

# DPIPWE Biosecurity and Disease Management Protocols for Captive and Wild Orange-bellied Parrots in Tasmania

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## Introduction

The “critically endangered” Orange-bellied Parrot (OBP: *Neophema chrysogaster*) is the world’s most endangered parrot species and Australia’s most endangered bird species, surviving only as a tiny, single population. The Orange-bellied Parrot breeds only at Melaleuca in the southwest Tasmanian Wilderness World Heritage Area (TWWHA) in summer (October-April) and migrates to mainland south-east Australian coastal regions in winter. There are fewer than 70 birds remaining in the wild population. As a part of the National Recovery Plan, there is an actively managed captive insurance breeding population of ca. 320 birds, over half of which is housed at the DPIPWE Tasmanian captive wildlife breeding facility. Other breeding facilities are located at Healesville Sanctuary and Adelaide Zoo. The protocols provided below are designed to guide biosecurity and disease management for both the captive and wild Tasmanian populations of Orange-bellied Parrots. The protocols have been developed to be effective, affordable and implementable.

## Scope

These protocols focus on the health and biosecurity of OBPs at the Taroona captive breeding facility as well as wild birds. The protocols and disease focus reflects the known issues currently affecting these populations e.g. Psittacine Beak and Feather Disease (PBFD). However many screening and management protocols relate to all captive OBP populations. Over time these protocols could be modified and adapted by Disease Risk Analysis to identify current risks and consistently manage OBP health and biosecurity among multiple institutions.

# Captive Orange-bellied Parrots at Taroona

## A. Hygiene

### *1. General Disinfection*

The principles of disinfection that apply generally are described below:

Ensure all equipment, surfaces, boots etc are fastidiously washed / scrubbed (warm water if possible and detergent), and free of organic material prior to disinfection. Disinfect with F10 (1:100 dilution) with contact time of three minutes. Take care that the F10 solution does not dry out in spots during the contact time. Rinse off residual disinfectant to avoid the possibility of corrosion of metals or transfer of disinfectant to birds.

### *2. General facility design / management*

Current aviary design at Taroona includes four (two old and two new) separate aviary buildings, all with a portion of the roofing made up of double mesh wire only (e.g. opportunity currently exists for wild birds to land on the roof and defaecate into aviaries). Each aviary building is further divided into smaller aviaries divided by solid walls, or double-wire only. Given the current aviary construction, there are limits to the level to transmission mitigation strategies that can be applied.

Within these limitations, a reasonable approach is to consistently apply personal biosecurity protocols to reduce transmission opportunities between each separated aviary building (rather than manage biosecurity risks between individual birds, individual aviaries or conjoined aviary strips within each building). The level of hygiene should also be consistent with these limitations while maintaining best practice for the circumstances. Actions are listed below:

- Dedicated equipment to be used in each aviary building - unique to that aviary building, remain within the building and not be used elsewhere on the property. This equipment includes catching nets, towels, transport / holding boxes, brooms, tables.
- When bringing equipment into the breeding facilities, care must be taken to ensure that this equipment has not been previously used in other facilities housing parrots.
- Ensure each aviary complex is rodent and cat-proof. Check for incursions regularly and control incursions quickly and appropriately.
- Sweep up faeces and food scraps on aviary substrate a minimum of every third day, or more often as required (using dustpan and broom with long handle). This will reduce transmission opportunities for endoparasites and pathogens.

- Remove and bury substrate annually between breeding seasons when aviaries are temporarily evacuated. Then thoroughly clean aviary (high pressure hose then scrub with warm water and detergent). Then disinfect and rinse as above. Ensure substrate is always covered when left outside and infected substrate is deep buried. Use appropriate PPE for hosing and disinfection.

Nest-boxes:

- Consider nest-box materials and design to allow for adequate cleaning / disinfection / insulation. Consider using a disposable 'inner' nest-box.
- Clean (scrub with warm water and detergent) then disinfect and rinse, or replace nest-boxes annually after the breeding season.
- Remove nest-boxes from aviaries after the breeding season, clean and disinfect, and leave to dry outside the aviaries within the aviary building during the non-breeding season (replicates wild scenario). Re-introduce nest-boxes at the start of the next breeding season (provides breeding cue and long drying time).

**3. Personnel biosecurity / hygiene**

- Limited access to the facility to required personnel. Visiting personnel who are given access to the aviaries should be; recorded into a dedicated log book, provided with appropriate overalls and boots, and should be required to adopt the standard biosecurity procedures described above.
- Change to dedicated gum boots when entering each aviary building. Take off boots at the door when exiting. Wear clean overalls each day and move from clean to contaminated areas (see dot point below). Change overalls when entering/ leaving aviary building when disease transmission risk is high. Disinfect hands (alcohol gel or similar) on entry and exit.
- Movement by staff at the facility should aim to reduce potential transmission opportunities; young birds to old birds where possible, healthy to sick (or suspect) birds, clean to contaminated areas, and current collection to new/quarantine birds.
- Specifically do not to enter facilities that house birds infected with Psittacine Beak and Feather Disease virus (PBFDV) or other infectious diseases before the general aviaries. Do not re-enter breeding facilities on the same day after contact with contaminated aviaries.
- Supply OBP staff with a uniform that they do not wear home, uniforms and overalls should be laundered daily on site.
- Staff should not have psittacine species of their own or have contact with other psittacines before coming to work.

#### **4. Food and water hygiene**

- Purchase bird food from sources that do not also sell pet birds or poultry.
- Stainless steel food bowls / plates should be used as they are light and easy to effectively clean and disinfect. Plastic is an alternative though may be more likely to harbour pathogens in cracks. Scrub food bowls daily in using warm water and detergent. Disinfect cleaned bowls with diluted F10, allow 3 minute contact time, and then rinse thoroughly. Use duplicate food bowls so that they can be cleaned and dried properly between uses. Clean water bowls within aviary and return to the same aviary.
- Food preparation areas should have an impervious surface and should be cleaned after each food prep session using warm water and detergent. If increased levels of biosecurity are required (during a disease outbreak), disinfect and rinse after cleaning as above.
- Un-sprouted seed should be fed unwashed, fresh and dry. Discard any grain that becomes moistened.
- Soak sprouted seed in Aviclen (from Vetafarm, Chlorhexidine Gluconate 10mg/mL, dilute 1ml Avicleans into 2L water) to reduce fermentation. Soak seed for up to 24 hours then rinse before feeding.
- Store frozen and fresh foods in a dedicated fully enclosed food storage area (ensure no access by wild or captive birds).
- Source wild food where possible to encourage wild behaviours, including recognition of wild food. Sourcing of wild foods should consider biosecurity risks above background levels. One risk identified is the possibility of birds ingesting plants with fungal growth associated with seed heads. Mitigate this risk by inspecting plants before feeding and watering base of plants / soil rather than the tops of plants.
- Use regular town water for drinking and cleaning.

#### **B. Capture and Handling of Birds**

Capture and handling of birds provides some degree of risk (stress, injury) each time it is done, therefore it should be done only as necessary by experienced staff, following guidelines outlined under personal biosecurity and hygiene. Gear and equipment for banding / testing / examining birds should be well organized before birds are handled to minimise handling time. Birds should be handled gently with appropriate firmness to avoid excess struggling or escape. During capturing, handling and processing, a quiet and calm atmosphere should be maintained. Mobile phones and other sources of extraneous noise should be on silent when in the aviaries and in vicinity of the birds. Ensure that bird boxes or bags are available for restraining birds when not being handled (birds in bags should be hung and not rested on ground or cold surface).

## C. Quarantine

### 1. *New birds entering facility*

For quarantine of new birds, the following is consistent with Healesville Sanctuary standard psittacine arrival quarantine protocols:

- Quarantine birds for a minimum of 45 days.
- Each bird should have a dedicated identification number and record sheet including details of all examinations and assessments.

When birds enter quarantine conduct the following health checks:

- Examine and weigh bird. Perform a quick but thorough examination of the bird, including feathering, wings and legs, head, beak and mouth, abdomen and cloaca. Assess body condition (Appendix 1). Record any abnormal findings.
- Health screening:
  - Screen for PBFD virus via PCR blood test. Repeat this test at least four weeks after initial testing. This may be modified according to pre-arrival testing undertaken (See Appendix 2 for details).
  - Screen for Chlamydia via blood and / or cloacal and / or choanal swabs (See Appendix 2 for details).
  - Worm birds (veterinarian to choose appropriate anthelmintic) as they enter the quarantine facility and repeat two weeks later. Pooled faecal samples from all aviaries should be checked two weeks after the second treatment and then monthly until release from quarantine (Appendix 4).
- Other diseases should be considered and added to screening if necessary:
  - OBPs have a species specific mite. It is currently not considered necessary to treat as it does not appear to cause significant health issues.

### 2. *Isolation of sick birds*

- Where an infectious disease process is diagnosed / suspected, isolate bird in a single purpose facility in a non-through traffic area separate to the other captive birds.
- Visit last and do not re-enter general aviary unless necessary. If it is necessary to enter general aviary (either on the same day or on subsequent days) change overalls and boots and adhere to general hygiene principles (Hygiene section above).

## **D. Routine monitoring / surveillance and treatment**

- Observe all birds once or twice daily for signs of health and disease issues. Record any abnormality and notify veterinarian.
- Health assessment of captive birds:
  - Health assessments are to be performed by trained keepers or veterinarian twice yearly timed with key events including the lead up to the breeding season. Assessments can also be opportunistic when birds caught for transfer/transaction.
  - Basic health assessment – Examine and weigh bird. Perform a quick but thorough examination of the bird, including feathering, wings and legs, head, beak and mouth, abdomen and cloaca. Assess body condition (Appendix 1). Record any abnormal findings.
- Routine health screening:
  - Internal parasite screening – twice a year using pooled faecal samples unless there is a specific concern, though if known history of internal parasite issues, increase to quarterly. Treat as necessary as prescribed by veterinarian (detailed options in Appendix 4)
  - PBFDF virus - If it becomes cost effective in future, it would be useful to screen all birds for PBFDF virus via blood and feather samples using PCR, HA and HI (Appendix 2).

## **E. Response to sick or dead birds found in aviary**

### ***1. Dead bird (s) found in aviary***

- Use appropriate Personal Protective Equipment (PO2 mask, clean overalls) if infectious / zoonotic cause suspected, and adopt personal biosecurity / hygiene measures including rubbing hands with F10 gel (see Hygiene section above). Notify / discuss with Senior Keeper and veterinarian (Appendix 5).
- If dead bird(s) is/ are found in aviary investigative options include:
  - On site gross necropsy with samples collected (fresh and formalin fixed).
  - Transport whole bird to laboratory for necropsy (see Appendix 3 for protocols describing timing, transport and laboratory details).
  - Collect genetic material from freshly dead birds; breast muscle and liver into small vials. Store in -80°C freezer.

## **2. Sick bird (s) found in aviary**

- Use appropriate PPE (PO2mask, clean overalls) if infectious / zoonotic cause suspected, adhere to personal biosecurity / hygiene measures as above. Ensure Senior Keeper and veterinarian are notified (Appendix 3).
- Isolate birds that show general signs of ill health, or specifically become clinically affected with feather and / or beak abnormalities (see isolation of sick birds above).
- Check in-contact birds on a twice-daily basis for signs of disease.
- Veterinarian to examine sick bird (s) and decide on appropriate tests and treatments.
- Minimum assessment includes physical examination (Appendix 1), blood collection for general health profile (Appendix 2), faecal sample collection for endoparasite assessment +/- gram stain, radiography where appropriate.
- Consider options for birds that test positive to PBF (PCR and / or HA positive):
  - Euthanasia.
  - Remove birds for research to be conducted at a non-breeding facility. Aim is improve our understanding PBF infected birds longitudinally.

## **F. Pre-release monitoring / surveillance**

To supplement the critically endangered wild OBP population, captive birds have recently been released at Melaleuca from Tasmanian and mainland breeding facilities. The birds to be released are selected based on genetic (genetic representation in the insurance population, relatedness) and demographic (age/sex) parameters. Birds may be transported to Melaleuca directly from the breeding facilities or mainland birds may be housed at the Taroona facility for quarantine for a minimum of 45 days prior to release into the wild. Before release birds undergo pre-release screening and a period of flight and fitness conditioning where they may be held as a flock in a large aviary. On arrival in Melaleuca, birds will be held in an aviary for several days prior to release. Feed stations are situated both inside and outside the aviary to supplement the feed of the translocated birds.

To mitigate the risk associated with transmitting disease with captive bred birds that are released from multiple institutions into the wild, all pre-release birds should be considered 'one meta-population' (i.e. same pre-release testing protocols should be conducted at all institutions). Accordingly consistency among the captive institutions in relation to pre-release screening and general biosecurity is highly desirable. Achieving consistency may be challenging as available resources and funding vary between institutions, however consistency is necessary if risk is to be mitigated.

Health assessment for pre-release screening (conducted ideally at original breeding institution):

- Examine and weigh bird. Perform a quick but thorough examination of the bird, including feathering, wings and legs, head, beak and mouth, abdomen and cloaca. Assess body condition (Appendix 1). Birds should be in the average weight range for wild birds that are considered healthy (40-50 grams for an adult sized bird). Significant trends in weight loss or weight gain should be reviewed by a veterinarian prior to the birds' release.
- Options for pre-release screening include:
  - Collect blood for Complete blood count (CBC, into EDTA) coinciding with the first PDFD blood test
  - Choanal and cloacal swab (transfer to slide) for oral and faecal gram stain. Also to coincide with first PDFD blood test
- Faecal parasite screen x 2 with at least one week between samples, treat as indicated.
- Ensure large aviaries for birds in flight and fitness training are well away from isolation facilities.

Screen for PBFV virus, using one of the following three options, aiming for the best that can be achieved with the funding that is available. Consistency among institutions is recommended:

- **Option 1: Extensive PBFV screening** – collect samples to conduct PCR, HA and HI testing x 3 with 4 weeks between samples. Undertake at one or more institutions depending on bird movements pre-release. This protocol will provide maximum understanding of disease status during potential viraemic, shedding and immune response phases and would therefore maximize our understanding of the disease status of birds pre-release.
- **Option 2: Adequate PBFV screening** – collect samples to conduct PCR, HA and HI testing x 2 with 4 weeks between samples. There is a small possibility that the true disease status of birds may be misrepresented.
- **Option 3: Minimum PBFV screening** – collect samples to conduct PCR testing x 2 with 4 weeks between samples. The true disease status of birds may be misrepresented.
- Quarantine any birds positive to PCR and/or HA. If there are any PCR and/or HA positive birds then re-examine the potential for the release of all in-contact birds. Options for birds positive to PCR and/or HA outlined above in Sick Bird section. Birds that are HI positive and PCR and/or HA negative on all tests can be released.

## Wild Orange-bellied Parrots at Melaleuca

### A. Wild OBP disease surveillance

- Monitor population trends and demographic parameters.
- Collect blood and contour feathers from wild-bred chicks (nestlings during routine annual monitoring program) for PBF D screening, determination of gender and genetic assessments. Due to the minimum incubation period for PBF D of 21 days (DEH 2006) and considering horizontal transmission is likely to be more significant than vertical transmission (Andrew Peters pers. comm.), chicks should not be tested until they are at least 3 weeks old. See Appendix 2 for blood collection technique.
- Collect blood and contour feathers from wild adults (if trapped) for PBF D screening and genetics as required (Appendix 2).
- Collect blood from other psittacines in nest-boxes for PBF D virus PCR (and HA and HI in older chicks / adults) to establish prevalence and consider likelihood of contact / transmission to OBPs.
- Collect nest material for genetic forensic assessments and also traces of PBF D.
- Assess the impact and increase knowledge of PBF D in wild birds:
  - Compare survivability between infected and uninfected birds. Compare survivability between antibody (HI) positive and negative birds.
  - Collate data from other relevant psittacine research programs to increase knowledge of PBF D distribution and prevalence in non-OBP psittacines.

### B. Biosecurity / Hygiene

- Clean out nest-boxes by removing old nest material annually before the breeding season. Proper cleaning will be very difficult due to logistical constraints. Effective disinfection of old nest-boxes is not worthwhile due to the slightly porous wooden material and inability to completely remove organic material. New nest boxes have a replaceable wooden inner so that adequate cleaning and disinfection may be achievable.
- Feed table hygiene – each day during breeding season thoroughly clean feed table trays and mat with detergent to remove all organic material. Rinse thoroughly and dispose of soapy water as below. Air dry before reuse (cycle with previous day's matting).

- Disinfect feed table weekly with F10 as per general instructions above. Collect run off and dispose of on middle of Melaleuca air strip or gravel mullock heaps so run off to water on edges of strip where frogs may breed is not possible. Thoroughly rinse tables with water. Collect and dispose of rinse water on air strip as above.
- Between handling each clutch or adult wild bird the following hygiene should be adopted: disinfect hands with alcohol gel, use a dedicated washed cotton/calico bag for each bird, use new ziplock into plastic container for weighing birds, clean all in contact instruments and surfaces with ethanol. Handling bags should be washed and disinfected at the end of each trip and not reused within a trip.

### **C. Dead or sick bird found in wild**

- Contact veterinarian to discuss situation.
- Use appropriate PPE (minimum of disposable gloves for dead bird), and personal hygiene measures as much as possible.
- Follow protocols in Appendix 3 if possible / feasible.

## Appendix 1. Small psittacine general examination and body condition score

Only a veterinarian or person who has a good knowledge of parrot physiology and is experienced at handling this species should conduct a detailed physical exam

**Table 1. OBP general examination checklist**

Observe the bird in cage prior to exam	Note posture, respiration, demeanor and appetite, as well as that of cagemates
Check the birds identification	Leg band and ARKS number.
Weigh the bird	Place in clean cloth bag in container on digital scales. Subtract bag weight.
Examine feathers	Coat condition, feathers should be clean, groomed and glossy, note any change to plumage colour. Examine for stress lines in feathers and ectoparasites.
Body Condition	Pectoral muscles convex – good body condition  Pectoral muscles concave – poor body condition
Assess respiration	Normal HR 300 – 500 beats per minute. Normal RR 85 breaths per minute. Assess respiration when bird is resting then on return to the aviary.
Check Head – eyes, ears, face, mouth and beak	Check top of head for feather loss or abrasions. Check ears for exudate, obstructions, or wounds. Check eyes and nostrils for discharge or other abnormality. Check eyes for pupillary reflex and cataracts. Check beak (top and bottom) and cere for crusty lesions, swellings, fractures or deformity. Check mouth, choanal slit and tongue for foreign objects, swellings and growths.
Examine body	Palpate crop and abdomen for abnormalities. Examine wings, joints and feather shafts. Examine tail feathers, preen gland and cloaca.
Examine limbs	Palpate legs, toes and claws. Check for joint movement, grip response, crusty lesions, lumps or swellings. Check toenail length, trim if required.

## Appendix 2. Health screening details

Blood collection – Collect no more than 1% of the body weight of the bird.

- Basilic (ulnar, or wing) vein: this vein is located over the medial surface of the proximal ulna, and is a convenient location for blood collection in non-anaesthetised captive and wild birds. Swab basilic vein as it crosses proximal ulnar with chlorhexidine soaked swab. Insert a 27 G - 30G needle into vein bevel up. Collect blood into a 75mm heparinized capillary tube (approximately three quarters full).
- Jugular: the right jugular is easily visualized the right side of the neck. The vein should be occluded with a thumb or forefinger at the level of the thoracic inlet prior to venipuncture. Isoflurane anaesthesia may be chosen to immobilized bird for jugular venipuncture. Use a chlorhexidine swab and withdraw blood directly using a 27G needle and 1ml syringe.

Swab collection

- Choanal swab - hold bird with head up and insert swab into mouth, direct tip up into choanal slit, rotate swab gently and either test swab immediately or place into transport media.
- Cloacal swab- hold bird and gently bend tail back to expose cloaca. Insert swab (moisten with sterile water first) gently into cloaca and gently rotate to collect a small amount of faecal material. Test swab immediately or place into transport media.
- Processing Choacal and Cloacal swabs:
  - For Chlamydia (Clearview in-house test or send to lab for PCR)
  - For oral and faecal gram stain
  - For culture if necessary

**Table 2. Disease sampling from blood, swabs and feathers**

Disease	Sample required	Tests for	Test	Notes
Chlamydia	Whole blood smeared onto filter paper	Antibodies	(Immunocomb) In-house test	Indicate exposure only (NB: high antibody level coupled with appropriate clinical signs is strongly suggestive of chlamydiosis)
	Swab of the choana and or cloaca	DNA	PCR at an external lab  In-house clearview test	Positive detection means bird is shedding chlamydia  Less accurate than PCR, can result in false +ve/-ve (but only \$15)
PBFDV	Whole blood onto Whatman no. 2 filter paper	DNA and antibodies	PCR (DNA) and HI (antibodies)  Repeat 1-2 times with 4-6 weeks between testing. This may be modified according to pre-arrival testing undertaken.	Frequency of testing (2 or 3 tests) and whether to test PCR, or PCR + HI + HA may vary with risk assessment e.g. currently recommending 2 x PCR for new birds entering facility and 2 x PCR+HA+HI for pre-release testing.
	Feather collection – pluck 2-3 small growing contour feathers from chest and place in an envelope.	Antigen	HA  Repeat 1-2 times with 4-6 weeks between testing. This may be modified according to pre-arrival testing undertaken.	
General health profile	Place drop of blood between 2 coverslips then separate coverslips and air-dry. Collect rest of blood into small heparin tube.	Haematology and biochemistry		

Transport to laboratories – Australia post or courier

- Fastaway courier 62734544 (for prepaid vouchers contact veterinarian).

Laboratories

- Charles Sturt University Veterinary Diagnostic Laboratory, Boorooma St, Wagga Wagga 2678 (Shane Raidal) will screen PBFd samples. Cost is currently \$65 for each test (PCR, HI and HA together cost \$195)
- Molecular Diagnostic Services. Physical address 163 Swan Drive Fernleigh Park, Googong, NSW 2620. Postal address P.O. Box 2206 Queanbeyan NSW. Tel: (02) 6299 7740. [mdsaustralia@bigpond.com](mailto:mdsaustralia@bigpond.com) (cost around \$50 for PCR).

### **Appendix 3. Sending dead birds to Animal Health Laboratories Launceston**

- Consult with veterinarian after any mortality. If it is less than 24 hours since death and the bird has not been necropsied on-site, aim to transport bird to the laboratory. Double bag bird (ziplock or similar), and place in an esky with frozen ice brick and scrunched up newspaper as filling (or in fridge temporarily). Label esky appropriately. Record the following details: Bird ID, sex, whether adult, juvenile or neonate, the date of collection, what findings were made with skin and plumage inspection, and what signs were observed prior to death.
- Arrange transport to Animal Health Laboratory in Launceston ASAP (direct or via veterinarian). Discuss relevant history with veterinarian, they will help with transport as needed / fax a specimen advice form to lab and ring the on duty pathologist.
- If it is 24-48 hours since death it may or may not be worthwhile sending a fresh bird to the laboratory. It will depend on how soon after death the bird was collected / refrigerated, environmental conditions etc. Discuss with veterinarian. If you are unable to speak with veterinarian double bag and freeze bird.

If more than 48 hours since death, double bag and freeze bird.

## Appendix 4. Managing endoparasites particularly Ascarids (roundworm).

Ascarids are a common problem in psittacine bird collections in Australia and have caused mortality in captive OBPs. Ascarids have a direct life cycle (no intermediate host required). Treating the environment to remove eggs is an ideal part of control (requiring deep substrate changes at least annually to be effective) as repeated long term use of anti-parasitic drugs will result in resistance.

Treatment options:

Many anthelmintic treatments can be administered in-food. Water based anthelmintics in OBPs have appeared to be ineffective in the past (Joc Hockley pers. comm.). Administration via crop needle is not generally undertaken at the Taroom facility. Crop needles should only be used by trained and experienced staff.

Treatment options include (from Hygiene Protocols, DEH 2006)

Moxidectin 200µg PO, repeat in 3 weeks

Fenbendazole 25-50 mg/kg PO SID x 3-7 days, or 100 mg/kg PO once. Taroom has used Panacur 25 mixed in with the seed. The recipe is as follows: 12mls Vegetable Oil, 8 mls Panacur 25, 1 kg seed.

Mebendazole 25-50 mg/kg PO once

Levamisole 15 mg/kg PO once

Oxfenbendazole 20 mg/kg PO once. 2.5 mL/L DW.

Thiabendazole 100-200 mg/kg PO BID x 10 days

Albendazole 5 mL/L in water x 3 days (or 0.1mL/50g BW x 3 days).

For information on trade/ manufacturer names as well as potential toxicity, see:  
<http://avianmedicine.net/content/uploads/2013/03/18.pdf>

## **Appendix 5. Abbreviations and Contact details**

### ***Abbreviations***

PBFDV – Psittacine Beak and Feather Disease Virus

OBP - Orange-bellied Parrot

PCR - polymerase chain reaction

HI – haemagglutination inhibition

HA -haemagglutination

PPE - personal protective equipment

### ***Current Contact details***

Managers – Captive Program Jocelyn Hockley 0419660171, Drew Lee 0427736484,

Wild Program - Rosemary Gales 0409002418

Veterinarians - Annie Philips 0400954295, Sarah Peck 0417311085.

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