

TARALGA WIND FARM

**OPERATIONAL ENVIRONMENTAL
MANAGEMENT PLAN (OEMP)**

**Updated extract - Section 3 Only
- Bird and Bat Adaptive Management Program**

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3. BIRD AND BAT ADAPTIVE MANAGEMENT PROGRAM

This version of the Bird and Bat Adaptive Management Program (BBAMP) has been updated in July 2018 to reflect the findings of the first two years of implementation of the BBAMP. The findings of the first two years of monitoring are outlined in the report: *Taralga Wind Farm, Bird and Bat Adaptive Management Program – Annual Report – Second year of implementation Report 8129 (23.2)* prepared for Pacific Hydro Australia, by Brett Lane & Associates (BL&A), 2017.

The BBAMP is applicable to the area licenced by the Taralga Wind Farm (TWF) entity for the purposes of operating the wind farm. This generally includes the turbines and associated infrastructure including hardstands, access tracks, cable trenches, sub-station and Operations and Maintenance Facility. TWF staff, their consultants and contractors do not have legal access rights to undertake activities outside the licenced area.

3.1. Introduction

This Bird and Bat Adaptive Management Program addresses the conditions outlined in the Conditions of Consent (No. 11216 of 2007).

3.1.1. Condition of Consent

Condition 93 states:

“Prior to the commencement of Construction, the Applicant must prepare and submit for the approval of the Director-General, a Bird and Bat Adaptive Management Program must be prepared and undertaken, which takes account of bird/bat monitoring methods identified in the current editions of AusWEA Wind Farms and Birds: Interim Standards for Risk Assessment (July 2005). The Program must be undertaken by a suitably qualified expert, approved by the Director-General.

The Program must incorporate Monitoring, and a Decision Matrix that clearly sets out how the Applicant will respond to the outcomes of monitoring. It must:

- (a) incorporate an ongoing role for the suitably qualified expert;*
- (b) set out monitoring requirements. The requirements must account for natural and human changes to the surrounding environment that might influence bird and/or bat behaviour such as changes in land use practices, and significant changes in water levels in nearby water bodies;*
- (c) incorporate a decision making framework that sets out specific actions and when it may be required to reduce identified impacts on birds and bats;*
- (d) set out available mitigation measures;*
- (e) incorporate reporting requirements on the outcomes of monitoring, including details on all mortalities, on the application of the decision making framework, the need for mitigation measures, progress with implementation of such measures, and their success*

and details of all payments made to WIRES (as required under condition 92) that have been made during each reporting period. Reports must be prepared on an annual basis, from the commencement of operation and must be prepared within 2 months of the end of the reporting period and be provided to the Director-General. The Director-General may vary the reporting requirement or period by notice in writing to the Applicant; and

- (f) *identify any necessary mitigation measures and implementation strategy including, but not limited to, those referred to in condition 91.*

The Applicant is required to implement reasonable and feasible mitigation measures, to the satisfaction of the Director-General, where the need for further action is identified through the Bird and Bat Adaptive Management Program.”

The table below indicates where in this plan each condition of consent has been addressed

| Consent Condition | Reference |
|--|-------------------------------|
| Condition 93 | |
| (a) “incorporate an ongoing role for the suitably qualified expert.” | Section 3.4 |
| (b) “set out monitoring requirements ...” | Section 3.4 |
| (c) “incorporate a decision making framework..” | Section 3.6.2 |
| (d) “set out available mitigation measures.” | Section 3.5 and Section 3.6.3 |
| (e) “incorporate reporting requirements...” | Section 3.4.4 |
| (f) “identify any necessary mitigation measures...” | Section 3.5 and Section 3.6.3 |

3.2. Risk assessment

This sub-section outlines the risk assessment framework used to prioritise responses to the risk the project represents for birds and bats.

Risk assessment involves combining an assessment of the consequences of a particular potential impact of an action on birds and bats with the likelihood of it occurring. To enable this assessment, both consequence and likelihood criteria have been developed (see Table 1). In addition, scores have been allocated to different levels of consequence and likelihood to enable a consistent comparison of risks.

Risks to birds and bats arise from four possible impact mechanisms, described briefly below.

- Direct impacts arising from collision with operating wind farm infrastructure;

- Direct impacts arising from the removal of habitat for the construction of wind farm infrastructure;
- Indirect impacts arising from disturbance effects to surrounding habitats; and
- Indirect effects arising from barrier effects of rows of turbines.

Table 2 provides a matrix showing applicable risk ratings for particular consequence and likelihood levels.

Table 1: Consequence and likelihood criteria and scores for bird and bat risk assessment at the Taralga Wind Farm.

| Consequence Criteria | | | | |
|---|--|---|--|--|
| Negligible | Minor | Moderate | major | Extreme |
| Local population size or behaviour may change but detectable change unlikely to be beyond natural variation | Detectable change (1 – 5 %) in local population size and /or behaviour beyond natural variability but no impact on population viability (i.e. recruitment, breeding, recovery capacity). | Detectable change (5 – 10 %) in local population size and/or behaviour beyond natural variability but no impact on population viability (i.e. recruitment, breeding, recovery capacity) in the long term but recovery may be delayed. | Detectable change to local (>10%) and regional (1 – 5 %) population size and/or behaviour beyond natural variability. Impact on local population viability and capacity to recover | Local extinction likely detectable change to regional population (> 5%) beyond natural variability. Impact on regional population viability and capacity to recover. |
| Likelihood Criteria | | | | |
| Almost impossible | Very Unlikely | Possible | Highly Probable | Certain |
| No previously documented instance | Instance has occurred elsewhere but under different patterns of bird and bat use | Instance has occurred very rarely elsewhere under similar patterns of bird and bat use | Instance has occurred regularly elsewhere under similar patterns of bird and bat use | Certain to occur based on experience elsewhere |

Table 2: Risk matrix

| Consequence Likelihood | Negligible | Minor | Moderate | Major | Extreme |
|---------------------------|------------|----------|----------|----------|----------|
| Almost Impossible | Low | Low | Low | Low | Moderate |
| Very Unlikely | Low | Low | Low | Moderate | High |
| Possible | Low | Low | Moderate | Moderate | High |
| Highly Probable | Low | Moderate | Moderate | High | High |
| Certain | Moderate | Moderate | High | High | High |

Potential impacts are rated for their risk in Table 3 based on the criteria in Table 1 for the following bird and bat groups:

- Threatened bird species (incl. Powerful Owl, Gang Gang Cockatoo and Glossy Black Cockatoo);
- Threatened bat species (incl. Yellow-bellied Sheath-tail Bat and Eastern Falsistrelle)
- Wedge-tailed Eagle;
- Common birds; and
- Common bats.

Table 3: Risk Assessment rating for Taralga Wind Farm impacts on bird and bats

| Impact | Pre-mitigation | | | Mitigation Actions | Post-mitigation | | Residual Risk Level |
|--|----------------|-------------------|------------|--|-----------------|-------------------|---------------------|
| | Consequence | Likelihood | Risk Level | | Consequence | Likelihood | |
| Threatened birds (particularly Powerful Owl) | | | | | | | |
| Turbine Collision | Minor | Very unlikely | Low | None | Minor | Very unlikely | Low |
| Habitat removal | Minor | Certain | Moderate | Procedure 1 of Flora and Fauna Management Sub-Plan | Minor | Certain | Moderate |
| Disturbance and displacement | Minor | Almost impossible | Low | None | Minor | Almost impossible | Low |
| Barrier effects of lines of turbines | Negligible | Almost impossible | Low | None | Negligible | Almost impossible | Low |
| Threatened birds (particularly Glossy Black Cockatoo) | | | | | | | |
| Turbine Collision | Negligible | Almost impossible | Low | None | Negligible | Almost impossible | Low |
| Habitat removal | Negligible | Almost impossible | Low | None | Negligible | Almost impossible | Low |
| Disturbance and displacement | Negligible | Almost impossible | Low | None | Negligible | Almost impossible | Low |
| Barrier effects of lines of turbines | Negligible | Almost impossible | Low | None | Negligible | Almost impossible | Low |

| Impact | Pre-mitigation | | Risk Level | Mitigation Actions | Post-mitigation | | Residual Risk Level |
|--------------------------------------|----------------|-------------------|------------|---------------------------------|-----------------|-------------------|---------------------|
| | Consequence | Likelihood | | | Consequence | Likelihood | |
| Threatened bat species | | | | | | | |
| Turbine Collision | Negligible | Possible | Low | None | Negligible | Possible | Low |
| Habitat removal | Minor | Possible | Moderate | None | Minor | Possible | Moderate |
| Disturbance and displacement | Minor | Possible | Moderate | None | Minor | Possible | Moderate |
| Barrier effects of lines of turbines | Minor | Possible | Moderate | None | Minor | Possible | Moderate |
| Wedge-tailed Eagle | | | | | | | |
| Turbine Collision | Minor | Highly Probable | Moderate | Procedures 7 and 9 of this plan | Minor | Possible | Low |
| Habitat removal | Negligible | Certain | Low | None | Negligible | Certain | Low |
| Disturbance and displacement | Minor | Certain | Low | None | Minor | Certain | Low |
| Barrier effects of lines of turbines | Negligible | Almost impossible | Low | None | Negligible | Almost impossible | Low |
| Common birds | | | | | | | |

| Impact | Pre-mitigation | | Risk Level | Mitigation Actions | Post-mitigation | | Residual Risk Level |
|--------------------------------------|----------------|---------------|------------|--------------------|-----------------|---------------|---------------------|
| | Consequence | Likelihood | | | Consequence | Likelihood | |
| Turbine Collision | Negligible | Certain | Low | None | Negligible | Certain | Low |
| Habitat removal | Negligible | Certain | Low | None | Negligible | Certain | Low |
| Disturbance and displacement | Negligible | Very unlikely | Low | None | Negligible | Very unlikely | Low |
| Barrier effects of lines of turbines | Negligible | Very Unlikely | Low | None | Negligible | Very Unlikely | Low |
| Common bats | | | | | | | |
| Turbine Collision | Negligible | Certain | Low | None | Negligible | Certain | Low |
| Habitat removal | Negligible | Certain | Low | None | Negligible | Certain | Low |
| Disturbance and displacement | Negligible | Very unlikely | Low | None | Negligible | Very unlikely | Low |
| Barrier effects of lines of turbines | Negligible | Very Unlikely | Low | None | Negligible | Very Unlikely | Low |

3.3. Adaptive Management Program Objectives

The objective of this adaptive management program is to minimise bird and bat impacts from the construction and operation of the Taralga wind farm and in particular reduce bird and bat turbines collision risk. Risk reduction measures will be implemented to ensure that a significant impact trigger does not occur (section 3.5). In the event that a significant impact trigger does occur, further mitigation measures will be implemented to reduce the risk of the impact continuing to occur (section 3.6.3).

Monitoring of bird and bat impacts will be achieved by establishing monitoring and management procedures, consistent with the methods outlined by the Australian Wind Energy Association (2005) and the Clean Energy Council (2013). A reporting program is also described to present results and proposed improvements to management measures.

In order to ensure the efficacy of this adaptive management program, all activities will be undertaken subject to regular review and reporting by a suitably qualified expert approved by the Secretary of the Department of Planning and Environment (DP&E) with relevant experience. Personnel undertaking the carcass searches will be adequately trained to undertake the assessments. The expert will also be in charge of data analysis, interpretation and reporting. In February 2012, the Brett Lane from BL&A and Greg Richards from Greg Richards and Associates were approved by the Director General as being suitably qualified experts to undertake this work (Appendix 11).

Should the detected mortality rate of birds and bats significantly exceed two to four bats per turbine per year, or should repeat fatalities of listed threatened bird or bat species occur then measures will be taken to investigate and reduce impacts. The Decision Matrix in Figure 8 indicates how this will occur (see section 3.5.1).

3.4. Pre-construction and Operational Monitoring Activities

On the Taralga Wind Farm, management procedures are proposed to mitigate the potential impact of the project on birds and bats, and monitoring methods are identified to test the success of the management procedures and inform their refinement, if necessary.

The monitoring program will include:

- Input from a suitably qualified expert approved by the Secretary. The suitably qualified expert (i.e. Brett Lane and Greg Richards – Appendix 11) will oversee implementation of the program and preparation of annual reports;
- Collection of baseline data before construction to provide a level of bird and bat utilisation within the site boundary;
- Pre-construction avian and bat fatality monitoring program including a protocol for handling and reporting fatalities and injured wildlife;
- Operational avian and bat monitoring program including a protocol for handling and reporting fatalities and injured wildlife; and
- Regular monitoring reporting program.

Methods for pre-construction and operational monitoring surveys are detailed below.

3.4.1. Pre-construction Bird and Bat Monitoring

Baseline data was collected prior to construction and included:

- Bird utilisation surveys
- Bat utilisation surveys
- Fatality monitoring

The methods for the above activities are described below.

The results from each of these surveys is included in the report Brett Lane & Associates (BL&A), 2013. *Taralga Wind Farm, Pre-Construction Bird Utilisation and Bat Surveys. Report 8129 (2.0)*, prepared for CBD Energy Group. January 2013. It is understood this was provided to OEH.

Bird Utilisation Surveys (BUS)

Within the wind farm, fixed point censuses of birds were undertaken. This is achieved by establishing impact monitoring points within the site boundary and reference monitoring points, situated 350m from the turbine locations. At each point, a 15-minute count of all birds were undertaken, with all species identified and their flight height recorded within a 100m radius of the central point. A total of 10 impact monitoring points were established within the wind farm and four reference monitoring points nearby (>500m from the nearest turbine) in similar landscape and habitat settings.

Flight height was recorded in twenty metre height intervals and later divided into three categories: below Rotor Swept Area (RSA) height; at RSA height; and above RSA height.

The pre-construction bird utilisation surveys (BUS) were conducted for TWF in four seasons in 2012 as described in the table below.

Table 4: BUS survey timetable in 2012

| Survey period |
|---|
| Summer: 4th – 16th February 2012 |
| Autumn: 19th – 23rd March and 25th – 30th March 2012 |
| Winter: 19th – 22nd June and 24th – 29th June 2012 |
| Spring: 1st – 5th October and 8th – 12th October 2012 |

Bat Utilisation Surveys

Bat activity surveys were undertaken using Anabat® detectors which record bat calls within a 20 to 30 m radius. The methodology used is provided in “*Guidelines for Bat Surveys in Relation to Wind Farm Developments*” (Lumsden 2007), which although prepared for Victoria are equally applicable to any setting in south eastern Australia. Bat surveys should be undertaken during the peak bat activity season (November to April) and in optimal weather conditions (relatively mild, dry and with little or no wind).

Surveys should be undertaken within each habitat type, spread across the whole wind farm site. The survey should be undertaken at 20 sites for five consecutive nights.

The pre-construction bat surveys were undertaken at Taralga Wind Farm summer/autumn of 2012. To gain an insight into the frequency of bat utilisation of this area, pre-construction monitoring was conducted for a period of 38 consecutive nights at a peak time of the season (February-March). The calls from the survey were analysed by appropriately trained specialists.

The bat survey was conducted in four stages as follows:

Stage 1: Recording of bats was carried out over five nights between 5th and 10th February 2012. During this time, eight Anabat systems operated concurrently from six sites (1 – 6) and two Anabats from wind mast 1.

Stage 2: Recording of bats was carried out over five nights between 10th and 15th February 2012. During this period eight Anabat systems operated concurrently from six sites (7 – 12) and two Anabats from wind mast 2.

Stage 3: Recording of bats was carried out over 15 nights between 15th February and 1st March, 2012. During this period four Anabat systems operated concurrently from four forest sites (1 – 4). Recording in this stage failed due to inundation of the Anabats during unusually heavy rain.

Stage 4: Recording of bats was carried out over 15 nights between 1st and 15th March 2012. During this period seven Anabat systems operated concurrently from four forest sites (1-4), two at wind mast 2 and one at site 10.

Bird and Bat Fatality Monitoring Program

The first stage of monitoring bird and bat fatality resulting from collisions with the turbines is achieved by collecting baseline mortality of birds and bats within the site. This involves searching future turbine sites for birds and bats that have died of natural causes prior to the construction of the wind farm.

Pre-construction fatality monitoring involved a carcass search procedure that included:

- Searches for carcasses within 100m of the potential turbine sites (impact sites) for bird and bat carcasses; and
- Searches for carcasses within 100m of fixed areas in similar habitat to the turbine sites centred on a point at least 350m away from the turbines (reference sites).

The mortality search was undertaken in each season over one year. During each survey, 15 proposed turbine sites and eight reference points were targeted. The surveys commenced in February and were completed in October, 2012. The methods and results of the survey are presented in this section of the report.

The results of all searches were recorded in a carcass search data sheet (see Appendix 2). The data sheets were filled out for every site search undertaken, to ensure details of all searches are recorded, including those during which no carcasses were found (likely to be for most searches).

3.4.2. Operational Bird and Bat Fatality Monitoring Program

An operational bird and bat fatality monitoring program, including pulsed (monthly, with a repeat survey 2-3 days later) carcass searches, was undertaken for two years. Pulsed carcass searches at monthly intervals are sufficient to obtain data that will provide statistically robust mortality estimates, when combined with data from scavenger and searcher efficiency trials. This sampling methodology balances data requirements with logistical constraints. This frequency is sufficient to obtain a robust picture of overall blade strike and is based on available scavenger information and commonly applied practice at other Australian sites (see Symbolix (2013) in Appendix 3). An additional six months targeted Gang-Gang Cockatoo carcass searches were also undertaken

The first two-years of carcass monitoring involved intensively searching around turbines for dead or injured birds and bats. These carcass searches took place over from August 2015 to July 2017, covering 24 monthly searches. The carcass monitoring included the following elements:

- Formal monthly carcass searches were carried out at twenty turbine sites (impact points) and five reference sites over 24 months;
- An additional two turbines (T29 and T31 - **Error! Reference source not found.**) were added to the formal searches from November 2015 to October 2016 to address a significant impact trigger initiated by the finding of a Gang-gang Cockatoo featherspot;
- Impact sites were searched out to a radius of 100 metres;
- A pulse search regime was implemented that involved a second search of impact points two to three day following initial searches.
- Five reference sites were searched every three months from August 2015. These sites were searched to 100m and were not pulse searched.

The results from the first two years of monitoring were compiled into a second-year annual report (BL&A 2017). In summary, the report of the first two years of monitoring concluded that the Taralga Wind Farm had a low impact upon the local bird and bat populations. Investigations into 2017 indicated that Taralga Wind Farm posed a low risk to threatened bird and bat species and concluded that the intensive data collection and robust statistical analysis have provided a satisfactory indication of the impact of the wind farm on bird and bat species. Continuation of the routine carcass monitoring beyond 2 years is not warranted and was not recommended. Routine reporting of any incidental bird and bat carcass finds under wind turbines by wind farm personnel is recommended to continue.

The results of the additional six month GGC carcass surveys also supported these recommendations. No GGC carcasses were identified during this targeted six month survey campaign and GGC were found to rarely engage in behaviour that puts them at risk of colliding with wind turbines. The vast majority of observed flights are below rotor swept height

Further monitoring may be deemed necessary by the (Secretary of the) Department of Planning and Environment however based on the results outlined above this has not been recommended by BLA.

Procedures for on-going carcass monitoring (if required)

Procedures for this component of the monitoring program are provided below.

As observers do not necessarily detect all carcasses present and because scavengers can remove carcasses before they are found, correction factors for these two variables will be provided. The correction factors will be calculated from dedicated scavenge and search efficiency surveys.

In addition, the pulse carcass search method will be utilised, which aims to reduce the error around the mortality estimate by decreasing the likelihood that carcasses are missed. A pulse search regime is characterised by a series of alternating short and long intervals (days) between searches, as described below. These aim over time to provide an estimate of the rate at which carcasses appear, which is necessary for refined mortality rate estimation.

Following the first two years of monitoring, a mortality estimate for birds and bats was calculated using an appropriate model for estimating mortality that incorporates the results of mortality searches using the pulsed survey design, and the results of the scavenger and searcher efficiency trials. These factors assist in reducing the uncertainty on the mortality estimate. The mortality estimate was undertaken by an appropriately qualified statistician.

These same techniques would be applied to any future carcass monitoring program.

Site selection, frequency and area for carcass searches

Twenty proposed turbine sites, referred to as impact points, were selected in addition to a minimum of five reference sites. The impact points included different turbines with distinct habitat variables (i.e. woodland vs open pasture). Selected impact and reference sites were distributed as evenly as possible throughout the wind farm site with the exact site chosen randomly within habitat sub-areas that ensure an even geographical spread. Once the impact and reference points were randomly chosen, these points were surveyed for the duration of the monitoring period.

Similar to pre-construction surveys, reference sites were searched out to a radius of 100 metres once every three months.

Impact sites were searched monthly out to a radius of 100 metres, except where difficult terrain prevented safe access for searchers. The order in which they are searched was chosen at random. A pulse search regime was implemented for the first two years, which involved a second search of impact points two to three days after initial searches. Pulse searches were also be undertaken out to a radius of 100 metres (except where terrain prevented safe access).

These same techniques would be applied to any future carcass monitoring program.

Search method

The searcher walked the area at approximately 30–60 metres per minute (or faster if ground cover does not limit visibility of carcasses) and searched thoroughly for dead birds and bats to a distance of three metres either side of the

search route. The searcher generally therefore walked transects about six metres apart across the circular search area until all of the area has been searched. Searching was undertaken once the sun is a reasonable height above the horizon, providing good back-lighting at ground level. It is estimated that the searching will take several days to complete for each search period.

The results of all searches were recorded in a carcass search data sheet (see Appendix 2). The data sheets were filled out for every site search undertaken, to ensure details of all searches are recorded, including those during which no carcasses were found (likely to be for most searches).

These same techniques would be applied to any future carcass monitoring program.

Scavenger Trials

Estimates of carcass removal by scavengers (expressed as the average carcass persistence) are used to correct for the fact that scavenging significantly reduces the detection of bird and bat carcasses under wind turbines. It is necessary to conduct scavenger trials to estimate the length of time bird and bat carcasses remain detectable before being scavenged. Two scavenger trials were conducted, one when vegetative ground cover is high and lush (October) and one when vegetative cover levels are low (March/April).

A procedure for the scavenger trials is provided below.

- The trials will be conducted at twenty randomly-selected impact sites.
- Placed carcasses will be checked daily for the first five days then every second day until all carcasses have disappeared, or for a maximum of 30 days. After 30 days, remaining carcasses will be removed. (Experience suggests that most carcasses disappear within five to ten days)
- At each trial site, one carcass (or more) will be placed randomly within a 50 metre radius search area around the turbine.
- A mix of small, medium and large native birds (collected from road-sides before the monitoring begins) and some bat carcasses (if available) will be obtained for use in the scavenger trial. In the absence of available native carcasses, quail and mouse carcasses will be used. Ten carcasses will be used in each size category, carcasses permitting.
- Carcasses used in the trial will have their coordinates recorded to ensure that they are not confused with an actual fatality found under a turbine during the trial searches.
- The mean length of time a carcass remains in the study area before being scavenged and associated variance will be calculated.
- Notes will be taken on evidence remaining at sites where carcasses have been scavenged (e.g. scavenger scats, bones, feather[s], animal parts and type of scavenging, if visible, such as tearing, pecking, complete removal of carcass, partial removal of carcass, bird or mammal predator evidence).
- Notes will be taken on the daily state of remaining carcasses.

- Latex gloves will be worn at all times while handling carcasses to minimise contact with human scent, which may alter predator responses around carrion and to minimise disease risk to the handler.
- The mean persistence of carcasses before scavenging will be calculated and a correction factor developed accordingly.

These same techniques would be applied to any future carcass monitoring program.

Searcher efficiency trial

Searcher efficiency trials were conducted on the first day that the scavenger trials are undertaken. This enabled an estimate of the percentage of carcasses found by searchers. Data collected at other wind farms indicates that the detection of bats is very similar to that of small birds (Johnson *et al.* 2002).

The procedure for the searcher efficiency trial is presented below.

- Personnel conducting searches will not know the location of carcasses until after the searcher efficiency trial but the GPS coordinates of carcasses will have been recorded so that the observer(s) can later be shown the carcass for the scavenger trial.
- Personnel conducting searches are to apply the same search method as intended for normal carcass searches.
- Carcasses will be placed in search areas as before the observer's first search but on the same day, thereby minimising the chances of a carcass being removed by a scavenger before the searcher can find it.
- Carcasses will be placed in a variety of exposures to simulate a range of conditions.
- Carcasses will have their GPS coordinates recorded to avoid the possibility of being counted in subsequent carcass searches or incidental collections.
- The mean proportion of placed carcasses found by searchers will be calculated and a correction factor derived.

These same techniques would be applied to any future carcass monitoring program.

3.4.3. Protocol for Handling and Reporting Fatalities and Injured Wildlife

All dead birds, feather-spots and/or dead bats found during formal carcass searches or incidentally will be handled in the manner described below. The carcass details in the carcass search data sheet (see Appendix 2) will be filled out for each search where a carcass is found, in addition to the search details.

- The carcass will be removed from the site (in accordance with Pacific Hydro's Injured or Dead Bird and Bat Procedure, PHA.HSE.01.007, or contractor equivalent) to avoid re-counting;
- It will be transferred to a freezer at the site office for storage so it can be used in any future observer efficiency and scavenger trials or to enable confirmation

of species. However, if the carcasses are not required for trials they will be stored in the freezer for at least three months and then will be disposed of;

- A copy of the completed carcass search data-sheet for recorded carcasses will be maintained in the Facilities Management Office;
- If a listed species is recorded the procedure will be followed for an impact trigger as outlined in Section 3.6;
- It will be necessary for the wind farm operator to obtain from the Office of Environment and Heritage a permit under the state *National Parks and Wildlife Act 1974* to handle and keep native wildlife (even dead wildlife) as part of the monitoring program;
- Contact details of local veterinary clinics and wildlife carers will be provided so that advice and/or treatment may be sought for injured wildlife; and
- The Office of Environment and Heritage regional office will be provided with an annual report that provides a summary of all recorded wind farm mortality on an annual basis.

Additionally, all records of Wedge-tailed Eagle collision will be recorded separately to ensure that the appropriate compensation fee is paid to WIRES (as per condition 92 and 93[e]). Records of payment will also be recorded and reported within the annual report to the Secretary.

3.4.4. Annual Report

Results from the any post-construction monitoring will be presented within an annual report, to be prepared at the end of each year of monitoring.

The first-year post-construction report focused on presenting the results from the first year of monitoring, and reviewing the monitoring methods and recommending refinements, if necessary, for the second year. The second post-construction annual report included an evaluation of the adaptive management program. This report was provided to the Secretary and included a recommendation that continuation of monitoring is not warranted based on an informed risk assessment.

The second-year annual report provided recommendations on whether further monitoring is warranted (or not), based on the results of the post-construction monitoring.

In the future, each annual report will contain:

- A brief description of the management prescriptions implemented and identify modifications made to the original management practices proposed;
- Results from any bird and bat utilisation surveys and discussion on any observed changes in habitat utilisation or population numbers, and any reasons for the observed changes.
- Results from any bird and bat collision surveys and an estimate of collisions that takes into consideration the scavenger and searcher efficiency correction factors;
- Reports on any carcasses recorded outside of any formal carcass searches;

- Results from the comparison of management prescriptions with the performance criteria;
- Discussion of the analysis of results and the efficacy of the management plan;
- Details of payments made to WIRES;
- Mitigation measures implemented;
- Any significant impact triggers recorded;
- Analysis of the effectiveness of the Decision-Making Framework; and
- Proposed modifications to the adaptive management program.

Further monitoring may be deemed required by the (Secretary of the) Department of Planning and Environment however based on the results outlined above this has not been recommended by BLA. If deemed necessary, monitoring will continue for up to another three additional years. Annual reports in year's three to five will follow a similar structure as listed above.

3.5. Mitigation measures to reduce risk

Mitigation involves the prevention, avoidance and/or reduction of the risk of an impact trigger occurring or continuing to occur. This section outlines measures that will be undertaken during operation of the wind farm to prevent or reduce the potential for an impact to occur. The overall objective of mitigation measures is to ensure that the Taralga Wind Farm does not lead to significant impacts on threatened or non-threatened birds and bats. Section 3.6.3 outlines mitigation measures that are specific to hypothetical impacts, if they were to occur.

Carrion removal program

The original BBAMP provided for an assessment of the need for continuation of the carcass removal program after one year of operation. The overall aim of the carcass removal program is to reduce impacts to Wedge-tailed Eagles and other raptors that may feed on carcasses, in particular dead lambs, and other carrion. Carrion is defined as the dead and decaying flesh of an animal that often serves as a food source for animals.

In the first two years of implementation of the BBAMP, there were six WTE carcasses recorded. Analysis of these impacts reveals the following:

- Location of fatality:
 - Four of the six Wedge-tailed eagle fatalities occurred adjacent to or within cattle properties;
 - One of the six Wedge-tailed eagle fatalities occurred in sheep grazing farmland; and
 - One of the six Wedge-tailed eagle fatalities occurred in forested habitat.
- There is not an apparent correlation between:
 - Sheep properties and Wedge-tailed Eagle fatalities;
 - Location of carrion and Wedge-tailed Eagle fatalities; and

- Seasonality of lambing (usually autumn /early winter) and WTE fatalities, although there were fewer fatalities in the period of December to May (fatalities were recorded: 14/7/2015, 29/9/2015, 17/11/2015, 23/6/2016, 20/9/2016 and 6/10/2016).

The BBAMP is a document that takes a conservative approach to addressing issues related to bat and bird management in and around the wind farm. It is also noted that the BBAMP is adaptive in nature and is intended, particularly in its first years of implementation, to inform a longer –term approach.

Thus, the BBAMP should continue to minimise the “potential attractiveness” of the site to WTE which would include:

- During lambing season (usually late autumn / early winter) working with landholders to minimise lambing within 500 metres of turbines, and during lambing season monitor any instances of lambing in paddocks with 200 metres of turbines;
- In order to reduce collision risks to birds, working with landholders to ensure that stock will not be fed grain underneath turbines as this may also attract parrots and cockatoos, and raptors which prey on these species; and
- Support landholder’s rabbit control programs across the wind farm by monitoring hardstands and access tracks for rabbit harbour locations. Further, Pacific Hydro will ensure that wind farm activities do not prevent any landholder rabbit control activities; and
- An active carrion removal program implemented with land holders to include the elements as outlined below.

The carrion removal activities will provide for the regular removal of carcasses likely to attract raptors to areas near turbines the procedures and activities below will be adopted by technical staff and operational staff of the wind farm and contractors and coordinated by the TWF. The activities will include:

- Inspections during routine maintenance of the wind farm site by service technicians) will record any stock, introduced or native mammal and bird carcasses that may attract raptors (e.g. kangaroos, foxes, rabbits, dead stock). Regular routine maintenance includes driving around all access tracks and visually scanning from the hard stand all visible surrounding areas around the turbines;
- Any observations of carcasses made by any on-site staff in the vicinity of turbines will be reported to the Site Manager who will request that the landholder removes the carcass as soon as possible in line with recommended best practice¹; and
- Consult with landowner or manager in relation to the appropriate disposal of collected carrion.

Lighting on turbines and buildings

¹ NSW Department of Primary Industries Factsheet - Animal carcass disposal, December 2017, Primefact 1616, first edition, Animal Biosecurity, NSW DPI

It has long been known that sources of artificial light attract birds, particularly night-migrating birds in North America and Europe. This is probably the most important factor under human control that affects mortality rates of birds and bats colliding with all structures (Longcore et al. 2008). Most bird mortality at communication towers for example, occurs in poor weather with low cloud in autumn and spring, i.e. during migration periods (Longcore et al. 2008).

It is postulated that bright lights may temporarily blind birds by bleaching the visual pigments of the retina, causing the birds to fly toward the light source and colliding with the structure (Gauthreaux and Belser 2006). Birds therefore become disoriented or 'trapped' in the field of light (Longcore et al. 2008).

Bats are also attracted to the increased numbers of insects that may congregate near bright light sources. They would appear prone to saturation of their retinas, causing temporary blindness when subjected to bright light (Beier 2006) and mortality of both birds and bats can result from collisions with lit structures.

Measures to reduce the impact of lighting include using low pressure sodium or mercury lamps with UV filters to reduce brightness. The colour of lighting may also be important. Some studies have found that red lights resulted in a lower mortality than white lights (Longcore et al. 2008), but more recent research on oil rigs at sea suggests that blue or green lights may result in lower mortality than red or white lights (American Bird Conservancy 2008).

For the above reasons, building lighting should be baffled and directed to avoid excessive light spillage and security lighting should be baffled to direct it towards the area requiring lighting and not skyward. Should aviation safety lighting be required on turbine nacelles then this should take the form of low intensity, LED red flashing lights with a narrow vertical cross-section directed at aircraft.

Marking of power lines

If required, powerlines within the wind farm boundary may be fitted with deterrents including marker balls and/or flags that will reduce bird collision risk.

Mitigation measures that are specific to hypothetical impacts and the time to implement such measures are detailed in Section 3.5.3.

3.6. Significant Impact Triggers and Mitigation Measures

The purpose of this section is to define the circumstances that represent a significant impact trigger (section 3.6.1) and to detail the decision-making framework to be undertaken in the event that a significant impact trigger is recorded (section 3.6.2). Section 3.6.3 outlines potential mitigation measures to be implemented to prevent specific hypothetical impacts from continuing to occur.

3.6.1. Trigger for Significant Impact

A significant impact trigger on birds and/or bats, for the purposes of scheduled and non-scheduled reporting is defined as circumstances where:

- In any two successive mortality searches, two or more carcasses (of any species) are found at an impact point in each search (i.e. a total of four carcasses in two successive searches at the one turbine); and/or

- A threatened or listed migratory species (listed on the EPBC Act or The Biodiversity Conservation Act 2016) is found dead under a wind turbine during any mortality search.

The decision-making framework to be followed should a significant impact trigger be identified is detailed in the following section.

3.6.2. Decision-Making Framework

The Decision-Making Framework is designed to simply identify methods of responding to results from the monitoring program. This framework assists in the identification of significant impacts and provides a step-by-step mitigation program.

The following provides a framework for mitigating significant bat and avifauna impacts of the Taralga Wind Farm. The relationship between these activities is shown in Figure 1. The activities include:

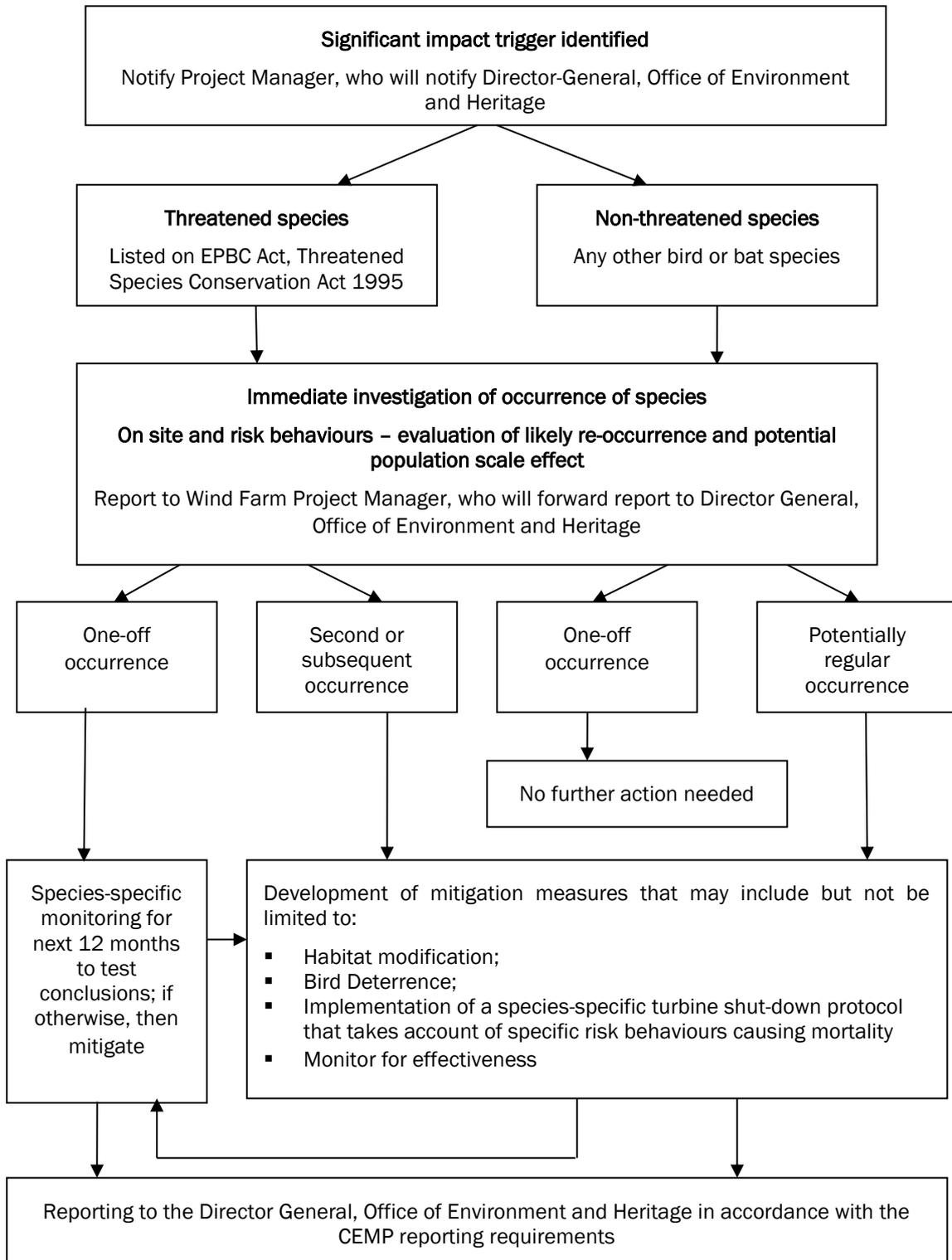
- Immediate reporting of the fatality to Taralga Wind Farm Environment and Planning Manager, who will report it to the relevant statutory planner at OEH within two days of it being recorded.
- Immediate investigation (within seven days) by an appropriately qualified ecologist of the on-site occurrence of the affected species to identify any particular risk behaviours that could have led to the collision or could lead to further collisions. An investigation is necessary to determine the actual cause of death/injury and whether this was related to wind farm operations. The impact trigger may be one-off or cluster events. The investigation should therefore also focus on the evaluation of the likelihood of further occurrences.
- The rapid one week investigation will assess the most effective mitigation and will ensure that the mitigation is implemented correctly and quickly, if possible, subject to a clear understanding of the cause of the fatality.
- If the cause of the fatality is deemed to be a one-off random occurrence, mitigation measures may not be possible or effective.
- If the cause of the fatality is not clear, further onsite investigation of risk behaviours and evaluation of likely re-occurrence will be required over the following weeks. If these investigations suggest that the impact is unlikely to re-occur, supplementary mitigation measures may not be possible or effective.
- If the onsite investigation suggests that the cause of the fatality may be the result of likely on-going risk behaviour and wind farm operation, species-specific monitoring may be required. During the monitoring period, periodic (three-monthly at first) reports will be provided to the relevant parties at OEH.

Should species specific monitoring suggest that one particular turbine is regularly in the flight path of a species of concern and is therefore presenting a higher risk of collision, shut down of the high-risk turbine may be deemed necessary. Any decision to shut down a turbine will be based on rigorous field surveys and a shutdown protocol will be prepared that is relevant to the behaviour and activity of the species of concern.

Responsive mitigation measures will be developed and implemented as needed and in a timely manner. Supplementary mitigation measures specific to possible causes of the fatality are outlined in Table 5 and section 3.5.3.

Any required investigation, and recommended management and supplementary mitigation measures, will be documented in the site management log and detailed in annual reports. This log will be available for inspection by the Environmental Representative or on the request of the Secretary.

Figure 1: Operational procedure for mitigating significant impact triggers



3.6.3. *Supplementary mitigation measures*

Supplementary mitigation measures will be implemented in the event that a significant impact trigger is recorded. The purpose of supplementary mitigation measures will be to prevent the impact from continuing to occur. Specific mitigation measures will be implemented depending on the nature, cause and significance of any impact recorded. It is difficult at this stage to know what the cause of a significant impact trigger will be, therefore examples of impacts and potential mitigation measures specific to the impact, and the time taken to implement these measures, are detailed in Table 5.

Table 5: Supplementary mitigation measures in the case of a significant impact trigger

| Hypothetical cause of impact | Mitigation Measure | Likelihood of impact continuing following mitigation | Time to implementation |
|---|--|--|---|
| Foraging source identified that attracts threatened species to impact areas | Use acoustics (i.e. loud music/irregular noise) to discourage birds from foraging in this location | Low | Implement as soon as possible and no later than two days after recording the impact. |
| | Encourage species into alternative areas outside of the wind farm boundary, where available, through the use of social attraction techniques offsite (decoys and audio playback systems) | | |
| | Investigate and, if considered appropriate, remove foraging habitat from the wind farm site | | Before removal of foraging habitat is undertaken, alternative mitigation measures should prove to be ineffective in reducing collision risk to acceptable levels. |
| Specific perching opportunity located on wind farm (man-made) that lead to impact | Remove perching opportunity | Low | Implement as soon as possible and no later than two days after recording the impact. |
| | Install perch guard | | |
| Farming practice attracts threatened species to risky areas (e.g. grain feeding of stock) | Halt farming practice and remove attraction | Low | Immediately |
| Wind/rain/fog causing low visibility | Temporary shutdown of turbines during periods of extreme low visibility – to be implemented only in the event that threatened species are experiencing high mortality rates. | Low | Immediately |

| Hypothetical cause of impact | Mitigation Measure | Likelihood of impact continuing following mitigation | Time to implementation |
|--|--|--|--|
| Attraction to lights on the wind farm site | Avoid high intensity lighting within the wind farm site (e.g. use of light hoods) or switch off lighting temporarily while species is on or near the wind farm site. Alternative measures include: <ul style="list-style-type: none"> • Synchronise any flashing lights, • Use red rather than white or yellow lights, or • Remove lights | Low | Implement as soon as possible and no later than two days after recording the impact trigger. |
| Attraction to small dams on site | Fill in dam | Low | Implement as soon as possible and no later than two days after recording the impact trigger. |

3.7. Management Activities, Timing and Performance Criteria

The following table outlines the proposed management activities to be implemented for this bird and bat adaptive management program, the timing of activities and performance criteria to measure the success of actions.

Table 6: Management Procedures for minimising and adaptively managing bird and bat collision risk at the Taralga Wind Farm

| Management objectives | Management activities and controls | Timing | Performance criteria for measuring success of methods | Completed (yes/no) |
|--|---|---|---|--|
| Procedure 6: Monitoring and Preparation of Annual Reports | | | | |
| Baseline surveys | Obtaining pre-construction baseline bird and bat utilisation data | Pre-construction | <ul style="list-style-type: none"> Baseline surveys undertaken and completed. | <ul style="list-style-type: none"> Yes. Pre-construction surveys completed in 2012 |
| | Obtaining pre-construction bird and bat mortality data | Pre-construction | <ul style="list-style-type: none"> Pre-construction bird and bat mortality surveys undertaken. | <ul style="list-style-type: none"> Yes. Pre-construction mortality surveys completed in 2012 |
| Estimate of mortality | Calculating annual mortality of birds and bats per turbine based on post-operational repetition of monitoring activities. Annual mortality estimates should include correction factors from scavenger and searcher trials | Up to five years post-construction (the frequency of monitoring following two years will be based on the monitoring results thus far. | <ul style="list-style-type: none"> Post-construction mortality surveys undertaken for at least two years and up to five years. Scavenger and searcher efficiency trials undertaken The number and distribution of carcass finds show that criteria for a significant impact trigger was not met. | <ul style="list-style-type: none"> Yes. Post-construction mortality surveys completed in 2015-2017. Mortality estimate generated; Impact trigger (Gang Gang Cockatoo) was investigated: <ul style="list-style-type: none"> Gang-gang Cockatoo 12-month targeted survey, October 2015 – September 2016 Additional Gang-gang Cockatoo Monitoring, September 2017 – February 2018; |
| Annual Reports | Preparation of Annual Reports | Prepared within three months of completion of yearly monitoring | <ul style="list-style-type: none"> Annual reports delivered within three months of completion of yearly monitoring. | <ul style="list-style-type: none"> First annual report submitted -2016; Second annual report submitted -2017 |
| Procedure 7: Prey Management | | | | |
| Carrion Removal | Inspections during routine maintenance of the wind farm site by service technicians will record any stock, introduced or native mammal and bird carcasses that may attract raptors (e.g. kangaroos, foxes, rabbits, dead stock) Any observations of carcasses made by any on-site staff in the vicinity of turbines will be reported to the Site Manager who will request that the landholder removes the carcass as soon as possible in line with recommended best practice ² ; | During operation | <ul style="list-style-type: none"> Carcasses removed Increase frequency of carcass removal and disposal if required | <ul style="list-style-type: none"> Implementation of activities; |
| | Request landholders to minimise lambing to paddocks at least 500m from turbines. | During operation | <ul style="list-style-type: none"> No increase in raptor mortality during lambing season | <ul style="list-style-type: none"> No increase in raptor mortality recorded during lambing season |
| Pest control program | Implement an integrated rabbit control program if the carrion removal program suggests rabbit carcasses are an issue | During operation | <ul style="list-style-type: none"> Monitor effectiveness of rabbit control and, where bird mortality is clearly related to rabbit numbers, increase the effectiveness of rabbit control | <ul style="list-style-type: none"> Ongoing monitoring process of the licenced area (e.g. – tracks and hardstands) and consultation with the landholder, if conditions require it. |

² NSW Department of Primary Industries Factsheet - Animal carcass disposal, December 2017, Primefact 1616, first edition, Animal Biosecurity, NSW DPI

| Procedure 8: Habitat management | | | | |
|--|--|---------------------|--|---|
| Minimise perching and roosting opportunities | Monitor use of perching and nesting sites within 100 metres of proposed turbines. Should these locations be used in a manner that elevates collision risk, turbines should be micro-sited to a greater distance from habitat trees, if feasible. | Pre-construction | <ul style="list-style-type: none"> • Turbine locations minimised within 100 metres of perching and nesting opportunities, if monitoring shows this is a potential risk. • If necessary, alternative perching, nesting and bat roosting sites will be provided at safe distances from collision risk zone (>500m). | <ul style="list-style-type: none"> • No further action unless required |
| Habitat compensation | Habitat compensation areas that are required for vegetation removal will be located in areas at least 100 metres away from wind turbines. | During construction | Any habitat compensation areas do not increase the risk of birds or bats colliding with turbines. | <ul style="list-style-type: none"> • No further action unless required |
| Procedure 9: Turbines and associated structures management | | | | |
| Minimising external lighting | If required, aviation safety lighting should use low intensity, LED, red flashing lights on nacelles. | During construction | Monitor bat and bird utilisation adjacent to lit and unlit turbines. If mortality at lit turbines significantly exceeds that of activity at unlit turbines, type and duration of lighting will need to be reviewed, subject to other limitations, such as any CASA requirement. | <ul style="list-style-type: none"> ▪ No aviation safety lighting is installed on site ▪ No further action unless required |
| | Baffle lights on buildings and substations to avoid light spillage and visibility from above. | | | |
| | Baffle security lighting to avoid light spillage and visibility from above. | | | |
| Use of deterrents | Overhead powerlines should have marker balls and/or flags where they cross waterways | During construction | No incidental records of bird mortality from power line collision around waterways. | <ul style="list-style-type: none"> ▪ Take action if required |

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Appendix 2: Symbolix (2013)

Appendix 3: Director General Approval of suitably qualified expert

Appendix 4: Director General Approval of suitably qualified expert