Before the Independent Commissioner Hearing Panel

Under	the Resource Management Act 1991 (**RMA**)
In the matter of	an application by Dunedin City Council to develop a landfill at Smooth Hill, Dunedin.

Statement of evidence of Phillip Patrick Shaw

29 April 2022

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Qualifications and experience

1 My name is Phillip Patrick Shaw.

2 I am founder and Managing Director of two Australian consulting firms, Ecosure Pty Ltd and Avisure Pty Ltd and President of a Vancouver-based Canadian company, Avisure Services Limited (a wholly owned subsidiary of Avisure Pty Ltd).

3 I am a Principal Biologist with a Bachelor of Science and Diploma of Education.

4 I am a member of the Environment Institute of Australia and New Zealand.

5 I have more than 26 years consulting experience, with specialist knowledge and application in the field of aircraft/wildlife collision risk mitigation. In this field I have advised the operators of more than 100 airports and defence-force bases across the globe including in Australia, USA, Canada, New Zealand, Fiji, and the Middle East.

6 I have sat on the Steering Committee of the International Birdstrike Committee (now the World Birdstrike Association).

7 I have more than 60 publications and presentations on the wildlife strike issue, regularly delivering papers at international conferences.

8 I am very familiar with the birdstrike risks associated at Dunedin Airport having been engaged by Dunedin International Airport Limited (DIAL) to complete a Wildlife Hazard Assessment and draft a Wildlife Hazard Management Plan in 2018. I have also completed the Smooth Hill Bird Hazard Assessment and assisted with updating the Smooth Hill Draft Bird Management Plan (Attachment A).

9 I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2014. This evidence has been prepared in accordance with it and I agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

Scope of evidence

10 I have been asked to prepare evidence in relation to the potential attraction of birds to the proposed Smooth Hill Landfill and the impact this could have on aviation safety. This includes:

(a) Background to birdstrikes;

(b) Birds and landfills;

(c) Birdstrike risk in the Dunedin Airport airspace;

(d) Birdstrike safeguarding around the world: a review of best practice in relation to safeguarding aerodromes from birdstrikes by controlling certain activities such as putrescible waste landfilling within the vicinity of an aerodrome; and

(e) Birdstrike risk to aircraft operations in the Dunedin Airport airspace arising from the proposed landfill and an assessment of the proposed approach to manage the risks.

11 For this statement of evidence, I reviewed relevant local and international literature; reviewed relevant reports that were submitted as part of the resource consent applications; and, I have previously completed site visits and bird surveys of the known bird-attracting habitats on and around Dunedin Airport.

12 Additionally, I have considered matters raised by the ORC peer review of the application, reviewed submissions from DIAL (11 November 2021),the New Zealand Airline Pilot's Association ([NZALPA], 10 November2021), and the Otago Aero Club (15 November 2021). In my evidence I respond to the matters raised by ORC and submissions as they relate to bird strike risk.

Executive summary

13 The consequence of bird collisions with aircraft can be very serious. Worldwide, in civil and military aviation, there have been 581 human fatalities and 657 aircraft losses due to wildlife strikes since aviation commenced.

14 The main factors determining the consequences of a strike are the number and size of birds struck, the phase of flight when struck and the part of the aircraft hit. Generally, the larger the bird or animal, the greater the damage. Strikes involving more than one bird (multiple strikes) can be serious, even with relatively small birds, potentially disabling engines and/or resulting in major accidents.

15 Long-life putrescible waste landfills that allow birds regular access to the waste can significantly influence local bird populations.

16 In New Zealand, the main bird species attracted to putrescible waste landfills and is a major hazard to aircraft because of their size and flocking nature is the Southern black-backed gull (SBBG). I estimate that around

3000 SBBG regularly use the existing Green Island Landfill and that landfill probably contributes significantly to the aviation riskdespite being more that 15km away from the airport.

17 There is international and New Zealand based guidance on the development of landfills near airports. Generally, the guidance indicates that a risk assessment/study is done to identify if the risk to aviation would be unacceptable and/or if mitigation can reduce the risk to acceptable levels. In nearly all cases, the guidance is in relation to putrescible (food) waste landfills.

18 I completed such an assessment and concluded that the proposed Smooth Hill Landfill without mitigation could be a significant aviation hazard, especially as Dunedin Airport has an existing high bird strike risk.

19 The Bird Management Plan for the proposed landfill includes measures to limit larger birds below set thresholds and escalate responses if these are breached. The ultimate requirement if repeated breaches occur would be for a net to be installed over the landfill which is a proven defence against foraging birds at landfills.

20 The Applicant's decision to remove food from the waste stream that enters the landfill relieves many of the concerns in relation to this application. I believe that with the base measures applied under the Bird Management Plan, that escalation of measures is unlikely to be required and the installation of a net will almost certainly be unnecessary. These escalation measures should remain in place as insurance.

21 Prior to opening the new landfill, management of SBBG at Green Island should be phased in to reduce the numbers feeding there. Simultaneously, restricting breeding of this species at breeding colonies should commence to reduce the overall population size in the region.

22 If implemented well, the Bird Management Plan coupled with appropriate management at the existing Green Island Landfill and at SBBG breeding sites, could have a overall reduction in aviation risk as the Otago SBBG population should be diminished significantly.

Background to birdstrikes

23 The consequence of bird collisions with aircraft can be very serious. Worldwide, in civil and military aviation, there have been 581 human

fatalities and 657 aircraft losses caused by wildlife strikes since aviation commenced[1], most of those within the last 30 years.

24 Wildlife strikes cost the commercial civil aviation industry an estimated US$1.5 billion per annum and involve more than just the repair of damaged engines and airframes[2]. Minor strikes that result in no damage can reduce engine performance, cause concern among aircrew and add to airline operating costs through aborted procedures and/or delay and/or unscheduled maintenance checks.

25 In 2017, I presented an analysis of wildlife strike data from various airlines[3]. We concluded that on average, each wildlife strike costs airlines $69,000 USD.

26 The main factors determining the consequences of a strike are the number and size (total mass) of wildlife struck, the phase of flight when struck and the part of the aircraft hit. Generally, the larger the bird or animal, the greater the damage. Large birds and bats can destroy engines and windshields and cause significant damage to airframe components and leading-edge devices. Strikes involving more than one bird (multiple strikes) can be serious, even with relatively small birds, potentially disabling engines and/or resulting in major accidents. Engine ingestions on take-off and initial climb when power settings are high are normally more damaging and potentially more threatening to continued flight than those on approach. En-route strikes are less common as en-route flight normally occurs above the threat layer, but they are potentially more disabling to the aircraft because collision speed is normally high during this phase of flight.

27 In the USA (where the largest dataset exists), 82% of strikes to commercial aircraft were reported to have occurred at or below 1500 feet above ground level[4]. Birds mostly fly at lower altitudes, so conflict with aircraft is most likely when the aircraft are lower, i.e. on take-off and landing. Consequently, management of the risk has traditionally focused on managing birds at the

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[1] Shaw, P and Dolbeer, R. (2022) Fatalities and destroyed aircraft in civil and military aviation database. https://avisure.com/wp/serious-accident-database/ Accessed 28 April 2022.

[2] [2] Allan, J. (2002) The Costs of Birdstrikes and Birdstrike Prevention. in Clarke L (ed.) Human Conflicts with Wildlife: Economic Considerations pp 147-153. US Department of Agriculture, Fort Collins.

[3] Shaw P., Dolbeer R., McKee J., & Patrick K., 2017. "Human Fatalities and Destroyed Civil Aircraft Due to Wildlife Strikes, 1912 to Present" In *Proceedings of the 2017 North American Birdstrike Conference, Dallas Texas USA.*

[4] Dolbeer, R. Begier, M. Miller, P. Weller, J. and Anderson, A (2021). Wildlife Strikes to Civil Aircraft in the United States, 1990-2019, Federal Aviation ADMINISTRATION National Wildlife Strike Database Serial Report Number 26.

airport itself. However, hazards arising from off-airport bird attractants can contribute to risk if the birds fly through shared airspace (see below). The best management approaches now seek to extend to appropriate distancesbeyond the airport to manage risk.

28 Global trends indicate an increasing strike rate (strikes per 10,000 aircraft movements). This trend is thought to be multifactorial, being associated with a range of environmental, ecological, air operational and aircraft design factors. Importantly, aircraft are getting larger, faster and quieter and with larger engine intakes. Over the past few decades, increasing emphasis has been placed on managing bird populations beyond the airport fence. It is long recognised that birds in flight conflict with aircraft beyond the airport fence and that off-airport conflicts can be more catastrophic. Similarly, it is recognised that birds will come onto the airport to feed or rest because off-airport sites support significant populations.

29 In a recent review of birdstrikes in the USA, Dolbeer et al[5] found that despite increasing strike reporting rates (190% increase from 2000 to 2019), the damaging strike rate has declined by 4% in the same period. Much of this improvement is accredited to Wildlife Hazard Management Plans adopted by airports since US Airways Flight 1549, an Airbus A320, ditched into the Hudson River after colliding with Canada Geese.

30 Despite this, damaging strikes above 1500 feet have increased indicating that the area which is least controllable for the airport, i.e. the areas beyond the fence, are the areas which need increased focus.

31 Dolbeer and other experts, including me, are calling for more risk mitigation in off-airport locations. This is known in the aviation industry as ‘safeguarding’.

Birds and landfills

32 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. Putrescible waste includes organic material that is subject to decay, and includes household and commercial food wastes.

33 Long-life putrescible waste landfills that allow birds regular access to the waste can significantly influence local bird populations. Green Island Landfill is a typical landfill that processes mixed wastes, including

[5] Dolbeer, R. Begier, M. Miller, P. Weller, J. and Anderson, A (2021). Wildlife Strikes to Civil Aircraft in the United States, 1990-2019, Federal Aviation ADMINISTRATION National Wildlife Strike Database Serial Report Number 26.

foodwaste, and supports thousands of Southern black-backed gull ([SBBG], *Larus dominicanus*) and other species (Figure 1). In my estimation there are at least 3000 SBBG that regularly use this landfill as a primary forage site.

Figure 1. Southern black-backed gulls at Green Island Landfill, May 2021

34 Once a putrescible waste landfill 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 compromised.

35 Landfills sometimes include waterbodies, trees and other landscape features that may also attract birds.

36 It is very important to note (and especially relevant to the Smooth Hill Landfill proposal), that waste facilities that have nil or very low putrescible waste content tend not to attract birds in large numbers.

37 There are three main ways that putrescible waste landfills near airports can affect bird strike risk:

(a) **Site Risk:** Aircraft overfly the landfill and birds soaring above can conflict with aircraft.

(b) **Flight Path Risk:** Birds traverse aircraft flight paths to and from the landfill (Figure 2).

(c) **Spill Over Risk:** Significant population growth of species receiving abundant food results in ‘spill over’ onto areas around or on the

airport. This can be highly influenced by certain events, such as heavy rainfall, calving season, or ploughing activity.

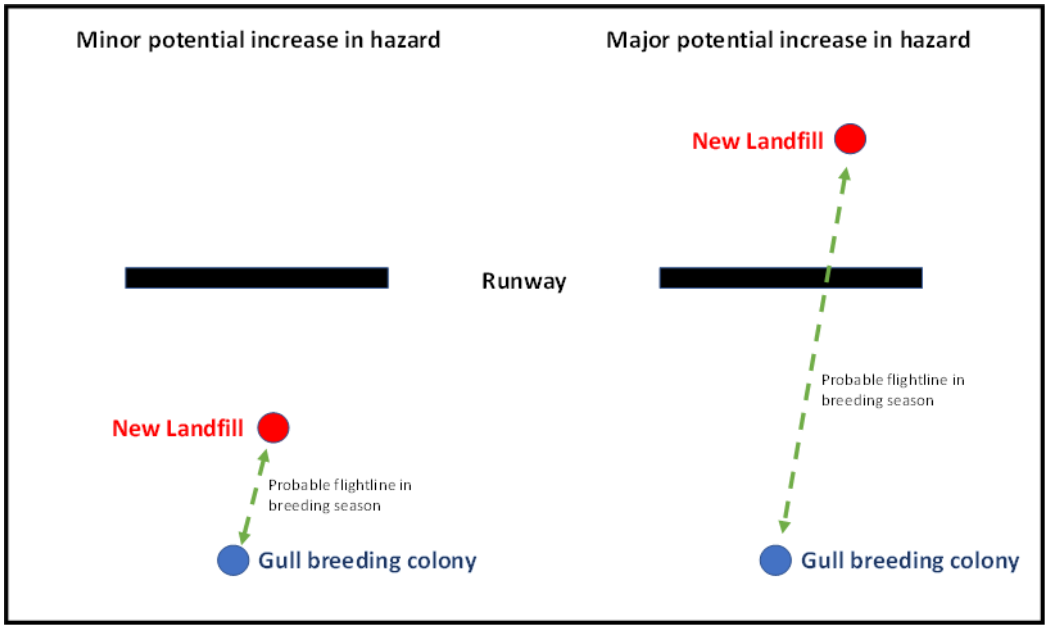


Figure 2. Position of new putrescible waste landfill in relation to the runway and other bird habitats can impact risk (adapted from UK CAA CAP 680[6]). Note: A highly attractive habitat that has a complementary habitat on the other side of the aerodrome, significantly impacts strike risk because birds are likely to transit though critical airspace.

38 In New Zealand, the main bird species attracted to putrescible waste landfills include: the SBBG, red-billed gull (*Larus novaehollandiae*), feral pigeon (*Columba livia*), common starling (*Sturnus vulgaris*), house sparrow (*Passer domesticus*), various finch species, along with ducks and shags that can be attracted to landfill waterbodies such as retention ponds.

39 From my experience on projects at New Zealand's larger airports including Auckland, Wellington, Christchurch and Dunedin, the most significant bird hazard to aviation in New Zealand are gulls, particularly the SBBG (Figure 3). They are predators and scavengers and are attracted to food scraps and organic 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 organic food sources at landfills, farms, parks, piggeries, fishingareas, food processing factories, etc.

[6] UK CAA (2002), CAP 680: Aerodrome Bird Control. (Superseded by CAP 772, 2017).

40 They are also common in coastal environment (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*)

Birdstrike risk in the Dunedin Airport airspace

41 The Civil Aviation Authority of New Zealand (NZ CAA) provides quarterly Bird Incident Rates for New Zealand airports. The most recent available report (Quarter 3: July to September 2021) indicates that Dunedin Airport has a strike rate of 4.4 per 10,000 aircraft movements as a 12-month moving average[7]. The NZ CAA consider a strike rate of less than 5 per 10,000 aircraft movements to be low risk.

42 I consider that the method for assessing risk in the NZ CAA quarterly Bird Incident Rates is not robust. It gives guidance on the frequency of birdstrikes, but does not provide information on the species involved, which is very important in understanding the consequence component of risk.

43 In 2018, I completed a Wildlife Hazard Assessment for DIAL where I determined that the strike risk was high. The implication in risk management terms for the proposed Smooth Hill Landfill is that it should not increase DIAL's strike risk any further.

44 The airport is predominantly grassland and in 2018 around 40ha of this habitat was being used to produce hay, which tends to attract birds, particularly during and after harvest when the grass is short. I am unsure

[7] https://www.aviation.govt.nz/assets/publications/bird-hazard-reports/bird-incident-rate-report-2021-q3.pdf

ifthis activity continues. Drains (particularly the drain to the west of the carpark), trees lining the roadway into the airport and built structures are the other habitats that support bird populations on the airport.

45 I understand that DIAL leases some of the land adjacent to the airport to dairy producers and who spray manure-rich water over the pastures which, DIAL staff have reported to me, attracts gulls (Figure 4).

Figure 4. Irrigation on farms adjacent to Dunedin Airport that reportedly attracts gulls

46 Other habitats in the vicinity of Dunedin Airport include Lake Waihola and Lake Waipori that support very large populations of birds that could be a hazard to aviation. These lakes and surrounding wetlands don't appear to be highly attractive to gulls, although I did record 150 SBBGs in one count in March 2018.

47 Sinclair Wetlands supports small numbers of ducks but does not appear to contribute greatly to the risk at Dunedin Airport.

48 Green Island Landfill, supporting around half of the region's estimated 6000 SBBG, is the most attractive habitat for large flocking bird species in the Dunedin area. It is likely that despite Green Island being more than 15km from the airport, it contributes to the strike risk, primarily from spillover risk (see paragraph 37(c)). Irrespective of if Smooth Hill is developed as a landfill, the closure of Green Island to normal putrescible waste landfilling practices could significantly alter the risk profile for the Dunedin airspace. It is my strong advice that this is managed over several years to limit the potential impacts on aviation.

49 The Otago Peninsula, the coastline, rivers, estuaries and various other habitats also provide habitat for birds that could present a hazard to aviation.

International Standards to Safeguarding from Landfills

50 Some of the international standards and recommendations that relate to land use near airports are quoted below. All suggest that landfills are acceptable if a study or risk assessment indicates that the risk is managed.

51 Some specifically refer to organic or food waste facilities. The Smooth Hill Landfill is now not forecast to receive food wastes. I discuss this point later in my evidence.

52 The International Civil Aviation Organization (ICAO) states[8]:

> "The appropriate authority shall take action to eliminate or prevent the establishment of garbage disposal dumps or any such other source attracting bird activity on, or in the vicinity of, an aerodrome, unless an appropriate aeronautical study indicates that they are unlikely to create conditions conducive to a bird hazard problem". It also states: "When a bird strike hazard is identified at an aerodrome, the appropriate authority shall take action to decrease the number of birds constituting a potential hazard to aircraft operations by adopting measures for discouraging their presence on, or in the vicinity of, an aerodrome."

53 ICAO states[9]:

> "The appropriate authority should encourage prohibiting or restricting the establishment of new or existing organic waste sites near aerodromes."

54 ICAO states[10]:

> "The following is a non-exhaustive list of the types of land uses which have proven to attract hazardous wildlife and which should, in particular, be prevented, eliminated or mitigated on and in the vicinity of aerodromes:
>
> "a) …..g) garbage dumps and landfill sites…."

[8] ICAO (2004). International Standards and Recommended Practices. Annex 14 to the Convention on International Civil Aviation. Aerodromes – Volume 1 Aerodrome Design and Operations.

[9] ICAO (2020). Doc 9137, Airport Services Manual. Part 3. Wildlife Hazard Management. Fifth Edition.

[10] ICAO (2020). Doc 9981, Procedures for air navigation services – Aerodromes. Third Edition.

55 The World Birdstrike Association (formerly the International Birdstrike Committee (IBSC)) Standard 9 states[11]:

> "Where national laws permit, airports, or airport authorities, should seek to have an input into planning decisions and land use practices within the 13km bird circle for anydevelopment that may attract significant numbers of hazardous birds/wildlife. Such developments should be subjected to a similar risk assessment process as described above and changes sought, or the proposal opposed, if a significant increase in birdstrike risk is likely to result."

56 Aviation authorities in many countries (Unites States of America[12], Canada[13], United Kingdom[14]) recommend airport operators liaise with land use planning authorities to safeguard against inappropriate land use in the vicinity of the airport.

57 The Australian government's Department of Infrastructure and Regional Development (DIRD) has developed the National Airports Safeguarding Framework (NASF)[15]. The framework identifies the wildlife attraction risk for putrescible waste landfills as 'high' and proposed landfills are considered incompatible up to 3km from the airport; require mitigation between 3 and 8km; and, should be monitored between 8 and 13km (Figure5).

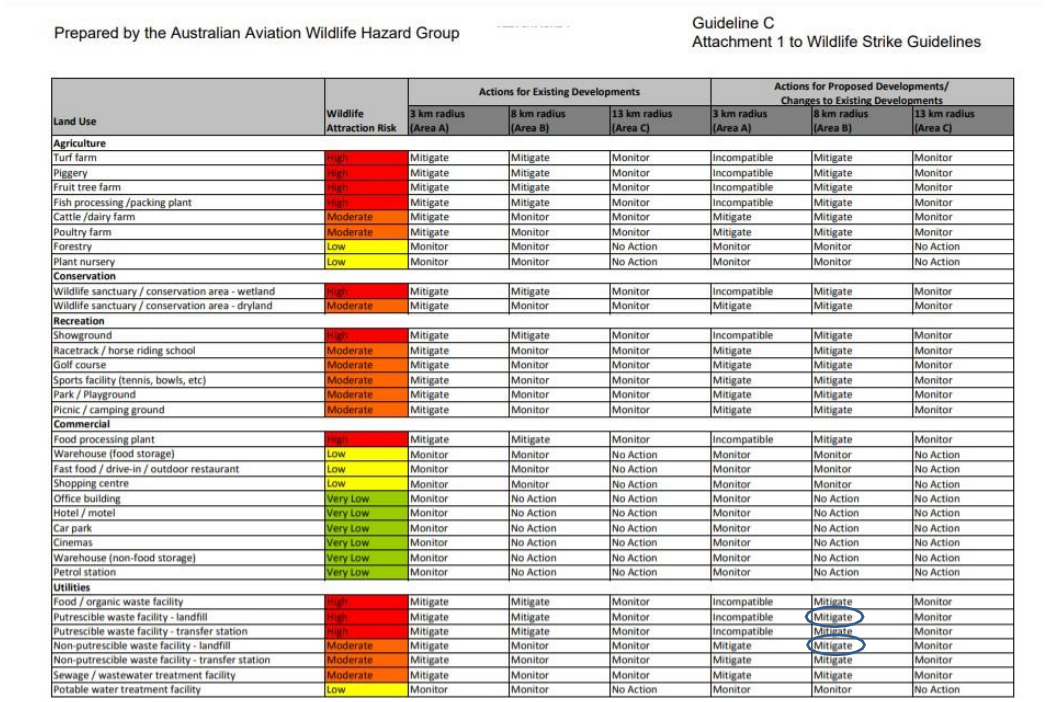
[11] IBSC (2009). Recommended Practices No. 1. Standards for Aerodrome Bird/Wildlife Control.

[12] FAA. (2020). Advisory Circular AC 150/5200-33C. US Department of Transportation. Federal Aviation Administration. Subject: Hazardous Wildlife Attractants on or near Airports.

[13] Transport Canada (2002). Wildlife Control Procedures Manual – TP11500.

[14] UK CAA (2017). CAP 772 Wildlife Hazard Management at Aerodromes.

[15] DIRD (2012) NASF Guideline C.



Prepared by the Australian Aviation Wildlife Hazard Group

Guideline C
Attachment 1 to Wildlife Strike Guidelines

Land Use	Wildlife Attraction Risk	Actions for Existing Developments			Actions for Proposed Developments/ Changes to Existing Developments		
		3 km radius (Area A)	8 km radius (Area B)	13 km radius (Area C)	3 km radius (Area A)	8 km radius (Area B)	13 km radius (Area C)
Agriculture							
Turf farm	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Piggery	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Fruit tree farm	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Fish processing /packing plant	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Cattle /dairy farm	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Poultry farm	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Forestry	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Plant nursery	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Conservation							
Wildlife sanctuary / conservation area - wetland	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Wildlife sanctuary / conservation area - dryland	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Recreation							
Showground	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Racetrack / horse riding school	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Golf course	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Sports facility (tennis, bowls, etc)	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Park / Playground	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Picnic / camping ground	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Commercial							
Food processing plant	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Warehouse (food storage)	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Fast food / drive-in / outdoor restaurant	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Shopping centre	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action
Office building	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Hotel / motel	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Car park	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Cinemas	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Warehouse (non-food storage)	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Petrol station	Very Low	Monitor	No Action	No Action	Monitor	No Action	No Action
Utilities							
Food / organic waste facility	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Putrescible waste facility - landfill	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Putrescible waste facility - transfer station	High	Mitigate	Mitigate	Monitor	Incompatible	Mitigate	Monitor
Non-putrescible waste facility - landfill	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Non-putrescible waste facility - transfer station	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Sewage / wastewater treatment facility	Moderate	Mitigate	Monitor	Monitor	Mitigate	Mitigate	Monitor
Potable water treatment facility	Low	Monitor	Monitor	No Action	Monitor	Monitor	No Action

Figure 5. NASF Attachment 1—Wildlife Attraction Risk and Actions by Land Use. Note: actions for proposed developments that relate to the Smooth Hill Landfill are circled.

58 The NASF acknowledges that non-putrescible waste facilities are a lesser 'moderate' attraction to birds and their development, even when within 3km of an airport (i.e. closer than proposed for Smooth Hill), is not considered incompatible, as long as mitigation is applied.

59 The NZ CAA has an Advisory Circular that provides New Zealand airport operators with guidance on bird strike matters[16]. It lists particular 'hazardous land use practices' including landfills and states the following:

> "Landfills should not be located close to aerodromes, because they are immensely attractive to scavenging birds due to the abundant food source. However, landfills can be made less attractive to birds with:
>
> - overhead wires installed to interfere with the birds' flight path
> - the working area of the tip face made as small as possible and, preferably, contained in a pit where access by birds is restricted

[16] NZ CAA (2011). Advisory Circular AC 139-16 (2011): Wildlife Hazard Management.

- refuse being covered with soil daily to reduce available food sources when the landfill is not operating.

The dumping of food waste should be strictly controlled, with waste covered immediately. Most active management techniques used at aerodromes can also be used effectively at landfills. Reducing a food source should reduce the bird population."

60 The Advisory Circular does not specify the distance from the airport that restrictions should apply. Nor does it comment on non-putrescible waste facilities.

61 The Advisory Circular also mentions risks that can arise from agriculture adjacent to airports and harvesting grass on airport, activities that occur on and around Dunedin Airport.

The Proposed Smooth Hill Landfill and Birdstrike Risk

62 In my opinion, without mitigation the Smooth Hill Landfill would present an unacceptable risk to aviation.

63 I have been engaged by the Applicant to develop a Preliminary Bird Hazard Assessment and assist with developing a more robust Bird Management Plan. As part of this engagement, I visited a modern landfill at Kate Valley north of Christchurch that had been reported to have very low bird attraction.

64 The Bird Hazard Assessment was based on non-breeding season surveys in May 2021 and a review of Dunedin Airport data. The assessment indicated that mitigation could adequately manage the risk and it was proposed that escalating measures be put in place as insurance, with the ultimate requirement for a net if other measures did not adequately manage the bird numbers below the established thresholds.

65 As identified in the assessment and then transferred into the Bird Management Plan, I emphasised that the risk from putrescible waste was much greater than other forms of waste and if food wastes can be eliminated and organic wastes kept below 16% (as they are at Kate Valley) the risk potential would be greatly reduced.

66 As noted in the evidence of Mr Chris Henderson, on 30 June 2021, after the Bird Hazard Assessment and drafting of the Bird Management Plan,

Dunedin City Council approved a 10 Year Plan, including the 'four bins plus one'kerbside collection option[17].

67 My understanding from this is that food waste will be separated at the kerbside and subsequently processed for beneficial reuse. The processing facility for food waste (and garden waste) will also accept commercial drop-off. General waste will be consolidated at Green Island Transfer Station prior to transport to Smooth Hill. This provides an opportunity for waste to be screened and to minimise the food that mixes into the waste stream.

68 The processing of wastewater treatment sludges is still to be determined, but even if it is stabilised and mixed with general waste and delivered to Smooth Hill, the resultant waste stream would appear to be similar to that at Kate Valley Landfill where current bird attraction is extremely low. It would be appropriate to classify the proposed landfill as a non-putrescible facility.

69 Nets have been successfully used for putrescible waste landfills in several jurisdictions. I have personally overseen the installation of a net at Ballina, Australia (Figure 6). It drastically lowered the numbers of birds feeding on the food waste.

Figure 6. Ballina Landfill enclosed by a net allowing waste to be dumped in an area where access for birds was denied.

70 Very little of the United Kingdom's land mass is not within 13km of an airport, so building landfills near airports is relatively common. For many of these, nets have been a requirement for approval. The active waste cells are covered by nets an automated doors allow waste vehicle to enter avoiding bird entry.

[17] Council resolution 31st May 2021, Item 7.
https://infocouncil.dunedin.govt.nz/Open/2021/05/CNL_20210531_MIN_1655_WEB.htm

71 Key to a successful installation is regular maintenance on nets that tear or are damaged. I have been made aware by an industry expert[18] of certain landfills in Northern Ireland that were originally netted, but as the waste streams changed from putrescible to non-putrescible, the nets fell into disrepair and bird activity remained very low, so the nets were removed.

72 It is my view that with the waste types that are now destined for the proposed Smooth Hill Landfill, if all the other mitigation is in place that nets will almost certainly not be required. That said, there is no harm in leaving the requirement for a net in the Bird Management Plan as an escalating response.

73 How the SBBG population is managed during the changes to waste types, and landfilling practices at Green Island, is likely to influence the birdstrike risk. This site supports around half the foraging population of SBBGs in the Dunedin area. It is preferable to simultaneously reduce the food supply and limit population growth through breeding control so that the numbers of SBBGs in the region will decrease, with a likely result of fewer birds entering the airspace.

74 It is a very real possibility that with appropriate management at Smooth Hill, Green Island and at SBBG breeding sites, the overall risk to aviation will be reduced.

Response to any issues in section 42A report

75 I will respond to three issues raised in Section 6.1.8 of the section 42A report:

76 It is suggested that "…it is important not to limit the management plan to a select species of birds (i.e. Black backed Gulls) but define the parameters in what would classify a species and population to need control to zero densities i.e. it is appropriate to include all bird species over 50 grams in body weight as this size and above would cause the greatest risk in terms of bird strike on aircraft." This is precisely what is provided in the Smooth Hill Bird Management Plan.

77 As to minimising putrescible waste from the waste stream, it is suggested that wording "to the extent practicable" should be removed. I agree that the lower the proportion of putrescible waste the lower the probability of bird attraction to the site. Ideally, zero putrescible waste would be achieved, but I am informed that this cannot be guaranteed. In any event, it is the bird

[18] Andy Baxter Personal Communication 2021. Director Birdstrike Management Ltd, York, United Kingdom.

number thresholds that will determine the escalation of actions (if required). In the unlikely event these thresholds are breached, it will be in the interests of the operator/proponent to ensure whatever the source of bird attraction that it is managed, as breaching thresholds would ultimately result in the installation of an expensive net.

78 It is suggested that a condition be included: "All bird species specified in the Bird Management Plan greater than 50g feeding at the landfill or accessing waterbodies must be managed to zero densities daily. If this is not achieved over 3 consecutive days, then the landfill operation must cease, and material covered (including netting if necessary) until zero densities of birds over 50g can be reached over 5 consecutive days." In my view this is too onerous and ignores that there is a background level of bird activity that any habitat will support and that achieving zero birds all the time, is not achievable. The thresholds set in the Smooth Hill Bird Management Plan are onerous and appropriate. The numbers are well below what is regularly seen in habitats on and around Dunedin Airport.

79 I understand that any waterbodies that are designed to be semi-permanent will be appropriately treated e.g. by covering with a net or similar, to exclude large birds.

Response to matters raised in submissions

80 In response to the **DIAL** submission, I make the following remarks.

81 It is not unsurprising that DIAL oppose the proposal, as on face value, a landfill 4.5 kilometres from an international airport is concerning. However, as stated above, in my opinion, with appropriate mitigation it is likely that the birds strike risk could be decreased through measures adopted at Green Island, Smooth Hill and at SBBG breeding sites.

82 Paragraph 5(a) of the DIAL submission states that the proposed landfill will be *"….8.5km closer than the 13km buffer between municipal solid waste landfills and airports unanimously recommended by all current international guidance, including but not limited to the International Civil Aviation (ICAO) Guidelines, The World Birdstrike Association (WBA) Standard 9 and the Australian Department of Infrastructure and Regional Development Framework, and nationally in NZ CAA in Advisory Circular 139-16 (2011)."*

83 In the abovementioned guidance, there is no requirement/recommendation to prevent landfills - there are provisions for risk assessments and/or mitigation to permit such developments:

> (a) "…..unless an appropriate aeronautical study indicates that they are unlikely to create

conditions conducive to a bird hazard problem." (ICAO).

(b) "Such developments should be subjected to a risk assessment process as described above and changes sought, or the proposal opposed, if a significant increase in birdstrike risk is likely to result." (WBA).

(c) "Where local authorities seek to establish land uses which may increase the risk of wildlife strike near existing airports, steps should be taken to mitigate risk in consultation with the airport operator and qualified bird and wildlife management experts." (DIRD).

84 Furthermore, DIRD specifically recommend putrescible waste landfills at this distance from an aerodrome for 'mitigation', not 'incompatibility' as is the case within 3km of an aerodrome.

85 DIRD suggest that bird management plans should be developed:

"…….that include:

(d) regular monitoring surveys;

(e) wildlife hazard assessments by qualified ornithologists or biologists;

(f) wildlife awareness and management training for relevant staff;

(g) establishment of bird population triggers;

(h) implementation of activities to reduce hazardous bird populations; and

(i) adoption of wildlife deterrent technologies to reduce hazardous birdpopulations."

These components have all been included in the Draft Bird ManagementPlan for Smooth Hill.

86 In addition, the guidance documents referred to are in relation to putrescible waste landfills (although DIRD do separately refer to non-putrescible waste landfills as a lower threat). Under the expected waste stream for Smooth Hill, the landfill will be considered a non-putrescible waste facility, greatly reducing the potential attractiveness to birds.

87 Paragraph 5(b) of the DIAL submission refers to protection from "incompatible activities". As stated above, the proposed activity is not incompatible if the proposed mitigation is applied.

88 Paragraph 5(c) of the DIAL submission quotes the Assessment of Environmental Effects at 8.12.2 Airspace Safety indicating an *"…increased abundance of birds and could increase the risk of bird strike…."* As stated, my opinion is that with the mitigation in place, this will not occur.

89 Paragraph 5(c) also quotes from the Draft Bird Management Plan which quotes an outdated ICAO source. The Bird Management Plan has been updated accordingly.

90 Paragraph 5(d) is noted and agreed with. The birdstrike risk in the Dunedin airspace is already high and additional risk should not be created. This will not occur under the Smooth Hill proposal. However, in my opinion, there are actions DIAL should take on their own property that would lower the risk and this is irrespective of if the landfill proceeds or not. I note that the threshold bird numbers indicated in the Bird Management Plan are much lower than are regularly recorded at the airport itself.

91 Paragraph 5(e) is noted and agreed with. The Council decision to separate food waste at the kerbside is a significant change to the risk profile of the project.

92 Paragraph 5(f) asserts that *"…other viable solutions to depositing putrescible waste at Smooth Hill which the Applicant has elected not to pursue."* I cannot vouch for the other solutions, but the removal of the bulk of food from the waste stream is considerable and effective step in managing the risk, provided other mitigations are also implemented.

93 Paragraph 5(g) refers to *"...administrative controls (changes to the way people work)"* that DIAL believe are inadequate for managing the risk. The administrative controls are only a minor component of the mitigation proposed, with food waste control and escalating responses of wires, baling and ultimately a net being installed if required.

94 Paragraph 9 is noted and agreed with, however, mitigation of very high risks to acceptable levels is valid and appropriate.

95 Paragraph 10 is noted, but I am unclear on the point the submitter is making in relation to this application.

96 Paragraph 11 refers to limitation of one non-breeding season survey and consideration of the Kate Valley Landfill. I acknowledge that limitation and have recommended further monitoring to fill information gaps, which has now commenced. It is also whya very low threshold of bird numbers has been established in the Bird Management Plan and a requirement for escalation of interventions, ultimately requiring a net. If a net is installed

well and maintained, it will prevent all large bird entry, if bird attraction cannot be managed by other means. In my opinion, a net is very unlikely to be required and it would be unreasonable to require the Applicant to install one just in case. The requirement for a net if thresholds are breached, stands as insurance in theevent that other practices do not perform as expected.

97 Paragraph 12 identifies the differences between the Kate Valley Landfill and the proposed Smooth Hill Landfill, particularly in the distance from the landfills they respectively replace(d). This is noted and agreed with. To avoid the transfer of SBBGs from Green Island to other areas around the airport, including Smooth Hill Landfill (although this is unlikely given that food waste will not enter this landfill), I have recommended a program to control SBBGs. Monitoring has commenced of birds at Green Island, key habitats around Dunedin, the Smooth Hill site and Dunedin Airport. This is to inform the SBBG control program and update hazard assessments.

98 Paragraph 13 indicates DIAL's concern around basing practices on the Kate Valley Landfill when there are potential differences with Smooth Hill. I agree that were some uncertainties, particularly around the constitution of the waste stream, however that is now clearer, and the Smooth Hill waste stream will now be like that at Kate Valley. Kerbside food waste separation will limit the amount of food entering the Smooth Hill Landfill. I also accept that there are other elements that mean direct comparisons are uncertain, however, the Kate Valley example demonstrates that landfills can be developed in a way that allows open landfilling (i.e. not netted).

99 Paragraph 13 also states that *"…escalating mitigations indicate increased risk to the airport from the proposed landfill is anticipated."* On the contrary, it is likely that the base elements of the bird control program will be very effective, particularly with a control program for SBBG at Green Island Landfill and at breeding colonies and now that food will not enter the waste stream in large quantities.

100 The tolerance level for birds greater than 50grams using the Smooth Hill Landfill will be zero, so any bird that arrives will be dispersed by trained and equipped staff. If the unexpected occurs and more than 20 individuals of a species greater than 50g or more than 100 individuals of all species is observed at the landfill, this is considered a breach of the tolerance threshold and will require an escalating response if that occurs more than 12 times in a year.

101 These thresholds have been set such that even if they are breached, the impact on risk will be insignificant. I note that if these thresholds were to

apply to the drainage channels airside and along the edge of the Dunedin Airport carpark,the numbers of mallard would regularly breach thresholds (Figure 7). I alsonote that ebird counts[19] on 4 February 2021 recorded 200 SBBG at DunedinAirport, well above the proposed threshold. I suspect that SBBG regularly operate around the airport, particularly on DIAL owned land during irrigationand/or calving season. The management of the regional population as proposed, should ease this risk.

Figure 7. Mallard in drainage channel west of Dunedin Airport Carpark

102 Paragraphs 14 to 19 refer to questions around putrescible waste which have now been resolved. It would seem that many of the concerns raised in the DIAL submission should be alleviated by the decision Applicant has made to separate food from the waste stream.

103 Paragraph 20 raises the concern around ponding and wetlands that may attract birds. The advantage of the Smooth Hill proposal is that any attraction of birds over 50g will require a response, no matter the attraction. That means if ponds repeatedly attract birds, the operator will be compelled to find a solution, even if it means netting the pond. If a farm situated at the same distance from the airport were to construct a dam containing less than 20,000m^3 of water, there would be noopportunity under existing planning schemes for Council (or DIAL) to seek mitigation from the owner.

104 Paragraph 21 is noted and agreed with. Dunedin Airport does have a relatively high risk of bird strike.

105 Paragraph 22 highlights the concern that changing the landfilling practices at Green Island Landfill may cause SBBGs to seek other food sources. This is acknowledged and a management plan for the regional population of SBBG, with a focus on Green Island Landfill is, in my view, necessary.

[19] https://ebird.org/map/kelgul?neg=true&env.minX=169.6163700525194&env.minY=-46.25109877665183&env.maxX=171.041044984433&env.maxY=-45.63396623883648&zh=true&gp=true&ev=Z&mr=1-12&bmo=1&emo=12&yr=all&byr=1900&eyr=2021

Properly enacted, this management plan can assist in reducing the current risk the airport experiences from SBBG, irrespective of where the new landfill is located.

106 Paragraph 23 suggests a conflict between not allowing the risk to be elevated by the new landfill and the current high strike risk. This is not a conflict at all, as mitigation can manage the risk adequately.

107 In Paragraph 24, DIAL is concerned by increasing bird attractions near the airport. As discussed earlier, with a regional population management approach, this risk is addressed.

108 In Paragraph 25, DIAL state "….the high underlying risks cannot be avoided whereas the additional risk from establishing the proposed Smooth Hill Landfill can." In my opinion there are actions that DIAL could and should take on and around the aerodrome to mitigate the underlying risk. Some of the underlying risk is not "unmanageable". I cannot agree that with the mitigation as proposed for Smooth Hill that there will be "additional risk".

109 Paragraph 26 and 48 refers *to "…the anticipated very high risk to aviation from the proposed landfill…"* which is unfounded, as it does not account for the mitigation that will adequately address the risk.

110 Paragraph 43 relates to the proposed site being closer than 6.5 km from the airport. The proposal, including the appropriate mitigation, means the distance is irrelevant, whether 4.5, 6.5 or greater than 13km from the airport.

111 Paragraph 44 is inaccurate and is now irrelevant, as it refers to a putrescible waste landfill, which Smooth Hill will not be.

112 Paragraph 45 is concerned with tiers of mitigation with anticipation of failure. On the contrary the escalation of interventions is designed to circumvent any potential for a risk increase. The question is asked *"What happens if things do not go as intended?"* In this very unlikely event, the landfill operator will be required to install a net at great cost, as is done in other parts of the world. The cost implication will be an additional enticement to ensure other mitigations work.

113 Paragraphs 46 and 48 relate to international guidance and incorrectly asserts that such guidance indicates that mitigation is only appropriate for existing landfills. The guidance (ICAO, WBA, DIRD, NZ CAA) invariably determines that mitigation can be considered appropriate for new landfills as long as the risk has been assessed and managed as is the case for Smooth Hill.

114 I believe DIAL are referring to section 4.4.7 of ICAO Airport Services Manual Part 3: “The appropriate authority should encourage prohibiting or restricting the establishment of new or existing organic waste sites near aerodromes. If a waste management site in the vicinity of an aerodrome cannot be closed, it may be necessary to provide control measures at the site to reduce its attractiveness to hazardous wildlife.” I highlight that “restricting” which is another term for ensuring mitigation is in place, is acceptable for new organic waste sites. As organics are to be significantly limited at Smooth Hill, then this is further validation of the approach adopted by the Applicant.

115 I note the **Otago Aero Club** submission opposes the proposed landfill on basis of perceived reduced aviation safety and they are in support of the DIAL submission. My responses to the DIAL submission are therefore valid for the Otago Aero Club.

116 In response to the New Zealand Air Line Pilots Association (NZALPA) submission, I make the following remarks.

117 Reference is made to ICAO’s Doc 9182, Airport Planning Manual, Appendix I presume that NZALPA is referring to Doc 9184 and I also presume it is referencing the now outdated Third Edition (2002) as Appendix 2 of the current Fourth Edition (2018) makes no reference to the two concentric circles mentioned in the submission. I have provided an extract of what I believe NZALPA are referring to (Figure 8).

118 In Figure 8 you can see that guidance is given for what is considered suitable in Area A (up to 3km from the aerodrome) and Area B (between 3 and 8km from the aerodrome). “Food garbage landfills” are discouraged, but I have highlighted, that a study, such as that completed for the proposed Smooth Hill Landfill, can provide the mechanism to overcome such risks. In any event, the proposal is now for a “Non-food garbage landfill” which is “Yes” for both zones A and B.

respectively) around an airport, centred on the Airport Reference Point. Any land use that has the potential to attract birds to the airport vicinity should be the subject of a study to determine the likelihood of bird strikes to aircraft using the airport.

uidelines

Land Use	*Area A*	*Area B*
Commercial*		
offices	YES	YES
retail sales	YES	YES
hotels and motels	YES	YES
restaurants	YES	YES
parking lots	YES	YES
indoor theatres	YES	YES
warehouses	YES	YES
shopping centres	YES	YES
service stations	YES	YES
cemeteries	YES	YES
drive-in restaurants	NO	YES
food-processing plants	NO	YES
Municipal Utilities*		
water treatment	YES	YES
non-food garbage landfill	YES	YES
food garbage disposal	NO	NO

Source: Transport Canada, *Land Use in the Vicinity of Airports*.

* These are general guidelines for planning and land-use zoning only. The avoidance of bird hazards during airport operations is another subject that can involve special controls to keep land free from food and shelter for birds.

Figure 8. Extract from ICAO[20]

119 Sections 4.7.1 and 4.7.2 of ICAO's Doc 9137, Airport Services Manual. Part

120 Wildlife Control and Reduction, is quoted. I note that this is the now outdated Fourth Edition (2012) and the updated Fifth Edition (2020) does not include the quoted paragraphs. However, the sentiment in the quoted paragraphs are noted and agreed with.

121 On page 3 of the NZALPA submission, a section of the Smooth Hill Landfill Draft Bird Management Plan has been quoted. As stated earlier this is

[20] ICAO (2002). Doc 9184 Airport Planning Manual, Appendix 2

fromthe NZCAA quoting an outdated ICAO document and has been removed from the Bird Management Plan.

122 The NZCAA (2008) guidance material for land use at or near aerodromes also states:

> "Garbage disposal dumps and other sources that may attract wildlife activity on, or in the vicinity of, an aerodrome, need to be assessed as a potential source of wildlife hazard. It is an International Civil Aviation Organisation requirement that such activities are closely managed by the controlling authority. If necessary, an aeronautical study may need to be undertaken to assess the potential wildlife activity hazard."

Such an aeronautical study has taken place for this Application.

123 NZALPA suggest that:

> "….it is doubtful that such measures will totally prevent attracting birds greater than 50grams…"

As stated, I cannot agree, as the measures proposed for mitigation are suitable.

Other points made in the submission have been dealt with elsewhere in my evidence.

Conclusion

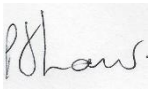
124 The proposed Smooth Hill Landfill without mitigation could be a significant aviation hazard.

125 The Applicant's decision to remove food from the waste stream that enters the landfill relieves many of the concerns in relation to this application.

126 The Bird Management Plan provides the necessary safeguards to ensure aviation risks are managed.

127 In fact, if implemented well, the Bird Management Plan coupled with appropriate management at the existing Green Island Landfill and at SBBG breeding sites, could have an overall reduction in aviation risk as the Otago SBBG population should be diminished significantly.

128 I understand the Applicant is committed to achieving this aim.



Phillip Shaw

29 April 2022

AVISURE
safety | aviation | wildlife

Boffa Miskell

Smooth Hill Landfill – Bird Management

Draft Management Plan
Prepared for Dunedin City Council

4 June 2021

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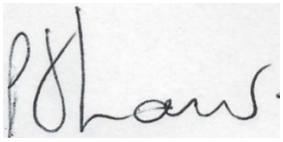
Avisure</td><td>  </td></tr>
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Cover photograph: Proposed Smooth Hill landfill location, © BML, 2019

Contents

1.0 Introduction

This draft Bird Management Plan (BMP) describes the bird management for operation of the Smooth Hill Landfill, located 4.5 km southeast of Dunedin Airport. It is a draft plan, given that some details about the components of the waste stream, delivery and operation of Smooth Hill landfill are yet to be finalised. Prior to operation of the landfill, this plan will be updated to reflect finalised details and procedures. It will also be updated to include action plans on how to manage different bird species at the landfill, standard operating procedures for the different deterrence and control methods included in this plan, key performance indicators, and roles and responsibilities. Examples of the latter two components are provided in Appendix 1.

This BMP is one of a suite of ecological management plans and is to be read in conjunction with the draft Landfill Management Plan (LMP), which has been prepared as part of the consent application documents for the construction, operation, closure and aftercare of the Smooth Hill Landfill.

The BMP is based on information provided in scientific (and unpublished) literature, landfill best practise documentation, a Smooth Hill preliminary bird hazard assessment prepared by Avisure (Avisure, 2021), and communications had with personnel involved with other landfills in New Zealand. Adaptive management will be applied as necessary. For example, if a better way of undertaking a bird control technique is found, or learned through conversations had with other landfill personnel, then this will be applied so that bird deterrence and control is maximised and conducted in the most effective manner.

Prior to the commencement of operation, the following will be arranged:

- A “Bird Control Officer” will be assigned who is responsible for overseeing bird management at the site and is the “go to” person for people to report black-backed gull sightings and other bird-related observations.
- A marksman / shooter will be on-site for when black-backed gulls are observed (black-backed gulls are Not Threatened and are not protected under the Wildlife Act). This person will be trained in bird identification, have a gun license and be registered with the Department of Conservation (DOC; among other things outlined in Section 3.3.1).
- A dedicated small team of personnel will be trained in techniques to deter birds from the active tip face. This component of the plan could be provided in-house or contracted out.
- Suitable netting and support material for enclosing the landfill (if bird control escalation is required) will be identified and a plan will be put in place for installation, detailing the supplier, installer, cost, etc.
- A suitably qualified and experienced ecologist / ornithologist will be engaged to complete and analyse bird monitoring data and assess risk.
- Health and safety documentation for specific activities that relate to bird control on site (e.g. shooting gulls, poison use, etc).

1.1 Background Information

1.1.1 Attraction of birds to landfills and bird strike risk with aircraft

A number of bird species are attracted to landfill sites, particularly scavenging species such as gulls. This is because landfills can provide a foraging opportunity for birds if putrescible (organic) waste is exposed and not managed well. Birds may also use landfill grounds for roosting and breeding (Centre for Advanced Engineering, 2000; ISWA Working Group for Landfill, 2010; Queensland Department of Environment and Resource Management, 2010; Ryder Environmental Limited, 2019; Stantec, 2019; Waste Management NZ Ltd, 2018). It is important that these bird foraging, roosting and breeding opportunities are reduced as much as possible at landfill sites. Birds can be a nuisance to people in neighbouring properties (e.g. noise, fouling), can present a potential health risk (via the transfer of pathogens and contaminants) (Cook et al., 2008; Ryder Environmental Limited, 2019; Waste Management Institute New Zealand, 2018), and can increase bird strike risk with aircraft if the landfill is located near an airport (Belant et al., 1995; Cook et al., 2008; Ryder Environmental Limited, 2019).

Given the isolated, rural location of the Smooth Hill Landfill, public nuisance and contamination effects are not a major concern[1]. However, the risk of bird strike with aircraft is of concern, given that the landfill is approximately 4.5 km from Dunedin Airport and is within the Airport's flight fan (see Figure 1). The consequences of wildlife strike with aircraft can be very serious. In the extreme, wildlife strikes can cause human fatalities, injuries, aircraft loss and damage. The New Zealand Civil Aviation Authority (NZ CAA) and International Civil Aviation Organisation (ICAO) '…recommends that refuse dump sites be located no closer than 13 km from the airport property" (Civil Aviation Authority of New Zealand, 2008). These statements are guidance only and not regulated. The guidance applies to all Part 139 aerodromes, including Dunedin Airport[2]. Consequently, it is of the utmost importance that landfills within 13 km of airports (i.e. Smooth Hill) are carefully planned, monitored and operated appropriately to mitigate bird strike risk and manage this risk to acceptably low levels.

The species of most concern at the Smooth Hill Landfill is black-backed gull. This is because they are large, common, flocking birds that fly to and from the coast and Taieri Plains, including over and in the vicinity of the landfill site and around Dunedin Airport. Black-backed gulls are also the species most attracted to landfills with putrescible (organic) waste[3] and are at risk from strike with aircraft. There is a large local population of black-backed gulls in Dunedin, including at least 3,000 birds at Green Island Landfill, which is proposed to close in the next few years. These birds will be seeking an alternative food source when Green Island Landfill closes and thereby may be attracted to Smooth Hill Landfill if food is readily available and accessible. If black-backed gulls establish a population at Smooth Hill Landfill, this would increase aviation strike risk.

Other species that may use the landfill, and / or associated infrastructure (e.g. water retention basins) that have been identified as posing a low to moderate aviation strike risk are mallard ducks, red-billed gulls, harrier hawks and starling (Avisure, 2021).

[1] This is because there are few houses in close proximity to the landfill as a result of the rural context of the area, and bird control management and methods will minimise attractiveness of the landfill to birds and thereby further minimise potential nuisance and contamination effects.

[2] Additional information on requirements and recommendations for managing land use near airports is provided in Appendix 2.

[3] Putrescible waste is a solid waste that contains organic matter capable of being decomposed by microorganisms and is capable of providing food for birds and other vectors.

Without mitigation, the preliminary bird hazard assessment concluded that there is a very high risk to aviation from the landfill (Avisure, 2021). However, the risk can be managed to an acceptably low level with mitigation, involving multiple actions and based on an escalating response if initial mitigation actions are not successful (Avisure, 2021). It is therefore very important to implement mitigation measures to keep bird numbers to very low levels at the landfill.

This BMP, therefore, focuses on black-backed gulls and procedures / control methods to manage them at the site (refer to Appendix 3 for a species identification guide). With the implementation of good landfill operational techniques, bird management, monitoring, deterrence and control methods, black-backed gulls can be kept to very low numbers (as well as mallard duck, red-billed gulls, harrier hawk and starling numbers)[4] and, therefore, aviation strike risk will be managed to an acceptably low level.

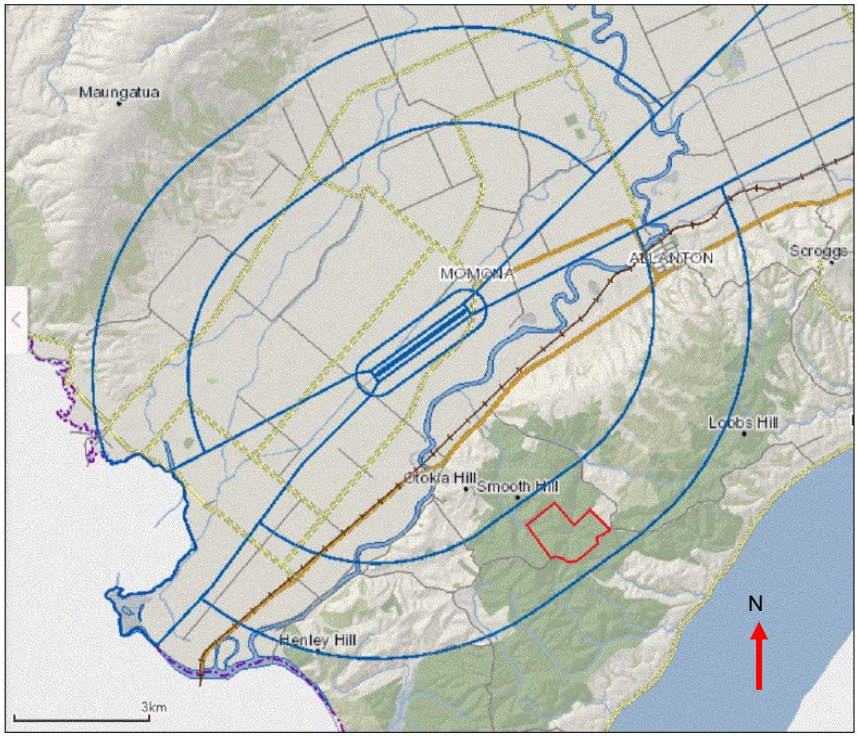

Figure 1. Dunedin Airport's flight fan (blue ovals) in relation to Smooth Hill landfill (red polygon). The two outer ovals are approximately 4 km and 6.2 km from the outer edge of the Airport's runway (blue rectangle).

1.1.2 Importance of this plan

It is critical that the operational procedures, bird deterrence and bird control measures are applied well so that bird numbers are kept very low at the landfill (i.e. below threshold levels, refer to Section 3.1). This will require a high standard of operation, bird management, discipline and vigilance that needs to be maintained throughout the lifespan of the landfill. These standards will be applied by all people working on site and it is everyone's responsibility to keep

[4] Operational measures to reduce and manage black-backed gull numbers at the landfill will also be effective for other bird species that are attracted to landfills. Likewise some of the bird deterrence and control methods will also be effective for controlling these species, noting however that red-billed gulls and harrier hawks are protected under the Wildlife Act therefore cannot be killed (i.e. poisoning, colony control or shooting are prohibited control options).

an eye out for gulls at and around the landfill, and to report observations to the Bird Control Officer. This unified and disciplined approach will reduce the attractiveness of the Smooth Hill Landfill to birds and, therefore, keep bird numbers and associated aviation strike risk low. Furthermore, there will be regular communication with Dunedin Airport to discuss bird numbers and coordinate management methods.

2.0 Operational Procedures

It is very important to establish and maintain effective operational procedures at Smooth Hill Landfill. If operational procedures are not conducted adequately, birds may become resident at the landfill and once birds are established and resident at a landfill, they are very difficult to disperse. Therefore, the procedures outlined below must be executed to a high standard from the outset of operation of the landfill and sustained throughout operation of the landfill.

2.1 Reducing putrescible / organic waste

Putrescible (organic) waste at landfills is an attractive food source for many bird species. Even with kerbside collections including a “food waste bin” and an optional “garden waste bin”, it is anticipated that some organic waste will still enter the general waste stream. It is critical that this is minimised as much as is reasonably possible. The landfill will also receive “special wastes” that have a high putrescible content (e.g. waste from food manufacturing or as part of clean up during emergency response).

Details have not been finalised on how much putrescible waste will be present in the waste stream at Smooth Hill Landfill (although it will be greatly reduced, relative to levels at the current Green Island Landfill

Based on observations made at Kate Valley Landfill (a modern landfill where very few birds are present), the following is recommended:

- Reducing putrescible waste as much as possible (at Kate Valley Landfill it is estimated that over the past five years organics comprised 3-16% of all waste)
- Separating putrescible and general waste streams.
- Transporting the waste to the landfill in sealed containerised trucks.
- Unloading special waste with a high putrescible content into a ‘V’ pit formed by the parallel lines of general waste, which is then covered and compacted with general waste as placed This pit makes access to special waste with a high putrescible content difficult for birds as they would need to go into the pit, which is unsettling for them to enter.
- Applying daily cover at the end of operation each day to all waste placed in that day (including the putrescible waste V pits) to ensure putrescible (organic) waste is well covered and not exposed (see Section 2.2).

2.2 Good daily cover

Providing good daily cover of the active tip face is a very important operational procedure to reduce the attractiveness of the landfill to birds as a food supply. Good cover results in no food being left exposed at the end of each day, thereby denying birds a food source and minimising bird numbers at the site (Centre for Advanced Engineering, 2000; Environmental Protection Agency, 1997; ISWA Working Group on Landfill 2019, 2019; Queensland Department of Environment and Resource Management, 2010; Waste Management NZ Ltd, 2018).

The guidelines for daily cover provided in the draft Smooth Hill Landfill Management Plan will be adhered to. In brief, daily cover will involve spreading / grading and thorough compaction of waste at the tip face (including the putrescible waste V pits) at the end of operation each day (Environmental Protection Agency, 1997; ISWA Working Group on Landfill 2019, 2019; Waste Management NZ Ltd, 2018). The entire active tip face will be covered with daily cover consisting of either at least a 150 mm layer of soil or a suitable artificial cover that is compacted to seal and stabilise it (Waste Management NZ Ltd, 2018)[5]. The guidelines in the draft Landfill Management Plan for intermediate and final cover will also be adhered to in order to reduce bird numbers at the landfill.

In addition to waste compaction and cover at the end of the day, if possible, all waste that could provide a food source to birds will be compacted and covered immediately with general waste and then daily cover (soil or artificial cover) applied throughout the day if possible, particularly in areas where no more waste will be received that day (ISWA Working Group on Landfill 2019, 2019; Waste Management NZ Ltd, 2018). This will reduce the amount of time food is exposed to birds.

If black-backed gulls are observed at the landfill, extra vigilance and care will be taken when covering the tip face to make sure that it is thoroughly and evenly covered and is also well compacted. Bird deterrence and / or control methods must also be employed as described in Section 3.1.

If black-backed gulls persist at the site, cover thickness will be increased (WasteMINZ Technical Guidelines for Disposal to Land) and observations of the tip face will be made to see if / where birds are foraging. These areas will then be targeted for additional compaction and soil coverage. Bird deterrence and control methods will also be implemented to deter the birds from the landfill and to avoid birds increasing above acceptable thresholds, as outlined in Section 3.1.

The landfill's soil cover plan will be abided by to ensure that an adequate supply of soil cover is always available and accessible on site (Waste Management NZ Ltd, 2018). Personnel involved in applying daily cover will be made aware of the importance of this task, with respect to bird management and reducing strike risk with aircraft.

2.3 Minimising the extent of the active tip face

The active tip face will be kept as small as is practicable to reduce the area where food may be available to birds (Centre for Advanced Engineering, 2000; Waste Management NZ Ltd, 2018). At Kate Valley Landfill, the active tip face is moved daily so that waste does not have to be

[5] Thorough waste compaction is very important as it makes the process of covering the waste quicker and is a more conservative use of soil as it reduces the total area over which soil needs to be spread. Grading the waste is also important because it reduces the number of ruts and depressions in the tip face and therefore also reduces the amount of soil required for daily cover and the time required for this task.

pushed very far (R. Ward, pers. comm., February 24, 2020)[6]. This minimises open exposure to waste material and thereby reduces foraging opportunities for birds. If practicable, this practise will be employed at the Smooth Hill Landfill.

2.4 Minimising open earthworks and pools of water

It is important to minimise open areas of earthworks around the landfill and to make sure that there are no hollows or depressions where water can pool as birds will use these areas to drink and clean themselves (ISWA Working Group on Landfill 2019, 2019; Waste Management NZ Ltd, 2018). The stormwater attenuation basin on site will be dry most of the time, however, some water may pool. Pooling should not exceed 100 m^2 of open water for more than a continuous 48-hour period; if this occurs and birds are attracted to the site above acceptable thresholds (see Section 3.1) then Council should investigate the installation of wires, permeable membranes or nets over the basin or other such method to discourage birds being attracted to the attenuation pond.

Restored and non-operational areas of the landfill will be checked regularly to make sure that there are no areas of exposed waste, or areas where water can pool. If detected, there areas will be graded, covered with soil, compacted and grassed.

Underground drains and water storage will be used where possible to reduce availability to birds.

2.5 Reducing barren areas

Barren areas around the landfill will be minimised by planting grass. The grass will be maintained at a minimum sward length of 200 mm, but preferably at approximately 300 mm. This will reduce the attractiveness of the area to birds for roosting and nesting and make it more difficult for birds to land and take off. Birds may also be fearful of predators where long grass is present (ISWA Working Group on Landfill 2019, 2019).

3.0 Bird Deterrence and Control Methods

Birds cannot be allowed to establish at the site, as once resident at a site it can be very difficult to disperse them (R. Ward, pers. comm., February 24, 2020; P. Withers, pers. comm., February 19, 2020). Therefore, the key to bird deterrence and control is being vigilant, disciplined and proactive, so that appropriate deterrence and control actions can be implemented or changed in response to changes in bird numbers. Vigilance is particularly important during the egg laying stage of the black-backed gull breeding season (egg laying broadly occurs between the start of October and end of January) as this is the time when they are looking for nesting sites and laying eggs. If nests are found, eggs will be removed, and the nests will be oiled. Bird control responsibility will be assigned to someone on site (i.e. a “Bird Control Officer” who has some personnel trained in deterring birds from the active tip face) and it will be their responsibility to manage the control response. However, everyone on site will work as a team and immediately

[6] Some landfills only have one tip for up to one to two years. This results in waste being pushed large distances and increases exposure to birds.

alert the Bird Control Officer when black-backed gulls (as well as red-billed gulls, mallard ducks, harrier hawks and starlings) are observed on site and if observations are made of birds becoming habituated to a deterrence or control technique.

3.1 Bird Number Threshold Levels

There will be zero tolerance for birds greater than 50 g in size feeding at the landfill or accessing waterbodies. This size class includes species from the size of a starling and above. Occasional use by small birds (such as house sparrows) in low numbers will be tolerated.

An escalation procedure will be implemented to deter and control bird numbers at the landfill (these methods are additional to operational control procedures that will always be implemented). In the first instance bird management will involve bird deterrence and lethal methods (as discussed in Sections 3.2 and 3.3, below). If this is unsuccessful, i.e. **if at any time more than 20 individuals from a species greater than 50 g, or combined numbers of these species exceeds 100 individuals, then management actions will be elevated to also include lethal control methods**. If lethal control methods are unsuccessful, other escalation procedures will include trialling wires above the landfill and baling waste. **If more than 12 breaches of these thresholds occur in any 12-month period, the final step in the escalation procedure will be to position a net over the landfill** to ensure no further bird activity is possible, unless an aviation risk assessment indicates that the risk can otherwise be managed to an acceptable level.

3.2 Deterrence methods

3.2.1 Disperse birds from the active tip face

To prevent birds from accessing waste at the active tip face, a team of landfill staff or contractors will be responsible for dispersing birds from the tip face during daylight operational hours (until end-of-day cover is applied). Dispersal methods will include using stockwhips, pyrotechnics, starters pistols and portable distress callers. These personnel will be trained by a suitably qualified and experienced person.

3.2.2 Anti-roosting strips on structures

To prevent birds landing and roosting on structures at the landfill, anti-roosting strips / bird spikes will be fixed to the rooves of the buildings, signs and other built structures prior to the commencement of operation of the landfill (Queensland Department of Environment and Resource Management, 2010; Waste Management NZ Ltd, 2018). Appropriately sized spikes will be installed to deter gulls[7].

3.3 Lethal methods

Based on scientific literature and conversations had with personnel involved with other landfills in New Zealand, the two most effective bird control measures are shooting / scaring birds and

[7] The following website has an example of anti-roosting strips that are appropriate to deter gulls, https://www.pestrol.co.nz/buy-online/pestrol-bird-spikes/.

setting out poison (Centre for Advanced Engineering, 2000; ISWA Working Group on Landfill 2019, 2019; Waste Management NZ Ltd, 2018)[8]. These methods may be used if bird deterrence methods (Section 3.2) are unsuccessful and bird numbers on site breach threshold levels (refer to Section 3.1). Shooting should be conducted first (if dispersal methods are unsuccessful) and then potentially poisoning as a last resort before netting (refer to Section 3.6). Lethal control will be used randomly and sparingly so that birds are continually unsure of the type of danger they are being exposed to and may react by relocating away from the area (Cook et al., 2008; ISWA Working Group for Landfill, 2010; Waste Management Institute New Zealand, 2018). This will increase the effectiveness of the lethal control methods as they will present a more novel danger to birds in the area and should increase the chance of birds leaving the area and seeking safer foraging sites. The longer a technique is used the less successful it generally becomes because birds can become habituated to it.

3.3.1 Shooting

Shooting is an effective measure to scare birds from landfills (Centre for Advanced Engineering, 2000; ISWA Working Group on Landfill 2019, 2019; Waste Management NZ Ltd, 2018). If bird numbers breach threshold levels on site (refer to Section 3.0), then a shooting operation will be conducted as instructed by the Bird Control Officer. The landfill's designated shooter / marksman will be contacted to undertake the shooting operation at the earliest opportunity it is safe to do so. It is recommended that a high-powered .22 gun is used during these operations (R. Ward, pers. comm., February 24, 2020).

Prior to a shooting operation commencing, the Bird Control Officer will confirm that the shooter can correctly identify black-billed gulls[9], red-billed gulls, harrier hawks, eastern falcon and paradise ducks. These are protected native species that may be present at, or near the landfill, and must not be shot. A species identification guide is provided in Appendix 3.

During a shooting operation, bird strike rates are likely to be low, but nonetheless the shots fired should scare birds away from the area. If birds are killed, the number shot (and date of kill) will be recorded in a register of birds killed (see Section 4.0). Dunedin Airport should also be contacted prior to a shooting operation to inform them that this activity will be occurring so they can implement bird deterrence methods at the Airport if required.

Although black-backed gulls (a native species) are not protected under the Wildlife Act, before commencement of operation of the landfill, conversations will be had with the Department of Conservation about the intention to shoot black-backed gulls observed at the site. People who own properties in the vicinity of the Smooth Hill Landfill will also be informed that shooting may occur from time to time at the landfill, so they are not alarmed when they hear shots.

A comprehensive health and safety plan will be prepared and abided by that documents the procedure to follow when undertaking shooting operations during operational hours. There will also be appropriate documentation about gun security, transport, maintenance and safe use of firearms. The shooter will have a valid firearms licence and must also be a licensed shooter registered with the Department of Conservation.

[8] This method was also endorsed by a conversation had with the regional manager of Canterbury Waste Services (R. Lord, pers. comm., February 24, 2020).

[9] It is highly unlikely that black-billed gulls will be present, however they are a Threatened species so positive identification is necessary.

3.3.2 Poisoning

If bird numbers still breach threshold levels (refer to Section 3.1) following a shooting operation, or birds are too far away to shoot, then poison will be set but only as a last resort before installation of a net (refer to Section 3.6). Poisoning will involve putting out plain (unbaited / without poison) bread where the birds are observed for three to four days to allow time for the birds to recognise this as a food source. After three to four days, an appropriate bird poison will be added to the bread (R. Ward, pers. comm., February 24, 2020). The baited bread will not be set by water and it will only be laid during calm weather, as windy conditions may blow poisoned gulls away from the area into neighbouring properties (Bell & Harborne, 2018).

Pestoff Bird Control Paste will be used (it is also known as Alpha Bird Paste)[10]. This product is supplied by Animal Control Products Ltd and can be bought from rural merchants. The paste will be liberally applied to the bread and then set in the areas frequented by the gulls. The poison is more effective at lower temperatures, therefore, the baited bread will be laid out as close to dusk as possible (particularly in summer; this is less important in winter) (Bell & Harborne, 2018). For birds the LD_{50} (lethal dose) is 32-56 mg / kg B/W[11]. This poison does not kill the birds but renders them incapacitated, therefore, following a poisoning operation regular checks will be made for incapacitated birds and they will be humanely dispatched.

Poison will only be set if no black-billed gulls and red-billed gulls have been observed at the landfill for the past three to four days. If poison is set at dusk and left overnight, the Bird Control Officer, and / or a small team of trained personnel, will monitor for and deter non-target species (e.g. red-billed gulls, harrier hawks) until dark and again from first light until the bread has been consumed; this is to prevent potential poisoning of these non-target species.

The paste is a harmful substance, therefore, a health and safety plan will be prepared and abided by when using this substance. The chemical safety datasheet for this product is provided in Appendix 4.

Alphachloralose, the active ingredient of Pestoff Bird Control Paste, can persist in the tissue of poisoned birds, which can result in secondary poisoning of scavenging birds such as hawks. Therefore, after a poisoning exercise, dispatched birds will be collected and appropriately disposed of.

Prior to operation of the landfill, discussions will be had with the Department of Conservation regarding this control method as well as adjacent landowners in case any poisoned birds end up on their properties. Appropriate signage will also be installed on site and will remain in place until toxic baits and poisoned gulls are retrieved. Appropriate approvals and Approved Handler Test Certificates will also be gained for the operation and poison handling (Bell & Harborne, 2018).

3.3.3 Colony control

Black-backed gull colony control is occasionally conducted at some airports and by the Department of Conservation to manage bird populations. If black-backed gull numbers at Smooth Hill Landfill are increasing, despite the implementation of operational and control procedures, then colony control is something that may be investigated and potentially implemented.

[10] This poison is used at Kate Valley Landfill. If another poison proves effective at bird control, based on the literature and / or on the ground use elsewhere, then alternative/s may be used.

[11] The average weight of a black-backed gull is approximately 1 kg, therefore, to be conservative, 56 mg should be used per piece of bread to achieve the LD_{50}.

Prior to closure of Green Island Landfill this may be conducted during the breeding season to reduce bird recruitment and thereby help minimise a significant scattering of birds across the landscape during and following closure. Implementation of this method may reduce the population of gulls subsequently attracted to Smooth Hill Landfill (managing black-backed gulls in Dunedin is discussed further in Section 7.0).

Colony control would involve culling birds and / or breaking or pricking eggs at nesting colonies (as identified during the off-airport bird monitoring regime described in Section 5.1.2). Prior to this occurring, discussions will be had with the Department of Conservation, and possibly the Otago branch of the Ornithological Society of New Zealand. The objectives of these discussions are to determine their receptiveness to this activity and potentially for help locating colonies not identified during the monitoring regime and assisting in undertaking this control. It must be noted that culling black-backed gulls may not be perceived favourably by some members of the public, however, it is an effective control method. Note that culling is only appropriate for black-backed gulls; it is not appropriate for the protected red-billed gulls or black-billed gulls that are At Risk and Threatened species, respectively. These species, particularly black-billed gulls, however, are unlikely to utilise the Smooth Hill Landfill.

3.4 Further Bird Management Options

Below are further options that the Council should investigate if the other bird management methods outlined above were unsuccessful.

3.4.1 Installation of wires above the landfill

If bird deterrence and lethal control methods are unsuccessful it may be necessary to escalate management efforts. Trialling the installation of wires above the landfill may be an option, although this is unproven in New Zealand. The type of wire used, spacing and height of installation will be dependent on operations (i.e. the level of the tip face, the reach of vehicles / equipment used, etc) and will be advised by the a suitably qualified ecologist or ornithologist.

3.4.2 Baling waste

Another escalation procedure if bird thresholds are breached will be to bale waste. This does not eliminate the food (putrescibles) but compresses it and makes access for birds very difficult. Waste will first be unloaded into a bird-proofed building to prevent access at the unloading stage.

3.4.3 Installation of a net over the landfill

If more than 12 breaches of the bird thresholds occur in any 12-month period, the final escalation procedure to be implemented will be installation of a net over the landfill. This is an expensive but tested solution to prevent birds from accessing food waste. Dunedin City Council will establish the cost of this installation (as well as net maintenance) and where to source the materials from prior to operation of the landfill so that the Council is prepared to implement this management action if required. Nets tear easily so good maintenance regimes will be essential to maintain the integrity of the enclosure.

4.0 Bird Management and Control Registers

During operation, a number of registers will be kept updated regarding the use of bird deterrence and bird control measures and their effectiveness. Black-backed gull observations at the landfill will be recorded as well as the numbers shot and poisoned. Records will also be kept of red-billed gulls, black-billed gulls (although their presence is highly unlikely), harrier hawks, starlings and mallard ducks observed at the landfill, as well as any bird threshold trigger breaches. The following registers will be kept:

- The number of black-backed gulls observed at the landfill;
- The number of black-backed gulls killed by shooting;
- The number of black-backed gulls killed by poison;
- The number of red-billed gulls, harrier hawks, starlings and mallard ducks observed at the landfill;
- The number and date of bird threshold trigger breaches;
- The date/s bird control measures are implemented and the duration of implementation;
- A success register that documents how effective bird control measures are / were; and
- Sightings of falcon at or near the landfill (this will help inform if it is appropriate to use falcon decoys as a potential bird control option).

These registers, which will be combined into one spreadsheet, will help keep track of what bird deterrence and control methods have been used at the site (including their frequency) and how successful they have been. This information will be used to inform what techniques to use at the site to maximise the effectiveness of bird control and keep bird numbers, and thereby strike risk, to very low levels.

5.0 Bird Monitoring

A monitoring regime will be established prior to the closure of Green Island Landfill and establishment of Smooth Hill Landfill. Monitoring will commence as soon as possible and will occur for at least a 12-month period. Following this period, discussions will be had with a suitably qualified ecologist / ornithologist and Dunedin Airport to determine if the monitoring frequency can be scaled back to seasonal monitoring (i.e. once each in summer, autumn, winter and spring). The purpose of this monitoring regime is to:

- Determine the year-round behaviour patterns of key bird species and their populations in the Dunedin area, especially black-backed gulls.
- Determine how black-backed gulls and other species, respond to management initiatives at Green Island Landfill leading up to, during and after its closure to organic waste.
- Establish a baseline estimate of risk at and around Dunedin Airport through structured regular surveys that allow risk assessment models to be updated.

- Enable comparisons to be made between baseline (pre-operation) and operational bird data to assess aviation strike risk and success of bird management at Smooth Hill Landfill.

Information obtained from monitoring will be used to inform risk assessments to determine the impact of the landfill's operation on aviation safety. It will be used to demonstrate that risks are being managed to an acceptable level, or if not, then indicate further mitigation is required.

5.1 Monitoring regime

The following monitoring regime will be conducted by a suitably trained bird observer (training is discussed in Section 5.2). Binoculars will be used during these surveys to enhance vision and aid species identification.

Refer to Appendix 5 (Smooth Hill Preliminary Bird Hazard Assessment) for more information and previous survey results (Avisure, 2021).

5.1.1 On-airport surveys

Monthly on-airport bird surveys will be conducted at Dunedin Airport (noting that this requires Dunedin International Airport Ltd to give consent to access these sites) using the following methodology (which was established during the survey conducted for the Smooth Hill Preliminary Bird Hazard Assessment; (Avisure, 2021)).

Three surveys will be conducted at Dunedin Airport over one day: early morning, middle of the day, and late afternoon. Each survey will include observations at assigned observation points within the seven sectors that cover the area inside the fence at Dunedin Airport (Appendix 6).

The observer will travel from one observation point to the next following the established anti-clockwise route through each sector making observations while en route. The observer will spend 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 should be recorded regardless of whether they are in the current sector or not. Information recorded will include: time, species, number sighted, location, estimated height above ground level, heading and activity (breeding, chasing, foraging, perching, sheltering, thermalling or transiting). Survey records will also include ambient conditions (first and last light, rainfall, temperature, air pressure, wind speed and direction).

Prior to commencing each survey, the Dunedin Airport Operations Manager will be contacted, and appropriate arrangements will be made to facilitate the survey (e.g. health and safety requirements, having an appropriate escort while on site, etc).

5.1.2 Off-airport surveys

Monthly off-airport surveys will be conducted at three locations in close proximity to Dunedin Airport as identified (and surveyed) in the Preliminary Bird Hazard Assessment (Avisure, 2021). These sites include Dam 3, Landside Paddock and Drain West of Carpark (Appendix 7). At each location, all bird species present upon arrival will be identified, and their numbers recorded (no specified time period for the count, just until all species present have been counted).

Additionally, seasonal counts (i.e. summer, autumn, winter, spring counts) will be conducted at the same locations surveyed in the Smooth Hill Preliminary Bird Hazard Assessment (Avisure, 2021) (Appendix 7). Each location will be visited once per season. All bird species present upon arrival will be identified, and their numbers recorded (no specified time period for the count, just until all species present have been counted). Black-backed gulls departing Green Island Landfill at closing (just before 5 pm) will also be followed once per season to observe where they roost at night.

5.1.3 Green Island landfill surveys

Monthly counts of gulls arriving at Green Island Landfill will be conducted by a suitably trained bird observer. The surveys should be conducted at first light and approximately 100 m north of the landfill admission booths. All gulls arriving at site should be identified to species, counted using a clicker (one continuous count rather than recording numbers in flocks) and the direction of approach should be noted. Approximate numbers of birds departing the site should also be recorded.

5.1.4 Smooth Hill landfill surveys

Prior to and during operation, monthly bird counts will be conducted from one vantage point overlooking the Smooth Hill Landfill site, concurrently with the off-airport surveys and using the same methods as the off-airport surveys. These counts will be conducted by a suitably trained bird observer.

Once Smooth Hill Landfill is operational, counts will be undertaken on the days the landfill is operating and completed by suitably trained operational staff using binoculars. Just prior to the commencement of operation, a standard survey route will be established around the designated site. The route will not include every single structure / location at the landfill but will target key sites. Stopping points will be designated where areas are scanned for birds. During the surveys, data will be collected for each bird, or flock of birds observed, and will include the following:

- Date;
- Time;
- Species;
- Number of birds;
- Bird behaviour (e.g. foraging, perching, transiting, etc);
- Bird habitat usage (e.g. grass, building, drain, tank, etc); and
- Any other observations of interest (e.g. nesting activity, unusual bird activity, effectiveness of mitigation devices).

Weather conditions will also be noted at the start and end of each survey and will include:

- Visibility (e.g. sunny, partly cloudy, overcast, etc);
- Cloud cover (as a percentage of the sky);
- Precipitation (e.g. none, drizzle, light, heavy etc);
- Temperature (°C);

- Wind strength; and
- Wind direction.

5.1.5 Monitoring records and analysis

Information collected during this monitoring will be entered into an electronic database (e.g. Excel, Fulcrum) and a suitably qualified and experienced ecologist / ornithologist will be engaged to analyse the data and assess risks. This engagement will occur prior to the commencement of monitoring.

5.2 Training

The bird observer and Smooth Hill Bird Control Officer conducting the surveys will be trained by a suitably qualified and experienced person prior to commencing monitoring to make sure the correct survey methods are implemented. This training will either be in person or via phone / email communications.

All staff at the landfill will also be trained by a suitably qualified and experienced person on:

- Bird identification
- Bird dispersal
- Bird counts
- Hazard assessment and reporting
- Firearm use

All staff will be familiar with the contents of this plan, their responsibilities with regards to reporting bird sightings and undertaking good operational procedures.

6.0 Risk Assessment

An annual risk assessment will be conducted by a suitably qualified expert in bird strike risk assessments to determine the contribution to bird strike risk. This will be conducted using a method that considers:

- Species (behaviour, mass, tendency to flock or roost communally)
- Land use / activity type
- Location relative to Dunedin Airport and the approach / departure paths
- Location relative to nearby land uses that attract, or have the potential to attract, birds
- Species strike risk based on Dunedin Airport strike data.

7.0 Managing Black-Backed Gulls in the Dunedin Area

To avoid a significant scattering of birds across the landscape during and following the closure of Green Island Landfill, and to reduce the population of black-backed gulls likely to be attracted to Smooth Hill Landfill, a management plan should be prepared for black-backed gulls in the Dunedin area.

This management plan will be prepared prior to the closure of Green Island Landfill to putrescible waste and:

1. In collaboration with Dunedin Airport, the Department of Conservation and Dunedin City Council, to establish a breeding season control program at key black-backed gull breeding sites.

2. In consultation with Dunedin Airport to commence a staged dispersal program for black-backed gulls at Green Island Landfill. It will be necessary to have excellent communications between bird controllers and Dunedin Airport staff to ensure that aviation risks are well managed. This program should commence prior to the next black-backed gull breeding season, as populations deprived of food at this critical time are less likely to build nests and lay eggs. They are also more likely to disperse away from the region more rapidly. Dispersal will involve a trained and equipped bird control officer positioned at the landfill to prevent birds from feeding on the active tip face for all daylight hours. Over time, the hours required on site can be scaled back based on the success of the program and / or the impact on the aviation risk as assessed in consultation with Dunedin Airport.

8.0 Review and Updating of the Plan

This Bird Management Plan is a dynamic document that will be prepared and reviewed biannually (halfway through the year and at the end of the year) for the first three years of operation of Smooth Hill Landfill. If, after 3 years, birds have been successfully kept at low numbers, then the plan will be reviewed on an annual basis.

The plan will be reviewed and updated by the Smooth Hill Landfill Bird Control Officer in collaboration with an external expert in aviation safeguarding. Communications will also be had with an external expert in aviation safeguarding or a suitably qualified and experienced ecologist / ornithologist each time a bird threshold level is triggered; based on these discussions a review and update of the plan may be required.

The Bird Management Plan will be updated based on lessons learned on site, bird numbers at the site, risk assessments, and new information available in landfill bird management literature. There will also be regular communication with other landfills to get up-to-date information about what techniques they are using and which bird control techniques they are having most success with.

During operation, this Bird Management Plan will include a section on bird monitoring results, the number of black-backed gulls observed on site, bird threshold breaches, control methods employed, and how successful controls employed have been. These aspects will be updated during each plan review so that it can be determined which control methods are the best at reducing bird numbers; these methods will then be employed thereafter to maximise control.

9.0 Communication with Dunedin Airport

Regular communication will be had with the Wildlife Officer (or equivalent person) at Dunedin Airport to remain informed on bird numbers and trends at the Airport and what bird deterrence and control mechanisms are most effective.

It is recommended that a Wildlife Hazard Management Committee is established or the Dunedin Airport Wildlife Hazard Management Committee (if established) is joined to provide a forum to discuss wildlife hazard management with relevant stakeholders and local authorities. Regular meetings will help with:

- Ongoing exchange of information between stakeholders to improve wildlife management.
- Ensuring stakeholders are aware of their responsibilities.
- Encouraging stakeholders to adopt a proactive approach to wildlife management.
- Improving communication between stakeholders.
- Reducing the economic impact on aircraft operators and improving operational safety.

Information collated from these communications should be incorporated into the bird management plan during the biannual reviews.

10.0 Summary of Key Messages

- A Bird Control Officer will be appointed by the landfill operator to oversee bird management at the landfill.
- Putrescible waste should be removed from the waste stream, or if not possible, reduced as much as possible to reduce the attractiveness of the landfill to birds by denying them a food source.
- Good operational procedures, bird deterrence and control measures will be used during operation of the Smooth Hill Landfill (right from the onset of operation) to reduce the attractiveness of the site to birds. Applying good daily cover at the tip face (including the putrescible waste V pits) at the end of operation each day is a key control to ensure putrescible (organic) waste is well covered and not exposed to reduce attractiveness to scavenging birds.

- An escalation approach will be followed whereby, if operational and bird deterrence methods do not deter birds and bird numbers exceed thresholds, then lethal control methods will be employed. If lethal control is unsuccessful and thresholds are still exceeded, then the Council should investigate the other bird management methods outlined in Section 3.4.
- Bird control measures, and some bird deterrence methods, will be implemented randomly and occasionally to maximise effectiveness of the bird control strategy.
- Regular communication with Dunedin Airport will be had to discuss bird numbers and the coordination of bird management methods.
- All staff on site will undergo bird training and will be familiar with the contents of this Bird Management Plan, their responsibilities with regards to reporting bird sightings and undertaking good operational procedures.
- It is crucial that birds are not allowed to become resident at the site. To prevent this from occurring, the operational procedures outlined in this plan will be executed to a high standard. This requires discipline and vigilance throughout the lifespan of the landfill. Furthermore, when implementing bird control methods, a proactive and responsive approach will be conducted so that appropriate and effective methods are employed if, and when, needed.
- Bird management and control registers will be maintained that document observations of gulls at the site, bird control methods used and their success at reducing bird numbers.
- Formal, standardised bird surveys will be conducted at various locations in Dunedin prior to construction of the landfill as well as during operation of the landfill. Comparisons will then be made between baseline (pre-operation) and operational bird data to assess aviation strike risk and success of bird management at the landfill.
- Black-backed gull deterrence should be conducted at Green Island Landfill prior to closure in conjunction with colony control in Dunedin to reduce bird numbers in the area prior to operation of Smooth Hill Landfill.
- This plan will be reviewed and updated biannually (and after bird threshold trigger breaches if required) so that it remains current and has the most up-to-date information about bird control options, and their relative effectiveness, so that the best bird management approach can be applied at the landfill.
- With implementation of the operational procedures, bird deterrence and control methods outlined in this plan, black-backed gulls can be kept to very low numbers at the landfill and aviation risk can be managed to an acceptably low level.

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Appendix 1: Key Performance Indicators, Roles and Responsibilities

Examples of Key Performance Indicators and Roles and Responsibilities Sections to be Incorporated into this Plan Prior to Operation

Key Performance Indicators example. These indicators could include the landfill's compliance conditions as set out by Dunedin City Council.

Legislation and Regulatory Requirements		
To develop, implement and maintain procedures and systems to ensure operations at comply with applicable legislation, regulations, standards and industry best practice.		
Target	**Performance Indicator**	**Evidence**
Continual improvement to meeting legislative compliance.	Compliance to legal requirements is conducted at least annually.	Record of BMP review

Roles and Responsibilities example to be tailored to the landfill and updated.

Position	**Responsibilities**
[add]	Endorse the final BMP.
	Provide resources for implementing the BMP.
	Attend the annual WHMC meetings or delegate a representative.
[add]	Oversee the implementation and review of the BMP.
	Ensure wildlife control staff are trained and competent in the functions required for wildlife hazard management, including inspections, bird counts, bird and animal identification, bird harassment and reporting techniques.
	Issue the BMP and procedures to relevant staff and ensure implementation.
	Ensure wildlife control staff and other relevant staff adhere to the procedures and actions detailed in the BMP.
	Liaise with airport operators, local government and other stakeholders to assist in identifying and managing wildlife issues
	Provide information regarding wildlife hazards and their management to regulatory authorities

Position	Responsibilities
	Coordinate interactions with WHMC stakeholders for the management of land use surrounding the airport.
	Attend WHMC meetings or delegate a representative.
[add]	Ensure that all Procedures contained in the BMP are implemented.
	Review of the BMP at least annually, particularly the Operations Procedures and Firearms Policy. Forward any recommended modifications to the [position].
	Ensure wildlife management staff monitor, inspect, assess, record and report as described in the BMP.
	Ensure that the wildlife management staff are trained and competent in the functions required for wildlife hazard management, including wildlife surveys, wildlife identification, and wildlife dispersal and reporting techniques.
	Provide technical presentations and advice to wildlife hazard management meetings.
	Coordinate training for personnel assigned to conduct wildlife harassment with appropriate firearms certification.
	Attend WHMC meetings or delegate a representative.
Wildlife Control staff	Manage wildlife and their habitats as described in the relevant sections in the BMP and adhere to wildlife management procedures.
	Attend wildlife hazard management training as required.
	Use, store and maintain firearms and ammunition as required by the ’s firearms policy and procedures.
	Record management actions as per wildlife management procedures.
	Report wildlife hazards.
	Maintain the database detailing species and number of wildlife culled as part of airfield management.
	Collect and maintain dispersal data, including ammunition use.
	Provide input in the revision of the BMP and associated procedures.
	Attend the WHMC meetings.
[consultant name]	Undertake standardised wildlife surveys.
	Provide advice regarding environmental matters.

Position	Responsibilities
Environment Manager	Prepare wildlife strike data and depredation data and monitor species risk and hazards.
	Ensure that the principles BMP are consistent with the Environmental Management System.
	Maintain the necessary permits for culling lethal control, egg and nest removal, and relocation of birds and other wildlife.
	Ensure compliance with permit conditions.
	Regularly review waste management practices at the airport to secure food and waste attractants for birds and other wildlife.

Appendix 2: Requirement and Recommendations for Managing Land Use Near Airports

There are a number of national and international requirements and guidance documents that indicate land use in the vicinity of an airport can contribute significantly to the wildlife hazard levels and safety of aircraft operations.

The following NZCAA documents provide guidance and/or advice primarily for aerodromes that hold a 139-aerodrome operating certificate, however, the principles are relevant for good risk management.

Table 1. Sections of the NZ CAA Part 139 and AC relevant to the proposed Smooth Hill Landfill.

Document	Requirement
NZ CAA Part 139, CAA Consolidation, Aerodromes – Certification, Operation and Use, March 2017	Subpart B, Section 139.71 states: "An applicant for the grant of an aerodrome operator certificate must, if any wildlife presents a hazard to aircraft operations at the aerodrome, establish an environmental management programme for minimising or eliminating the wildlife hazard." DUD has a documented Wildlife Management Program.
NZ CAA Guidance material for land use at or near aerodromes, June 2008	The document states: "It is important that land use changes are monitored and reviewed by the aerodrome operator in areas outside their immediate control to ensure that these land use changes do not increase wildlife hazards for the aerodrome. Garbage disposal dumps and other sources that may attract wildlife activity on, or in the vicinity of, an aerodrome, need to be assessed as a potential source of wildlife hazard. It is an International Civil Aviation Organization requirement that such activities are closely managed by the controlling authority. If necessary, an aeronautical study may need to be undertaken to assess the potential wildlife activity hazard".
NZ CAA Advisory Circular AC139-16, Wildlife Management at Aerodromes, Revision 0, October 2011.	This advisory circular (AC) is applicable for certificated and non-certificated aerodromes. It lists landfills as a potentially hazardous land use practice.

ICAO defines aerodrome standards for wildlife hazard management at civilian airports. Tables 2 and 3 summarise the standards relevant to the proposed landfill.

Table 2. Sections of ICAO Annex 14 Vol 1. 6th Ed. 2013 relevant to the proposed Smooth Hill Landfill (International Civil Aviation Organisation, 2013).

Section	Requirement
9.4.3	Action shall be taken to decrease the risk to aircraft operations by adopting measures to minimize the likelihood of collisions between wildlife and aircraft.
9.4.4	The appropriate authority shall take action to eliminate or to prevent the establishment of garbage disposal dumps or any other source which may attract wildlife to the aerodrome, or its vicinity, unless an appropriate wildlife assessment indicates that they are unlikely to create conditions conducive to a wildlife hazard problem. Where the elimination of existing sites is not possible, the appropriate authority shall ensure that any risk to aircraft posed by these sites is assessed and reduced to as low as reasonably practicable.
9.4.5	States should give due consideration to aviation safety concerns related to land developments in the vicinity of the aerodrome that may attract wildlife.

Table 3. Sections of ICAO Airport Services Manual Doc 9137 5th Ed. 2020 relevant to the Smooth Hill Landfill (International Civil Aviation Organisation, 2020).

Section	Recommendation/Guidance
4.2.1.5	Landfills and garbage dumps are a significant source of food for wildlife. Certain species will travel several tens of kilometres to reach a dump. Birds flying to and from these sites may cross over an aerodrome or aircraft flight paths. It is not uncommon to observe hazardous birds, for example gulls, kites and vultures, soaring over dump sites in the thermals created by composting garbage. The greater presence of birds may give rise to problems for approaching aircraft.
4.4.1	The concept of compatible land use planning is the environmental relationship between airports and their community neighbours. Its implementation requires careful study and coordinated planning. Land use around airports can influence restrictions on aircraft flights and affect aircraft safety
4.4.2	A 13-km circle centred on the aerodrome reference point is recognised where land use should be assessed with regard to wildlife hazard management. However, the circle may be extended or reduced based on a wildlife evaluation of the aerodrome vicinity. States should consider all aviation safety concerns related to land development in the vicinity of the aerodrome to minimize the attraction of wildlife. Aerodrome operators are encouraged to communicate their safety concerns with the local authority in order to raise awareness Prior planning is necessary to ensure that incompatible land use is not allowed to become established. Such developments should be subjected to a risk assessment process … and changes sought, or the proposal opposed, if a significant increase in the wildlife strike risk is likely to result
4.4.3	In order to successfully deal with land use issues, a comprehensive WHMP including coordination among the aviation regulatory authority, aerodrome operator, aircraft operators and the surrounding communities should be implemented

Section	Recommendation/Guidance
4.2.1.5	Landfills and garbage dumps are a significant source of food for wildlife. Certain species will travel several tens of kilometres to reach a dump. Birds flying to and from these sites may cross over an aerodrome or aircraft flight paths. It is not uncommon to observe hazardous birds, for example gulls, kites and vultures, soaring over dump sites in the thermals created by composting garbage. The greater presence of birds may give rise to problems for approaching aircraft.
4.4.4	A monitoring process of sites where hazardous wildlife is to be found should be instigated, at least seasonally. The survey of the land use around aerodromes should be reviewed at a period determined by the safety risk assessment. In general, it is desirable to carry out a new comprehensive land use survey assessment every five years
4.4.7	The appropriate authority should encourage prohibiting or restricting the establishment of new or existing organic waste sites near aerodromes. If a waste management site in the vicinity of an aerodrome cannot be closed, it may be necessary to provide control measures at the site to reduce its attractiveness to hazardous wildlife

Appendix 3: Species Identification Guide

Black-backed gull (*Larus dominicanus*)

Adult

Juvenile

The black-backed gull is a native, Not Threatened species.

They are large gulls that are c.60 cm in length and weigh c.1 kg.

Adults are black and white with a white head and underparts, a yellow bill and a distinctive black back.

Juveniles look different to adults. They are a mottled dull brown colour with dark brown eyes and bill.

Red-billed gull *(Larus novaehollandiae)*

The red-billed gull is a native species that has a threat status of At Risk, Declining.

They are medium sized gulls with a pale grey mantle, back and wing coverts. They have a red bill, red legs (adults) and a white iris with a red eye-ring. Their main flight feathers are black with white tips.

The main way to distinguish them from black-backed gulls is their much smaller size. Red-billed gulls are c.37 cm in length, whereas black-backed gulls are c.60 cm in length. Red-billed gulls weigh c.240-320 g, whereas black-backed gulls are much heavier and weigh c.1000 g.

Black-billed gull (*Larus bulleri*)	
	The black-billed gull is a native species that has a threat status of Threatened, Nationally Critical. They are medium sized gulls with a pale back and grey wings, black legs and a black beak. Their flight feathers have white-tipped black margins and they have a white iris with a red eye-ring. They can be identified from black-backed gulls by their much smaller size. Black-billed gulls are c.35-38 cm in length, whereas black-backed gulls are c.60 cm in length. Black-billed gulls weigh c.230g, whereas black-backed gulls are much heavier and weigh c.1000 g.
Harrier hawk (*Circus approximans*)	
	The harrier hawk is a native species that has a threat status of Not Threatened. They are a large (c.50-60 cm in length), long-legged harrier with long taloned toes, long pointed wings, prominent facial discs and a strongly hooked bill. Adults have a tawny-brown back, pale cream streaked breast, yellow eyes and a creamy white rump visible in flight. Juvenile and immature birds are uniformly dark chocolate brown.
Eastern falcon (*Falco novaeseelandiae "eastern"*)	
	The eastern falcon is an endemic species with a threat status of At Risk, Recovering. They are a robust falcon, c.40-50 cm in length with broad wings, long tail, long yellow legs and toes, yellow eye ring, dark eyes and a distinct moustache striped from the base of the strongly hooked bill down the face. Adults are brown-backed with a streaked cream breast and a red- brown under tail and thighs. Fledglings and juveniles are dark brown, lack cream streaking, with blue-grey legs and eye ring.

Paradise shelduck (*Tadorna variegata*)	
	The paradise shelduck is a native species with a threat status of Not Threatened. They are large ducks c.63-70 cm in length. Males weigh c.1.7 kg and females weigh c.1.4 kg. Both sexes have a chestnut undertail, black primary and green secondary wing feathers, and a white upper wing surface. Males have a dark grey or black body and head (bird on the right in the image) while females are rich chestnut brown with a white head and upper neck (bird on the left in the image).

Appendix 4: Chemical Safety Datasheet for Pestoff Bird Control Paste

Animal Control Products Ltd

Bird Paste

orillion

SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name:	**PESTOFF BIRD CONTROL PASTE**
Synonyms:	Alpha Bird Paste
Supplier 1:	Animal Control Products Ltd
Street Address:	408 Heads Road Whanganui 4501 New Zealand
Telephone:	64 (0) 6 344 5302
Web site:	www.pestoff.co.nz
Emergency Telephone No:	021 919 624
National Poisons Centre:	0800 764 766

2. COMPOSITION / INFORMATION ON INGREDIENTS

Active Ingredient:	Alphachloralose 2.5% w/w
Other Ingredients:	Icing sugar, red fleck, oil, petrolatum
Active constituent:	2.5% (R)-1,2-O-(2,2,2,-Trichloroethylidene)-α-D-glucofuranose
Active Cas Number:	15879-93-3
Molecular Weight:	309.5
Molecular Formula:	$C_8H_{11}Cl_30_6$
Recommended use:	For the control of birds
Appearance:	A thick white paste with red aluminium fleck

3. HAZARDS IDENTIFICATION

This product is classified as a **HARMFUL SUBSTANCE.**

HSNO Approval Code: HSR001600

HAZARD IDENTIFIERS:	**Priority Identifiers** - Harmful. Keep out of reach of children. Ecotoxic. **Secondary Identifiers** - Warning. May be harmful if swallowed, inhaled or absorbed through the skin. When handling open containers or baits, wear protective gloves and overalls. Harmful to terrestrial vertebrates. Ensure domestic birds and animals and cannot be exposed to the toxin either through eating baits or through eating the carcasses of poisoned birds.
DANGEROUS GOODS CLASS:	Not classified as dangerous goods.
GENERAL REQUIREMENTS:	No special requirements. The product may be used only in accordance with label directions.

NOT CLASSIFIED AS DANGEROUS GOODS FOR TRANSPORT PURPOSES

4. FIRST AID MEASURES

Ingestion: If eaten, call a doctor. Keep patient awake and warm. Give patient stimulants if possible. Large doses may reduce body temperature to a fatal level.

Appendix 5: Preliminary Smooth Hill Bird Hazard Assessment

Smooth Hill Landfill

Preliminary Bird Hazard Assessment – Final

Boffa Miskell

May 2021

AVISURE
aviation | wildlife | safety

Summary

Dunedin City Council engaged Boffa Miskell Ltd and subcontractor Avisure to prepare this Smooth Hill Preliminary Bird Hazard Assessment. This was in response to concerns the proposed facility could increase the bird hazard for air traffic at and around Dunedin International Airport which is adjudged to already have a high bird strike risk. The proposed Smooth Hill Landfill is located approximately 4.5 km from the airport and regulatory guidance suggests that putrescible waste landfills are not located within 13 km of an airport. At this stage it has not been decided if the proposed landfill will accept organic waste, or if it will, how it will be handled and in what quantity. This will be critical for the likely attraction of birds to the new landfill.

The assessment was based on non-breeding season surveys in May 2021 and a review of Dunedin International Airport data. A modern Landfill in Kate Valley north of Christchurch was also visited to explore why that landfill is relatively unattractive to birds.

The assessment was limited by a range of factors; accordingly, it is considered preliminary. More surveys across all seasons, updated information on what the waste stream will consist of and how it will be handled at Smooth Hill, and a review of key factors contributing to the low bird numbers at Kate Valley are necessary to update this risk assessment.

Without appropriate mitigation, the assessment indicates that there is a very high risk to aviation from the proposed Smooth Hill Landfill. Mitigation involving multiple actions and based on an escalating response requirement depending on the success of initial mitigation, will manage the risk to an acceptably low level. If monitoring finds population targets are not met at the new site and this proves to increase the risk at the airport, then as a last resort it would be necessary for operators to net the landfill to prevent bird entry to the site.

Southern Black-backed Gulls present the greatest aviation risk owing to their size, flocking nature, current local population size, utilisation of the existing Green Island Landfill, preference for putrescible waste, ability to soar, opportunistic response to food from farm paddocks, and their ability for population growth based on artificial food supply leading to spill over into the general environment.

A series of recommendations to manage the risk has been provided:

1. Limiting organics in the waste stream.

2. Updating the Draft Smooth Hill Bird Management Plan to include:

    a) a detailed monitoring regime prior to its operations to establish baseline population data and risk levels, and to assess populations around the Dunedin area, including at Dunedin International Airport and Green Island Landfill. Monitoring should start immediately, and frequency reassessed annually

    b) monitoring protocols during operations

    c) acceptable thresholds for bird numbers at the new landfill

    d) details of actions taken on site to mitigate risks

    e) training requirements for people involved in the bird control program

    f) Standard Operating Procedures for bird control activities.

3. Developing a bird management plan for Southern Black-backed Gulls around Dunedin at their breeding sites and at the Green Island Landfill prior to its closure. This will assist with managing the number of gulls that could be attracted to the new site and minimise the risk that gulls scatter around the landscape, including on or around the Dunedin International Airport upon the landfills closure.

Glossary

Aerodrome/Airfield	Any location where aircraft take off, land and are stored and maintained. An airfield consists of at least one runway for an aircraft to take off and land, and may contain a helipad, buildings such as control towers, hangars, and terminal buildings.
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.
Loafing	When animals rest.
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 vectors.
Risk	The effect of uncertainty on objectives.
Roosting	When birds repeatedly return to a particular place in numbers to loaf or spend the night.
Runway	A defined area on an aerodrome prepared for the take-off and landing of aircraft.
Transit	When birds fly from one place to another.
Wildlife Strike	A collision between wildlife and an aircraft.

Abbreviations

AGL	Above Ground Level
ASRI	Airport Survey Risk Index
BBG	Southern Black-backed Gull
CEMP	Construction Environment Management Plan
DIAL	Dunedin International Airport Ltd
DUD	Dunedin International Airport
ICAO	International Civil Aviation Organization
NZCAA	New Zealand Civil Aviation Authority
SOP	Standard Operating Procedure
SRI	Species Risk Index

Table of Contents

1. Introduction

1.1. The Wildlife Strike Issue

The consequence of wildlife strikes[1] with aircraft can be very serious. Wildlife strikes have caused 532 human fatalities and 614 aircraft losses since the beginning of aviation (Shaw et al, 2019[2]). 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[3].

[1] 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.

[2] A database that lists more details about significant and fatal wildlife strike events is available at https://avisure.com/about-us/fatalities-and-destroyed-aircraft-due-to-wildlife-strikes-1912-to-present/

[3] 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 x mass x velocity^2).

1.2. Bird Strikes and Land Use Around Airports

In civil aviation around 93% of strikes occur at 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.

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.

1.2.1. 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 the 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) "…. recommends that refuse dump sites be located no closer that 13km 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 Airport (DUD). Therefore, landfills within 13km of airports require careful planning, monitoring, and operating to mitigate potential bird strike risks. In some situations, landfill projects have been rejected by local planning authorities because the risk was assessed as unacceptable.

There are three main ways that landfills near airports can affect bird strike risk:

1. **Site Risk:** Aircraft overfly the landfill and birds soaring above can conflict with aircraft.
2. **Flight Path Risk:** Birds traverse aircraft flight paths to and from the landfill (Figure 1).

3. **Spill Over Risk:** Significant population growth of species receiving abundant food results in 'spill over' onto areas around or on the airport. This can be highly influenced by certain events, such as heavy rainfall, calving season, or ploughing activity.

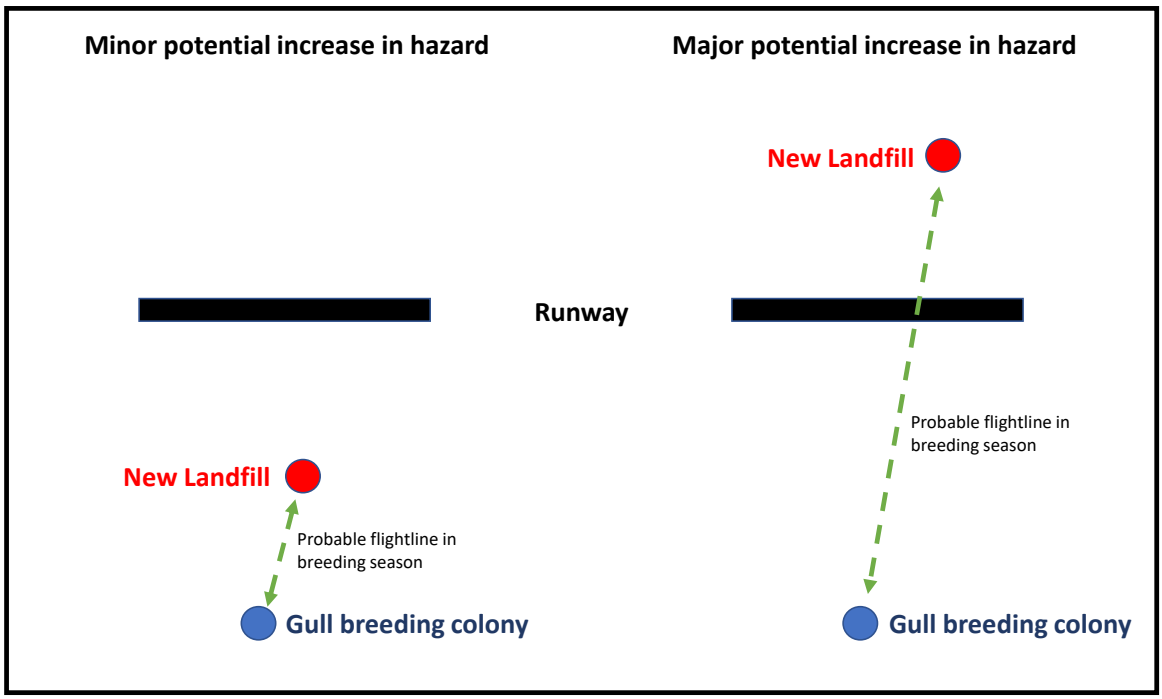

Figure 1. Position of new landfill in relation to the runway and other bird habitats can impact risk (adapted from UK, CAA CAP 680). *Note: A highly attractive habitat that has a complementary habitat on the other side of the aerodrome, significantly impacts strike risk because birds are likely to transit though critical airspace.*

In New Zealand, the main bird species attracted to landfills include: the Southern Black-backed Gull (*Larus Dominicanus* [BBG]), Red-billed Gull (*Larus novaehollandiae*), Rock Dove/Pigeon (*Columba livia*), Common Starling (*Sturnus vulgaris*), House Sparrow (*Passer domesticus*), various finch species, along with 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. 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, food processing factories etc.

They are also common in coastal environment (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 2. Black-backed Gull (*Larus dominicanus*)

1.3. Dunedin Airport

DUD, comprising 110ha, is located approximately 22km south-west of Dunedin City and operates with more than 20,000 aircraft movements per annum (pre-COVID19) on its single runway. Flights are primarily domestic, but there are also scheduled flights to Australia.

DUD management have raised concerns about the proposed Smooth Hill Landfill.

1.4. Smooth Hill Landfill Project Description

A putrescible waste landfill is proposed at Smooth Hill, 4.5km south-east of DUD. The landfill is expected to operate for up to 55 years. Details are yet to be finalised on aspects that could influence bird attraction to the site, such as:

1. The amount of organic material in the waste stream and if that will be separated from the general waste.
2. How waste will be transported to the site.
3. How the waste will be unloaded at the site.

1.5. Scope of this Report

The resource consent application has addressed the bird strike issue in various documents that generally indicate that with good bird management at the landfill, low bird numbers will be maintained and there will be a negligible change to strike risk for aircraft operating at DUD.

In November 2020, Dunedin City Council engaged Avisure to provide expert advice on the suitability of the proposed approaches to manage the risk to aviation that could arise from bird activity created by the new landfill. The review determined that the initial documentation relevant to managing birds at the proposed landfill, primarily Smooth Hill Landfill Bird Hazard Assessment (Ryder 2019) and Draft Bird Management Plan (Boffa Miskell 2020), did not adequately address the issue or how to best manage the risk. The Avisure report (2020) recommended:

1. That the Smooth Hill Landfill will need to be carefully planned and managed because landfills are generally not recommended within 13 km of an airport in various aviation regulation and guidance material.

2. The removal of putrescible waste from the waste stream should be considered as it would significantly alter the site's risk profile.

3. Updating the Hazard Assessment and the Draft Bird Management Plan to provide a more informed and robust understanding of the issues and more comprehensive risk management.

Dunedin City Council engaged Boffa Miskell Limited to complete the requirements of item 3 above, who subcontracted Avisure to prepare this hazard assessment and assist with updating the Draft Bird Management Plan. This risk assessment was based on a 3.5 day site visit in May 2021 which included:

1. A meeting with council staff and key staff of the Dunedin International Airport Limited (DIAL) to discuss council's approach to this issue.

2. A visit to the proposed site of the new landfill.

3. Reviewing, where available, background data on bird populations from ornithological groups and eBird.

4. Bird surveys on and around DUD to assess the current bird strike risk.

5. Bird surveys in and around Dunedin City, including the proposed Smooth Hill site, Green Island Landfill, the Otago Peninsula, the Dunedin coastline, Lake Waihola, Lake Waipori and the Sinclair wetlands to better understand populations of the bird species of interest (primarily BBG), their relative population size and behaviour.

6. A visit to a modern landfill operation at Kate Valley north of Christchurch to allow comparison with the proposed site.

2. Methods

2.1. Review of Existing Data

A desktop review of eBird provided information on bird populations around Dunedin and provided guidance on locations for surveys. The focus was on locations likely to support BBGs but also Red-billed Gulls, waterbirds, and other species of interest. Previous bird data from DUD and surrounds was also available from the draft DUD Wildlife Hazard Management Plan (Avisure 2018).

2.2. Stakeholder Meeting

A meeting was held on 6th May 2021 in DIAL offices involving Richard Roberts, Glen Pleasants, Jesse Gibbs, Bruce Smail, Chris Henderson (Dunedin City Council), Rachael Eaton (Boffa Miskell), Karin Sievwright (Boffa Miskell) and Phil Shaw (Avisure). There was no set agenda, nor were minutes taken. The meeting offered an opportunity for DIAL to express any concerns and for Council to explain the processes in place to manage aviation risks.

2.3. Bird Surveys

Principal Aviation Ecologist Phil Shaw (Avisure) and Ornithologist Karin Sievwright (Boffa Miskell) completed the following bird surveys between 4 and 7 May 2021. Binoculars were used to assist with identification of birds.

2.3.1. On Airport

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 DUD 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 are 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).

2.3.2. Smooth Hill

On 5 May the site of the proposed Smooth Hill Landfill was visited to assess the habitat and consider the current and future attraction for bird species that could be a risk to air traffic.

2.3.3. Green Island Landfill

The Green Island Landfill surveys estimated the numbers of birds (gulls in particular) using the landfill and determined night-time roosts by tracking gulls leaving the landfill. Surveys occurred on 4 May 2021 (0715 to 0845 hrs) and 7 May 2021 (0715 to 0905 hrs), commencing at first light until the majority of the birds had arrived and only occasional individual birds were still arriving.

The two observers were positioned approximately 100 m north of the landfill admission booths. 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.

Incidental observations of other bird species seen and heard at the site during the survey were noted. Abundances were not recorded.

Discussions with the Waste Management Operations Manager (Paul Withers) and Dunedin City Council landfill engineer (Lincoln Coe) provided information on landfill operations, bird numbers and management. A walkover of the landfill allowed the observers to view the site, surrounding areas (e.g., Kaikorai estuary) and gull behaviours.

On 4 May 2021, the observers completed an additional count at 1600 hrs to observe the direction the gulls departed the landfill for their roosting site. As soon as the birds began departing, the observers followed in a vehicle to determine the location of roosting sites. Counts were then made from vantage points overlooking the roost sites to determine the number of roosting birds (See 2.3.4 Dunedin City).

2.3.4. Dunedin city, Coastline and wetlands and surrounds

Between 4 and 7 May 2021, off-airport bird surveys were completed at several locations of interest within 13 km of DUD, and at locations along Otago Peninsula, the Dunedin coastline, Sinclair Wetland, Lake Waihola and Lake Waipori (**Error! Reference source not found.**, Figure 3). At each site, all bird species were identified, and numbers recorded. These surveys helped to:

- Understand bird communities and abundances around DUD and the wider area.
- Determine likely feeding, roosting and nesting sites of BBG.
- Determine likely bird flight paths and how they might interact with aircraft flight patterns.

On 6 May 2021 evening roosting observations were made from two vantage points, one off Sunshine Lane and the other from Ocean View Beach. Counts were made to determine the number of roosting gulls and their locations.

2.3.5. Kate Valley Landfill

On 7 May 2021, Phil Shaw visited Kate Valley landfill in Teviotdale (approximately one hour north of Christchurch) to observe the landfill and to talk to the Environmental Engineer from Canterbury Waste Services (Ajay Krishna). The purpose of this site visit was to understand how they are able to manage bird populations to very low levels.

Table 1. The locations of off-airport surveys conducted between 4-7 May 2021 in Dunedin.

Survey Date	Survey Location
4 May 2021	Kaikorai Estuary - Top (from Green Island Landfill)
	Green waste
	Keep It Clean
	Dunedin Harbour road transect– western shore southern half
	Otago Peninsula – Harwood tidal flat
	North of Harwood
	Otago Peninsula north-eastern sand bank
	Taiaroa Head
5 May 2021	Dam 3 off Kirks Drain Road
	Drainage channel to west of Dunedin airport carpark
	Dunedin airport landside paddock
	Taieri River bridge (Allanton)

Survey Date	Survey Location
6 May 2021	Tomahawk Lagoon 1
	Tomahawk Lagoon 2
	Smails Beach
	Maori Head
	Bird Island
	St Kilda Beach
	Lawyers Head
	White Island
	Kaikorai Estuary – Top (from landfill)
	Kaikorai Estuary - Mid
	Kaikorai Estuary - East
	Green Island (offshore island)
	Ocean View beach
	Brighton
	Beach on Taieri Mouth Road
	Rock outcrop on Taieri Mouth Road
	South of Kuri Bush
	Moturata Island
	Moturata Island Reserve
	Taieri River mouth
	Lake Waihola site 1
	Lake Waihola site 2
	Sinclair Wetlands Information Centre
	Sinclair wetlands
7 May 2021	Watson Beach north
	Kaikorai Estuary – Top (from Walton Park)
	Lake Waipori

Figure 3: Location of survey sites, 4 to 7 May 2021

Boffa Miskell Limited

Smooth Hill Landfill Preliminary Bird Hazard Assessment

Smooth Hill Landfill proposed site

Off-airport sites

3, 8 & 13km buffers from runway

Dunedin Airport runway boundary

Dunedin Airport boundary

AVISURE safety | aviation | wildlife

Job number: PR6386
Revision: 1
Author: AS
Date: 21/05/2021

0 1 2 4 Kilometers

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

PR6386_MPX_OffairportLocations_Landscape
A4

2.4. Risk Assessment

We reviewed the species identified as a risk in the DUD Draft Wildlife Hazard Management Plan (Avisure 2018) and updated the risk assessment based on the May 2021 airside surveys (Appendix A). The key species of concern to the airport were considered in the context of species that could be attracted to the Smooth Hill Landfill and then become a threat to aviation.

The off-airport surveys were analysed for:

1. The size and nature of bird populations in Dunedin and surrounds.
2. How the closure of the Green Hill Landfill and opening of the proposed Smooth Hill Landfill could influence these populations, both in size and behaviour, and how that could impact aircraft flight paths.

The above assessment was then appraised for risk levels by species under the following categories:

1. **The existing risk at DUD**. This was based on assessments completed in 2018 and 2021. Where a species had not been classified as a risk due to an absence from surveys or strikes, it was assumed to be a very low risk.
2. **Existing population size in the Dunedin Survey Area.** Species were classified according to numbers observed during surveys: > 5000 = Very Large; 1000 to 4999 = Large; 100 to 999 = Moderate; 10 to 99 = Low to moderate; < 10 = Low. If a species had not been recorded at DUD and was observed in numbers fewer than 10 elsewhere, it was left out of the analysis as its impact on risk was deemed to be negligible.
3. **Existing population size at Green Island Landfill.** Species were classified according to numbers observed during surveys: as categorised above.
4. **Likely attraction to a new putrescible waste landfill.** Observations from various New Zealand landfills including three around Wellington, the former Burwood Landfill in Christchurch, and Green Island Landfill, informed a qualitative assessment of this category for each species.
5. **Likely impact on Site Risk.** (see Section 1.2.1). The ability for a bird species to soar and to do so in flocks was appraised to determine the classification of risk. Soaring and flocking birds scored higher.

6. **Likely impact on Flight Path Risk.** (see Section 1.2.1). The availability of complimentary habitats in positions that could encourage birds to move to and from the proposed site and through flight paths was considered for this category. Species with complimentary habitat around and across the airport scored higher.

7. **Likely impact on Spill Over Risk.** (see Section 1.2.1). The availability of a food supply from a putrescible waste landfill that supports significant population growth was considered for this category. Bird species that benefit from the artificial food supply from a landfill score higher.

8. **Likely unmitigated risk to aviation.** This was assessed based on an amalgamation of the seven factors listed above. High scores in multiple categories resulted in a higher score in this category.

9. **Residual risk to aviation after mitigation.** This assumed the successful implementation of mitigating actions recommended in Section 6 of this report.

2.5. Limitations

This Bird Hazard Assessment is considered 'preliminary' due to the following limitations:

1. A single site visit. Survey and risk assessment results are a snapshot of bird populations and do not account for climatic and seasonal fluctuations. Surveys were completed in May, so information on breeding activities and locations is based on eBird records alone.

2. Several of the sites recorded on eBird as supporting BBG, including some breeding sites, were inaccessible and would require private landholder permission to access.

3. Surveying across multiple days increases the chances that birds move between sites and it is possible we many have over or under counted birds as a result.

4. One-off risk assessment. The risk assessment cannot accurately quantify changes in local bird populations. It identifies attributes that currently attract hazardous species and the likely hazards presented by those species for the proposed landfill to contribute.

5. Details on the how the waste stream will be managed, including organic content, the transportation and unloading of the waste at the proposed Smooth Hill Landfill are yet to be decided. These will significantly influence the site's bird attraction.

6. The DUD Wildlife Hazard Management Plan has not been finalised and requires updating. Risk assessments have been based on strike data that are not recent.

7. A considerable risk to aviation will arise upon the closure of the Green Island Landfill with the redistribution of birds that currently forage there. This will be irrespective of what happens at Smooth Hill. This risk has not been assessed in this report, although it is considered in the recommendations (Section 6).

8. Details on the organic proportion of waste dumped at Green Island was not available for comparison with Kate Valley Landfill.

As a result of these limitations, there is some uncertainty around the risk outcome from the project and a precautionary approach has been recommended. As further information becomes available, the assessment should be updated.

3. Results

3.1. Review of Existing Data

eBird information on BBG indicates a significant population Dunedin and surrounds (Appendix B). Kaikorai Estuary – Top supported the highest recorded numbers of 2800 at any one site, adjacent to the Green Island Landfill. Nesting has been recorded at Blackhead, Tunnel Beach, Sandymount Seacave, Hooper's Inlet, Penguin Place, Heyward Point Blueskin Bay, Goat Island, Taieri Mouth, Taieri Island, Akatore Coast Head, and Watson Beach North.

In surveys completed at DUD in March 2018 (Avisure 2018), Common Starling was most abundant with 131 observed across three daytime surveys. Unidentified ducks and Grey Duck (collectively, most likely to be Grey Duck-Mallard Hybrids, *Anas spp.*) were the next most populous with 67 observed. Six BBG were observed.

In March 2018 (Avisure 2018), Lake Waihola recorded 150 BBG, the site with the highest number across a limited number of off-airport sites visited.

3.2. Bird Surveys

3.2.1. Overview

BBGs were by far the most abundant species recorded across all survey locations. Daytime totals for this species across all sites exceeded 6000 (Table 2 and Figure 4). The Green Island Landfill was the site with the most birds recorded, accounting for nearly half of all daytime observations of this species.

The second most populous area was the western flank and northeast sandflat of Dunedin Harbour. This area supported 1478 BBG (mostly loafing during the day) and a range of other bird species. Of the 246 Red-billed Gulls recorded across all sites, more than 200 were recorded in this area, and it supported 272 of the overall 411 Grey Duck-Mallard Hybrids recorded across all sites. Areas near the DUD were attractive to this species, including the Landside Paddock (45), the Drainage Channel to west of the carpark (20) and Dam 3 (10). Surveys also recorded the Grey Duck-Mallard Hybrid at Tomahawk Lagoon 2 (49) and the mid-section of the Kaikorai Estuary (15).

Large numbers of BBG (>1300) were observed in the Kaikorai Estuary, along with other species. This estuary is close to the Green Island Landfill and it is highly likely that birds

interchange between these sites. Smails Beach (178) and the roof of the Dunedin Ice Stadium (134 observed from St Kilda Beach) also support significant numbers of BBG during the day.

To the south of the survey area, Moturata Island Reserve (250) and Watson's Beach North (83) also recorded BBG and would be important complementary sites if Green Island Landfill populations were allowed to relocate to the proposed Smooth Hill site.

Table 2. Maximum daytime BBG counts across all survey sites. *The Kaikorai Estuary – Top count was excluded from the total count, as birds observed here were likely to have been counted during fly-in to the Green Island Landfill.

Survey Location	Maximum Count
Green Island Landfill	3002
Otago Peninsula – Harwood tidal flat	594
Sand bank - northeast	550
Kaikorai Estuary East	510
Kaikorai Estuary Mid	500
Kaikorai Estuary Top	300*
Moturata Island Reserve	250
North of Harwood	220
Smails Beach	178
Dunedin Ice Stadium (St Kilda Beach)	134
Dunedin Harbour road transect	114
Watson Beach North	83
Keep it Clean	60
Ocean View Beach	40
Bird Island	29
Lawyers Head	28
Lake Waipori	20
Tomahawk Lagoon 2	15
Taiaroa Head	15
Taieri River mouth	10
Green waste	10
Brighton	7
Moturata Island	4
White island	4
Beach on Taieri Mouth Road	4
Maori Head	4

Survey Location	Maximum Count
Landside Paddock	2
Tomahawk Lagoon 1	2
Lake Waihola Survey Site 1	1
Total	**6390**

Figure 4: Location and number of Southern Black-backed Gull observations, 4 to 7 May 2021

Boffa Miskell Limited

Smooth Hill Landfill Preliminary Bird Hazard Assessment

3, 8 & 13km buffers from runway
Dunedin Airport runway boundary
Dunedin Airport boundary

1 to 40 Gulls
41 to 134 Gulls
135 to 300 Gulls

301 to 594 Gulls
595 to 3,002 Gulls

AVISURE safety | aviation | wildlife

Job number: PR6386
Revision: 1
Author: AS
Date: 21/05/2021

0 1 2 4
Kilometers

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

PR6386_MPX_Black-backedGullLocations_Landscape
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3.2.2. On Airport

Surveys completed at DUD in May 2021 reflected similar abundance and species diversity to surveys completed in March 2018 (Figure 3). Common Starling were the most abundant with 290 counted across the three surveys. Unidentified Small Bird (202) and Grey Duck-Mallard Hybrid (99) were other species observed in significant numbers. BBG were observed in the morning (13) and afternoon (6). Red-billed Gull were not recorded.

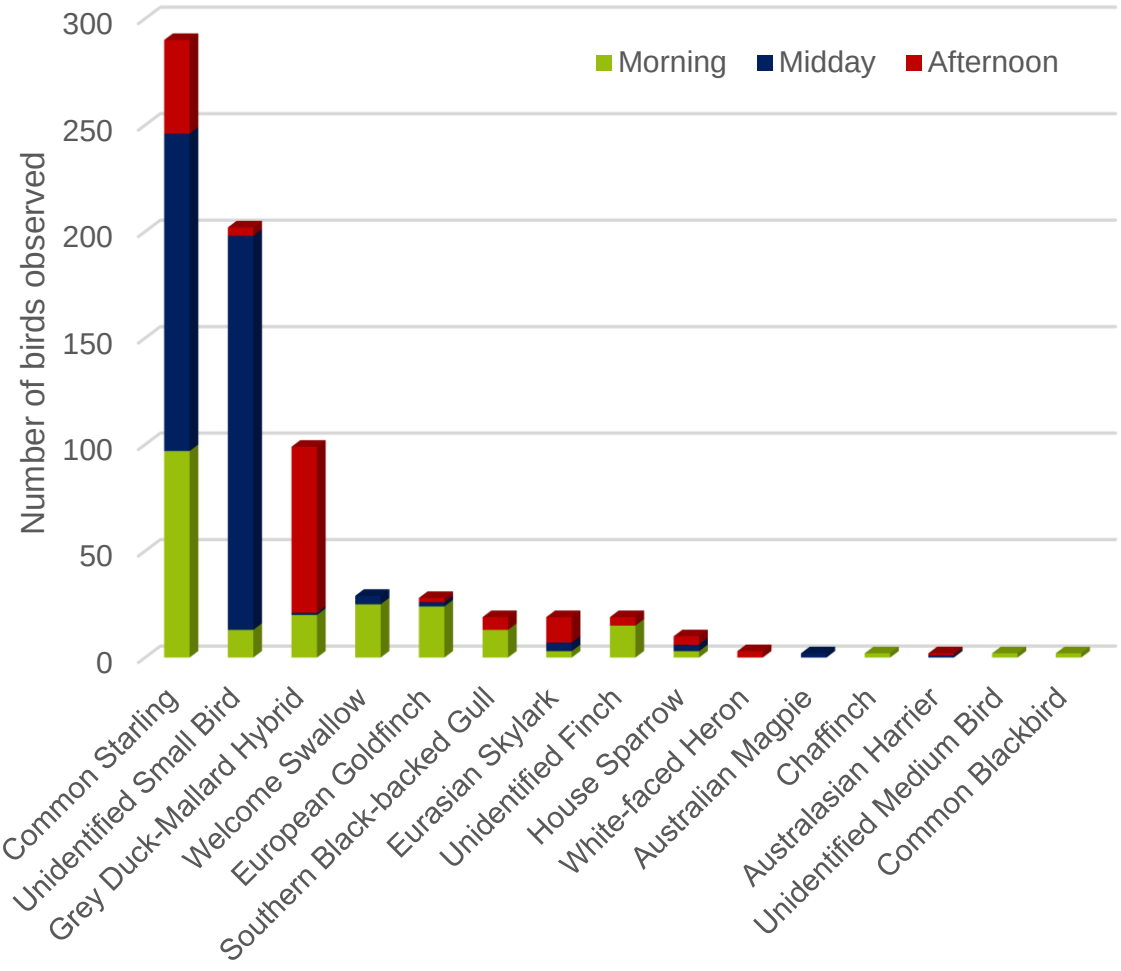

Figure 5. Bird numbers observed during surveys at DUD, May 2021

3.2.3. Smooth Hill

Bird activity was very low and a detailed bird survey was not completed.

3.2.4. Green Island Landfill

On the morning of 4 May, 3002 BBG were recorded flying into the site, mainly from the north and north west. During that period approximately 300 left the site but did not appear to return. On 7 May 2600 BBG were observed entering the landfill from the same directions. Time constraints did not allow us to remain counting until all birds were on site. It is reasonable to estimate that more than 3000 BBG use the site daily to forage. It is highly likely that this is the main food source for the majority of BBG in the Dunedin area.

Approximately 550 BBG were observed roosting during the day on the large flat roof of a shed located at the landfill. It is unknown if they use this roof to roost overnight.

Only three Red-billed Gull were recorded. Other species recorded included Australasian Harrier (*Circus approximans*), Common Blackbird (*Turdus merula*), Chaffinch (*Fringilla coelebs*), Pukeko (*Porphyrio melanotus*), House Sparrow, Songthrush (*Turdus philomelos*), Spur-winged Plover (*Vanellus miles*), Common Starling, Tui (*Prosthemandera novaeseelandiae*), and duck species.

3.2.5. BBG Roost Sites

Of an evening, BBG return to the north and most appear to roost at night on various flat roofed buildings around the city. Some drop into the southern part of Dunedin Harbour to bathe prior to relocating to the roofs. We observed different roofs being used on different nights, so it is possible that several other flat roofed buildings could be used. BBG roosted on the following building during our observations: Mainfreight transport, Bunnings Warehouse, Mico Plumbing and the Dunedin Ice Stadium. It is possible that these same buildings are used during the breeding season for nesting, although this needs to be confirmed.

3.2.6. Kate Valley

Observations at the Kate Valley Landfill indicated very low bird use which is consistent with previous anecdotal reports. One BBG was observed flying over the site, apparently not interested in what the site had to offer. Approximately 20 small unidentified birds (probably House Sparrow, but distance did not allow accurate identification) were observed around the tip face and were likely to be obtaining food.

Kate Valley is a very modern and 'clean' landfill with two main waste streams (Ajay Krishna, Pers comm, May 2021):

1. General waste - which consists of curb side collection of red-lidded bins taken to transfer stations and then transported in sealed containerised trucks to Kate Valley where it is unloaded, bulldozed, compacted by a 55-tonne compactor, and covered at the end of each day. There appeared to be very little organics mixed in with this general waste, hence the compactor was not exposing much food for birds.

2. Special waste - which includes a concentration of animal by-products and a range of other organics unloaded into the 'V' pit formed by the parallel lines of general waste, compacted with an excavator bucket, and covered at the end of the day. The placement of organic material into the 'V' would make accessing the organic material difficult as birds would need to go into a 'pit' which would be unsettling for them to enter.

It was estimated that that over the past 5 years, organics comprised 3-16% of all waste.

The reason for the low bird use may be due to:

1. The relatively low organic content of waste material.

2. The delivery of most organic material into a 'V' pit that would be difficult for birds to access.

3. The landfill was opened in 2005 and a bird population has never been allowed to establish.

4. The landfill is approximately 50km from the Burwood Landfill (Christchurch's main landfill prior to closing in 2005) where significant gull populations foraged, and a similar distance from the braided Waimakariri River where gulls (especially BBG) have traditionally nested. This distance could be an impediment for bird populations to have shifted.

The Kate Valley Landfill is a good example of how waste facilities can operate without attracting large populations of birds that could be hazardous to aviation.

4. Risk Evaluation

4.1. Existing Risk at DUD

DUD had a strike rate of 2.1 strikes per 10,000 aircraft movements in 2017 which was lower than each of the previous three years. However, nine strikes in the first 10 weeks of 2018 indicated that the strike rate is likely to increase in 2018 (Avisure 2018). Strike rate is a poor estimation of risk. Damaging strikes and strikes resulting in an adverse effect are better indicators of risk, as is the mass struck per 10,000 aircraft movements. In the absence of recent strike data, these analyses have not been completed as part of this hazard assessment.

Between 2014 and 17 March 2018, the most frequently struck species was House Sparrow with 14 strikes. BBG along with Unknown Species reported six strikes each, followed by five Spur-winged Plover strikes. Other bird species struck for the same period include Unidentified Finch (2), Welcome Swallow (2), Unidentified Duck (1), South Island Pied Oystercatcher (1), and Australasian Harrier (1).

It is reasonable to estimate DUD's strike risk to be significant. The implication for the Smooth Hill Landfill project is that from a risk management perspective, the project should not elevate the strike risk.

4.2. Airport Species Risk Assessment

Survey data from 2021 provided very similar results in the species risk assessment from March 2018. Grey Duck-Mallard Hybrids were assessed as a very high risk, BBG as a high risk and Common Starling, Australasian Harrier, Australian Magpie (*Cracticus tibicen*), White-faced Heron (*Egretta novaehollandiae*), Welcome Swallow (*Hirundo neoxena*), and Skylark (*Alauda arvensis*) as moderate risk (Figure 6). Other species observed including European Goldfinch (*Carduelis carduelis*), House Sparrow, Common Blackbird and Chaffinch were assessed as low risk.

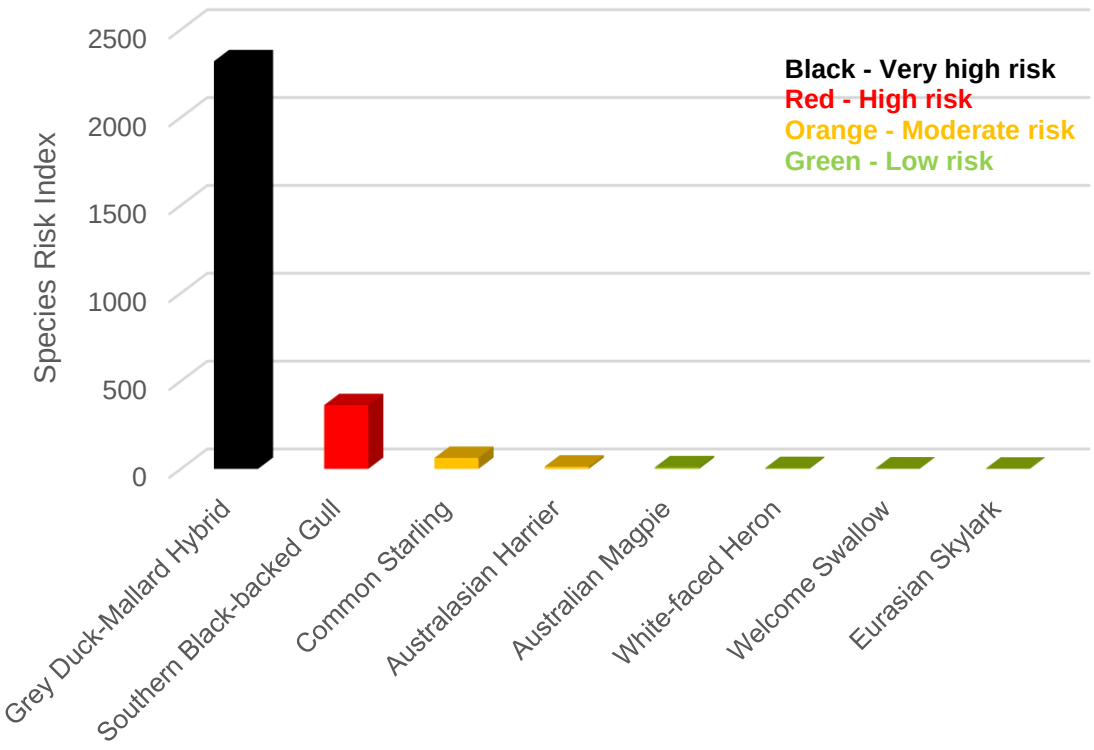

Figure 6. Species Risk Index, DUD, May 2021.

4.3. Smooth Hill Hazard Assessment

4.3.1. Assessment of risk by species

The species assessment for the proposed Smooth Hill Landfill indicates that the risk (Table 3) can be managed to an acceptable level if mitigating actions recommended in Section 6 are successfully implemented. By far the most significant contributor to risk is the BBG and managing their populations will be critical in managing the overall risk.

Grey Duck-Mallard Hybrid could add a low to moderate risk to the existing very high risk this species currently presents at the airport. This would occur if populations were allowed to build in any retention basins and other waterbodies proposed for the landfill site.

The other species that could present a low to moderate additional risk are Red-billed Gulls, Australasian Harrier and Common Starling, all of which can be effectively managed by the actions applied to mitigate the BBG risk.

Table 3. Assessment of risk from the proposed Smooth Hill Landfill

Species	Risk at DUD	Existing population size in Dunedin Survey Area	Existing population size at Green Island Landfill	Likely Attraction to a new putrescible waste landfill	Likely impact on Site Risk	Likely impact on Flight Path Risk	Likely impact on Spill Over Risk	Likely unmitigated risk to Aviation	Residual risk to aviation after mitigation
Southern Black-backed Gull	High	Very Large	Large	High	Moderate	Moderate	High	Very High	Low
Grey Duck-Mallard Hybrid	Very High	Large	Low	Low to moderate	Very Low	High	Low	Moderate	Very Low
Common Starling	Moderate	Low	Low to moderate	Moderate	Low	Low	High	Low to moderate	Very Low
Australasian Harrier	Moderate	Low	Low	Moderate	Low to moderate	Moderate	Moderate	Low to moderate	Very Low
White-faced Heron	Moderate	Low	Not recorded	Very Low	Low	Moderate	Low	Low	Very Low
Australian Magpie	Moderate	Very Low	Not recorded	Low	Low	Moderate	Low	Low	Very Low
Welcome Swallow	Moderate	Very Low	Not recorded	Low	Low	Low	Low	Low	Very Low
Striated Heron	Moderate	Very Low	Not recorded	Very Low	Very Low	Low	Low	Low	Very Low
South Island Pied Oystercatcher	Low	Moderate	Not recorded	Low	Very Low	Low	Low	Low	Very Low
Spur-winged Plover	Low	Moderate	Low	Moderate	Low	Low	Low	Low	Very Low
Pukeko	Low	Low	Low	Low	Low	Low	Low	Low	Very Low
Red-billed Gull	Very Low	Moderate	Low	Moderate	Moderate	Moderate	Moderate	Low to moderate	Very Low
Canada Goose	Very Low	Moderate	Not recorded	Very Low	Moderate	Moderate	Low	Low	Very Low
Black Swan	Very Low	Large	Not recorded	Low	High	Moderate	Low	Low	Very Low
New Zealand Scaup	Very Low	Moderate	Not recorded	Very Low	Low	Low	Low	Low	Very Low
Black -winged Stilt	Very Low	Moderate	Not recorded	Very Low	Low	Low	Low	Low	Very Low
Shags (all species)	Very Low	Moderate	Not recorded	Very Low	Low	Low	Low	Low	Very Low
Variable Oystercatcher	Very Low	Low to moderate	Not recorded	Very Low	Low	Low	Low	Low	Very Low
White-fronted Tern	Very Low	Low to moderate	Not recorded	Very Low	Low	Low	Low	Low	Very Low
Paradise Shelduck	Very Low	Low to moderate	Not recorded	Very Low	Low	Low	Low	Low	Very Low
Common Blackbird	Very Low	Low	Low	Very Low	Low	Low	Low	Low	Very Low
Rock Pigeon	Very Low	Low	Not recorded	Moderate	Moderate	Low	Moderate	Low	Very Low
Grey Teal	Very Low	Low	Not recorded	Low	Low	Low	Low	Low	Very Low
House Sparrow	Very Low	Very Low	Low	Moderate	Low	Low	Moderate	Low	Very Low
Chaffinch	Very Low	Very Low	Low	Low	Low	Low	Low	Low	Very Low
European Goldfinch	Very Low	Very Low	Not recorded	Low	Low	Low	Low	Low	Very Low
Overall risk								**Very High**	**Low**

4.3.2. Assessment of BBG risk

Without appropriate mitigation, the BBG presents a very high risk for the proposed Smooth Hill Landfill. The reasons for this include:

1. Their current high risk at DUD. They are a large flocking bird species with a body mass of 850-1150g. Surveys recorded them on the airport, and they have been reported in six strikes between January 2014 and 17 March 2018. When flocks are moving through aircraft airspace a multiple strike (i.e., where more than one bird is struck in a single incident) is more likely.

2. There is a large existing population of more than 6000 in the Dunedin region.

3. Around half of the known population appear to feed at the existing Green Island Landfill.

4. Transition to a new landfill at Smooth Hill is likely when Green Island is closed unless major modification is made to the composition of the waste stream and/or how it is handled.

5. Aircraft flight paths occasionally pass over the proposed Smooth Hill site and as BBG are known to soar to considerable heights, the Site Risk is considered moderate.

6. The Flight Path Risk was assessed as moderate. There are no known roosting and or breeding colonies to the southwest, west or northwest of the airport and the habitat is not ideal for such colonies to develop. It is likely that populations would generally move in a southward direction along the coast from their current preferred locations. However, there are many farm paddocks and dams to the southwest, west or northwest of the airport and, during certain conditions (such as during calving or lambing, during or following high rainfall conditions), some BBG could move from Smooth Hill across aircraft flight paths to these habitats to feed.

7. The Spill Over Risk was assessed as high because a population of BBG using the proposed Smooth Hill Landfill would continue to obtain artificial food resources and fuel population growth.

5. Conclusion

This preliminary bird hazard assessment based on non-breeding season surveys and a review of DUD data indicates that there is a very high risk to aviation from the proposed Smooth Hill Landfill. Mitigation involving multiple actions and based on an escalating response requirement depending on the success of initial mitigation, indicates that the risk can be managed to an acceptably low level.

BBG present the greatest aviation risk owing to their size, flocking nature, current local population size, utilisation of the existing Green Island Landfill, preference for putrescible waste, ability to soar, opportunistic response to food from farm paddocks, and their ability for population growth based on artificial food supply leading to spill over into the general environment.

Guidance material from the NZ CAA and ICAO indicates that putrescible waste landfills should ideally be situated at least 13km from airports. As the bird strike risk is already high at DUD then the risk assessment and the Bird Management Plan must detail how the landfill will not exacerbate the risk.

Dunedin City Council will decide by the end of May 2021 if it intends to proceed with separating organics at the curb side. This will be a critical factor influencing if birds will relocate from Green Island to Smooth Hill. In any event, the closure of the Green Island facility is likely to scatter BBG populations across the landscape and a heightened risk to aviation can be expected at that time. This will be irrespective of what happens at Smooth Hill and is a risk that must be managed.

This assessment was limited by a range of factors (Section 2.5), accordingly it is considered a preliminary assessment. More surveys across all seasons, updated information on what the waste stream will consist of and how it will be handled at Smooth Hill, and a review of key factors contributing to the low bird numbers at Kate Valley are necessary to update this risk assessment.

6. Recommendations

6.1. Limit Organics from the Waste Stream

Key to managing the attraction of birds to waste landfills is eliminating organic materials. Where elimination is impossible, reducing the organic content to as low as possible is likely to provide the best results. The way organics are processed is important for bird attraction, as evidenced by the Kate Valley Landfill. A more detailed understanding of why birds are not attracted to Kate Valley is advised to see if a similar process can be established at Smooth Hill.

6.2. Update the Draft Smooth Hill Bird Management Plan

The Draft Smooth Hill Bird Management Plan requires updating. Apart from detailing the acceptable amount of organic material to be unloaded at the landfill and how that is to occur in a manner that restricts access, there are a number of initiatives that need to be included:

6.2.1. Monitoring

A monitoring regime should be established prior to the closure of Green Island and establishment of Smooth Hill. This should be designed to:

1. Determine the year-round behaviour patterns of key bird species and their populations in the Dunedin area, especially the BBG.

2. Determine how BBG and other species respond to management initiatives at Green Island leading up to, during and after its closure to organic waste.

3. Establish a baseline estimate of risk at and around DUD through structured regular surveys that allow risk assessment models to be updated.

Commencing immediately and reassessed annually, the following monitoring frequency is suggested by a suitably trained and qualified bird observer:

Monthly

- On airport surveys – morning, middle of day, afternoon.

- Off airport surveys – Dam 3, Landside paddock, drain west of carpark, Smooth Hill.

- Green Island fly in count at first light.

Seasonally

As above plus:

- Repeat surveys completed in May 2021.

Monitoring at Smooth Hill, once operational, should be more frequent. Daily counts should be completed by trained onsite staff using binoculars. Monthly counts should be completed by a suitably trained and qualified bird observer. Detailed procedures and survey data sheets should be included in the management plan.

6.2.2. Establishing acceptable thresholds of bird numbers

There should be zero tolerance for birds greater than 50g in size feeding at the Smooth Hill Landfill or accessing waterbodies. This size class includes species from the size of a Common Starling and above. Occasional use by small birds in numbers fewer than 100 such as House Sparrows can be tolerated.

If at any time more than 20 individuals from a species greater than 50g, or combined numbers of these species exceeds 100, then management actions should be elevated. If more than 12 breaches of these thresholds occur in any 12-month period, a net should be positioned over the landfill to ensure no further bird activity is possible, unless an aviation risk assessment indicates that the risk can otherwise be managed to an acceptable level.

6.2.3. Mitigation at Smooth Hill

In addition to the above, the following key elements should be added to the Draft Bird Management Plan:

1. Ponds as attraction for waterbirds. The Plan indicates that there will be a detention basin that will usually be dry. If this is the case, there is unlikely to be a significant attraction to birds. However, if monitoring indicates that numbers increase above acceptable thresholds and that pond(s) are contributing to that increase, then measures that may need to be retrospectively installed, such as wires or nets. The Plan should highlight these measures.

2. Training. Add detail on the level or type of training required for people involved in implementing the Plan.

3. Standard Operation Procedures (SOP). SOPs for each main activity related to the Plan should be included.

The Bird Hazard Assessment and Draft Management Plan should be updated to accommodate the concepts outlined in Table 4 which lists recommendations to mitigate the potential strike risk at DUD associated with birds using Smooth Hill Landfill.

Table 4. Bird hazard management recommendations for Smooth Hill Landfill.

Area	Recommendation
Risk Assessment	Determine the contribution to bird strike risk using a method that considers: • species (behaviour, mass, tendency to flock or roost communally) • land use/activity type • location relative to DUD and the approach/departure paths • location relative to nearby land uses that attract, or have the potential to attract, birds • species strike risk based on DUD strike data. This would include a detailed assessment of the current bird population at Green Island Landfill and the areas they roost and nest.
Bird Management Plan	Should include: • regular monitoring surveys • bird hazard assessments by qualified ornithologists or biologists • details of bird awareness and bird management training for relevant staff, including syllabus • establishment of bird population triggers • implementation of activities to reduce hazardous bird populations • adoption of bird deterrent technologies to reduce hazardous bird populations • performance indicators to evaluate implementation and compliance to consent conditions • a review process to regularly assess implementation against performance indicators, identify gaps, and ensure currency • allocation of roles and responsibilities for plan implementation and review. • regular reassessment of the risk • escalation of measures to reduce bird attraction if bird population triggers are met.
Bird Management Plan	Standard operating procedures should include: • bird dispersal • bird counts

Area	Recommendation
	• maintaining a small single tip-face • Lethal control.
Monitoring	Commence a monitoring program prior to construction to obtain a baseline of bird activity and habitat use on the landfill site and in the vicinity.
Monitoring	Ensure the monitoring program is regular and standardised so that it: • determines the level of bird attraction • identifies temporal variation of bird activity (i.e., how birds use the site at different times of the day, year, or climatic phase) • identifies current, emerging and potential risks • monitors the presence and behaviour of birds • identifies attractants (e.g., water, food).
Monitoring	Monitoring procedures should: • Establish a standard survey route around the designated site. This does not have to include every single structure/location but should include key ones. • Designate stopping points where areas are scanned for birds. • Record bird data on a standardised form (electronic or paper) that has been created to capture at least the following data: - date - time - observer - weather - bird name - bird number - bird behaviour (e.g., perching, foraging, transiting, etc.) - bird habitat usage (e.g., grass, building, drain, tank, etc.). Monitoring should also note any nesting activity, unusual bird activity, effectiveness of mitigation devices.
Landfill construction	Include bird hazard management as part of Construction Environment Management Plans (CEMP). This will assist with identifying potential bird attractions and identify ways to mitigate any risks. It can also help deter birds becoming attracted, and habituated, to the site who may

Area	Recommendation
	contribute the DUD strike risk. The CEMP can include options for managing bird hazards associated with: • earthworks • soil and other material stockpiles • temporary infrastructure • water retention area.
Landfill construction	Level the ground during clearing and construction. Grading the ground effectively on commencement of construction will reduce the number and extent of low-lying areas and ground depressions.
Tip face management	Maintain the tip face area to as small as possible.
Tip face management	Cover exposed waste at the end of each day.
Tip face management	Disperse birds from the tip face.
Dispersal	Dedicate trained personnel to disperse birds from the tip face during daylight operational hours (until end-of-day cover is applied).
Dispersal	Tools: stockwhip, pyrotechnics, starters pistol, portable distress caller.  

Area	Recommendation
	 
Nesting/ Roosting	If birds establish nests or roosts on site, arrange to restrict breeding success (e.g., by removing eggs and nests or egg oiling) and/or roost dispersal. If applicable, acquire necessary permits.
Waste management	If the initial actions do not manage the risk, it may be necessary to escalate management efforts. Trialling wires above the landfill maybe an option, although is unproven in New Zealand.
Waste management	Consider baling waste as an escalating action if thresholds are breached. This does not eliminate the food but compresses it and makes access for the birds very difficult. Waste should first be unloaded into a bird-proofed building to prevent access at the unloading stage.

Area	Recommendation
	
Waste management	An expensive but tested solution to prevent bird access to food waste is netting. This may be considered as the final escalating action and Dunedin City Council should establish the costs of installation and maintenance. Nets tear easily so good maintenance regimes are essential to maintain the integrity of the enclosure. 
Grass management	Maintain grass height at 200-300mm to deter ground foragers. 
Water management	Use underground drains and water storage where possible to reduce water availability to birds.

Area	Recommendation
Water management	Ensure any water detention ponds fully drain with 24-48 hrs (where this does not occur, apply the same management as retention areas).
Water management	Ponding should not exceed 100m^2 of open water, for more than a continuous 48-hour period.
Water management	The continuous water surface area of detention and retention basins should not exceed 100m^2.
Water management	Net detention and retention basins (or other permanent water) if surface area exceeds 100m^2. Bird hazard assessments should consider this within the context of distance from the airport and location relative to other off-airport hazards. Consider replacing open water areas with underground storage. 
Water management	If netting is not feasible, cover retention basins and other permanent water sources with exclusion devices such as wires or permeable membranes. 

Area	Recommendation
	
Water management	Water depth between 0.5m and 1.18m is less likely to attract hazardous flocking bird such as swans, and cormorants or upending ducks.
Water management	Bank slopes for retention and detention areas and stormwater drains should not exceed 4V:1H. Narrow-sided retention and detention ponds are very effective at deterring birds from accessing water from the banks. Use of gabion or other edging treatment (see images below) can assist with maintaining steep banks and minimising erosion.  
Buildings and other infrastructure	Where perching, roosting or nesting activity is detected on structures, install exclusionary devices such as netting or anti-perching spikes. Carefully evaluate any retrospective installation of exclusionary devices to ensure they are effective.

Area	Recommendation
	
Buildings and other infrastructure	At the design stage, assess and evaluate building and infrastructure design to identify ways to proactively reduce the bird attraction. Minimise any retrospective efforts required to reduce the attraction by installing exclusionary devices or retrofitting structures.
Stakeholder committee	Establish a Wildlife Hazard Management Committee or join the DUD Wildlife Hazard Management Committee (if established) to provide a forum to discuss wildlife hazard management with relevant stakeholders and local authorities. Regular meetings will assist with: • The ongoing exchange of information between stakeholders to improve wildlife management. • Ensuring stakeholders are aware of their responsibilities. • Encouraging stakeholders to adopt a proactive approach to wildlife management. • Improving communication between stakeholders. • Reducing the economic impact on aircraft operators and improving operational safety.

6.3. Managing BBG in the Dunedin area

To avoid a significant scattering of birds across the landscape during and following the closure of Green Island Landfill and to reduce the population of BBG likely to be attracted to the new landfill, prepare a management plan for BBG in the Dunedin area.

Prior to the closure of Green Island Landfill to putrescible waste:

1. Collaborate with DIAL, the Department of Conservation and Dunedin Council, to establish a breeding season control program at key BBG breeding sites.

2. Consult with DIAL to commence a staged dispersal program for BBG at Green Island Landfill. It will be necessary to have excellent communications between bird controllers and DIAL staff to ensure that aviation risks are well managed. This program should commence prior to the next BBG breeding season, as populations deprived of food at this critical time are less likely to build nests and lay eggs. They are also more likely to disperse away from the region more rapidly. Dispersal will involve a trained and equipped bird control officer positioned at the landfill and preventing birds from feeding on the active tip face for all daylight hours. Over time, the hours required on site can be scaled back based on the success of the program and/or the impact on the aviation risk as assessed in consultation with DIAL.

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Appendix A: On Airport Survey Risk Assessment

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 risk ranking of an airport.

Table A1. Species Risk Index and Airport Survey Risk Index 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.

Appendix B: Southern Black-backed Gull (*Larus dominicanus*) eBird Records

High counts of kelp gulls (black-backed gulls) around Dunedin, accessed 27 April 2021.

https://ebird.org/map/kelgul?neg=true&env.minX=169.6163700525194&env.minY=-46.25109877665183&env.maxX=171.041044984433&env.maxY=-45.63396623883648&zh=true&gp=true&ev=Z&mr=1-12&bmo=1&emo=12&yr=all&byr=1900&eyr=2021

Location	Notes	Count	Date	GPS Coordinates
Dunedin Airport		200	4 Feb 2021	45.9226771,170.199573
School Road South		689	10 Aug 2017	45.8659869,170.2784729
Henley farmland	Paddock	500	29 Apr 2018	45.96896,170.1688886
Green Island (offshore island)		200	13 Jun 2020	45.9531796,170.3870487
Kaikorai Reserve		800	20 Mar 2021	45.9263191,170.3910828
Kaikorai Estuary		410	18 Feb 1990	45.9282076,170.3917265
Kaikorai Estuary		900	22 Jun 2012	45.9263191,170.3910828
Kaikorai Estuary		1033	14 Apr 2018	45.9263191,170.3910828
Kaikorai Estuary		2265	19 May 2001	45.9077266,170.4065752
Kaikorai Estuary		2800	19 May 1991	45.9059349,170.41224
Blackhead	Chicks in creche, near flying. Boulder beach east side of Blackhead	200	31 Dec 2020	45.92652, 170.43486
Tunnel Beach	Fresh juveniles and some adults still at nest sites on stack to east	40	7 Jan 2020	45.9212143,170.4580736
Bird Island	Roosting	>200	26 Jul 2015	45.9117199,170.5593967
Sandymount Seacave	Nests	20 nests	22 Nov 2017	45.8923978,170.6861687
Hooper's Inlet	On nests	108	29 Nov 2020	45.861564,170.6691742

Location	Notes	Count	Date	GPS Coordinates
Hooper's Inlet		399	3 Mar 2021	45.8691666,170.6692757
Papanui Inlet		506	17 Jun 1989	45.847456,170.6938934
Victory Beach		600	20 Sep 2009	45.8463611,170.7301111
Penguin Beach		300	20 Feb 2021	45.8037942,170.7440293
Penguin Place	Numerous nests (not quantified)	80	4 Dec 2019	45.7967932,170.7303071
Aramoana Mole/Harbour Entrance		300	29 May 2020	45.7709955,170.719471
Heyward Point	About even numbers of adults and fledglings. Westside of the main headland is a large colony	50	22 Jan 2021	45.767,170.708
Blueskin Bay	Colony of ~30 nests – eggs or small young	91	10 Nov 2010	45.734643,170.5831718
Otago Harbour		300	5 Jan 2020	
Otago Peninsula – Harwood tidal flat		500	16 Feb 2020	45.8170758,170.6688309
Otago Peninsula – Portobello & adjacent bays		700	7 Jun 2020	45.8381284,170.6537247
Goat Island	Nesting on Goat Island cliffs	20	21 Dec 2015	45.8245349,170.6257979
Dunedin Harbour		400	11 Mar 2018	45.8750708,170.5393982
Taieri Mouth	Nesting colony	2500	10 Sep 2008	46.0505992,170.199852
Taieri Island	Nesting with chicks	150	9 Dec 2013	46.0578798,170.2165461
Taieri Beach		350	1 Aug 2020	46.0556331,170.1950717
Akatore Coast Head	Indictive of colony site	70	8 Jul 2018	46.1294514,170.1856041

Location	Notes	Count	Date	GPS Coordinates
Watson Beach North	Indicative of colony site	60	8 Jul 2018	46.1576789,170.1620865
Nugget Point		300	16 Feb 2011	46.448107,169.817058
Nugget Point		580	25 Jan 2016	46.447575,169.816596

NB: 6 nests noted at Kaikorai estuary for one survey conducted and 4 nests on island 400m east of Tunnel Beach; 6 nests at Christinas Rock Stack; 16 juveniles and 6 immature birds on Bird Island; breeding colony on offshore rocks - 30 immature birds seen from Tomahawk lookout; 20 juveniles on Bird Island; some nesting at Nugget Point.

NB: Kaikorai Estuary is near Green Island landfill – numerous counts at the estuary have recorded very high numbers of black-backed/kelp gulls around this area.

Revision History

Rev. No.	Rev. Date	Details	Prepared by	Reviewed by	Approved by
0	19/05/2021	Preliminary Smooth Hill Landfill Bird Hazard Assessment (Draft)	Phil Shaw Principal Aviation Ecologist	Kylie Patrick Principal Consultant	Phil Shaw Principal Aviation Ecologist
1	2**5**/05/2021	Preliminary Smooth Hill Landfill Bird Hazard Assessment (F**inal**)	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	2**5**/05/2021	E-copy (Word)	Boffa Miskell	Karin Sievwright
2	25/05/2021	E-copy (Word)	Boffa Miskell	Rachael Eaton
3	20/05/2021	E-copy (Word)	Avisure	Administration

BoffaMiskell-RE.SmoothHillPreliminaryBirdHazardAssessment.Final

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Appendix 6: Dunedin Airport On-Airport Bird Monitoring Locations

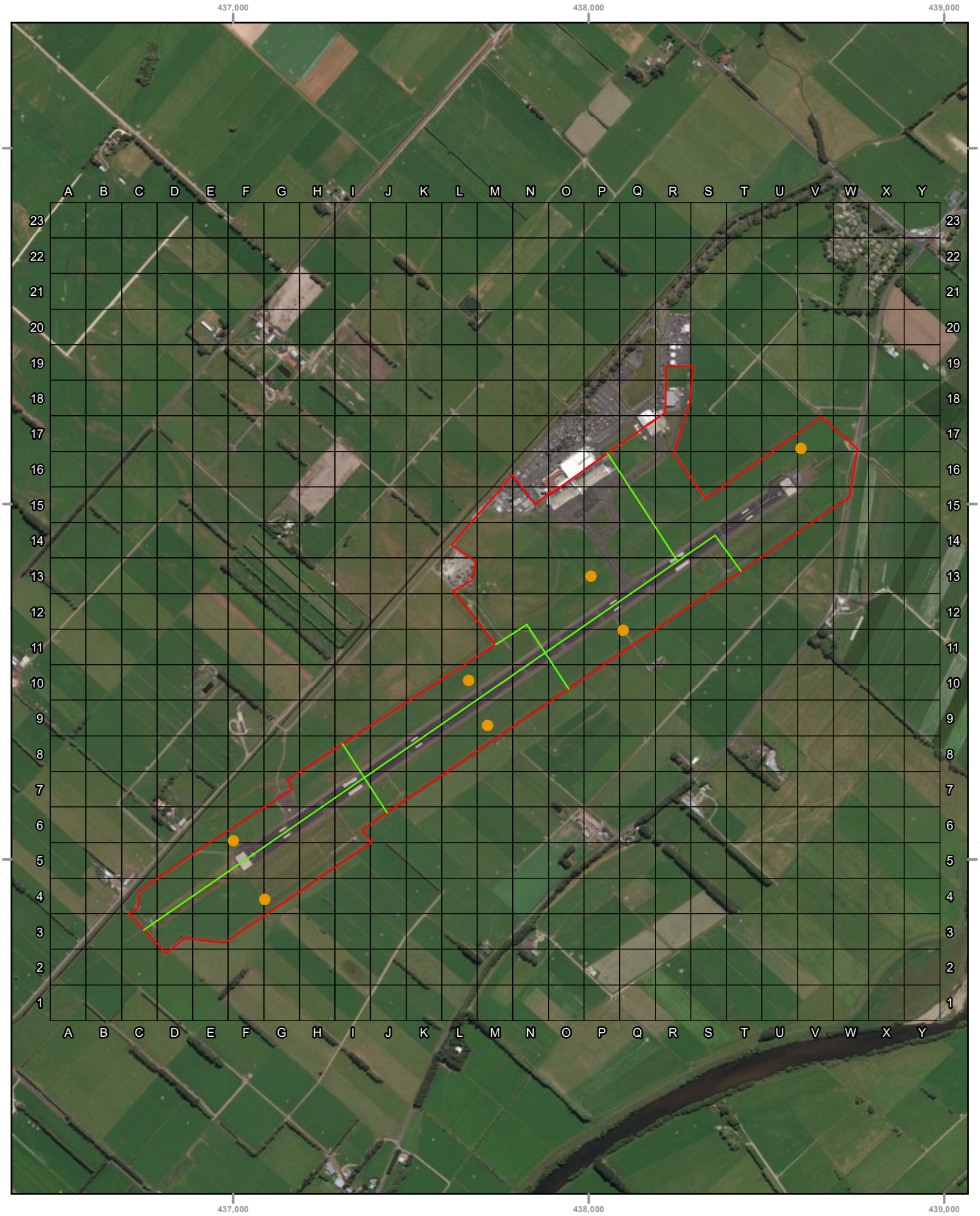

Figure A1 : On-airport Survey

Dunedin Airport

Wildlife hazard assessment and management plan

- On-airport Survey Points
- On-airport Survey Points
- Airport Boundary

AVISURE
safety | aviation | wildlife

Job number: PR2189
Revision: 2
Author: DB, AS
Date: 28/03/2018

0 100 200 400
Meters

NZGD 2000 UTM Zone 59S
Projection: Transverse Mercator
Datum: NZGD 2000
Units: Meter

Appendix 7: Off-Airport Bird Monitoring Sites

Figure 3: Location of survey sites, 4 to 7 May 2021

Boffa Miskell Limited

Smooth Hill Landfill Preliminary Bird Hazard Assessment

Smooth Hill Landfill proposed site

Off-airport sites

3, 8 & 13km buffers from runway

Dunedin Airport runway boundary

Dunedin Airport boundary

AVISURE safety | aviation | wildlife

Job number: PR6386
Revision: 1
Author: AS
Date: 21/05/2021

0 1 2 4 Kilometers

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

PR6386_MPX_OffairportLocations_Landscape
A4

About Boffa Miskell

Boffa Miskell is a leading New Zealand professional services consultancy with offices in Auckland, Hamilton, Tauranga, Wellington, Christchurch, Dunedin and Queenstown. We work with a wide range of local and international private and public sector clients in the areas of planning, urban design, landscape architecture, landscape planning, ecology, biosecurity, cultural heritage, graphics and mapping. Over the past four decades we have built a reputation for professionalism, innovation and excellence. During this time we have been associated with a significant number of projects that have shaped New Zealand's environment.

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