

**OPERATIONAL MANAGEMENT PLAN
FOR THE ENHANCEMENT OF AVIFAUNA
HABITAT AT THREE SITES IN THE LOWER
HAKATERE/ASHBURTON RIVER**



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and improve our
environments



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HAKATERE/ASHBURTON RIVER**

Contract Report No. 6228

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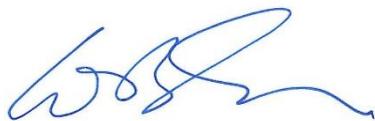
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1. INTRODUCTION

The Hakatere/Ashburton River, from the Gorge to the mouth, is an important breeding and nesting habitat for Threatened and At Risk indigenous shorebirds/waders/braided river birds. The river mouth has the highest avian species richness of any site within Ashburton District (Stäger 2019).

This management plan aims to enhance avifauna breeding success at three sites on the Hakatere/Ashburton River to compensate for potential deaths of migrating shorebirds caused by the Waverley Wind Farm, in South Taranaki. The plan is focussed on the maintenance, enhancement and protection of habitat to support bird species that nest in braided river beds, such as: black-billed gull (*Larus bulleri*, At Risk-Declining), black-fronted tern (*Chlidonias albobristatus*, Threatened-Nationally Endangered), wrybill (*Anarhynchus frontalis*, Threatened-Nationally Increasing), and banded dotterel (*Charadrius bicinctus bicinctus*, At Risk-Declining). Spotted shag (*Stictocorbo punctatus punctatus*, Threatened-Nationally Vulnerable) nest at the hāpua/river mouth.

The three sites on the Hakatere/Ashburton River (Figure 1) are:

- The riverbed a short distance upstream of the State Highway 1 (SH1) bridge and half a kilometre downstream, which is used by large colonies of black-billed gulls.
- A three kilometre reach adjacent to Lake Hood that has a rich history of bird use.
- The hāpua/river mouth and the lower two kilometres of the river, which has a high diversity of birds and also a history of community interest and involvement.

Starting from the financial year 2022 (FY22), Environment Canterbury will receive \$25,000 per annum to enhance the braided river habitat to help increase breeding success. This fund will continue until such time as the Waverley Wind Farm is decommissioned. In addition, Environment Canterbury will receive a one-off payment of \$25,000 for set up costs in the first year. This report is a management plan for three sites on the Hakatere/Ashburton River where this funding is to be used for active management to support braided river avifauna.

2. SITE DESCRIPTIONS

2.1 SH1 Bridge

This site is where the Ashburton River passes under SH1 (Figure 2). This is an area where black-billed gulls are known to breed, with up to five black-billed gull colonies known to occur here, including one colony on an island directly below the road and rail bridges. As many as 3,000 gulls have been recorded in the area (Cann 2018), with more than 850 nests recorded during the 2018-2019 breeding season (Sandys 2019).

2.2 Lake Hood

Reasonable numbers of birds have been observed in the reach adjacent to Lake Hood. This management area (Figure 3) is adjacent to the small township of Lake Hood. Residents of Lake Hood may be interested in participating in shorebird management.

2.3 Hāpua/River Mouth

The third management area is at the river mouth (Figure 4), which contains a coastal lagoon/hāpua, an important wetland utilised by a wide range of braided river birds, wetland birds, and seabirds (Crossland 2021). The area comprises shingle spits, a river mouth discharge area, a lagoon (hāpua), and a braided riverbed delta. These areas provide major roosting and/or breeding areas for populations of gulls, terns, and shags. The river mouth has the largest known roosting colony of spotted shags in New Zealand. Environment Canterbury has commissioned surveys since 2018, and thirty-five bird species were recorded during surveys in 2020-2021 (Crossland 2021).

3. POTENTIAL MANAGEMENT ACTIONS

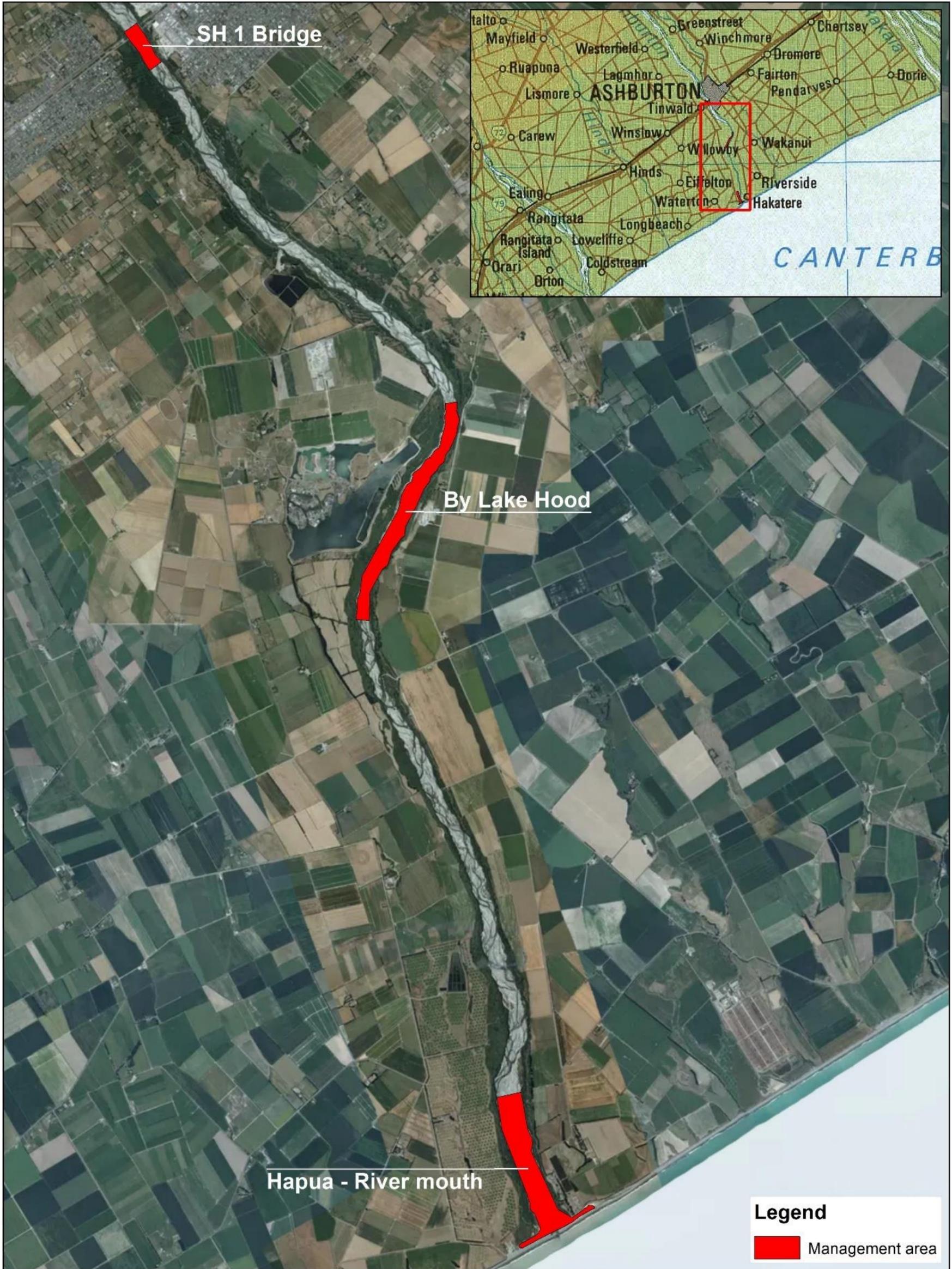
3.1 Overview

This section assesses potential management actions to improve braided river bird habitat and protect birds from predators and other threats. Prioritisation of these management actions is provided in Section 5 below.

Potential management actions are:

- Control of introduced mammals.
- Control of karoro/southern black-backed gulls and kahu/Australasian harriers.
- Weed control.
- Creation of artificial islands.
- Prevention of human disturbance.
- Water management.

Predation of nesting birds by mammalian (feral cats, rats, hedgehogs and mustelids) and avian predators is a major factor in the decline of populations of braided river bird species (O'Donnell *et al.* 2016). Braided river breeding birds require protection from predation during their nesting season, August to February. The establishment of woody weeds on the riverbed limits the availability of nesting spots and provides cover for predators. If river freshes or floods do not clear enough high nesting habitat, breeding birds are forced to breed in sub-optimum areas where there is an increase in predation flood risk, disturbance, and nest failure. However, these issues can be addressed and managed through weed control and the creation of islands. Similarly, human disturbance by vehicles, people on foot and uncontrolled dogs can disturb nesting birds and destroy nests, eggs, and chicks.



Data Acknowledgment
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Figure 1: Proposed Ashburton/Hakaterere River bird management areas.

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Wildlands
 www.wildlands.co.nz, 0508 WILDNZ

Scale: 1:46,000
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Figure 2: Braided river management area adjacent to the State Highway 1 bridge over the Hakatere/Ashburton River. The management area extends approximately 100 metres upriver of the bridge and 500 metres downriver, and covers approximately 12.4 hectares.



Figure 3: Braided river management area adjacent to Lake Hood. The management area covers three kilometres of riverbed over an area of 56.6 hectares.



Figure 4: Hāpua/river mouth management area. This reach is approximately two kilometres long and covers 62.3 hectares.

3.2 Control of introduced mammals

The following trapping and baiting protocols are derived from best practice protocols (Department of Conservation a, b; NPCA 2009, 2015, 2018, 2018b), and research (Smith and Jamieson 2003; Smith *et al.* 2015).

Approximately one month before nesting commences, trapping, and application of toxic baits should begin around breeding bird colonies. The overall trapping strategy is based on the programme in the upper Clarence/Waiiau River management, with a berm line and two buffer lines on each side of the river (Bell and Connor-Mclean 2020).

Predator control should focus on mustelids and feral cats. No effective trapping protocol has been developed for hedgehogs or rats, although they are caught as bycatch in mustelid traps.

Reliable rat control requires the use of toxins. Cholecalciferol paste (Feracol) should be used for initial knockdown of rats, followed by diphacinone paste (RatAbate) to keep numbers low throughout the breeding season. Use of toxins must follow the label instructions, including appropriate public notification and signage.

Trap and poison lines should run along the edges of paddocks, along roads, windbreaks, and fence lines where possible. However, effective trapping and poisoning will involve some lines going through paddocks. After liaison with landowners and farmers, some adjustment of trap and poison lines may be necessary to ensure they do not affect farm activity. However, best practice spacing should be adhered to as much as possible, rat bait stations should not be further apart than 100 metres, and mustelid lines should not be further apart than 600 metres (Smith *et al.* 2015). If best-practice line spacings must be exceeded, the chances of all pest animals encountering traps within their home ranges will be reduced.

All trapped pest animal carcasses should be buried in the river berm to avoid attracting kahu/harrier into the river bed. Poisoned animals must be disposed of at an approved landfill.

3.3 Rings of steel

“Rings of steel” are intensive localised trapping grids covering a 500-1,000 metre radius around bird colonies. Within the grids, trap sites are 100 metres apart, with each trap site containing one or more double-set traps of various types aimed primarily at catching cats and mustelids (Bell and Connor-Maclean, 2020; Schori *et al.* 2021). Rings of steel use significantly more traps than best practice, greatly increasing operating costs.

Given the available budget for the Ashburton/Hakatere bird management areas, and the expense of rings of steel compared with best-practice approaches, rings of steel are not currently recommended in this plan. They have shown potential in helping to protect nesting braided river birds, but they have not been subject to rigorous testing or direct comparison with best-practice trapping. Black-fronted tern colonies on the Ohau and Clarence Rivers have shown improved hatching success when rings of steel were used as part of enhancement programmes that integrated several habitat enhancement

techniques (e.g. bulldozer to deepen and widen river channels and remove weeds; Bell and Connor-Maclean 2020, Schori *et al.* 2021). If additional funding becomes available, it would be useful to implement rings of steel in a comparative manner with best practice techniques in the Hakatere/Ashburton River.

3.3.1 Berm and buffer trapping

Berm and buffer trapping should use DOC-series traps (DOC150, DOC200, DOC250) to target mustelids, with one trap every 200 metres, alternating trap types in series. Mustelid traps should be baited with fresh rabbit or hen eggs. As is standard practice, all mustelid traps should be placed inside wooden tunnels with mesh guards (Department of Conservation 2001).

One Timms trap should be set every 500 metres, baited with fresh rabbit, for feral cats. Trap entrances should be modified by widening the hole by 25 millimetres around its circumference.

All traps should be checked, cleared, and rebaited fortnightly.

Risks to Pets and the General Public

Appropriate signage and safety protocols must be used when setting traps. In areas where domestic pets are at risk, such as areas of the river mouth and SH1 that are close to dwellings, cage traps should be used instead of kill traps, with ongoing community engagement to encourage keeping cats indoors during the bird breeding season. Wet cat food or fresh rabbit should be used to bait cage traps. They must be checked daily and run in 10-day pulses in response to nesting, fledging, or elevated cat catches in kill traps.

3.3.2 Toxic baits

Correct bait type selection is important for any poisoning operation, particularly where the public or non-target animals may be at risk. Fast-acting, relatively humane toxins such as 1080 or cyanide are not appropriate where humans are likely to come into contact with the bait. Any toxin that causes a sensation of illness is likely to rapidly create bait aversion in the rat population. The lower Ashburton/ Hakatere River needs a poisoning programme that uses effective toxins for continuous baiting throughout the braided river bird breeding season. There must be minimal risk to humans and non-target animals (including secondary poisoning).

Cholecalciferol is recommended here as an initial knockdown toxin. Cholecalciferol does not require a controlled substance licence, is effective, and is readily available. In the form of Feracol paste, the toxin is used in bait stations, reducing the risk to the public and non-target animals. It does not leave a long-term residue or bioaccumulate. The risk of secondary poisoning and by-kill from cholecalciferol in bait stations is low (NPCA 2015).

Cholecalciferol is thought to be inhumane as it is an anticoagulant. Cholecalciferol mixed with diphacinone, another anticoagulant, is considered to be more humane. The

mixture kills both possums and rats, and is faster-acting than cholecalciferol alone. However, it is currently only available in one form, called Double Tap, which is relatively new. Its efficacy has not been demonstrated in the field, though it has shown promise in both laboratory and field trials (Eason *et al.* 2020). However, it appears to be less palatable than Feracol or RatAbate (V. Smith, pers. obs). Nevertheless, Double Tap is recommended where possums and rats coexist. Double Tap may be used as a replacement toxin for RatAbate and Feracol if its efficacy is proven and bait palatability is not found to be an issue for these other toxins.

Since cholecalciferol is known to cause bait aversion, we recommend its replacement with diphacinone when bait uptake is reduced. Diphacinone is less effective as a knockdown toxin, but it is suitable for long-term use and causes less bait aversion. Diphacinone is an anticoagulant and is therefore slow-acting and inhumane. Diphacinone in bait stations has a very low risk of secondary poisoning or by-kill (Fisher *et al.* 2004) and breaks down quickly in the environment (Siers *et al.* 2018).

Poison bait application should aim for an initial phase of rapid knockdown of rat populations using Feracol paste when rat concentrations are moderate to high (Eason *et al.* 2010). Feracol use can lead to bait shyness in rats, so it is not recommended for long-term population control. The second phase of rat control should therefore introduce diphacinone paste (RatAbate) to maintain low numbers throughout the breeding season.

Feracol should be placed in bait stations suitable for paste bait, such as KKs or Run Throughs. A bait station should be placed every 10-50 metres (depending on rat density) in a grid formation. The grid should extend for a 100 metre buffer around each river site. The total area covered by each grid will be affected by waterways, urban development, and dwellings, especially in the SH1 bird management area.

Bait stations should be pre-fed twice with non-toxic peanut butter paste (e.g. Ferafeed) for 2-3 weeks before baiting with toxic bait. Checking the bait stations once per week should give operators an idea of how often bait stations need to be topped up; the bait stations should never be empty, as multiple doses of bait are required to kill rats.

After several weeks of cholecalciferol baiting, bait uptake will likely begin to decrease. At this point, Feracol should be replaced with diphacinone paste (RatAbate). Diphacinone should be used to keep rat numbers low until all chicks have fledged.

Note that diphacinone bait will be ineffective against rats if possums are abundant. In this case, Double Tap poison in Philproof bait stations should be used to target both rats and possums.

3.3.3 SH1 Bridge

Due to the proximity to the Ashburton township, the SH1 bird management area cannot be trapped using continuous lines. Figure 5 shows the proposed trapping plan for the SH1 bridge. Berm lines should run along the river's edge, extending 500 metres upriver and downriver of the edge of the protected bird management area. Two buffer lines should run approximately parallel to the berm line on each side of the river (Figure 5). However, due to public risk and difficulties in gaining permission, the lines do not run

through the urban area; instead, making use of the adjacent park, reserve, and farmland. Landowner permission would be needed for the placement of lines on private land. The berm and buffer lines are all approximately 500 metres apart.

3.3.4 Lake Hood

The Lake Hood bird management area runs through arable land. Continuous berm and buffer lines use fence lines, tracks, roads, and lake edges where predator traffic may be increased (Figure 6). However, predators could be active anywhere in the landscape, so all lines should be approximately 500 metres apart (Figure 6).

3.3.5 Hāpua/river mouth

The river mouth trap line layout is based on the same principles as the Lake Hood trap network. The buffer lines will be shorter because the berm line extends laterally at the estuary (Figure 7). Likewise, fewer bait stations will be required.



Figure 5: Berm and buffer trap lines (green lines) at the State Highway 1 bird management area.



Figure 6: Berm and buffer trap lines (green lines) at the Lake Hood bird management area.



Figure 7: Berm and buffer trap lines (green lines) at the hāpua/river mouth bird management area.

3.4 Karoro/southern black-backed gull control

Karoro/southern black-backed gulls (*Larus dominicanus dominicanus*, Not Threatened) should be controlled annually. Currently, a black-backed gull colony of around 3,000 gulls is located in the lower river, near the top end of the river mouth. Poisoning should be prioritised as it is the most effective control method, followed by shooting and egg oiling (Bell and Harborne 2018). As soon as a southern black-backed gull colony has settled and begun incubating its eggs, poisoning should occur before the eggs hatch (late October-early November). After poisoning, shooting should occur as soon as possible, followed by egg oiling. Egg oiling should ideally take place in the third week of incubation, reducing incidences of nest abandonment and subsequent renesting (Blackwell *et al.* 2000).

Before disposal of shot or poisoned karoro/southern black-backed gull, local iwi representatives should be consulted to see if they want to the feathers. Poisoned karoro/southern black-backed gull feathers could be used in cultural practices.

3.4.1 Control targets

Poisoning (*c.*50% target for reduction) and shooting (*c.*25% target for reduction) should reduce each colony by approximately 75%, leaving 25% of the original adult breeding population. Egg oiling aims to reduce the number of chicks that hatch while preventing adults from re-nesting as they continue to incubate the oiled eggs. Evidence suggests that eggs oiled 7-15 days before hatching have only a 1% chance of hatching (Blackwell *et al.* 2000).

3.4.2 Poisoning

Before any poisoning operation, best practices must be followed, including signage, certification, and landowner notification protocols. Karoro/southern black-backed gull must be pre-fed non-toxic bread and margarine bait up to four times before the toxic bait is laid, to ensure that there is a feeding frenzy and rapid consumption of baits. The pre-feeding must occur close to the poisoning, including retreat and observation (see below).

Alphachloralose powder should be mixed with margarine and applied to bread according to a standard protocol (see alphachloralose label). Poisoning should occur around dusk, ideally on a cool, windless evening. Bread should be spread quickly and quietly in the colony before all operators retreat and observe to ensure that no non-target birds are at risk of feeding on the bait. If non-target birds approach the colony, all bread must be retrieved and then re-laid after the non-targets have disappeared. If a non-targeted bird is affected by the bait, the bird can be revived by placing in a warm dark place (Bay of Plenty Regional Council).

The morning after poisoning, all dead karoro/southern black-backed gulls must be retrieved from the colony and surrounding areas. A boat may be needed to check downstream and across the river from the colony. Any live chicks should be humanely euthanised.

3.4.3 Shooting

If poisoning is not undertaken, pre-feeding of colonies with bread before shooting may help to ensure that gulls are in one place and accustomed to human presence, making control easier. However, after poisoning, gulls are likely to be shy of bait and human presence. Therefore, shooting operations should be quick and cause minimal disturbance to maximise chances of success.

Operators should approach each colony slowly, using shotguns to target birds as they take flight. Winged birds must be humanely euthanised. Gulls that are cautious after poisoning take flight easily, so an experienced shooter is required.

3.4.4 Egg oiling

Egg oiling can be a successful control method for gull colonies. However, its high intensity of labour and its relative lack of efficacy make it the last priority after poisoning and shooting. Operators should move systematically through the nests in the colony, completely covering any eggs in a film of mineral oil or liquid paraffin. The

eggs should then be returned undamaged to the nest. The embryos inside will suffocate, but the parents will continue to try to incubate them. Operators must move quickly and quietly through the colony to reduce the risk of gulls abandoning their nests.

3.5 Kahu/Australasian harrier

Control of the kahu/harrier population could provide benefits for braided river birds if and where they are identified as a problem. For example, 116 chick remains were attributed to kahu/harrier predation in the Ashley River (Davey 2020). Kahu/harriers should be monitored within the three management areas, and if they are observed attacking nesting braided river birds, then they should be controlled.

When problem kahu/harriers are identified, they should be shot (Table 5). The firearms user must be licenced, and caution must be used when using a shotgun near SH1 or the Lake Hood community. Use of a firearm must be in accordance with the New Zealand Firearms Act. Kahu/harrier are listed as ‘wildlife that may be hunted or killed subject to Minster’s notification’ under Schedule 3 of the Wildlife Act 1953, and no permit is required. Pre-feeding with rabbit carcasses at the same time every day, and observing the kahu/harrier’s movements, will help increase the chances of a problem harrier being present during shooting operations. Kahu/harrier carcasses should be offered to local iwi or buried if not required.

3.6 Weed control

Braided rivers are dynamic ecosystems where water flows across a gravel floodplain in multiple mobile channels (Gray and Harding 2007). Small and large floods are common and are responsible for creating a highly diverse mosaic of habitats at different successional stages. The most recent flood event occurred in Cyclone Dovi, in February 2022. These flood events can remove or suppress pest plant species in an area. However, low flows and reduced channelisation can increase weeds and regeneration after flood events.

Pest plants identifiable in recent imagery at the three management areas include gorse (*Ulex europaeus*), broom (*Cytisus scoparius*), willows (*Salix* spp.) and what appears to be yellow tree lupin (*Lupinus arboreus*). Other pest plants known to be present in the catchment are Russell lupin (*Lupinus polyphyllus*), false tamarisk (*Myricaria germanica*), grey willow (*Salix cinerea*), basket willow (*Salix viminalis*), sweet briar (*Rosa rubiginosa*), and blackberry (*Rubus fruticosus* agg.), all of which can invade braid plains if left uncontrolled.

Recent flooding events may have shifted some of the islands and altered braid plains since the last satellite images were taken. However, there is some consistency of braid plain and island locations within the historical imagery that have been used to identify potential weed control areas (Figures 8-9). All of these are currently relatively free of substantial pest plant infestations and would most likely only need localised spot spraying of scattered and regenerating pest plant species.

The three management areas should be surveyed annually for the presence of weeds (Figures 8-10). Following this, mechanical clearance should be used during July-August for the initial clearance of woody weed infestations. This will provide a clear

open area by removing the woody debris which would be left if spraying was used initially. Dead material should be graded into a windrow along the side of the island or onto the river bank. Following this, spraying should be undertaken in September before weeds start to germinate (R. Dynes, Environment Canterbury, pers. comm.). If weeds persist, additional spot spraying should be undertaken after the breeding season (March), to reduce ongoing infestation. This is a high priority, especially on raised islands where river fresh and winter floods are unlikely to clear vegetation.



Figure 8: Potential weed management areas (yellow polygons, 2.7 ha and 1.6 ha) in the SH1 management area.

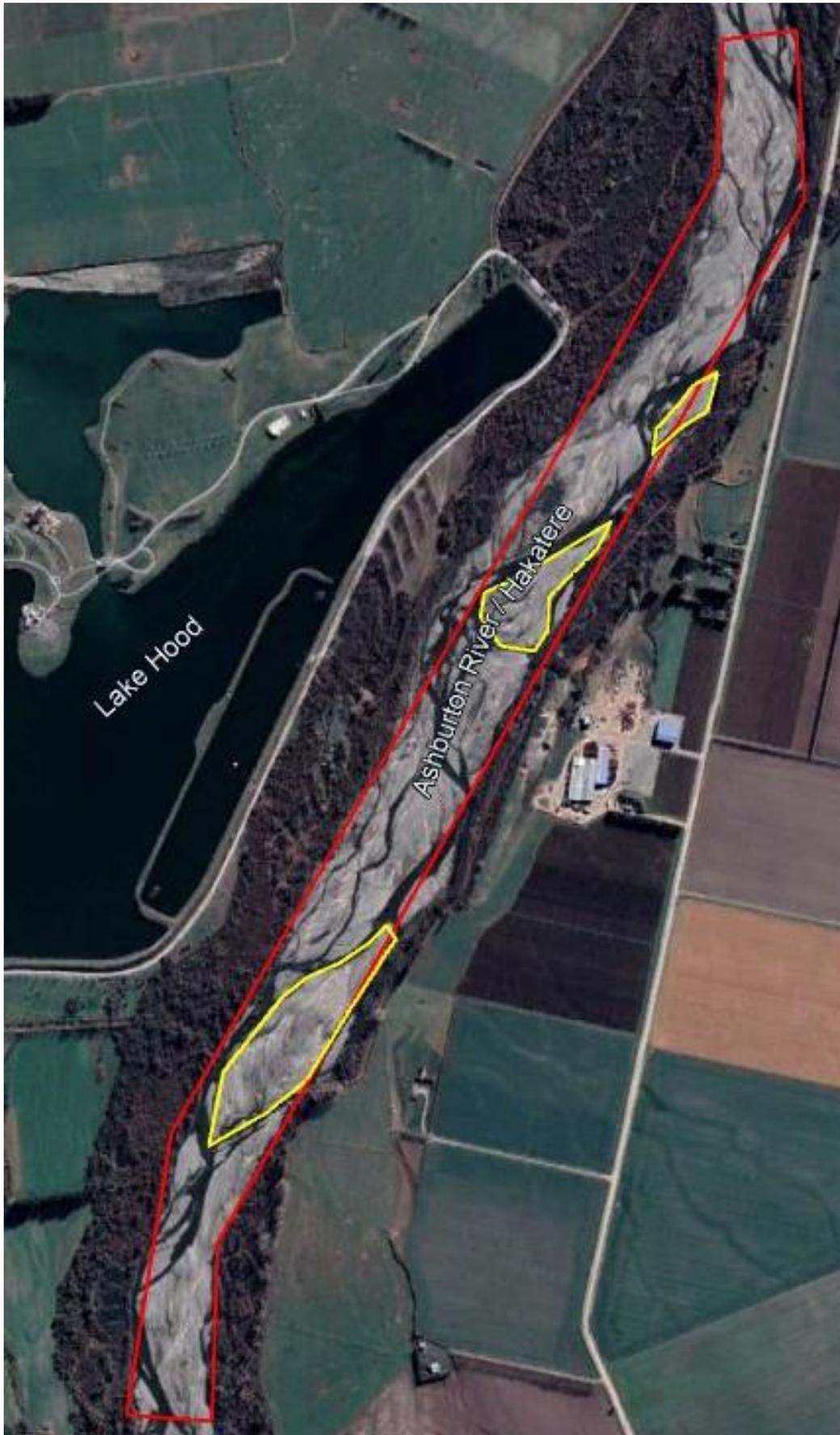


Figure 9: Potential weed management areas (yellow polygons, 0.7, ha, 2.4 ha, and 5.0 ha) in the Lake Hood management area.



Figure 10: Potential weed management areas (yellow polygons, 2.3 ha, 3.5 ha and 4.3 ha) in the hāpua/river mouth management area.

Mechanical Clearance

Mechanical methods to clear weed encroachment are effective for large areas, especially if no significant flood events occur to ‘clean out’ the riverbed (Crossland 2021). Various methods can be used, including undercutting, grading and rotary hoeing. Mechanical clearance will provide an open area free from weeds and can create a loose, coarse gravel substrate suitable for breeding birds (Ledgard and Davey 2020). For example, the Ashley-Rakahuri River Group undertook a trial evaluation where half an island was graded and half was rotary-hoed (G. Johnston, Taggart Earthmoving Limited, pers. comm.). Survey results showed that black-billed gulls preferred the rotary-hoed areas, whereas other indigenous braided river birds preferred the graded half of the island. Similarly, undercutting will also provide a suitable weed-free area. However, breeding success can vary despite the method used (Davey and Ledgard 2019).

Each year, the three management areas should be surveyed for the presence of weeds on suitable large, long, narrow islands as these areas are preferred breeding areas. Mechanical weed removal should be undertaken by grading the substrate to provide uncompacted, poorly-sorted coarse gravel with large scattered pebbles (Davey and Ledgard 2019). Grading should occur in July and August.

Islands that would be suitable for grading are the three long narrow islands: 2.7 hectares under the SH1 bridge (Figure 11), the middle island at Lake Hood (2.45 hectares; Figure 12) and the 4.3 hectare island in the lower reaches adjacent to the river mouth (Figure 13).



Figure 11: Potential mechanical clearance (yellow polygons, 2.7 ha) in the SH1 bird management area.



Figure 12: Potential mechanical clearance (yellow polygons, 2.4 ha) in the Lake Hood management area.



Figure 13: Potential mechanical clearance (yellow polygons, 4.3 ha) in the hāpua/river mouth management area.

3.7 Construction of islands

Island construction and enhancement provides habitat suitable for nesting and are safer from predators and flood risk (Environment Canterbury 2017). Constructed islands need to be separated from the mainland by channel construction. The area selected should be naturally high in a mixed substrate, with some boulders and medium and fine-sized cobbles (Davey and Ledgard 2019), preferably with few weeds. The island perimeter should be assessed each year and the channels should be excavated to ensure that there is deep, fast-flowing water, to provide protection from predators.

The three management areas should be surveyed annually for suitable island management areas. Historic imagery indicates the braid plain and island locations are reasonably consistent, and recurring enhancement and maintenance could be undertaken on an annual basis. On reviewing images in Google maps, there are already many islands within each management area, and it appears that limited island creation will be needed (Table 8). One island should be selected within each management area for enhancement. The area should be >20 metres from the mainland and have more than >6 m³/second flow. Each area should be assessed for water flow, channel depth, and island isolation. The SH1 bridge area (2.7 hectares; Figure 11) and the mouth (4.3 hectares; Figure 12) appear to be suitable distances from the river bank. The Lake Hood (2.4 hectares; Figure 13) area may require reshaping to provide a wider channel between the island and riverbank (Table 9).

Channel excavation may be required at all management areas to provide increased water flows, providing further isolation from mammalian predators. The management areas should have around 50 cm to one metre of freeboard above the 'normal' flow level. Excavated material should be used to build up the island's height to prevent floods overtopping the islands. Ongoing maintenance will be necessary to control weed establishment, maintain the shape of the islands post-flood events, and dredge braids around the islands to keep a good depth of flow.

3.8 Human disturbance

The Hakatere/Ashburton River has two public trails running along the river banks. The Ashburton River trail (northern bank) and the braided waters/Lake Hood trail (southern bank) allow public access to the river. Signage should be placed at all road access points to the river and near the three management areas to inform the public of the presence of any breeding birds, advising that foot access should not occur within 200 metres of any nesting bird between October to February each year. It is estimated that four signs will be required for the SH1 and Lake Hood areas (two signs on each side of the river), and six signs for the river mouth track and road access points (Table 10). These should be placed adjacent to each end of each management area. The signs should also state that all dogs must not be allowed to off-leash as they can disturb birds and destroy nests. Each colony should be roped off during the breeding season to delineate the breeding locations further and provide a physical barrier to reduce human access. The signage for the hāpua/river mouth should describe the ecology of the shorebirds/braided river birds and the spotted shags.

Four-wheel drive vehicles driving over the gravel islands and near the river mouth could disturb foraging birds and significantly damage the foraging site. Discussions should be undertaken with the Ashburton Bridge to Beach Run 4WD event organisers at least one month before the event. Prior to the event taking place, the main foraging areas within the river mouth should be signposted and flagged so that drivers avoid them during the event.

Vehicle access at Lake Hood should be prevented during the breeding season by using padlocked gates to prevent road access. This will make it more difficult for 4WD vehicles to access the riverbed, launch boats and accidentally drive over nests. By applying for a gate key, important information about the bird management area and appropriate river use behaviour can be imparted. Signage should also be placed at all access points to inform vehicle users of the breeding colony. Dogs should be kept in vehicles when keyholders pass through the area.

3.9 Water management

The Rangitata River diversion race and the Highbank Power Station divert water down the Ashburton/Hakatere River each year for maintenance. This activity increases the water flow and causes small freshes that can flood and destroy nesting sites. If the extra water were diverted down the Hines River or released in a controlled manner, it would reduce or prevent damage to nesting sites.

4. MANAGEMENT COSTS

4.1 Pest mammals

Estimated annual costs for predator control at the SH1, Lake Hood, and the hapua/river mouth manager areas are provided in Tables 1, 2, and 3, respectively.

Table 1: Estimated annual costs for pest animal control in the SH1 bird management area.

Item	Cost per Item	Number Required	Total Cost
DOC150 traps	50	13	650
DOC200 traps	99	14	1,386
DOC250 traps	130	13	1,241
Timms traps	50	17	850
KK bait stations	7.59	144	1,093
Pre-feed (Ferafeed) per kg	6.5	72	468
Cholecalciferol (Feracol) per kg	47.5	108	5,130
Diphacinone (50D) per kg	1.87	360	673
Contractor, labour and travel			15,117
Total			\$26,607

Table 2: Estimated costs for pest animal control at the Lake Hood bird management area.

Item	Cost per Item	Number Required	Total Cost
DOC150 traps	50	46	2,300
DOC200 traps	99	46	4,554
DOC250 traps	130	46	5,980
Timms traps	50	55	2,750
KK bait stations	7.59	244	1,852
Pre-feed (Ferafeed) per kg	6.5	122	793
Cholecalciferol (Feracol) per kg	47.5	183	8,693
Diphacinone (50D) per kg	1.87	610	1,141
Contractor, labour and travel			19,504
Total			\$47,567

Table 3: Estimated costs for pest animal control for at the Hāpua/river mouth bird management area.

Item	Cost per item	Number Required	Total Cost
DOC150 traps	50	26	1,300
DOC200 traps	99	27	2,673
DOC250 traps	130	26	3,380
Timms traps	50	32	1,600
KK bait stations	7.59	260	1,973
Pre-feed (Ferafeed) per kg	6.5	130	845
Cholecalciferol (Feracol) per kg	47.5	195	9,263
Diphacinone (50D) per kg	1.87	650	1,216
Contractor, labour and travel			19,504
Total			\$41,754

4.2 Karoro/black-backed gulls and kahu/harriers

Estimated annual costs to control karoro/black-backed gull colony near the Ashburton/Hakatere river mouth and kahu/harriers are provided in Tables 4 and 5 respectively.

Table 4: Estimated costs for a contractor to carry out black-backed gull control, per colony of 1,000 birds.

Location	Control Method	Number in Colony	Annual Cost
River mouth	Poisoning	1,000	\$14,092
	Shooting	500	\$2,500
	Egg oiling	250	\$2,645

Table 5: Estimated costs for kahu/harrier shooting by contractor, for two pre-feeds and one three-hour shoot.

Location	Control Method	Annual Cost
Lower Ashburton River	Shooting (two pre-feeds plus one two-hour shooting operation).	\$1,964

4.3 Mechanical weed control

Estimated annual costs for the mechanical control of weeds are provided in Table 6.

Table 6: Estimated annual mechanical weed control costs using a grader, including hire.

Location	Area	Annual Cost
SH1	2.7 hectares	1,810
Lake Hood	2.45 hectares	1,642
River mouth	4.3 hectares	2,881
		\$6,333

4.4 Herbicide control

Estimated annual costs for knapsack foliar spraying are provided in Table 7.

Table 7: Estimated annual costs for knapsack spraying (foliar spray), targeting regrowth or emergence of seedlings.

Location	Comments	Area	Cost per Hour
SH1	Contractor, labour and travel	2.7 hectares	5,956
Lake Hood	Contractor, labour and travel	2.45 hectares	5,405
River mouth	Contractor, labour and travel	4.3 hectares	9,486
			\$20,847

4.5 Artificial island construction

Estimated annual costs for the formation of islands are provided in Table 8 below, and annual costs for channel execution are provided in Table 9.

Table 8: Estimated annual construction costs for the formation of artificial islands, including channel creation, weed removal, and increasing island height.

Location	Area	Total Cost
SH1	2.7 hectares	8,100
Lake Hood	2.45 hectares	7,350
River mouth	3.7 hectares	12,900
		\$28,350

Table 9: Estimated annual channel digging costs for island protection.

Location	Area	Total cost
SH1	980 metres	1,960
Lake Hood	810 metres	1,620
River mouth	960 metres	2,060
		\$5,640

4.6 Management of human disturbance

Estimated costs for general signage are provided in Table 10, for signage associated with the annual 4WD run in Table 11, and in Table 12 for concrete blocks to be used for road closures.

Table 10: Estimated breeding bird signage costs for island protection. This is a one-off cost and the signs and fencing tape should be re-used each year, assuming that no damage occurs.

Item	Comments	Total cost
SH1	Four A2 corflute boards breeding signs	156
Lake Hood	Four A2 corflute boards breeding signs	156
River mouth	Six A2 corflute boards breeding signs	234
Wooden stakes	Fence stakes \$18.20 each	510
SH1	Fencing standards and tape	881
Lake Hood	Fencing standards and tape	776
River mouth	Fencing standards and tape	915
		\$3,628

Table 11: Estimated hāpua/river mouth foraging protection signage costs for the Ashburton River to Beach Run four-wheel drive event. This is a one-off cost and signs and flagging rope should be re-used each year, assuming that no damage occurs. This estimate relies on the re-using of the fencing standards from the colony breeding sites, once the breeding season is over.

Item	Comments	Total Cost
River run flagging rope	Reusable 30 metre flagging ropes.	102
Island signage	Six A2 core flute boards per area	234
Wooden stakes	Garden stakes	60
		\$396

Table 12: Estimated costs for concrete blocks for road closures.

Item	Comments	Total Cost
Concrete block	2.5 tonne blocks (\$92 each)	184
Delivery and installation	Truck hire: 1.5 hours per site for two blocks (excludes mileage and fuel adjusted factor 13.2%)	285
		\$469

5. MANAGEMENT PRIORITIES

5.1 Overview of total costs

An assessment has been undertaken of the relative threats to each site and these threats have been prioritised. Table 13 gives the total cost per annum cost if all prioritised work was to be undertaken in one year at all sites.

Table 13: Estimated total annual costs for all priority actions. Options that are not a first year priority are marked as 'No'.

Treatment	Action	SH1	Lake Hood	Hāpua/River Mouth
Weed control	Knapsack spot spraying	5,956	5,405	9,486
	Mechanical control	1,810	1,642	2,881
Island enhancement	Channel digging	No	1,620	No
	Island creation	No	No	No
Pest control	Mammalian	26,608	47,567	41,754
	Black-backed gull (poisoning)	No	No	14,092
	Black-backed gull control (shooting)	No	No	No
	Black-backed gull control (egg oiling)	No	No	2,645
	Harrier (shooting)	No	No	No
Human disturbance	Breeding signage	302	302	453
	Breeding fencing standards and tape	881	776	915
	4WD Beach run protection	No	No	396
	Concrete blocks (6 locations)	No	No	2,814
Total		\$35,557	\$57,312	\$75,436
Project total				\$168,305

It will not be possible to implement all of the management with the available budget as the first year's budget is \$38,000 (excluding management report \$12,000) and \$25,000 per year after that. Various prioritised options are therefore provided below:

Various options are set out below:

- Option 1: Control of karoro/black-backed gulls at the hāpua/river mouth and weed control in all three management areas.
- Option 2: Island enhancement at Lake Hood and weed control at all three management areas.
- Option 3: Karoro/black-backed gulls at the hāpua/river mouth, island enhancement at Lake Hood, and mechanical weed control in all three management areas.
- Option 4: Karoro/black-backed gull control at the hāpua/river mouth and island enhancement at Lake Hood, human disturbance management at all three sites.
- Option 5: Weed control at all three sites.

5.2 Prioritised options for Year 1

5.2.1 Option 1: Control karoro/black-backed gulls at the hāpua/river and weed control in all three management areas

This option will protect breeding birds at Lake Hood from karoro/black-backed gulls control at the hāpua/river mouth and increase nesting choice for the various bird species through mechanical weed clearance at Lake Hood, SH1 and the hāpua/river mouth. The Lake Hood bird management area is isolated from road traffic (SH1) but, human disturbance does occur through boating, fishing, four-wheel driving and dogs. This site is up-river from a large karoro/black-backed gull colony, and gull control will benefit breeding braided river birds between SH1 and hāpua/river mouth. Prioritising the use

of most of the funding at the Lake Hood bird management area will create an island habitat with an open weed-free area with loose, coarse gravel substrate, separated from the mainland through the construction of a channel. This will further isolate the bird management area and greatly reduce the potential for mammalian predators to access the island.

Karoro/black-backed gull control is the top priority at the hāpua/river mouth, followed by mechanical weed clearance, channel construction, and repeated spot-spraying (September and March; Table 14) at the Lake Hood bird management area. Mechanical weed control and human disturbance should also be undertaken at SH1 and the hāpua/river mouth.

Signage placed along the Ashburton walkway and cycle trails will inform the general public of the need to avoid these areas, and to keep dogs on a leash during the breeding season. The placement of fencing tape and standards around each bird management area will provide an additional visual cue to inform the public of the areas to be avoided. The placement of signage and flagging rope at the hāpua/river mouth before the Ashburton Bridge to Beach Run event will greatly reduce the likelihood that the foraging birds at the hāpua/river mouth are disturbed, and the foraging sites are not damaged during this event.

It is recommended that a discussion with the Highbank Power Station and Rangitata Diversion Race management should be undertaken regarding diverting (e.g. down the Hines River) and/or controlling the excess water which is released each year to minimise flooding and damage of the breeding colonies on the Ashburton/Hakaterere River.

Table 14: Option 1 - cost for karoro/black-backed gull control (poison and egg oiling) at the hāpua/river mouth, and mechanical weed control at all sites, and weed spraying and channel digging at Lake Hood. Also, breeding signage and four-wheel-drive beach run signage. A total of \$38,000 is available in Year 1.

Treatment	Action	SH1	Lake Hood	Mouth/Hāpua
Pest control	Black-backed gull (poisoning, 1000 birds)			14,092
Weed control	Spraying		10,810	
	Mechanical control	1,810	1,642	2,881
Island enhancement	Channel digging		1,620	
Human disturbance	Breeding signage	302	302	453
	Breeding fencing standards and tape	881	776	915
	4WD Beach run protection			396
Total		\$2,993	\$15,150	\$18,737
Project Total				\$36,880

5.2.2 Option 2: Island enhancement at Lake Hood and weed control at all three management areas

Option 2 allows for island enhancement at Lake Hood and weed control at SH1, Lake Hood and the hāpua/river mouth in Year 1 (Table 15). This includes mechanical weed control at all areas, repeat spot spraying at SH1 and Lake Hood (September and March), and single spot-spraying (September) at the hāpua/river mouth. Channel excavation

should be undertaken at Lake Hood, to ensure isolation of the bird management area from mammalian predators through enhanced water flows and increased distance to the mainland. The gravel extracted should be used to raise the height of the island.

Table 15: Option 2 - habitat enhancement for all three sites in Year 1. A total of \$38,000 is available.

Treatment	Action	SH1	Lake Hood	Mouth/Hāpua
Weed control	Spraying	11,912	10,810	7,721
	Mechanical control	1,810	1,642	2,881
Island enhancement	Channel digging		1,620	
Total		\$13,722	\$14,072	\$10,602
Project Total				\$38,396

5.2.3 Option 3: Control of karoro/black-backed gulls at the hāpua/river, island enhancement at Lake Hood, and mechanical weed control in all three management areas

Protection of karoro/black-billed gulls at the SH1 area should be supported through black-backed gull control at the hāpua/river mouth (Table 16). General habitat enhancement and breeding bird signage should be implemented at SH1, Lake Hood and the hāpua/river mouth in Year 1. Channel excavation at Lake Hood will further isolate the bird management area from mammalian predators by increasing the distance and water depth between the island and the riverbank. Gravel extracted should be used to raise the island's height. Mechanical weed clearance is important as it will provide and maintain clear breeding areas that are weed-free. Signage placed along the Ashburton walk and cycle trails will inform the general public of the work undertaken, the need to avoid these areas, and to keep dogs on a leash during the breeding season. The placement of fencing tape and standards around each bird management area will provide an additional visual cue to inform the public of the areas to be avoided. The placement of signage and flagging rope at the hāpua/river mouth before the Ashburton Bridge to Beach Run event will greatly reduce the likelihood that the foraging birds at the hāpua/river mouth are disturbed, and that foraging sites are not damaged during this event. To reduce vehicle access to the hāpua/river mouth, concrete blocks should be placed at access points as needed.

Table 16: Option 3 cost - karoro/black-backed gull control (poison and egg oiling) at the hāpua/river mouth and habitat enhancement for all three sites in Year 1. A total of \$38,000 is available.

Treatment	Action	SH1	Lake Hood	Mouth/hāpua
Pest control	Black-backed gull (poisoning, 1000 birds)			14,092
	Black-backed gull control (egg oiling, 250 eggs)			2,645
Weed control	Mechanical control	1,810	1,642	2,881
Island enhancement	Channel digging		1,620	
Human disturbance	Breeding signage	302	302	151
	Breeding fencing standards and tape	881	776	915
	4WD Beach run protection			396
	Concrete blocks (6 locations)			2,814

Treatment	Action	SH1	Lake Hood	Mouth/hāpua
Total		\$2,993	\$4,340	\$23,894
Project Total				\$31,227

5.3 Prioritised options for Years 2 to 5

5.3.1 Option 4: Karoro/black-backed gull control at the hāpua/river mouth and island enhancement at Lake Hood, and human disturbance management at all three sites

Option 4 is the maintenance plan for Option 1 and 3 above, including ongoing habitat enhancement at Lake Hood, karoro/black-backed gull control at the hāpua/river mouth and signage to prevent human disturbance at all bird management areas (Table 17). Mechanical weed control and spot-spraying should be undertaken to maintain open areas and loose substrate for nesting birds. Ongoing channel maintenance will continue to isolate the bird management area from the mainland, and gravel will be used to raise the island height to provide flood protection. Karoro/black-backed gull control in the hāpua/river mouth area will reduce predation at the three bird management areas. Signage should be placed along the Ashburton walking and cycle trails will inform the general public of the work being undertaken, the need to avoid these areas, and to keep dogs on a leash during the breeding season. The placement of fencing tape and standards around each bird management area will provide an additional delineation of the areas public need to avoid. The placement of signage and flagging rope at the hāpua/river mouth before the Ashburton Bridge to Beach Run event will greatly reduce the likelihood that the foraging birds at the hāpua/river mouth are disturbed, and the foraging sites are not damaged during this event.

Table 17: Option 4 - ongoing karoro/black-backed gull control at the hāpua/river mouth, island maintenance at Lake Hood, and signage for breeding bird management areas and foraging site protection at the hāpua/river mouth during the Ashburton Bridge to Beach Run 4WD event.

Treatment	Action	SH1	Lake Hood	Mouth/Hāpua
Pest control	Black-backed gull (poisoning, 500 birds)			7,046
	Black-backed gull control (egg oiling, 250 eggs)			2,645
Weed control	Spraying		5,405	
	Mechanical control		1,642	
Island enhancement	Channel digging		1,620	
Human disturbance	Breeding signage	302	303	453
	Breeding fencing standards and tape	881	776	915
	4WD Beach run protection			396
Total		\$1,183	\$9,745	\$11,455
Project Total				\$22,383

5.3.1 Option 5 - weed control at all three sites

Option 5 is the maintenance plan for Options 2. Ongoing habitat enhancement through mechanical weed control and single spot spraying (September) will be prioritised at the three sites (Table 18). This will provide a weed-free area before breeding commences

and will prevent the continued growth of any persistent weeds that endured the mechanical grading. This will prevent mammalian predators from using weeds as cover.

Table 18: Option 5 - ongoing weed control at all three areas to \$25,000. This option involves mechanical clearance and a single spot-spraying in September.

Treatment	Action	SH1	Lake Hood	Mouth/Hāpua
Weed control	Spraying	5,956	5,405	7,721
	Mechanical control	1,810	1,642	2,881
Total		\$7,766	\$7,047	\$10,602
Project Total				\$25,415

5.4 Additional funding

If additional funding becomes available, predator control should be addressed at SH1 and then at Lake Hood, respectively. The hāpua/river mouth currently has some trapping undertaken by the Hakatere Trapping Group and Forest and Bird, but further trapping within this management area should also be considered. SH1 and the hāpua/river mouth would benefit from further island enhancement through channel excavation to increase water flows and island distances from the riverbanks. Gravel removed during channel digging should be used to increase the height of the islands. Also, any bird management area that is not receiving spot-spraying under the selected options above should have regular treatment, implemented as additional funding becomes available. This will maintain gravel for nesting birds. Drone surveys could be used to assess weed encroachment and to identify nest locations, although the cost relative to the small areas of the management areas may not be cost-effective.

6. COMMUNITY ENGAGEMENT AND MONITORING

6.1 Community engagement

6.1.1 SH1

Public education and awareness are important components to ensure the long-term survival of braided river bird populations. Signage should be placed at the start of the Ashburton walking and cycle trails at the State Highway 1 bridge. This will inform the general public of the management area, the importance of the braided river birds and should inform the public not to let dogs roam off-leash during the breeding season.

6.1.2 Lake Hood

To increase awareness of the breeding birds in the Hakatere/Ashburton River, the Lake Hood House Holders Association should be notified of any predator control and weed control undertaken in the management area and the general location of nesting birds to prevent disturbance. A yearly reminder should be provided to the Association before the commencement of the breeding season that uncontrolled dogs from neighbouring properties or dogs roaming off-leash can disturb and destroy nests and remind dog owners not to allow their dogs to roam.

6.1.3 Hāpua/river mouth

The Hakatere Trapping Group, Forest and Bird, and Hakatere Hut Holders Association are close to the hāpua/river mouth, where the community is undertaking mammalian predator control. Discussion with these groups should be undertaken each year prior to the breeding season about providing them support and assistance with trapping (e.g. petrol vouchers, traps and bait, priority locations and techniques). It is essential to update these interested parties regularly on the active management area and breeding activity. Yearly reminders should be provided to the Hakatere Trapping Group and Hakatere Hut Holders Association that uncontrolled dogs from neighbouring properties, or dogs roaming off-leash can disturb and destroy nests during the breeding season and remind dog owners not to allow their dogs to roam. The Ashburton District Council should be approached regarding closing all vehicle access points at the spit to prevent vehicles from driving over the mudflats and feeding areas. This will reduce the disturbance of breeding and foraging birds and avoid damage to feeding areas.

6.2 Braided river bird monitoring

Braided river bird monitoring has not been assigned a high priority in this management plan. With only 10% of the budget earmarked for this activity (\$3,800 for Year 1 and \$2,500 per year thereafter), this money would be better spent on the management actions described above. However, the following monitoring is suggested if further funding becomes available. This monitoring would help to gauge the success of the management actions, and allow for adaptive management.

6.2.1 SH1

- Survey using binoculars from the SH1 bridge to assess the effectiveness of the weed control (mechanical, September and/or March spot spraying).
- Determine water flow and braids between the management area and the river banks is sufficient to help reduce the possibility that predators will access the island.
- Undertake weekly bird breeding surveys from October to later February to determine the number of nests and breeding success (laying, hatching dates, and chick fledging).
- Each nest site should be marked on a map.
- The SH1 bridge would provide a suitable vantage point to undertake this monitoring as the site is small.

6.2.2 Lake Hood

- A transect survey should be undertaken to assess the effectiveness of the weed control (mechanical, September and/or March spot-spraying).
- Channel depth between the island and the ‘mainland’ should be checked to confirm that it is sufficient to isolate that management area. Excavation may be required to enhance the effectiveness of the channel barrier.

- Weekly breeding bird surveys should be undertaken between October and late February to determine the number of nests, bird species and breeding success: laying, hatching dates, and chick fledging.
- A hand-held GPS unit should be used to record each nest or colony location.
- During avifauna surveys, any evidence of dog activity (footprints) or vehicle tracks on the riverbed should be noted. If vehicle tracks and dog activity is observed, further river access control will need to be implemented (e.g. concrete blocks at access points) and the placement of additional signage informing dog owners of the requirement to control dogs at all times. In addition, discussions should be undertaken with the Lake Hood House Holders Association about the need to protect the braided river birds within the bird management areas.

6.2.3 Hāpua/river mouth

- The hāpua/river mouth management area should be transect-surveyed to assess the effectiveness of weed control: mechanical and spot-spraying (September and/or March).
- Weekly surveys of breeding birds should be undertaken to determine the number of nests, bird species and breeding success: laying, hatching dates, and chick fledging.
- A hand-held GPS unit should be used to record nest locations.
- During surveys, the presence and behaviour of southern black-backed gulls and kahu/harriers should be noted to help identify whether and where control is required.
- If a kahu/harrier is identified as a predator at the site, the bird's colouration and markings should be noted.
- If dead chicks or destroyed nests are identified, karoro/black-backed gull and/or kahu/harrier control should be undertaken.

7. PLAN REVIEW

This plan should be reviewed every five years or more frequently as more funding becomes available.

8. CONCLUSIONS

This management plan provides options for the enhancement of bird breeding success at three locations on the lower Hakatere/Ashburton River: SH1, Lake Hood, and the hāpua/river mouth. The plan focuses on the predator control, habitat enhancement through weed control and island creation, and the management of human disturbance. Options have been tailored to fit within the available budget of \$38,000 in Year 1, and \$25,000 per year ongoing (until the Waverley Wind Farm is decommissioned). A total budget has also been provided, to enable evaluation of a more comprehensive suite of management actions at all sites if further funding was to be obtained.

Management options are ranked below for the budget that is currently available:

- Option 1 (Year 1) and Option 4 (Years 2-5): karoro/black-backed gull control at the hāpua/river mouth, and mechanical weed clearance within the three bird management areas, and spot-spraying and channel excavation at Lake Hood. Also, breeding bird signage along the Ashburton walking and cycling trails and breeding colony fencing tape to identify the breeding colony within the Lake Hood management area. Signage and flagging rope at the hāpua/river mouth before the Ashburton Bridge to Beach Run 4WD event.
- Option 2 (Year 1) and Option 5 (Years 2-5): habitat enhancement at all three management areas by undertaking mechanical weed control, repeat spot-spraying, as well as channel excavation at Lake Hood.
- Option 3 (Year 1) and Option 4 (Years 2-5): weed control in all three bird management areas, and signage along the Ashburton walking and cycling trails, placement of fencing tape during the breeding season, and signage and flagging tape around each bird management site before the Ashburton Bridge to Beach Run 4WD event, and placement of concrete blocks at access points. Option 3 also allows for black-backed gull control at the hāpua/river mouth.

A review should be undertaken after five years, to assess whether the priorities are being met and to adjust the management plan as required.

9. COMMUNITY LIAISON

As part of this management plan, local community groups were contacted via email and informed of the three areas the bird management plan is being prepared for. These groups included the Hakatere Trapping Group, Hakatere Hut Holders Association, Ashburton Forest and Birds, Lake Hood House Holders Association, the Mid-Canterbury Four-wheel-drive Association, and the Ashburton/Hakatere River Zone Committee. A letter emailed to the Ashburton/Hakatere River Zone Committee was also intended to inform rūnanga representatives. When corresponding with all groups feedback was invited.

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