

# Green Island Landfill

Bird Hazard Assessment – Final (Rev 02)

Boffa Miskell

March 2023



# Summary

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## Background

Dunedin City Council engaged Boffa Miskell Ltd and subcontractor Avisure to prepare this Bird Hazard Assessment as part of the consent application for changes to the use of Green Island Landfill. The landfill supports a variety of bird species, with Southern Black-backed Gulls present in the thousands and Red-billed Gulls regularly in the low hundreds. Other species are in relatively low numbers.

## Green Island Landfill

The Green Island Landfill is a putrescible waste landfill located approximately 16 km from Dunedin International Airport. Putrescible waste has provided an anthropogenic food supply and caused bird populations to grow. The proposed changes to the use of Green Island Landfill will significantly reduce the putrescible waste available as food to birds. In the long-term, is likely to reduce the regional population of birds supported by it. In the short- to medium-term, the hazard to aviation may increase from birds searching for food as waste management practices change at Green Island Landfill.

## Bird Hazard to Aircraft

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 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.

## Hazard Assessment

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

The assessment found that Southern Black-backed Gulls present a medium likelihood of increasing the short-term aviation hazard following closure of Green Island Landfill. Red-billed gulls are a low probability and Starling a very low probability. All other species present a negligible probability.

## Recommendations

The key recommendations for mitigating bird strike risk that may arise from the closure of Green Island Landfill include:

Enacting the Draft Southern Black-backed Gull Management Plan – Dunedin and Environs.

As part of the above management plan, monitoring is essential. Other species likely to be displaced by the landfill closure should be included in the monitoring and analysis. Red-billed Gulls in particular, must be considered.

# Glossary

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Bird Strike	A collision between bird(s) and an aircraft.
Consequence	The outcome of an event affecting objectives.
Critical Area	Areas within or in proximity to the runway strip, approach and landing paths, and movement areas of an aerodrome.
Foraging	When animals search for and obtain food.
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
BBG	Southern Black-backed Gull
ICAO	International Civil Aviation Organization
NZ CAA	New Zealand Civil Aviation Authority
SOP	Standard Operating Procedure
SRI	Species Risk Index

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# 1. Introduction

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## 1.1. Background and scope

Dunedin City Council engaged Boffa Miskell Ltd and subcontractor Avisure to prepare this Bird Hazard Assessment as part of the consent application for the closure of Green Island Landfill.

Green Island Landfill is a putrescible waste landfill located approximately 16 km from Dunedin International Airport (Figure 1 and 2). The landfill supports a variety of bird species, with Southern Black-backed Gulls present in the thousands and Red-billed Gulls regularly in the low hundreds. Other species are in relatively low numbers. Putrescible waste provides a food supply and has caused bird populations to grow. With the closure of the landfill, a major regional food source will no longer be available to birds. In the long-term, bird populations that are currently reliant on this food resource are likely to stabilise at lower levels and generally will reduce the bird strike hazard at Dunedin International Airport. In the short- to medium-term as populations readjust to the reduced availability of food, birds are likely to search for alternative food sources nearby, potentially bringing them into aircraft flight paths and presenting an aviation hazard.

A Draft Southern Black-backed Gull (BBG) Management Plan has been developed to mitigate this hazard for BBG (Avisure 2023). The development of that Plan was a requirement of the consent conditions for the Smooth Hill Landfill.

This hazard assessment aims to consider all bird species present at the Green Island Landfill and the potential for them to cause an aviation hazard. The assessment will be submitted as part of the consent application for the landfill closure.

## 1.2. Green Island Landfill Project Description

As part of Dunedin's wider commitment to reducing carbon emissions and reducing waste going to landfill, the Dunedin City Council has embarked on the Waste Futures Programme to develop an improved comprehensive waste management and diverted material system for Ōtepoti Dunedin. The Waste Futures Programme includes the roll out of an enhanced kerbside recycling and waste collection service for the city from July 2024. The new service will include collection of food and green waste.

To support the implementation of the new kerbside collection service, the Dunedin City Council are planning to make changes to the use of Green Island landfill site in coming years.



**Figure 1. Green Island Landfill Site**

The proposed changes include:

- planning for the closure of the Green Island landfill, which is coming to the end of its operational life
- developing an improved Resource Recovery Park to process recycling, and food and green waste
- providing new waste transfer facilities to service a new Class 1 landfill currently planned for a site south of Dunedin, at Smooth Hill.

The resource consents for the new Smooth Hill landfill are subject to appeal. Depending on the outcome of this appeal process, and the time needed to undertake baseline monitoring, preparation of management plans, landfill and supporting infrastructure design and construction, Dunedin City Council anticipate that the new Class I landfill facility, won't be able to accept waste until 2027/2028 at the earliest.

In the interim, Dunedin City Council therefore plans to continue to use Green Island landfill for waste disposal. Based on Dunedin's current waste disposal rates, it is likely that that the Green Island landfill can keep accepting waste for another six years (until about 2029). Between now and then, and as it continues to fill up, the landfill will be closed and capped in stages. When the landfill closes completely, there will be opportunities for environmental enhancements and public recreational use around the edge of the site. Examples could be planting restoration projects and new walking and biking tracks beside

the Kaikorai Estuary. Long term use and public access to the landfill site post closure will be determined in consultation with Te Rūnanga o Ōtākou, the local community and key stakeholders.

As current Otago Regional Council resource consents needed to operate a landfill at Green Island expire in October 2023, the Dunedin City Council are now applying to Otago Regional Council for replacement resource consents to continue to use the landfill until it closes completely, and waste disposal can be transferred to a new landfill facility. The replacement consents relate to ground disturbance, flood defence and discharges to land, water, and air. The site is subject to an operative designation (D658) in the Proposed Second-Generation Dunedin City District Plan (2GP) for the purpose of Landfilling and Associated Refuse Processing Operations and Activities.

The development of the new Resource Recovery Park and waste transfer facilities at Green Island does not form part of the replacement consent applications. Resource consents for the development and operation of the Resource Recovery Park will be applied for following the completion of design work and technical assessments later in 2023.

### 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 2).

Dunedin International Airport has an existing wildlife strike risk that is considered to be high (Shaw 2022), so any land use changes should aim to ensure no exacerbation of that risk.





**Figure 2: Dunedin Airport and Green Island Landfill**

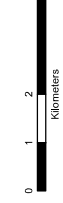
Boffa Miskell Limited

Green Island Bird Hazard Assessment



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

Job number: PR7845  
 Revision: 1  
 Author: AS  
 Date: 7/03/2023



NZGD 2000 New Zealand Transverse Mercator  
 Projection: Transverse Mercator  
 Datum: NZGD 2000  
 Units: Meter

Data Sources: AVISURE Pty. Ltd. 2023; Imagery: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community  
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## 1.4. The Wildlife Strike Issue

The consequence of wildlife strikes<sup>1</sup> 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. 2022). 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>3</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 and mitigation processes, and that high-risk operations consider predicted or observed bird movement patterns.

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<sup>1</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.

<sup>2</sup> A database that lists more details about significant and fatal wildlife strike events is available at <https://avisure.com/wp/serious-accident-database/>

<sup>3</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 =  $1/2 \times \text{mass} \times \text{velocity}^2$ ).

It is also critical that external stakeholders, including wildlife authorities, local planning authorities and land users, are engaged to monitor and mitigate bird hazards, and that both 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.

### 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 for many species. 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, 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 International Civil Aviation Organization (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 mitigate potential bird strike 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: the BBG, Red-billed Gull (*Larus novaehollandiae*), Rock Dove/Pigeon (*Columba livia*), Starling (*Sturnus vulgaris*), House Sparrow (*Passer domesticus*), various finch species, and 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 BBG (Figure 3). They are predators and scavengers and are attracted to food scraps and organic waste. BBG prey on a range of terrestrial and marine insects and animals, as well as small mammals and other birds. As scavengers, they exploit organic food sources at landfills, farms, parks, piggeries, fishing areas, and food processing factories.

BBG 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.



**Figure 3.** Southern Black-backed Gull (*Larus dominicanus*)

## 2. Methods

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### 2.1. Bird Surveys

Principal Aviation Ecologist Phil Shaw (Avisure) and Ornithologist Karin Sievwright (Boffa Miskell) completed bird surveys between 4 and 7 May 2021. All remaining monthly surveys (January 2022 to February 2023) were completed by Boffa Miskell's sub-consultants, Urtica. Binoculars were used to assist with identification of birds.

#### 2.1.1. On-airport

Each month, three surveys were completed: 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 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.



## 2.2. Risk Assessment

We reviewed the species present at Green Island Landfill and cross referenced those with records in bird strikes (data was supplied by Dunedin International Airport Limited) and records in the surveys. We completed aviation industry standard risk assessments on the strike data (2018 to 2022) and survey data (January 2022 to February 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 bird strike hazard arising as a result of the landfill closure 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 moving around 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. Heezik and Seddon, 2012; Heather and Robertson; 2015; NZ Birds Online<sup>4</sup>); and from professional judgment.
5. **A qualitative assessment of the potential unmitigated hazard for aviation upon closure of Green Island Landfill.** Considering the above factors, an overall assessment of the probability of increasing the hazard was determined. The implication here, is that as the current birdstrike risk at the airport his high, any probability of increasing the hazard should be mitigated.

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<sup>4</sup> <https://nzbirdsonline.org.nz/>

## 3. Results

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### 3.1. Bird Surveys

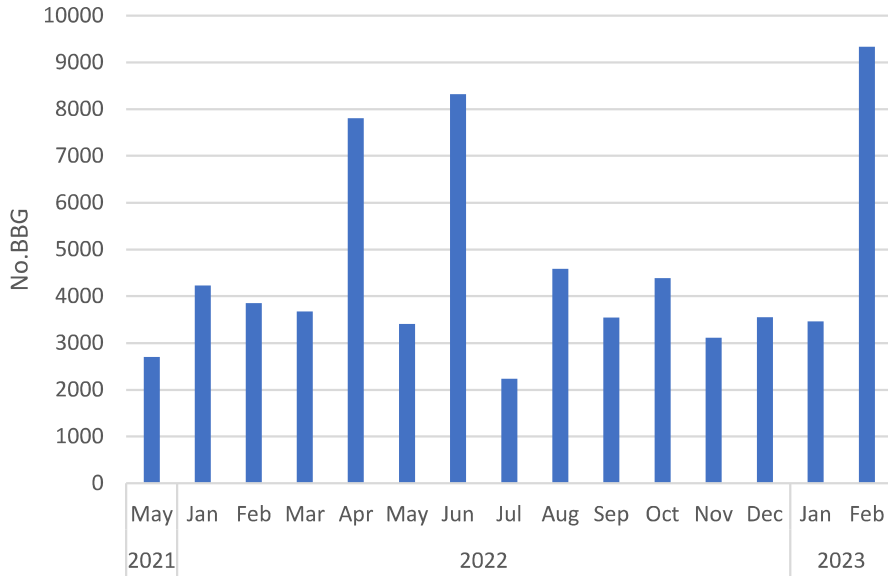
#### 3.1.1. Green Island Landfill

BBG are by far the most abundant species at the landfill (Table 1). Red-billed Gull were recorded in numbers from three to 450. Other species recorded included Australasian Harrier (*Circus approximans*), Blackbird (*Turdus merula*), Chaffinch (*Fringilla coelebs*), Pukeko (*Porphyrio melanotus*), House Sparrow, Songthrush (*Turdus philomelos*), Spur-winged Plover (*Vanellus miles*), Starling (*Sturnus vulgaris*), Tui (*Prosthemandera novaeseelandiae*), and duck species. None of these other species were in large numbers.

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

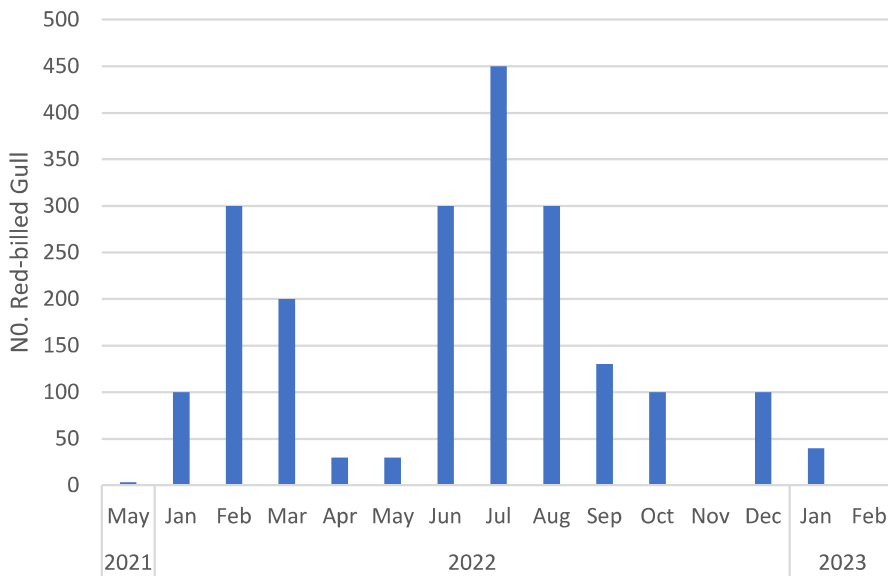
Species	Maximum Count
Black-backed Gull	9334
Red-billed Gull	450
Starling	30
Unidentified Duck	7
Pukeko	5
Blackbird	5
Harrier Hawk	4
Tui	2
House Sparrow	2
Spur-winged Plover	2
Song Thrush	2
Chaffinch	2

BBG numbers ranged from 2240 in July 2022 to 9334 in February 2023 (Figure 4).



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

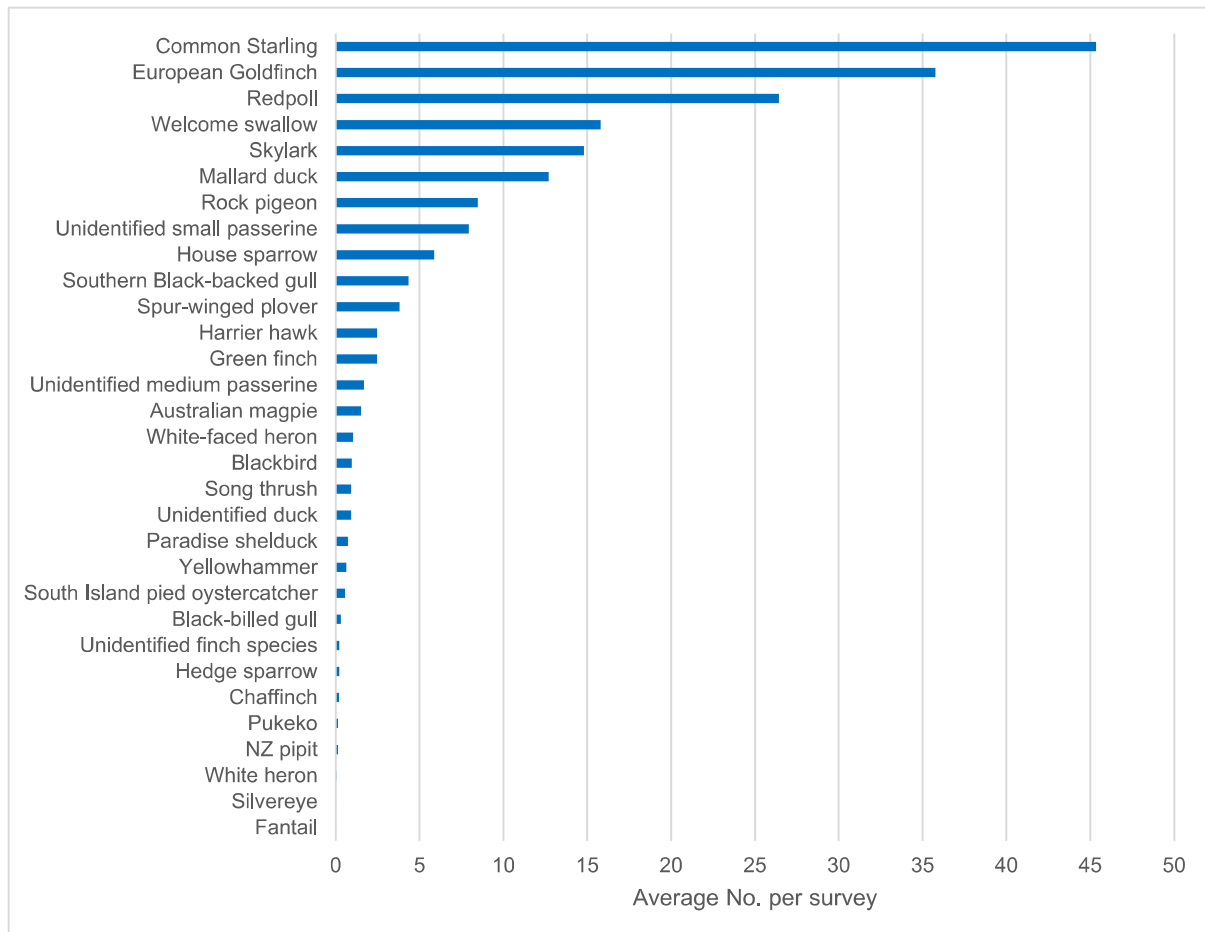
Red-billed Gull numbers ranged from three in May 2021 to 450 in July 2022 (Figure 5).



**Figure 5.** Red-billed Gull numbers recorded in monthly surveys at Green Island Landfill. Note: no count was recorded for November 2022 and February 2023 – this does not necessarily mean there were zero birds.

### 3.1.2. On Airport

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, BBG averaged at just over four per survey and Red-billed Gulls were not observed at all. All of the BBG 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 February 2023

## 4. Risk Evaluation

### 4.1. Airport Species Risk

#### 4.1.1. Strike Risk

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

In the five years (2018 to 2022), three BBG were recorded as being struck. “Unidentified Gull” was also recorded three times. If this data is amalgamated, BBG 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).



#### 4.1.2. Survey Risk

The survey risk assessment indicates that there are three species that present a high risk: Mallard Duck, BBG, and Rock Pigeon (Table 2). There were eight moderate risk species, 12 low risk species and six very low risk species.

**Table 2.** Survey risk assessment (Shaw 2004).

Rank	Species	Survey Risk
1	Mallard Duck	High
2	Southern Black-backed Gull	High
3	Rock Pigeon	High
4	Spur-winged Plover	Moderate
5	Harrier Hawk	Moderate
6	Unidentified Duck	Moderate
7	Paradise Shelduck	Moderate
8	Starling	Moderate
9	Unidentified Bird	Moderate
10	White-faced Heron	Moderate
11	Australian Magpie	Moderate
12	South Island Pied Oystercatcher	Low
13	Black-billed Gull	Low
14	Welcome Swallow	Low
15	Skylark	Low
16	Redpoll	Low
17	Blackbird	Low
18	White Heron	Low
19	Greenfinch	Low
20	House Sparrow	Low
21	Pukeko	Low
22	Song Thrush	Low
23	Chaffinch	Very Low
24	Yellowhammer	Very Low
25	Unidentified Finch	Very Low
26	Hedge Sparrow	Very Low
27	New Zealand Fantail	Very Low
28	New Zealand Pipit	Very Low
29	Silvereye	Very Low

## 4.2. Green Island Landfill Hazard Assessment

### 4.2.1. Assessment of hazard by species

The assessment found that the closure of Green Island Landfill has a moderate chance of increasing the short-term 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 BBG strike risk associated with their dispersal from the Green Island Landfill. While the landfill supports a very high proportion of the regional BBG population, the airport does not currently attract large numbers of BBG. However, the landfill closure may result in more BBG present at and around the airport while they search for new food sources. Because their size and flocking nature and because of their presence in the strike records, BBG are already a high risk species for Dunedin International Airport, therefore it is necessary to mitigate the potential risk associated with the moderate hazard rating.

Although present in the hundreds, 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.

Starling are a very low probability 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.

**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	9334	25	High	Very Large	Moderate
Red-billed Gull	450	Nil recorded	Negligible	Small	Low
Common Starling	30	171	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

## 5. Conclusion

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

Red-billed Gulls present a low probability and Starling a very low probability. 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 Green Island Landfill closure. A comprehensive Plan to mitigate the hazard is essential for BBG and monitoring for Red-billed Gulls should be done to ensure no increased hazard to aviation.

## 6. Recommendations

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The key recommendations for mitigating bird strike risk that may arise from the closure of Green Island Landfill 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 BBG, GPS tracking, patrols)
  - c. Measurable targets
  - d. Active management (dispersing BBG from Green Island Landfill, breeding restriction)
  - e. Regular review and adaptive management.

Other species likely to be displaced by the landfill closure should be included in the monitoring and analysis associated with the BBG management plan. Red-billed Gulls in particular, must be considered.

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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.

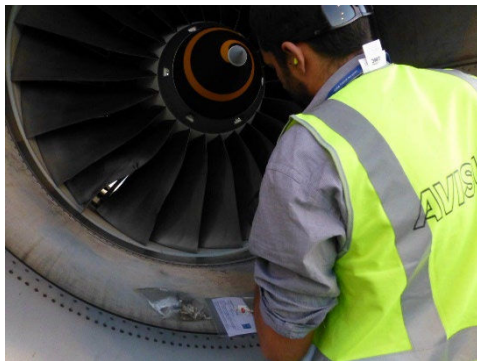
## Revision History

Rev. No.	Rev. Date	Details	Prepared by	Reviewed by	Approved by
0	10/03/2023	Preliminary Smooth Hill Landfill Bird Hazard Assessment (Draft)	Phil Shaw Principal Aviation Ecologist	Jeff Follett CEO	Jeff Follett CEO
01	15/03/2023	Preliminary Smooth Hill Landfill Bird Hazard Assessment (Final)	Phil Shaw Principal Aviation Ecologist	Phil Shaw Principal Aviation Ecologist	Phil Shaw Principal Aviation Ecologist
02	15/03/2023	Preliminary Smooth Hill Landfill Bird Hazard Assessment (Final) Rev02	Phil Shaw Principal Aviation Ecologist	Phil Shaw Principal Aviation Ecologist	Phil Shaw Principal Aviation Ecologist

## Distribution List

Copy No.	Date	Format	Issued to	Name
1	15/03/2023	E-copy (Word)	Boffa Miskell	Rachael Eaton
2	15/03/2023	E-copy (Word)	Boffa Miskell	Tanya Blakely
3	15/03/2023	E-copy (Word)	Avisure	Administration

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