



Lord Howe Island Rodent Eradication Project

EPBC Public Environment Report December 2016

Appendix F - Non-target Impact Management Plan

F.1 Non-target Species Impact Mitigation Plan

Lord Howe Island Rodent Eradication Project

Non-target Species Impact Mitigation Plan



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Executive Summary

The Non-target Species Impact Mitigation Plan (the Plan) is a document containing the methodology and techniques proposed for the mitigation of negative impacts of the Lord Howe Island Board Rodent Eradication Project (REP) on non-target wildlife species. REP is a large-scale project with the aim of eradicating Black rats (*Rattus rattus*) and House mice (*Mus musculus*) to protect natural ecosystems and World Heritage Values on Lord Howe Island and surrounding islets. The REP also intends to concurrently eradicate the Masked Owl a species that was introduced to Lord Howe Island (LHI) IN 1920.

The one-off eradication proposes to distribute a cereal-based bait pellet (Pestoff 20R) containing 0.02g/kg (20 parts per million) of the approved active constituent, Brodifacoum across the Lord Howe Island Group (LHIG) including islets (excluding Balls Pyramid). Methods of distribution will be dispersal from helicopters using an under-slung bait spreader bucket in the uninhabited parts of the island (most of the LHIG) and by a combination of hand broadcasting and the placement of bait stations in the settlement areas. In dwellings (e.g. in ceiling spaces or floor spaces) bait trays and bait stations will be used. Bait stations will also be used around pens for the remaining dairy herd containment area. Given the size and rugged terrain of the LHIG, and the home ranges of rats and mice, the exclusive use of baits stations is not feasible for an eradication.

The operation is targeted for winter of 2017 however, to allow operational flexibility and to account for unforeseen delays, a permit is sought for at least a three year period.

The following additional measures are planned for implementation during the 2017 baiting season:

- The establishment of the Scientific Advisory Committee (SAC) to inform the development and implementation of the non-target species impact mitigation plan;
- A planned and adequately resourced non target carcass collection and disposal process undertaken by a dedicated team through the settlement area where feasible;
- An intense 3 week baiting period with 2 individual baiting programs staged to allow missed or young denned rodents to have access to bait
- Additional monitoring and reporting requirements, including monitoring of mortality and cause of death of non-target species, and long-term monitoring of the population recovery of native species that are currently impacted by rodents.
- This Plan sits alongside the Lord Howe Island Pest Eradication Plan which also contains elements outlining non-target species mitigation measures. These documents will be referred to within this Plan.

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Summary of Proposed Management Actions

No.	Proposed management action	Section
Non-target species		
1	Implementation of the non-target mitigation plan will be based upon advice from the SAC. Weekly reporting to the SAC, the Project Manager, and the Steering Committee will enable real time tracking of non-target mortality, the efficacy of carcass search and removal operations and implementation of adaptive management. This information will be used to adapt carcass search and removal activities as required to further minimise impacts on non-target species, in particular threatened bird species.	4.2
2	Captive Management: The protection of LHPC and LHW requires that a proportion of the population of these species be taken into captivity during the eradication. Approximately 80 - 85% of woodhen and 50-60% of currawong population will be captured prior to the baiting and will remain in captivity for the duration of the operation; that is, until the baits and rodent carcasses have disintegrated and pose no further risk. The captive population will include both adults and juveniles, and will be collected from across LHI to capture genetic diversity within the population. Birds originating from the remotest parts of LHI (e.g., the summit of Mt Gower) will be transported to, and back from, the holding facility by helicopter to minimise transport time and its associated stress on the birds. The captive facility will be located on LHI and will be managed by a highly experienced aviculturist from Taronga Zoo.	3.1
3	Bait spreading to be confined to periods of the day when the majority of non-target species, particularly Providence Petrels, are inactive.	3.2
4	A dedicated collection team will remove and dispose of poisoned carcasses to reduce the incidence of secondary and tertiary poisoning through the settlement areas and selected beach and walking track areas. This dedicated team will be supplemented with additional personnel as required to ensure effective and adequate carcass collection and removal activities are undertaken and will average about 10 people per day after the initial bait drop. Adequate records of these activities will be maintained to verify that this occurs. Where non-target species impacts as a result of secondary poisoning are observed, additional resources will be allocated on advice of the SAC as required to minimise impacts on non-target species.	3.8
5	Helicopter staff and pilots to be briefed on the location of nesting areas for Providence Petrel, and how to minimise impacts when working within these zones. Observer teams to be strategically positioned both at sea and on land to monitor bird movement around the southern mountains	3.3
6	Monitoring of mortality and cause of death of non-target species, with weekly reporting of this information to the SAC, Project Manager, and Lord Howe island Rodent Eradication Team. Biological samples to be	3.6

No.	Proposed management action	Section
	taken when cause of death is required to be known.	
7	Label procedures to be followed to minimise accidental poisoning of non-target species.	3.5
8	Dogs trained to detect rodents will be engaged for the post operation and monitoring program.. Dogs will be trained to avoid non-target species on Lord Howe Island.	3.7
9	Spotlighting and shooting teams of Masked Owls during and after the program will be made aware of the location of vulnerable species and undergo training to minimise impacts.	3.4
10	A non target mitigation team will be established to monitor and coordinate team members to collect and collate collection of non target species from the settlement areas, designated walking tracks and beaches	3.8
11	Search protocols to facilitate and observe detection of carcasses from the settlement areas, walking tracks and selected beach areas will be developed within 2 weeks of the commencement of baiting	3.11
13	Disposal protocol will be developed to effectively and safely dispose of both rodent and non target carcasses on Lord Howe Island. Personnel will be trained in implementation of disposal protocols.	3.12
13	Additional emergency measures will be considered during the baiting operation with the aim of minimising non-target species mortality. This will include consideration of contingency measures included in this plan where non-target species impacts are high or unacceptable, as determined based on advice from the SAC or other experts.	3.16
12	Undertake identified selected beach and walking trails to locate rodent and non-target carcasses.	3.14
13	Selected field staff will be trained in the appropriate techniques of identifying moribund non target and rodent species. A documentation system will be developed to record all incidences.	3.15
14	Implement a monitoring of non target species post baiting program on LHI woodhens and currawongs	3.17
15	Reporting format and timelines protocols and requirements	4.1

1 Introduction

1.1 Background

The overall Lord Howe Island Rodent Eradication Project comprises the following documents:

- Part A – Overview
- Part B – Operational Plan (including Masked Owl eradication)
- Part C – Environmental Impact Statement
- Part D – Occupational Health and Safety Plan
- Part E – Project Biosecurity Plan
- Part F – Monitoring Plan
- Part G – Communications Plan
- Part H – Project Plan
- Part I – Procurement Plan
- Part J – Staff Recruitment and Training Plan.

This document (Non-target Species Impacts Mitigation Plan, hereafter referred to as the Plan) documents the non-target species impact mitigation measures to be implemented on Lord Howe Island during the REP.

The proposed operation involves an initial bait drop of the second generation anti-coagulant poison brodifacoum in Pestoff 20R form followed by a second application up to 21 days later to ensure all rodents have been exposed to bait.

Brodifacoum presents a significant risk of primary and/or secondary poisoning to a small number of non-target native species, in particular the Lord Howe Island Woodhen and Lord Howe Island Currawong (listed as threatened species under State and Commonwealth legislation) as well as other species. The use of helicopters for operational purposes on the island presents additional potential impacts on non-target species, particularly the Providence Petrel.

1.2 Objectives of the Non-target Species Mitigation Plan

The aim of the plan is to provide clear and effective guidance for the REP team and project stakeholders in the implementation of mitigation, monitoring and adaptive management actions to minimise impacts on non-target species.

The objectives of the plan are to:

- Minimise mortality of non-target species as a result of primary/secondary/tertiary poisoning from baiting, in particular listed threatened and migratory bird species;
- Minimise disturbance to populations of non-target species from baiting techniques, aerial, hand broadcast and bait stations.
- Monitor the impacts of the REP on non-target species and the efficacy of mitigation measures to inform adaptive management and report to project stakeholders.

2 Scope

This Plan is a working document designed to provide field staff with guidance for non-target mitigation actions to be undertaken during the REP. Implementation of the Plan will be supported by ongoing advice from the SAC as the impacts of the REP on non-target species and the efficacy of mitigation measures included in this plan become apparent through ongoing monitoring and reporting.

The scope includes:

- A summary of the mitigation measures within the project design.
- A description of non target mitigation measures to be implemented including:
- Protocols to ensure systematic, targeted and effective carcass search through the settlement areas, walking trails and selected beaches, collection and disposal from the commencement of baiting until at least late August 2017;
- Contingency planning and adaptive management provisions with the aim of minimising non-target species mortalities;
- Provisions for long-term monitoring of the of Lord Howe Island Woodhen and Currawong populations for a period of at least 5 years following completion of baiting;
- Regular short-term and longer term reporting of non-target species mortality and the efficacy of carcass search and removal operations and other mitigation measures to key project stakeholders, including the SAC, the Steering Committee and LHIREP team.

The actions detailed in this Plan cover the time period of the REP. Following the proposed winter 2017 baiting operation, there is an approximate two year follow-up monitoring period to determine if the program has been successful in eradicating all rodents. Therefore, the proposed endpoint of the on-ground REP operations is November 2019.

2.1 Target Audience

The target audience of this Mitigation Plan is the REP team and project stakeholders. The Plan will provide a detailed adaptive management framework to mitigate, monitor, document and report on the impacts of the REP on non-target wildlife. The Plan will assist the REP in its development of project priorities and resource allocation by ensuring that implementation is guided by ongoing monitoring of impacts, and efficacy of mitigation measures and advice from relevant experts, such as the SAC.

Roles and responsibilities for key personnel are identified for each mitigation measure. Key personnel and stakeholders identified in the plan are:

- REP Manager
- Eradication Team Leader
- Mitigation Team Manager/Leader
- Lord Howe Island ranger-in-charge
- SAC: the Scientific Advisory Group established to advise implementation of the plan and assist with reducing non target casualties.
- Project Steering Committee: for the Lord Howe Island Pest Eradication Project.

2.2 Summary of Non-target Species Impact Mitigation Measures Considered

Documents were produced from 2009-2015 examining the impacts of the 2017 LHIREP baiting operation on non-target species and evaluating measures that could be implemented to reduce the impact in a subsequent baiting operation. These are:

- Lord Howe Island DRAFT Plan of Action-bait toxicity trials 2 and Biodiversity Benefits Project (November 2015)
- Lord DRAFT Plan of Action-bait toxicity trials 2 and Biodiversity Benefits Project (November 2015)
- Zoo management for LHI Woodhen and LHI Currawong associated with the Lord Howe Island Rodent Eradication project
- Monitoring, Evaluating and Reporting the biodiversity benefits of eradicating exotic rats from Lord Howe Island 2015

Of the many issues raised by these reports, 3 were determined to be worth pursuing for the LHIREP. These are:

1. Captive Management Program for Listed Endangered Species
2. An intense two staged baiting program during winter period June – August 2017
3. A planned and resourced carcass collection process with a dedicated team in designated areas of the Island, including the settlement areas.

3 Overview of Mitigation Measures

A number of these measures are copied from other REP Plans, with modifications made to reflect changed permit and operating conditions from when the earlier LHIREP plans were written.

3.1 Captive Management of Listed Threatened Species

The proposed rodent eradication poses a significant threat to two Listed Threatened Species on Lord Howe Island, the Lord Howe Island Currawong *Strepera graculina crissalis* and Lord Howe Woodhen *Gallirallus sylvestris*. Currawongs are very unlikely to eat the baits deployed in the rodent eradication programme but there is a significant risk that they will succumb to secondary Brodifacoum poisoning by eating poisoned rodents. To mitigate for this, as many individuals of the population (approximately 50-60%) as possible from across the island will be captured immediately prior to the baiting, and will remain in captivity until baits and rodents breakdown (estimated to be approximately 100 days post baiting), after which the risk of secondary poisoning for currawongs is likely to be negligible (as by then poisoned rodents will no longer be a potential food source). Although approximately 90% of those rodents poisoned are likely to die in dens underground (Vercauteren et.al. 2002, Howard et al 1999) or amongst dense vegetative cover, it is possible that a number of those currawongs left at large during the eradication will consume baited rodents, thereby placing some of the current population at risk. It should be noted, however, that rodents do not form a large part of the Currawong's diet (Carlile and Priddel 2006) and it is unlikely that a large number of free-ranging Currawongs will die from secondary poisoning.

The captive facility will be located on LHI and will be managed by a highly experienced aviculturist from Taronga Zoo. To ensure all husbandry protocols are correct, a trial involving 10 birds was conducted in 2013 (Taronga Conservation Society Australia, 2014) with all birds successfully released. Holding currawongs in captivity from approximately June until October may disrupt the birds' breeding season for one year. However, as stated above, it is unlikely that all birds left in the wild will be poisoned by the operation and thus disruption would not affect the entire population, and given that currawongs can live for up to 24 years (ABBBS 2016) such disruption is not expected to result in long-term harm to the population.

The Lord Howe Island Woodhen is at risk of both primary and secondary poisoning during the eradication program. Woodhen have been recorded eating non-toxic Pestoff bait pellets. They are also known to eat rodents that have been poisoned during the ground baiting that currently takes place around the Settlement area.

Approximately 80 - 85% of the population will be captured prior to the baiting and will remain in captivity for the duration of the operation; that is, until the baits and rodent carcasses have disintegrated and pose no further risk (expected to be around 100 days). The captive population will include both adults and juveniles, and will be collected from across LHI to capture genetic diversity within the population. Birds originating from the remotest parts of LHI (e.g., the summit of Mt Gower) will be transported to, and back from, the holding facility by helicopter to minimise transport time and its associated stress on the birds. The captive facility will be located on LHI and will be managed by a highly experienced aviculturist from Taronga Zoo. Woodhen have previously been successfully held in captivity (Gillespie 1993) so information is already at-hand for captive management. A trial involving 22 birds was conducted in 2013 to ensure all husbandry protocols are correct (Taronga Conservation Society Australia, 2014). At least one other captive colony will be established on the Australian mainland. These actions, namely the establishment of on-site and off-island

captive facilities, are in accordance with recommendations made in the “Recovery Plan for the Lord Howe Woodhen *Gallirallus sylvestris*” (NPWS 2002) which calls for the development of a plan for the establishment of an on-island captive-breeding facility in the event of a substantial reduction in woodhen numbers; and the establishment of captive populations at sites other than LHI as insurance against a catastrophe affecting the wild population.

Action	Responsibility
Undertake captive management program for LHI Woodhen and Currawongs on LHI	LHIREP Manager/ Taronga Zoo
Establish captive management facility on mainland to ensure insurance for woodhen populations	LHIREP Manager

3.2 Baiting Strategy: Temporal and Spatial Considerations

One of the primary management approaches to minimise the risk of poisoning to migratory sea birds, is to conduct the baiting operation during winter when numbers of species present on the island are significantly reduced. A significant proportion of these species’ populations are away from the island during the winter, and as a result may be less significantly affected by secondary or primary poisoning.

The listed Migratory species, the Providence Petrel, breeds principally in the southern mountains, particularly the two mountain summits. From March to November annually they arrive at LHI from mid-afternoon onwards to display in the airspace above the breeding sites, find mates and visit burrows (Hutton 1991). Baiting is currently scheduled to commence in June 2017. Helicopter strike with those birds involved in courtship and incubation will be avoided by restricting helicopter flights around the southern mountains to midday on each day of baiting. The majority of returns from foraging to provision chicks occur after early July (Marchant and Higgins 1990) avoiding any overlap with proposed helicopter movements, which will be monitored closely during the program..

Whilst temporal considerations are important, it must also be recognised and acknowledged that due to the persistence of the toxicity of the bait, primary non target mortality could continue until the baits disintegrate, and thus a secondary poisoning risk is present. However, this is expected to be minimal as the Providence Petrels forage in deep water at sea where its diet consists of fish and squid. Ongoing monitoring during and following the baiting operation will be used to determine the efficacy of mitigation measures and the significance of impacts on non-target species. Where non-target species mortality is significant (which is expected to be minimal), procedures and protocols will be adapted and contingency measures will be adopted. These decisions will be informed by the SAC and project stakeholders.

Action	Responsibility
Undertake baiting program during winter while the majority of migratory seabirds are absent from LHI group.	LHIREP Manager
Undertake aerial baiting of the southern mountains between mid morning and early afternoon to avoid Providence Petrel flight paths.	

3.3 Helicopter Over Flight Heights Around Providence Petrels

Only experienced pilots with island eradication bait laying experience will be used during the REP to aerially bait areas around providence Petrel nest sites. Pilots will be briefed daily before flights to be well informed of the location and direction of departing foraging birds before baiting begins. Although it is very unlikely any birds will be present due to early departure from the island to foraging grounds at sea, pilot safety and bird impacts at anytime must be taken into consideration.

Providence Petrel breeding grounds are located on the southern end of Lord Howe Island on the slopes of Mt Lidgebird and Mt Gower. Due to the inaccessible terrain, a mitigation team member will view all baiting over-flights from Capella Hill which provides a clear view of all mountainous nesting areas on the southern mountains. In order to view Providence Petrels flight paths behind the mountains a second mitigation team will be observing flight paths via a boat from the ocean behind Mt Gower. Should Providence Petrels display unusual behaviour or become overly agitated during baiting over-flights, the observer will contact the pilot by radio to instruct on an alternative action, which may include gaining further altitude to reduce the proximity to birds while maintaining the flight path, or abandoning the flight path and returning at a later time from a different altitude. Both observers will, in any case, provide a commentary on the birds' behaviour to the pilot during each flight, to supplement or confirm what the pilot will be seeing beneath the helicopter.

Action	Responsibility
All aerial baiting over seabirds colonies to be conducted while foraging birds have departed for sea feeding grounds on LHI	Mitigation Team Manager
Two observer teams will be on site and in contact with pilots. If unacceptable disturbance is observed baiting is to be temporarily ceased pending advice from SAC and mitigation Team Leader	Mitigation Team Manager
Report over flight observations of bird movement to pilots ASAP from observation points nominated.	Mitigation Team Manager / Pilots

3.4 Spotlighting and Shooting Masked Owls

Spotlighting is expected to be a component of the field work in both locating and eliminating surviving Masked Owls during the REP. Spotlighting is generally low-impact on non-target species although one area of concern has been identified. Firstly, large numbers of burrow-nesting petrels are active at night and may be drawn to light beams used for locating owls. Disorientation of some birds is possible in this circumstance and care will need to be exercised by field staff to keep light beams as horizontal as practical in searching for owls. Field staff will be fully briefed on possible impacts and shall be instructed to minimise the use of spotlights around Petrel nest sites. If impacts on breeding colonies are observed, SAC advice will be sought to assist with minimising further impacts. It needs to be recognised however that although the majority of Masked Owls are likely to succumb to secondary poisoning by eating poisoned rodents, spotlighting will be an essential tool for locating owls and some impact may occur as a result of searching for remaining owls. Any deleterious impacts to wildlife that results from these activities shall be fully documented.

The primary rifle calibre to be used is the .17 HMR. While shooting is expected to account for the majority of owls surviving secondary poisoning from baiting, the numbers are expected to be relatively low. . It is estimated that currently there are between 10 and 100 pairs present on LHI (DECC 2007). Shooting teams will only comprise of fully qualified and experienced licensed hunters under LHI Firearms Policy Regulations.

Maps of known burrowing petrel breeding colonies will be provided to staff and staff will be trained in methods for minimising impacts on burrows, vegetation and soils. This is to ensure that the trampling of burrows is minimised, particularly during breeding season if shooting activities are to be undertaken.

Action	Responsibility
All hunting staff to be briefed on the potential impact of spotlighting Masked Owl	Eradication Team Leader
All hunting staff to be made aware of the location of burrowing petrel colonies and trained in methods for minimising impacts on burrows, vegetation and soils.	Eradication Team Leader
Any negative impacts are to be recorded and reported with advice sought to further mitigate future impacts	Eradication Team Leader

3.5 Bait Quantities, Label Requirements and APVMA Conditions

Pestoff 20R baits will be used as per the APVMA conditions and label requirements.

To further reduce the likelihood of accidental poisoning of non-target species, Australian Pesticides and Veterinary Medicines Authority permit conditions and brodifacoum label procedures for handling, transport, clean-up and disposal of pesticides will be followed.

Action	Responsibility
All conditions associated with bait handling, spreading and disposal to be adhered to.	LHIREP Manager
Handling, transport, clean-up and disposal of the pesticide <i>brodifacoum</i> must be undertaken in accordance with the Pestoff 20R label requirements and APVMA permit conditions.	LHIREP Manager

3.6 Collection of Biological Samples

Samples from deceased wildlife may be collected for two different reasons during LHIREP; 1) to confirm species and determine sex of non-target species killed, or 2) to determine the levels of brodifacoum in deceased individuals of the non-target populations.

Samples for brodifacoum testing

The collection of samples to assess the amount of brodifacoum within the non-target species is slightly more labour intensive than genetic samples, although very straightforward when abdomens are opened for assessment of haemorrhaging. Samples can be collected to confirm the cause of death on those carcasses where it is unclear, as well as providing information on toxic loads and potentially the longevity of the toxin within non target populations. It must be noted that sample information will have to be sent to Brisbane for testing at a NATA accredited analytical laboratory.

Livers provide the most appropriate tissue for brodifacoum samples to be collected from. These must be frozen once collected. Ten samples to be collected from code 2 and 3 carcasses (see Appendix 3) per species per month. The sample collection process will be in accordance with the 'NZ vertebrate pest residue database guidelines', copies of which will be held on Lord Howe Island and used as a reference by field staff.

Action	Responsibility
Genetic samples will be taken from all non-target species that are identified as likely to have been killed by brodifacoum poisoning.	Mitigation Team Manager
10 samples of code 2 & 3 non-target species carcasses to be collected each month to test for brodifacoum levels	Mitigation Team Manager
Information on non-target species mortality and cause of death will be collected, collated, and reported on a weekly basis to the SAC, Steering Committee, and LHIREP.	Mitigation Team Manager

3.7 Dog Training in Relation to Non-target Species Avoidance

Dogs used for detecting rodents on Lord Howe Island are specifically trained and certified to avoid impacts on non-target species during the Monitoring Phase of the program.

Only dogs that have undergone rigorous training and have met assessment criteria will be used on Lord Howe Island during this phase of the operation to ensure that impacts on other wildlife are minimised.

Dogs will undergo training for deployment to Lord Howe Island in late August 2017. A significant part of the training, in terms of both duration and cost, is the training for aversion to non-target species. Dogs are trained to be absolutely obedient and to be averse to the scents or presence of any animals other than rodents. The dogs undergo two levels of assessment based on criteria developed specifically for this project, and are certified by the Project Dog Training Coordinator before they are considered to have met the standard required for use on the island.

Action	Responsibility
All dogs to be trained to avoid non-target species. All dogs used on Lord Howe Island must meet the requirements of the training modules contained in the Lord Howe Island Pest Eradication Project Dog-Training Standards and be certified by the Project Dog Training Coordinator as having met those requirements prior to commencement of hunting operations	LHIREP Manager
Any impacts of dogs on non-target species to be recorded and reported	Eradication Team Leader

3.8 Non-target Species Impacts Mitigation Team

As part of the REP aerial baiting and hunting teams, a team led by a designated Mitigation Team Manager will be present on Lord Howe Island for the duration of the baiting operation and at least until 31st August 2017.

A core team of mitigation personnel will be supervised by the Mitigation Team Manager or Eradication Team Leader from the commencement of baiting. These staff will be employed with the specific task of implementing non-target mitigation measures on Lord Howe Island as prescribed in this plan. The baiting teams are expected to range from 22 -30 personal. This larger team allows more flexibility in implementing the core functions of the team, including the search and removal of animal carcasses through the settlement areas, walking trails and designated beach areas. The collection and removal of animal carcasses will be an important part of both non target mitigation and human health concerns through these areas. These teams will also participate in the initial hand broadcast baiting of the settlement areas on the island.

The mitigation team will be supported by other baiting REP staff when not required to undertake other duties. It is expected that an average of 10 personnel per day over the winter period will be required to adequately undertake carcass search and removal to minimise impacts on non-target species through designated areas. As such, it will be the responsibility of the Eradication Team Leader and Mitigation Team Leader to ensure that resources are allocated accordingly.

If non-target species mortalities from poisoning are high, additional staff resources will be allocated from the broader REP team, and/or any other personnel on Lord Howe Island to ensure that carcass search and removal efforts minimise non-target species impacts. Where impacts on non-target species are unacceptable and on the advice of the SAC additional staff must be appointed to assist with rodent carcass collection and removal efforts.

Staff involved in non target species mitigation work will receive induction and training as detailed in appendix 4.

Action	Responsibility
A Mitigation Team Leader will be appointed from the commencement of baiting until at least the end of the distribution of bait. The Mitigation Team leader will be responsible for coordinating and rostering team members, and for the collection and collation of information on non-target species mortality, documenting and reporting this information, and using this information to further inform carcass search and removal.	LHIREP Manager
Once baiting has occurred and been completed during the 2 baiting regimes, the teams will be dedicated solely to carcass search and removal and monitoring of non-target species mortality around the settlement areas and designated walking tracks and beaches..	Mitigation Team Leader
Additional personnel will be tasked with non-target species impact mitigation tasks as required to meet	Eradication Team Leader Mitigation Team Manager

the requirements of the plan, in accordance with baiting progress and non-target species mortalities and on advice from SAC. This includes the requirement for an average of 10 personnel per day over the winter period to be undertaking carcass search and removal activities.	
Non-target mitigation efforts, including carcass search and removal efforts (dates, person hours, location, etc) will be recorded and reported to project stakeholders. This information will also be used to inform systematic and targeted carcass search and removal activities across the island and to ensure that aerial baiting operations do not surpass search and collection efforts.	Mitigation Team Manager

3.9 Collection and Removal/Disposal of Carcasses

The removal of carcasses of both rodents and non-target species killed during the baiting phase of the REP project is proposed to minimise the incidence of secondary and tertiary poisoning of non-target species around the settlement areas only. It will be impossible to remove carcasses from the remote areas of the island.

The premise is that once a carcass is removed, the toxin it contained is no longer available to cause poisoning to no target species on the island, provided it is disposed of appropriately. The removal of dead carcasses from around the settlement area will also reduce the smell of decomposing rodents from around resident's homes and lodge accommodation. This will be confirmed by records maintained by the Mitigation Team Leader and reported to project stakeholders as required.

Trials conducted on Lord Howe Island for toxicity efficacy show that rats take 4 to 10 days to die (Wheeler et al in prep) and mice take 2-20 days to die from brodifacoum poisoning (O'Dwyer 2016). Searches of settlement baited areas will commence from about 3 days after bait has been laid in any area and search effort will continue in a targeted and systematic manner at the instruction of the Mitigation Team Leader. Following bait drops, observations by a mitigation team member will be made to determine the time taken until carcasses first appear, in order to confirm the lag time between bait being laid and the recommended commencement of carcass search and removal. Residents will also be advised to contact the REP team in order to have any exposed dead rodents removed from around the settlement area. A number of areas on the island (particularly in the southern and northern mountainous parts of the island) will be too steep or unstable to support a physical search and removal of carcasses. It is acknowledged that some target and non-target species may be scavenged in areas not accessible to staff.

Action	Responsibility
Baiting operations will be limited in scope and timed to ensure that baited settlement areas can be systematically and comprehensively searched and carcasses collected and disposed of to minimise risk to non-target species on the island.	LHIREP Manager; Mitigation Team Leader
Regular aerial searches and reconnaissance by	Mitigation Team Leader;

mitigation team members across the settlement area will be undertaken to ensure that carcass search and removal is also targeted to areas where high densities of carcasses are observed around the settlement areas.	Eradication Team Leader
Systematic, targeted and adequate carcass search and removal will be confirmed by records maintained by the Mitigation Team Leader and reported to project stakeholders.	Mitigation Team Leader

3.10 Non-target Species

Of the birds that forage in the terrestrial environment on Lord Howe Island, the Woodhen and Currawong provide the largest non-target risk due to their foraging and diet habits. Woodhens breed and forage in the settlement and elevated areas of the island and will scavenge dead rodents while currawongs will also feed on dead or moribund rodents that may have taken bait.. Both these species will be subject to captive management program during the baiting program.

Black/mallard ducks are known to take the Pestoff baits. As such, the carcasses remain toxic could possibly contribute to secondary or tertiary poisoning of non-target species. if carcasses will be found along the coast, as they primarily inhabit the coastline, but also on the plateau, where they also forage and roost. Black/mallard duck are primarily located around the airport around ponds to the east of the airport.

Given the distribution and behaviour of the primary non-target species susceptible to poisoning and the search effort will initially be focussed on the selected beaches until these areas have been systematically covered. Search and collection will then systematically move to higher elevation and other terrain until available carcasses are collected and removed.

Action	Responsibility
Following baiting of an area, systematic carcass search and removal will be targeted at coastal areas and the coastal escarpment in the first instance, followed by systematic coverage of higher elevations and all accessible terrain until all available carcasses are collected and removed.	Mitigation Team Leader

3.11 Search Methodology

The concentration of the search effort will be dependent on the progress of baiting. Due to the relatively small scale of Lord Howe Island, it is expected that baiting for each of the two bait drops (undertaken up to 21 days apart) will be completed in 3-4 days. Once the baiting has been completed, teams will begin systematic search grids through the settlement areas, beaches and high profile walking tracks for carcasses. As stated above, the aerial baiting effort will need to be limited in scope and sequencing to ensure that baiting does not surpass the capacity of carcass search and removal efforts.

In addition to systematic non target carcass search and removal coverage of the island, the Mitigation Team Leader will develop a search protocol to facilitate effective observation and detection of carcasses in the settlement terrains areas of the island. This protocol will be

developed before the commencement of aerial baiting and will be adapted by the Mitigation Team Leader based on experience gained over the course of the carcass search and removal activities as required to ensure that they are effective. The protocol will also be informed by advice from the SAC and should include:

- The identification of systematic search grids through the settlement area to search for carcasses based on GPS grids during the baiting,
- Methods to maximise the likelihood of carcass discovery or detection, preferred distance between personnel, or adapted flora and fauna survey methodologies;
- Altered methods to support adequate detection in difficult terrain or vegetation, e.g. rocky or vegetated areas; and
- Prioritisation of areas based on their likelihood of supporting carcasses

All personnel undertaking search and removal activities will be trained by the Mitigation Team Leader in the implementation of the search protocol.

Action	Responsibility
A search protocol to facilitate effective observation and detection of carcasses from settlement areas, beaches and designated walking tracks will be developed prior to the commencement of aerial baiting. This protocol will be continually adapted and improved as required based on experience gained over the course of the carcass search and removal activities to ensure that they are effective. Advice will be sought from the SAC on the protocol.	Mitigation Team Leader
All personnel undertaking search and removal activities will be trained in the implementation of the search protocol.	Mitigation Team Leader

3.12 Carcass Disposal

Brodifacoum breaks down in the environment from the action of soil micro-organisms. As pellets and carcasses containing brodifacoum decompose, the toxin also breaks down. The baits and poisoned carcasses can remain toxic for at least seven months after being broadcast. The aim of carcass removal is to remove and dispose of poisoned animal carcasses to ensure that they are unavailable to be scavenged by woodhens and currawongs when they are released. Burial and or incineration at the Waste Management Facility is a practical means of disposal available in remote field situations encountered on Lord Howe Island.

All carcasses encountered during search and collection must be disposed of in an appropriate manner that ensures safe disposal and meets label requirements. A disposal protocol will be developed by the Mitigation Team Leader prior to the commencement of baiting that will ensure this objective is achieved. This will be based on 2 options for burial and incineration that exist on Lord Howe Island – in preferred order these are;

- use existing incinerator located at the Waste Management Facility (WMF) to incinerate carcasses (preferred option).
- purpose dug deep burial pits located at the WMF to appropriate depth to allow microbial breakdown of carcasses.

Opening of the skin and body cavity to check for haemorrhaging will also greatly assist decomposition of carcass by allowing better contact between soil and tissue rather than fur/feathers.

Action	Responsibility
A disposal protocol to facilitate effective disposal of carcasses will be developed before commencement of baiting. This protocol will be continually adapted and improved as required based on experience gained over the course of the carcass search and removal activities to ensure that they are effective. Advice will be sought from the SAC on the protocol.	Mitigation Team Leader
All personnel undertaking search and removal of carcasses activities will be trained in the implementation of the disposal protocol.	Mitigation Team Leader

3.13 Documentation

TARGET SPECIES (rodents and owls)

Dead rodents collected will not be recorded however, recording of the following points is mandatory for all non target species carcasses found:

- The date
- The search area – e.g. Lagoon Beach, walking tracks etc.
- The species, sex and carcass condition using standard categories
- The number of and GPS point of each deceased individual found.
- A field autopsy examination to establish whether internal haemorrhaging is evident and thus whether brodifacoum poisoning is the likely cause of death (by a suitably trained employee)
- The disposal method and location
- Any obvious signs of external trauma

NON TARGET SPECIES

For data collection and recording protocols refer to section 4.1.

Equipment list required for searching and burial

Equipment	Purpose
Gloves	Personal hygiene
Sharp knife	To check carcass for internal haemorrhage
GPS	Record location of carcasses and burial sites & search effort
Plastic bags/pack liners	For carrying carcasses to a disposal site
Note book & pencil	For recording data and labelling samples
VHF radio	For coordinating search efforts with other team members
Specimen vials and labels	Storing tissue samples

Pocket knife/scalpels and sharps containers	For sample acquisition
Solid blunt object (mallet, shovel, steel pipe etc)	For euthanasia

Action	Responsibility
Mitigation team members and other LHIREP staff will undertake carcass collection, recording and disposal. Searches will be based on baiting progress, focussed on recently baited areas and coordinated by the mitigation team manager. The level of resourcing will meet the requirements set out in this plan.	Mitigation Team Manager
All non target carcasses collected and disposed will be recorded and reported	Mitigation Team Manager
The level and area of search effort will be recorded and reported	Mitigation Team Manager
Monitoring of carcass disposal sites will occur	Mitigation Team Manager

3.14 Selected Island Beach and Walking Track Searches

Beach and walking track patrols will be undertaken to as required to assist with targeted and systematic carcass search and removal. Of particular attention will be the Lagoon foreshore, Neds Beach and Settlement Beach. Blinky Beach will also be monitored for non target carcasses. Walking tracks including but not restricted too, Transit Hill, Stevens Reserve and Foreshore Walk will also be monitored for carcasses. As a minimum, these will occur in the days immediately following each bait drop, however additional searches will be undertaken as required where non-target species mortality is reported. It is less likely to be effective in locating rodent carcasses, but may assist in the evaluation of the number of possible non-target carcasses. These searches will allow staff to locate carcasses, GPS point and location description and remove them for testing where deemed necessary.

Action	Responsibility
Undertake selected beach and walking trail searches of the island as required to assist with targeted and systematic carcass search and removal.	LHIREP Manager; Mitigation Team Leader

3.15 Euthanasia of Poisoned Wildlife

Euthanasia of poisoned wildlife is considered appropriate for the welfare of affected animals, and to enable mitigation personnel to collect and dispose of what will become a toxic carcass once an animal dies. The removal of these animals may reduce the threat of non-target species poisoning. Euthanasia will only be a feasible option for those animals that are very easily caught and restrained e.g. completely or nearly immobile animals. If an animal is still mobile and not easily caught, it should not be chased. All woodhens and currawongs will all be bought in for treatment with antidote Vitamin K in all instances.

In order to euthanize moribund non target species in New South Wales, necessary training and the appropriate ethics approval to euthanize non-targets is required. Personnel will be trained in euthanasia by blunt trauma/ cervical dislocation as this method is practical for remote field use. Unless a vet is present, it is recommended that all sick animals that can be accessed to be euthanased or rendered unconscious with a strong blow to the head, sufficient for immediate loss of consciousness and for them not to recover.

This method must be properly applied to be effective and humane; therefore training to ensure sufficient skill of the operator is essential. It is proposed that training be undertaken by a number of staff in order to meet these ethics requirements with visiting vets while on the island. These trained staff will then be assigned to search teams during the monitoring period. An appropriate mallet or similar instrument should be used and birds need to be restrained adequately with the head held against a solid surface and one blow with sufficiently force needs to be applied at an appropriate angle to the skull. If not performed correctly, various degrees of consciousness with accompanying pain can occur. All incidents of euthanasia must be documented and reported in weekly reports to SAC and the steering committee. Documentation must include details of the demeanour/condition of the bird prior to euthanasia, as well as details of the method and efficacy of euthanasia. This process will enable appropriately qualified and experienced personnel to make informed assessments and provide advice as required.

Action	Responsibility
Moribund poisoned target and non-target species to be euthanized by appropriately trained personnel and carcasses disposed as per disposal protocols	Mitigation Team Leader
All euthanasia of non-target species to be documented and reported	Mitigation Team Leader

3.16 Contingency Planning and Adaptive Management Measures

Given the residual uncertainty regarding the magnitude of the impact of baiting on non-target species, the efficacy of the mitigation measures proposed, and the risks associated with the action for threatened bird species, an adaptive management framework is critical to ensure impacts are effectively managed over the duration of the operation.

The reality of logistics associated with undertaking works on Lord Howe Island means that large scale approaches for mitigating the effects of the REP baiting operation must be planned and organised and the scope for implementing new measures is limited. However, if the operation is not managed effectively it could lead to long-term and devastating impacts on populations of threatened species, in particular the LHI Woodhen and LHI Currawong. As such, all efforts must be made to ensure that impacts are minimised and this will require the investigation and implementation of appropriate mitigation measures.

Within two weeks of the commencement of baiting, the Mitigation Team Leader on the advice of SAC and other relevant experts, will identify key threshold impact levels (e.g. number of seabirds strikes via helicopter flights, number of moribund currawongs or woodhens found), or as well as contingency measures that will be implemented should those thresholds be breached. Thresholds will be based on the acceptability of the level of mortality (if any) on populations of Providence Petrels (and other species where relevant), considering the ability of these populations to recover in the short and long-term and conservation advice and published information for these species.

The following contingency measures must be considered by the Mitigation Team Leader and the SAC and allocated to appropriate impact thresholds:

- Allocation of additional personnel to carcass search and removal, either from the LHIREP team, or transport of additional of trained personnel on the island;
- Modification of search procedures (including additional search protocols and disposal protocols);
- Temporary suspensions of aerial baiting operation until risks are mitigated, particularly for Providence Petrels.

If a contingency measure cannot be implemented due to logistical reasons, this must be adequately justified. Adopted contingency measures must be implemented.

Action	Responsibility
Within two weeks of commencement of baiting, the Mitigation Team Leader based on advice from SAC and other relevant experts will identify impact thresholds for Providence Petrels and corresponding contingency measures based on the content of this plan. These will be reported to project stakeholders, including the Steering Committee and DSEWPAC.	Mitigation Team Leader and SAC
Based on the results of non-target species mortality monitoring, the adoption of specific contingency measures must be implemented if requested by SAC or LHIREP	Mitigation Team Leader and SAC

3.17 Monitoring the Extent of Non-target Mortality

Monitoring of wildlife populations on Lord Howe Island will be consistent with LHIREP's guidelines. This will include:

For a period of at least 5 years following the completion of baiting:

- annual whole-of-island census and breeding success monitoring of the Lord Howe Island Woodhen population;
- annual census and breeding success monitoring of the Lord Howe Island Currawong.

Survey information for other species will be collected as per the ongoing Lord Howe Island Board monitoring regimes. The survey area for Woodhen and Currawong monitoring may be increased if resources are available, and the following monitoring regime will be implemented in relation to Lord Howe Island birds if resources permit:

- annual whole-of-island census and breeding success monitoring of Woodhen and populations for a period of at least five years following completion of aerial baiting as per current annual monitoring program .
- re-survey and continue to refine Woodhen and Currawong numbers and study areas annually for five years following the baiting.

Action	Responsibility
Implement the monitoring of non-target species.	LHIREP Manager

4 Reporting Requirements

4.1 Field Data and Sample Collection

The mitigation team manager will be responsible for the effective documentation of field data and sample curation. The SAC and LHIREP will provide guidance and may request additional data to be documented as the program proceeds. A Microsoft Excel spreadsheet will be used to store and collate all records relevant to the mitigation team work. Field data will be collected in record sheets, see Appendix 2, based on the required information contained in table 2 below.

Table 2 – Dead non-target species, required information for collection

Identifying No/Code	Species, date and finder code e.g. NGP_dd/mm/yy_LG_1
Date	Full dd/mm/yy format
Time	24 hr clock
Species	Common name
Live/Dead	
Euthanised	NA/Y/N - if yes, method.
Carcass code	Carcase condition codes as provided by BMS
GPS Easting	
GPS Northing	
Finder/Recorded by	Name and code e.g. Anthony Wilson (AW)
Location	Keep short - but provides verification of GPS if something goes awry
Necropsied	Y/N. If yes, comments? Brodifacoum confirmed?
Adult/Juvenile	
Sex	M-F-UN - if known, how determined? (necropsy/morphometric - GPs can be sexed in the field with bill measurements - would provide real time data)
Genetic Sample Collected	Y/N - if Y use ID code with a G in it?
Broadifacoum Sample collected	Y/N - if Y use ID code with a B in it?
Comments	Particularly info if found
Banded	Y/N if yes include number
Disposal method	Incineration/ burial
GPS tracklog ID	

4.2 Reporting Structure and Frequency

Weekly reports will be produced and provided by the Mitigation Team leader directly to the SAC, Steering Committee, and REP Project Manager. Reports will summarise non-target species mortality, the percentage of populations of threatened birds poisoned to date, and the efficacy of carcass search and removal operations. During the REP reports will be produced and reported by the Mitigation Team Leader. Once phase 2 (second baiting) of the REP commences, the reports will be compiled and reported directly to the above groups by the Eradication Team Leader who will also be filling the role of Mitigation Team Leader.

The Mitigation Team Leader, and following his departure from the island, the REP Manager shall be responsible for ensuring the comprehensive collection and documentation of the required information on non-target species mortality. Included in this is the accurate and comprehensive compiling of information in the non-target mortality spreadsheet and the curation and transfer of biological samples.

More frequent reports will be provided if requested. The reports will include:

1. Baiting progress – including baiting dates, quantities and broadcast areas;
2. Maps and locations of non-target carcasses;
3. Summary of non-target mitigation works undertaken;
4. Summary of samples collected to date;
5. Number and species breakdown of carcasses found;
6. An ongoing figure of carcasses collected since baiting commenced;
7. Incidental relevant information;
8. An updated spreadsheet containing the information described in section 4.1;
9. Details of any euthanasia events.

Action	Responsibility
Weekly reports will be provided to SAC, the LHIREP manager, the steering committee and in accordance with this plan.	Mitigation Team Leader

4.3 Interim and Final Reports

An interim and final report will be completed for the SAC, the steering committee and the LHI Board within 3 months following completion of baiting and once the mitigation team complete works on Lord Howe Island REP. The report will be completed by the LHIREP Project Manager. A draft of the report will be forwarded to SAC for final advice and comment. The report will summarise monitoring results collected on non-target species mortality, in particular the impacts on populations of threatened Lord Howe Island Woodhen and Currawong.

Action	Responsibility
An interim report and final report will be provided to SAC, the steering committee and LHI Board within 3 months following completion of baiting and in August 2017	LHIREP Manager

4.4 Acknowledgements

This non-target species impact mitigation plan has been produced with the significant input of the SAC members, Anthony Wilson and as well as members of the LHIREP.

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Appendix 2 – Indicative Field Data Recording Sheet

Team member:

Date	Time	Species	Carcass code	Scavenged ?	Location	GPS easting	GPS northing	Brodifacoum Y/N/?	Samples collected	Notes

Carcass code: 1 - Alive, 2 - Good condition

3 Decomposed but organs intact

4 - Advanced decomposition, 5 - mummified or

Samples collected: (G)- genetic or (B) - tissue samples for brodifacoum testing

Notes to include: band numbers, euthanasia, disposal method, brood patch presence

skeletal

Appendix 3 – Carcass Codes

Carcass Condition Classification (following Geraci and Lounsbury 2005)

CODE 1 – Live Animals

Useful for: morphometrics, biopsy, blood studies, toxicology, microbiology etc

CODE 2 – Carcass in Good Condition (Fresh)

Useful for: morphometrics, genetics, toxicology, nutritional analyses, gross pathology

Characteristics: normal appearance, usually with little scavenger damage; fresh odour, minimal drying and wrinkling of skin, eyes and mucous membranes; eyes clear; viscera intact and well defined (liver is a good indicator), gut contains little or no gas.

CODE 3 – (Decomposed but organs basically intact)

Useful for: molecular analyses, gross pathology, histopathology, toxicology,

Characteristics: carcass intact, , possible scavenger damage, mild odour, , mucous membranes dry, , eyes sunken or missing, muscles soft and poorly defined, blood haemolyzed, viscera soft friable but still intact,

CODE 4 – (Advanced decomposition)

Useful for: morphometrics, life history, DNA, parasitology, gross pathology

Characteristics: carcass may be intact but collapsed, skin sloughing, severe scavenger damage likely, strong odour, muscles nearly liquefied and easily torn, viscera friable and difficult to dissect, gut gas filled,

CODE 5 – (Mummified or Skeletal Remains)

Useful for: morphometrics, gender and DNA analyses

Characteristics: skin draped over skeletal remains, any remaining tissues are desiccated.

Appendix 4 – Mitigation Team Training and Induction Checklist

- The aims of the non target mitigation program
- The methods to be employed (familiarity with the mitigation plan)
- Identification of seabird species (e.g. Provenance Petrels)
- What brodifacoum poisoning looks like (necropsy process)
- Genetic and brodifacoum sample collection, labelling and storage
- Data collection requirements
- Special Management Area briefings
- Briefing on behaviour around nesting birds
- Disposal methods for poisoned carcasses at the Waste Management Facility (WMF)
- Euthanasia – in which circumstances it will occur, methods to be used and equipment available
- Burrowing petrel colony locations and methods for determining reduction in collapsing burrows during carcass collection and Masked Owl eradication shooting programs.