazing

land in the mid-1990s following the removal of agricultural subsidies (and reduced application of fertilizer). In the past generation it has displaced all productive high country grazing land on FLOCKHILL (a mixture of hard tussock, assorted herbs, and pastoral species), and is the key reason why carrying capacity dropped from 20,000 to 5,000 stock units, making the station unviable. The development which has taken place since 2015 was of areas degraded by hieracium. Despite this, extensive mats of hieracium remain in some areas, for example around the Battlefield.

Exotic scrub - Sweet Briar, Gorse, and Broom. Exotic woody weeds compete very effectively with Matagouri and other native scrubby species. This means that without active intervention, lightly grazed or retired areas will revert to gorse, broom, or sweet briar, (and eventually wilding pine species), instead of the natural pattern of native scrublands and native forest species. While gorse and broom are present in many places, it is suppressed by current programmes, and it is critical that this is continued to support a transition away from exotic dominance. The proximity of the gorse to the Rosa Swamp warrants ongoing control.

The story is different for sweet briar which is becoming a major problem in Matagouri shrublands, particularly in Nomans Land and The Weaning, Middle, and Waimakariri blocks. Matagouri has benefited from OSTD programmes and is quickly recolonising grazed hill country across much of FLOCKHILL, but tends to be displaced by sweet briar, which can inhibit indigenous vegetation succession. The result is the loss of these areas to production, but with little to no long-term gain for biodiversity.







## Other Areas<sup>6</sup>

There are various other weed issues which require attention: Stonecrop is abundant in the “Battlefield” area and may pose a future threat. Willow is a problem for Slovens Stream in as much as it has reduced indigenous dominance of the riparian margin, which lowers its vegetation biodiversity priority. St John’s wort is present in the Vagabonds and needs to be removed as it will become a threat to production and for nature if it becomes established.

One grazed pine was seen on the eastern side of Rosa Swamp, and there are small pines coming up on the terrace on the western side of The Whale – testimony to the ever-present issue that FLOCKHILL Station faces with wilding pine control.

Hawthorn and elderberry present in Puffers Stream. Both of these weeds will out-race indigenous shrubland to form a dense cover of exotic-dominant habitat. Care is required because the most effective means of their control (aerial spraying) is likely to affect native species/habitats.

Browsing pests. Browsing animals such as goats and deer remove very large amounts of foliage and commonly kill even well-established young trees. From the 1970s to around 1995, feral deer numbers were low in Canterbury, but have risen steadily over the last generation due to reduced hunting pressure and ‘wild harvest’.

Despite this, the impact of deer is low because of ongoing control efforts by the farm team, and because the open situation and good access enables ready observation and response on most areas of the farm. Numbers and impacts of pigs, and possums are also low at most sites with around 300 pigs and 800 possums killed each year. Much of this activity is

cost neutral because these species are production pests, and because of voluntary efforts.

Despite control efforts, pig sign is obvious and pigs may be a threat to fauna values in The Weaning, Middle, and Waimakariri blocks. Continued active management of pigs is needed in Rosa Swamp and the Constitution / Milliken’s blocks. Ongoing vigilance is required in limestone country because pigs can be very destructive in this environment.

The advent of calicivirus in the early 2000’s has transformed the viability of many high-country farms, including FLOCKHILL as rabbits no longer reach the plague proportions they did in earlier times. Hares are starting to reach high enough numbers to cause problems on some parts of FLOCKHILL, particularly in the Vagabonds Inn area where hare browse is probably a significant contributor to slow recovery of native vegetation inside the fenced reserve area.

Canada Geese lack natural predators in New Zealand and can reach very high numbers. They consume and foul pasture and are a significant source of contamination for lakes like Blackwater which are shallow and confined, and therefore very vulnerable to nutrient enrichment. They are currently subject to community control efforts when they become a nuisance to production.

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<sup>6</sup> While very little of FLOCKHILL is on the Waimakariri braided bed, the position and influence of the station could lead to positive management of braided riverbeds as a habitat type, and the predators and weeds which constrain conservation. Russell lupins invade braided riverbeds and displace native birds such as black beaked gulls, wrybills, banded dotterels, and terns which require open gravel areas to raise their young in safety from predators.







Predator Pests. Predators have a major impact on native birds and are a key reason for their relatively low abundance and threatened (or extinct) status of many species. Predators are also a threat to native reptiles. Currently there is little farm activity around predator control, other than some cat control.

Ship rats and mice are abundant in beech forest and expand hugely in number during 'mast years' when native forests seed prolifically. Stoats, and ferrets exist in association with rat populations, and follow a similar population pattern around mast years.

Wasps are sustained at unnaturally high numbers by black beech forests which provide honeydew throughout the year. Wasps are a significant production pest for bees and there is likely to be an opportunity to achieve cost-neutral control wasps by working with beekeepers.

Magpies, which suppress or drive off native birds, are often seen.

Time. This is our greatest constraint, with pinch-points particularly around times of drought. We will have a small amount of new capacity to take on biodiversity management under our plan, but the plan needs to be flexible around time constraints.

Funding. We have a limited budget to invest in biodiversity maintenance and enhancement, particularly at the scale we are dealing with. Additional environmental expenses need to be prioritised according to their ability to enhance outcomes or align with economic drivers.

Knowledge. The scope and scale of FLOCKHILL is vast which means merely knowing what we have is very challenging. Tracking progress so we know we are doing a good job of managing the environment will require an ongoing commitment of resources.

### Extrinsic Constraints

Some factors external to the property can also have an adverse impact on biodiversity conservation and need to be considered in farm management planning.

OIO regulations and requirements. The FLOCKHILL lease is overseas owned and management is therefore subject to an Overseas Investment Office agreement. This includes requirements protect specific areas (e.g.; Winding Stream, Vagabonds, and Blackwater), allow access (various areas), and acknowledge mana whenua in interpretation and communications. The leaseholder is also required to develop and expand the tourism potential of the property including the lodge facilities.

Regulation and government policy. We face an ever-changing pattern of regulations and social expectations. On high-country stations, regulation is a challenge to conservation because it can confuse important decisions on how to invest in environmental management, and disincentivizes positive management. For example, a costly and complex consent application process (to 'clear' native vegetation) will likely be required to achieve sustainable management of Matagouri scrublands.

Climate change. The effects of climate change for us are hard to predict, but like everywhere in New Zealand we are likely to experience more extreme events whether they be droughts or intense rainstorms associated with ex-tropical cyclones.





## Management Goals and Basis of Operational Plan

Goal 1. Maintain indigenous dominance of wetland systems. There are numerous high value wetland systems on FLOCKHILL. Wetland grasses usually maintain dominance over exotic grasses due to a denitrifying environment but can have issues with gorse or willows. A particular priority is Rosa Swap which is large and representative of original type but is threatened by cattle and gorse which are managed under the current program.

Work Programme. Where wetlands are not permanently fenced, set up a single hot wire and a temporary unit used when cattle are present. This enables controlled grazing by sheep, which helps manage weeds, and excludes cattle. Where a hot wire is not used (FLOCKHILL Stream, and Constitution), monitor wetlands for pugging to ensure they are maintained and don't lose integrity because of grazing. (Bottom of Winding Stream, Flock Hill Stream, MPI) - evaluate if wetland fencing is required.

Rosa Swamp - Fence to exclude cattle and continue active management of pigs and install alternative water supply. Also remove isolated wilding pines and continue/increase management of gorse. Slovens Stream - Undertake willow control (Drill and fill from ground where trees are accessible, use of helicopter control (late summer) in dense large areas in summer, followed by ground control to get regrowth). Establish a photo point to track progress, especially if we follow up willow removal with planting. The Weaning, Middle, and Waimakariri FMUs - Complete planned fencing (use temporary fencing in the meantime). Vagabonds – Remove St John's Wort before it becomes established.

Goal 2. Maintain the currently excellent water quality and health of lakes and streams. It is very important that FLOCKHILL can demonstrate good water quality and a very low level of human influence. This is quite realistic

given the extensive nature of the farming operation and large proportion of catchment in native cover.

Work Programme. Vagabonds Inn, the Air Strip and Avoca - Areas of stream and wetland need fencing from cattle, though there are areas where stock do not obtain access due to the steep terrain or vegetation barriers. Rosa paddock - Install water scheme (Lower part of Winding Stream before it enters Broken River). Complete evaluation of other areas which may require fencing, water systems, or change of stocking policy to prevent adverse effects. Vicinity of Blackwater - Cull geese (1000 in winter 2021) Aerial culling and annual cull when molting. Trigger level for control is about 300. In future look to work with other farms to achieve a united effort across the Waimakariri basin.

Goal 3. Elevated areas (Broken Hill/Constitution Hill, Nomans Land, parts of Tarnmoor) continue their current trajectory of a very slow change from tussock country to mixed Matagouri, native shrubland habitat and eventually alpine totara and black beech. Elevated areas are vulnerable to over-grazing because of thin soils and presence of hieracium, although areas with good tussock cover are more resilient. They are also threatened by wilding pine invasion, as well as emergent biosecurity threats such as sycamore. Hares are also an issue with at least as much impact as sheep browsing, if not worse in scrubby habitat. The impact of sheep grazing is acceptable under the current regime as they are grazing in exotic grass areas.

Work Programme. Remove sycamore behind Constitution. Remove probable seed source in gully near homestead/lodge. Remove Douglas firs growing near the Lodge. Monitor other plant biosecurity threats and address as they emerge over time. Hare control (think about viable methods of control).







Goal 4. Maintain or improve rare plant and animal communities in Limestone areas. Limestone areas are a high priority for conservation because of the distinctive set of species adapted to them. The biggest threat is invasion and excessive growth of exotic grasses which will quickly displace native plant species under these conditions. Wilding pines and briar are also an ongoing threat. As a priority, continue the current grazing regime and continue to suppress and wilding pine/sweet briar threat. Avoid OSTD across the high value area.

Work Programme. Maintain high hunting effort for pigs. Work with the local Department of Conservation Office (Rangiora) to develop a restoration plan for the Limestone area, including management of Stonecrop, management of Myosotis, fencing/change of grazing regime, and an enrichment planting to re-introduce scrub species which would have been present in the area in the past. (Once work plan is underway) Erect signboard explaining the work we are doing, and unique botanical and cultural history and values in the limestone area.

Goal 5. Forest and scrubland communities are in a good state of ecological health and display a natural successional trajectory. This is a general goal which applies across all habitat areas on FLOCKHILL. It is about: Managing woody weeds (wilding pine, sweet briar) to maintain and continue successful transition away from exotic dominance in scrublands and regenerating and mature forest. Facilitating slow change from tussock country to mixed Matagouri native shrubland. The current destruction of invasive exotic species in high biodiversity value native habitats needs to continue. This goal works in with Goal 6 which concerns maintaining low to zero level herbivory of forest floor. One area of potential difficulty is areas of lower value Matagouri regenerating in previously developed pasture. These areas need to be managed to achieve a controlled reversion and

prevent a succession to wilding pines and briar, which will displace Matagouri and remove other native values as well as creating a threat to currently clean areas of the farm.

Work Programme. Increase hunting effort for pigs in in The Weaning, Middle, and Waimakariri blocks, Pig Gully (Rosa Swamp), and The Constitution. Maintain control effort for deer and possums. Control sweet briar where it is a threat to native succession, and proactively maintain the Matagouri signature on FLOCKHILL. Waimakariri Block - Enrichment planting to establish a seed source in isolated kanuka patch. Winding Stream, Craigieburn, and the vicinity of the Lodge - Undertake enrichment planting to establish native forest. Broken Hill/Constitution - Scope enrichment planting to initiate establishment of a native succession to beech forest in the Craigieburn Cutting. The Objectives of this are to improve perceptions, create corridors for birds, and return values that existed prior to pine invasion. Investigate location and status of *Helichrysum dimorphum* in areas of older Matagouri.

Goal 6. Mammalian predators are managed to very low levels, and restoration has increased food resources to the point that native birds and lizards have become more abundant than any time the past generation. A healthy balance of human and natural use creates opportunities for bird and lizard conservation. The management team are particularly interested in birdlife, and good abundance and diversity of birds is fundamental to forest health.

Work Programme. Initiate a programme of wasp control in partnership with beekeeper<sup>7</sup>. Lodge, Home Block, and Winding Stream – Initiate a trapping programme for cats, stoats, and ferrets<sup>8</sup>. Set up a magpie trap near the homestead. Continue cat trapping but keep records of location, number, and date of captures.

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<sup>7</sup> James Lambie to assist with practical design.

<sup>8</sup> Practicalities to be further discussed - number and type of traps. Suggest a tiered approach based first on bird appeal (i.e., focus close to lodge), then linkages / bird

corridors that would help improve the lot for kea and falcon. Consider seeking advice from the Kea Conservation Trust focused on Broken Hill / Constitution.  
<https://www.keaconservation.co.nz/wp-content/uploads/2020/01/SOP-Safe-Pest-Control-in-Kea-Habitat-v9-updated-april2019.pdf>







## Demonstrating biodiversity improvement<sup>9</sup>

Monitoring will help us understand how the condition biodiversity condition of FLOCKHILL is changing over time, and track progress towards goals.

### Photo-point monitoring

We will locate a number of landscape photo-points across the farm and rephotograph every five years. These photos will be used to track the general trend in native vegetation cover across the farm. We will take photos in Spring to reduce seasonality differences between years.

Photo-points will be located where they help track matters of interest from a biodiversity perspective, including success in managing sweet briar and maintaining Matagouri, health of unique plant communities in limestone areas, and advancement of vegetation communities in wetlands or in more elevated parts of the farm. We will establish photo-points in the following locations:

Wetlands and open low country (Rosa Swamp, Winding Stream, Flock Hill Stream, Waimakariri). Elevated areas (Broken Hill/Constitution Hill, Nomans Land, parts of Tarnmoor). Limestone areas (The Battlefield and associated limestone rock field). We will continue Professor Norton's photo-points (15 years of data) and continue 5-yearly basis. James Lambie to assess suitability of existing data and assist with establishing new points if necessary.

### Freshwater (MCI) monitoring

We will undertake some stream health monitoring to compliment chemical monitoring undertaken by ECan. Undertake baseline assessments of stream health (Aquatic life/MCI surveys) in Winding Stream, Slovens Stream, and Craigieburn Stream. Consider a trophic status (Lake SPI) assessment for Lake Blackwater every five years to track trends<sup>10</sup>. Continue to observe chemical monitoring undertaken by ECan (report on as part of monitoring).

### Bird monitoring

Bird abundance and diversity reflects forest health. We will also monitor reptiles as these are also rare and pressured by similar factors to birds. We will undertake the following actions to monitor birds: Winter Garden Bird Survey. Track sightings of kea (use the DOC Kea sighting app), and NZ falcon.

We will participate in the national Winter Garden Bird survey that occurs in June/July for the home garden and farm homestead. While this will not have statistical meaning, it will allow us to track trends over time and also allow us to compare what we are noting in our garden with national trends. We will also start recording rare or uncommon (to the farm) birds that we encounter on the farm during our usual activities. Observations of these species (kea and karearea especially) will be noted with location, date and time and the number of birds seen.

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<sup>9</sup> This section requires further development. Think about what we are doing to support biodiversity, progress being made, and what is practical or meaningful as an observed response. A key area is likely to be monitoring to assess suitability of current grazing regime.

<sup>10</sup> May be costly as it needs to be done by a lake's specialist. Potential partnership project with University of Canterbury (e.g., aquatic ecology students) or NIWA contract. <https://niwa.co.nz/our-science/freshwater-and-estuaries/lakespi-keeping-tabs-on-lake-health/how-lakespi-works>



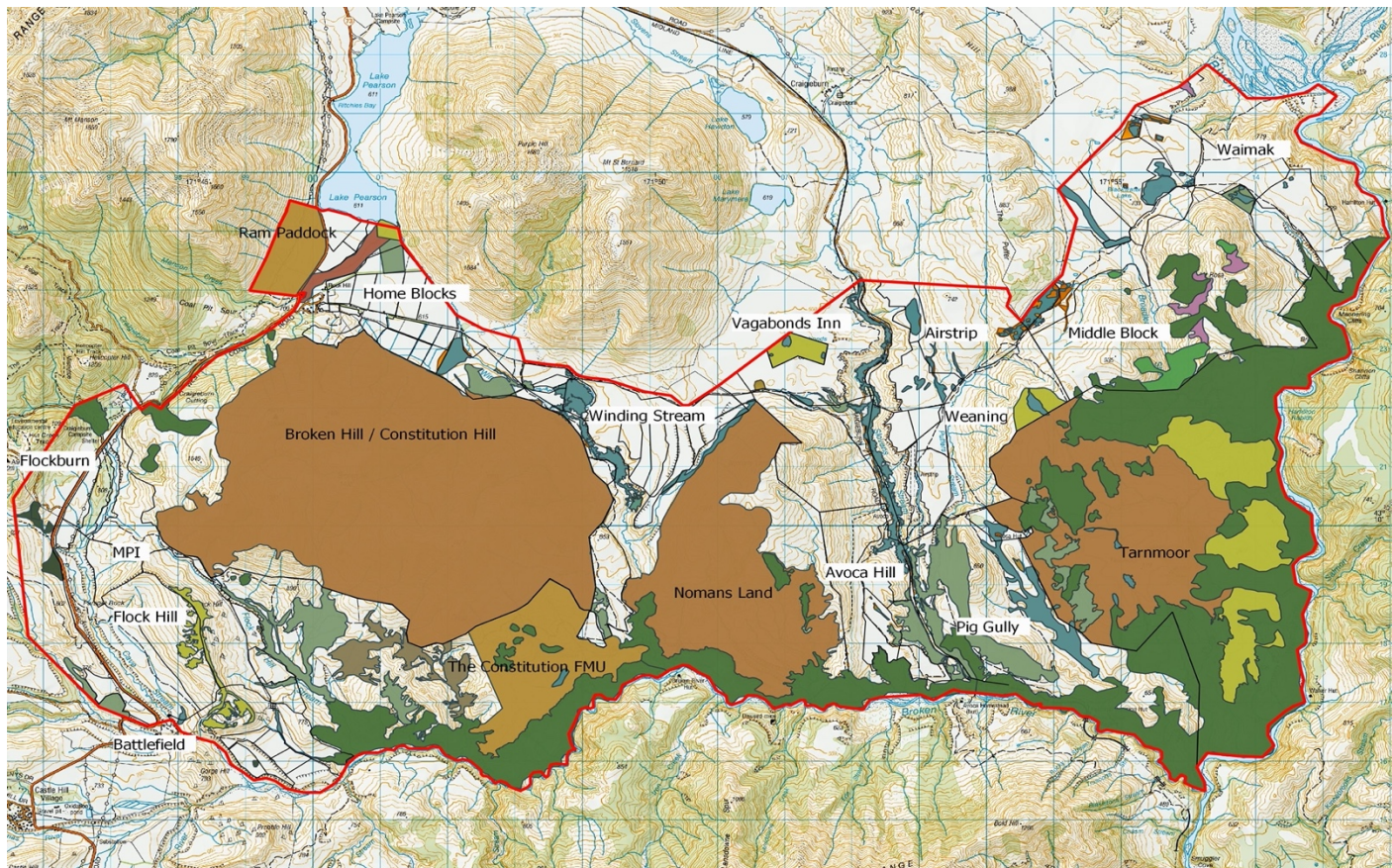




## Plan Review

While the whole biodiversity plan will have a substantial review every five years, annual reviews and updates to the five-year operational plan are considered essential and will be undertaken. We see this plan as a 'living' document a key part of our farming operations. Annual review is also important because this plan is designed to be able to meet the needs of regulators and market auditors. We propose to review this biodiversity plan at the same time that we are setting our over-all farm work programme and

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









## Glossary

Black Beech – One of five species of native beech. Named for the distinctive black mold which covers the bark and nearby forest floor. The dominant native canopy tree species on FLOCKHILL and Upper Waimakariri Basin.

BMP - The Biodiversity Management Plan

Ecological District (ED) - A local part of New Zealand where the topographical, geological, climatic, soil and biological features, including the broad cultural pattern, produce a characteristic landscape and range of biological communities (Park et al., 1983).

EIANZ – Environmental Institute of Australia and New Zealand

Farm Management Unit (FMU) – An area of a farm which has similar characteristics and is managed in the same way.

Hapū - kinship group, clan, tribe, subtribe - section of a large kinship group and the primary political unit in traditional Māori society. It consisted of a number of whānau sharing descent from a common ancestor, usually being named after the ancestor, but sometimes from an important event in the group's history. A number of related hapū usually shared adjacent territories forming a looser tribal federation (iwi).

Hectare (Ha) - 2.47 acres.

Hieracium – Mouse Ear Hawkweed. An invasive, low growing, mat forming herb which has degraded large areas of high-country grazing land. Hieracium produces substances which discourage other plants growing near it and it excludes almost all other species. Appropriate grazing management, applying fertilizer, and pasture renovation are the most effective ways of controlling Hieracium.

Kāinga nohoanga - home, village, settlement

Kaitiaki - Iwi, hapū or whānau group with the responsibility of kaitiakitanga (guardianship or stewardship of a particular area)

Kanuka - white tea-tree, *Kunzea ericoides* - leaves like mānuka but soft to touch. Taller than mānuka. Has small white flowers. Leaves are soft, unlike mānuka leaves which are prickly.

LCDB – Land Cover Database

Mahinga kai - Food and other resources, and the areas they are sourced from Mana Whenua – The Local Tribe with stewardship responsibilities over a given area. Nga Tuahuriri has Mana Whenua over the Waimakariri Basin which includes FLOCKHILL.

Manuka - tea-tree, *Leptospermum scoparium* - a common native scrub bush with aromatic, prickly leaves and many small, white, pink, or red flowers.

Matagouri – Grey thorny scrub.

NPSIB

Oversown and Topdressed (OSTD) – Uncultivated hill country pasture.

Run – An unfenced grazing area with stock controlled through mustering or reliance on natural barriers. FLOCKHILL was farmed as a run until after the Second World War.

Station – Traditionally the homestead base with houses, yards, and shearing, now refers to the areas of FLOCKHILL under the direct management of people, via farming or otherwise.

Stock Unit (SU) – A measure of carrying capacity determined by the amount of feed a farm can grow. One ewe is equivalent to 1.3 stock units.

Tangata Whenua – Lit 'People of the Land', descendants of Polynesian settlers who arrived in the 1300s.

Taonga - Treasures

Tikanga - Correct procedure, custom, habit, lore, method, manner, rule, way, code, meaning, plan, practice, convention, protocol - the customary system of values and practices that have developed over time and are deeply embedded in the social context.

Tussock – Tall native grass

Wilding Pines – Introduced pine trees, not native to New Zealand, but highly adapted to spread and thrive in high altitude environments. A significant threat to landscape, conservation, and productive values on FLOCKHILL.



