Sunwater: Rookwood Weir Project EPBC 2009/5173 Turtle habitat enhancement program: Expanded feral pest animal management plan

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Table of contents

List of abbreviations	5							
کاossary6								
Declaration	8							
Executive summary	9							
1 Purpose and objectives of this management plan 1	1							
2 Expanded management area 1	2							
2.1 Overview	2							
2.2 Expanded feral pest animal management area1	2							
2.3 Terrain and land access 1	4							
2.4 Landholder engagement and involvement 1	4							
2.5 Priority feral pest animal control areas 1	6							
3 Analysis of risks to achieving management objectives and plan outcomes 2	6							
4 Feral pest animal control measures 2	9							
4.1 Aerial shooting strategies and control effort	0							
4.2 Ground shooting	1							
4.3 Wild dog and fox control	1							
4.4 Adapting pest control techniques	2							
4.5 Timing of management measures	3							
4.6 Responsible parties	5							
4.7 Emergency procedures	5							
5 Offset success measures	5							
5.1 Evaluation methodology:	5							
6 Monitoring and reporting	6							
7 Adaptive management and plan review 3	8							
8 Conclusion 3	8							
Reference list	9							
Appendix A: Feral predator control record templates4	0							
Appendix B – Standard operating procedures 4	1							
Appendix C: Aerial shooting of feral pigs: Standard Operating Procedure 4	2							

Index of figures

Figure 1: Project location	10
Figure 2: Expanded feral animal control management area	13
Figure 3: Sector 1 priority control area	17
Figure 4: Sector 2 priority control area	18
Figure 5: Sector 4 priority control area	19
Figure 6: Sector 5 priority control area	20
Figure 7: Sector 8 priority control area	21
Figure 8: Sector 9 priority control area	22
Figure 9: Sector 16 priority control area	23
Figure 10: Sector 18 priority control area	24
Figure 11: Sector 19 priority control area	25

Index of tables

Table 1: Priority control areas	. 16
Table 2: Risk matrix	. 27
Table 3: Risk assessment for the Expanded Feral Pest Animal Plan	. 28
Table 4: Timing of pest control actions	. 33
Table 5: Feral pest animal management actions, triggers and corrective actions	. 34
Table 6: Monitoring and reporting schedule and methodology to be used	. 37

List of abbreviations

Abbreviation	Description
DAWE	Department of Agriculture, Water and the Environment (Commonwealth) (former)
DCCEEW	Department of Climate Change, Energy, the Environment and Water (Commonwealth)
DEWHA	Department of the Environment, Water, Heritage and the Arts (former)
DoEE	Department of the Environment and Energy (Commonwealth) (former)
DoR	Department of Resources (Qld)
DSEWPAC	Department of Sustainability, Environment, Water, Population and Communities (Commonwealth) (former)
EPBC Act	Environment Protection & Biodiversity Conservation Act 1999 (Cth)
km	kilometres
LFRIP	Lower Fitzroy River Infrastructure Project
m	metres
MNES	Matters of national environmental significance
MSES	Matters of state environmental significance
NC Act	Nature Conservation Act 1992 (Qld)
OAG	Offset Assessment Guide (DCCEEW)
OIA	Offset Investigation Area
OMP	Offset Management Plan
PCA	Priority control area
PNPA	Priority nest protection area
Project	Rookwood Weir Project
TNPMP	Turtle Nest Protection Management Plan
USL	Unallocated state land

Glossary

Term	Definition
1080	Sodium fluoroacetate (1080) is a very useful pesticide for the control of declared pest animals and has been used throughout Australia since the early 1960s. 1080 is the most efficient, humane and species-specific pesticide currently available for declared pest animal control in Australia. In Queensland, 1080 is registered for use in the control of wild dogs, feral pigs, foxes and rabbits. Native animal species are generally less susceptible to fluoroacetate than introduced species. 1080 is water-soluble and is readily broken down by naturally occurring bacteria and fungi. It therefore does not cause a build-up of toxic residues in soil, water or plants, nor does it bioaccumulate in organisms.
Appropriately qualified contractor	Means a contractor who is highly experienced, suitably licensed and accredited, and with qualifications that are current within a 12-month period prior to undertaking any work.
Business day	A day that is not a Saturday, a Sunday or a public holiday in the state or territory of the action.
Compliance report/s	 Written reports: a) providing accurate and complete details of compliance, incidents, and non-compliance with the conditions and plans; b) consistent with the Department's Annual Compliance Report Guidelines (2014) (or subsequent published revision); c) include a shapefile of any impact of any protected matters, or their habitat, undertaken within the relevant 12 month period; and d) identifying the version/s of the plans prepared and in existence in relation to the conditions of this approval during the relevant 12 month period.
Defining bank	 The bank which confines the seasonal flows but may be inundated by flooding from time to time. This can be either: the bank or terrace that confines the water before the point of flooding; or where there is no bank, the seasonal high water line which represents the point of flooding.
Department	The Australian Government Department responsible for the <i>Environment Protection and Biodiversity Conservation Act 1999</i> (Cth) from time to time.
Feral predator	A feral pig, wild dog or European fox
Independent suitably qualified expert	 Person/s: that does not have individually, or by employment or family affiliation, any conflicting or competing interests with the approval holder and/or suitably qualified ecologist; and if the role is in relation to the greater glider, possessing a postgraduate degree (or equivalent or better) and a minimum 10 years of relevant experience in greater glider ecology research; or if the role is in relation to the koala, possessing a postgraduate degree (or equivalent or better) and a minimum 10 years of relevant experience in greater glider ecology research; or if the role is in relation to the koala, possessing a postgraduate degree (or equivalent or better) and a minimum 10 years of relevant experience in koala ecology research.
Minister	The Minister administering the <i>Environment Protection and Biodiversity Conservation Act 1999</i> .

Term	Definition
Plan/s	Any of the documents required to be submitted to the Department, implemented by the approval holder and/or published on its website in accordance with the approval conditions.
Riparian zone	The area within a minimum of 100 metres of the defining bank of any watercourse (as defined under the Queensland <i>Water Act 2000</i>).
Sensitive ecological data	Data as defined in the Australian Government Department of the Environment (2016) Sensitive Ecological Data – Access and Management Policy V1.0.
Suitably qualified ecologist	A person who has professional qualifications and at least 3 years of work experience designing and implementing surveys for the listed threatened species and their habitat, and can give an authoritative assessment and advice on the presence and habitat requirements of the listed threatened species using relevant protocols, standards, methods and/or literature.
Suitably qualified person	A person who has professional qualifications, training, skills and/or experience related to the nominated subject matter and can give authoritative independent assessment, advice and analysis on performance relative to the subject matter using the relevant protocols, standards, methods and/or literature.
Website	A set of related web pages located under a single domain name attributed to the approval holder and available to the public.

Declaration

In making this declaration, I am aware that section 491 of the Environmental Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) makes it an offence in certain circumstances to knowingly provide false or misleading information or documents to specified persons who are known to be performing a duty or carrying out a function under the EPBC Act or the Environment Protection and Biodiversity Conservation Regulations 2000 (Cth). The offence is punishable on conviction by imprisonment or a fine, or both. I am authorised to bind the approval holder to this declaration and that I have no knowledge of that authorisation being revoked at the time of making this declaration.

Signed:

CR. Rand/

Full name: Chris Delamont
Organisation: Sunwater Limited
EPBC Referral Number: EPBC 2009/5173
Turtle habitat enhancement program: Expanded feral pest animal management plan
Date: 22/11/2023

Executive summary

The Rookwood Weir Project (the **Project**) involves the construction of the new Rookwood Weir component of the Lower Fitzroy River Infrastructure Project (**LFRIP**) (see *Figure 1*). The LFRIP was approved by the Queensland Government's Coordinator General in December 2016 and the Australian Minister for the Environment in February 2017 (EPBC 2009/5173), subject to conditions.

Sunwater Limited (**Sunwater**) (ACN: 131 034 985; ABN: 17 020 276 523) is the sole proponent of the Project. Sunwater is a statutory government-owned corporation under the Queensland *Government Owned Corporations Act 1993*. Sunwater owns and operates the Queensland Government's bulk water supply and distribution infrastructure located throughout regional Queensland.

As per Condition 5 of the approval issued by the Department of Climate Change, Energy, the Environment and Water (**DCCEEW**) under the *Environment Protection and Biodiversity Conservation Act 1999* (**EPBC Act**), offsets for the impacts of the Project to turtle aquatic habitat was to be delivered via a financial offset. In accordance with the Queensland environmental offsets policy's financial settlement calculator, the total cost to offset turtle aquatic habitat is \$9,470,000. Delivery of this financial offset is proposed to occur through the implementation of on-ground offsets of which the expanded 'feral pest animal' management program is part thereof. The total cost of the turtle management and conservation effort undertaken as part of the Rookwood Weir Project is estimated at approximately \$15,900,000.

This total cost includes management actions dedicated to implementation of Nest Protection Management Plans for the Fitzroy River turtle (*Rheodytes leukops*) and white-throated snapping turtle (*Elseya albagula*) over the life the Project, to offset the inundation of turtle nests within the impoundment and downstream of Rookwood Weir. Additionally the project has/will invest in onground turtle and turtle habitat protection, research and species management associated with pre-clearance surveys, a turtle movement study, turtle passage infrastructure and monitoring, and Species Management Programs. The additional conservation efforts will mitigate the impacts caused by the Rookwood Weir Project and will substantially contribute to the recovery of the Fitzroy River turtle and white-throated snapping turtle in the Fitzroy River catchment.

The delivery of the offset shall occur through this plan and the combination of the following plans:

- Rookwood Weir Turtle Management and Conservation Outcomes Report
- Rookwood Weir Fitzroy River turtle and white-throated snapping turtle nest protection management plans
- Rookwood Weir Operations Species Management Plan

It is proposed that the on-ground conservation outcomes achieved by the Project during the design and construction phase, above and beyond those required by approval conditions, contributes as partial payment of the \$9,470,000 financial contribution required for turtle aquatic habitat. The remaining offset for aquatic habitat is proposed to be delivered through additional on-ground conservation actions for the two turtle species. Actions are expected to include extended pest control management plan (this offset management plan (**OMP**)), extended monitoring of the turtle ramp and/or other conservation actions agreed with DCCEEW.¹ This is detailed in the Rookwood Weir Turtle Management and Conservation Outcomes Report.

¹ GHD, August 2022, Rookwood Weir – Turtle Management and Conservation Outcomes Report.

This document is the *Turtle habitat enhancement program: Expanded feral pest animal management plan* (**Expanded Feral Pest Animal Plan**) that supplements both the Fitzroy River turtle and white-throated snapping turtle nest protection management plans (**TNPMPs**).² This Expanded Feral Pest Animal Plan details the implementation, management and monitoring of an expanded pest feral animal control program that will specifically target the priority nest protection areas (**PNPA**s) (the areas around identified turtle nesting sites, as identified in the TNPMPs (GHD, 2022a and GHD, 2022b) and extended inland for up to 1 kilometre (**km**). The implementation of this plan will contribute to the overall success of the two THPMPs.



Figure 1: Project location

 Vightreftight/WUBriskandP.pojects/41/29978/GIS Maps/MXD/241 Data source: GHD: Invindation Area 46.2 (2010); Sources: Esri, HERE, Garmin, Internape, increment P. Corp., GEBC O, US OS, FAO, NPS, NRC 4N, GeoBase, IGN,

 29978_169_LocalityMap_Rev0.mxxl
 Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, @ OpenStreedMap contributors, and the GIS User Community Created by: AJ

² GHD, April 2022, Rookwood Weir – Fitzroy River Turtle Nest Protection Management Plan, (GHD 2022a) and GHD, April 2022, Rookwood Weir – White-throated Snapping Turtle Nest Protection Management Plan (GHD 2022b).

1 Purpose and objectives of this management plan

This Expanded Feral Pest Animal Plan supplements the overarching TNPMPs that have been prepared by GHD, being:

- Rookwood Weir Fitzroy River Turtle Nest Protection Management Plan, (GHD 2022a)
- Rookwood Weir White-throated Snapping Turtle Nest Protection Management Plan (GHD 2022b).

This Expanded Feral Pest Animal Plan details the expanded feral pest animal management area and the specific management actions that will be undertaken in managing and reducing the impacts of feral predators on turtle nesting sites identified within the TNPMPs. This plan should be read in conjunction with the two TNPMPs, and the Rookwood Weir terrestrial OMP.³

The greatest risk to the survival of the Fitzroy River turtle and white-throated snapping turtle is the lack of recruitment into the population (Commonwealth of Australia, 2008; Limpus et al., 2011a). Predation of nests by feral predators, goannas and water rats, plus trampling of nests by cattle results in extremely poor survival of egg clutches (close to 100% of clutches predated each season). Current recruitment rates are not considered adequate to sustain populations within the catchment (Limpus et al., 2011a). The protection and management of nests as part of the TNPMPs will mitigate project specific risks, improve hatching success and hatching rates as well as address the key processes currently threatening the survival of these species throughout the catchment. It is conservatively estimated that the time required for the proposed offset to achieve ecological benefits is five years.⁴

In accordance with EPBC Act approval condition 5, the TNPMPs will be implemented for the life of the Project to better ensure the effectiveness of the management actions in achieving a long-term protection and management of Fitzroy River turtle and white-throated snapping turtle nesting habitat. During the operation of the weir funds have therefore been dedicated to implementing the TNPMPs and therefore achieving long-term protection and management of turtle nesting habitat and recruitment of hatchings into the population to support recovery of the species.

The management actions detailed within this Expanded Feral Pest Animal Plan have been developed to meet the feral predator control outcomes as described in each of the TNPMPs (GHD 2022a and 2022b) as follows:

- Measure of success: Successful implementation (>95%) of planned predator control measures implemented annually.
- Evaluation methodology: Feral predator control measures will be planned and implemented according to industry best practice and measured against planned activities. Feral pest populations will be monitored utilising camera trap arrays on priority control areas (PCA's).

³ Earthtrade, August 2022. Sunwater: Rookwood Weir Project EPBC 2009/5173 Terrestrial Offset Management Plan.

⁴ GHD, 2022a, p.3.

Achievement of the predator control measures are critical to achievement of the overall success measures of each of the TNPMPs, namely:

- a reduction of 80% in feral predator activity on priority pest control areas
- a reduction of 90% in the nest predation rate
- an increase of 90% in the hatchling success rate.

The implementation of this Expanded Feral Pest Animal Plan will be from the balance of funds as detailed in the Rookwood Weir Turtle Management and Conservation Outcomes Report.⁵

2 Expanded management area

2.1 Overview

This EPAP targets the area between Hanrahan Crossing and the northern boundary of Foleyvale (Lot 1LR146), which is the northernmost of the 2 adjoining riverfront properties that contain the terrestrial offset areas. This stretch of the Mackenzie River also has several sandbanks that are noted as either high or medium value nesting banks. It is these areas that will be targeted during this program. It is important to note that the location of the high and medium priority nesting banks will be revised each year after the turtle nest monitoring program described in the TNPMPs (GHD 2022a, 2022b) has located the nests for that season.

Pre-clearance surveys for turtle nesting activity have been undertaken within, upstream and downstream of Rookwood Weir from 2019 to 2021 (GHD, 2022a, section 3.2), as required by EPBC approval condition 3. The results of this survey work have led to the identification of initial PNPAs, which will be located within one or more of:

- the inundation area
- upstream of the inundation area to the terrestrial offset area at Foleyvale
- downstream of the weir to Hanrahan Crossing.

The specific locations of the PNPAs are expected to change throughout the life of the Project. Initially, they are expected to align with confirmed aggregated nesting areas identified during preclearance surveys. Throughout Project operation, the condition, suitability and use of these areas by turtles for nesting will be monitored and alternative PNPAs identified and established based on natural and/or Project-related fluctuations in habitat suitability and actual use by turtles for nesting. These factors will also influence the number and size of PNPAs established annually.

2.2 Expanded feral pest animal management area

The expanded feral pest animal management area has been determined as being within a 1km buffer either side of the centreline of the Fitzroy, Mackenzie and Dawson Rivers between Hanrahan's Crossing and the northern boundary of Foleyvale This area has been divided into 19 sectors as per *Figure 2*. The area contains wetlands and is complex as it intersects 85 different freehold properties.

⁵ GHD, August 2022, Rookwood Weir – Turtle Management and Conservation Outcomes Report.

Figure 2: Expanded feral animal control management area



2.3 Terrain and land access

The terrain in the area is relatively flat, predominantly composed of floodplains. The riverbanks are steep, and often in excess of 20 metres (**m**) in height. Gullies flowing into the river are heavily incised, steep, and provide shelter for animals from observation due to the near-full canopy cover above. Tall and thick vegetation is contained within riparian and wetland areas and often contains a thick understorey which often consists of dense weed species such as lantana (*Lantana camara*), rubbervine (*Cryptostegia grandiflora*) and scattered infestations of parkinsonia (*Parkinsonia aculeata*). The land use in the area is a mix of dryland and irrigated cropping, horticulture and extensive cattle grazing operations.

A significant risk to the success of this pest animal control program is access to freehold land intersecting the expanded feral pest animal management area. Eighty-five holdings adjoin the expanded feral pest animal management area footprint. Access to these properties (and the PCAs contained within them) will be reliant on Sunwater engaging with landholders to obtain permission to carry out feral predator control operations. Community engagement strategies and activities are outlined in *Section 2.4* below.

2.4 Landholder engagement and involvement

Effective communication and consent (to permit aerial shooting, baiting, trapping and pest animal monitoring) will be crucial to the success of this pest control program. Communication with landholders by both Sunwater and pest control contractors should be carefully managed and carried out through trusted points of contact. Strategies to gain, build and maintain landholder involvement are outlined below.

Where access is required on, or activities are undertaken adjacent to Council owned land, Sunwater shall engage with the respective Council (Rockhampton Regional, Central Highlands or Woorabinda) prior to undertaking feral pest management activities.

Gaining landholder permission

All landholders within the expanded feral pest animal management area footprint should be contacted and lines of communication established. At least one landholder event will be held prior to the initiation of the control program, and one landholder event held annually prior to control works. Landholders' permissions will be prioritised to those that intersect with PCAs (at least initially) and should be individually negotiated. Pest control contractors should be trained to industry standards and should understand and comply with operating guidelines for the use of 1080 baits, Standard Operating Procedures (see *Appendix B* and *Appendix C*) and subsequent risk mitigation procedures and techniques.

Maintaining landholder involvement

Effective pest control operations require sustained and integrated effort over medium to long timeframes. Therefore maintaining landholder engagement (and permissions) in the program will be vital to its success. Effective communication of control results and successes, hatchling survival and broader successes of the program will assist in maintaining landholder involvement. Communication strategies should include 6-monthly reports to all landholders (regardless of permission status) containing PCAs (or part of) on their land.

Building permissive intent

Building landholder trust (and access permission) across the entire expanded feral pest animal management area will be important where PCAs may relocate or expand due to the detection of

new or moved nest sites. To enable flexibility and agility in landholder consent; communication should be comprehensive, sustained across the life of this plan and include all landholders.

2.5 Priority feral pest animal control areas

Priority control areas for feral pest animal control will be determined yearly based on the prenesting surveys to be undertaken as part of the turtle nest protection program (GHD, 2022a, 2022b). The PCAs will concentrate on high and medium priority nesting sites within the expanded feral pest animal management area (*Figure 2*).⁶ The PCA areas include the high and medium priority nesting sites and the adjoining areas containing lacustrine, palustrine and/or riverine wetland areas up to 1km either side of the high bank of the river, where access is permitted.

As a result of the turtle monitoring program and turtle nest mapping undertaken to date, the sectors that are to be targeted as being the initial PCAs are listed in *Table 1* and shown in *Figure 3 to 11* inclusive.

Sector	Figure	Location	Number of turtle nesting sites	Area (ha)	Wetlands adjacent to the area	Comments
1	3	Hanrahan's Crossing	2	858	Lacustrine	Large areas of
2	4	Sandbanks at bends below the weir	2	2,026	and palustrine	wetlands behind the riparian area
4	5	Above the weir	5	1,665		Gullies and creeks
5	6		3	1,175		above the weir leading to large sandbanks
8	7	Bend in the Fitzroy River at Gogango	1	1,400		Alluvial areas either side. Main focus will be
9	8	Stretch of river	2	1,534		the riparian vegetation
16	9	Stoney Creek below Apis Creek Road crossing	5	1,858	Lacustrine	Riparian vegetation and large gullies leading to the river and large sandbanks
18	10	Foleyale	0	1,447		Large areas of
19	11		0	523		wetlands behind the riparian area
			Total:	11,986		

Table 1: Priority control areas

⁶ GHD (2022a), Section 4.4.

Figure 3: Sector 1 priority control area



Figure 4: Sector 2 priority control area



Sunwater: Rookwood Weir: EPBC 2009/5173 – Expanded Feral Pest Animal Management Page 18 of 50

Figure 5: Sector 4 priority control area



Figure 6: Sector 5 priority control area



Figure 7: Sector 8 priority control area











Figure 10: Sector 18 priority control area



Figure 11: Sector 19 priority control area



3 Analysis of risks to achieving management objectives and plan outcomes

Potential risks to achieving the management objectives and outcomes have been considered in the Plan (*Table 3*). They have been assessed against the risk matrix (*Table 2*) that was supplied by DCCEEW. The risk matrix has been used to assess the risk that the plan's objectives will not be met and identify the sources of those risks and strategies for managing them.

The risk assessment:

- a) identified events that will, may, or are likely to impact the attainment of the completion criteria
- assessed the likelihood and consequences of those events, and characterises residual risk levels, taking into consideration the mitigation of the risk by implementing the management actions
- c) identified the level of uncertainty in mitigating the risk with the management actions and trigger criteria and corrective actions until the risk is reduced to an acceptable level.

Table 2: Risk matrix

RISK MATRIX										
Qualitative measure of likelihood (how likely is it that this event/circumstances will occur after management activities are implemented)										
Highly likely	,	Is expected to occur in most circumstances								
Likely		Will probab	ly occur during	g the life of the	project					
Possik	ole	Might occur	r during the life	e of the project						
Unlike	ly	Could occu	r but consider	ed unlikely or c	loubtful					
Rare		May occur	in exceptional	circumstances	i					
Qualita occur)	ative	measure of	consequence	es (what will b	e the consec	quence/result	if the issue does			
Minor		Minor incide (e.g. short- characteris	ent of environi term delays to ed corrective a	mental damage achieving plar actions)	e that can be n objectives, i	reversed mplementing	low-cost, well-			
Moder	ate	Isolated but substantial instances of environmental damage that could be reversed with intensive efforts (e.g. short-term delays to achieving plan objectives, implementing well-characterised, high-cost/effort corrective actions)								
High		Substantial instances of environmental damage that could be reversed with intensive efforts (e.g. medium-long term delays to achieving objectives, implementing uncertain, high-cost/effort corrective actions)								
Major	Najor Major loss of environmental amenity and real danger of continuing (e.g. plan objectives are unlikely to be achieved, with significant legislative, technical, ecological and/or administrative barriers to attainment that have no evidenced mitigation strategies)									
Critica	l	Severe wid damage (<i>e.g. plan</i> o	espread loss o	of environmenta	al amenity an chieved, with	d irrecoverabl	e environmental mitigation strategies)			
			Consequen	се						
			Minor	Moderate	High	Major	Critical			
po	High	ly Likely	Medium	High	High	Severe	Severe			
iho	Like	ly	Low	Medium	High	High	Severe			
ikel	Pos	sible	Low	Medium	Medium	High	Severe			
_	Unli	kely	Low	Low	Medium	High	High			
	Rare	•	Low	Low	Low	Medium	High			

Table 3: Risk assessment for the Expanded Feral Pest Animal Plan

Note: The risk ranki	ng codes relate to the risk matrix as follow	s: L	. = Lik	elihoo	d C = Consequence	R = Risk			
Risk	Threats	ln r	Initial risk M ranking L C R		Management measures	Management measures/actions	Residual ri ranking		
		L							R
					Force majeur	re events			
Cyclones/ severe tropical lows/ flooding	The most significant impact from tropical cyclones or tropical lows is typically flooding. Systems generally form between November and April.	Likely	Moderate	Medium	Mitigate impacts to PNPAs	Limited mitigation measures can be implemented. The expanded feral pest animal management area and the PNPAs are in parts of the landscape that regularly experience flooding from force majeure events. This is due to the focus on areas that contain wetlands and are near to turtle nesting sites. However, the likelihood of extended flooding of the areas is extremely low due to flood waters usually receding from areas outside the wetlands and within the bed and banks of the river, within 1 week. ⁷ Timing schedules for pest control activities (such as ground baiting) are flexible and can accommodate extreme weather events. Remove monitoring cameras before they would become inundated.	Likely	Minor	Low
				F	Feral Pest animals in the Pr	iority Nest Protection Areas			
Increased nest predation by feral predators within the Expanded Feral Animal Control Area	Pest animal control operations are ineffective in reducing impacts upon turtle nesting success.	Highly likely	High	High	Aerial shooting feral pigs Baiting foxes and wild dogs Pig baiting if indicated Supplementary trapping of pigs and dogs	The implementation of a coordinated and integrated feral predator program will control feral pest animals within the PCA's during nesting and hatching times. Control will be undertaken by aerial shooting and 1080 ground baiting to best practice industry standards of quality assurance, technique, timing, monitoring and overall functional response (the amount of effort required to reduce pest animal populations). Control methods and techniques will be reviewed annually and adapted or improved as indicated by monitoring and in consultation with industry experts.	Possible	Minor	Low
Landholders refuse access to the PNPAs	Sustained or increased predation by feral animals due to a lack of control measures being implemented	Possible	High	Medium	Implementation of landholder engagement program	Seek and obtain landholder permissions at least two months prior to initiation of control Implement landholder engagement actions and carry out field days Undertake direct landholder engagement where required Conduct consultation or negotiation sessions as required Effectively and clearly communicate risks posed by 1080 baiting to working dogs to landholders Consider moving control timing to increase landholder access if required (e.g. outside of mustering period) to reduce risks to working dogs Regularly communicate the results of control activities and monitoring results to landholders	Possible	Minor	Low
	Management measures fail to achieve the	he inte	rim p	erforn	nance targets and/or comp	letion criteria within the anticipated 5-, 10-, 15- and 20-year timeframes, respectively			
Offset fails to achieve the performance targets and/or completion criteria within the anticipated 5, 10-, 15- and 20-year timeframes, respectively	Failure to achieve and maintain management success criteria	Possible	High	Medium	Pest predator control program implemented	Implement the management actions of this Expanded Feral Pest Animal Plan. Monitor and report on attainment of performance targets and completion criteria.	Unlikely	High	Medium

⁷ Pers. comms., Tim Thompson, General Manager, Woorabinda Pastoral Company

4 Feral pest animal control measures

The feral pest animal management measures have been prepared in accordance with the requirements of each of the TNPMPs (GHD 2022a, 2022b) and to current industry best practice standards in planning, implementation and monitoring.

The management measures include, but are not limited to, management actions required at the PNPAs to control feral predators prior to and during nesting and hatching. The Fitzroy River turtle nests from August to December and hatchlings emerge during December and January. The white-throated snapping turtle nests from March to May and hatchlings emerge during December and January. The management measures provide for the management (*Table 5*), and the monitoring and reporting program (*Table 6*), that will be undertaken for the period of the EPBC Act approval (EPBC 2009/5173).

Table 4 describes the timing of the actions to be undertaken throughout the PCAs.

This plan has been produced in consultation with industry experts who have provided advice relating to pest control strategies and principles, control effort and timing, and monitoring and evaluation techniques.

The elongated shape of the expanded feral pest animal management area creates inherent pest control edge effects, as pest re-immigration into the area from untreated areas outside of the expanded feral pest animal management area will be significant. As a result significant control effort (such as baiting rates and duration, and aerial shooting effort) will be required to meet the objective of this plan.

Effective and all possible efforts to encourage complementary, best practice, cooperative and coordinated pest control actions by adjoining landholders will be prioritised. Sunwater will work cooperatively with adjoining landholders where requests to join local or regional pest control groups or similar cooperative actions are made.

Contemporary pest control programs utilise primary and secondary control techniques. Primary control methods are well established pest control methods where the risks, industry best practice standards and the function response (the effect of the technique in reducing the target pest population) is maximised. Primary control methods will form the basis of this pest control program.

Primary control methods utilised will be:

- 1080 ground baiting of wild dogs and foxes in priority pest control areas
- Aerial shooting of feral pigs (and incidental shooting wild dogs and foxes).

Secondary control methods are sub-optimal techniques (in functional response) and tools that may be used where primary control methods are not suitable or are essential in gaining access permission from landholders. Secondary control methods may also be employed where pest predators are avoiding conventional control techniques. They should not form the basis of this pest control program.

Secondary control methods utilised will be:

- Feral pig trapping
- Feral pig 1080 meat baiting (also sodium nitrate baiting)
- Wild dog and fox foothold trapping.

Annual reports will be prepared by the proponent as listed in *Table 6* (refer to *Section 6*). These will report against each of the management actions shown in *Table 5* and monitoring actions shown in *Table 6*. The reports will provide transparency regarding how the site management actions are being implemented, and where relevant, identify any force majeure events impacting the offset site, and any non-compliance with the management plan.

4.1 Aerial shooting strategies and control effort

Aerial shooting provides an effective method of culling feral pest animals, particularly pigs, and will be implemented as the primary control method. Aerial shooting operations will aim to remove 70% of the feral pig population per control event, which is the annual proportion of the population required to prevent population growth (Bengsen 2014).

The effect of aerial shooting on feral pig populations is relatively well known and control effort is expressed as hours of shooting per square km. Aerial shooting effort between 0.21 - 0.4 hrs/km² has been shown to reduce feral pig populations by 80% (Saunders and Bryant 1988, Hone 1990). If pigs have access to refuge areas where they either hide and survive control operations, or where they move into areas where aerial shooting is not permitted, higher rates of control effort and greater frequency would be indicated to meet population reduction targets (Choquenot et. al. 1999).

Aerial control operations will be carried out over PCAs at a rate of 0.2 hrs per km² (3.0 hrs per 1,000 hectares) (cumulative over the shoot event and requiring multiple passes during a shoot) (Saunders 1993, Choquenot et. al. 1999, Hone 1990). Due to re-immigration and edge effects as described above, aerial shooting should be conducted at least twice in a calendar year (to remove animals who may have re-entered the expanded feral pest animal management area since the previous control program). To reduce the numbers of juvenile pigs, where possible aerial shoots should be spaced closer than 4 months apart (feral pig gestation is 115 days).

If monitoring indicates a 70-90% reduction in feral pig activity after 2 years (4 aerial shooting operations over the PCAs) subsequent shooting (in Years 3-5) can be conducted at a rate of 0.15 hours per square km.

Therefore, the current PCAs (total ~12 000 hectares) will require a minimum of 24 hours of aerial shooting per shoot event (48 hrs per annum), potentially reducing to 18 hours (36 hrs per annum) in Years 3-5 (depending on monitoring results).

The entire expanded feral pest animal management area is 23,000 ha (230 km²) and would require approximately 46 hours of aerial shooting per shoot (92 hrs per annum) (at least for the first 2 years and 4 shooting operations).

To reduce alternative food resources (pig carcases) and to minimise site disturbance prior to aerial shooting should be carried out immediately after (and not before) the completion of ground baiting wild dog and foxes (see *Section 4.3* below).

Before each annual control campaign a safety risk assessment will be conducted, and an aerial shoot plan developed by an appropriately qualified contractor.⁸ The plan will be approved by Sunwater prior to it being implemented by the appropriately qualified contractor.

⁸ See glossary for a full definition of the term "appropriately qualified contractor".

The program will be reviewed in accordance with best practice standard operating procedures.

Aerial shooting will concentrate within the designated PCAs but can be extended outside of the priority area if landholder permissions are in place and feral pigs are located within the expanded feral pest animal management area. These areas will be reviewed and amended each year upon Sunwater receiving updated information regarding the location of the high and medium priority PNPAs. The area up to 1km inland from the high bank of these locations will become the PCA for the nesting and hatching seasons.

Shooting will be undertaken by experienced and appropriately trained and licensed expert contractors.

4.2 Ground shooting

Ground shooting will be limited to destruction of animals on animal welfare grounds and to the destruction of animals in traps (see secondary pest control techniques above). Before each annual control program a ground shoot plan will be produced by an appropriately qualified contractor, or the previous plan reviewed. The plan will be approved by Sunwater prior to it being implemented by the appropriately qualified contractor. This plan will be consistent with best practice risk mitigation and safety protocols.

Shooting will be undertaken by experienced and appropriately trained and licensed expert contractors.

4.3 Wild dog and fox control

Wild dogs and foxes are known predators of freshwater turtles throughout Australia. The nests and nesting females of western saw-shelled turtles (*Myuchelys bellii*) are preyed upon by the introduced red fox and feral pigs (Spencer and Thompson 2000; Blamires et al. 2005; Spencer et al. 2007). The nest predation rate of the Murray River turtle exceeds 90% from foxes alone (Thompson 1983).

This plan will initiate and sustain ground baiting of wild dogs and foxes for two separate 2-week periods in July and December. Baiting will be timed to:

- impose maximum population reduction of the target species.
- reduce nest visitation and predation at key nesting and hatching times.

Due to immigration into the sites from unbaited areas intensive ground baiting (at the upper limits of conventional best practice methods) is indicated across PCAs for the life of this plan. Both mobility, dietary preferences and edge effects of the expanded feral pest animal management area will require intensive, sustained control effort to minimise predation by wild dogs and foxes on nest sites and hatchlings.

Wild dog and fox control should be carried out in cooperation with adjoining neighbours where possible, but intensive unilateral effort will reduce nest predation.

1080 ground baiting is a common and widely used technique in protecting turtle nesting sites and can reduce local wild dog and fox populations significantly, but this technique must be carried out by trained and experienced operators and must be in accordance with best practice techniques (see *Appendix B*).

As a minimum, all baits should be buried and deployed for two weeks at each baiting round, with bait material types varied and baits checked (and eaten baits replaced) every 2 days. Uneaten baits should be replaced with fresh baits every 7 days (to ensure bait palatability and toxicity).

Due to the presence of both wild dogs and foxes in the project area, 6mg wild dog strength baits will be used.

Bait placement should be comprehensive across each PCA to create the best chance of the target animal encountering a bait. Baiting rates should be 10 baits per lineal kilometre for elongated sites and one bait per 10 ha for other areas. This will require approximately 400-600 baits per baiting operation (depending on access availability and baiting distance restrictions).

Effective 1080 baiting will require excellent communication with landholders to reduce the risk to working dogs. 1080 baiting will be carried out in compliance with the *Queensland Health Departmental Standard: Dealing with restricted S7 poisons for invasive animal control* (see also *Table 3*: Risk assessment for the Expanded Feral Pest Animal Plan above).

4.4 Adapting pest control techniques

Most conventional pest control programs assume that the relationship between pest impact and pest density is linear; that is, greater pest density equates to greater impacts. In most situations this is a viable assumption, especially where pest densities are medium or high. However, as pest control operations progress, some pest animals can learn to avoid the control tool or technique. These animals may persist in the control zone and some individuals may carry out disproportionable levels of predation. If this pattern of predation and/or avoidance is indicated by camera trap monitoring, then alternate best practice control techniques will be employed (see secondary control tools above). Specialised contractors may be required.

This plan utilises Standard Operating Procedures for pest control developed by the NSW Department of Primary Industries as they are considered by the industry to be the most comprehensive and up-to-date at the time of writing (see *Appendix B* and *Appendix C*).

4.5 Timing of management measures

The timing of the management measures over the course of each year has been designed around the nesting and hatching seasons of the two turtle species, as shown in *Table 4.*

Table 4: Timing of pest control actions

Species	January	February	March	April	Мау	June	July	August	September	October	November	December
Fitzroy River turtle	hatching							nesting	nesting	nesting		hatching
White- throated snapping turtle	hatching		nesting	nesting	nesting							hatching
Activity												
Pest control action	aerial shooting			landholder engage- ment and permission			ground baiting	aerial shooting				ground baiting
Monitoring action		initial camera placemen t/ service				service cameras					service cameras	

Table 5: Feral pest animal management actions, triggers and corrective actions

Threat to turtle habitat values	Manage- ment objective	Performance criteria	Management actions	Monitoring and reporting	Trigger for adaptive management and corrective action(s)	Co
Predation and destruction of turtle nests by feral pest animals	Reduce the destruction of turtle nests by feral pest animals so that 90% of detected and mapped turtle nests are not impacted by feral predators	Reduction in feral pest activity (species per camera per night) on PCA's of 90% at the completion of the first year of management.	Participate fully in, and cooperate with, any and all regional pest control programs, unless those would otherwise contravene a part of this plan. Aerial shooting will concentrate within the 1 km buffer zone either side of the river at the designated PNPAs at industry best practice standards (at a rate of at least 2.0 hrs per 1000 hectares). Initiate and maintain 1080 ground baiting for two, two week periods for foxes and wild dogs at industry best practice standards.	Monitoring of this management action will be undertaken by Sunwater, or suitable qualified person appointed by Sunwater, during nesting season surveys, throughout pre-nesting, nesting and hatching seasons. Complete and maintain predator control records (see <i>Appendix A</i>):	Feral predator activity (species/camera/night) does not decrease 90% from baseline data. Individual animals show aversion behaviour (recorded on camera) (hiding from aircraft or avoiding baits).	•
Offset fails to achieve the performance targets of 90% of located nest not being predated by year 5.	90% of turtle nests located in the expanded feral pest animal management area during nesting season surveys, are not predated by feral predators	The interim performance targets are achieved by year 5, 10 and 15. The completion criteria are achieved by year 20.	All management actions outlined in in this plan will be implemented to ensure that the interim performance targets and completion criteria are achieved.	Monitoring of the offset area will be undertaken in accordance with Section 6.	Interim performance targets are not achieved by year 2, 3 or 5.	Ste V ir a n a Ste As det cor (thu If th ma witt pes cha

rrective action and timing

- Expand aerial shooting and baiting operations to include entire expanded feral pest animal management area and extent 1km buffer to 2km
- Increase baiting rate per hectare for foxes and dogs Initiate feral pig baiting program
- Meat bait pigs at priority nesting sites where possible and legal
- Initiate foot hold trapping program at priority nest sites

ep 1: Investigate cause of trigger

Within one month of detection of the trigger, complete an investigation with industry experts into the reasons why the interim performance targets or the completion criteria were not achieved within the specified timeframes. This investigation must re-evaluate the suitability of the relevant management measures in the OMP and must identify appropriate corrective actions.

ep 2: Implementation of corrective action/s

- soon as practicable, and in any case within three months of tection of the trigger, complete implementation of the rective actions identified under Step 1. These may include ough are not limited to):
- Increasing the frequency and intensity of pest animal measures or revising the type of measures to be implemented.
- Expanding the PCAs to include other preferred areas for feral predators within the expanded feral pest animal management area.

he investigation under Step 1 recommends changes to the inagement regime, then as soon as possible, and in any case hin 3 months of detection of the trigger, implement a revised st management plan incorporating those recommended anges.

4.6 Responsible parties

As approval holder, Sunwater is accountable for implementing this pest management plan. Completing the actions will be ensured through the annual reporting requirements (*Section 6*). Sunwater will coordinate reporting, reviewing, inspections, auditing and any adaptive management changes to the plan. A person within Sunwater (e.g. Environment Manager) will be assigned the responsibility of managing offset requirements for the company.

Sunwater will enter into an arrangement with the predator control contractor to undertake the offset management actions. The contractor will also provide reporting as per *Table 6*.

4.7 Emergency procedures

Incidents identified within any of the PCAs will be reported by the contractor to Sunwater. Initial verbal correspondence will be made immediately by the contractor to Sunwater's Health, Safety and Environment Manager and to the Operational Manager of Rookwood Weir, with written notification to follow within 24 hours of the incident occurring.

The level of severity will dictate the necessary actions through the company's formal incident management system. General incidents will be managed by the landowner or contractor. Responses to incidents adversely impacting turtle nests will be coordinated by Sunwater, to ensure enhanced management measures (*Table 5*) are implemented to address the incident as soon as reasonably possible.

In keeping with approval Condition 19, Sunwater will notify the Department within 2 business days of becoming aware of any incident, non-compliance with conditions, or non-compliance with any of the commitments made in this plan. In keeping with Condition 20, Sunwater will also provide the details of any incident or non-compliance to the Department as soon as practicable and no later than 10 business days of becoming aware of the incident or non-compliance. (See also Section 7 - Adaptive management and plan review).

5 Offset success measures

The management actions detailed within this plan have been developed to meet the predator control outcomes as described in each of the TNPMPs. The measure of success, as described in each of the TNPMPs is "successful implementation (>95%) of planned predator control measures each year".

5.1 Evaluation methodology:

The monitoring program described in each of the TNPMPs will record the number of nests located within the PCAs for that season, and the number of nests located within the PCAs that have that have been predated.

Achieving the required success rate of >90% of turtle nest (within the PCAs) not being predated, will enable turtle hatching rates to improve and achieve the outcomes of each of the TNPMPs. The annual reports will provide transparency regarding how this Expanded Feral Pest Animal Plan is being implemented, and where relevant, identify any force majeure events impacting the area, and any non-compliance with this management plan.

6 Monitoring and reporting

The monitoring methods (*Table 6*) will enable comparative changes to be measured in levels of feral pest animal activity and the subsequent impact on turtle nests. Together with the outcomes of the monitoring and reporting from each of the TNPMPs, this will inform the control effort, control method selection and duration of management actions (or corrective actions) required.

Monitoring of pest animal activity pre- and post-control operations will be undertaken using camera traps placed at 500m intervals across the PCAs (a minimum of 40 cameras will be used across the PCAs). The presence and level of activity of pest animal predators (feral pigs, foxes and wild dogs) will be recorded as visits per species per camera per night.

Pest animal activity will be recorded and reported in annual reports and will be used to inform management decisions and to adapt and improve management actions as indicated.

Pest animal control reporting and recording will be carried out in accordance with industry best practice (see *Appendix A*, *Appendix B* and *Appendix C*) and will include bait take results and locations, aerial shooting track logs and culled animal data points.

Sunwater, its successors or assigns, will, as per Condition 10 of the Approval, provide an Annual Compliance Report each year following the date of the commencement of the action for the period of the approval. Management Plan Reports describing the progress of the feral pest animal control program over the relevant 12-month period will be part of those reports until the completion criteria are achieved or the end of the EPBC Approval (i.e. until 25 February 2046), whichever comes first. The monitoring and reporting methodology and schedule is outlined in *Table 6*.

The Annual Reports will contain records substantiating all activities relevant to the implementation and management of the offsets, in keeping with the requirements of Condition 10 of the Approval.

Sunwater, its successors or assigns, will publish the annual compliance reports, of which the Management Plan Reports form a part, on the website within three months of the relevant 12-month period. Sunwater, its successors or assigns, will supply documentary evidence showing proof of the date of publication of the compliance report will be supplied to the Department at the same time that the compliance report is published. These commitments ensure that Condition 10 of the approval is being met.

Monitoring	Attributes monitored	Timing	Method	Location/s	
Records collated and maintained by predator control contractor					
Feral predator activity within PCAs	 Visits (detections) per species per camera per night of feral predators pre- and post-control Predator activity recorded and charted over the annual period 	Ongoing, initiated 3-4 months prior to first treatment to develop baseline data	40 camera traps placed at 500m intervals throughout PCAs. Camera batteries and memory cards replaced by contractors at 3-4 month intervals.	At all PCAs	
Feral pest animal control activities	 Locations of control activities Duration of control activities Type of control method (aerial shooting, trapping etc.) Results of control activities (bait take rates, aerial shooting catch per unit effort) Aircraft track logs and culled animal waypoints 	Ongoing	Records maintained before, during and immediately after control activities are undertaken	At designated PCAs and PNPAs across the management area	
Annual reporting (Sunwater)					
Annual report	Annual Feral Pest Control Report, which contributes to the Annual Compliance Report as per Approval Condition 10, detailing the implementation of management actions, any triggers for corrective actions and implementation of those corrective actions, if implemented, and offset success measures.	Each 12 months ending 30 June following the commencement of the program	Annual Report to be prepared by Sunwater or their appointed contractor and submitted to DCCEEW as part of the overall annual Offset Reporting.		

7 Adaptive management and plan review

This plan has been prepared to be implemented until the offset completion criteria have been achieved when the approval for the action ceases. Management measures will be reported in the Offset Area reports, and adapted, where required, if triggers are reached and corrective actions are implemented (see *Table 5*). If management measures need substantial adjustment, Sunwater will review this plan.

In keeping with EPBC Approval Condition 20, Sunwater will provide to the Department the details of any incident or non-compliance with the conditions or commitments made in this OMP as soon as practicable and no later than 10 business days after becoming aware of the incident or non-compliance, specifying:

- a) any corrective action or investigation which the approval holder has already taken or intends to take in the immediate future
- b) the potential impacts of the incident or non-compliance
- c) the method and timing of any remedial action that will be undertaken by the approval holder.

8 Conclusion

This Feral Pest Animal Management Plan has been prepared to address all the requirements of the *Environment Protection and Biodiversity Conservation Act 1999*. This document supplements the two Turtle Nest Protection Management Plans (GHD 2022a, 2022b), in that it details the implementation, management and monitoring of an expanded pest feral animal control program that will reduce the impacts of feral predators on nesting success of the Fitzroy River turtle (*Rheodytes leukops*) and white-throated snapping turtle (*Elseya albagula*). The implementation of this plan will contribute to the overall recruitment success and survival of the Fitzroy River turtle and white-throated snapping turtle.

These offsets for the Project will be implemented consistent with the EPBC Act *Environmental Offset Policy* and the Approval Conditions for the project. The approval holder commits to the implementation of this plan.

As per EPBC Approval Condition 5.e) The approval holder will not begin inundation of the impoundment of Rookwood Weir unless the Minister has approved in writing this OMP.

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Appendix A: Feral predator control record templates

Wild dog and fox baiting

Site information

Recorder:

Date / /

Property		Priority Site (sector) no.	
		Site name	
Landholder			
Bait material	or type (e.g. Doggone)		
First date of h	aiting		
	Janny		

Appendix B – Standard operating procedures

Feral pigs

https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0007/1396789/NSWPIG-SOP2-Aerialshooting-of-feral-pigs.PDF (supplied at *Appendix C*)

https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0006/1396788/NSWPIG-SOP1-Trapping-offeral-pigs.PDF

https://www.dpi.nsw.gov.au/ data/assets/pdf file/0009/1396791/NSWPIG-SOP4-Poisoning-offeral-pigs-with-sodium-monofluoroacetate-1080.PDF

https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0005/1396787/NSWPIG-SOP6-Poisoning-offeral-pigs-using-HOGGONE-meSN-sodium-nitrite-baits.PDF

Foxes

https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0004/1396777/NSWFOX-SOP1-Ground-baiting-of-foxes-with-sodium-monoflouroacetate-1080.PDF

https://www.dpi.nsw.gov.au/ data/assets/pdf file/0009/1396773/NSWFOX-SOP5-Trapping-offoxes-using-padded-foot-hold-traps.PDF

Wild dogs

https://www.dpi.nsw.gov.au/__data/assets/pdf_file/0009/1396764/NSWDOG-SOP4-Ground-baiting-of-wild-dogs-with-sodium-monofluoroacetate-1080.PDF

1080 baiting

https://documents.parliament.qld.gov.au/tableoffice/tabledpapers/2021/5721T1447.pdf

Appendix C: Aerial shooting of feral pigs: Standard Operating Procedure

NSW PIGCOP: Feral Pig Code of Practice and Standard Operating Procedures



Background

Aerial shooting of feral pigs from a helicopter is used in extensive or otherwise inaccessible areas. It is an effective and relatively cost-effective method of quickly reducing feral pig populations. Teams involved in shooting from a helicopter require (at minimum) a shooter (seated immediately behind the pilot), an observer/navigator and the pilot. The observer or navigator primarily looks for and reports hazards plus keeps the helicopter within the approved shooting area, identifies target animals for the pilot, and records locations, species and animals killed. The pilot aligns the helicopter for the optimum shot, advises the shooter when to shoot and can also confirm kills and advise on requirements of additional shots for humaneness purposes.

Aerial shooting is a humane method of killing feral pigs when it is carried out by experienced and skilled shooters and pilots; the animal can be clearly seen and is within range; the correct firearm, ammunition and shot placement is used; and wounded animals are promptly located and killed.

This standard operating procedure (SOP) is a guide only; it does not replace or override the relevant NSW or federal legislation. The SOP should only be used subject to the applicable legal requirements (including WHS) operating in the relevant jurisdiction.

Individual SOPs should be read in conjunction with the overarching Code of Practice for that species to help ensure that the most appropriate control techniques are selected and that they are deployed in a strategic way, usually in combination with other control techniques, to achieve rapid and sustained reduction of pest animal populations and impacts.

Application

- All aerial shooting programs conducted by Government Agencies National Parks and Wildlife Service (NPWS) or Local Lands Services (LLS) - in NSW must be planned and implemented under the NSW Feral Animal Aerial Shooting Team (FAAST) framework and in accordance with the procedures of the NSW FAAST Manual.
- Private or commercial operators in NSW that are not conducting shooting as part of a FAAST program must still adhere to all relevant regulatory and legislative requirements.
- Shooting of feral pigs should only be performed by competent, trained personnel who
 have been tested and accredited for suitability to the task and marksmanship and who
 hold the appropriate licences and accreditation (e.g., accredited through the NSW Feral
 Animal Aerial Shooting Team [FAAST] training course or other approved competency,

e.g., AHCPMG311 – Use firearms for pest control activities from aircraft, AHCPMG304 – Use firearms to humanely destroy animals).

- Aerial shooting should only be used in a strategic manner as part of a coordinated program designed to achieve sustained and effective control. A shooting operations plan must be prepared and approved by the relevant agency for each FAAST aerial shooting program.
- Aerial shooting is a cost-effective method where pig density is high or the area is inaccessible. Costs per pig increases as pig density decreases. Also, pigs learn to avoid helicopters, so successive shoots can become less effective.
- Aerial shooting is best suited to areas where pigs are living and feeding in extensive or inaccessible areas (e.g., swamps, marshes and rough terrain or broadacre crops) where vehicle access is impossible or impractical and/or pre-feeding will not successfully attract enough pigs for trapping or baiting.
- There are two scenarios in which aerial shooting can be used. The first in areas of closed vegetation (e.g., heavily vegetated creek lines, woodlands and dense forest), effectiveness is limited since pigs may be concealed and difficult to locate from the air. In this scenario aerial shooting would be a secondary method. The second scenario is in relatively open country where pigs are highly visible and readily shot. Aerial shooting here would be a primary method of control.
- The optimal period for aerial shooting is when pigs are away from cover e.g., during dry seasons or droughts when pigs are forced to congregate in areas with limited access to water and feed.
- For safety reasons, shooting from a helicopter cannot be undertaken in adverse weather conditions (e.g., strong wind, rain, low cloud, hot days that cause unpredictable thermals).
- Operators (including helicopters, pilots, shooters and navigators/observers) must hold the appropriate licences and permits and be skilled and experienced in aerial shooting operations. Where managed by Government Agencies they must also be approved by FAAST.
- Helicopter operators must have approval from the Civil Aviation Safety Authority to undertake aerial shooting operations.
- Aerial shooting should comply with all relevant federal and state legislation, policy and guidelines.
- Storage use and transportation of firearms and ammunition must comply with relevant legislative requirements.

Animal welfare implications

Target animals

- The humaneness of aerial shooting as a control technique depends on the skill and judgement of both the shooter and the pilot. If properly done, it can be a humane method of killing feral pigs.
- Only chest (heart-lung) or head (brain) shots must be used. Although well-placed head shots result in instant insensibility, a more realistic target point for aerial shooting of feral

pigs is the larger heart-lung zone. The initial shot must be followed up with a further accurate heart-lung shot once the animal has collapsed. This deliberate 'overkill' policy is aimed at ensuring a quick death given the difficulty in confirming death from the air.

- Death from a shot to the chest is due to massive tissue damage and haemorrhage from major blood vessels. Insensibility will occur sometime after the shot, ranging from a few seconds to a minute or more. If a shot stops the heart functioning, the animal will lose consciousness very rapidly. Correctly placed head shots cause brain function to cease, and insensibility will be immediate.
- Shooting must be conducted in a manner that maximises its effect thus causing rapid death. This requires the use of appropriate firearms and ammunition.
- A target animal can only be shot when:
 - o it is clearly visible and recognised
 - o it is within effective range of shooter and the firearm and ammunition being used
 - o a humane kill is probable.
 - o if in doubt do NOT shoot.
- The pilot must offer the shooter the best opportunities for a humane kill. This includes maintaining a stable shooting platform and to ensure that the helicopter is always aligned so that the shooter can maintain accuracy and to avoid shots to unacceptable parts of the body e.g., spine or neck shots. Aerial shooting should not be carried out if the nature of the terrain reduces accuracy resulting in too many wounding shots and prevents the humane and prompt despatch of wounded animals.
- If lactating sows are shot, reasonable efforts should be made to find dependent piglets and kill them quickly and humanely. Piglets older than 5 weeks of age will tend to fall in to line behind the sow. Any piglets that escape after a sow has been shot will usually return to the area over the following few hours.
- Aerial shooting programs by their nature must be highly accountable. Apart from maintaining absolute animal welfare standards, records should be kept of number and location of animals killed, hours flown, ammunition used and fly-back procedures.

Non-target animals

- Shooting is relatively target specific and does not usually impact on other species. However, there is always a risk of injuring or killing non-target animals, including livestock, if shots are taken before an animal has been positively identified.
- Sensitive livestock such as horses, farmed deer and free range poultry are easily frightened by gunshots, helicopter rotor noise, wind etc. and may injure themselves by running into fences and other obstacles. Avoid shooting in areas where these livestock occur or organise the removal of them from the area prior to the shooting program.

Workplace health and safety considerations

 The potentially hazardous nature of aerial shooting requires that safety protocols be strictly followed. Each team member must be aware of and trained in all aspects of helicopter and firearm safety.

- The helicopter pilot must perform a thorough pre-flight briefing with all personnel to establish communication protocols between the shooter and the pilot including pre-shot manoeuvre, commands for firing and emergency procedures.
- Shooting from a helicopter can be hazardous, particularly in areas of rugged topography. The combination of low-level flight, close proximity to obstacles (trees, rocks, and wires) and the use of firearms makes this task extremely hazardous.
- It is essential that ejected ammunition cases do not interfere with the safe operations of the helicopter. It might be necessary to fit a deflector plate (mandatory for FAAST operations) to the firearm to ensure shells are ejected safely.
- Firearm users must strictly observe all relevant safety guidelines relating to firearm ownership, possession and use.
- When not in use, firearms must be securely stored in a compartment that meets state legal requirements. Ammunition must be stored in a locked container separate from firearms.
- Adequate hearing protection should be worn by the shooter and others in the immediate vicinity of the shooter. Repeated exposure to firearm noise can cause irreversible hearing damage.
- Safety glasses are recommended to protect the eyes from gases, metal fragments and other particles.
- Refer to the current version of the FAAST Management and Training System for further details on workplace health and safety requirements.

Equipment required

Firearms and ammunition

- Firearms should be:
 - o Reliable, well maintained and capable of good accuracy
 - o Fitted with a red dot scope with zero magnification
 - o Rifles should be semi-automatic .308 calibre.
 - Shotguns should be 12-gauge and either pump action or semi- automatic for small to medium sized pigs only.
- To provide a backup in case of firearm/ammunition malfunction, at least two functioning firearms must be carried by shooters at all times.
- The accuracy and precision of firearms should be tested against inanimate targets before any shooting operation.

- Ammunition
 - Hollow point, 130gn -135gn; protected point 130gn or SG, SSG (larger pigs) and AAA, BB (small pigs or piglets)
 - Firearm and ammunition combinations for rifles with maximum shooting distances are included in the table below:

Cartridge	Bullet weight (gr)	Muzzle velocity (ft/sec)	Muzzle energy (ft-lbs)	Maximum distance (metres) [*]
.308 Winchester	130	3050	2685	70
.308 Winchester	135	3000	2699	70

Source:

https://www.federalpremium.com/rifle/american-eagle/american-eagle-varmint-and-predator/11-AE308130VP.html https://www.osaaustralia.com.au/products/ammunition/centrefire-rifle/308-win/osa-ammo-308win-135gr-sierra-20-pack/ *With aerial shooting, most shots are taken at 20 to 50 metres and the maximum range would be about 70 metres

- Specifying ammunition based on species alone rather than individual body mass is
 problematic. Shooters should select ammunition (from those specified) that best suits
 their situation, and which is justifiable on animal welfare grounds. This may particularly
 apply to situations where multiple species are being controlled in the one operation.
- The accuracy and precision of firearms should be tested against inanimate targets before any shooting operation.

Aircraft

- Aircraft used for aerial shooting should be manoeuvrable, fast and responsive to allow quick follow-up of any wounded animals.
- The FAAST governance structure has compiled a list of helicopter operators, aircraft and pilots who are approved for FAAST operations. Only helicopter operators and aircraft deemed appropriate to the particular task will be selected for FAAST operations. Approved operators can be sourced through the State Air Desk (LLS) or the through the Flight Operations Unit (NPWS).
- GPS (global positioning systems) and computer mapping equipment with appropriate software must be used to assist in the accurate recording of information (e.g., where animals are shot) and to eliminate the risk of shooting in off-target areas.

Other equipment

- Flight helmet (with intercom).
- Fire-resistant flight suit.
- Safety harness.
- Other personal protective equipment including lace-up boots, gloves and appropriate eye and hearing protection.
- Survival kit (including a first aid kit.)

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- Emergency locating beacon.
- Lockable firearm box.
- Lockable ammunition box.
- Refer to the current FAAST Manual for further information.

Procedures

- Shooters must not shoot at an animal unless they are confident of cleanly killing it without unnecessary pain, distress or suffering. Only chest (heart-lung) or head/brain shots must be used. Shooting at other parts of the body is unacceptable.
- Wounded animals can suffer from pain and the disabling effects of the injury (including sickness due to infection). The cost of ammunition and extra flying time must not deter operators from applying fly-back procedures.
- Where target animals are encountered in a group they should typically be shot from the back of the group first (the last one shot is furthest away from the helicopter). This may not always be possible e.g., when an animal breaks away from a group. In this case the shooter and pilot need to communicate so they focus on the same animal.
- Each animal must be shot *at least* twice with at least one bullet placed in the heart/lung and before shooting further animals. The only exemption to two shots is when the heart/lung is completely destroyed after the first shot as may be the case with smaller animals.
- The shooter must shoot an animal more than twice in the following circumstances:
 - o where directed by the pilot or if the shooter considers it necessary
 - o until a bullet is placed in the heart/lung of the animal
 - o if the animal doesn't appear dead (signs of life could include attempting to lift its head, any coordinated body movement, eye blinking or breathing).
- Each animal shot must be considered dead by the shooter and pilot, and verbally announced as a 'kill' by the pilot before shooting further animals. This procedure allows for both the shooter and pilot to make a judgement of each animal shot being dead, by the animal exhibiting no sign of life and/or by observing the placement of a bullet into the heart/lung.
- A flyback procedure is required after shooting a group of animals and must be applied at all times. The procedure is as follows:
 - o fly back over each animal of the group shot
 - hover over each animal long enough to assess that the animal doesn't exhibit any sign of life
 - where there is any doubt by the shooter or pilot that the animal is dead or that there
 is a bullet in the heart/lung, the shooter is to shoot further bullet/s into the heart/lung
 of the animal.

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- When large groups of animals are encountered or when groups are encountered in heavy vegetation, the shooter and pilot must consider the ability to conduct an effective flyback procedure. If an effective flyback is likely to be hampered by continuing to shoot further animals in a group or when animals already shot are unlikely to be found, shooting should temporarily cease, and a flyback conducted over animals already shot.
- The best time to shoot feral pigs is when they are most active and away from cover, that is, in the early morning, late afternoon and evening. During winter months and on cooler, overcast days pigs will be more active during daylight hours.
- Target pigs should be mustered away from watercourses and areas of dense vegetation before being shot, as wounded animals will be difficult to locate if they go down in these locations.
- Once a target is sighted and has been positively identified, the pilot should position the helicopter as close as is safe to the target animal to permit the shooter the best opportunity for a humane kill.
- The pilot should aim to provide a shooting platform that is as stable as possible.

Target and shot placement

Aiming points for head and chest shots are as follows (see also Figure 2).

Chest Shot

Side view

• The firearm is aimed at the centre of a line encircling the minimum girth of the animal's chest, immediately behind the forelegs. The shot should be taken slightly to the rear of the shoulder blade (scapula). This angle is taken because the scapula and humerus provide partial protection of the heart from a direct side-on shot.

Head Shots

Poll position (rear view)

• When aerial shooting, most head shots will be taken at this position as animals are running away from the helicopter. The firearm should be aimed at the back of the head at a point between the base of the ears and directed towards the mouth.

Temporal position (side view)

• This shot is occasionally used where a second shot needs to be delivered to an injured animal that is lying on its side. The pig is shot from the side so that the bullet enters the skull at a point midway between the eye and the base of the ear.

Frontal position (front view)

• This position is occasionally used when an animal faces the shooter. The firearm is aimed at a point in the middle of the forehead slightly above a line drawn between the eyes.



Figure 2: shot placement for aerial shooting of feral pigs

Note that shooting an animal from above or below the horizontal level as depicted here will influence the direction of the bullet through the body. Adjustment to the point of aim on the external surface of the body may need to be made to ensure that the angled bullet path causes extensive (and therefore fatal) damage to the main organs in the target areas.

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