

# Appendix 8: Green Island Resource Recovery Park Precinct Bird Hazard Report

# Green Island Resource Recovery Park Precinct Bird Hazard Report

Prepared for Dunedin City Council  
February 2024

# Summary

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## Background

Dunedin City Council (DCC) engaged Avisure to prepare this Bird Hazard Assessment as part of the resource consent application for the redevelopment of the Green Island Resource Recovery Park Precinct (RRPP) at the Green Island landfill site. The purpose of the assessment is to consider the potential for the development of the RRPP, and the resulting changes in the use of the Green Island landfill, to change the behaviours of the bird species currently present at the site and increase the risk of an aviation hazard.

## Green Island Resource Recover Park Precinct

To support the roll-out of an enhanced kerbside recycling and waste collection service across Dunedin from July 2024, Council is proposing to develop an improved RRPP at the Green Island landfill site. The RRPP development includes a new materials recycling facility (MRF), a new bulk waste transfer station (BWTS) and various organics receiving, processing and composting facilities.

The new kerbside collection service will include collection of organic waste. Currently, organic waste is disposed of at the Green Island landfill and this practice has provided a food source and caused bird populations, including Southern Black-backed Gulls (SBBG) and Red-billed Gulls at the landfill and around the Otago region to grow. The disposal of organic waste to the landfill will be significantly reduced following the development of the organic receiving, processing and composting facilities at the RRPP. The landfill is being closed in stages, with stage 1 of the final capping completed in 2023. Final closure of the landfill is anticipated to occur around 2029/2030, depending on waste disposal rates.

## Bird Hazard to Aircraft

The Green Island Landfill is located approximately 16 km from Dunedin International Airport. International guidance on land use in the vicinity of airports generally considers activities within 13 km of a major airport. Although Green Island Landfill is further than 13 km from Dunedin International Airport, the significant size of the bird population (primarily SBBG) means that altering current practices could result in a redistribution of birds looking for food, potentially bringing them into aircraft flight paths and presenting an aviation hazard. The purpose of this report is to assess the likelihood of that hazard arising and provide appropriate risk management recommendations.

## Hazard Assessment

The assessment was based on monthly surveys at the landfill, regionally and at Dunedin International Airport and a review of Dunedin International Airport Limited bird strike data.

The assessment found that in the medium to long-term (12 months and beyond), the proposed changes to the use of Green Island landfill and the development of the RRPP, will significantly reduce the putrescible waste available as food to birds and is likely to reduce the regional population of birds supported by it. This in turn should reduce the overall hazard of some species (SBBG in particular) to aviation, provided other local food sources are not provided in some other form.

The proposed changes to the use of Green Island Landfill is likely to, in the medium to long-term (12 month and beyond), significantly decrease the regional SBBG population. By eliminating most of the primary food source for the population, recruitment of SBBGs from other locations and through successful breeding should be significantly reduced. It is anticipated that much of the population will leave the Otago region to find new food resources. In the short-term (6 to 12 months), the aviation risk may increase, but over time as the population depletes, there should be fewer SBBG operating in and around Dunedin, including near the airport. What remains of the population, will attempt to find replacement food from other sources.

In the short-term (6 to 12 months) however, the proposed changes would present a medium likelihood of SBBG increasing the aviation hazard unless management actions were taken. This is based on: SBBG already being recorded in Dunedin International Airport's strike records; SBBG regularly being seen flying over the airport in relatively low numbers; and the large number of SBBG currently using the landfill as an important food source needing to find alternative sources.

Red-billed gulls are of less concern and have a low probability of increasing the aviation hazard as they: are not currently mentioned in the strike record; have not been observed from surveys at Dunedin International Airport; and already have various food sources in the region other than at Green Island Landfill.

Starlings are considered a very low probability of increasing the aviation hazard. All other species present a negligible probability.

Following development of the RRPP, the residual attraction of birds to facility is likely to be low as the design and operation includes unloading wastes (including organic wastes) in enclosed buildings. There may be some level of attraction as birds enter the buildings as the doors open to allow vehicle movements. Roller doors and internal netting will prevent large numbers of birds entering buildings and roosting/nesting.

The numbers of birds are expected to be low, particularly the SBBG which present the greatest hazard. Certainly, the level of attraction to birds will be very significantly reduced from the current situation.

Organic waste will be shredded and mixed then composted in the open. Similar operations in other parts of the world demonstrate that they are likely to offer little bird attraction. In the unlikely event these piles become a bird attraction, retroactive covering with mulch or placing screens over the area could be adopted if necessary.

## Recommendations

The key recommendations for managing hazards that may arise from the changes to the use of, and closure of the Green Island Landfill, and development of the RRPP include:

1. Enacting the Draft Southern Black-backed Gull Management Plan – Dunedin and Environs (Avisure, 2023).
2. Other species likely to be displaced by the landfill closure should be included in the monitoring and analysis associated with the SBBG management plan. Red-billed Gulls in particular, must be considered.
3. Monitoring of bird populations should continue through the construction and operational phases of the RRPP. If after analysis, there is a greater bird attraction than anticipated, then proofing measures can be retro-fitted or dispersal actions commenced. Bird proofing options include overhead wires or netting (including on building roofs if necessary) and dispersal options involve deploying suitably trained and equipped dispersal teams.

# Glossary

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Bird strike	A collision between bird(s) and an aircraft.
Consequence	The outcome of an event affecting objectives.
Foraging	When animals search for and obtain food.
Habituate	When animals and birds become used to certain deterrents or stimuli and develop behaviours that adapt to the changed circumstance.
Hazard	A source of potential harm.
Incident	An occurrence, other than an emergency/disaster, associated with the operation of an aircraft that impacts on the safety of operations.
Probability	The extent to which an event is likely to occur (also referred to as 'likelihood').
Putrescible waste	A solid waste that contains organic matter capable of being decomposed by microorganisms and is capable of providing food for birds and other animals.
Risk	The effect of uncertainty on objectives.
Transit	When birds fly from one place to another.
Wildlife Strike	A collision between wildlife and an aircraft.

# Abbreviations

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AGL	Above Ground Level
ASRI	Airport Survey Risk Index
BWTS	Bulk Waste Transfer Station
DCC	Dunedin City Council
ICAO	International Civil Aviation Organisation
MRF	Materials Recovery Facility
NZ CAA	New Zealand Civil Aviation Authority
ORB	Organic Receival Building
RRPP	Green Island Resource Recovery Park Precinct
SBBG	Southern Black-backed Gull
SRI	Species Risk Index

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# 1. Introduction

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## 1.1. Background and scope

DCC engaged Avisure to prepare this Bird Hazard Assessment as part of the resource consent application for the redevelopment of the Green Island RRPP at the Green Island landfill site. The purpose of the assessment is to consider the potential for the development of the RRPP and the resulting changes in the use of the Green Island landfill to change the behaviours of the bird species currently present at the site and increase the risk of an aviation hazard.

Green Island Landfill is a putrescible waste landfill located approximately 16 km from Dunedin International Airport. The landfill supports a variety of bird species, with SBBG (*Larus dominicanus*) present in the thousands and Red-billed Gulls (*Larus novaehollandiae*) regularly in the low hundreds. Other species are in relatively low numbers. Putrescible waste provides a food source and has caused bird populations to grow at the landfill and around the Otago region. With proposed changes to the use of Green Island Landfill, including the redevelopment of the RRPP, a major regional food source for some bird species will no longer be available. In the medium to long-term (12 months and beyond), bird populations that are currently reliant on this food resource are likely to stabilise at lower levels across the region and generally will reduce the bird strike hazard at Dunedin International Airport. In the short-term (6-12 months) as populations readjust to the reduced food availability, birds are likely to search for alternative food sources nearby, potentially bringing them into aircraft flight paths and presenting an aviation hazard. There may also be residual bird attraction to the RRPP and this is assessed as part of this report.

A Draft SBBG Management Plan – Dunedin and Environs, has been developed to manage the hazard for SBBG (Avisure 2023). The development of that Plan was a requirement of the consent conditions for the Smooth Hill Landfill. The initial stages of that Plan’s implementation are underway.

This Report aims to consider all bird species present at the Green Island Landfill and the potential for them to increase the aviation hazard under the development of the RRPP.

## 1.2. Green Island Resource Recovery Park

DCC are planning to make changes to the use of Green Island landfill site in coming years including the development of new buildings and upgrade of existing facilities. As part of the wider strategy for waste diversion, the DCC will introduce a new kerbside collection service from July 2024, which will include the collection of domestic organic (food and green) waste. Following the introduction of this service, organic waste will be received, and composted at the RRPP resulting in a significant reduction of organic waste going to the landfill. The new organic waste collection service will require a new Organic Receiving Building (ORB) for receiving and processing organics.

A new Materials Recovery Facility (MRF) will be built to allow the sorting and baling of co-mingled recycled materials. A new Bulk Waste Transfer Station (BWTS) will also be constructed at the site to facilitate the compaction and trucking of waste to a landfill facility. A number of other buildings will be required including glass bunkers, staff facilities (office and amenities) and associated access roads and parking space.

The RRPP has been designed to minimise the bird attraction by unloading waste in closed buildings limiting the organic waste including food that enters the waste stream.

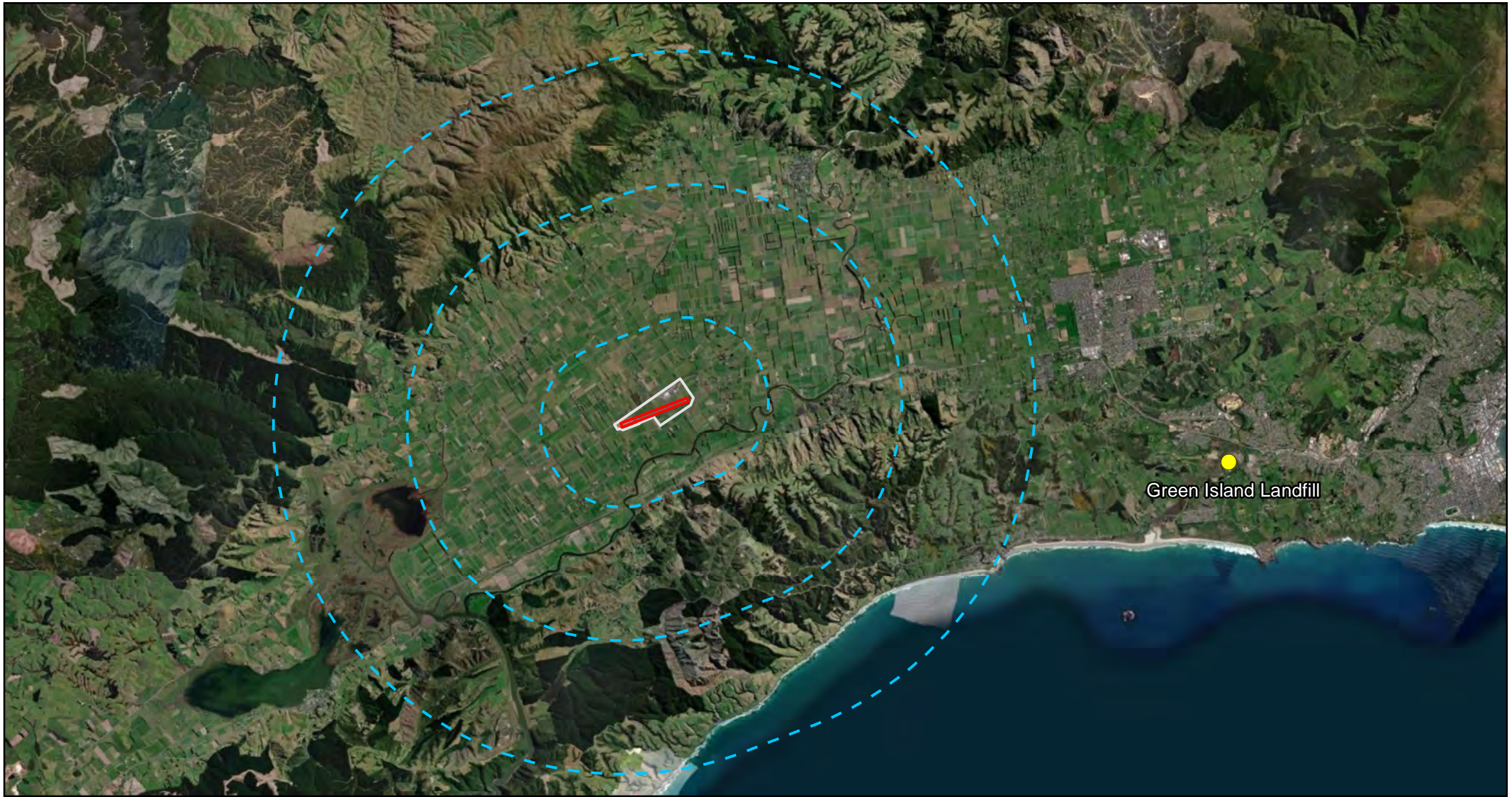
The landfill itself is being closed in stages, with stage 1 of the final capping occurring during 2022-2023. Final closure of the landfill is anticipated to occur around 2029/2030, depending on waste disposal rates.

### 1.3. Dunedin Airport

Dunedin International Airport, comprising 110 ha, is located approximately 22 km south-west of Dunedin City and operates with more than 20,000 aircraft movements per annum (pre-COVID19) on its single runway (Figure 1).

Green Island Landfill falls outside of the 13 km radius that is identified as the area of interest from a bird hazard perspective by the International Civil Aviation Organisation (ICAO) (International Civil Aviation Organisation 2020). However, since the Green Island Landfill has such a sizable bird population and Dunedin International Airport has an existing wildlife strike risk that is considered to be high (Shaw 2022), this land use change should aim to ensure no exacerbation of that risk.





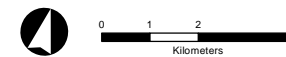
**Figure 1: Dunedin Airport and Green Island Landfill**

Boffa Miskell Limited  
Green Island Bird Hazard Assessment

- Green Island Landfill
- 3, 8 & 13km buffers from runway
- Dunedin Airport runway boundary
- Dunedin Airport boundary



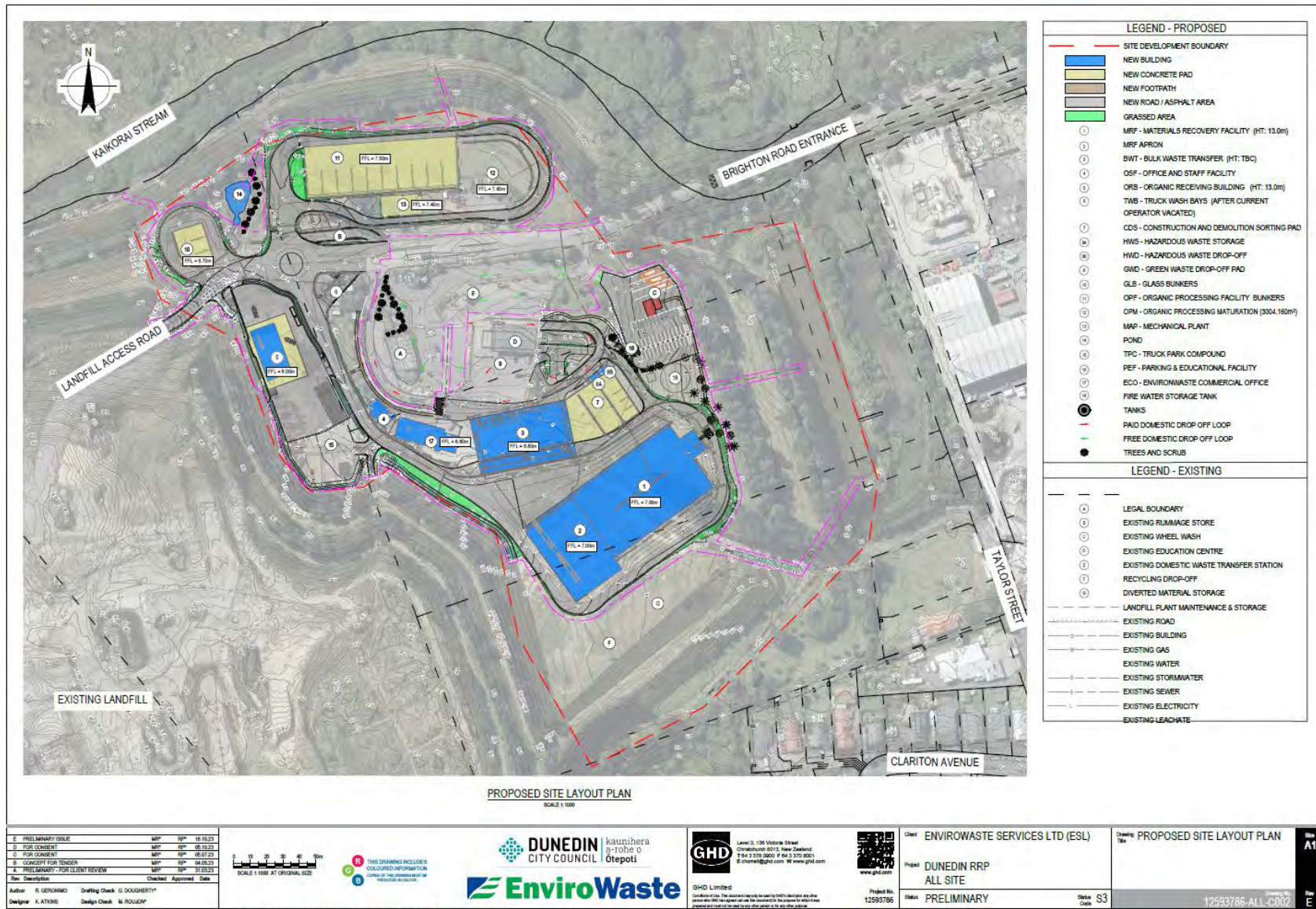
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Revision: 1  
Author: AS  
Date: 7/03/2023



NZGD 2000 New Zealand Transverse Mercator  
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Figure 2 Plan for the RRPP (GHD, Oct 2023)



## 1.4. The Wildlife Strike Issue

The consequence of wildlife strikes with aircraft can be very serious. Wildlife strikes have caused 744 human fatalities and 664 aircraft losses since the beginning of aviation (Shaw et al. 2023). Wildlife strikes cost the commercial civil aviation industry an estimated US\$1.2 billion per annum (Allan 2002) and involve more than just the repair of damaged engines and airframes. Even apparently minor strikes which result in no obvious damage can reduce engine performance, cause concern among aircrew and add to airline operating costs.

Strike risk depends on the probability of colliding with birds and the consequence to the aircraft if collision occurs. The probability of a bird strike occurring increases as the number of birds and aircraft operating in the same airspace increases. Strike probability also increases with airspeed. In practice, this means that the likelihood of colliding with a bird inflight increases when operating at high speed below 5000 feet above ground level (AGL), which is where the majority of birds operate. Bird density, and therefore strike probability, increases with decreasing height above the ground. Operating at low altitudes over, or near, known bird hazards will significantly increase strike probability.

The main factors determining the consequences of a strike are the number and size of animals struck, the combined closing speed at which the strike occurred, the phase of flight when struck and the part of the aircraft hit. Generally, the larger the animal, the greater the damage. Large animals can destroy engines and windshields and cause significant damage to airframe components and leading edges. Strikes involving more than one animal (i.e., a multiple strike) can be serious, even with relatively small birds, potentially disabling engines and/or resulting in major accidents. While total mass struck and impact site on the aircraft are important considerations, final impact speed is the most significant determinant as impact force varies exponentially with the square of closing speed<sup>1</sup>.

## 1.5. Bird Strikes and Land Use Around Airports

In civil aviation around 93% of strikes occur at or below 3500 feet AGL (Dolbeer 2011). Consequently, management focusses largely on terminal airspace and management responsibility has typically resided with aerodrome operators. However, aircrew and air traffic controllers should be engaged in strike risk management and should consider predicted or observed bird movement patterns in their operations.

It is also critical that external stakeholders, including wildlife authorities, local planning authorities and land users, are engaged to monitor and manage bird hazards, and that on- and off-aerodrome hazards are critically assessed. It is particularly pertinent for land use planning to consider bird strikes where new land uses in the surrounding areas are being proposed. Because they are the only sizable flying vertebrate in New Zealand, birds are the main concern when attracted to off-airport land uses.

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<sup>1</sup> The energy of the impact is proportional to the mass of the bird multiplied by the square of the speed of impact (impact energy =  $1/2 \times \text{mass} \times \text{velocity}^2$ ).

### 1.5.1. Birds and Landfills

Putrescible waste is attractive as a food resource to several bird species, as it is generally abundant, easily obtained, and is nutritionally adequate. Long-life putrescible waste landfills that allow regular access to waste can significantly influence local bird populations. Once the site is established as a reliable and primary foraging site, breeding activity increases, populations increase both at the landfill and regionally, and behaviours can become increasingly urbanised (i.e., more use of, and reliance on, urban areas). When this occurs close to airports, the strike risk can increase, and aviation safety is compromised. Landfills sometimes offer waterbodies, trees and other landscape features that may also attract birds.

The New Zealand Civil Aviation Authority (NZ CAA) and ICAO “... recommend that refuse dump sites be located no closer than 13 km from the airport property” (NZ CAA 2008). These statements are guidance only and not regulated. The guidance applies to all Part 139 aerodromes, including Dunedin International Airport. Therefore, landfills within 13 km of airports require careful planning, monitoring, and operating to manage potential bird strike<sup>2</sup> risks. In cases where movement of birds could be greater than 13 km (as is the case with the closure of Green Island Landfill), then land uses at distances beyond 13 km should be assessed.

In New Zealand, the main bird species attracted to landfills include: SBBG, Red-billed Gull, Rock Dove/Pigeon (*Columba livia*), Starling (*Sturnus vulgaris*), House Sparrow (*Passer domesticus*), various finch species, ducks, and shags that can be attracted to landfill waterbodies such as retention ponds.

By far the most significant hazard to aviation in New Zealand are gulls, particularly the SBBG (Figure 3). They are predators and scavengers and are attracted to food waste. SBBG prey on a range of terrestrial and marine insects and animals, as well as small mammals and other birds. As scavengers, they exploit food sources at landfills, farms, parks, piggeries, fishing areas, and food processing factories.

SBBG are common in coastal environments (harbours, estuaries, rocky and sandy shores) and usually breed in large colonial groups on braided rivers, cliffs/steep headlands, islands, sand, or shingle spits.

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<sup>2</sup> As birds are considered the main threat for this project, bird strikes are referred to here, rather than the broader wildlife strike terminology which includes collisions with mammals and other terrestrial animals. Bird strike is used for the remainder of this report.





**Figure 3.** Southern Black-backed

## 2. Methods

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### 2.1. Bird Surveys

Monthly surveys were completed between January 2022 and August 2023 by Boffa Miskell's sub-consultants, Urtica. Binoculars were used to assist with identification of birds.

#### 2.1.1. On-airport

Each round of surveys involved three surveys: early morning, middle of the day, and late afternoon. Each survey consisted of seven sectors that covered the area inside the fence at Dunedin International Airport with assigned observation points that overlooked each sector.

The observer travelled from one observation point to the next following a set route through each sector making observations while en-route. The observer spent five minutes at each observation point, recording all birds observed within the sector during this time. Birds observed in transit or thermalling within the aerodrome boundary or on aircraft flight paths were recorded regardless of whether they were in the current sector or not. Information recorded included: time, species, number sighted, and position, estimated height above ground level, heading (direction) and activity (breeding, chasing, foraging, perching, sheltering, thermalling or transiting). Survey records also included ambient conditions (first and last light, rainfall, temperature, air pressure, wind speed and direction).

#### 2.1.2. Green Island Landfill

The Green Island Landfill surveys estimated the numbers of gulls using the landfill. Counting commenced at first light until the majority of the birds had arrived and only occasional individual birds were still arriving. The two observers were positioned on or adjacent to the landfill at locations considered most ideal to detect birds present at the landfill and those arriving. Each surveyor had a designated survey sector to avoid double counting birds. All gulls arriving at the site were identified to species, counted (one continuous count rather than recording numbers in flocks) and the direction of approach was noted. Approximate numbers of birds departing the site were also recorded.

During the initial May 2021 survey, observations of other bird species indicated very low numbers, so data on non-gull species was not recorded in future surveys.

#### 2.1.3. Otago Region

Bird surveys at selected sites around Otago were completed seasonally between January 2022 and July 2023. This data was used to help determine the relative composition of the various bird populations i.e. the proportion of the regional population that currently uses the Green Island Landfill compared to other localities.



### 2.1.4. Green Island Landfill Bird Dispersal Trial

As part of the Draft SBBG Management Plan (Avisure 2023) a trial to disperse birds from Green Island Landfill commenced on 24<sup>th</sup> May and concluded July 31<sup>st</sup>, 2023. The aim was to develop techniques for dispersing SBBG from Green Island Landfill to imitate the situation when birds will not have regular access to putrescible waste under the RRPP processes. The trial provided better understanding of the potential impacts of reduced access to food wastes, including on aviation safety. During this period, additional monitoring occurred at the landfill and in the Dunedin region by various contractors. A second round of surveys was completed in late July 2023 by Urtica to coincide with this period.

## 2.2. Hazard Assessment

We reviewed the species present at Green Island Landfill and cross referenced those with bird strike records (data was supplied by Dunedin International Airport Limited) and survey records. We completed aviation industry standard risk assessments on the strike data (2018 to 2022) and survey data (January 2022 to August 2023) (Appendix A). The key species of concern to the airport were considered in the context of species that could disperse from Green Island Landfill and their potential to enter aircraft flight paths, presenting a collision risk.

For each species, the probability of a short-term increase in bird hazard arising as a result changes in waste management practices, considered the following factors:

1. **The maximum count recorded at Green Island Landfill.** The higher the numbers recorded at the landfill the greater the number that will redistribute.
2. **Maximum count in one survey at or flying over Dunedin International Airport.** Although not directly relevant to the hazard from the landfill closure, this gives an indication of the species already in the airspace.
3. **Overall current risk at Dunedin International Airport based on strike and survey risk assessments.** The higher the current risk from a species, the greater the concern if more of that species are transiting through the airspace.
4. **A qualitative assessment of the Green Island population as a proportion of regional population.** The greater the number at the landfill as a proportion of the overall population, the more difficult it will be for the species to be absorbed into existing habitats and more likely it will be that they move around the landscape, potentially into aircraft flight paths. The regional population size was assessed from surveys by Avisure and Boffa Miskell in May 2021 and subsequently; from a review of literature (e.g. Van Heezik and Seddon 2012; Heather and Robertson 2015; NZ Birds Online); and from professional judgment.

5. **The hazard assessment for aviation during the transitioning of waste management practices.** This considers the above factors to determine the probability of increasing the presence of the hazard assuming that there is no mitigation in place. The implication here, is that as the current bird strike risk at the airport is high, therefore any probability of creating an additional hazard should be managed.

### 2.3. Residual Bird Attraction To the RRPP

There may be some level of bird attraction at the proposed RRPP. Whilst this is expected to be significantly lower than under the current landfilling practices, the residual risk was assessed based on the proposed design and operational context of the RRPP. The following criteria were considered for each aspect of the RRPP:

1. The potential food content of the waste stream.
2. The accessibility of the waste stream.
3. The bird species that could be attracted to the RRPP.
4. How these species rank as a risk at Dunedin Airport.

## 3. Results

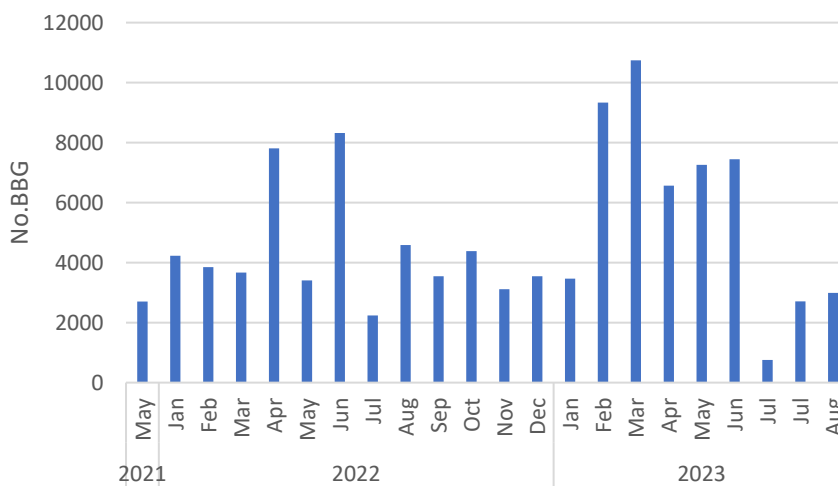
### 3.1. Green Island Landfill Surveys

SBBG are by far the most abundant species at the landfill (Table 1). Red-billed Gull were recorded in numbers from 3 to 700 in the regular monthly surveys. Other species recorded were in small numbers.

**Table 1.** Maximum counts per species at Green Island Landfill

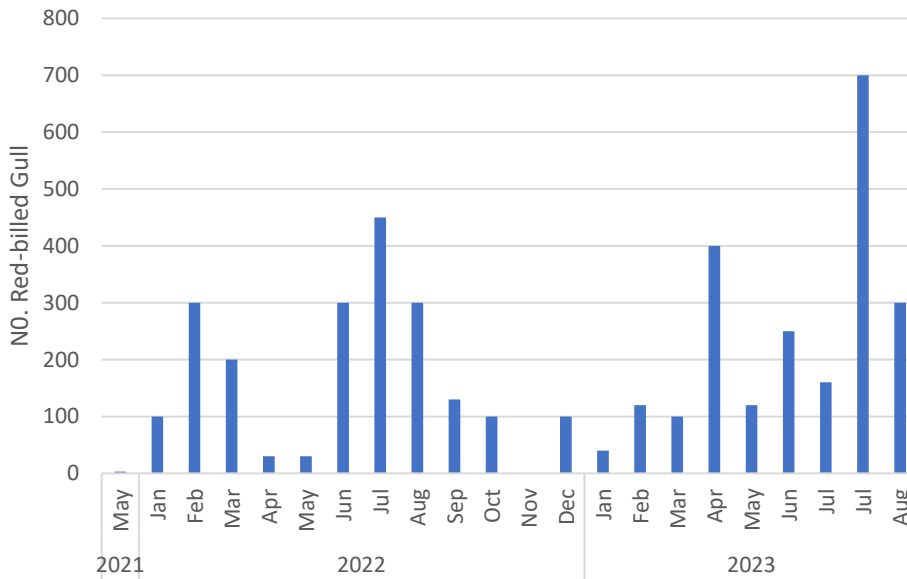
Species	Maximum Count
Black-backed Gull	10,744
Red-billed Gull	700
Starling	30
Unidentified Duck	7
Pukeko	5
Blackbird	5
Harrier Hawk	4
Tui	2
House Sparrow	2
Spur-winged Plover	2
Song Thrush	2
Chaffinch	2

SBBG numbers ranged from 2240 in July 2022 to 10,744 in February 2023 (Figure 4).



**Figure 4.** SBBG numbers at Green Island Landfill

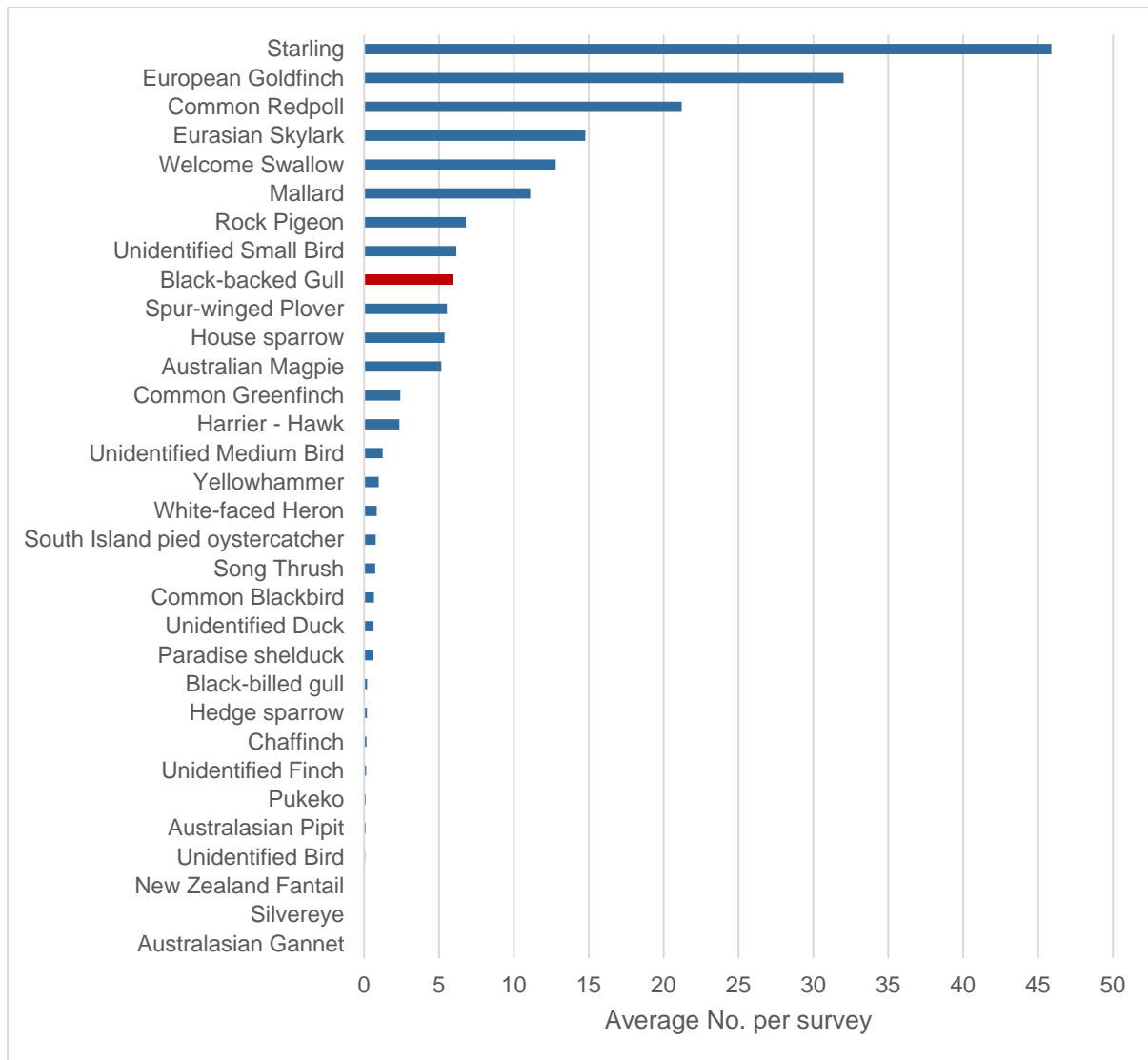
Red-billed Gull numbers ranged from three in May 2021 to 700 in July 2022 (Figure 5). Higher numbers were recorded during the dispersal trial (see 3.3).



**Figure 5.** Red-billed Gull numbers recorded in monthly surveys at Green Island Landfill. Note: no count was recorded for November 2022 – this does not necessarily mean there were no birds.

### 3.2. On-airport Surveys

Surveys indicate that Starling were the most abundant with an average per count of more than 45 (Figure 6). Of the species identified as significant at the Green Island Landfill, SBBG averaged nearly six per survey and Red-billed Gulls were not observed at all. Apart from two observations of singular birds, all of the SBBG observations were of birds in flight, not necessarily attracted to the airport habitats.



**Figure 6.** Average bird numbers observed during monthly surveys at Dunedin International Airport, January 2022 to August 2023

### 3.3. Regional Population

Regional surveys completed seasonally by Urtica of various bird attracting habitats around Dunedin and environs indicate that compared to populations at the Green Island Landfill, species other than SBBG are seen in much greater numbers in other areas.

For instance, Red-billed Gull counts at the landfill average around 200, compared to regional counts averaging around 1400. This suggests that for Red-billed Gulls and the species other than SBBG, the landfill is not a major contributor of food supply to the regional population.

On the other hand, on occasion, the Green Island Landfill has on occasion attracted more than 10,000 birds and the regional estimate for this species is around that number. Accordingly, it is considered as the major food source for the regional population of SBBG.

## 3.4. Green Island Landfill Bird Dispersal Trial

The dispersal trial initially had some impact on the number of SBBG present at Green Island. After a few weeks, the birds habituated to the tools used for dispersal. By increasing the dispersal team to three people, adopting additional tools and modifying the approach, the last three weeks of the trial (7th to 31st July 2023) were deemed highly successful. SBBG numbers were regularly under 2000 at Green Island Landfill and many were found in the environs of Dunedin and further afield. During this period, many of the birds redistributed to Dunedin Harbour with around 3,500 observed during patrols on 9th July 2023. Patrols confirmed the attraction to the Kaikorai Estuary. Other significant sites included the Dunedin Waste Transfer Station (650 SBBG 14th July 2023) and nearby Leith Brook (600 SBBG 17th July 2023). Later in July and into early August, after the gulls had been denied food from the landfill for 1-2 weeks, SBBG were observed more scattered and regularly in farm paddocks. This is evidenced by:

1. 55% of the regional population recorded at regional survey sites in these months. This compares to an average of 30% across all other seasonal surveys. These data are supported by similar numbers recorded during patrols.
2. The late July 2023 airport surveys recorded the greatest number of SBBG flying over (56). The 11th of August 2023 count of 35 at Dunedin International Airport was the second highest and probably indicates the lingering impact of the dispersal which concluded on 31st July 2023.
3. The GPS tracking of 10 SBBG indicated widespread movement through this period of several individuals and a more settled pattern at other times.

Interestingly, during this period, Red-billed Gulls were in much greater number than usual, regularly recorded at around 2000 birds. It appears that the absence of the larger and more aggressive SBBG provided an opportunity for the more agile Red-billed Gulls to take advantage of the available food. Red-billed Gulls also seem less affected by the tools used to disperse the SBBGs.

During the trial, regular counts by Urtica were more difficult due to the erratic behaviour of the gulls in response to dispersal, therefore numbers in June and July 2023 should be considered estimates only.

## 3.5. Hazard Assessment

### 3.5.1. Species Risk - Strikes

The strike risk assessment indicates that there are four species that present a medium risk: SBBG, Harrier Hawk, Unidentified Duck and Spur-winged Plover (Figure 7). Other species recorded in strikes were assessed as low risk.

From 2018 to 2022, three SBBG were recorded as being struck. "Unidentified Gull" was also recorded three times. If this data is amalgamated, SBBG would be a high-risk species.

The data supplied by Dunedin International Airport Limited did not include information on the number of individuals struck in each strike event. Striking more than one bird in an incident is considered a greater risk and the risk assessment technique requires such records to automatically increase the risk category to the next level. As this data was not available, we assumed that all strikes were with a single bird which could be an underestimate of the risk for some species.

Probability of strikes (5 year strike average for each species)						
		Very Low	Low	Moderate	High	Very High
Probability of damage	Very Low	European Goldfinch	House Sparrow Common starling Waxeye Thrush			
	Low	Australian Magpie			Spur-winged Plover	
	Moderate					
	High		Southern Black-backed Gull Harrier Hawk Unidentified Duck			
	Very High					
<b>Low Risk:</b> no further action beyond current management is required						
<b>Medium Risk:</b> review current management practices and options for additional action required						
<b>High Risk:</b> immediate action required to reduce the current risk						

Figure 7. Strike risk assessment of species (Allan 2006).

### 3.5.2. Species Risk - Surveys

The survey risk assessment indicates that there are three species that present a high risk: Mallard Duck, SBBG, and Rock Pigeon (Table 2). There were eight moderate risk species, 10 low risk species and 10 very low risk species.

**Table 2.** Survey risk assessment – High, moderate and low risk species (Shaw 2004).

Rank	Species	Risk Level
1	Mallard	High
2	Black-backed Gull	High
3	Rock Pigeon	High
4	Spur-winged Plover	Moderate
5	Harrier-Hawk	Moderate
6	Starling	Moderate
7	Paradise Shelduck	Moderate
8	Unidentified Duck	Moderate
9	Australian Magpie	Moderate
10	White-faced Heron	Moderate
11	South Island Pied Oystercatcher	Moderate
12	European Goldfinch	Low
13	Unidentified Medium Bird	Low
14	Welcome Swallow	Low
15	Black-billed Gull	Low
16	Eurasian Skylark	Low
17	Common Redpoll	Low
18	Australasian Gannet	Low
19	Common Greenfinch	Low
20	House Sparrow	Low
21	Unidentified Small Bird	Low
22	Common Blackbird	Low

### 3.5.3. Assessment of hazard by species

The assessment found that the transition of Green Island Landfill to operations under the RRPP has a moderate chance of increasing the short-term (6 to 12 months) hazard present within Dunedin International Airport’s critical airspace (Table 3). The moderate rating assumes that there are no initiatives in place to mitigate increased SBBG strike risk associated with their dispersal from the Green Island Landfill.



**Table 3.** Bird strike hazard assessment of species using Green Island Landfill

Species	Maximum count at Green Island Landfill	Maximum count in one survey at or flying over Dunedin International Airport	Overall current risk at Dunedin International Airport	Green Island Landfill population as a proportion of regional population (qualitative)	Probability of increasing the short-term hazard for aviation upon closure of Green Island Landfill (assumes no mitigation)
Black-backed Gull	10,144	25	High	Very Large	Moderate
Red-billed Gull	700*	Nil recorded	Negligible	Small	Low
Starling	30	244	Moderate	Very small	Very low
Unidentified Duck	7	37	Moderate	Very small	Negligible
Pukeko	5	4	Low	Very small	Negligible
Blackbird	5	5	Low	Negligible	Negligible
Harrier Hawk	4	8	Moderate	Negligible	Negligible
Tui	2	Nil recorded	Negligible	Negligible	Negligible
House Sparrow	2	54	Low	Negligible	Negligible
Spur-winged Plover	2	22	Moderate	Negligible	Negligible
Song Thrush	2	4	Low	Negligible	Negligible
Chaffinch	2	3	Low	Negligible	Negligible

While the landfill supports a very high proportion of the regional SBBG population, the airport does not currently attract large numbers of SBBG. However, the transition to the RRPP may result in more SBBG present at and around the airport while they search for new food sources. Because of their size and flocking nature and because of their presence in the strike records, SBBG are already a high-risk species for Dunedin International Airport, therefore it is necessary to manage the potential risk associated with the moderate hazard rating.

Although present in the hundreds (and during dispersal, up to 3,500) at Green Island, Red-billed Gulls were considered a low probability of causing a short-term hazard as they appear not to currently use the Dunedin aviation airspace in significant numbers and the Green Island Landfill population appears to be only a small proportion of the overall population. In 64 surveys completed at Dunedin Airport between January 2022 and August 2023, no Red-billed Gulls were recorded.

Starlings are a very low probability of causing a short-term hazard as their numbers at the landfill are relatively low, particularly compared to what is already observed at the airport.

All other species present negligible probability of increased hazard as their numbers are very low at the landfill.

### 3.5.4. Residual bird attraction from the RRPP

The following measures have been incorporated into the design of the RRPP to limit the bird attraction:

1. Waste with possible food content will be unloaded in enclosed buildings with doors that will only open to allow vehicles in and out.
2. Buildings will be internally lined to minimise the perching opportunities for birds.

An assessment of each waste stream is outlined in Table 4. This assessment includes consideration of:

1. The potential food content of the waste stream;
2. The accessibility of the waste stream;
3. The bird species that could be attracted to the RRPP; and
4. How these species rank as a risk at Dunedin Airport.

**Table 4.** Assessment of the residual bird attraction from the RRPP

Location	Likely food content	Accessibility of the food source	Species that could be attracted	Residual bird attraction
Materials Recovery Facility	Low	Possible	Red-billed Gulls, Starling, Sparrows in low numbers and SBBG occasionally	Birds could adapt to entering when doors are open. Likely in very low numbers
BWTS	Moderate	Possible	Red-billed Gulls, Starling, Sparrows in low numbers and SBBG occasionally	Birds could adapt to entering when doors are open. Likely in low numbers
Workers facility	Negligible	N/A	Nil	Nil
ORB	Very high	Possible	Red-billed Gulls, Starling, Sparrows in low numbers and SBBG occasionally	Birds could adapt to entering when doors are open. Likely in low numbers
C&D Sorting Pad	Very low	Likely	Red-billed Gulls, Starling, Sparrows in low numbers and SBBG occasionally	Although open to birds, because of the likely low food content, unlikely to attract birds in significant numbers
Hazardous drop off	Negligible	N/A	Nil	Nil
Hazardous waste storage	Negligible	N/A	Nil	Nil
Green waste drop off pad	Very low	Likely	Red-billed Gulls, Starling, Sparrows in low numbers and SBBG occasionally	Although open to birds, because of the likely low food content, unlikely to attract birds in significant numbers
Glass bunkers	Negligible	N/A	Nil	Nil
Organics Bunkers	Negligible consumable food	Likely	Red-billed Gulls, Starling, Sparrows in low numbers and SBBG occasionally	Organics, consisting of food and vegetation shredded and mixed. When positioned outdoors to breakdown into compost they generally do not attract birds in significant numbers
Organics processing facility maturation	Negligible consumable food	Likely	Red-billed Gulls, Starling, Sparrows in low numbers and SBBG occasionally	Organics, consisting of food and vegetation shredded and mixed. When positioned outdoors to breakdown into compost they generally do not attract birds in significant numbers
Pond	Negligible	N/A	Nil	Water bodies attract pukeko, ducks and other waterbirds. This has negligible impact as such ponds already exist
Envirowaste transport compound	Negligible	N/A	Nil	Nil
Office parking & educational facility	Negligible	N/A	Nil	Nil
Envirowaste Office	Negligible	N/A	Nil	Nil

The assessment indicates that there may be a relatively small number of gulls supported by the food made available by the RRPP, and the primary species is likely to be Red-billed Gulls, although Starling, Sparrows and to a lesser extent SBBG could also obtain some food. The species and numbers of birds likely to be attracted to the RRPP are not expected to be a significant aviation hazard.

## 4. Conclusion

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The proposed changes to the use of Green Island Landfill is likely to, in the long-term, significantly decrease the regional SBBG population. By eliminating most of the primary food source for the population, recruitment of SBBGs from other locations and through successful breeding should be significantly reduced. It is anticipated that much of the population will leave the Otago region to find new food resources. In the short-term, the aviation risk may increase, but over time as the population depletes, there should be fewer SBBG operating around Dunedin, including near the airport. What remains of the population, will attempt to find replacement food from other sources.

There is a medium probability of an increased bird strike hazard arising from SBBG dispersing after the reduction of putrescible waste being available. As the airport already has an overall high bird strike risk (Shaw 2022) and SBBG are a high-risk species, it is therefore necessary in risk management terms to manage.

Red-billed Gulls present a low probability of increased hazard presence and Starling a very low probability associated with the changes in the use of Green Island Landfill. All other species present a negligible probability.

The assessment assumes that there are no initiatives in place to mitigate increased bird strike risk associated with the changes in the use of Green Island Landfill. A comprehensive plan has been developed to manage the hazard presence that may arise from SBBG. Monitoring for Red-billed Gulls should be done to confirm that there is no increased hazard to aviation.

The residual risk of food availability for gulls at the RRPP is considered low. Some birds, mostly Red-billed Gulls, Starling and Sparrows are likely to be attracted to the facility. They are expected in relatively low numbers as any food waste will be dispatched within enclosed buildings with doors that will only remain open when vehicles are moving in and out. These species are expected to find weaknesses in the systems and still be able to enter buildings that offer food, but should remain in relatively low numbers. The larger and less agile SBBGs are not expected to be attracted in any significant number and accordingly as the species of most concern from an aviation perspective, the RRPP operation is unlikely to present a material contribution to bird strike risk at Dunedin International Airport. Monitoring should occur and if numbers of any species of concern reach unacceptable levels, retroactive measures can be incorporated to manage unacceptable risk.

## 5. Recommendations

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The key recommendations for managing hazards that may arise from the changes to the use of, and closure of the Green Island Landfill, and development of the RRPP include:

1. Enacting the Draft Southern Black-backed Gull Management Plan – Dunedin and Environs (Avisure, 2023). This plan includes:
  - a. Consultation (via the formation of a working group and direct consultation with stakeholders and in particular Te Rūnanga o Ōtākou, Dunedin International Airport Limited and the NZ Airline Pilots Association);
  - b. Comprehensive monitoring (surveys and counts, colour marking of SBBG, GPS tracking, patrols);
  - c. Measurable targets;
  - d. Active management (dispersing SBBG from Green Island Landfill, breeding restriction);  
and
  - e. Regular review and adaptive management.
2. Other species likely to be displaced by the landfill closure should be included in the monitoring and analysis associated with the SBBG management plan. Red-billed Gulls in particular, must be considered.
3. Monitoring of bird populations should continue through the construction and operational phases of the RRPP. If after analysis, there is a greater bird attraction than anticipated, then proofing measures can be retro-fitted or dispersal actions commenced. Bird proofing options include overhead wires or netting (including on building roofs if necessary) and dispersal options involve deploying suitably trained and equipped dispersal teams.

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# Appendix A: On Airport Survey Risk Assessment

## Strike Risk Assessment (Allan 2006)

The assessment phase of the risk management process involves categorising risks. To do this, a hazard needs to be measured in terms of its probability of occurring and the consequence should it occur. This allows it to be placed into a risk matrix as outlined below:

		Probability of Strikes (5yr average)				
		Very Low	Low	Moderate	High	Very High
Probability of damage	Very Low					
	Low		Species A			
	Moderate					
	High	Species B			Species C	
	Very High					

**Figure A1.** Strike risk assessment matrix (Allan 2006).

Risks which fall into the green section are classified as ‘low’ and require no further action beyond current management; yellow is ‘moderate’ and requires a review of current management practices and options for additional action, and; red is ‘high’ and requires immediate action to reduce the current risk.

Risk assessment procedures based on historical strike data are limited, as they cannot easily accommodate real-time changes in bird species composition or distribution.

## Survey Risk Assessment (Shaw 2004)

Avisure has developed a model for determining risk categories using professional bird survey data. The survey data is used to derive probability factors (population size, position on airport, time spent in air and the species ability to avoid) and consequence factors (bird mass and flock size) for all species recorded. The combination of these probability and consequence factors give a numerical risk index, the Species Risk Index (SRI). This provides a real-time method of risk assessment as it is able to react to observed changes in airside bird assemblages and movement patterns.



Table A1 outline the risk rating for wildlife species according to calculated SRI, and the Airport Survey Risk Index (ASRI).

**Table A1.** SRI and ASRI for determining risk categories based on survey data.

SRI ranges used to rate risk for each species		ASRI ranges used to rate risk of an airport	
SRI	Risk rating	ASRI	Risk rating
>1000	Very high	>10000	Very high
100 to 999.9	High	1000 to 9999.9	High
10 to 99.9	Moderate	100 to 999.9	Moderate
1 to 9.9	Low	10 to 99.9	Low
< 1	Very low	< 10	Very low

The process intends to provide a transparent, logical and systematic approach to the identification and treatment of wildlife related risks at the airport. The risk assessment identifies high risk species, which allows suitable management practices to be targeted in areas where the maximum reduction in risk may be achieved.

## Revision History

Rev. No.	Rev. Date	Details	Prepared by	Reviewed by	Approved by
0	8/9/2023	Green Island RRPP Bird Hazard Report	Phil Shaw Principal Aviation Ecologist	Jeff Follett CEO	Jeff Follett CEO
01	3/10/2023	Green Island RRPP Bird Hazard Report	Phil Shaw Principal Aviation Ecologist	Phil Shaw Principal Aviation Ecologist	Phil Shaw Principal Aviation Ecologist
02	27/2/2024	Green Island RRPP Bird Hazard Report	Phil Shaw Principal Aviation Ecologist	Phil Shaw Principal Aviation Ecologist	Phil Shaw Principal Aviation Ecologist
03	28/2/2024	Green Island RRPP Bird Hazard Report	Phil Shaw Principal Aviation Ecologist	Phil Shaw Principal Aviation Ecologist	Phil Shaw Principal Aviation Ecologist
04	28/2/2024	Green Island RRPP Bird Hazard Report	Phil Shaw Principal Aviation Ecologist	Phil Shaw Principal Aviation Ecologist	Phil Shaw Principal Aviation Ecologist

## Distribution List

Copy No.	Date	Format	Issued to	Name
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