

Appendix 9: Draft Southern Black Backed Gull (SBBG) Management Plan Dunedin and Environs

Southern Black-backed Gull Management Plan Dunedin and Environs

Final Draft

Dunedin City Council

November 2023



Executive Summary

The Karoro or Southern Black-backed Gull (*Larus dominicanus*) are a widespread bird species in New Zealand. They are a Taonga species but listed as unprotected under New Zealand law because of their abundance which has been enhanced since European settlement.

The Green Island Landfill is a major food source for Southern Black-backed Gull with a maximum count of 10,744 recorded in March 2023. This food source is likely to be the primary driver of the population across Dunedin City and environs.

Long-life putrescible waste landfills, such as the Green Island Landfill, which allow regular access to putrescible waste can significantly influence local bird populations. Changes in waste management practices across Dunedin City, including the development of the Green Island Resource Recovery Park Precinct, the closure of Green Island Landfill and the opening of the Smooth Hill Landfill which will be largely non-putrescible, is likely to reduce the regional population in the long run. In the short to medium term, increased impact may be felt from Southern Black-backed Gulls searching for food as waste management practices change at Green Island in the coming years.

Purpose of the Plan

This draft Southern Black-backed Gull Management Plan – Dunedin and Environs (Plan) was commissioned by Dunedin City Council. It is a requirement of condition 49 of the Discharge of Waste and Leachate to Land Conditions of the Otago Regional Council resource consent (RM20280) for the operation of a new Class 1 landfill to be located at Smooth Hill, south of Dunedin.

The purpose of the Plan is to manage Green Island landfill food availability and the breeding success at accessible Southern Black-backed Gull breeding sites to reduce bird strike risk prior to the closure of the Green Island landfill. Additionally, the Plan aims to limit the other impacts that redistributing Southern Black-backed Gulls may have on disease risk, stock predation, predation on eggs and chicks of native bird species, and the city amenity.

In accordance with the requirement of the Smooth Hill consent condition, the Plan is being developed in consultation with Te Rūnanga o Ōtākou, the Department of Conservation and Dunedin International Airport Limited.

Plan Development

Development of the Plan involves consultation with Te Rūnanga o Ōtākou, the Department of Conservation and Dunedin International Airport Limited, a review of relevant literature, and surveys of Southern Black-backed Gulls across seasons and years to determine population size, behaviour and locations for each of their key activities (breeding, roosting, foraging, loafing). To address the proposed phases for changes in waste management practices at Green Island, this Plan outlines a program to restrict food availability and control breeding, through an adaptive management approach. The Plan has measurable targets and a regular review schedule. It is intended that the Plan will be updated as necessary to provide guidance required to limit the impact of Southern Black-backed Gull populations as they redistribute after the bulk of putrescible waste is no longer available to birds at Green Island Landfill.

The Plan includes:

- a) Outcomes of consultation completed with Te Rūnanga o Ōtākou, the Department of Conservation and Dunedin International Airport Limited; (Section 3.2)
- b) A monitoring regime which enables identification of Southern Black-backed Gull breeding sites, baseline population characteristics, and how the population responds to management actions; (Section 2 and 3.3)
- c) Measurable targets for the reduction of the Southern Black-backed Gull population; (Section 3.4)
- d) Description of management actions and methods to be implemented to limit Southern Black-backed Gull breeding success at breeding sites identified under condition 49(b) where access is feasible, and limit landfill food availability at Green Island landfill leading up to its closure; (Section 3.5)
- e) Procedures for liaison with and sharing of information with Te Rūnanga o Ōtākou, the Department of Conservation and Dunedin International Airport Limited; and (Section 3.2.5 & 3.6)
- f) An adaptive management and review process (Section 3.6).

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1. Introduction

1.1. Background

This draft Southern Black-backed Gull (SBBG) Management Plan – Dunedin and Environs (Plan) was commissioned by Dunedin City Council. The Plan is being developed as a requirement of condition 49 of the Discharge of Waste and Leachate to Land Conditions of the Otago Regional Council resource consent (RM20280) for the operation of a new Class 1 landfill to be located at Smooth Hill, south of Dunedin. The consent was granted in May 2023. The purpose of the Plan as stipulated in the condition is to manage Green Island landfill food availability, and the breeding success of the existing SBBG population at Dunedin breeding sites where access is available.

1.2. Objective

The Plan's main objective is to meet the requirements in Smooth Hill Discharge of Waste and Leachate to Land Conditions, condition 49:A *SBBG Management Plan must be prepared by a suitably qualified person within 6 months of the granting of this consent. The purpose of the Plan is to manage Green Island landfill food availability and the breeding success of the existing SBBG population at Dunedin breeding sites where access is available, with the objective of reducing the existing level of bird strike risk to aviation prior to the closure of the Green Island landfill. The Plan must be developed in consultation with Te Rūnanga o Ōtākou, the Department of Conservation and Dunedin International Airport Limited. As a minimum the Plan must include:*

- a) *Outcomes of consultation completed with Te Rūnanga o Ōtākou, the Department of Conservation and Dunedin International Airport Limited; (Section 3.2)*
- b) *A monitoring regime which enables identification of SBBG breeding sites, SBBG baseline population characteristics, and how the SBBG population responds to management actions; (Section 2 and 3.3)*
- c) *Measurable targets for the reduction of the SBBG population; (Section 3.4)*
- d) *Description of management actions and methods to be implemented to limit SBBG breeding success at SBBG breeding sites identified under condition 49(b) where access is feasible, and limit landfill food availability at Green Island landfill leading up to its closure; (Section 3.5)*
- e) *Procedures for liaison with and sharing of information with Te Rūnanga o Ōtākou, the Department of Conservation and Dunedin International Airport Limited; and. (Section 3.2.5 & 3.6)*
- f) *An adaptive management and review process. (Section 3.6).*

The finalised Plan must be provided to Otago Regional Council, and implementation of the Plan by the consent holder must commence as soon as it is finalised.

1.3. Plan area

The Plan covers an area up to approximately 45km from the Green Island Landfill (Figure 1). The Dunedin coastline and offshore islands bound the area to the east and it extends from the Hawksbury Lagoon in the north, south to Crystals Beach and west to Lake Mahinerangi.

1.4. The Southern Black-backed Gull

The Karoro or SBBG (*Larus dominicanus*) are a widespread and super-abundant bird species in New Zealand (NZ Birds online, 2023) (Appendix A). Because of rapid population growth since European settlement, it is one of only two bird species listed under Schedule 5 of the *Wildlife Act* (1953) and is therefore unprotected throughout New Zealand and lawful for anyone to hunt, kill, or have in their possession. Despite this, SBBG is a Taonga species i.e., it has been recognised by the Crown under Schedule 97 of the Ngāi Tahu Claims Settlement Act. as an important species.

1.5. Green Island Landfill

The Green Island Landfill on the southern outskirts of Dunedin (Figure 1) is a major food source for SBBG, with a maximum count of 10,744 recorded in March 2023 (Urtica, 2023). This food source is likely to be the primary driver of the SBBG population across Dunedin City and environs (NZ Birds online, 2023). Putrescible waste (wastes containing food and other organic materials) is attractive to birds as a food resource, as it is generally abundant, easily obtained, and is nutritionally adequate. Long-life putrescible waste landfills, such as the Green Island Landfill, which allow regular access to the waste can significantly influence local bird populations. Once 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).

1.6. Changes to Waste Management Practices

Dunedin City Council are in the process of implementing a coordinated waste management system for the city that progressively reduces waste going to landfill. This includes the introduction of an organic waste kerbside collection service from July 2024, planning for the closure of Green Island landfill and the development of an improved Green Island Resource Recovery Park Precinct (RRPP). Organic waste will be received at a new RRPP organics receival building and, subject to relevant resource consents being granted, composted on site. The landfill itself is proposed to finally close around 2029/2030 depending on actual waste disposal rates. At that time largely non-putrescible wastes will be transferred to Smooth Hill.



Figure 1: Study area

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 Southern Black-backed Gull Management Plan Dunedin and Environs

- Study area
- Survey sites



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 Date: 2/02/2023



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

1.7. Potential Implications

The proposed changes to the use of Green Island Landfill is likely to, in the medium to long-term (12 month and beyond), significantly decrease the regional SBBG population. By eliminating most of the primary food source for the population, recruitment of SBBGs from other locations and through successful breeding should be significantly reduced. It is anticipated that much of the population will leave the Otago region to find new food resources. In the short-term (6 to 12 months) however, greater pressure may be felt as SBBGs seek alternative food resources in the nearby area.

1.7.1. Bird strike risk

Green Island Landfill will inherently be contributing to the current bird strike risk through the provision of food which has allowed an unnaturally large regional SBBG population to develop. On occasion, some of this population spills over into areas in the vicinity of the Dunedin International Airport, potentially entering aircraft flight paths and presenting a risk to aviation. In removing most of the food waste at Green Island Landfill, the population will in the long run be significantly reduced and the spill over effects decreased.

In the short to mid-term, if SBBGs redistribute to the Sinclair Wetlands, Lake Waipori and/or Lake Waihola, and/or to farmlands around Dunedin International Airport, they could adopt behaviours that mean they more regularly pass-through aircraft flight paths, elevating the bird strike risk. One of intentions of this Plan is to reduce the existing level of bird strike risk to aviation prior to the closure of the Green Island landfill.

1.7.2. SBBG investigating Smooth Hill Landfill

Smooth Hill is positioned approximately 4.5 km south-east of Dunedin International Airport, so if a significant SBBG population remains in the Dunedin area when Smooth Hill is operating in 2028/2029, they may investigate food availability at the new landfill bringing them closer to aircraft flight paths. There is an additional risk during construction of the new landfill where land clearing and other construction activities could attract gulls and other bird species to the site. A site-specific Bird Management Plan has been prepared for Smooth Hill, which will initiate when construction works commence and continue through the operational phase. The Bird Management Plan will not tolerate SBBG habituating to the area and the landfill will receive predominately non-putrescible waste that will be unattractive to birds, however, limiting the regional population size and therefore the number of SBBG searching for new food sources will be important.

1.7.3. City amenity

If SBBGs redistribute to the Dunedin Central Business District, harbourside or other facilities around Dunedin they may impact the amenity of the city, cause mess from faeces and bother people for food. Undoubtedly, there will be some level of this impact already, along with SBBG nesting on roofs and in some city building sites, but this could be exacerbated.

1.7.4. Disease risk

An increased presence of SBBG in urban areas and on farms could exacerbate the already present risk from disease transmission. SBBG are known to carry diseases such as *Campylobacter* and *Salmonella* that are a major cause of foodborne human gastroenteritis worldwide (Rodreguez *et al.*, 2012).

The SBBG is also implicated as spreading disease in sheep and cattle. *Salmonella* Brandenburg has caused widespread abortions and deaths in pregnant ewes in Southland, coastal Otago and mid-Canterbury (Clark 2001). SBBG feed on the aborted fetuses and membranes and may transfer the disease across farms as they fly from one to the next (Clark 2001). Clark (2001) indicates *Salmonella* Brandenburg is implicated in dairy cattle diarrhoea, dysentery and deaths, including abortions.

1.7.5. Stock predation

SBBG have been known to predate on lambs and old sick sheep (Higgins and Davies, 1996). Increased pressure for food during lambing season could result in loss of production.

1.7.6. Native bird species

SBBG are known to predate on eggs and chicks of various species native to New Zealand (Bell and Harborne 2018), including:

- Black-billed Gull (*Chroicocephalus bulleri*)
- Red-billed Gull (*Chroicocephalus novaehollandiae*)
- Black-fronted Tern (*Chlidonias albostratus*)
- Fairy Tern (*Sternula nereis*)
- White-fronted Tern (*Sterna striata*)
- Australasian Gannet (*Morus serrator*)
- Variable Oystercatcher (*Haematopus unicolour*)
- New Zealand Dotterel (*Charadrius obscurus*)
- Banded Dotterel (*Chadrius bicinctus*)
- Shore Plover (*Thinornis novaeseelandiae*)
- Black Stilt (*Himantopus novaezealandiae*)
- Wrybill (*Anarhynchus frontalis*)
- Black Swan (*Sygnus atratus*)
- Paradise Shelduck (*Tadorna variegata*)

Lack of food at Green Island Landfill could lead to more predation.

1.8. Plan development

Development of the Plan involves consultation with Te Rūnanga o Ōtākou, the Department of Conservation and Dunedin International Airport Limited, a review of relevant literature, and surveys of Southern Black-backed Gulls across seasons and years to determine population size, behaviour and locations for each of their key activities (breeding, roosting, foraging, loafing). To address the proposed phases for changes in waste management practices, this Plan outlines a program to restrict food availability and control breeding through an adaptive management approach. The plan has measurable targets and a regular review schedule. It is intended that the Plan will be updated as necessary to provide guidance required to limit the impact of SBBG populations as they redistribute after the bulk of putrescible waste is no longer available to birds at Green Island Landfill.

2. Southern Black-backed Gulls in Dunedin and Environs

2.1. The SBBG Population size

Surveys completed to date (May 2021 through August 2023) serve as the baseline for population trends and will provide an understanding on how the Plan and the changes in waste management practices affect the SBBG population and how they redistribute around the landscape. For details on survey locations and results, see Appendix B. A trial was conducted in June, July and August 2023 to establish techniques to disperse birds from Green Island Landfill. This aimed to mimic when food is made scarce at the landfill so that monitoring can determine how the bird populations respond (see Section 3.5.1).

The numbers recorded at Green Island Landfill ranged from 758 in July 2023 (when the dispersal trial was underway) to 10,744 in March 2023. As seasonal surveys of regional sites were done in February, May, August and November, a total count of regional sites and the landfill in March when there potentially was the highest total was not possible. During the months when seasonal surveys were completed, the total population counted from sites across the region plus at Green Island Landfill peaked at 11,171 (Figure 2).

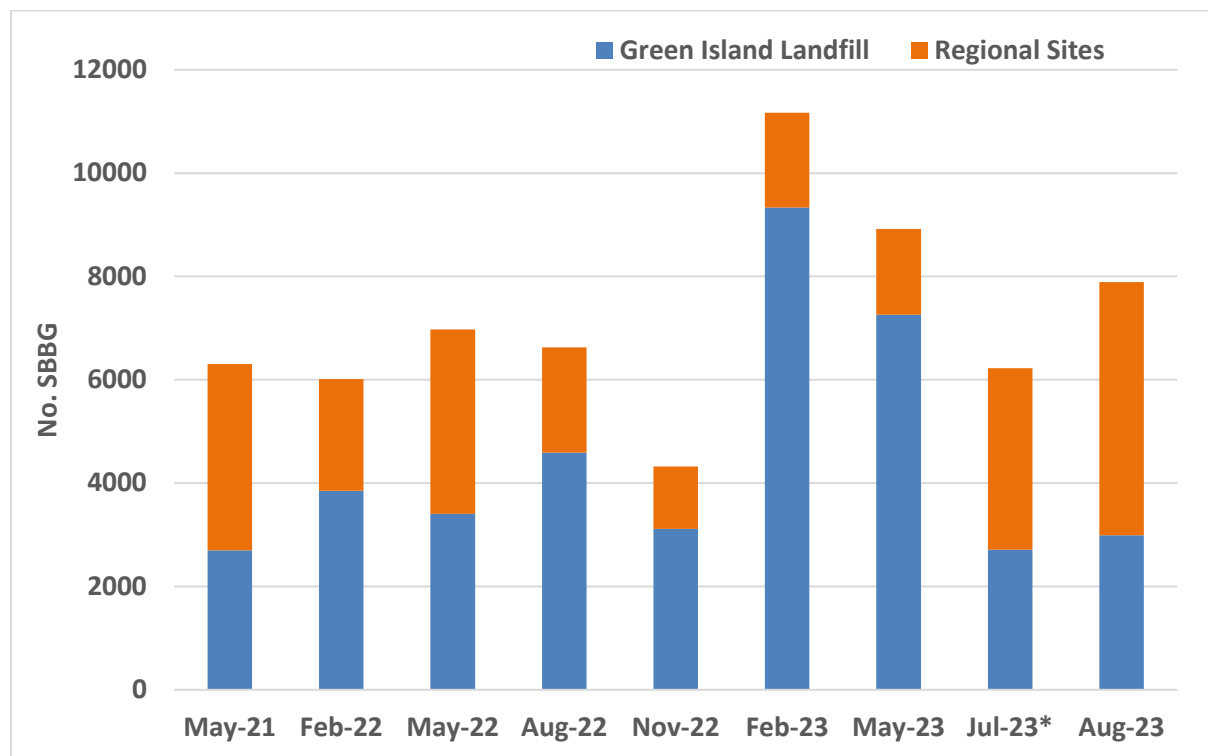


Figure 2: Southern Black-backed Gull counts at Green Island Landfill and Regional Sites during seasonal surveys. *Indicates the additional survey in late July when the dispersal trial was underway (See Section 3.5.1).

The aerial survey in November 2022 recorded 6104 SBBG excluding those at Green Island Landfill. Including the 3112 SBBG counted at Green Island Landfill in November 2022, the total count was 9216. The aerial survey identified that there are many sub-populations that are not accessible by road/foot and that the regional surveys are likely to significantly under-estimate the total population, particularly during the breeding season when SBBG are dispersed to sites that are inaccessible by road and on foot.

Assuming some sub-populations have been missed during the aerial survey, we estimate the total population index for the study area to be around 12-13,000 SBBG. Based on the reduction by half of the SBBG breeding population in the Waimakariri braided riverbed following the closure of Burwood Landfill in Christchurch (Bell and Harborne 2018), it is anticipated that within 5-7 years the population index for Dunedin and environs would be below 6,500 due to the reduction in food resource and the initiatives in this Plan.

2.2. SBBG at Green Island Landfill

More SBBG have been observed at Green Island Landfill compared to any other singular site and frequently more than the number at all other sites combined (Figures 3 & 4).

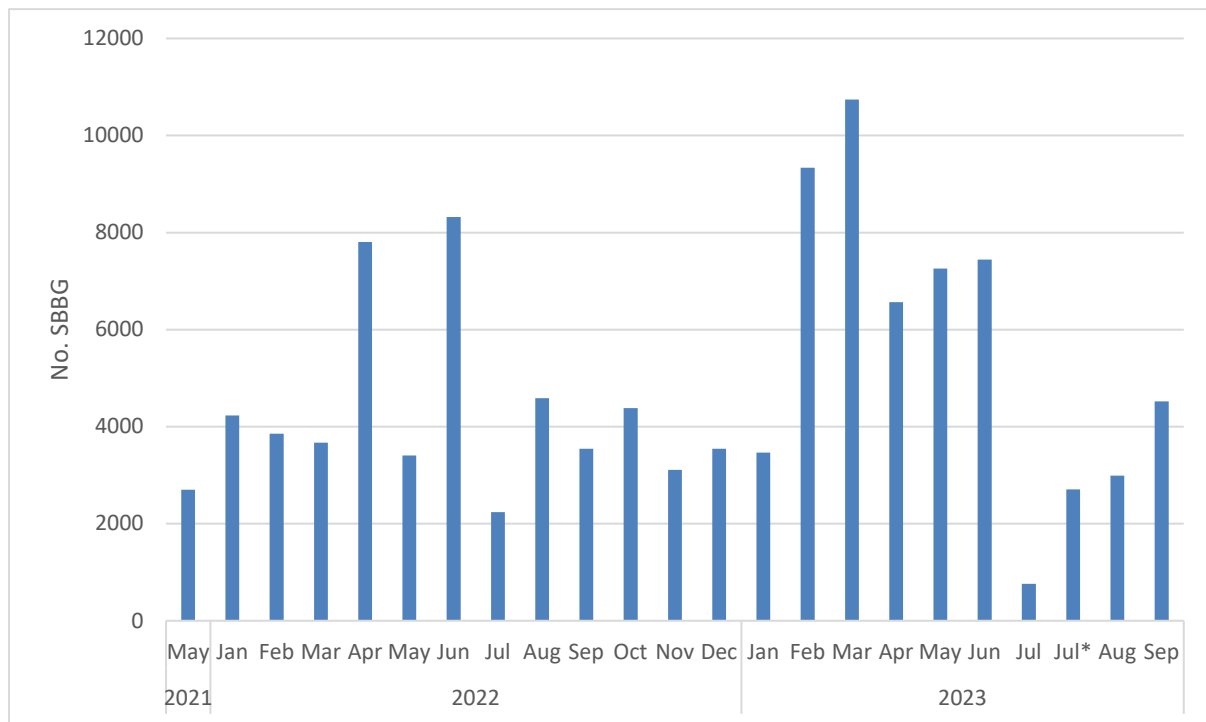


Figure 3: SBBG numbers at Green Island Landfill. *Indicates the additional survey in late July 2023 when the dispersal trial was underway.



Figure 4: Southern Black-backed Gulls at Green Island Landfill (4th May 2021).

2.3. SBBG across Dunedin and Environs

Seasonal SBBG counts of regional sites excluding Green Island Landfill, ranged from 1208 (November 2022) to 4,903 (August 2023) (Figure 5 and Appendix B). The top of the Kaikorai Estuary supports the highest average number of SBBG with 386 per count. This site and the mid and eastern part of the estuary is associated with the Green Island Landfill. Birds stage here (mainly at the top), awaiting opportunity to forage at the tip face, or retreat here when dispersed or otherwise exiting the landfill.

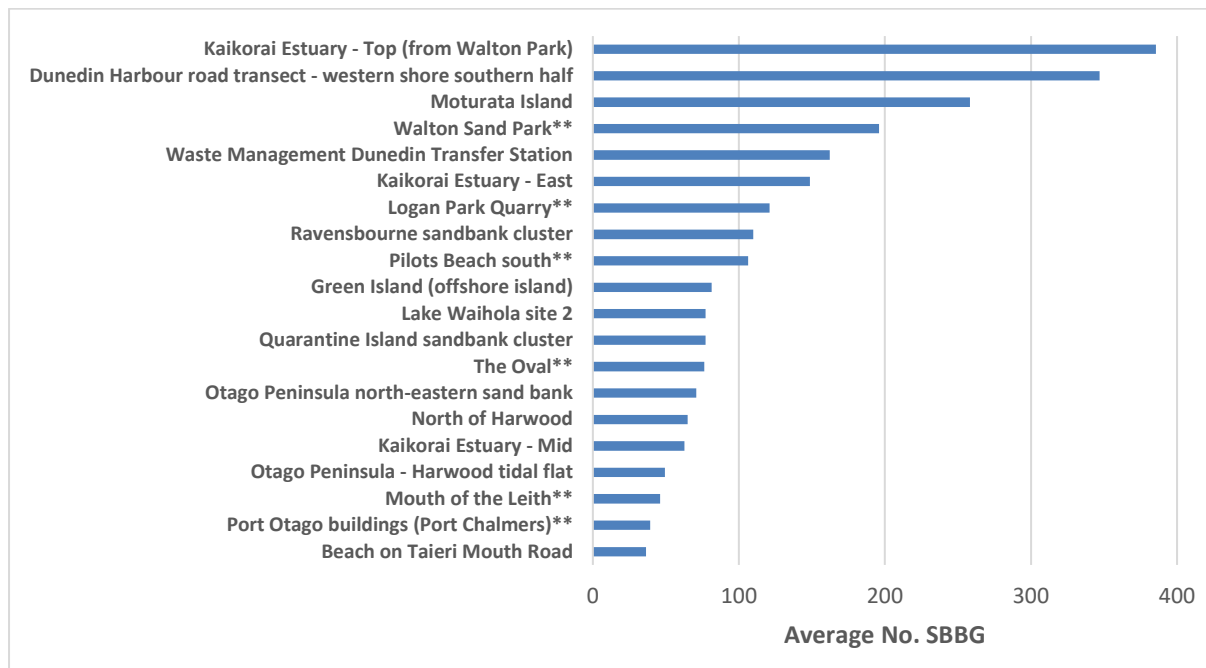


Figure 5: Top 20 SBBG sites (apart from Green Island Landfill). Calculated from average counts from seasonal daytime surveys at regional sites. **Indicates site added to survey in May 2023.

The western shoreline of the southern portion of Dunedin Harbour has the next highest average count of 347. Other sites along the Otago Peninsula are also well-populated by SBBG. Moturata Island (average count 258) and Waste Management's Dunedin Transfer Station (average count 162) support high numbers. Walton Sand Park is a site that was added to the count in May 2023 and supports an average of 196 per count. This is a known breeding site and is close to Green Island Landfill.

2.4. Roosting and Breeding Sites

SBBG roosting activity is season dependent. In the non-breeding season (typically February to September), most of the SBBGs leave Green Island Landfill toward the city. Some raft on the harbour before joining others that roost directly on the flat roofs of several city buildings. Some birds also head east towards Tomahawk Lagoon where they may roost for the night.

In April 2022, more than 3000 SBBG were observed leaving Green Island Landfill for the Kaikorai Estuary and some further on to Moturata Island.

During the months of September and October, roosting behaviour appears to change as SBBG prepare for the breeding season. Far fewer birds roost on the city roofs. The quarries are preferred roosts as they are also the preferred nesting sites in October through December.

Breeding was recorded at 46 sites during the aerial survey (Figure 6 & 7 & Appendix B). There are many colonies that have breeding adults numbering from very few into low hundreds. Most colonies were located along the coastline. Moturata and Green Islands were the most prolific sites with an estimated 1000 and 500 breeding SBBGs respectively.

Additional roosts have been identified from the GPS tracking study (see Section 2.5 and Appendix B). It is anticipated that additional breeding sites will be identified from tracked birds during the 2023/24 breeding season.

Few SBBG were nesting on the flat roofs of South Dunedin (30 nests observed). The main breeding sites around the city were visited on foot on the 5th and 6th of November. Walton Sand Park (62 nests), the Logan Point Quarry (30 nests in lower quarry), and the new hospital site (10 nests) were the main breeding sites. 20 to 30% of nests had no eggs with the remainder containing 1 to 3 eggs. At Walton Sand Park one nest had two chicks that were approximately two days old. With an incubation period of 23 to 26 days (Miskelly, 2013), it is estimated that the breeding season at these sites commenced in mid-October. There were 60 SBBG observed on a grassed area at the Mouth of the Leith. The site was not accessible so it was not possible to determine if they were nesting, but their behaviour suggested they could be.

Lake Waitahuna River is a significant site with 400 breeding SBBG. This site is approximately 40km west southwest of Dunedin and is probably not heavily influenced by food supplies at Green Island Landfill or along the coast. It is likely, along with SBBG at Lee Stream and Lake Mahinerangi that these SBBG rely on food available in the surrounding farmlands and have little daily interplay with the coastal populations.

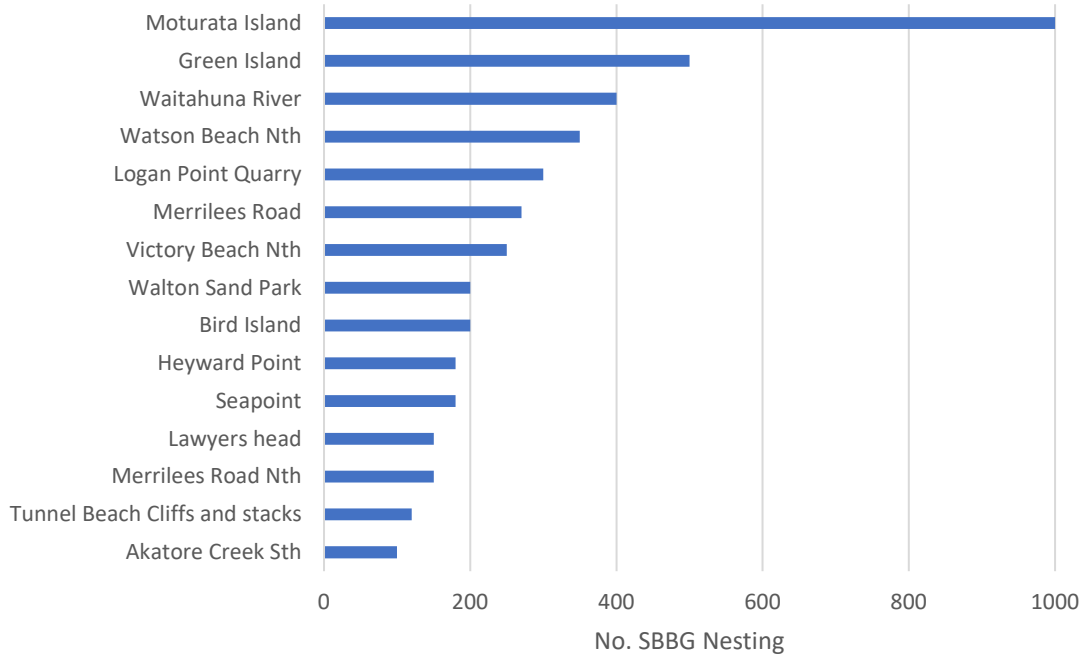


Figure 6: Breeding sites with more than 100 SBBG counted during aerial survey in November 2022.

2.5. SBBG Movement Patterns

The GPS tracking study (Section 3.3.2) indicates that SBBG have travelled over 100 km from the Otago to Southland, including movements of over 80 km in a single day. Other birds have demonstrated a more stable movement pattern, adopting a roost and moving to feeding locations (often Green Island Landfill) and back each evening. For a detailed analysis of GPS tracking study, see Appendix B.



Figure 7: Southern Black-backed Gull breeding colonies

● Black-backed Gull breeding sites

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

3. Managing the SBBG Population

3.1. Stages of the Plan

The Plan will occur in three stages (Figures 8 and 9).

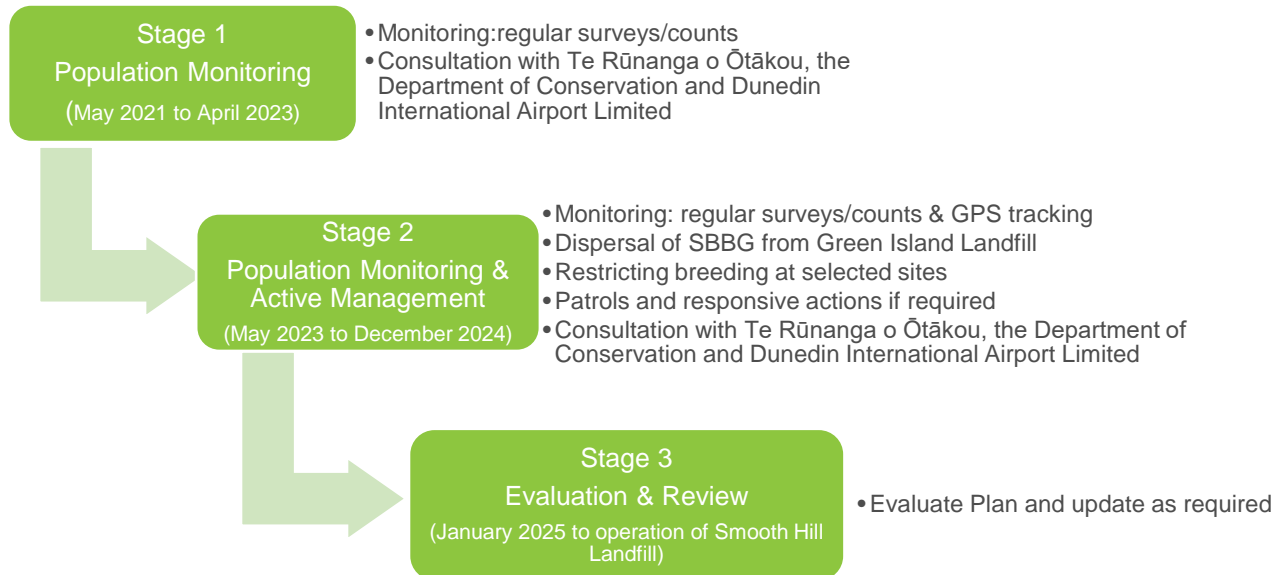


Figure 8: Three stages of the Management Plan

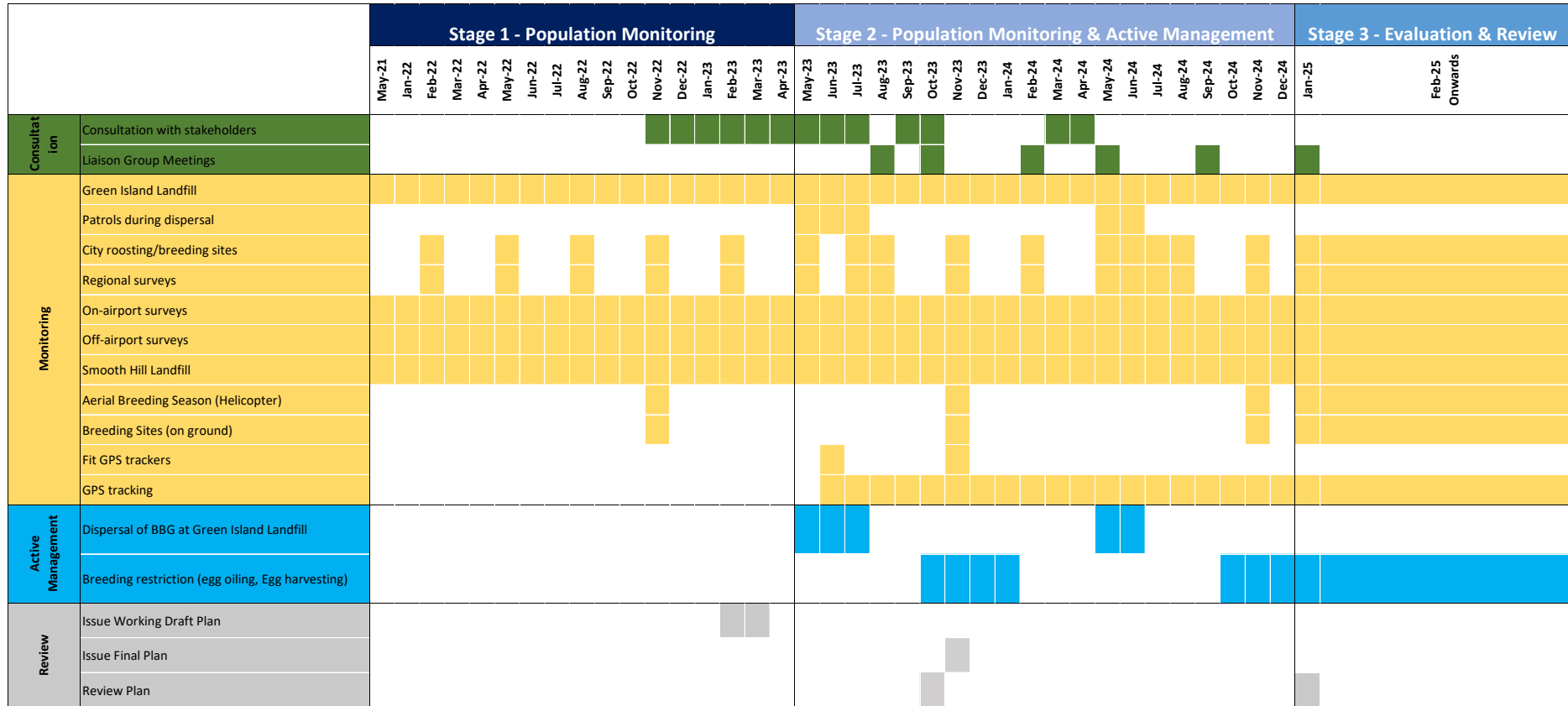


Figure 9: Timeline of events for each Stage

3.2. Consultation

The Plan is being developed in consultation with Te Rūnanga o Ōtākou, the Department of Conservation and Dunedin International Airport Limited. Other relevant stakeholders will be included as required.

3.2.1. Te Rūnanga o Ōtākou

Aukaha on behalf of Te Rūnanga o Ōtākou have provided input into the development of the Plan. Te Rūnanga o Ōtākou has a significant relationship with SBBG which is recognised as a Taonga Species under the Ngāi Tahu Claim Settlement Act, Schedule 97. Accordingly, Te Rūnanga o Ōtākou expect continued involvement in the Plan and any changes that may arise. They are interested in being involved with the implementation of the Plan, particularly in the survey work and monitoring, and population management.

SBBG adult birds and eggs were once a Mahika kai/traditional food resource collected by Kāi Tahu ancestors. Te Rūnanga o Ōtākou have a desire to restore custom and mātauraka māori associated with this practice. There are opportunities to restore this customary practice which can also contribute to the breeding restriction plans outlined in the Plan. Work will need to occur to identify suitable populations for egg harvest or suppression (oiling) while also investigating a 2-fold benefit of managing Karoro populations where they could predate native eggs or chicks.

Te Rūnanga o Ōtākou accept GPS monitoring as a method to help understand the dispersal of birds from the Green Island Landfill. Culling adult birds by poisoning or other means is not a preferred method of control. Culling is not considered necessary at this stage but is a technique for population management that should be held in reserve if it becomes necessary to rapidly reduce population numbers.

3.2.2. Dunedin International Airport Limited

As part of the consultation with Dunedin International Airport, it was agreed to form an Aviation Liaison Group currently consisting of Dunedin City Council, Dunedin International Airport, and New Zealand Airline Pilots Association to discuss aviation related matters associated with the Plan. The Group was established in July 2023 and has met in October 2023, with a further meeting scheduled for February 2024 and each quarter thereafter. Agreement was made at these meetings to resolve the issues raised by Dunedin International Airport through the review and implementation of the Draft Plan.

Dunedin International Airport Limited have suggested that the Civil Aviation Authority (CAA) also be consulted as the Plan continues to be developed and implemented. They also request that Smooth Hill site continues to be surveyed monthly, beyond current baseline data collection, in order to track any changes of behaviour (e.g., site over-flying) that might result from the proposed operational changes at Green Island landfill and the development and operation of the new landfill at Smooth Hill (e.g., site preparation, construction).

Dunedin International Airport Limited also suggest that Smooth Hill should have a target of zero SBBGs, beginning immediately and the site preparation works may also attract birds. They suggest developing a protocol for reporting compliance with targets and indicating what happens if targets are not met.

3.2.3. The Department of Conservation

As SBBG are taonga species, and not protected wildlife, the Department of Conservation, when consulted, noted that they have no statutory role in their management, or statutory requirement to be consulted on the development of the Plan. As such their main interest in the development of the Plan is focused on supporting Kāi Tahu in their aspirations regarding SBBG and the interests of Te Rūnanga O Ōtākou should they require this.

3.2.4. Other Stakeholders

The operators of Walton Sand Park and Logan Point Quarry (where nesting sites are accessible for active management) have been consulted and they have assisted with access for managing nesting birds (see Section 3.6.1).

3.3. Stage 2: Monitoring

3.3.1. Surveys and counts

Surveys and counts that commenced in May 2021 and then monthly and seasonally from January 2022 will be maintained until at least December 2024 (Table 1). Surveys have been and will continue to be completed by suitably qualified and experienced wildlife personnel.

Table 1: Bird surveys and counts

Survey Type	Survey Objective	Method	Frequency
Green Island Landfill	Estimate the SBBG population arriving at Green Island Landfill	Surveys commence at first light until the majority of the birds arrive. The two observers positioned at or near Green Island Landfill. Each surveyor with a designated survey sector to avoid double counting birds. All gulls arriving at the site identified to species, counted (one continuous count rather than recording numbers in flocks) and the direction of approach noted. Approximate numbers of birds departing the site recorded to obtain a net on-site population. In addition, daily counts will be taken prior during and after the dispersal.	Monthly Daily during dispersal (May, June and July 2023 and May and June 2024)
Patrols during and after dispersal	To observe where SBBG disperse to and identify if they are having any negative impacts	Trained technician rove Dunedin and environs while dispersal is occurring and for the month following. These patrols will extend to regional survey locations, but also allow response to observations of flight directions to locate SBBG congregations.	May, June and July 2023 and May and June 2024
City roosting / breeding sites	Identify key roosting/breeding sites around Dunedin City	The flat roofs of selected buildings around Dunedin city observed for approximately one hour before last light by vehicle and on foot. Time, species and numbers recorded.	Seasonal

Survey Type	Survey Objective	Method	Frequency
Regional survey	Identify key feeding, roosting, loafing and nesting sites around Dunedin and Surrounds	Selected sites around Dunedin and environs including city buildings, beaches, cliffs, islands, etc visited by vehicle and on foot during the day. Time, species and numbers recorded.	Seasonal
On-airport	Understand the species utilisation and risk at Dunedin International Airport	For each visit, three surveys completed: early morning, middle of the day, and late afternoon. Each survey consists of seven sectors that cover the area inside the fence at Dunedin International Airport with assigned observation points that overlooked each sector. The observer travels from one observation point to the next following a set route through each sector making observations while en-route. The observer spends five minutes at each observation point, recording all birds observed within the sector during this time. Information recorded included: time, species, number sighted, and position, estimated height above ground level, heading and behaviour.	Monthly
Off-airport	Understand the species utilisation and risk at selected sites near Dunedin International Airport	Selected habitats (wetlands, paddocks, drains, rivers) near Dunedin International Airport surveyed during the day Information recorded included: time, species and number.	Monthly
Smooth Hill	Determine the baseline number of SBBG using and/or overflying the site prior to its operation	Surveys for all species at the site.	Monthly
Aerial Breeding Season (Helicopter)	Determine the main breeding sites and estimated numbers in Dunedin and environs	Over a period of approximately 200 minutes, commencing at 09:15, three observers and an experienced helicopter pilot overfly the area of interest, recording SBBG (and other species where possible), their numbers and their breeding status. Early November was chosen as it was assumed most breeding sites would have been established by then.	Each November
Breeding Sites (on ground)	Inspect selected breeding sites to assess numbers, status and opportunities for control	Assess potential breeding sites around Dunedin City and surrounds to record nesting status and determine suitability for managing breeding success in future breeding seasons.	Each November

3.3.2. GPS tracking

Animal use in research, testing and teaching is strictly controlled under the Animal Welfare Act 1999 which is overseen by the Ministry for Primary Industries (see <https://www.mpi.govt.nz/animals/animal-welfare/>). The SBBG capture and GPS tracking protocol was approved by the University of Otago Animal Ethics Committee under the name of Professor Bruce Robertson.

Ten SBBG were fitted with solar recharging Global Positioning System (GPS) transmitters in late June 2023 in Dunedin. The birds were caught in a walk-in trap and self-noosing snares that trapped their legs. Two males were caught at the Dunedin Transfer Station (32 Wickliffe Street, Dunedin Central, Dunedin) on 28th of June. Five male and three female were caught at Green Island Landfill across the 29th and 30th of June.

The transmitters were fitted using the backpack and keel-strap method, with Teflon tape used as the harness material (Figure 10). A weak-link was incorporated in the keel strap.



Figure 10: Southern black-backed gull fitted with GPS transmitter, caught at Green Island Landfill June 2023.

The transmitters send the GPS data via the mobile phone network. The data collection schedule of the transmitters can be remotely programmed. The frequency of GPS fixes is contingent on regular solar exposure for battery recharge. The standard GPS fix rate is each hour from sunrise to sunset. Altitude and accelerometry data are collected with each fix. The GPS fix rate can be increased if consistent solar recharge allows; equally, the fix rate will be decreased if the battery voltage is low. Actively managing the duty cycle to maintain the battery voltage will increase the long-term functionality of the transmitter, aiming to collect up to several years of tracking data.

SBBG colour marking was also suggested as a possible technique to 'track' birds during dispersal periods. Given the quality of the data received to date via the 10 GPS tracked SBBGs, GPS trackers will be fitted to an additional 20 SBBG taking total of amount of birds GPS tracked to 30 SBBG. Given this, colour-marking birds will no longer be required.

3.4. Measurable Targets

Plan targets are outlined in Table 2.

Table 2: Plan Targets

Objective	Target	By when	How assessed
Reduce regional SBBG population	Estimated SBBG population index halved to below 6,500	January 2028	Compared with average seasonal counts across Green Island and regional sites (see Figure 2)
Reduce SBBG population at Green Island Landfill	Fewer than 100 SBBG frequenting Green Island Landfill	January 2028	Counts following the same method as described in Table 1.
Reduction in SBBG breeding population	Fewer than 5000 SBBG at breeding sites plus at Green Island Landfill	January 2028	Compared with standardised aerial survey (see Section 2.1)
Reduction in SBBG breeding population	Greater than 500 eggs oiled or harvested from breeding sites	January 2028	As counted during breeding restriction activities (see Section 3.5.2)
Maintain a very low SBBG population at Smooth Hill	Targets as set in Smooth Hill Bird Management Plan	During construction and operation	As monitored as part of this Plan and then when Smooth Hill Bird Management Plan is initiated at the commencement of construction activities

3.5. Active Management

Active management refers to the on-ground actions taken to prevent certain SBBG behaviours. It can involve scaring birds away from food supplies, controlling egg production or direct culling of birds.

3.5.1. Green Island Landfill Bird Dispersal Trial

The dispersal trial initially had an impact on the number of SBBG present at Green Island Landfill. After a few weeks, the birds habituated to the dispersal tools (Table 3). By increasing the dispersal team to three people, adopting additional tools and modifying the approach, the last three weeks of the trial (7th to 31st July 2023) were deemed highly successful. SBBG numbers were regularly under 2000 and often around 500 at Green Island Landfill.

Table 3: Overview of tools used for dispersal trial.

Tool	Used (Yes/No)	Effectiveness	Comment
Stock whip	Yes	High	The tool that proved most effective
Pool noodles	Yes	High	Cut in two and banged together to make a loud noise
Kite	Yes	Moderate	Suitable on windy days but only for short periods to avoid habituation
Sling shot	Yes	Low to Moderate	Lobbing a rock near the birds does make them move on, but it has localised effect
Paint ball gun	Yes	Low to Moderate	Used sparingly. The visual impact of a projectile flying past has a limited effect
Balloons	Yes	Low	Had some effect in a small area
Vehicle & car horn	Yes	Low	Chasing birds in the vehicle and using a horn works but the birds relocate away from roads
Arm wave	Yes	Very low	Worked for a very short period of time before becoming ineffective
Mirror	Yes	Nil	Had no effect
Gas cannon	No	N/A	Could not be used because of noise restrictions imposed at the landfill
Pyrotechnics	No	N/A	Could not be used because of noise restrictions imposed at the landfill
Siren	No	N/A	Deemed unnecessary as the whip and pool noodles had better effect
Starter pistol	No	N/A	Deemed unnecessary as the whip and pool noodles had better effect

During the period where dispersal was highly effective, many of the birds redistributed to Dunedin Harbour with around 3,500 observed during patrols on 9th July 2023. Patrols confirmed the attraction to the Kaikorai Estuary during this period. Other significant sites included the Dunedin Waste Transfer Station (650 SBBG 14th July 2023) and nearby Leith Brook (600 SBBG 17th July 2023). Later in July and into early August, after the gulls had been denied food from the landfill for 1-2 weeks, SBBG were observed more scattered and regularly in farm paddocks. This is evidenced by:

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

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

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

The findings from the 2023 trial will assist with effective dispersal procedures for May and June 2024.

3.5.2. Breeding restriction

Nesting across Dunedin and environs is scattered across many sites. This is unlike SBBG colonies in other parts of New Zealand such as around Christchurch where the majority breed on the braided bed of the Waimakariri River (Bell and Harborne, 2018). This has implications for managing the breeding population and/or culling adults at breeding grounds as it would be difficult to target a significant portion of the population. The larger breeding sites (Moturata Island and Green Island) are logistically difficult sites to access safely on a frequent basis.

Recruitment to the population will be restricted by limiting breeding success in the lead up to changes to landfilling practices. At Walton Sand Park and Logan Point Quarry breeding sites egg oiling will prevent chicks from hatching by preventing gaseous exchange through the eggshell. Monitoring of colonies in September and October each year allows identification of eggs prior to hatching. Oiling will commence when eggs are identified, and sites are revisited every two weeks to ensure newly laid eggs are oiled. The two-week period is less than the 23–26-day incubation period, so no chicks should be allowed to hatch. The oil-based solution will be sprayed onto the eggs via an atomiser bottle and will include a food dye that will alert the field technician to previously treated eggs, which will not need re-treatment. Numbers of eggs oiled will be recorded. This process will commence in October 2023 and continue each breeding season until the population has stabilised following landfilling changes.

3.5.3. Mahinga Kai

At site(s) yet to be determined, and subject to further consultation with Aukaha and Te Rūnanga o Ōtākou, there may be the opportunity for Te Rūnanga o Ōtākou to harvest eggs. This will have a similar effect as oiling eggs, although it is likely that adults will continue to lay after egg harvesting. It will therefore be necessary to revisit the breeding sites at least every two weeks to avoid chicks from hatching. Numbers of eggs harvested will be recorded.

3.5.4. Population Control - Poisoning

It is not anticipated that culling will be required. If the initial dispersal in 2023 results in unacceptable offsite impacts, it may be necessary to consider a culling program in 2024 in the lead up to the change in landfilling practices. This would involve using alpha-chloralose baits at nesting sites. Detailed protocols would be established only if culling is deemed to be necessary.

3.6. Stage 3: Review of the Plan

In addition to the Plan's adaptive management and review process, a formal review of the draft Plan and subsequent updates to the document is scheduled for January 2024 and January 2025. This review will be informed by ongoing data collection, consultation with Te Rūnanga o Ōtākou, the Department of Conservation and Dunedin International Airport Limited via the Aviation Liaison Group, and other stakeholders if required.

The January 2024 review will evaluate the dispersal and breeding restriction program and incorporate any adjustments as necessary prior to introducing new waste management practices in July 2024. Additional measures may be considered which are not specifically outlined in this management plan including but not limited to:

- Allow SBBG to return to the tip face to alleviate pressure offsite until an alternative option can be considered.
- Commence a culling program (Section 3.5.4).

The January 2025 review will be after the introduction of the new waste management practice and should allow sufficient time to evaluate how the SBBG population has responded. At this point, depending on the success of the Plan, it may be possible to scale back many aspects of the monitoring and active management.

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Appendix A: The Southern Black-backed Gull/Karoro (*Larus dominicanus*)



Distribution of the Southern Black-backed Gull in NZ.

Source: Ornithological Society of New Zealand Inc.



Mass (g):	850 – 1150g
<i>Wildlife Act 1953</i> listing	Schedule 5 - unprotected throughout New Zealand and lawful for anyone to hunt, kill, or have in their possession (if it is not a domestic animal).
NZTCS listing	Not threatened

The SBBG is the largest New Zealand gull. It is widely distributed across New Zealand on all non-forested habitat including landfills and ports. It is common in estuaries, harbours and shorelines, and is also found in farmland and sub-alpine tussock land and herb fields. It is considered a pest and is the only unprotected native bird species in New Zealand.

SBBG are predators and scavengers and are attracted to food scraps and organic waste (Miskelly 2013). 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, 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.

The adults of the species have a white head and belly with a black back (Figure A1). The bill is yellow with a red patch near the tip and the legs are pale green. The young are dark mottled brown with a black bill and legs and are often mistaken as a different species (Figure A1). Adult plumage is obtained at 3 years of age (Miskelly 2013).



Figure A1. Adult (back) and young (front) Southern Black-backed Gull.

Photo: Peter Prokosch <https://www.arida.no/resources/3154>

Breeding can be solitary or colonial, mostly on offshore islands and river beds. Nests consist of grass, sticks or seaweed, or can be a scrape on the ground. The flat roofs of buildings can also be used for roosting or nesting of some gull species. Pairs are monogamous and share incubation and chick care. In New Zealand, birds gather at breeding sites in September, and one to five grey-green eggs (Higgins and Davies, 1996) (Figure A2) are laid between October and January. Incubation is 23-26 days and chicks (Figure A3) fledge at 7- 8 weeks of age (Miskelly 2013).



Figure A2. Eggs in a nest



Figure A3. Chicks in a nest

The species is both a hunter and scavenger, with its diet consisting of terrestrial and marine invertebrates, fish, small mammals, other birds, chicks and eggs. Its very broad food preference allows it to be an opportunistic feeder at landfills, farms (both livestock farms and ploughed fields), and fish processing boats, playing fields, foreshores and beaches. This species is particularly attracted to farms during lambing where the placentas and dead lambs provide food (Heather and Robertson 2000). As opportunists, gulls are attracted to areas where people regularly feed birds or where poor waste management practices result in supplemental feed.

Appendix B: Southern Black-backed Gull/Karoro data collected to date

Regional Sites

Table B1. SBBG counts during seasonal surveys at Regional Sites

	Feb-22	May-22	Aug-22	Nov-22	Feb-23	May-23	Jul-23*	Aug-23	Average Count
Kaikorai Estuary - Top (from Walton Park)	300	125	40	0	255	250	800	1315	386
Dunedin Harbour road transect - western shore southern half	46	756	465	39	388	125	99	858	347
Moturata Island	250	427	17	406	300	36	350	280	258
Walton Sand Park**						38	150	400	196
Waste Management Dunedin Transfer Station	180	410	130	150	123	90	145	70	162
Kaikorai Estuary - East	171	560	40	2	206	80	8	122	149
Logan Park Quarry**						3	160	200	121
Ravensbourne sandbank cluster	200	88	12	44	0	5	300	230	110
Pilots Beach south**						6	153	160	106
Green Island (offshore island)	30	146	140	55	20	11	142	107	81
Lake Waiholo site 2	0	0	22	0	0	1	565	30	77
Quarantine Island sandbank cluster	0	65	85	27	0	94	16	330	77
The Oval**						220	7	2	76
Otago Peninsula north-eastern sand bank	200	197	12	31	45	30	18	34	71
North of Harwood	60	90	244	69	2	1	54	0	65
Kaikorai Estuary - Mid	65	25	70	60	6	30	36	210	63
Otago Peninsula - Harwood tidal flat	0	43	130	9	86	21	15	91	49
Mouth of the Leith**						22	37	79	46
Port Otago buildings (Port Chalmers)**						71	7	40	39
Beach on Taieri Mouth Road	20	215	15	30	0	1	8	3	37
Taieri River mouth	4	8	46	3	18	106	63	24	34
Taiaroa Head	17	0	4	20	6	200	15	7	34
Ocean View beach	70	10	110	12	18	11	20	17	34
Bird Island	27	47	58	50	23	8	20	17	31
Blue Skin Bay north**						23	14	51	29
Keep It Clean	67	20	39	16	67	17	7	1	29
Brighton	110	17	25	6	4	3	20	17	25
Green waste	45	4	35	28	30	11	34	10	25
Pilots Beach north**						6	55	10	24
Tomahawk Lagoon 1	23	61	12	2	47	7	4	31	23
Tomahawk Lagoon 2	8	38	23	4	43	44	1	23	23
Smails Beach	119	6	16	6	2	9	1	1	20
South of Kuri Bush	9	22	72	26	8	2	9	11	20
Moturata Island Reserve	5	24	80	5	6	22	6	7	19
St Kilda Beach	23	74	19	11	7	6	3	7	19
Agri-Nutrients Gladfield	60	43	1	1	0	2	8	3	15
Nash and Ross Building	0		1	16	71	1	6	8	15
Rock outcrop on Taieri Mouth Road	16	29	15	17	18	8	3	5	14
Drainage channel to west of Dunedin airport carpark	0	80	0	0	0	0	0	31	14
Tunnel Beach cliffs and stacks**						2	30	8	13
Lawyers Head	28	11	6	18	11	3	12	7	12
Lake Waiholo site 1	2	1	11	11	5	2	41	17	11
Maori Head	5	2	16	13	6	2	0	4	6
Lake Waipori	1	0	9	13	3	0	8	12	6
White Island	0	3	12	7	5	2	10	0	5
Blue Skin Bay south**						0	12	0	4
Ice Rink	0	0	0	1	0	26	4	0	4
Taieri River bridge (Allanton)	0	0	0	0	7	0	10	5	3
Landside Paddock	0	0	3	2	0	0	0	8	2
Dam 3	0	0	1	0	1	3	1	0	1
Sinclair Wetlands Information Centre	4	0	0	0	0	0	2	0	1
Drain West of Carpark	0	0	1	0	0	0	0	0	0
Total	2165	3567	2037	1210	1837	1661	3515	4903	2612

*Indicates the additional survey in late July when the dispersal trial was underway.

**Indicates site added to survey in May 2023.

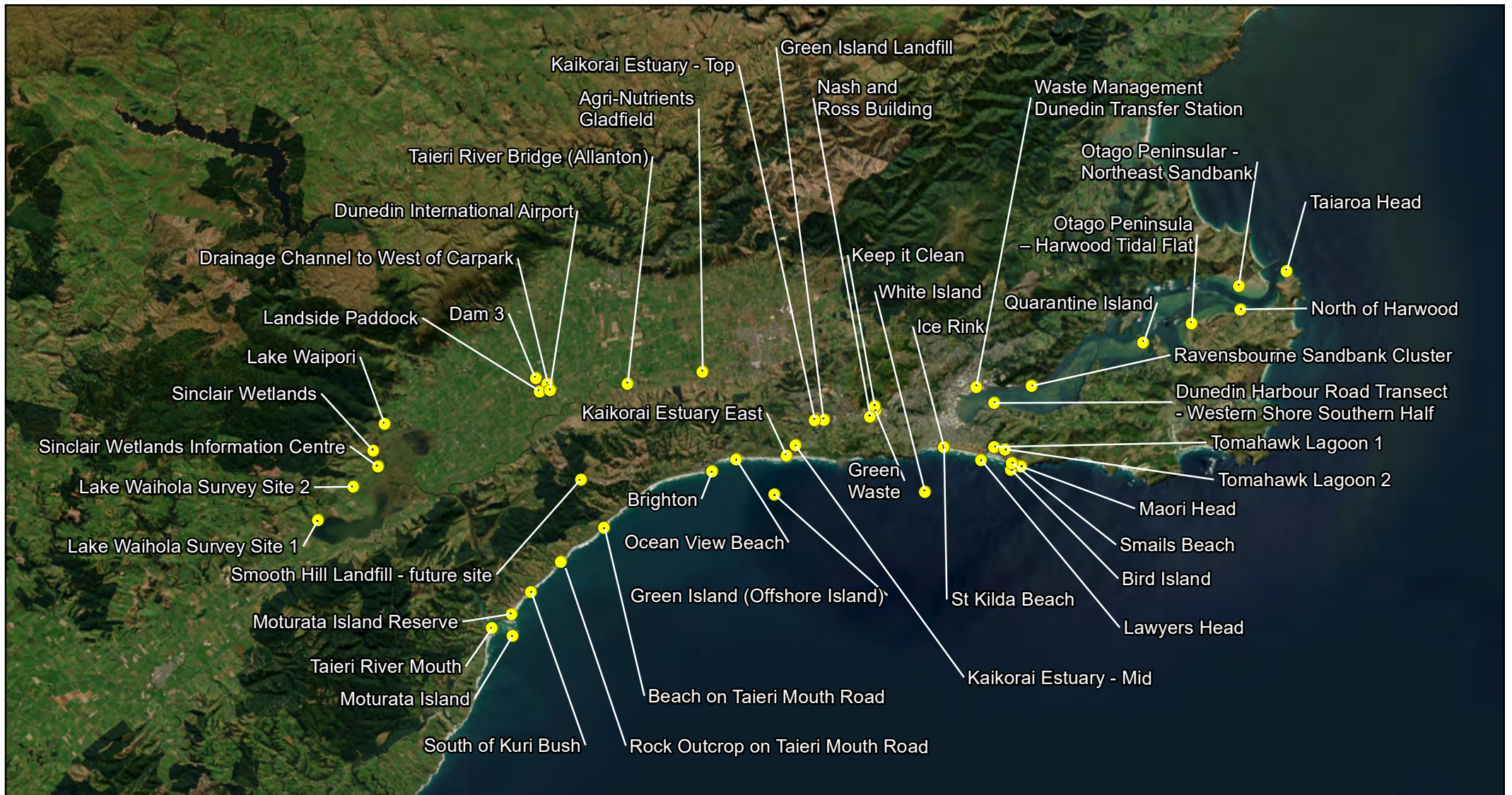


Figure B1: Regional survey sites

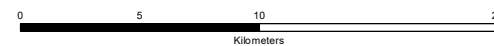
● Survey locations

Boffa Miskell Limited

Southern Black-backed Gull Management Plan Dunedin and Environs



Job number: PR7646
 Revision: 3
 Author: AS
 Date: 2/02/2023



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

SBBG Breeding Sites

Table B2. SBBG Breeding site results from aerial survey November 2023.

See Section 2.4 for Map of site locations.

Time	Location	No. BGG	No. Nesting	Notes
0915	Left heli pad			
0920	Lee Stream	60	40	40 nesting 20 flying
0930	Lake Mahinerangi	200	20	200 birds sitting on small island and banks of mainland. 7 - 8 nests seen but probably more have been washed away with heavy rain. Probably pockets of others nesting around the lake esp further to the NW
0935	Waitahuna River	400	400	Nesting on hillside
0945	Lake Waipori	50	10	Scattered numbers feeding in paddock and on lake. Possibly some nesting on Maimais
0950	Lake Waiholā Nth	20	20	On water and sitting on maimais
0952	Lake Waiholā Sth	10	10	Scattered on maimais
0955	Clarksville	30	0	Feeding behind plough
1000	Lake Tuakitoto	0	0	
1007	Chrystalls Beach Nth	40	40	Probably nesting
1010	Watson Beach	10	0	On rocks
1010	Watson Beach Nth	350	350	Nesting over a 400m stretch. 250 on rocks, 100 in paddock
1012	Merrilees Road	270	270	Nesting
1013	Merrilees Road Nth	150	150	Nesting
1014	Akatore Creek Sth	100	100	Nesting
1014	Akatore Creek Nth	80	80	Nesting
1016	Moturata Island	1000	1000	Nesting. 50 spoonbills also nesting
1025	Green Island	500	500	Nesting
1027	Kaikori Estuary Mouth	80	0	Roosting only
1028	Boulder Beach east side of Black Head	20	2	1 or 2 nesting but mostly flying
1028	Tunnel Beach Cliffs and stacks	180	120	120 nesting and 60 flying
1029	Cargills Castle	80	20	20 nesting and 60 flying
1035	Dunedin Ice Stadium	1	0	Roosting only
1035	Mitre 10	0	0	
1035	Bunnings	2	0	Roosting only
1035	86 Portsmouth Drive (old Placemakers)	10	10	5 nests
1035	Tyre land	1	1	1 nest
1036	Toll	20	0	Roosting only
1036	Hospital site	20	3	3 nesting, others roosting
1036	Bidfoods	50	1	1 nesting, others roosting
1036	Mouth of the Leith	60	0	Appeared to be roosting only
1037	Logan Point Quarry	300	300	Nesting
1040	Lawyers head	150	150	Nesting
1041	Bird Island	200	200	Nesting
1042	Pudneys Cliff	15	15	Nesting
1043	Highcliff	40	40	Nesting
1044	Seapoint	180	180	Nesting
1045	Harekeke Point	40	10	10 nesting, 30 flying
1046	The Chasm	80	80	Nesting
1047	Wharekakahu	80	30	20 nesting on mainland, 10 nesting on island and 50 flying
1048	Matakitaki Point	10	0	flying
1049	Cape Saunders	75	75	Nesting
1050	Otewhata	40	40	Nesting
1051	Titioraki	30	30	Nesting
1052	Victory Beach Nth	250	250	Nesting on cliffs
1052	Quion Cliff	80	80	Nesting on cliffs
1055	Pipikaretu Beach Nth	20	20	Nesting
1055	Aromoana Cliffs	40	10	10 nesting, 30 flying
1056	Heyward Point	200	180	Mostly nesting in paddock and cliff but some flying.
1057	Purehurehu Point	20	20	Nesting on cliffs at end of the point
1100	Mapoutahi	8	8	Nesting
1100	Blueskin Bay Sth	50	50	Nesting on low coastal turf shelf of mainland
1101	Blueskin Bay Island	50	50	Nesting on island
1102	Blueskin Bay Nth	50	50	Nesting on low coastal turf shelf on the mainland
1108	Hawksbury lagoon	0	0	
1115	Port Otago	27	27	12 on the orange building of the Nth and 15 on the building to the Sth
1117	Quarantine Island	60	0	Flying
1117	Goat Island	0	0	
1117	Pudding Island	15	0	Flying
1129	Walton Sand Park	200	200	Nesting
1135	Landed			Estimated time
	Total No.	6104	5242	

SBBG recorded in surveys at Dunedin International Airport

Monthly surveys at DIA recorded 376 SBBG, with only 13 birds being associated with the airport habitat (Figure 12). Apart from one soaring SBBG, all other observations were of birds flying over the airport and its surrounds. SBBG numbers ranged between 1 (February 2023) and 56 (extra survey on 25th July 2023 – during the dispersal trial) with an average of 18 birds across each set of three surveys per month. The second highest count was 35 on 11th August 2023, 11 days after the conclusion of the dispersal trial, suggesting there may have been some residual effect from the dispersal trial.

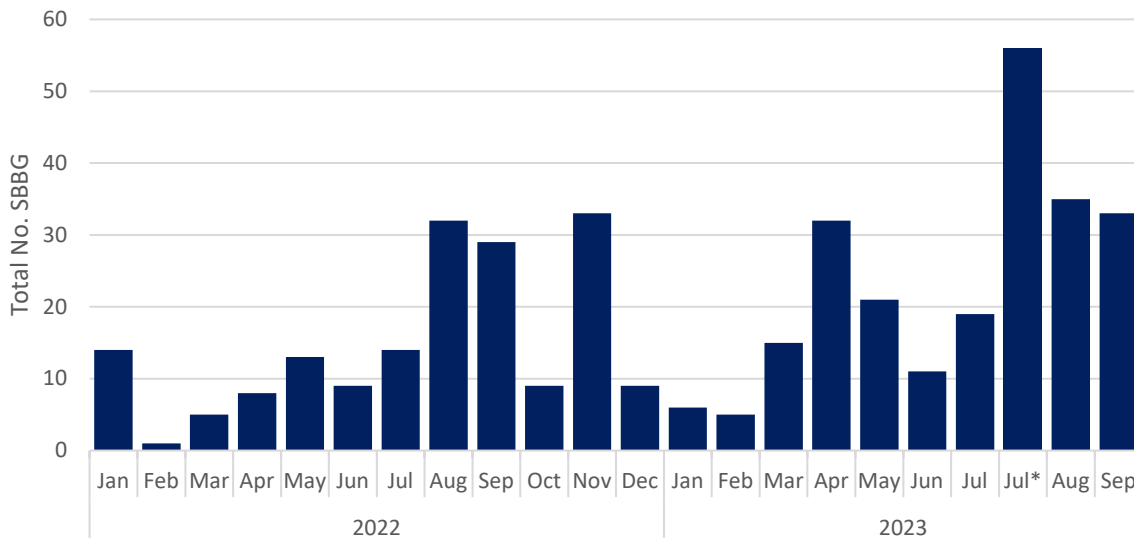


Figure B2. Total SBBG numbers observed during monthly surveys (three sets of surveys per visit) at DIA, January 2022 to September 2023. *Indicates the additional survey in late July when the dispersal trial was underway.

SBBG recorded in surveys at Smooth Hill

Monitoring recorded eighteen species at the proposed Smooth Hill Landfill site (Table 2). No SBBG have been recorded here during surveys completed for the development of this Plan, although seven were observed flying over the site during surveys for the Smooth Hill ecological impact assessments between May 2019 and February 2020 (Boffa Miskel 2020). Five of the seven headed west or north-west from the coast towards the Taieri Plains.

SBBG GPS tracking records

The most striking initial finding has been the distance that three of the GPS tracked SBBG travelled. Movements of over 100 km from the Otago Region to the Southland Region occurred (Figure B3 & B4), including movements of over 80 km in a single day. Two of these birds (B08, B12) quickly returned to the Otago Region after visiting farmland around Pukerau. The third bird (B14) followed a similar path, near Pukerau, then continued to Fortrose on the coast before moving northwest near the inland town of Tussock Creek. From Tussock Creek B14 was located up to 20 km further west, over 180 km southwest of Dunedin. Interestingly, B14 returned to Dunedin and the Green Island Landfill during late July.

The ten SBBG have shown varied movement and roost use behaviours (Figure B3). Six have made movements to the southwest (20-180km; Figure 8), including the three aforementioned SBBG that made longer movements. One moved to the northeast (~20 km), another to the east (~20 km), and the remaining two have consistently remained within Central Dunedin (Figure 9 and Figure 10). Data shows nine SBBG roosting within 20 km of Dunedin, with the remaining bird consistently roosting at Lake Waipori (~34 km southwest). Eight of the nine have been recorded at Green Island Landfill (B06, B07, B08, B09, B12, B13, B14, B15), and four at Dunedin Waste Transfer Station (B06, B11, B12, B15).

SBBG were recorded at known roosts located in Dunedin North, Central Dunedin, Dunedin South, Mosgiel (this may present an aviation hazard at Taieri Airfield), Green Island, and The Stack (near Allan's Beach; Figure B5). On average SBBG roosted at 28.9 m above ground level (average range per individual: 16.9 to 43.7 m), reflecting their behaviour of roosting on buildings in urban areas and natural peaks (e.g. islands and cliffs; see Table 3 for more detail). The two focal diurnal locations were Green Island Landfill and the Dunedin Waste Transfer Station (Figure B6). On average diurnal SBBG locations were recorded as 40.3 m above ground level (average range per individual: 11.9 to 73.6 m); the diurnal data includes flying and on-ground foraging data. A more detailed investigation of this data, when a larger dataset has been collected, will provide greater insights. Daytime fixes are referred to as 'diurnal' locations rather than classifying all daytime GPS fixes as foraging locations. Two birds were not recorded at Green Island Landfill, one of these birds has been roosting at Lake Waipori (B10), the other has roosted at Central Dunedin (B11) and consistently visited the waste transfer station. In general, all birds visited farmland on occasion and four visited sandbars within Otago Harbour.

SBBG were recorded at regional roosts between Seacliff, ~20 km north of Dunedin, to Tussock Creek, ~170 km southwest of Dunedin; with birds located across an area spanning over ~200 km. Additional roosts were located at Moturata Island (~28 km southwest), Matua River south of Summer Hill (~70 km southwest), Lake Waipori (~34 km southwest), and Blueskin Bay (~18 km northeast). Regionally, diurnal locations were predominantly associated with farmland, often within 15 km of roost sites.

Individual roosting and diurnal locations are summarised in Table B3.

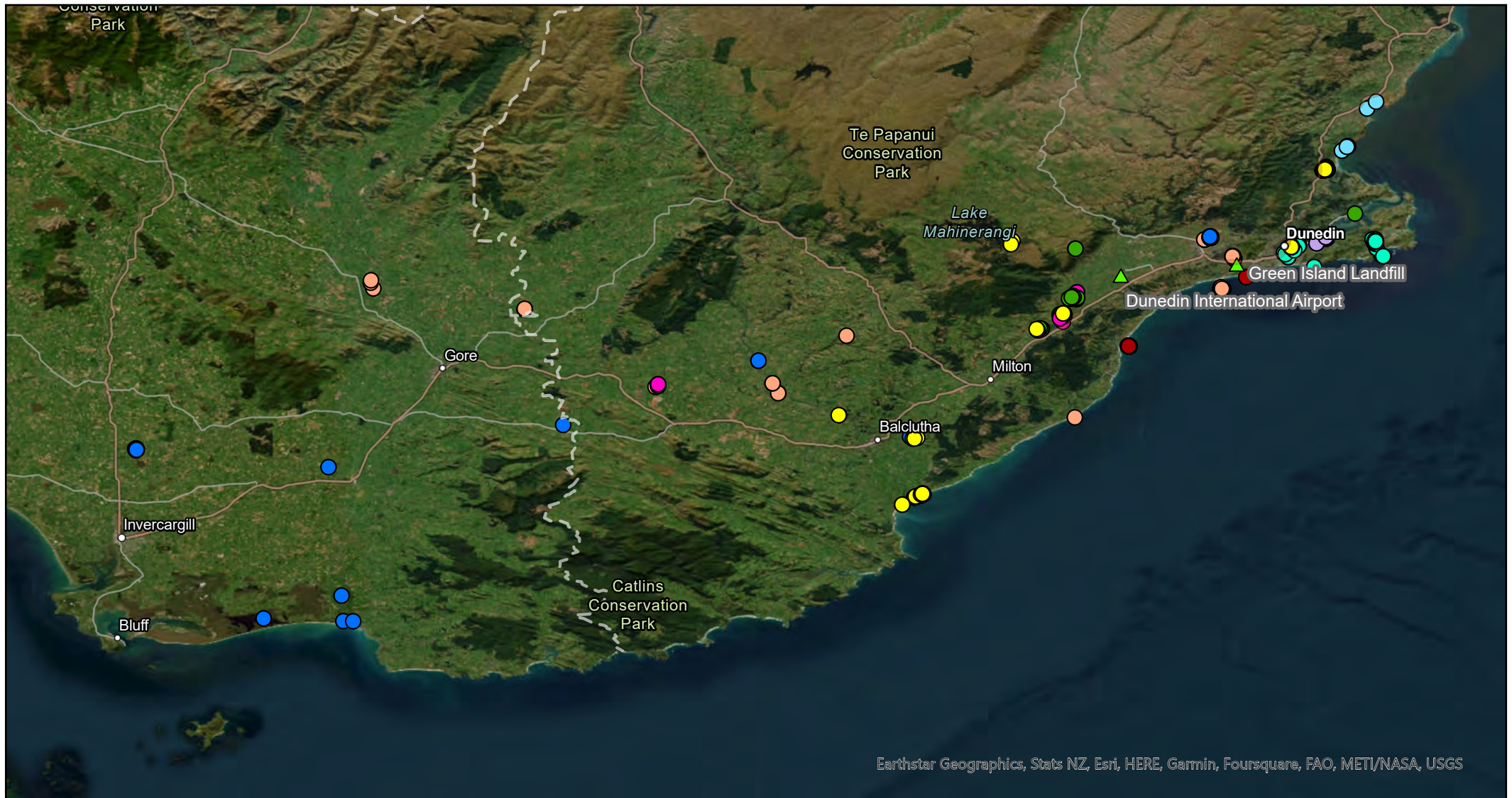
Table B3. GPS tracking summary

No.	Sex	Capture site	Tracking review
B06	Male	Dunedin Waste Transfer Station	<ul style="list-style-type: none"> • Roost: consistently at Otago Yacht Club. • Diurnal locations: <ul style="list-style-type: none"> ○ regularly at Green Island Landfill ○ occasionally in farmland near Ocean Grove. • Has shown highly consistent movement and habitat use patterns focused on Dunedin and the landfill. • Average altitude <ul style="list-style-type: none"> ○ roost: 21.6 m ○ diurnal: 49.4 m
B07	Male	Green Island Landfill	<ul style="list-style-type: none"> • Roost: consistently at Moturata Island), ~29 km southwest of Dunedin. • Diurnal locations: <ul style="list-style-type: none"> ○ regularly at the landfill, a distance of ~22 km from the roost ○ occasionally at farmland to the south of Moturata Island (up to 9km) and between Sinclair Wetlands and Mosgiel. • Has shown highly consistent movement and habitat use patterns focused on Moturata and the landfill. • Average altitude <ul style="list-style-type: none"> ○ roost: 18.2 m ○ diurnal: 36.8 m
B08	Female	Green Island Landfill	<ul style="list-style-type: none"> • Moved over 100 km to the Southland Region and returned to Dunedin during July. • Roosts: <ul style="list-style-type: none"> ○ Regularly at Green Island (offshore Island) ○ Occasionally at Mosgiel on the roof of a building and near Tuapeka. • Diurnal locations: consistently located at Green Island Landfill, ~5 km distant from the main roost on Green Island. • Average altitude <ul style="list-style-type: none"> ○ roost: 33.2 m ○ diurnal: 39.6 m

No.	Sex	Capture site	Tracking review
B09	Male	Green Island Landfill	<ul style="list-style-type: none"> • Roosts: <ul style="list-style-type: none"> ○ consistently at Blueskin Bay, ~20 km northeast of Dunedin ○ Mosgiel on occasions in August • Diurnal locations: <ul style="list-style-type: none"> ○ consistently located ~5 km to the north near Seacliff. ○ returned to Green Island Landfill on several occasions during August. • Has shown highly consistent movement and habitat use patterns, predominantly focused on natural habitats at Blueskin Bay and Seacliff. • Altitude <ul style="list-style-type: none"> ○ roost: 26.2 m ○ diurnal: 11.9 m
B10	Male	Green Island Landfill	<ul style="list-style-type: none"> • Roost: consistently roosted at Lake Waihola, ~34 km southwest of Dunedin. • Diurnal locations: consistently moving to farmland to the southwest (~9 km) and to the northeast (~13 km), including within ~1 km of Dunedin International Airport (DIA). • Has shown consistent movement and habitat use patterns focused on farmland surrounding Lake Waihola. • Average altitude <ul style="list-style-type: none"> ○ roost: 27.8 m ○ diurnal: 42.8 m.
B11	Female	Green Island Landfill	<ul style="list-style-type: none"> • Roost: consistently at sites in Central Dunedin (e.g., Liquigas) • Diurnal locations: <ul style="list-style-type: none"> ○ waste transfer station (<1 km) ○ on sandbars in Otago Harbour (~4 km northeast) off St Leonard's. • Has shown highly consistent movement and habitat use patterns focused on Central Dunedin. • Average altitude <ul style="list-style-type: none"> ○ roost: 16.9 m ○ diurnal: 34.9 m.

No.	Sex	Capture site	Tracking review
B12	Male	Dunedin Waste Transfer Station	<ul style="list-style-type: none"> • Roosts: <ul style="list-style-type: none"> ○ on the beach at the mouth of Matua River, south of Summer Hill (~70 km southwest of Dunedin) for several days ○ returned to Dunedin where he roosted in Central Dunedin and Mosgiel for more than a week ○ moved to Sinclair Wetland. • Diurnal location: <ul style="list-style-type: none"> ○ mainly at the landfill when in or near Dunedin ○ when roosting at Sinclair Wetland, moved to farmland up to ~12 km north near Woodside. • Has been highly mobile, utilising a range of roosts and foraging habitat. • Average altitude <ul style="list-style-type: none"> ○ roost: 23.1 m ○ diurnal: 33.0 m.
B13	Male	Green Island Landfill	<ul style="list-style-type: none"> • Roost: <ul style="list-style-type: none"> ○ regularly at The Stack, ~13 km east of Dunedin ○ occasionally at Hoopers Inlet and Central Dunedin • Diurnal locations: <ul style="list-style-type: none"> ○ travelled ~21 km most days to Green Island Landfill. ○ occasionally on farmland around The Stack and at Hoopers Inlet, behind Allan's Beach, ~5 km north of The Stack. • Highly consistent movement and habitat use patterns focused on The Stack roost and the landfill. • Average altitude <ul style="list-style-type: none"> ○ roost: 42.1 m ○ diurnal: 64.9 m.

No.	Sex	Capture site	Tracking review
B14	Male	Green Island Landfill	<ul style="list-style-type: none"> • Has shown the most mobility. moving over 180 km southwest to Drummond, in the Southland Region. • Returned to Dunedin during July and consistently roosted at Mosgiel and Tuapeka. • Diurnal movements: <ul style="list-style-type: none"> ○ upon return to Dunedin, primarily at the landfill ○ less frequently to farmland in the area and to sandbars in Otago Harbour near St Leonard's. • Has shown variable movement and habitat use patterns. • Average altitude <ul style="list-style-type: none"> ○ roost: 43.7 m ○ diurnal: 73.6 m.
B15	Female	Green Island Landfill	<ul style="list-style-type: none"> • Roost: consistently at Central Dunedin • Diurnal movements: <ul style="list-style-type: none"> ○ Mainly Green Island Landfill and ○ Occasionally sandbars within Otago Harbour, between Maia and Company Bay. • Has shown highly consistent movement and habitat use patterns focused on roosts located in Central Dunedin and the landfill. • Average altitude <ul style="list-style-type: none"> ○ roost: 20.7 m ○ diurnal: 32.9 m.



Earthstar Geographics, Stats NZ, Esri, HERE, Garmin, Foursquare, FAO, METI/NASA, USGS

Figure B3: Regional roost locations from GPS tracking 10 karoro during June to August 2023

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Project: PR8038 Dunedin Southern Black-backed Gull Tracking

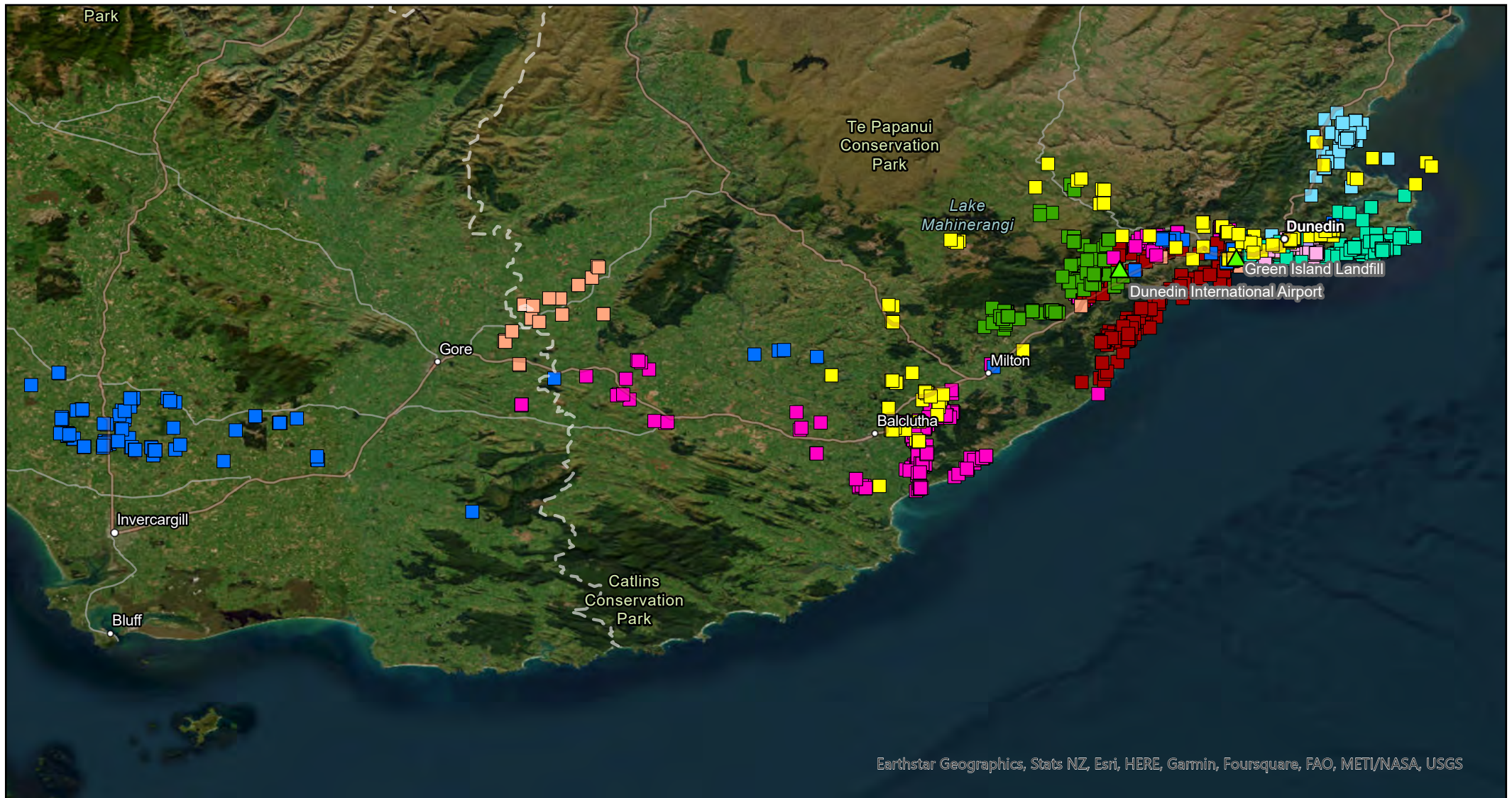
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|----------------------|-------|
| ▲ Points of interest | ● B10 |
| ● Individual SBBG's | ● B11 |
| ● B06 | ● B12 |
| ● B07 | ● B13 |
| ● B08 | ● B14 |
| ● B09 | ● B15 |



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GCS GDA 1994
 Datum: GDA 1994
 Units: Degree



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Figure B4: Regional diurnal locations from GPS tracking 10 karoro during June to August 2023

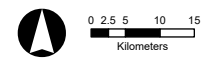
Client: Boffa Miskell Limited, Dunedin City Council

Project: PR8038 Dunedin Southern Black-backed Gull Tracking

- ▲ Points of interest
- Individual SBBG's
- B06
- B07
- B08
- B09
- B10
- B11
- B12
- B13
- B14
- B15



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GCS GDA 1994
 Datum: GDA 1994
 Units: Degree

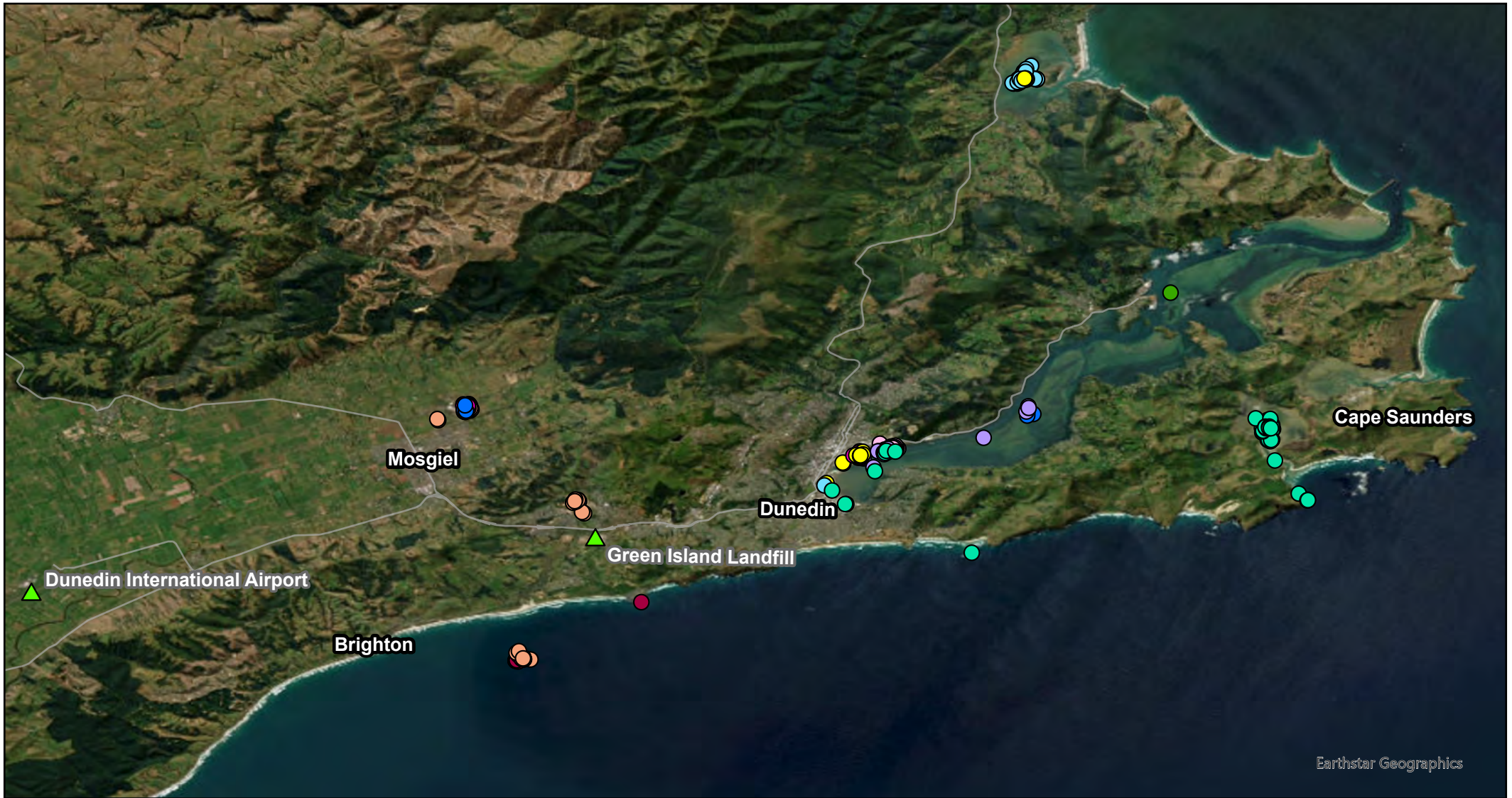













Figure B5: Roost locations around Dunedin from GPS tracking 10 karoro during June to August 2023

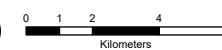
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- | | |
|--|---|
|  Points of interest |  B10 |
| Individual SBBG's |  B11 |
|  B06 |  B12 |
|  B07 |  B13 |
|  B08 |  B14 |
|  B09 |  B15 |



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GCS GDA 1994
 Datum: GDA 1994
 Units: Degree

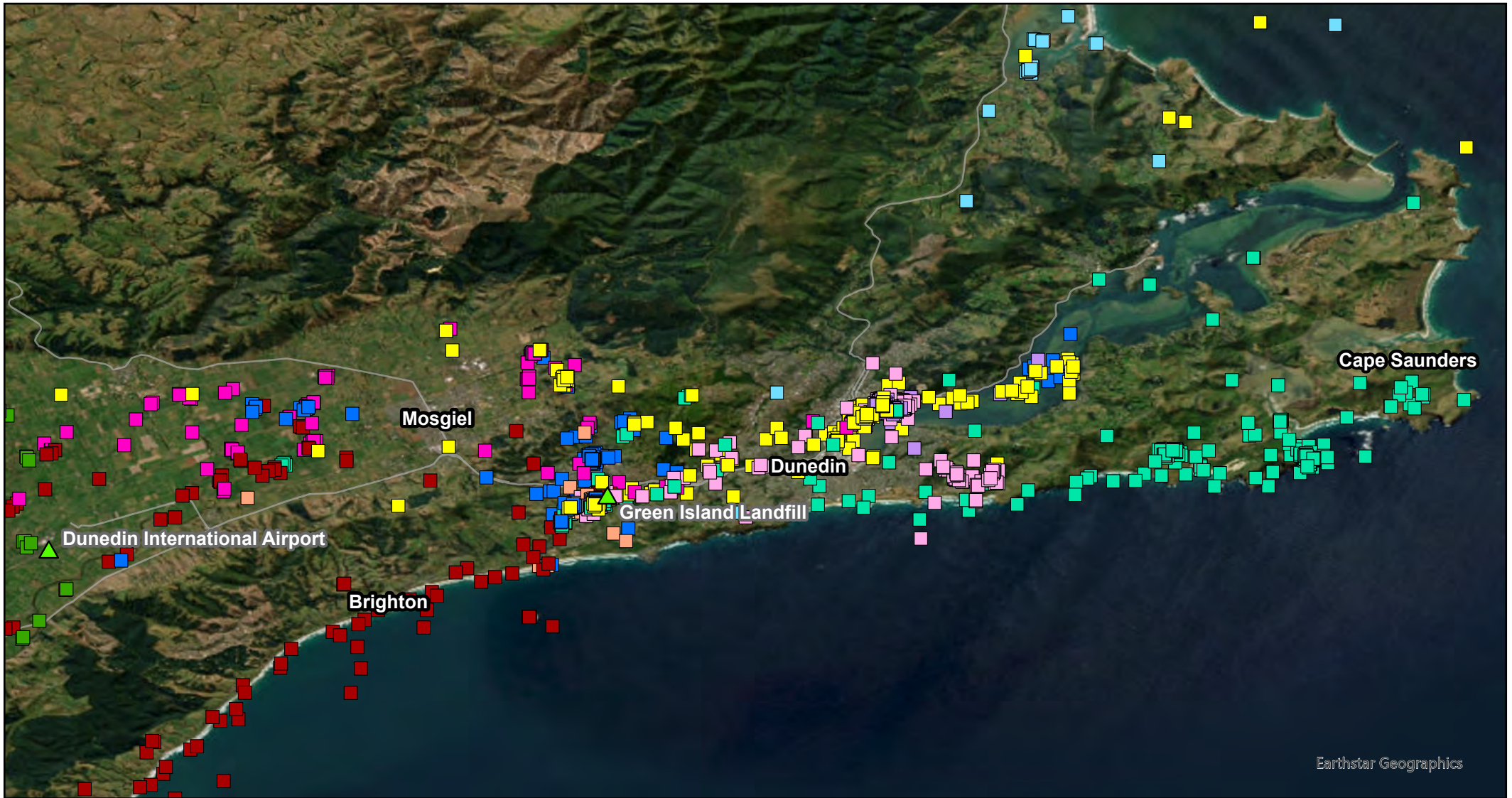


Figure B6: Diurnal locations around Dunedin from GPS tracking 10 karoro during June to August 2023

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Project: PR8038 Dunedin Southern Black-backed Gull Tracking

- | | |
|----------------------|-------|
| ▲ Points of interest | ■ B10 |
| Individual SBBG's | ■ B11 |
| ■ B06 | ■ B12 |
| ■ B07 | ■ B13 |
| ■ B08 | ■ B14 |
| ■ B09 | ■ B15 |



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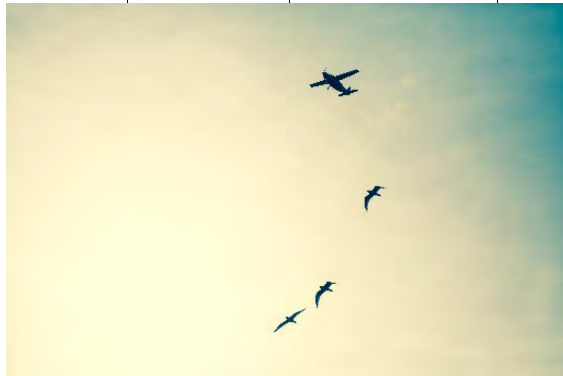
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 Units: Degree

Revision History

Rev. No.	Rev. Date	Details	Prepared by	Reviewed and approved by
0	6/11/2023	Southern Black-backed Gull Management Plan – Dunedin and Environs (Final Draft)	Phil Shaw Principal Wildlife Biologist	Phil Shaw Principal Wildlife Biologist

Distribution List

Copy No.	Date	Format	Issued to	Name
1	6/11/2023	E-copy (PDF)	Boffa Miskell	Tanya Blakley
2	6/11/2023	E-copy (PDF)	Boffa Miskell	Rachael Eaton
3	6/11/2023	E-copy (PDF)	Avisure	Administration



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PR7646.BoffaMiskell-RE.SouthernBlackbackedGullManagementPlan - Dunedin and Environs.Rev06

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