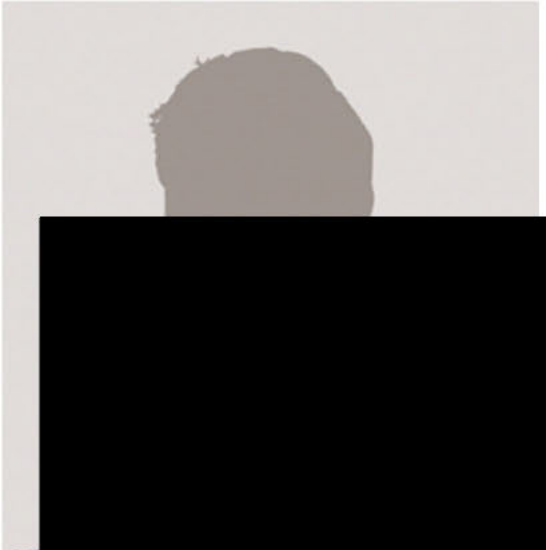

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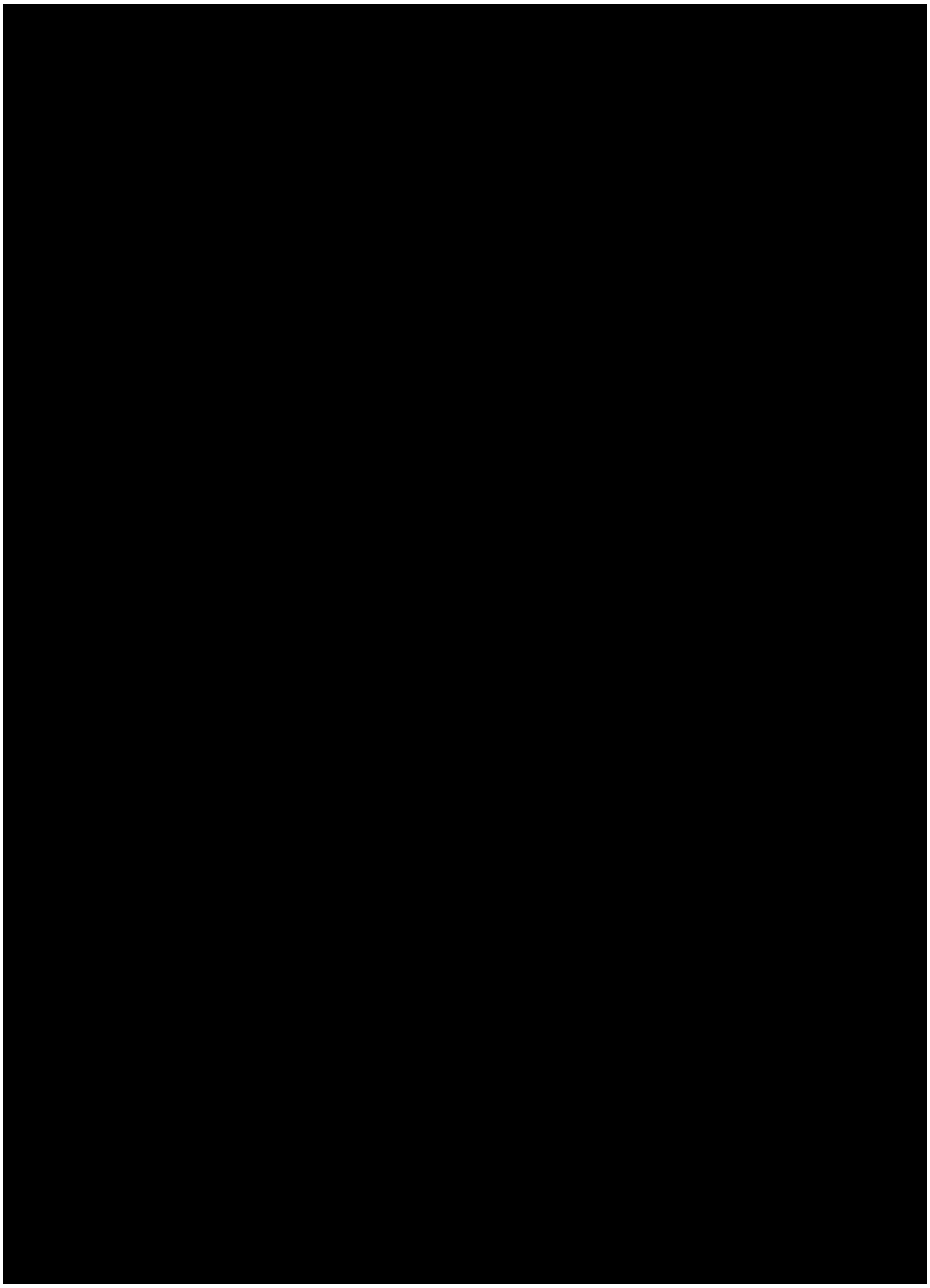
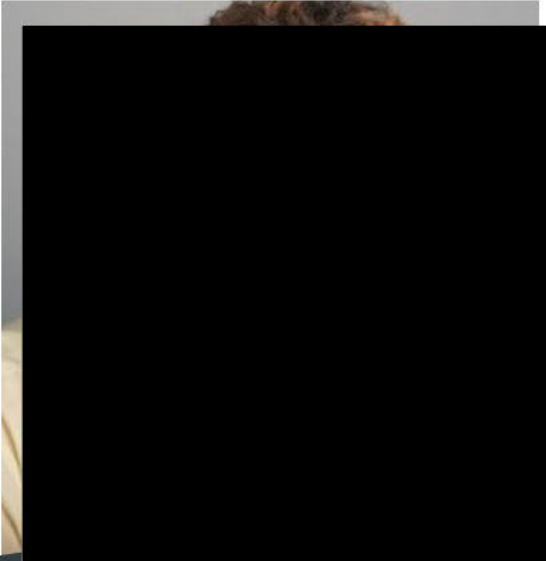
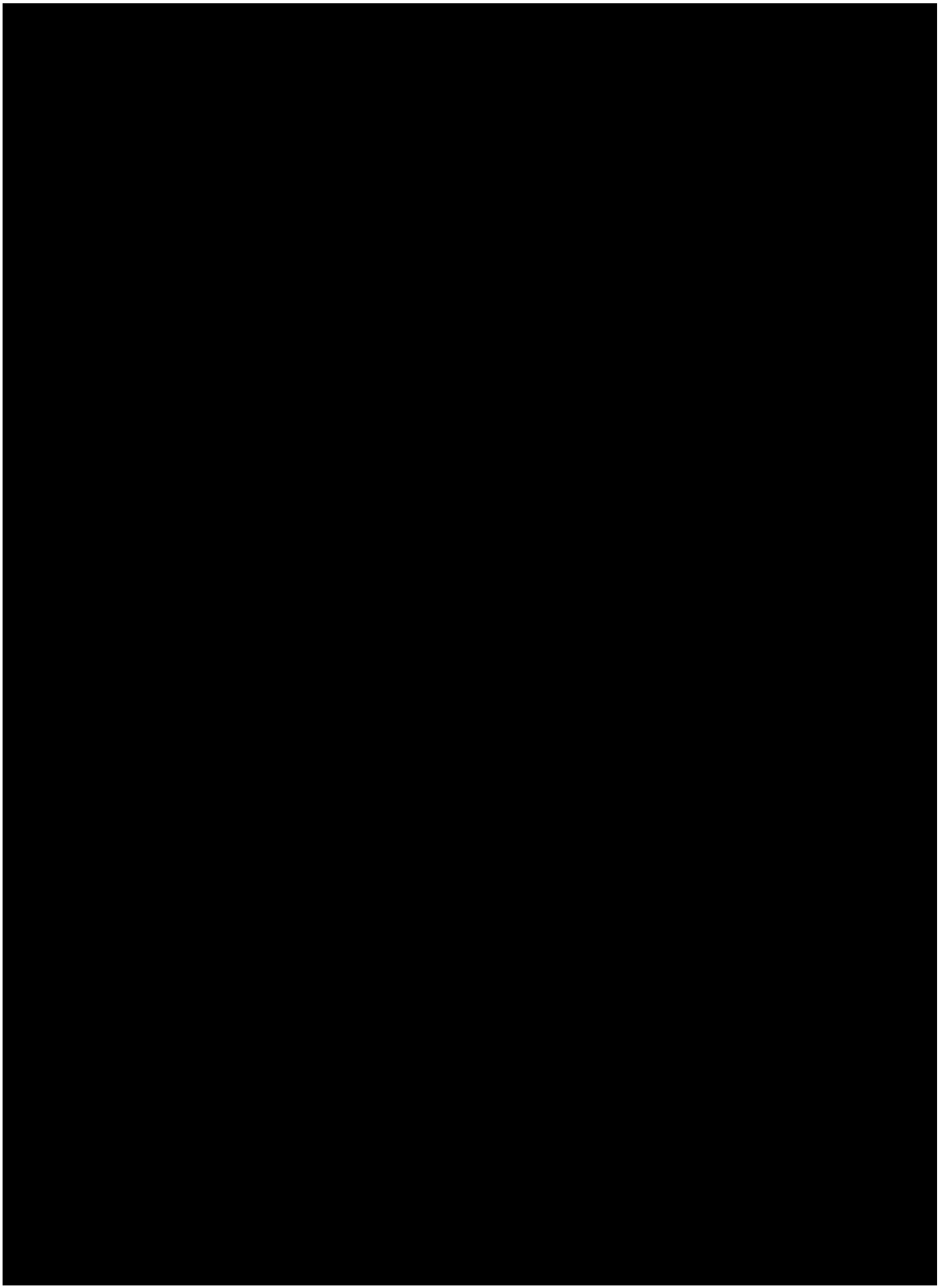
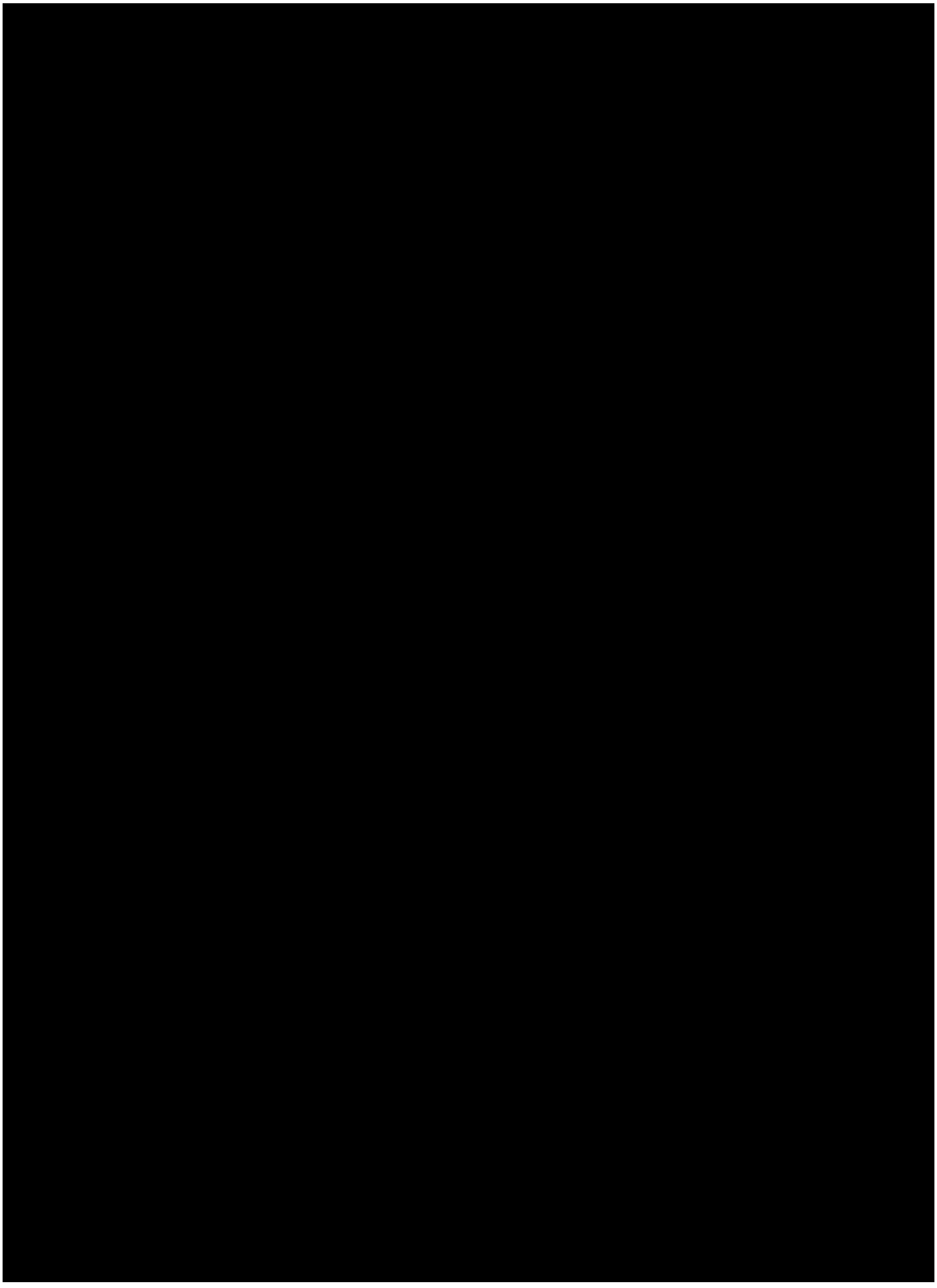








Department of Environment, Land, Water and Planning

Barwon South West
State Government Offices
Level 4/30-38 Lt Malop Street
PO Box 103
GEELONG VIC 3220
Ph: 03 5226 4667
www.delwp.vic.gov.au

DELWP Ref: SP471070

29 June 2020

Mr Michael Pollock
Director Service Delivery (North) – South East Zone
Department of Defence
DPM-LVL North
661 Bourke Street
MELBOURNE VIC 3000
Email: [redacted]

Dear Michael

CONSENT FOR USE AND DEVELOPMENT OF COASTAL CROWN LAND
SECTION 70 *MARINE AND COASTAL ACT 2018*

Crown Description: Crown Allotment 3D1, Parish of Murtcaim

Local Name: **Point Wilson**

Street Address: **Tewntynine Mile Rd, Point Wilson**

CONSENT FOR: **Point Wilson Waterside Infrastructure Remediation Project**

Thank you for your correspondence on 17 March 2020, and further information received 21 May 2020, for consent to use or develop coastal Crown land under *Section 68* of the *Marine and Coastal Act 2018*.

The application is for the Point Wilson Waterside Infrastructure Remediation Project.

Pursuant to *Section 70* of the *Marine and Coastal Act 2018* and as delegated by the Minister, I consent to the proposed use and development subject to the following conditions:

1. Works are to be completed to the satisfaction of the Program Manager, Land and Built Environment, Department of Environment, Land, Water and Planning (the Manager).
2. All works are to be consistent with the application dated 17 March 2020, and further information received 22 April 2020 and 21 May 2020. All works are to be consistent with the Environmental Management Plan (EMP) (Environmental Management Plan, CPB Contractors, dated 25 February 2019).
3. Any proposed amendments to the works including changes to the design or siting must be provided in writing to the Manager and written approval obtained from the Delegate, prior to any changes being implemented.
4. The construction site is to be maintained to a safe standard to avoid risk to public/workers, and where practical public access excluded from the construction area using appropriate communications.
5. All future maintenance is the responsibility of the Department of Defence.

6. Management of risks to environmental and heritage values that arise from project construction activities are the responsibility of the Department of Defence. Any remediation required to address the impacts to environment and heritage are the responsibility of the Department of Defence and as directed by the Manager. Regular site meetings are to be facilitated throughout the construction period, every 3 months or as agreed.

7. A quarterly project report must be submitted to the manager for review prior to scheduled site visits, addressing the following:

   Summary of monitoring undertaken:

   i. Results of impacts (distribution and abundance) of any highly invasive marine species in the works footprint and immediate surrounds. The surveys which inform this information must be undertaken by a qualified marine biologist and informed by the marine monitoring baseline assessment as stated in the Environmental Monitoring Program (Cimic, dated 9/12/2019).

   ii. Contaminants in the marine environment in the works footprint and immediate surrounds.

   iii. A summary of all environmental incidents or near misses that occur during the relevant reporting period.

   iv. A summary of consultation undertaken advising any stakeholder and community feedback or complaints received during the relevant reporting period, and how community concerns were addressed.

   v. A timeline of construction activities for the following reporting period, to coordinate with Orange-Bellied Parrot protection and release.

   DELWP may require adjustments to the EMP based on the above information.

8. If night works are required, or if pier or buoyage lighting is required for navigation purposes, light needs to be limited to areas only necessary and prevented from projecting out into the marine environment to prevent impacts on marine ecological values.

9. Timing of the construction activities must be sensitive to the ecological values of the site and the potential spread of marine invasive species, with the aim of reducing the spread of invasive species.

10. The EMP must be adjusted to incorporate the following matters:

    a. The design of the silt curtains, which must incorporate the results of the sediment grain size analysis.

    b. The method for detection of contaminants in the marine environment, and the plan for managing risks to the marine environment should contaminants be detected.

    c. Expected received sound levels in the marine environment arising from all construction activities. Detailed plans for mitigating noise in the marine environment and mitigating impacts to marine mammals, including species and location appropriate Observation and Shut Down Zones.

    d. A risk assessment which outlines the appropriate timing of works to minimise overall impacts to the ecological values of the surrounding area, specifically with regards to marine invasive species.

    The amended EMP must be provided to DELWP before construction.

11. All records of marine cetaceans, seals, turtles or seabirds collected by the Marine Mammal Observer must be lodged with the Victorian Biodiversity Atlas.

12. Any whale or dolphin incidents or near misses should be immediately reported to the whale and dolphin emergency hotline on 1300 136 017 with details of species, location, time and what was observed. Incidents and near misses with seals, turtles or seabirds should be reported to the Zoos Victoria Marine Response Unit on 1300 245 MRU. All works must cease immediately and must not recommence until DELWP has investigated the incident and the Manager has provided advice that the Department of Defence can continue the project.

13. Department of Defence is required to enter an appropriate tenure for the use and occupation of the seabed buffer area (Crown allotment 3D1) surrounding the Point Wilson wharf.

14. Within 3 months of completion of the works, a report must be provided to the satisfaction of the Manager detailing site impacts from these works and steps taken to remediate any impacts, and compliance with the conditions of this consent (including photos or other evidence) by provided to the Manager.
15. The consent will expire if the works are not completed within 3 years of the date of issue unless an extension of time is applied for and granted by the Manager.
16. The works are subject to all other approvals.

Please note that the works are subject to all other approvals including the Aboriginal Heritage Act 2006 that requires the discovery of Aboriginal cultural heritage places or objects on any public land in Victoria be reported to the Office of Aboriginal Victoria.

To ensure compliance with the *Marine and Coastal Act 2018*, action may be taken against breaches of these conditions. If you are unsure of any of the conditions, please contact Samantha Culver on 0438 790 835.

Yours sincerely

Colleen White
Regional Director, Barwon South West
(as delegate for the Minister for Environment and Climate Change)

Ref: 13.20 V2

Works Permit

Port Management (Local Ports) Regulations 2015

Pursuant to the *Port Management Act 1995* and the *Port Management (Local Ports) Regulations 2015*, *Regulation 17,* Parks Victoria as the Local Port Manager gives approval to the Permit Holder to undertake the Permitted Works within the Permitted Area for the period of this Permit.

This Permit is subject to Parks Victoria's Standard Works Permit Conditions and the conditions set out below. The conditions set out below will take precedent to the extent of any inconsistency with Parks Victoria's Standard Works Permit Conditions.

1.	**Permit Holder:**	**Name:**	Department of Defence
		Contact person:	Mr Michael Pollock
		Address	661 Bourke Street Melbourne, Victoria 3000
		Ph:	[redacted]
2.	**Port:**	Local Port of Port Phillip	
3.	**Permit Area:**	The Point Wilson Pier within the waters of the Local Port of Port Phillip, as per permit application documents received between 18 March 2020 and 29 June 2020.	
4.	**Permitted Works:**	The Point Wilson Waterside Infrastructure Remediation Project, associated bunkering, and associated vessel mooring as per permit application documents and information received between 18 March 2020 and 23 June 2021.	
5.	**Permit Period:**	7 July 2020 to 7 July 2023	
6.	**Permit Fee:**	NA	Inclusive of GST
7.	**Permit Bond:**	NA	
8.	**Additional Conditions:**	8.1 An Exclusion Zone is to be established and maintained to the satisfaction of Parks Victoria and (Continued)	

Maritime Safety Victoria before any works are undertaken, and for the duration of the works.

8.2 A Notice to Mariners will be required to be issued before any works begin.

8.3 All vessels, plant and equipment are to be cleaned prior to use to prevent the spread of marine pests. search; 'check, clean and dry' and 'marine pests' at parks.vic.gov.au for more information.

8.4 Mooring tackle to be installed within the permit area will be subject to the following:

a. Inspection by an Authorised Mooring Contractor (as authorised by Parks Victoria) before use.

b. Annual inspections by an Authorised Mooring Contractor.

c. Tackle must be adequately designed, constructed and installed for the actual vessel (or buoy) to be moored.

d. Confirmation of the owner of each vessel (or buoy) attached to a mooring.

e. Nominated vessels associated with the works may use any mooring within the Local Port permit area that is designed for that vessel.

Signed for and on behalf of **Parks Victoria** by its authorised officer in the presence of:)

)

[redacted]

Signature of Witness	Signature of authorised officer
[redacted]	[redacted]
Name of Witness	Name of authorised officer
30 June 2021	A/Senior Manager Local Ports and Waterways
Date	Position of authorised officer

Standard Works Permit Conditions

Port Management (Local Ports) Regulations 2015

1. Effect of Permit and Permit Fees

1.1 The Permit Holder will be granted the Permit by Parks Victoria on the payment of the Permit Fee.

1.2 The Permit is not transferable. Any assignment of the Permit will only be effective with the written consent of Parks Victoria.

1.3 All activities the subject of the Permit must be undertaken in accordance with the provisions of the laws in force from time to time in the State of Victoria.

1.4 Works are to begin within 12 months of permit issue and are to be completed within 2 years of commencement.

1.5 The Permit Holder is to provide written notification to Parks Victoria of the commencement date of works and provide written notification of the completion date of works.

1.6 The Permit Fee is entirely non-refundable.

1.7 The Permit does not create any proprietary interest on the part of the Permit Holder.

1.8 The Permit Holder:

(a) is not entitled to exclusive possession of the Permit Area; and

(b) may only use the Permit Area for the Permitted Works.

2. Insurance Conditions

2.1 The Permit Holder must during the period of the period of the Permit, effect and maintain with an insurer approved by Parks Victoria:

(a) a public and products liability insurance policy of not less than twenty million dollars ($20,000,000) in respect of any one claim providing covering all third party claims for loss or damage to property or injury to persons (including death), which must also note the interest of Parks' Victoria; and

(b) employer's liability and workers compensation insurance.

2.2 The Permit Holder must, on request, provide Parks Victoria with evidence that the insurances required by the Permit have been effected and maintained.

2.3 The Permit Holder must immediately notify Parks Victoria if:

(a) any event or circumstances occurs which may or does give rise to a claim under any insurance required by the Permit; or

(b) any insurance required by the Permit is cancelled.

2.4 The Permit Holder must not do anything or allow anything to be done which may prejudice or invalidate any insurance required by the Permit.

3. Standard Conditions

3.1 The Permit Holder must carry out the Permitted Works:

(a) in a safe and competent manner;

(b) provide a Construction and Environment Management Plan (CEMP) prior to the commencement of works;

(c) provide a Traffic Management Plan (TMP) with details on the intended marking of the work zone, including the installation of on-water aids prior to commencement of works;

(d) so as to not cause any danger, offence, nuisance or annoyance to any other person;

(e) so as to not create any hazard to the environment or any risk of health or safety to any person (as far as reasonably practicable); and

(f) with appropriately qualified and experienced personnel; and

(g) with plant and vessels that are fit for service and free from aquatic pests and pathogens; and

(h) so that all plant, equipment, works vessels, and masters meet the requirement of Transport Safety Victoria (TSV) and National laws for domestic commercial vessels.

3.2 The Permit Holder must obtain all necessary permits, consents, licenses and approvals from any other government agencies required for the carrying out of the Permitted Works and ensure the same remain in place for the duration of the Permit.

3.3 The Permit Holder must:

(a) not and is deemed to have not relied upon any representation by Parks Victoria concerning the Permit Area or the Permitted Works;

(b) ensure it is aware of all laws and legal requirements affecting the Permit Area and the Permitted Works.

3.4 The Permit Holder releases Parks Victoria from all actions, claims, demands, losses, damages, costs and expenses (whatsoever and howsoever arising), as a result of the Permit Holder occupying the Permit Area or performing the Permitted Works.

3.5 The Permit Holder must ensure all employees, contractors and agents are informed of any restrictions applying under the Permit.

3.6 The Permit Holder must notify Parks Victoria immediately of any changes to the details of the Permit Holder.

3.7 The Permit Holder must ensure that all works are to be carried out in accordance with documentation provided. Any variation to the works as detailed is required to be forwarded to Parks Victoria for approval.

3.8 The Permit Holder must permit Parks Victoria or any other person authorized by Parks Victoria to enter the Permit Area at any time.

3.9 The Permit Holder must ensure that at the completion of the works that the site is 'made good' and all material and equipment used, and any waste produced as the result of the works, is removed from the waterway/ and or its environs.

3.10 The Permit Holder must promptly rectify any damage to the Permit Area caused or contributed to by the Permit Holder or any other party carrying out the Permitted Works.

3.11 The Permit Holder must immediately notify Parks Victoria of any of the following:

(a) loss or damage to property;

(b) death or personal injury; or

(c) environmental damage, pollution or contamination

arising out of or in connection with the Permitted Works.

3.12 The Permit Holder indemnifies and agrees to keep Parks Victoria and its officer, employee and agents indemnified against all action, claims, demands, costs and expenses (whatsoever and howsoever arising) suffered or incurred by Parks Victoria or its officers, employees and argents arising out of or in connection with:

(a) a breach of any condition of the Permit;

(b) any negligent, reckless or wrongful acts or omissions of the Permit Holder or its employees, officers or agents;

(c) the use of the Permit Area;

(d) the performance of the Permitted Works; or

(e) loss or damage or injury to property of any person or death or personal injury,

except to the extent caused or contributed to by Parks Victoria.

3.13 All complaints received by Parks Victoria during the proposed operation will be referred to the permit holder and must be dealt with by the proponent to the satisfaction of Parks Victoria.

3.14 The Permit Holder shall appropriately notify all users of the precinct as to the nature and scheduling of the works including the intended temporary closure of elements of the current facility.

3.15 All floating plant and equipment or potential hazards to navigation are to be appropriately marked to IALA standards during works with yellow flashing lights from sunset to sunrise.

3.16 The Permit Holder is responsible for the ongoing monitoring and maintenance of the structure to an appropriate safe and operational standard.

4. Permit Bond

4.1 Parks Victoria may apply the proceeds of the Permit Bond to discharge the performance of the Permit Holder's obligation not properly performed in accordance with the Permit.

4.2 Within 30 days of the expiry or termination of the Permit (whichever is earlier), Parks Victoria will return the Permit Bond, less any amount required to discharge the performance of the Permit

Holder's obligation not properly performed in accordance with the Permit.

5. OHS

5.1 The Permit Holder must:

(a) comply with all laws relating to occupational health and safety in occupying the Permit Area and performing the Permitted Works;

(b) ensure there is no risk to the environment or health and safety or any person in occupying the Permit Area and performing the Permitted Works.

5.3 If requested by Parks Victoria, the Permit Holder must prepare an occupational health and safety plan which satisfies all reasonably requirements of Parks Victoria.

5.4 The Permit Holder must comply with all policies and procedures prepared by or on behalf of Parks Victoria in respect of the Permit Area, including all policies and plans relating to occupational health and safety and the environment.

5.5 This Permit must be produced for inspection by the Port Manager, officer of the Port Manager or a member of Victoria Police upon request. Failure to produce this Permit for inspection is an offence under regulation 23 of the Port Management (Local Ports) Regulations 2015.

6. Breach of Permit

6.1 Parks Victoria may cancel or vary the Permit or exclude the Permit Holder from the Permit Area if the Permit Holder:

(a) breaches or causes a breach of a condition of the Permit;

(b) fails to comply with its obligations as and when required;

(c) conducts an activity which places the health and safety of any person at risk;

(d) conducts an activity which may cause a risk of loss or damage to any property;

(e) interferes with the orderly and efficient management of the Permit Area or the port; or

(f) fails to comply with any direction of Parks Victoria given under the Permit or the *Port Management Act 1995.*

6.2 Any and all remedial actions that may be required to bring conditions up to Parks Victoria's satisfaction will be at the cost of the Applicant.

7. Interpretation and Definitions

7.1 A word or phrase in this permit has the same meaning as the word or phrase has in the *Port Management Act 1995* and the *Port Management (Local Ports) Regulations 2015.*

7.2 A reference to a date includes that date.

7.3 Failure to comply with the conditions in this permit is an offence under regulation 18 of the *Port Management (Local Ports) Regulations 2015*

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

Notification of
REFERRAL DECISION – not controlled action if undertaken in a particular manner

Point Wilson Explosives Area Waterside Infrastructure Remediation, Victoria (EPBC 2012/6376)

This decision is made under sections 75 and 77A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Proposed action

person named in the referral	Department of Defence ABN 687 068 143 12
proposed action	To remediate the Point Wilson Explosives Area Waterside Infrastructure, including the jetty structure, wharf and link structure, mooring dolphin, amenities building and services, located on the north shore of the Geelong Arm of Port Phillip Bay, Victoria [See EPBC Act referral 2012/6376].

Referral decision: Not a controlled action if undertaken in a particular manner

status of proposed action	The proposed action is not a controlled action provided it is undertaken in the manner set out in this decision.

Person authorised to make decision

Name and position	James Tregurtha Assistant Secretary South-Eastern Australia Environment Assessments
signature	
date of decision	7 **August 2012**

manner in which proposed action must be taken	The following measures must be taken to avoid significant impacts on: • Listed threatened species and communities (sections 18 & 18A) • Listed migratory species (sections 20 & 20A) • Wetlands of international importance (sections 16 & 17B)

- Commonwealth land (sections 26 & 27A)
- Commonwealth action (sections 28)

1. Measures to prevent and/or minimise impacts to Natural Temperate Grassland of the Victorian Volcanic Plain (NTG VVP) must be implemented for the duration of the proposed action and include, but may not be limited to:
    a. clearance of NTG VVP must not exceed 0.305 hectares and must only occur within the **Project Works Footprint**;
    b. the **Project Works Footprint** must be clearly delineated and cordoned off using appropriate barricading;
    c. site accommodation, car parking and construction hardstands are only to be located within the **Project Works Footprint**; and
    d. all materials, plant and equipment are to remain within the **Project Works Footprint**.
2. Measures to minimise the risk of physical impacts, including **temporary threshold shift**, to whales, marine turtles, dugongs and dolphins during **underwater piling** activities must be implemented in accordance with the *Underwater Piling Noise Guidelines* (Department for Transport, Energy and Infrastructure, Government of South Australia (2011)) and include, but may not be limited to:
    a. visual observations for dolphins, whales, sharks or marine turtles must be undertaken to the extent of the marine **observation zone** by a **suitably qualified crew member** for at least 30 minutes before the commencement of each act of **underwater piling**;
    b. during **underwater piling**:
        i. visual observations to the extent of the **observation zone** must be maintained continuously by a **suitably qualified crew member** to identify if there are any dolphins, whales, sharks or marine turtles present;
        ii. if dolphins, whales, sharks or marine turtles are sighted within the **shutdown zone**, **underwater piling** must cease within 2 minutes of the sighting or as soon as safely possible and must not recommence until all dolphins, whales, sharks or marine turtles are observed to move outside the **shutdown zone** or 30 minutes have passed since the last sighting; and

iii. after all dolphins, whales, sharks or marine turtles are observed to move outside the **shutdown zone** or 30 minutes have passed since the last sighting, **underwater piling** must be initiated at the **soft start** level and then may build up to full operating impact force.

3. Measures to mitigate potential impacts to the marine environment must be implemented in accordance with the *Urban Stormwater: Best Practice Environmental Management Guidelines* (CSIRO, 1999), the *Environmental Guidelines for Major Construction Sites* (Environment Protection Authority, Victoria, 1996) and the *Construction Techniques for Sediment Pollution Control* (Environment Protection Authority, Victoria, 1991). These measures must include, but may not be limited to:

    a. stormwater must be diverted around the perimeter of the **Project Works Footprint**;

    b. timber fenders must be cut off at the sea bed, rather than removed completely, to minimise disturbance of marine sediment;

    c. install a silt curtain around the works zone during **underwater piling**;

    d. avoid and/or cease sediment disturbance works during conditions where sediment disturbance would increase;

    e. any chemical storage areas must be designed in accordance with the appropriate Australian Standards (AS 1940-2004/Amdt 1-2004);

    f. on site refuelling must occur in bunded areas and spill kits must be readily accessible;

    g. any spills or leaks must be contained and cleaned up using spill kits and absorbent material and pollutants disposed of as soon as practicable in an appropriate manner;

    h. construction boats, barges and equipment that are launched or dock at the Point Wilson Explosives Area **Project Works Footprint** must be washed down with freshwater prior to and after deployment. Equipment must be checked for individuals of non-native species and those individuals removed;

    i. a vehicle wash-down bay must be constructed in an appropriate location within the **Project Works Footprint**; and

    j. any stockpiles of loose material must be covered or wet down during above average wind conditions.

4. Measures to minimise impacts to Indigenous heritage sites must be implemented in accordance with the referral information and must include, but may not be limited to:
    a. an exclusion zone of a 200 metre radius must be established around the AAV Sites 7721-0156 and 7721-0157, identified in Annexure 3; and
    b. subsurface archaeological test excavations are to be undertaken if any new electricity poles are proposed to be installed within 200 metres of the AAV Sites 7721-0156 and 7721-0157. If subsurface Indigenous heritage archaeological deposits are discovered, new electricity poles must not be installed at these sites.

Definitions

Observation zone: The area on the figure in Annexure 2 defined as "Observation zone". This area has a radius of 500 metres from the source of the **underwater piling**.

Project Works footprint: The area on the map in Annexure 1 defined as "Project Works Footprint". This area includes all construction and infrastructure for the action.

Shutdown zone: The area on the figure in Annexure 2 defined as "Shutdown zone". This area has a radius of 250 metres from the source of the **underwater piling**.

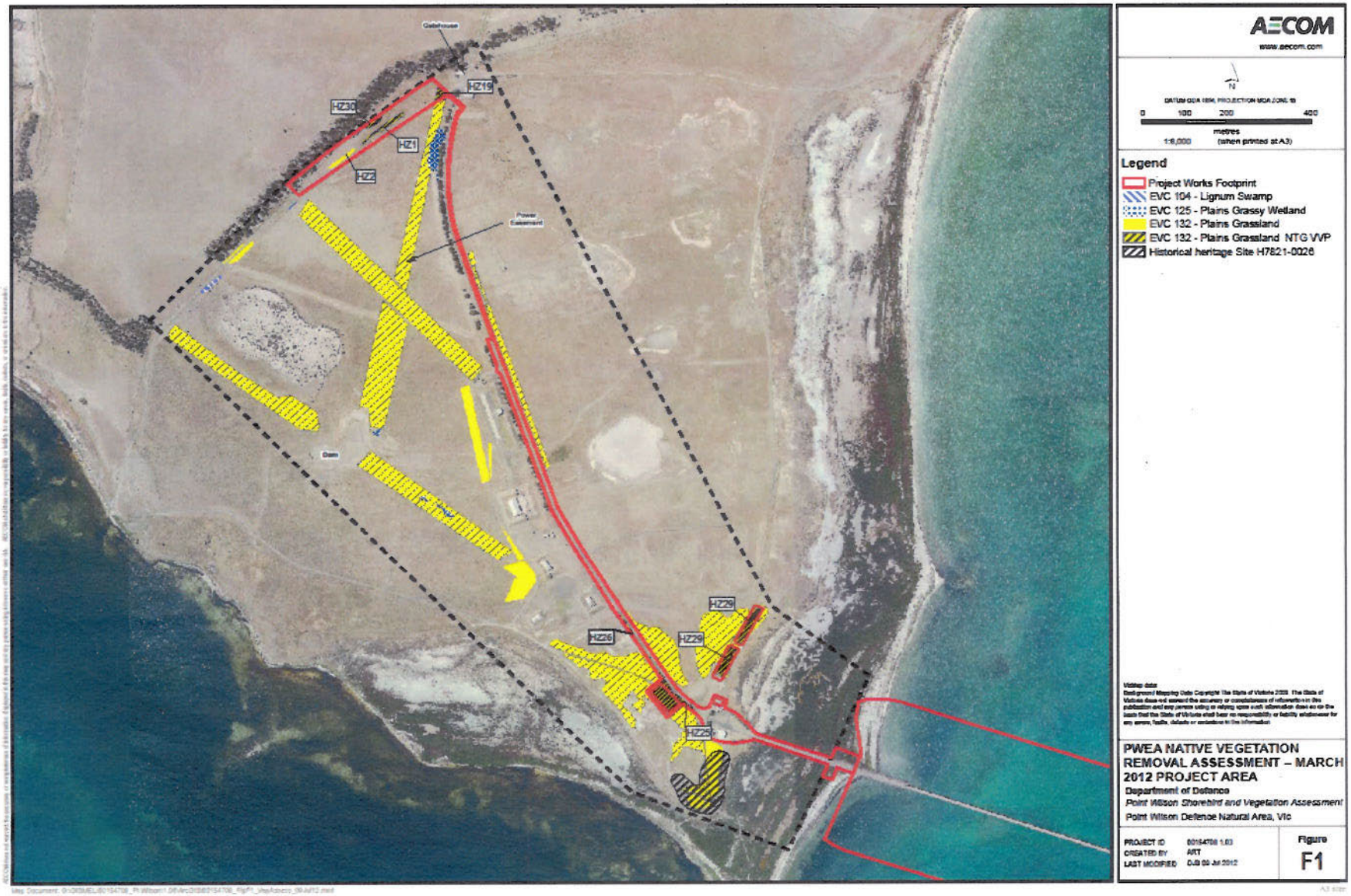
Soft start: The piling impact energy is gradually increased over a 10 minute time period. The soft start procedure should also be used after long breaks of more than 30 minutes in piling activity. Visual observations of marine mammals within the **Observation** and **Shutdown zones** should be maintained by trained crew throughout soft starts.

Suitably qualified crew member: A person or persons with qualifications in ecology, zoology or environmental sciences and demonstrated experience with the identification and appropriate management of dolphins, whales, sharks or marine turtles.

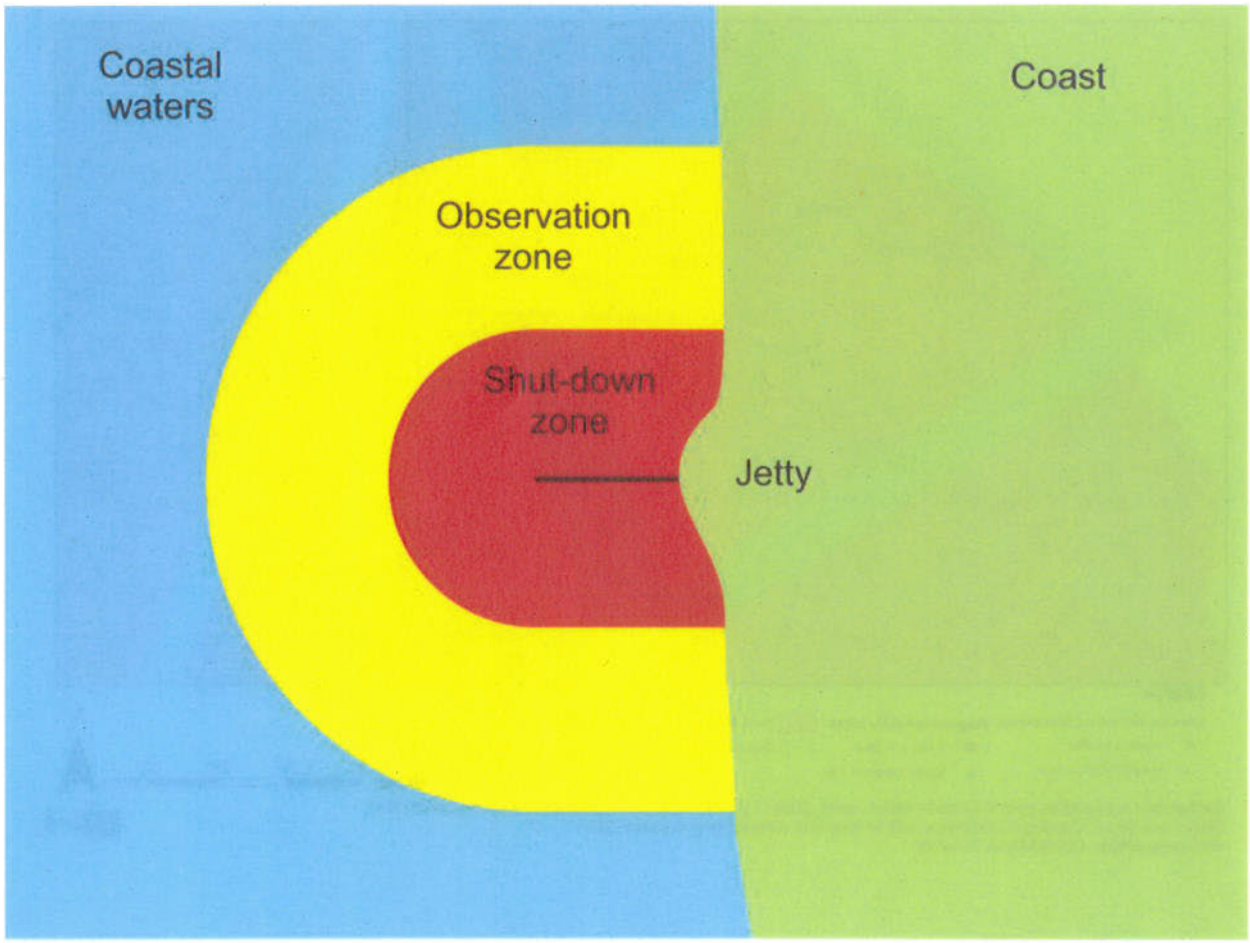
Temporary threshold shift (TTS): A temporary reduction in hearing sensitivity as a result of exposure to sound. Exposure to high levels of sound over relatively short time periods can cause the same amount of TTS as exposure to lower levels of sound over longer time periods. The duration of TTS varies depending on the nature of the stimulus.

Underwater piling: This includes any method of piling including impact pile driving (i.e. a pile is hammered into the ground by a hydraulic ram), and vibro-driving (i.e. where rotating eccentric weights create an alternating force on the pile, vibrating it into the ground).

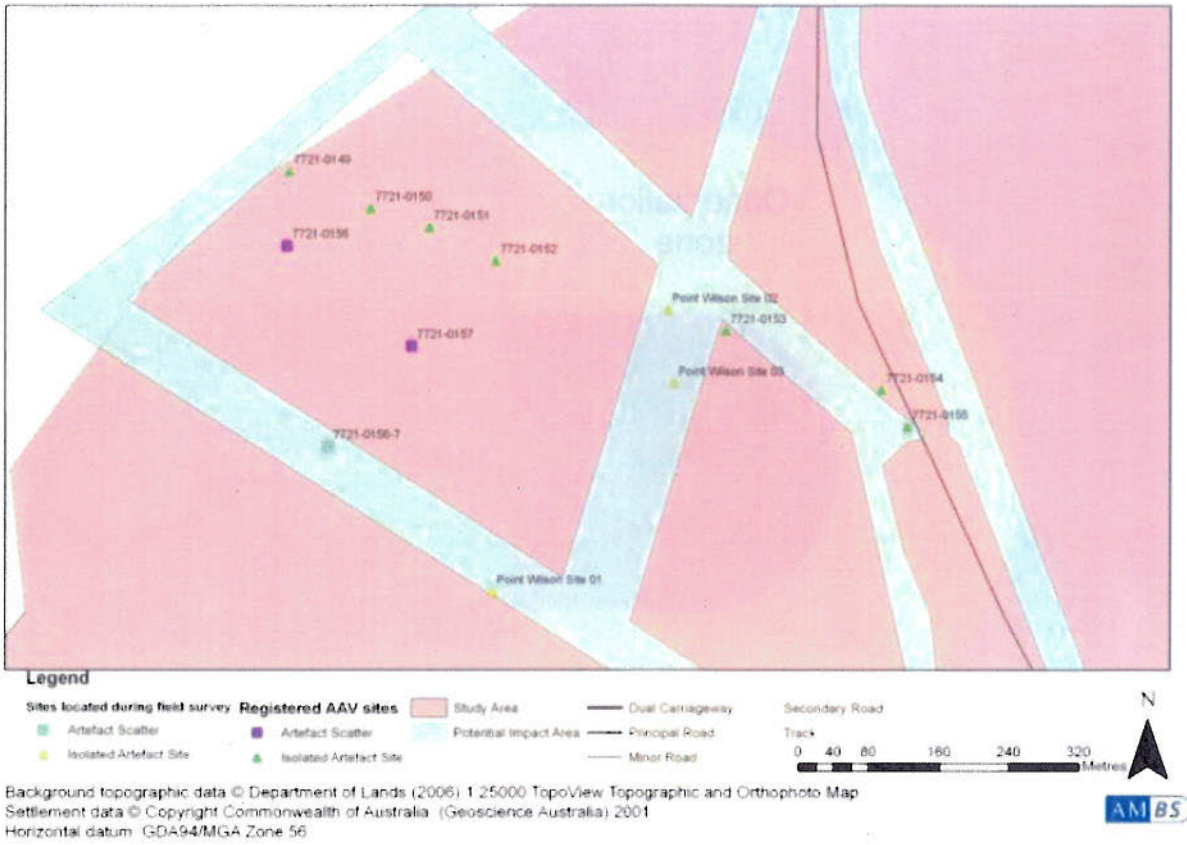
Annexure 1


Gatehouse
HZ19
HZ30
HZ1
HZ2
Power Easement
Dam
HZ29
HZ26
HZ29
HZ25
AECOM
www.aecom.com
DATUM GDA 1994, PROJECTION MGA ZONE 55
0 100 200 400
metres
1:6,000 (when printed at A3)
Legend
Project Works Footprint
EVC 104 - Lignum Swamp
EVC 125 - Plains Grassy Wetland
EVC 132 - Plains Grassland
EVC 132 - Plains Grassland NTG VVP
Historical heritage Site H7821-0026
PWEA NATIVE VEGETATION REMOVAL ASSESSMENT – MARCH 2012 PROJECT AREA
Department of Defence
Point Wilson Shorebird and Vegetation Assessment
Point Wilson Defence Natural Area, Vic
PROJECT ID 60154708 1.03
CREATED BY ART
LAST MODIFIED DJB 09 Jul 2012
Figure
F1

Annexure 2


Coastal waters
Coast
Observation zone
Shut-down zone
Jetty

Annexure 3



Background topographic data © Department of Lands (2006) 1:25000 TopoView Topographic and Orthophoto Map
Settlement data © Copyright Commonwealth of Australia (Geoscience Australia) 2001
Horizontal datum: GDA94/MGA Zone 56

Australian Government

Department of Sustainability, Environment, Water, Population and Communities

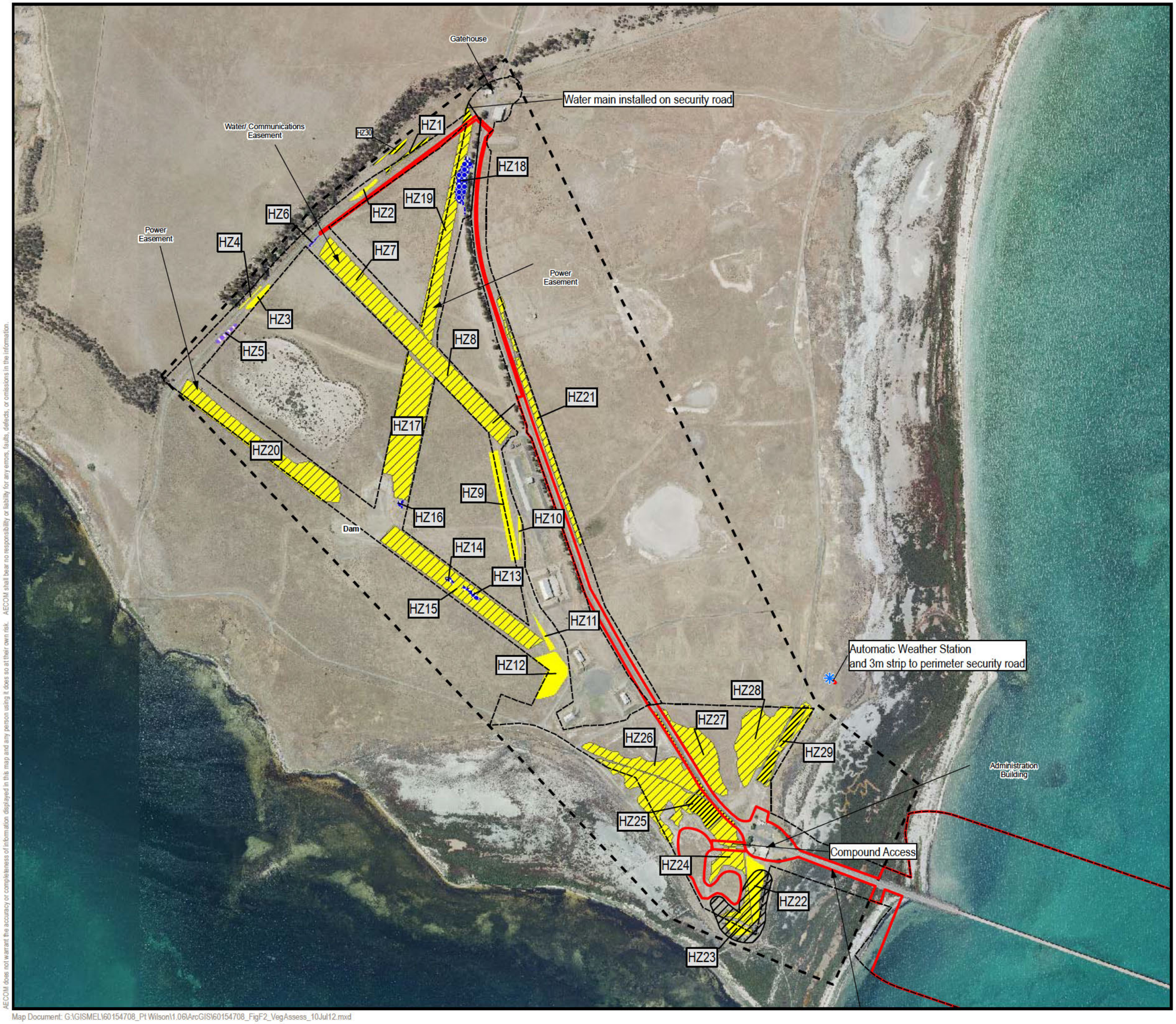
CORRECTION NOTIFICATION

Notification of
REFERRAL DECISION – not controlled action if undertaken in a particular manner

The notice incorrectly included an obsolete figure outlining the allowable clearance area of Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) located in the Project Works Footprint. The correct figure is provided at Annexure 1 and replaces Annexure 1 of the notice signed 7 August 2012.

Person making correction

Name and position	James Tregurtha Assistant Secretary South-Eastern Australia Environment Assessment Branch
signature	
date of correction	30 August 2012



AECOM

www.aecom.com

N

DATUM GDA 1994, PROJECTION MGA ZONE 55

0 100 200 400

metres

1:8,000 (when printed at A3)

Legend

- Project Area for remediation works
- Survey Area
- EVC 104 - Lignum Swamp
- EVC 125 - Plains Grassy Wetland
- EVC 132 - Plains Grassland
- EVC 132 - Plains Grassland NTG VVP
- Historical heritage Site H7821-0026

PWEA NATIVE VEGETATION REMOVAL ASSESSMENT – JULY 2012 PROJECT AREA

Department of Defence

Point Wilson Shorebird and Vegetation Assessment

Point Wilson Defence Natural Area, Vic

PROJECT ID	60154708 1.03
CREATED BY	ART
LAST MOD FIED	DJB 10 Jan 2012

Figure

F2

Map Document: G:\GIS\MEL\60154708_Pt Wilson\1.06\ArcGIS\60154708_FigF2_VegAssess_10Jul12.mxd

A3 size

Australian Wildlife Conservancy

Animal trapping, handling, sampling and photographing guidelines

March 2013

Purpose of document

The mission of the Australian Wildlife Conservancy is the effective conservation of all Australian animal species and the habitat in which they live. The use of scientific research to assess conservation management practices is central to this mission. As part of conducting scientific research it is essential that all researchers on AWC properties (i.e. AWC staff and non-staff) maintain the highest standards of animal welfare and hygiene.

To that end, this document sets out AWC's expectations in relation to trapping, handling, sampling and photographing animals. The intention of these guidelines is to minimise stress, injury and mortality of wildlife used in research projects carried out on AWC sanctuaries.

All AWC staff, students and volunteers are required to adhere to these guidelines. For non-AWC personnel, approval to conduct research on AWC sanctuaries is conditional on adherence to these guidelines.

Note that, in addition to adherence to these guidelines, all research projects must be covered by the relevant State/Territory permits, including Ethics permits.

These guidelines were drafted by AWC staff. Outside sources have been referenced .

Contents

1. TRAPPING PROCEDURES

1.1 General guidelines

- A trapping team should include enough skilled people to ensure that all traps can be set, located and cleared in a timely and efficient manner.
- Traps should be in good working order and clean prior to setting.
- Set traps so they are shaded during the day - position/install traps under or close to foliage and/or other dense vegetation.
- Avoid trapping at times when animals may be susceptible to greater stress, such as during breeding or lean seasons. Where possible, trapping should also be avoided in weather conditions that may threaten the welfare of trapped animals (e.g. heavy rain, hot temperatures, etc.).
- All equipment (e.g. callipers, tape measures, ear tattooing pliers etc.) that comes into direct contact with an animal should be sterilized prior to use on a new animal. Use bleach in preference to ethanol, especially for items used in genetic sampling (because bleach will denature any contaminant DNA, including viruses, as well as kill microbes). All traps should be cleaned by soaking for 10 minutes in a container of 5% Lysol solution and then remove all dirt and faecal material with a long-handled brush while the trap is immersed. After disinfection, traps should be rinsed thoroughly with freshwater.
- If possible, traps should also be property specific and not moved between properties.
- Data recording should be undertaken by persons with a clear understanding of what is required and can clearly communicate both verbally (with the handler) and in writing so that data recorded is legible.
- ***If external researchers are bringing their own equipment, make sure they have followed these equipment hygiene guidelines.***

1.2 Elliot, wire cage and other box-type traps (e.g. devil traps)

Note: Elliot and wire cage traps should NOT be opened or left open during the day. Traps must be cleared at dawn and closed and not be re-opened until late afternoon.

Placement

Traps should be positioned to reduce exposure to the sun, wind, rain etc. (e.g. place trap under shrubs, beside logs, covered with hessian/shadecloth). In targeted surveys, they should also be strategically positioned to minimise the likelihood of non-target species being caught. Each trap should be marked with flagging tape (or reflective tape if they are to be checked during the night) and the location recorded with a GPS. Locations of traps should be made known to at least one other person than the initial trap-setter in the event that the initial setter is unable to continue the survey (e.g. due to illness or accident). The number of traps set should match the ability of personnel to clear all traps well before animals are exposed to heat, cold or light (researchers should have contingencies for potential mishaps which could alter the speed with which traps could be cleared).

Shading and bedding

Traps should be placed in shaded positions. Cages should be heavily covered with either shade cloth or hessian for shade and to prevent animals becoming distressed. If rainy or damp conditions (e.g. heavy dew/leaf drip) are expected traps should be covered with waterproof material (e.g. pallet wrap, plastic bags, waxed paper milk cartons). Traps should be closed during daylight hours and only re-baited in the cool part of the late afternoon (to avoid accidental death of non-target

species, e.g. corvids, lizards, snakes etc.). Suitable bedding material (e.g. coarse cotton or leaf litter) should be provided in Elliot and cage traps in areas with low night-time temperatures.

Baiting

Bait should be removed from traps each morning and replenished each afternoon. Sufficient bait should be used to ensure that trapped animals have adequate food for the duration of their capture. Traps should be closed if they are infested with ants or alternative baits should be utilised.

Checking and handling

Traps must be inspected as early as possible in the morning or at night, to reduce the possibilities of stress and predation. All traps must be located and checked each time a trapline/grid is checked and all traps must be removed from the field at the end of the survey (or locked open or shut).

Captured animals should be approached carefully and quietly to reduce panic and risk of injury.

For nocturnal species that are especially prone to sustaining injury in traps, (e.g. bettongs, rock wallabies, etc.) one or more of the following options should be utilised:

- The rear door of the trap should be removed and replaced with a large bag made of dense (90-100%) shade cloth, attached to the ground with tent pegs. If predation by foxes is a concern, the bag will need to be protected inside a wire cage.
- Traps should be checked in complete darkness with low-intensity lights (e.g. LED head torches) and should not be set for the entire evening.

The use of alternative traps, e.g. PVC devil traps, should be investigated.

Separate handling bags should be used for each animal captured. Bags should be sterilized before reuse (see section on hygiene).

Non-target animals

Non-target animals caught in traps should be released immediately at the site after checking for injuries and signs of illness or distress. In the event that an animal is injured or stressed, assess the severity:

- Animals with minimal injuries such as minor cuts or abrasions should be immediately released at the site of capture.
- Animals with more severe injuries or which are suffering from thermal stress should receive appropriate attention. An animal suffering from thermal stress can initially be placed in a suitable quiet holding area that provides warmth or shade to allow recovery before release. Animals with treatable injuries that cannot be immediately released or those failing to recover from thermal stress should be presented to a veterinarian or a registered wildlife carer for treatment.
- Before any trapping, acquire contact details for local wildlife careers, or if in remote locations have equipment and facilities to deal with any injured or orphaned animals.

1.3 Pitfall traps

Placement and cover

If possible, always install pits under foliage or other dense vegetation (however, be aware of proximity to large trees, as large roots can complicate installation). When in use, shading material (i.e. shade cloth/hessian) should be placed in the bottom of pit. Avoid the use of external covering/shading above pit traps, as this can lower capture success. Make sure material is large enough to allow cover for a large lizard (i.e. blue-tongue/small goanna) or snake (up to 600 mm total length). The material should be folded several times and placed in the northern side of the pit and a small rock or log placed on top to keep in place. During hot weather, cloth should be moistened at first opening and also at each subsequent check.

Checking

Pits MUST be checked at least twice per day (dawn and late afternoon), and more often during extreme weather conditions. Before attempting to reach into a trap, check thoroughly for presence of hazardous animals (snakes, spiders, centipedes), using large forceps or tongs and a torch. Completely remove all covers, rocks and other debris when checking, making sure to check thoroughly for animals hiding within covers. Once all animals have been removed, all excess soil and litter should be removed from trap, though covers and rocks (and water) should be placed back at the northern side of trap. Pits can be left open during light rain, providing a rock has been placed in the pit beforehand. Pits should also be checked more regularly under these conditions.

Pits MUST be closed during heavy rain or if heavy rain is predicted. If a trap has water in it, remove all material from inside and dry using a suitable container and cloth. It can be handy to have pre-drilled holes in the base of pits to allow for drainage of water. However, this will only be practical in well-drained, sandy soils. Traps installed in poorly drained soils will continue to have water seepage problems, particularly in low lying areas or during times of heavy rain.

Ants

Pits that show signs of ant activity should be treated prior to opening/re-opening. Use only repellents or insecticides of low toxicity and odour that DO NOT contain Pyrethrins or Tetramethrin. Repellent/insecticide should be sprayed directly into the base of and around the pit, also at the base of the drift fence. Each pit should then be resprayed accordingly based on ant activity. Re-apply as necessary (i.e. disturbance such as wind, rain, animal activity will reduce effectiveness).

Upon completion

After each trapping session always ensure pits are closed properly.

Remove everything from inside trap (soil, leaf litter, sticks, etc.), making sure all animals have been removed. Gouge a trench around the rim of the trap, allowing room to reattach lid. For buckets, make sure lid snaps shut. For PVC pipes, make sure lid follows thread pattern and twists at least 2-3 full rotations. Cover pits with soil, mounded in the middle to at least 20 cm in height and then place rocks/logs on top of mound, preventing erosion. Pit lids need to be covered this way to prevent UV damage to the lids, which could make them brittle. If using buckets in an area with large hooved animals (cattle, horses, etc), put a sheet of tin over the bucket lid before heaping dirt and rocks over the tin. This will prevent large animals from punching a hole in the lid if they walk over the pit.

Drift fences MUST always be taken down after each trapping session and not re-installed until the next session. Otherwise, its presence will affect future capture rates.

1.4 Funnel traps

Shading

Each trap needs to be covered with as much shade as possible. Suitable shade includes a combination of the following: building insulation (preferably the bubble-wrap style, Air Cell - Glareshield®), shade-cloth, hessian, excess drift fence, bucket lids, logs, leaf litter and/or dirt. Building insulation is recommended, as by reflecting radiant heat, it can reduce the ambient temperature by as much as 40%.

Checking

Providing builders insulation is used as shading, traps can be left open continuously and checked in the morning and afternoon. However, without building insulation, traps must be checked more regularly. In cool conditions, traps can be left open all day, though will need to be checked at least 3-4 times/day (dawn, mid morning, midday, mid-late afternoon). In hot conditions, traps must only be opened for the morning, afternoon and also overnight. In this case traps must be checked at dawn, then mid morning and closed, then re-set mid afternoon and checked before dusk. Traps

can and should be left open overnight, though must be checked within 1-2 hours after dawn, no later.

It is essential that traps be checked very carefully, as vision into funnel traps can be easily obscured, and many species can hide extremely well in corners, edges and folds in the material. Remove all shading material, then before picking up trap, scan for potentially hazardous animals (e.g. snakes). Once deemed 'safe', lift trap into the air and scan for animals. Once animals have been removed, bend trap end to end and lightly shake. Any animals left inside will then fall into the middle of trap. Scan over trap once more then reinstall trap, ensuring adequate cover.

1.5 Goanna PVC pipe traps

Checking

In cool conditions, traps can be left opened all day, although they will need to be checked at least 3 times/day (mid-morning, midday, late afternoon). In hot conditions, traps must only be opened for the morning and then in the afternoon. Trap should be opened and baited at dawn, checked mid-morning then closed. Traps should then be re-opened early afternoon, checked late afternoon and then closed. In all cases, traps must remain closed overnight. Check traps using a torch. Traps should be closed during heavy rain. Light rain is fine, though traps should be checked more regularly. If a trap contains water or debris, remove, empty and reinstall. After trapping session, remove trap and turn it upside down to remove excess bait. Traps should then be cleaned thoroughly and the open end should be fitted with a PVC end cap.

Ants

Traps that show signs of ant activity should be treated with Coopex®, applied in a ring around the trap. Reapply as necessary (i.e. disturbance such as wind, rain, animal activity will reduce effectiveness).

1.6 Soft-jaw traps

It is imperative that researchers using soft-jaw traps constantly revise their techniques to ensure highest ethical standards are maintained.

Setting traps

The only leg-hold traps approved for use on AWC properties are soft-jaw traps which have offset jaws and rubber padding. Soft-jaw traps come in several different sizes. The size of the traps used should be appropriate for the target species. Victor #1 and #1.5 traps are intended for rabbits and cats. They have a smaller gape and close with less force. Victor #3 traps are intended for dogs/dingoes. They have a broader gape and greater closing force.

Traps are typically set in multiple-trap sets. Individual traps can be anchored via a chain to a short metal dropper/s inserted into the ground. Droppers should be set into the ground straight. If it is possible to pull the trap out with two-hands without reasonable effort it is not secure. An alternative to droppers are heavy 'drags' such as rocks, logs or pieces of metal. These are only suitable if heavy enough to prevent the animal moving a long way but light enough to be moved by the animal when pulled against in order to reduce the chance of dislocation.

The length of chain between the anchor and each trap should be no longer than 30cm. This reduces the radius of movement of the animals making handling of trapped animals easier and reducing the risk of injury. Traps must have a spring incorporated into the chain so that when animals pull on the trap there is some 'give' in the chain. This reduces the chance of dislocation and is a legal requirement in some states. Traps should be attached to the dropper or drag using D-shackles rather than wire which can break when stressed.

Trap checking and animal handling

- Traps should be checked regularly. At a *minimum* traps must be checked once during the night, and then again at first light in the morning and closed/covered for the day. More frequent checking is encouraged.
- In order to minimize the chance of non-target captures, traps should not be set until (or after) dusk, and must be checked before or at dawn (not later).
- Where animals are trapped as part of a control regime they should be euthanized as quickly as possible.
- Several people should be aware of the position of each trap in case the initial trap-setter is unable to check traps due to illness or injury.
- The number of handlers attending a capture must be kept to a minimum. Captured animals should be approached quickly, but do not startle them.
- When checking traps stop before reaching the trap station and approach on foot to determine if there is an animal in the trap. If there is an animal in the trap, return to the vehicle and retrieve the necessary equipment.
- Handlers should wear leather gloves.
- If animals are to be sedated, syringes should be prepared before approaching the animal.
- Dingoes and foxes can be quickly suppressed using a noose pole or dog jigger. Once on their side they will rapidly become submissive. Cover the head with a blanket to reduce stress. If the animal is initially agitated it can help to cover it with a blanket before suppressing it.
- Always keep in mind where the captured limb is facing and whether or not it is being twisted or bent in uncomfortable positions. When restraining animals try and secure the animal with its limb in the most natural position.
- If processing a dingo one useful method of restraint is a board with straps attached which hold the dingo on its side at the neck, chest and pelvis, with a blanket covering the head. The animal will settle right down once strapped to the board. Weighing and processing can be done on the board.
- When releasing the animal give it a clear escape path, i.e. open area with no obstructions. If sedating an animal, retain animal in a cage (cats, foxes) or restrained on a board with the head under a blanket (dingoes) until completely recovered before releasing.

Non-target animals

There is a real possibility of non-target captures when using soft-jaw traps. These include macropods, peramalids, varanids and birds.

Assess the risk - do not use soft jaws if the chance of by-catch is high, and/or the probability of injury for the by-catch is large.

- During the day lures should be removed, traps can be discharged or covered (e.g. with large rocks) to avoid catching varanids.
- Avoid setting traps near water courses, holes in fences and animal pads where chance of by-catch is high.
- Avoid setting traps in the open and look for potential locations with as much shade from trees or bushes as possible (this will lessen stress on captured animals and protect them from weather and potential predators).
- Meat or animal lures should be hidden from birds by burying or shading.

Handling non-target animals

Birds of prey will react to approaching humans but should settle down once covered. Cover the birds' eyes with a blanket immediately. Restrain the bird while releasing the trap. Take care to avoid causing injury to wings. Check for injuries to the legs, talons and wings before releasing the animal. Make sure the birds' exit is clear of obstructions. Do *not* throw the bird into the air upon release.

In the event of capturing a non-target mammal, cover the animals head with a blanket immediately. Assess any injuries and if no serious injuries remove the trapped body parts from the traps and release.

1.7 Hair-tubes

The floor of the hair tube should be free of adhesive tape to prevent small lizards and frogs becoming stuck. Hair tube surveys should be discontinued in areas where non-target species are being captured. Hair tubes should be angled with the entrances pointing slightly downwards/upwards to ensure drainage. All hair tubes should be disinfected by soaking for 10 minutes in a container of 5% Lysol solution prior to reuse.

1.8 Harp traps

Placement and checking

It is possible to catch too many bats and thus dangerously extend handling time. Harp traps at roost entrances must be continually monitored. Great care needs to be taken if setting harp traps at roost entrances suspected to contain long-winged bats (Mollosidae, Emballonuridae) as they return to roosts with great speed and can seriously injure themselves.

If harps are to be left standing during the day, use flagging tape tied to strings to avoid diurnal birds colliding with traps.

Bat workers vary in their opinion of checking times, from regularly to never throughout the night, clearing them only at dawn. AWC's policy is two-hourly checking (unless at roost entrances) to avoid exposure of delicate species (see below) and carnivory inside traps.

There are several delicate species, which die readily if held for extended periods due to desiccation. Such species usually roost in high humidity caves, e.g. *Hipposideros ater*. If such species are expected, check traps frequently and consider closing traps at least 3 hrs before dawn to allow individuals to find their way back to their roosts before humidity drops too low.

It is almost impossible to keep sensitive species alive during the day for release the following night. It is preferable to release all individuals on the night of capture. Handling and processing should continue throughout the night. If non-sensitive species are to be held during the day for subsequent release carefully consider stress induced by heat, noise and excessive light. **NEVER use wet calico bags,** as the weave closes and bats suffocate.

1.9 Mist nets - bats

The use of mist nets is debated among bat workers, because bats are typically very difficult to extract, and because they can do considerable damage to nets. However, mist nets are the only way to catch some species (e.g. high-flying, long-winged bats). Nets should be continually monitored and entangled bats extracted immediately. Be cautious of bats that emit distress calls, which can attract other bats. This can lead to the undesirable situation of having dozens of bats entangled at once.

1.10 Mist nets – birds

Personnel

Bird handling is a specialised skill - handlers should hold a license from the Australian Bird and Bat Banding Authority. Trainees must be supervised at all times. Ensure there are a sufficient number of handlers to process all birds safely, quickly, quietly, and respectfully.

Handlers must be properly trained and possess the following attributes:

- A paramount concern for the welfare of birds.
- A patient disposition.
- Vigilance to monitor the health of birds in nets.
- Good eyesight.
- Sensitive fingers and dexterity.
- The ability to work out how birds have been caught.
- Some knowledge of avian anatomy.

Placement

Nets must be set-up on a rigid framework of poles and guy-ropes capable of withstanding wind, or a hit by a large animal or human. Shelf-strings must be taut and set with a suitably deep pocket. A single person alone must be able to adjust the tension on the mist-net. Vegetation below the net must be tied back or removed discretely to assist the banders view and prevent birds from becoming tangled. In hot climates nets must be closed once temperatures rise too high for catching. Erect nets in the shade to reduce heat stress of birds.

DO NOT band in inclement weather. Close nets in windy or hot conditions.

DO NOT erect a net where a large number of birds are likely to frequent (i.e. at waterholes in the dry season). In situations where this cannot be avoided, use extreme caution with adequate personnel, minimal net coverage and observe the net at all times.

DO NOT leave nets unattended especially in open environments. Hidden nets should be checked thoroughly by walking the entire length of the net every 10-15 minutes depending on weather.

Be cautious if there are known predators in the area. Be aware of what predators may be around (including non-typical predators like bowerbirds, coucals, etc.) and stay constantly vigilant for them. If you find that possible bird predators are in the area during netting, shut the mist nets until the threat has left the area or leave the site and attempt bird capture at another site. Frequently assess the condition of the nets and repair them quickly. Be prepared to keep injured birds, take veterinary advice or euthanize in cases of injury.

Banders must continually assess their own work to ensure that it is beyond reproach.

- Reassess methods and your approach whenever an injury or mortality occurs.
- Accept constructive criticism from other banders.
- Banders must offer honest and constructive assessment of others' work to help maintain the highest standards possible.

Banders must ensure that the data gathered are accurate.

Priority extractions

Be aware of the condition of all birds in your net. Capture and process only as many as can be safely handled and release the rest. When banding, always be prepared for the worst. Always carry bird bags, radio, and scissors with you. When extracting birds from a mist-net, prioritise as follows:

1. Any birds that have excessive net strain on them;
2. Injured birds;
3. Birds in the sun;
4. Birds in the bottom shelf (to avoid being accidentally kicked, hitting the ground or picking up sticks, etc. which will make extraction all the more difficult);
5. Easy birds should be taken out before difficult ones because it can be done quickly and because birds in bags are safer than birds in the net;
6. Females with eggs in their oviducts (**and release these immediately**);
7. Fledglings.

Never place bags containing birds on the ground near the net. Place in unoccupied shelves, or tie onto guy-ropes. Always count the number of holding bags you use when extracting birds from a net. This will ensure that all birds are accounted for before you leave to go back to the banding station.

1.11 Call sampling

Birds

Birds use calls for defending territories, mate finding, mate guarding, etc., and so using play-backs can cause significant stress and disruption. It should only be used for cryptic species that are otherwise difficult to census/detect. Visitors/tourists to sanctuaries should be discouraged from using playbacks for bird-watching.

Bats

Lethal reference call sampling for bats is not permitted.

Pre-capture calls are preferred because it causes least stress and the resulting reference call is normally more useful/better quality – distress calls recorded in the hand are not very useful for bat detecting.

Good results can be obtained from release calls if small pieces of reflective tape are adhered to the bat's back (bats can be spot lit and recorded later that night once they have resumed foraging). The tape is usually groomed off in the same night so represents only a temporary disturbance.

2. ANIMAL HANDLING

2.1 General guidelines

Broad guidelines of handling animals can be found in the *Australian code of practice for the care and use of animals for scientific purposes* (1997). The primary principle is that captured animals should be handled in a manner that minimises the risk of injury or stress-induced disease. Minimising injury and stress is best done through firm and quiet handling, keeping handling and restraint time to the minimum needed to achieve objectives, using sufficient competent persons to restrain animals, using techniques and timing appropriate to the species, and using, where appropriate, chemical restraint.

Risks to animals are sometimes unavoidable, but can be minimised. Often one trapping session can provide samples, information and data for many purposes and reduces the need to re-trap animals. In addition, integration of trapping objectives, tasks and animal handling should be incorporated in to the planning of any trapping program, further reducing handling time, stress and repeated trapping sessions.

When releasing the animal (after processing) the researcher should check for any predators in the area (birds of prey, snakes and goannas).

2.2 Small mammals

Box-type traps (cage and Elliott traps) should be approached quietly. Cage traps should be approached from a 'blind-side' so animals are not aware of the approaching person. Removing animals from traps should be done quickly, confidently and quietly. This may mean limiting the number of people attending the trapping. The time spent handling the animal should be minimal, with animals only held as long as needed to identify, take measurements, samples and apply collars, etc.

Calico/cloth bags are the best form of container to transfer small mammals into from traps, as the reduced visibility for the animal reduces stress. A clean and sterilised bag should be used for each animal. **Note**: **Wash bags between each use**. Bags should be free of loose threads, which can snare animals' feet. Only one animal should be kept in a bag at one time. Where handling is likely to be rapid (i.e. for identification of well-known species only) and measurements of animals are not being taken, sturdy plastic bags may be used. However the handler must take into account the heightened stress on the animal.

Small mammals should be transferred from box-type traps and pit traps to holding bags gently. Movement from box-traps can be encouraged by tapping the cage or by gently blowing in the back door of the trap. Using inertia to 'fling' animals into a bag is NOT appropriate. Transfer of small mammals from pit-traps to holding bags can be done by placing the bag around the hand, picking up the animal and pulling the bag around the animal.

Taking some body measurements or attaching collars may require handling of the animal outside of the holding bag. The 'bird-hold' technique can be used either through the bag or by directly holding the animal. Some smaller rodents can be scruffed by holding the fur along the neck and back with all fingers and the base of the palm. The bird-hold is likely to cause less discomfort to the animal than scruffing. Some small dasyurid species may be free-handled, although this gives poor control for taking measurements. Holding the base of the tail may increase control of dasyurids with minimal discomfort. Extreme care should be taken to avoid handling rodents and bandicoots by the tail. Handling some species such as rock rats (*Zyzomys* spp) is not advised as they have easily-torn skin.

Animals should be released at the point of capture, at a time consistent with the species' normal activity rhythm.

Some small mammal species with high metabolisms may require food prior to release. Small dasyurids can be fed meal worms by hand or left in the calico bag with the animal. In some cases it

may be preferable to hold an animal over the day to ensure it is sated before release. If animals are required to be held over daylight hours for identification, ensuring satiation, etc. they must be held in a cool, quiet environment. Small dasyurids can be kept for short periods in a calico bag in a well-ventilated area. Rodents should be kept either in an insulated Elliott trap in a well-ventilated, cool area or in a purpose-built enclosure. Care must be taken to ensure animals receive sufficient food and water while being held.

2.3 Medium to large mammals

Handling techniques

Traps should be set in a manner that allows safe, quiet and 'blind side' access. Animals should be transferred into and processed in dark, strong cloth bags. **Note: Bags should be checked regularly for weakening and rips**. Animals should be gently encouraged to move from the trap into the bag by placing the bag over the end of the trap and then opening the trap into the bag. If the animal stalls or panics in the trap, other forms of encouragement should be used such as removing hessian cover from the end of the trap, blowing at the animal from the end of the trap or gently lifting the trap to use gravity to encourage the animals in to the handling bag.

With hard-wire cage traps it is important to get the animal out of the trap and into the handling bag as soon as possible as the animal is less likely to be injured in the handling bag. Nobody should approach the trap or be in the vicinity of a trap with an animal in it until completely prepared to remove the animal from the trap.

If using soft sided traps (Bromalo's, Thomas traps) animals (i.e. wallabies) will need to be removed from the trap by standing the trap on it's end with the opening up and then reaching into the trap and grabbing the base of the tail (tailing), then lifting the animal out and straight into the bag. Two people should be on-hand if "tailing" the animal is necessary. Personnel need to be physically capable of restraining and lifting large animals if tailing in this situation. Wallabies may launch up into the person getting them out of the trap; this can cause serious injury. Personnel also need to be aware of animals striking, kicking, biting and scratching; appropriate first aid should be available.

Animals should be handled in the bag by exposing only the section of the animal that is being assessed to increase control for the handler and reduce stress to the animal. The eyes of the animal should remain covered unless absolutely necessary. To process the animal the handler should apply broad, firm, but gentle pressure to the rump and shoulders of the animal; animals should never be restrained by their limbs alone.

Processing

Processing should be done at the point of capture and the animal released as soon as possible to reduce stress and the risk of contamination and quarantine breaches. Under circumstances when it is appropriate to transfer animals to another place for more intensive processing (taking blood, radio collaring, etc.) the animals should be returned to the exact site of capture and nocturnal animals should be released as soon as it is dark (not in day light) to allow them to have a full nights' foraging. All animals should be processed as fast as possible without reducing the accuracy of the records.

Special cases – pouch young (PY)

Good practice and awareness will avoid most incidents of pouch young ejection:

- Trap in seasons where PY are less likely to be present.
- Follow all trap-setting protocols to reduce animal stress.
- Once an animal is in the handling bag the first assessment should be breeding condition so that extra care or precautions can be taken if the animal is carrying a PY.

- If a PY is ejected it should be removed from the bag that the mother is in to avoid the young being kicked or bitten, and placed in a separate bag.

See below for how to react to different PY circumstances.

Embryonic Pouch Young (EPY) (smaller than 40 mm crown to rump): As a precaution, tape only if mother is overly agitated.

Medium Pouch Young (MPY) (larger than 40 mm but not haired): Even if not ejected, always tape as precaution. If ejected, separate PY and mother, process mother as normal, then use two people to put young back into pouch (this should be done as quickly as possible with the mother well restrained), then tape the opening of the pouch (be sure to only put tape on the mother, not the PY), then soft release.

MPY orphans (when mother is not dead but escaped or tape failed): Keep MPY warm and hydrate with water or formula (if available) and try to trap mother back. When mother is caught; tape in, soft release, etc. If the mother cannot be re-trapped then the animal is deemed an orphan. Different sanctuaries will have different procedures for orphans; make sure you know what they are before you start trapping.

Large Pouch Young (LPY) (haired PY): If the LPY is NOT ejected, just soft release. If the PY is ejected, separate PY and mother, process mother as normal, then soft release together. Never tape LPY into the pouch.

LPY/ young at heel in trap alone (without mother): Soft release.

Definitions

'Tape as precaution' or **'tape'** = use a generous amount of tape (Fixamol, Elastoplast or similar) to cover the opening of the pouch; important not to put tape on PY, only the mother. Tape will need to be well massaged onto the fur.

'Soft release' = Place mother, followed by the young into a thick hessian bag that has been folded down and out so that it is half as deep (and twice as thick) and place the bag (with the two animals) under a thick bush that will be protected from sun all day, walk away quietly and quickly. Check the bag the following morning.

2.4 Bats

The handling of both mega- and microchiropterans requires proper training and supervision. For advice on how to hold microbats while taking morphometrics, refer to page 49 in Churchill (1998). All bats have extremely delicate bones in their wings and feet, and much of their soft tissue (e.g. wing and tail membranes, nose leaves, tragus, etc.) is extremely fragile. The utmost care must be taken while extracting bats from mist nets and traps. In addition, most species can inflict painful bites, through to the bone, and some Australian species are known to carry the rabies-like lyssavirus.

ALL AWC STAFF HANDLING BATS MUST HAVE THE PRE-EXPOSURE RABIES (LYSSAVIRUS) VACCINATION.

2.5 Birds

Hold each bird for no longer than 1 hour in a bag. Juvenile birds should not be held for more than 30 minutes. Release birds showing any sign of heat-stress, apathy, shock, etc. Be prepared to offer stressed birds water or sugar-water, though do not force feed - you may put water into the bird's lungs, which is very dangerous.

Birds are fragile and must be handled carefully. Care must be taken not to hold the bird too tightly or too loosely. In the ringer's grip the bird is held resting on its back in the bander's palm. The bird's neck is held loosely between the first and second fingers of the left hand and the other fingers and thumb form a loose cage around the bird. The legs of birds with sharp claws may be held between

the third and forth fingers to immobilize them. Hands should be kept as dry as possible to avoid feathers sticking to them.

A variety of holding bags exist. The basic features are soft cloth material (i.e. breathable cotton), usually opaque, with no edges protruding into the bag, which might tangle and injure the enclosed bird. The drawstring material should be soft, smooth and easy to un-knot.

Only one bird should be placed in each bag. The safest way to carry birds in bags over rough terrain is around the neck, this frees your hands in-case you trip and fall. Holding bags must be kept out of the sun, and off cold surfaces and placed in a safe position to avoid trampling, suffocating or overheating of birds. Exercise extreme caution if bags containing birds are placed anywhere on the ground. Preferably use a box, or hang from a nearby branch.

Holding bags must be washed after each use with non-irritating soap and bleach to avoid possible disease transmission between birds.

Birds should always be released by or under supervision of experienced banders. If banding in a hot climate, before release, offer the bird water by placing a droplet on the end of the bill with a clean piece of cotton wool. Release birds by opening the hand (passerines) or placed onto the ground facing into the wind. Be sure to watch each individual to ensure they can fly and perch properly.

2.6 Reptiles

Reptiles are less fragile, in some respects, than many other taxa. However, handling should always be kept to a minimum, and the animals' welfare should always be the first priority. Some species can also be extremely dangerous to handle, and the handler must also take into account his/her own welfare. For these reasons, the following handling techniques should be followed:

Skinks, geckos and dragons

These should never be held by the tail. For small lizards (< 150 mm total length), the front foot should be held between the thumb and index finger (right foot = right hand, left foot = left hand). The body should then be supported by the remaining fingers. Further support can also be offered by the other hand, by grasping the diagonally opposite hind foot. For larger lizards (> 150 mm total length) hold by restraining head between the thumb and index finger and supporting body in palm of both hands, while providing slight pressure with the three remaining fingers. Care should be taken with larger species (> 450 mm total length, i.e. blue-tongues or frill-necks) and should only be handled by an experienced handler as they can inflict painful bites and/or scratches. Geckos should be handled very gently, as their skin is extremely delicate and can be torn easily.

Legless lizards

Legless lizards should never be held by the tail. Hold by lightly restraining the head/neck between the thumb and index finger and supporting body in palm of hand, while providing slight pressure with the three remaining fingers. Be constantly aware of the tail, as the thrashing and coiling of the tail around the fingers can damage or break it. If possible, gently support the tail with the other hand and keep handling time to a minimum. If possible, place lizard in a zip-lock bag and observe through it.

Goannas

Small goannas (< 300 mm total length) should be held by restraining head between the thumb and index finger and supporting body in palm of both hands, while providing slight pressure with the three remaining fingers. Large goannas (> 300 mm) should only be handled by an experienced handler. However, they can be safely handled by holding the neck with one hand and the pelvis with the other. Animals should be held away from your body, with claws (and head) facing away.

Freshwater turtles

Always hold by the carapace (upper shell). Using the fingers and thumb of one hand, hold the carapace just above the hindlimb. The other hand should then hold the carapace above the head, though always be aware of where the head is at all times, particularly in long-necked species (*Chelodina* spp) or snapping turtles (*Elseya* spp), as a bite can be nasty. Always face the head and claws away from the body.

Snakes

With the exception of blindsnakes, all snakes should only be handled by an experienced person.

Crocodiles

All crocodiles should also only be handled by an experienced handler, regardless of size of crocodile.

General

All reptiles can be held in calico/coth bags (size of bag will depend on animal), though small lizards (<150 mm total length) and small snakes (<300 mm total length) can be held in a plastic zip-lock bag, providing the bag contains ample leaf litter. Animals must be kept out of direct sunlight and warm temperatures at all times. They must be kept in suitable shade or inside an esky. **They must also not be kept for longer than 24 hours**. For long term holding (> 24 hrs), reptiles need to be kept in suitable vivaria, providing area to move freely, water, food and shelter. Venomous snakes must be kept in a well-ventilated, sealed, preferably lockable container with a caution label.

Hands should be washed immediately after handling animals with hospital grade antiseptic, preventing spread of potential disease from reptile to reptile, or reptile to handler.

2.7 Frogs

Handling of frogs should be kept to a minimum. Frogs captured by hand can be held by either holding the front foot between the thumb and index finger, or by grasping the pelvis/hind legs between the base of thumb and index finger.

Where longer handling periods are required, e.g. problematic identification, frogs should be held in plastic zip-lock bags. Bags must contain leaf-litter and some green vegetation (grass is ideal) and be misted with water. Frogs must be kept out of direct sunlight and warm temperatures at all times. They must be kept in suitable shade or inside an esky. **They must not be kept for longer than 24 hours.**

Frog handling in areas of high chytrid risk

In areas of high chytrid risk or potential high chytrid risk a high level of hygiene is required. Frogs must be handled with disposable vinyl gloves (changing gloves between handling) or using clean plastic bags (zip-locks are ideal). If frogs come into contact with handler's skin, wash immediately with hospital grade antiseptic.

Only one adult animal should be kept in a container at one time. Multiple tadpoles may be kept in the same container as long as they are all from the one site. Holding containers must not have been used for other animals or must have been sterislised between uses.

Never move frogs into new areas. Each frog MUST be released back to site of capture.

Chytrid fungus is sensitive to temperature above 29°C and will die at 32°C. Complete drying will kill chytrid fungus. Equipment used with frogs, containers and shoes must be cleaned and sterilised before fieldwork and between sites using either 70% ethanol for 1 minute, bleach for 1 minute or complete drying (>3 hours). Mud and dirt should be removed from shoes before sterilization.

2.8 Exotic species

Exotic species should be removed from traps and handled with the same care and consideration as native species. However, apart from special circumstances (i.e. radio-tracking), all exotic species should be euthanized, preferably on site, and done so in accordance with the approved standards and procedures (these vary between States and Territories, so make sure you are familiar with them). See Section 7. Euthanasia.

3. ANIMAL PHOTOGRAPHY

AWC's aim is to ensure best practice is maintained by our staff, volunteers and visitors, and to encourage everyone working in or with AWC to actively consider whether the photography is appropriate for the situation. The term 'photography' includes all forms of image capture, whether stills or videography, in any media.

3.1 General photography guidelines

- Photographers should ask permission of people who are in photos. This can be as simple as a general question at the start of a survey to check if anyone objects to being photographed and their image published.
- For cultural reasons, sensitivity is required in the presence of Aboriginal and Torres Strait Islanders and their significant sites.
- Photography should not impinge on:
    - the health and wellbeing of any animal, nor
    - the minimum handling standard contained within the Animal Handling Policy, nor
    - the conditions of the approved Animal Ethics permits.

3.2 Guidelines for photography when handing animals

- Captured animals should ideally be photographed at the release site so that they are not endangered in the event of inadvertent escape.
- The person handling the animals can stop photography if it is affecting their ability to properly handle the animal.
- Supervising AWC ecologists can limit the exposure of the animal or stop photography if the animal shows signs of excessive stress.
- Photography of captured animals is best done when they are being handled by AWC ecologists. The combination of the two activities will reduce the length of time the animals need to be handled and held captive.
- Photographers should tell the person handling the animal if they are using flash, as it may cause animals to struggle, bite or escape if the handler is not prepared.
- Where many people are present, it may be in the animals' best interest if only one or two people photograph the animal. It should be made clear from the outset who the assigned photographers are, and that they have the skills to adequately photograph the animal in the most efficient way.
- If photography needs to be done at a different time or place, the assigned photographers should use a less threatening setting (e.g. see specific guidelines on animal groups, below). Supervisors should ensure that the assigned photographers abide by the Animal Handling Policy and the conditions of the approved Animal Ethics Permit for the transport, storage, tracking and handling of the specimens.

In all cases, sudden movement and loud noise should be avoided, and the photo session should be restricted to the minimum time needed to achieve the desired results.

Below are guidelines for the photography of specific classes of animals, in accordance with existing standards or research findings. Research indicates that different animals can respond differently to potential causes of stress, and some guidelines are specific to one group. Other guidelines have general application and should be used wherever appropriate.

Mammals

- Large mammals should be approached with care, with as little intrusion as possible. Photographers should familiarise themselves with the species, and know the cues that the species shows when disturbed.
- Use time rather than stealth to approach an animal, monitoring disturbance cues, because over time, wildlife will accept a non-predatory presence without suffering stress or cornering.
- Be mindful of the animal's needs (e.g. for food, water, shelter, and security) and avoid blocking access to them. Make sure the animal stays in control of the situation.
- Try to reduce or eliminate the use of bright flash/video lights, especially at night, or during releases when they can cause temporary night-blindness. Use of a broad beam and a higher ISO/lower shutter speed is preferable in these situations. If lighting is necessary, a high ISO and wide aperture will significantly reduce the intensity needed.
- When photographing smaller mammals in captivity, use a vivarium or diorama where only the lens is visible. The animal will be much less stressed than if the photographer is visible.
- The two sources of potential stress or injury in this type of photography – the containment and the photography (shutter noise, flash, lens movement, breath etc.) – must be managed by closely monitoring the animal's reaction. Determine whether the containment or the photography is the cause of the stress.
    - If the containment, without photography, continues to cause stress or risk of injury, it should be discontinued and the animal returned to the dark bag or released.
    - If only the photography is causing the distress, it should be paused until the animal settles down or becomes inquisitive. Mammals learn quickly, and a careful process of training can then be employed, in which each disturbance (shutter without flash or flash without shutter, etc.) can be introduced when the animal is most secure (e.g. behind a rock). A mammal will normally soon recognize the disturbance as irrelevant to its safety. If the animal's reaction is still strong after this conditioning, the photography should be abandoned.

Birds (including nesting birds)

- It is not acceptable to capture birds for photography.
- The photography of captive birds should only be in established pens or when they are held in the hand by an experienced ecologist or bird bander who is supervising the photography.
- Call-playback techniques should be used with care and ideally limited to ecological surveys, particularly with regards to nocturnal predators, as it can cause stress to the animal.
- When photographing larger birds in the wild, adhere to the guidelines for mammals, above. Avoid repeated disturbance, as bird flight is energetically expensive and may compromise survival or breeding success, especially of migrants.

Adapted from http://www.wildlifephotographersaustralia.org/codeofconduct.html:

- Electronic flash needs careful use, and if the flash causes distraction to the animals, its use must be abandoned. The flash heads usually need to be well camouflaged
- Likewise the shutter noise of a camera set close to a subject needs to be minimised, monitored for disturbance effect, and the device moved away or its use discontinued if stress is caused.
- Consider alternative approaches in preference to bird-at-the-nest photography.
- The nest, nesting hollow, eggs, chicks or other young should never be touched.
- The following guidelines refer equally to photographing from a hide or a remotely released camera set close to the subject. The term "hide" includes such setups. Close techniques should

only be used if longer-distance techniques such as a longer lens and smaller format are not practical.

- Avoid obstructing the normal path of the animal.
- Only use hides and other setups out of the general public's view. No hide should be left unattended in a place with any potential public access.
- Avoid erecting hides close to nests that are being constructed, or when there are eggs in a nest, as the chance of the bird abandoning its nest is greater than when there are chicks present.
- Moving of vegetation should be minimal and at most only to tie back intruding foliage. Foliage is often a protection against predators, sun, rain and wind. Removing foliage reduces the protection and so the chance of survival. Any foliage tied back must be returned immediately at the end of each photographic session.
- Hides should either be built over a period of time or erected some distance away and moved closer each day, as it takes time for animals and birds to get used to hides, usually about one week. After each change to the hide the photographer should retire to a safe distance and watch with binoculars. If any stress in the subject is observed the procedure should be reversed one stage, or the hide or setup removed completely.
- Approaches to the hide should be circuitous and varied to minimise a track or scent trail to the hide. Tracks may encourage other people, and tracks or human scent may attract feral animals such as cats and foxes.

Reptiles

- ***It is not acceptable to chill any animal to slow movement.***
- Handling should be minimised to avoid impacting on the energy budget and stress levels of the animals.
- A two-person approach is preferred, with one person handling the animal and the other photographing, to reduce handling time.
- Photographing venomous snakes needs particular skills and should not be attempted by inexperienced people. At a minimum, an experienced handler must be in control of any captured animal while it is photographed. If photographing venomous snakes in the wild, consider using a long lens. Photographers should approach no closer than absolutely necessary, and definitely no closer than the snake's own body length, ensuring the snake always has multiple avenues of escape.
- It is preferable to photograph reptiles as soon as possible after capture, as research indicates that handling a skink for less than 3 minutes induces less stress than holding the reptile in unfamiliar conditions (Langkilde and Shine 2006; Kreger and Mench 1993; Mathias et al. 2001).
- Gentle posing of a reptile is acceptable.

Amphibians

- ***It is not acceptable to chill any animal to slow movement.***
- Photographers must adhere to disease control guidelines in the Animal Handling Policy to eliminate the risk of transfer of chytridiomycosis or other diseases between animals.
- One person should handle frogs while another person photographs the animals. Some species are heat sensitive so time spent in a person's hands should be as short as possible.
- Amphibians tolerate handling and bright lights well, however time spent photographing them should be always be minimised.

Invertebrates

- ***It is not acceptable to chill invertebrates in order to slow movement.***

- Invertebrates should be disturbed as little as possible to obtain a photo.
- Consider using a longer lens to capture invertebrates engaged in undisturbed behaviour.

4. MARKING TECHNIQUES

4.1 Temporary methods

Paints and dyes

Paint and dye can be easily applied directly to the hair, fur or skin of many animals and is a highly visible form of marking. Application most often involves painting the mark directly onto the animal by hand using stencils and brushes, paint pens, liquid paper and nail polish, or more remotely with brush-tipped poles. Some studies have used paint filled balloons or a paintball gun to mark animals from a distance, but this method is not recommended as there is a potential for injury.

Only non-toxic paints and dyes should be used. Paint should not be used on animals with thick fur, as grooming will cause ingestion of the paint and even if the mark persists, fur matting may cause fur loss or skin irritation. Paint should not be applied to amphibians due to their moist and highly absorbent skin, which plays an important role in gas and water exchange. Paint should also not be applied to the wings of birds as it may affect the aerodynamic properties of the wing. Paint or dye markings may alter the animal's behaviour (e.g. increased time spent grooming) and increase its visibility to predators or prey.

The advantage of using paints or dyes is that handling and restraint time of the animal can be kept to a minimum. The longevity of this type of marking is a few weeks to several months and depends on hair shedding (moulting), wear (rubbing) and fade (e.g. dyes).

Method

Restrain the animal. Apply paint or dye to the area of the animal that will be most visible to the observer (e.g. both flanks for ground observation and the back for aerial observation). Use stencils if it is a requirement of the study to identify individual animals. If individual identification is not required then more remote methods may be used (e.g. balloon filled with paint) although marking of both sides may not be possible. Allow the mark to dry before releasing the animal.

Fur removal

This method of marking can only be used on animals with sufficient hair/fur. Fur can be clipped or shorn from sections of the animal's body that will be easily visible to the observer, whilst minimising the visibility of the animal to predators or prey. The use of powered clippers should be minimised as the noise can be an additional stressor. For larger animals, unique marks (e.g. numbers/combinations) may be applied to allow/improve individual animal identification. Removal of extensive amounts of fur must be avoided to reduce the possibility of sunburn or hypothermia. The longevity of this type of marking is a few weeks to several months and depends on when the next moulting occurs. As such, this form of marking is only appropriate for short-term studies.

Method

Restrain the animal. Use blunt-ended, curved blade scissors to clip hair from the area of the animal that will be most visible to the observer and most appropriate for the purposes of the study. Electric shears may be used on quieter animals to hasten the procedure. Ensure the mark is easily identifiable but does not involve excessive fur removal.

4.2 Semi-permanent methods

Semi-permanent markers are those that are required to last for months to years. Most marks are lost during the lifetime of the animal or are removed after recapture.

Ear tags

Care must be taken to ensure that the tag is of an appropriate size, shape and colour to permit normal behaviour of the animal marked. There is generally a trade-off between tag visibility and tag

size and, therefore, the negative effects on the animal (e.g. snagging on vegetation or grooming activity). Appropriate ear tags and attachment tools for most animals are available from rural suppliers and come with instructions for correct attachment.

Ear tags are either self-piercing or inserted through a punched hole. Attachment locations are usually the lower, inner region of the ear where there is heavier cartilage and the tag is better protected. Also this placement reduces the chance of ear tearing or the tag being pulled out.

The person attaching the ear tag must understand the ear anatomy of the study animal to avoid blood vessels and select optimum attachment points. The application site must be treated appropriately to prevent infection and ensure healing.

Method

Restrain the animal so that it cannot move its head. Cleanse the site of application with povidone iodine or chlorhexidine. Use the tagging tool appropriate for the type of tag being used. Most of the tools used to insert ear tags through the ear are sharp and can cause injury to the animal and handler. The site of insertion is treated with an antiseptic agent to minimise the risk of infection. The tag is attached, quickly and without hesitation, to the lower, proximal region of the pinna, avoiding blood vessels. Ensure that the tag is attached correctly and will not impair the behaviour of the animal.

Scale-clipping and branding

Extremely effective in species with numerous, large scales, particularly ventral scales (i.e. snakes). Clipping a scale or combination of scales can be reliable for short-term mark-recapture studies, however, clips do deplete over time, particularly during regular sloughing as the animal grows. Clipping the scale then branding with a soldering iron (or similar), fixes the mark, which will then scar and remain for a much longer duration.

4.3 Permanent methods

Permanent marks are those that are unlikely to be lost during the life of the animal.

Tattooing

Tattooing is considered to be a permanent method for marking wildlife, but the longevity of this type of marking can depend on the species and age of the marked animal, and the quality and location of the mark.

Animals of all sizes can be tattooed, with the advantages being that they add no weight to the animal; do not alter behaviour; and do not make the animal more conspicuous to predators. However, tattooing requires prolonged restraint during application, the process is painful, may result in infection and the animal requires restraint again when the tattoo is read. Tattoos can also fade or become otherwise illegible. The best results are achieved by tattooing any lightly pigmented area that is clean and relatively hairless. The most commonly tattooed area is the inside surface of the pinna of the ear.

There are two tattooing methods:

- Forceps, pliers or hammer instruments are used to pierce the skin in the required pattern, and a highly contrasting dye, ink or paste (e.g. red, green or black for non-pigmented skin) is then rubbed into the puncture wounds. The ink must be rubbed in well to make sure of a permanent mark. Forceps or pliers pierce the skin in patterns of letters and numbers when squeezed together, while hammer systems are 'slapped' onto larger animals to create a pattern of pinpricks.
- Electro-vibrator systems or needles that both pierce the skin and inject the dye can be used to simply 'write' an identifying code into the skin.

Method

Restrain the animal so that it cannot move its head. Short acting (inhalational) anaesthesia may be appropriate. The tattoo site is cleaned with povidone iodine or chlorhexidine to minimise infection risk.

If using tattoo pliers: before applying the tattoo to the ear check that the pliers have been loaded properly (e.g. numbers are placed in reverse to normal viewing). A piece of cardboard is a good aid for checking this.

Ensure that tattoo numbers and letters are sharp and clean so that they will pierce the skin deeply enough to allow for the absorption of the tattoo ink. Rub ink onto the area of the ear that will be tattooed and clamp the tattoo pliers on it tightly to puncture the ear avoiding where possible, hair, blood vessels or ribs in the ear. Unclamp and remove the pliers and promptly rub plenty of ink well into the ear with a cotton-tipped applicator. Rub ink well into the holes. If using an electro-vibrator, hold the ear firmly and scribe the desired mark. Wipe off the excess ink and clean the ear.

Freeze branding

Freeze branding involves making a permanent, individual mark by applying a branding iron that has been supercooled in liquid nitrogen or a dry ice and alcohol mixture or a commercial refrigerant to part of the body. In mammals this kills the pigment producing melanocytes of the skin but not the hair follicles so the hair grows back permanently white. Freeze branding has also been successfully applied in birds, reptiles, anurans and cetaceans.

This method has the advantage of being able to produce clear identification marks and the cold may act as a local anaesthetic. The primary disadvantage is that a period of weeks is required after application before the brand becomes evident. The brand may also become less distinct with time and the experience of the operator plays a strong role in the quality of the mark.

The optimal length of time and temperature of brand application varies between species and must be tested on the species before use of the technique in the field. Applying the brand for too long can cause injury and a bald scar, not applying the brand for long enough can fail to produce an identifiable mark.

Method

The animal should be restrained and if necessary hair around the branding site clipped. The branding site should be cleaned and wet with alcohol (to stop the brand sticking when it is removed). Brands should be cooled in the liquid to pre-determined temperature and then applied to the brand site for the pre-determined time. Brands should be applied in a position which is easy to see for resight purposes but which does not place the animal at greater predation risk.

Passive integrated transponders (PIT tags)

Passive Integrated Transponders are small, durable microchips that have no power supply. A hand-held scanner passed over the PIT ('scanning') generates a low energy radio signal that energises the PIT tag to transmit a unique number.

PITs are quick to apply, long lasting, reliable and provide unequivocal identification. Their small size and weight do not normally alter the behaviour or appearance of the animals. Application is briefly painful, but for a shorter period than tattooing. Poor technique may result in prolonged pain and/or infection.

Animals must usually be recaptured to identify marked individuals although they require only minimal short-term restraint. In some cases, scanning may occur passively as the animal walks past or through a scanner, minimising the need for handling.

Appropriate restraint, anaesthetic, asepsis and analgesia must be undertaken.

All PIT tag marking must be conducted using sterile injectors and tags.

PIT tags are most often implanted subcutaneously or intra-abdominally using a large bore syringe. The tags should be implanted in areas of low movement such as the body cavity (only for small animals), around the ears or between the shoulder blades. Whatever site is chosen, it should be used consistently to ensure ease of location at reading.

As PIT tags may migrate, the whole animal may need to be scanned.

PIT weight should not exceed 5% of the body weight of animals.

Disadvantages of this technique are the expense of the equipment required and that the tags may migrate if applied subcutaneously, making them more difficult to read in larger species.

Method

The animal must be restrained. The entire animal is scanned to ensure it has not already been implanted with a PIT. The PIT (within its single-use needle) is scanned to ensure that it is functioning and that it is indicating the number shown on the packaging. The skin is cleaned with povidone iodine or chlorhexidine at the point where the needle will be inserted. Brief application may have little effect on reducing bacterial numbers so the solution should be in contact with skin for at least a minute if this does not require excessive handling. The point of insertion will be a couple of cm behind where the PIT will be deposited. The skin is lifted at the point of insertion. The needle is then pushed under the skin and the plunger depressed then the needle removed all in a single rapid but smooth action. Ensure that all parts of the applicator and needle are removed. The insertion site is then scanned to ensure the PIT has been applied.

4.4 Banding

Metal bands

A poorly applied band may injure or inconvenience a bird. Therefore it is important to follow a good routine when banding birds.

Refer to the current List of Approved Band Sizes for the correct band size for birds you will be catching. However, be aware that band size information for some species is poorly understood in Australia. This is especially true in the north, where geographical variation in body size occurs and few people undertake regular banding. Be prepared to assess the fit of each band. In general, bands should be just tight enough not to slip over the foot, or the tarsus-tibia joint. A band that is too tight may not allow leg skin to slough properly, which can cause infection and even death.

Select the correct string of bands, removing the next band in sequence. Record the complete band number and select the appropriate banding pliers in preparation to apply the band to the bird's leg. Carefully close the band around the bird's leg using specialised bird banding pliers.

Examine the band closely to ensure it is satisfactorily closed and there are no sharp edges. Release the bird at or near the site of recapture. Refer to Lowe (1989) for a description on types of banding pliers available and for more detailed instructions on how to close standard and non-standard bands.

Colour bands

There are two types of colour bands, darvic and cellulose. Each requires a different technique for sealing the band. Darvic bands can be closed by heat sealing only, whilst cellulose bands can be both heat sealed or glued together with nail polish remover. Extreme caution must be used when using both methods as it is possible to burn the bird’s leg or foot (or your fingers) with the heated poker or aggravate the birds skin (or yours) with the chemical.

4.5 Visible implant elastomer (VIE)

A recent marking method, formulated in the marine industry for individually marking fish. A visual elastomer compound is injected into the ventral surface of the animal, just under the skin, with a

syringe. Elastomer markings can be highly visual to the naked eye in some species (e.g. geckos). While in other species, an LED or UV light will enhance visual identification. Used primarily in reptiles (squamates) and frogs, though could potentially be used with small mammals (i.e. ears). Several elastomer marks can be injected into many parts of the ventral surface, allowing for a wide range of combinations and patterns. See Kondo and Downes (2004).

4.6 Toe-clipping

Historically, an extremely reliable and simple method for marking reptiles and frogs. However, there are some ethical and locomotory performance issues with many species, particularly geckos as it can limit traction/locomotion. There are now many more options for permanent marking in reptiles and frogs (i.e. elastomer), AWC does not practice nor recommend this technique.

4.7 Scute notching

A simple, non-destructive technique that allows thousands of permanent/semi-permanent combinations. Suitable mainly for freshwater turtles, whereby a single (or multiple) scute is notched with a file or grinder (i.e. Dremmel drill). Suitable for short or long-term mark-recapture studies. Scutes may need to be re-grinded from time to time in long term studies.

5. TRACKING TECHNIQUES

5.1 Radio telemetry

Radio-telemetry is expensive and time consuming. Radio-telemetry transmitters (RTTs) should only be attached when project funding guarantees the ability to monitor a tagged animal for the life-span of the transmitter and the removal of the RTT when no longer required.

The basic system includes a transmitter, power supply, antenna, material to protect the electronic components and a collar, harness or adhesive to attach the transmitter to the animal.

Transmitter packages should be as light in weight as possible. The total weight (i.e. collar, transmitter, battery, aerial and bonding material) should ideally be no more than 5% of the animals' bodyweight (less in birds).

Transmitter profile may be more important than weight for some animals. Investigators need to consider the behaviour of the animals under study.

Reliable RTTs with the longest battery life possible (i.e. around 5 years for larger animals) should be used. It is preferable that they be fitted with mortality sensors.

There are a number of modes of attachment including harnesses, glue, tail clips, collars and implantation. There is no one best method: it depends on the animal and its habits. The guiding principle is to minimise the impact on the natural movement of the animal and to avoid short-term and long-term injury resulting from the transmitters.

For some species, sedation or anaesthesia may be required during the attachment procedure.

Harnesses or other attachment materials should be designed so that they have a weak link, ensuring that the transmitter is detached if it becomes entangled. Expandable collars/harnesses should be used on growing animals. Transmitters attached by adhesive will usually eventually detach. This method is preferred if it is unlikely that the animal can be recaptured. Except where attachment devices are designed to eventually detach, the animal should be recaptured before the battery is depleted in order to remove the transmitter. As the RTT may fail or the animal may move out of range, making recapture unlikely, RTTs should be designed so that long-term attachment will not result in injury.

Fit should be checked by looking for signs of irritation or hair loss under the collar/harness when recaptured. Collars should be made of materials, which are durable; comfortable and safe for the animal; can withstand extreme environmental conditions; do not absorb moisture; and maintain their flexibility in low temperatures. Common materials used include flat nylon webbing, butyl or urethane belting, PVC plastic and tubular materials. The collar is closed with a buckle or clamps. Whip or internal coiled antennae should also be incorporated into the collar wherever possible to prevent snagging on vegetation.

RTTs should always be tested before and after attachment to the animal (before release) to ensure they are functioning correctly.

It may be advantageous to attach (or implant) the transmitter on an individual in captivity and observe the animal for signs of impaired movement, irritation or rubbing caused by the transmitter over an appropriate period before release.

Mammals

Glue-on tags: The animal should be restrained. Fur should be clipped as close to the skin as possible, to allow adhesion to the skin rather than the fur. Cotton gauze may be attached to the radio tag using 2-octyl cyanoacrylate glue (Dermabond or Traumaseal) before applying to the skin and trimmed to overlap the tag by 1mm. This has been shown to enhance the adhesion to the animal. Once attached, allow an additional 10 minutes for the adhesive to strengthen. During this time, the animal should be placed in a dark, quiet area. Release the animal after checking that the RTT is operating correctly and that the attachment is effective.

Collars: The animal should be restrained by one handler while the other attaches the collar. The collar should be fitted snugly on the neck to ensure that no irritating movement or rubbing occurs. However, enough space should be left to allow the animal to behave normally and for it not to experience any discomfort while moving or feeding. To reduce the risk of irritation on the neck, the collar should be fastened at the side and any metal fitting should be covered or at least smoothed on the inside. Before releasing the animal, the magnet (battery stop) is removed or the collar turned on if it is fitted with a magnetic switch and transmitter operation and frequency is checked. Once the collar has been attached, and before release, the animal should be observed for any unusual behaviour that could indicate that the collar may cause a problem (eg. affecting balance, impeding movement or causing irritation to the skin) contact with skin for at least a minute if this does not require excessive handling.

Birds

Radio telemetry has become a frequently used tool in ornithology to monitor the movement of birds. There are a number of types of radio and satellite transmitters and a variety of techniques for attaching them (e.g. tail mount, necklaces, sutures, implants, gluing, harnesses, and collar).

A thorough discussion about transmitter attachment methods is beyond the scope of this document. However, AWC requires practitioners to be mindful of the following critical points:

- Critically assess whether or not your question can be answered by other means e.g. colour-banding observations, genetics etc;
- Keep transmitter size around 2-3% of body weight;
- Choose an attachment method appropriate for the expected life-span of the transmitter. For small birds, where transmitter weight imposes short expected transmitter life, consider dorsal mounting with inert glues such as super-glue. For larger birds, consider tail mounts, which will be shed next moult. Harnesses, collars and necklaces can be used safely in some circumstances, but there are many unpublished cases of birds becoming tangled in vegetation etc;
- Consider the ecology and behaviour of the study species when deciding upon attachment methods. Some attachments methods restrict the manoeuvrability of the bird, either by preventing the full range of movement or by altering the bird's centre of gravity;
- Radio-telemetry is expensive and carries significant risks for target individuals. Be prepared to make full use of the time the transmitter is operational. Ensure adequate personnel are available, and consider options for finding “disappearing” birds (eg aircraft) before the need arises; and
- Research attachment methods thoroughly. Has anyone worked on the same or similar species before? If so contact them if possible to get first-hand advice.

Reptiles and frogs

Transmitters may be attached internally or externally, however, all transmitters must weigh no more than 5% of an animals live weight.

Large goannas: For short-term radio-tracking, transmitters can be attached to the base of the tail with Elasoplast tape or equivalent. However, transmitters must be removed within 3 weeks to prevent damage to the tail. Transmitters are often likely to fall off within 2 weeks regardless. For long term tracking (> 2 weeks), transmitters can be stitched into a denim harness, sealed with epoxy resin and glued to the tail with contact cement.

Snakes and small goannas and other large lizards: Transmitters must be surgically inserted subcutaneously. This will require surgical training or assistance by a trained individual (i.e. veterinarian).

Frogs and small lizards: Small transmitters/diodes can be either fastened with a small harness to the pelvis (frogs) or fixed with contact cement to the dorsal surface (lizards).

5.2 Spool-and-line tracking

The system includes internally-wound nylon spools wrapped in polyethylene film and duct-tape and adhesive to the animal. The total weight of the package should ideally be no more than 5% of the animals' bodyweight.

Method

The animal should be restrained. Packages of internally wound nylon quilting spools (~800m in length) are attached with 2-octyl cyanoacrylate glue (Dermabond or Traumaseal) to clipped areas of fur generally at the dorsal surface at the base of the tail. Cotton gauze may be attached to the spool-package using 2-octyl cyanoacrylate glue before applying to the skin and trimmed to overlap the tag by 1mm. This has been shown to enhance the adhesion to the animal. Allow an additional 10 minutes for the adhesive to strengthen. Release the animal after checking to see that the package is working properly. Then, follow the spool-line.

5.3 Fluorescent powder tracking

Fluorescent powder tracking has been used widely to determine the home-ranges of small mammals and unlike radio-telemetry, it produces exact trails of animal movement

Method

The animal should be restrained. The animal is covered in non-toxic fluorescent powder and released.

6. ANAESTHETISATION

Use of local or general anaesthetics may be appropriate for minimising pain and stress in some circumstances. Anaesthetics and the method of administration must be appropriate to the species being examined. Users of anaesthetics must be trained and authorized in the use of the relevant anaesthetic agents by a veterinary surgeon.

A license from the state department of health is needed to purchase, store and use anaesthetic drugs. All Schedule 4+ drugs are required to be stored securely and usage of the drugs recorded. (Western Australia Poisons Permit applications are from the Department of Health, Pharmaceutical Services licensing officer: Paul Talbot. (08) 9388 4916).

Anaesthetics may be administered either remotely (using dart rifles, dart pistols, blow darts or pole syringes) or directly through direct injection. The researcher must be trained and familiar with the technique of drug administration. All equipment must be ready BEFORE the capture of an animal.

Desirable characteristics of anaesthetics are described in Tribe and Spielman (1996) as:

- being concentrated enough so that an effective dose (usually less than 3ml) does not exceed the quantity that can be carried in one administration (dart/syringe);
- being suitable for intramuscular injection, and hence non-irritant at the site of application;
- providing rapid and smooth onset resulting in sufficient immobilization;
- having a wide safety margin. In many cases, the exact weight and health status of the target animal will not be known until after it is immobilised. Consequently, drugs with a wide safety margin and which have minimal effects on the cardio-respiratory system are recommended; and,
- providing smooth and rapid recovery from immobilisation

In some cases the most appropriate inhalation based anaesthetic agents (e.g. Halothane or Isoflurothane) maybe the most suitable for a species.

Animals recovering from anaesthesia must be placed in a quiet, dark environment, free of disturbance. Recovering animals must be regularly monitored.

Reptiles*:* There is no evidence that lowering a reptile's temperature to as low as 4°C reduces its sensitivity to pain. Anaesthesia should be carried out within the species' preferred temperature range. If this is unknown, 26-32°C is adequate. Reptiles should be fasted for 24-48 hours prior to anaesthesia to prevent putrefaction of ingesta because of reduced activity in the gastro-intestinal tract. A full stomach may also compress the lungs or result in regurgitation (Tribe and Spielman 1996).

7. EUTHANASIA

7.1 General protocol

The euthanasia of animals within AWC sanctuaries is generally kept to a minimum, with actions only taken place under special circumstances where the animal is:

- in serious pain; or
- an exotic species; or
- a new or important species that needs to be collected.

7.2 Procedure

When euthanizing animals, it is best to do it in a way that is:

1. most humane, painless and quick for the animal(s); and
2. keeps the animal intact (vouchering only).

For methods of euthanasia refer to Sharp and Saunders (2001)

8. SAMPLING

8.1 Hair sampling

Hair sampling of live, captured animals should be done using forceps or fingers to take a small amount of hair in a single, rapid movement. The area from which hair is taken should be as small as possible while still providing sufficient hair for analysis (>20 hairs). Hair should be taken from the back of the animal and care should be taken to ensure primary guard hairs are included in the sample. Individual animals should only be sampled once.

Hair samples should be stored in a new plastic zip-lock bag with identification details of the animal from which the sample was taken.

8.2 Genetic sampling

Genetic sampling almost invariably causes some pain or distress. The objective is to minimise this and so destructive sampling (such as toe clips) should only be approved when it has been demonstrated that other samples are inadequate or impractical. Ear and tail clips are preferable for animals with non-nucleated red blood cells (eg mammals). For birds (nucleated red blood cells) blood sampling (eg brachial puncture) is the preferred way as it causes the least distress.

Disease transmission

Genetic sampling represents a highly likely route of disease transmission. Use a sterile antiseptic wipe prior to biopsy punching, ear-clipping etc to avoid infection. Use sterile disposable sampling instruments wherever possible. If instruments are to be reused, they must be bleached (for DNA sterility – see below), and then flamed with 100% ethanol before a final rinse with sterile water. Having several sets of non-disposable instruments speeds this process up.

Contamination issues

Most modern DNA techniques rely on a technique that at some stage amplifies DNA. This means that contamination, particular of small or degraded tissue samples, is a critical problem because any foreign DNA could be co-amplified producing spurious results. Nothing can reverse the contamination of a sample – it becomes useless. The most likely way for contamination to occur is by:

- Using sampling instruments on multiple animals without sterilisation (cross-sample contamination)
- Touching the tissue sample, collecting instruments or storage vials, which will result in your own DNA contaminating the sample.

By strictly applying proper sterile techniques, these problems are easily avoided. Thus the golden rules for sampling are:

- Where possible, use sterile, disposable biopsy punches, scalpel blades or needles. Use one unit per animal.
- If instruments need to be reused, they must be soaked in household bleach for 5-10 minutes prior to re-use, followed by a distilled water rinse (available from supermarkets). Do not reuse the water; a new plastic sauce dispenser bottle is a convenient way to rinse instruments. **Note that ethanol does not destroy DNA - it preserves it, and is therefore not a suitable decontaminant**. Multiple instruments are useful if several animals are being processed.

Storage medium and conditions (for blood, tissue, scales)

Labelling is crucial – location (preferably with GPS using decimal degrees), date and collector are minimum requirements.

See DNA Sampling protocols by Talbot et al (1996) – attached. In addition, consider the following:

- **Animal tissue** (including ear and tail clips, membrane punches for bats, etc.): Storage in 70% ethanol sterile plastic tubes with screw-caps (with O-ring). Storage at room temp is acceptable.
- **Blood** can be stored in 70% ethanol (although adds additional steps in the DNA extraction protocol); specialized buffers (eg Queen's, Longmire's) are preferred (higher DNA yields, arguably better preservation). Blood in buffers should be stored at 4^{o}C. Whatmans claim that just about any tissue etc. can also be stored directly on to their FTA cards. We have tried them for bird blood with good results, although they are expensive. Storage at room temperature is fine, but samples should be stored in a sealed container with a desiccant. See www.whatman.com for more details.

8.3 Bleeding and genetic assays – birds

Bird blood is nucleated (unlike mammals) so blood is the preferred tissue type for DNA work.

All birds can be bled safely from the brachial vein. This is a highly specialized skill that requires extensive training with closely supervised practice. General points are:

- Handling grip when bleeding is critically important – too loose and the bird may struggle leading to a tear in the vein with excessive bleeding that can be very difficult to stem, too tight and you can risk suffocating the bird.
- Bleed early during handling. This allows maximum time for clotting and healing before the bird is released. In addition, some assays (e.g. hormone analyses) are time sensitive.
- Have all necessary equipment ready before bleeding (i.e. Vaseline, needles, haematocrit tubes, cotton wool, blood storage receptacle (e.g. 2ml screw-cap tube) and other specialized gear e.g. haemacue cuvettes.
- Use an appropriately sized single use, sterile needle (hyperdermic style).
- Always use Vaseline (unless it interferes with downstream assays). It helps the blood bead up on the skin, and prevents the cotton wool sticking to the skin.
- Always apply a small amount of pressure to the puncture using cotton wool.
- For small samples, break off the haematocrit tube into the screw-cap storage tube.
- Some birds bleed better or worse than others. For those that bleed excessively, be prepared to sit quietly holding cotton wool swab with a small amount of pressure.

Sometimes, brachial bleeding just does not work. Bleeding from the alternative wing is an option. If this does not work, the tarsus and jugular veins are other options, but again, extensive training is required.

If bleeding fails altogether, adequate DNA can be extracted from feathers. For small birds, flight or tail feather are best. For large birds body feathers should yield enough DNA. Growing feathers (with partially sheathing) are best because they are vascularised, but this also means that plucking them causes some pain to the bird. Plucking seems to be least painful for the bird if a small amount of pressure is placed on the skin near the follicle.

8.4 Genetic sampling – mammals

Genetic samples of captured animals should only be taken by researchers with experience in the appropriate procedures. Samples taken should be as small as possible and taken with sterile equipment. Ear punches or removal of tale tip (post-final vertebrae) are suitable for small mammals. Ear samples are most suitable for larger species. Samples should be less than half a gram. The site of tissue removal should be sterilised and any blood flow stemmed using pressure following removal of tissue. Samples should be stored in 70% ethanol sealed vessels with animal details recorded on them.

8.5 Genetic sampling – reptiles and frogs

Genetic samples of captured animals should only be taken by researchers with experience in the appropriate procedures. Samples from reptiles can be relatively simple. In species such as snakes, which have large ventral scales, a scale clip can be taken. In addition, the tail tip of most reptiles can be more than adequate. A skin sample can also be taken from animals that are shedding their skin. In species such as frogs, turtles or crocodiles, which have toe webbing, a small piece of skin can be cut from the webbing. In extreme cases, blood samples can also be obtained from most species.

8.6 Genetic sampling – dead animals

Contamination is the primary issue with DNA samples of dead animals, so sample genetic material from deep within the body e.g. pectoral muscle for birds, heart tissue etc.

If the specimen is old and rotten, it is likely that the DNA is very degraded. In this case, sampling tissue that has dried quickly may have better preserved DNA. However, such tissue has normally been exposed to contamination, but may be worth trying.

9. DISEASE AND PREVENTING DISEASE SPREAD

9.1 General hygiene

Wildlife can carry a range of zoonotic diseases. Working with wildlife can expose humans to diseases and parasites. The actions of researchers can also potentially facilitate the spread of diseases and parasites within and between wildlife populations.

Preventing wildlife-to-human transmissions

Zoonoses pose a significant risk to humans. Open wounds and scratches on hands must be covered before handling animals. Bites and scratches should be immediately sterilised using an alcohol based antiseptic, then covered with a waterproof seal. Bat bites must be seen by a doctor.

All people handling animals must take basic precautions to prevent wildlife to human transfer of disease, including:

- aintaining high levels of personal hygiene;
- not eating, drinking, smoking or using personal insect repellent whilst handling animals;
- washing clothes and equipment that has come into contact with animals' blood or body fluids;
- cleaning all equipment between trapping locations;
- basic first aid for treatment of cuts, bites and scratches;

If a staff member who has handled animals becomes ill within 2 months of a survey, the attending medical practitioner must be informed of the potential exposure to zoonoses.

Preventing wildlife-to-wildlife transmissions

In order to reduce transmission of disease and parasites between individuals and populations it is necessary to maintain a high level of trapping hygiene.

Personnel

- A high level of personal hygiene, including hand washing, is required when handling animals.
- Footwear should be cleaned at the commencement of fieldwork and between sites.

Handling equipment

- Disposable marking equipment (scalpel blades etc) should be single use.
- Non-disposable equipment should be cleaned between sites.
- Handling bags (cloth or plastic) should be single use. Cloth bags should be washed with bleach between animals. Plastic bags should be single use.

Traps

- Wherever possible traps should be isolated to individual properties. The same is true of hessian and other shade/insulative material used with traps.
- Metal traps should be cleaned between sites. Bait should be removed, traps washed in detergent then soak traps for 10 mins in a 1% bleach solution or commercial disinfectant before rinsing in clean water and drying in the sun. The rinsing step in this process is important to protect animals from irritation due to residual bleach.

Vehicles

- **Trays**: Cleaning of vehicle trays between sites where animals may have been processed or traps have been stored in the tray. Hose out, wash with a weak solution of bleach, and rinse with water to prevent corrosion.
- **Tyres/wheels and underbody of vehicles**: When moving between properties wheels/tyres, underbody and trays of vehicles should be cleaned by hosing. In areas of high risk of chytrid fungus, wheels and tyres should be disinfected (using a disinfectant with *benzalkonium chloride* as the active ingredient).

9.2 Preventing disease spread (special cases)

Chytrid fungus

See the section on frog handling (Section 2.7) for specific details relating to chytrid fungus

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[redacted]

Subject: FW: Gannet Chick Relocation Permit Finalisation [SEC=OFFICIAL]

From: [redacted]@cardno.com.au>
Sent: Friday, 11 February 2022 2:15 PM
To: [redacted]@cpbcon.com.au>
Cc: [redacted]@cardno.com.au>
Subject: RE: Gannet Chick Relocation Permit Finalisation [SEC=OFFICIAL]

Hi [redacted],

Please see below summary of results from yesterday's Gannet monitoring which will later be incorporated into the bird monitoring report:

The Australasian Gannet colony at PWEA was first established in 1996 and there has been ongoing monitoring of the colony since then (see AECOM [2012] for details). The methods used for estimating the population size of this colony have varied over the years; counts on 2 March 2012 (AECOM, 2012) and 22 September 2020 (Cardno, 2020a) were conducted from the eastern end of the wharf and only a proportion of the birds on the dolphin mooring were visible from that location. A count on 13 December 2019 (AECOM, 2019) was conducted by estimating numbers of adult gannets from a boat positioned at three vantage points around the end of the wharf and four vantage points around the dolphin mooring. The most recent count (10 February 2022) was conducted circling the dolphin mooring and survey island by boat three times, with two ecologists counting the birds. An average was taken from the three counts. Cardno was unable to see on top of the old wharf via boat. To get a count from the old wharf Cardno were able to climb onto the remaining section of the wharf and took photos along the edge of the structure (to minimise disturbance to nesting birds). These photos were merged into a collage to avoid overlapping individuals and counted. Chicks and juveniles were counted on the day not via photos as many were hiding under the adult bird and would not be seen via imagery. Note that some individuals may have been missed as it is impossible to tell whether a chick is hiding under an adult from a distance/ the wrong angle (note the photo below).

Approximately 85 adults were counted roosting along the wharf, both at survey island along the new wharf structure with a further 281 adults nesting at both the dolphin mooring and the remaining old wharf structure. Some aggression was noted on the old wharf structure between adults. Aggression was not overwhelming, noting only three to four induvials showing this behaviour. Similarly to previous monitoring events there was no evidence to suggest the gannets were stressed by the nearby construction activity or by our observations and the adults remained with their young throughout the observation period.

Approximately 38 young gannets (of which 5 were downy chicks the rest feathered juveniles) were observed on the dolphin mooring. Most chicks were large with long, white fluffy down (and lacking obvious pennaceous feathering). The majority of juveniles were fully feathered with sparse or no down. A few birds were developing pennaceous feathering and retained considerable amounts of down. These observations indicated young were likely to range from 4-12 weeks old.

On the old wharf approximately 70 young gannets were present, of which 45 were chicks, most were larger downy chicks with a small percentage still nestlings (see photo above), the rest feathered juveniles. Most chicks were large with long, white fluffy down however some of the nestlings had only just started developing thicker downy fluff (see photo above). Many juveniles still retained a lot of down. These observations indicate that some of the young birds could be as young as 3-14 days old. Breeding on the old wharf structure appears to have been delayed in comparison to the dolphin mooring, most likely due to disturbance and attempts at preventing nesting on the wharf such as sweeping off nesting materials.

Young Australasian Gannets are large with white, fluffy down by approximately 1 month old and do not show visible primary (flight) feathers and rectrices (tail feathers) till 43-47 days old (Marchant & Higgins, 1990). They lose their down completely or nearly so by 85-94 days age. The mean incubation period is 44 days (range 37-50 days). Based on this published information it is considered here that the youngest chicks present on the old wharf structure on 10 February 2022 were clearly under a month old, however majority we at least a month old. The most mature, fully feathered juveniles at the dolphin mooring are estimated to be at least 85 days old. Given this spread of ages amongst young birds it is believed that egg laying in this colony started similarly to the last monitoring event, as early as the first week of September however this year has continued to as late as mid-December. The majority probably from late January. Previous observations of the colony made in late February 2011 and March 2012 also indicated egg laying occurring over a longer period noting some eggs laid as late as December.

Date	East end of the wharf		Dolphin mooring		Combined
	Adults	**Young**	**Adults**	**Young**	**Total adults**
2 March 2012 (AECOM 2012)	200	32	100	10	300
13 December 2019 (AECOM 2019)	234 (only adults were counted)	-	151 (only adults were counted)	-	385
29 September 2020 (Cardno 2020)	250	0	160	0	410
22 January 2021 (Cardno 2021)	160	0	130	65	290
10 February 2022	**168** (old structure) + **36** (roosting at survey island)+ **49** (roosting along existing wharf)	70 (old structure)	113	38	281

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Any questions, feel free to ask me ☺

Thanks,

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[redacted]