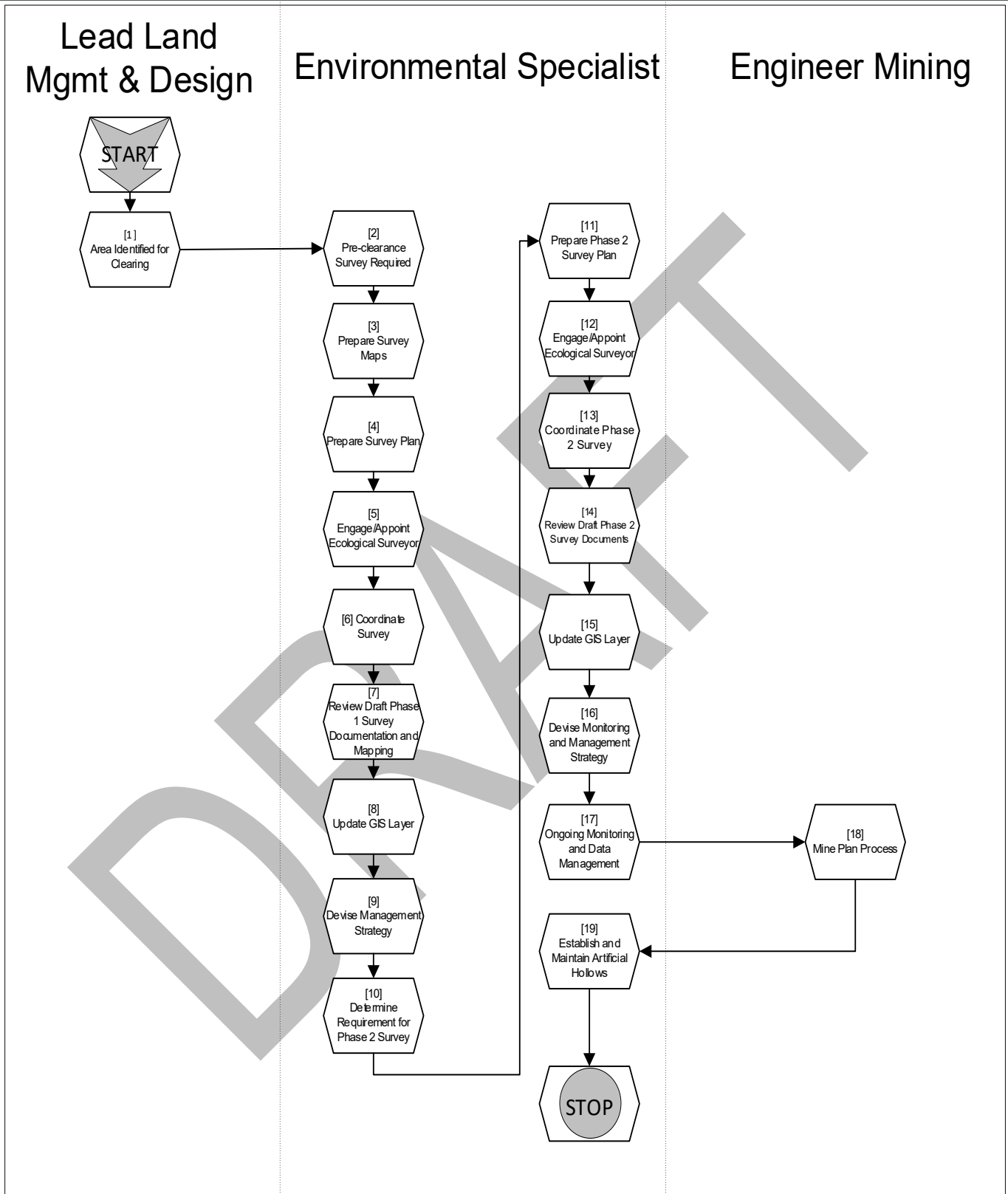


Threatened Fauna Pre-Clearance Survey and Management



Worsley Alumina



1 PURPOSE

Intent

The intent of this process is to ensure that mine pre-clearance Threatened species surveys are conducted in a consistent manner, with adequate survey effort and methods in line with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), *Biodiversity Conservation Act 2016 (WA)* (BC Act), *Environmental Protection Act 1986* (EP Act) and Department of Biodiversity, Conservation and Attractions (DBCA) recommendations.

Threatened fauna are considered umbrella species of biodiversity value indicative of a functioning ecosystem and fauna values within an area. Although some species are generalist in habitat requirement, the majority of the Threatened species have restricted, specific or critical habitat requirements.

This procedure identifies Threatened fauna species likely to occur within current and future operational areas and defines the pre-clearance survey methodology to be used to ensure the most effective opportunity of identifying significant habitat, habitat features or presence of individuals of Threatened species prior to habitat disturbance taking place. Pre-clearance surveys are required to identify, record and delineate areas of habitat considered to be essential in the lifecycle of the species and if not appropriately managed may present a risk of mortality or injury of individuals. The surveys are required to be integrated into planning processes to ensure consideration and appropriate management of identified areas occurs prior to and during harvesting, clearing and mining operations.

Results/Benefits

Process outcomes are:

- Threatened fauna surveys are conducted in a consistent manner across South32 Worsley Alumina Pty Ltd (Worsley) sites and in accordance with best practice, Environmental Protection Authority (EPA) guidance and DBCA recommendations.
- Areas of important habitat for Threatened species are recorded and mapped to ensure appropriate consideration during planning processes and development of appropriate management strategies.
- Investigation, review and management of breeding habitat (nesting, denning), roosting and refuge for Threatened fauna species prior to clearing and mining activity. In particular, those Threatened species that are unlikely to disperse in response to habitat modification (harvest, disturbance) and clearing activities.
- Survey methodology and data collection, are conducted in sufficient detail to provide supplementary information to inform impact assessment.
- Application of the mitigation hierarchy (avoid, minimise, rehabilitate, offset) to manage high value habitat (in particular breeding habitat and habitat features) and manage habitat for Threatened species prior to development activity.
- Minimise the likelihood of mortality or injury of fauna species including Threatened species, potentially impacted by clearing operations.
- Inform mine planning scheduling of harvesting and clearing activities.
- Records of Threatened fauna are retained for integration into existing spatial biodiversity database.
- Salvage of suitable habitat trees and forest residue as construction materials for rehabilitation constructed fauna habitats.

2 SCOPE

Scope Overview

The scope of this document includes:

- All Worsley clearing activities which occur within the WMDE, BTC and CBME.

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3 ACCOUNTABILITIES

Lead Land Management and Design

- Coordinate development and submission of the 10 Year Mine Plan, which includes mining areas planned for clearing within 3 years plus indicative clearing areas in the next 4 to 10 years.

Engineer Mining

- Include proposed 10 Year Mine Plan clearing layers in ArcGIS Library.
- Liaise with site Environmental Specialist regarding mine planning requirements; including areas planned to be cleared to support the mine plan in the next 3 years, and indicative areas expected to be cleared within ten years.
- Ensure identified confirmed or high potential Black Cockatoo trees and important breeding habitat features (nesting, denning), roosting and refuge habitat features suitable for Threatened species are displayed in pit disturbance plans.
- Maintain and update Vulcan protected layers with areas to be protected as required.

Environmental Specialist

- Determine requirement for and level of Threatened fauna pre-clearance surveys.
- Prepare Threatened fauna pre-clearance survey maps.
- Review Threatened fauna survey reports and analyse data.
- Conduct survey of proposed disturbance locations or engage and supervise ecological surveyor.
- Update GIS layers and mapping of high value habitat, **habitat features for Threatened fauna and identify suitable salvageable forest material for use in constructed fauna habitats in rehabilitation.**
- Apply hierarchy of control and define process for allocation of protection status.
- Recommend areas for protection following **the Biodiversity and Forest Management Plan (01012523) and Protected Areas Procedure (01013619) and Protected Areas Implementation and Management Procedure (200000484).**
- Ongoing liaison with Mine Planning.
- Consult with DBCA and other stakeholders as required.
- **Maintain records of habitat recorded via this procedure in Biodiversity spatial data base in accordance with the Protected Areas Implementation and Management Procedure (200000484).**

4 THREATENED FAUNA PRE-CLEARANCE SURVEY AND MANAGEMENT

4.1 LEGISLATION AND STATUTORY REQUIREMENTS

EPBC Act 1999 (Cth)

The EPBC Act (Commonwealth) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – recognised under the Act as Matters of National Environmental Significance (MNES). Under the EPBC Act, any actions that will have or are likely to have a significant impact on a listed Threatened species must be referred to the Federal Environment Minister for a decision on whether assessment and approval is required.

The Worsley Mine Expansion (WME) Revised Proposal (2019) was referred under the EPBC Act as it was identified that the proposal had the potential to significantly impact on several listed Threatened fauna species.

Biodiversity Conservation Act 2016 (WA)

The Biodiversity Conservation Act 2016 (WA) (BC Act) provides for the protection of wildlife and its habitat in Western Australia, specifically those species that are identified as under threat of extinction, rare and/or to be afforded special protection. Of the fauna recorded within the region that Worsley operates, the same species listed as Threatened under the EPBC Act are also listed as Threatened under the BC Act. The only exception is the Red-tailed Phascogale (*Phascogale calura*), which is listed as Conservation Dependent.

The BC Act also protects other species, such as those listed as conservation dependent or other specially protected species **e.g. Peregrine Falcon**. The BC Act comes into effect if there is direct disturbance impact to any of the listed species (i.e. disturbing an inhabited Black Cockatoo breeding hollow).

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EP Act 1986 (WA)

The EP Act provides for the prevention, control and abatement of pollution and environmental harm, for the conservation, preservation, protection, enhancement and management of the environment. The Act is managed and reviewed by the EPA who supplies notification for the appropriate level of government to grant approvals for disturbance activities of major works programs. Guidelines provided for EP Act approval are supplied typically through an Environmental Review Document (e.g. Environmental Review and Management Plan, Consultative Environmental Review, Public Environmental Review, ERD).

IUCN Red List

The International Union for the Conservation of Nature (IUCN) Red List of Threatened Species is widely recognised as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species. Each Threatened fauna species has an additional ranking under the World Conservation Union criteria.

4.2 REGULATORY AND CORPORATE REQUIREMENTS

Alumina Refinery (Worsley) Agreement Act 1973

Clause 5A(2) of the *Alumina Refinery (Worsley) Agreement Act 1973* (WA) requires that Worsley '...carry out continuous investigations and research (including monitoring and the study of sample areas) to ascertain the effectiveness of the measures they are taking pursuant to the approved environmental review and management programme for the protection and management of the environment'.

Ministerial Statement 719 (MS719)

Proponent Commitment 6 of MS719 requires that a Biodiversity and Forest Management Plan be in place for all activities inside the Primary Bauxite Area (PBA). The Biodiversity and Forest Management Plan (01005994) includes:

- A program of baseline flora and fauna surveys before mining to determine;
 - The occurrence and extent of vegetation communities;
 - The occurrence and extent of forest disease; and
 - Occurrence and abundance of vertebrate fauna, significant Short Range Endemic and other significant invertebrate taxa;
- Seasonal flora and fauna surveys in adjoining mining areas;
- Weed and feral animal control programs;
- Forest hygiene procedures;
- Identification of areas of potentially high conservation value;
- Control measures to ensure that the biodiversity and sustainability of these areas will not be substantially adversely affected by mining and bauxite conveyors; and
- Creation of wildlife corridors and establishment of fauna habitat zones in consultation with the State.

In addition to the above, a number of biodiversity related conditions exist under Part B of MS719. These must be complied with prior to undertaking any disturbance outside of the PBA.

4.3 THREATENED FAUNA

Threatened Fauna

The following list of Threatened fauna species (annotated with Federal and State conservation status accurate as at July 2021) are considered under this procedure:

- Carnaby's Black Cockatoo *Calyptorhynchus latirostris* (Endangered EPBC Act and BC Act)
- Baudin's Black Cockatoo *Calyptorhynchus baudinii* (Endangered EPBC Act and BC Act)
- Forest Red-tailed Black Cockatoo (FRBC) *Calyptorhynchus banksia naso* (Vulnerable EPBC Act and BC Act)
- Chuditch *Dasyurus geoffroii* (Vulnerable EPBC Act and BC Act)
- Woylie *Bettongia penicillata ogilbyi* (Endangered EPBC Act, Critically Endangered BC Act)
- Red Tailed Phascogale *calura* (Vulnerable EPBC Act, Conservation Dependent BC Act)
- Western Ringtail Possum *Pseudocheirus occidentalis* (Critically Endangered EPBC Act and BC Act)
- Quokka *Setonix brachyurus* (Vulnerable EPBC Act and BC Act)
- Peregrine Falcon *Falco peregrinus* (Specially Protected BC Act)

These Threatened species have been identified through the Worsley Mining Expansion (WME) Revised Proposal (State Assessment number 2216) Environmental Impact Assessment (EIA) process as species requiring special consideration under State and Federal requirements.

In addition other species will be considered as required. This may include:

- Numbat *Myrmecobius fasciatus* (Endangered EPBC Act and BC Act) - likelihood of occurrence low and population highly unlikely.

Ecological Requirements

Importantly the focus for pre-clearance is the consideration of habitat features that the species are reliant on for breeding, roosting, denning and refuge.

Species ecological requirement information is included within the Threatened Species Management Plan (200000338).

4.4 THREATENED FAUNA PRE-CLEARANCE HABITAT SURVEY METHODOLOGY

4.4.1 Phase 1 Habitat Assessment

Background Information

A review of Threatened fauna species (EPBC Act and BC Act listed) recommended survey methodology and advice, including EPBC SPRAT (Species Profiles and Threats) database profiles for federally listed Threatened species, EPA Technical guidance statements (2004, 2016, 2020), EPA Species Recovery Plans and consultation with fauna experts, have supported the development of species and habitat survey methodology. This review has also defined fauna habitat types within **Worsley operational areas**, species habitat suitability and likelihood of occurrence within the pre-clearance mining areas.

Guidelines and species profiles, for example, the EPBC SPRAT profiles for the three Black Cockatoo species (DoE, 2021 a, b, c) recommend habitat assessment as the primary technique that should be used to determine use of an area by Black Cockatoos. A similar process has been applied for potential occurrence of other Threatened species. Appendix 1: Survey Methodology Guidance summarises the aims, timing and standardised method for undertaking habitat assessment.

Habitat assessments have been completed for the Primary Application Area (PAA) as part of the WME (Revised Proposal) EIA process. Habitat assessments will still be required for any future mining areas and will include the following:

- Desktop assessment - historical data including vegetation complex mapping, basic (low-intensity survey, i.e. Level 1) fauna habitat mapping and analysis of DBCA/Landsat satellite imagery.
- **Baseline assessment of the extent, type and quality of the vegetation present.**
- **Baseline broadscale fauna habitat mapping for Threatened species.**
- Detailed habitat mapping for Black Cockatoos - i.e. designating habitat as potential breeding, roosting or foraging habitat (refer to **DSEWPaC (2012)** for habitat assessment methodology).
- Reconnaissance.
- Identifying and recording Potential Habitat Trees (PHTs) **including**: location, tree diameter at breast height (DBH), tree height, tree condition, presence of hollows (including orientation and **approx.** diameter), evidence of use.
- Record other habitat features of potential high value (breeding habitat (nesting, denning), roosting and refuge) for other Threatened species including Chuditch, Western Ring-tail Possum and Peregrine Falcon, for example, rocky outcrops, breakaways **and overhangs**, hollows and dreys.



Note

In addition to searching for suitable breeding hollows, in potential Black Cockatoo breeding habitat, measurements of the DBH of trees in a patch of woodland via transect monitoring supports tree and habitat demographics assessment, determining if the habitat could be considered breeding habitat.

Habitat Trees

'Potential Habitat Trees' (PHTs) refer to:

- Large hollow-bearing trees, generally within woodlands or forests that are suitable for Black Cockatoo breeding (Figure 1), or
- Significant trees utilised by Black Cockatoos as night roosting sites.

The DSEWPaC (2012) provides the following DBH guide for likely habitat trees for Black Cockatoos:

- General guide > 500mm.
- Exception of Salmon Gum and Wandoo, > 300mm.

Whilst Black Cockatoo species are the primary users of PHTs other Threatened species such as Chuditch may also make use of these habitat features.

Any PHT that is identified to be in use or recently used by Black Cockatoos or other Threatened species is then labelled as a 'Confirmed Habitat Tree'.

Trees of suitable DBH (as outlined above) are considered to be of sufficient age to begin to form hollows and hollow entrances with a diameter greater than 100mm as required for Black Cockatoos. In the Northern Jarrah Forest, Marri and Wandoo are the dominant tree species with hollow bearing potential, accounting for >90% of trees with confirmed breeding hollows (pers. comms. Tony Kirkby).

Fauna and specifically nesting Black Cockatoos respond to disturbance around the tree that they occupy. DSEWPaC (2012) recommend rubbing (hitting) a stick against a PHT to identify the presence of nesting Black Cockatoos. This is a simple method that can be used to verify habitat tree status, however, should not be relied upon as the only method of designating status. Other Threatened species may also respond to this technique, however visual inspection is recommended.



Note



Figure 1: Examples of 'Potential Habitat Trees'.

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Habitat Features

'Habitat Features' refer to specific features that offer potentially suitable breeding habitat (nesting, denning), roosting and refuge habitat for Threatened fauna species. 'Habitat features' include:

- high quality hollows or modified hollow 'ledge' used by Peregrine Falcon;
- bird nests
- ground logs with suitable hollows;
- dreys;
- burrows;
- significant rocky outcrops;
- breakaways; and
- Overhangs and caves

Any 'habitat features' identified to be in use or recently used by Threatened fauna is then labelled as a 'Confirmed Habitat Feature'.

Field Identification Protocol

Standard protocols must be used for identification and monitoring of identified PHTs and 'Confirmed Habitat Trees' as follows:

- Record GPS coordinates (GDA 1994).
- Trees must be marked as follows:
 - PHT: use double band of flagging tape (green and blue).
 - Confirmed Habitat Tree: use triple band of flagging tape (green, blue and orange). In addition to flagging, white spray paint is used to mark a 'H' on the tree trunk with an arrow pointing to the hollow entrance, this allows for longevity of field markings.
- Record required information on GIS data collection application including location of the tree, approximate height, maturity, tree condition, DBH, photos, orientation and height of any hollows.
- Trees flagged as PHT should be retained for fauna habitat construction requirements in rehabilitation where values are maintained after controlled felling.

Other 'Habitat Features' or 'Confirmed Habitat Features' should have the following information recorded for future use:

- GPS coordinates of feature (GDA 1994);
- Description of feature, location and any signs of current or historic use;
- Photos of habitat feature;
- Orientation (where applicable); and
- Any other information considered important in understanding the value of the habitat feature.

Confirmed Habitat Trees and Confirmed Habitat Features must be included on Clearing Plans to ensure proper consideration in Mine Planning processes.

Broad Habitat Assessment

The following information is required if a broad habitat assessment is necessary prior to significant alteration to **future mining areas**:

- Review of fauna technical reports, studies and database searches.
- 'Habitat Trees' appropriately demarcated in the field using standardised protocols for future identification and reference.
- Inclusion of assessed information into broad-scale habitat mapping to quantify the amount of habitat suitable for Threatened species within the development area and its significance within the local and regional area. This should compare vegetation types and condition and note the distance, size and connectivity of remnant habitat patches in breeding areas.
- Specific areas of habitat considered of high conservation value for Black Cockatoos or other Threatened fauna species (may warrant further detailed survey/assessment).
- GIS habitat mapping information defining:
 - Threatened species likelihood of occurrence assessment.
 - Habitat suitable for Black Cockatoo - breeding, roosting and/or foraging.
 - Transects in differing habitat types mapping PHTs, 'Confirmed Habitat Trees', potential 'Habitat Features' and 'Confirmed Habitat Features'.

4.4.2 Phase 2: Targeted Surveys

Phase 2 targeted surveys refer to surveys for:

- Breeding Black Cockatoos and 'habitat trees';
- Black Cockatoo night roosting habitat and 'habitat trees'; and
- Breeding (denning and nesting), roosting and refuge habitat for Threatened **fauna** species.

4.4.3 Breeding Black Cockatoos

Habitat Tree Status

PHTs and potentially significant breeding habitat identified, demarcated and mapped during the Phase 1 Habitat Assessment requires further assessment for potential to support breeding birds.

Phase 2 assessment requires visual investigation of any potential hollows. Investigation is undertaken from the ground using binoculars by an experienced Black Cockatoo and ecological surveyor. Experience for identification of potential hollows is gained by field time with dedicated fauna consultants and / or personnel who have previously conducted surveys of this type, and visual inspections of confirmed Black Cockatoo hollows.

Additionally, the use of a pole-mounted camera allows internal and external investigation of the hollow with live-feed recordable imagery. This method permits an assessment of the suitability of a hollow to be used by Black Cockatoos for breeding. This method may identify eggs or nestlings inside the hollow thereby confirming the breeding habitat status of the tree. Additionally, this may identify evidence of historical use and assess the potential for a hollow to be used in the future.



Note

The use of unmanned aerial vehicles (or drone) may be used to conduct an exterior assessment if the pole camera is not of a sufficient length to reach the hollow.

Appendix 1 summarises the aims, timing and survey effort required to undertake breeding bird surveys in line with recommended EPBC guidelines.

Active nests are located most easily at dusk, when the male returns to the nest with food for the incubating or brooding female (DEHWA, 2012). Breeding birds tend to forage near the nest during the breeding season and foraging birds during the breeding season may indicate nearby breeding habitat.

Surveys should note the distance, size and connectivity of remnant habitat patches in breeding areas (e.g. from satellite images).

Outputs from Survey

The Phase 2 Targeted Survey for 'habitat trees' should provide the following information:

- Refined area of breeding bird habitat.
- Number of birds and species identified during the survey.
- Photos/video evidence of hollow investigations.
- Identification of all of the trees surveyed including:
 - GPS coordinates (GDA 1994);
 - tree species with photographic log;
 - designated 'habitat tree' status (i.e. Confirmed or Potential Habitat Tree);
 - tree quality;
 - approximate DBH;
 - hollow height and orientation;
 - Recommendations of designated protective status (refer to Section 4.5); and
 - Any further action i.e. requirement (if any) for further mitigation or monitoring.

Following the completion of each annual breeding survey, the Black Cockatoo habitat and 'Habitat Tree' GIS layers must be updated by the Environmental Specialist and must reflect 'confirmed' and 'potential' habitat trees and recommended protective status. GIS layers and tree labels are captured via ArcGIS collector and associated ArcGIS online systems, with outputs provided to Mine Planning for allocation of scheduling and where appropriate deferment of mining operations.

The identification of multiple 'Confirmed Habitat Trees' within a localised area will be reviewed as a potential area that requires exclusion from disturbance activities (Section 4.5). Where possible, each identified location will be monitored over multiple seasons to determine level of use.

All Confirmed and High Potential Habitat Trees must be added to the Worsley mapping systems in accordance with the Protected Areas Implementation and Management Procedure (200000484) through completion of a Recommendation for Area Protection Form (00112994).

4.4.4 Black Cockatoo Night Roosting Habitat

Habitat Trees

Potential Black Cockatoo night roosting 'habitat trees' identified during the Phase 1 Habitat Assessment require further survey to investigate their use by Black Cockatoos.

Survey methods described in Appendix 1: Survey Methodology Guidance are to be performed during the breeding and non-breeding seasons to provide a snap-shot of indicative population estimates of Black Cockatoos utilising the site, how the site is used throughout the year, proximity to foraging and breeding habitat and an indication of the significance of the night roost site for Black Cockatoos locally and regionally.

Appendix 1: Survey Methodology Guidance summarises the aims, timing and survey effort required to undertake roosting bird surveys in line with recommended EPBC guidelines.

Outputs from Survey

The Phase 2 Targeted Survey for night roosting habitat should provide the following information:

- Presence/absence of roost site 'habitat trees';
- Refined area of night roost habitat;
- Numbers of birds or species identified during the breeding and non-breeding seasons, species dependent - providing an indication of local population estimates;
- Identification of all confirmed night roost 'habitat trees' surveyed (Refer section 4.4.1) including recommendation of designated protected status (refer to Section 4.5);
- Local and regional significance of night roosting 'habitat trees'; and
- Any further action i.e. requirement (if any) for further monitoring.

Following the completion of the survey, GIS layers must be updated to reflect identified night roosting habitat and 'habitat trees' and recommended protective status.

4.4.5 Black Cockatoo Foraging Habitat

Background

Surveys for Black Cockatoo foraging habitat should be undertaken in any remnant vegetation containing proteaceous heath/woodland, eucalypt woodlands or forest (particularly Marri and Jarrah forest) and in areas that may be dominated by Pine trees (*Pinus* spp).

Phase 2 targeted survey and refinement of Black Cockatoo foraging habitat (refer to **DSEWPaC (2012)**) is required to identify the significance of foraging habitat, with particular focus given to high quality habitat that may be of high importance to Black Cockatoos locally and regionally. This will inform the designated protected status that should be applied to that habitat.

Appendix 1: Survey Methodology Guidance summarises the aims, timing and survey effort required to undertake foraging Black Cockatoo surveys in line with recommended EPBC guidelines. **Given the completion of surveys as part of the Worsley Mining Expansion (Revised Proposal), this has been completed for the WMDE but will be required for any future mining areas.**

Outputs from Survey

The Phase 2 Targeted Survey for foraging Black Cockatoo and foraging Black Cockatoo habitat should provide the following information:

- Confirmed presence/absence of foraging Black Cockatoo and foraging habitat.
- Refined foraging habitat mapping and identification of foraging habitat considered of high importance to the species locally and regionally.
- Numbers of Black Cockatoo and species identified during the breeding and non-breeding seasons - indication of population estimates.
- Any further action i.e. requirement (if any) for further monitoring.

Following the completion of the foraging survey the Black Cockatoo habitat GIS layer must be updated to reflect identified confirmed and potential habitat and its recommended protective status (refer to 4.2).

4.4.6 Other Threatened Species

Background

Surveys for other Threatened fauna species should be conducted in proposed clearing areas within the 'species likelihood of occurrence' boundaries where suitable habitat for the specific Threatened species is identified. 'Likelihood of occurrence' has been determined by fauna specialists familiar with the area, the particular species and with local, regional and historical context. Surveys primarily target 'habitat features' potentially used for breeding (denning, nesting), roosting and refuge habitat, which for many of the arboreal or **predominantly** arboreal species may include 'habitat trees' with **hollow requirement** characteristics similar to those for Black Cockatoo or modified hollow 'ledge' used by Peregrine Falcon. Typically, these surveys can be undertaken in parallel with the Black Cockatoo habitat assessments.

Phase 2 targeted surveys delineate 'habitat features' and where identified, field signs of the species.

Further targeted monitoring assessments (i.e. multi-seasonal trapping) may be initiated to confirm use as some of the Threatened species are cryptic, highly mobile and territorial. These surveys should be designed to maximise the potential of detection and capture.

A summary of the pre-clearance survey methodology required for each Threatened fauna species currently identified as potentially occurring with Worsley operational areas is provided in Table 1.

Pre-clearance survey methods and activities will be reviewed under an adaptive management process considering improvements in methods, techniques and best practice.



Note

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Outputs from Survey

The Phase 2 Targeted Survey for other Threatened species should provide the following information:

- Threatened species confirmed presence/likely absence.
- Refined 'likelihood of occurrence' and suitable habitat mapping for the species.
- Updated habitat mapping and identification of 'habitat features' considered significant and of value to the species.
- Where possible, species and numbers of individuals identified during the breeding and non-breeding seasons, supporting population estimates.
- Any further action i.e. requirement (if any) for further monitoring or alternative mitigation (i.e. staged harvest and clearing, trap and release requirements).

Following the completion of the survey, a GIS layer is to be generated and updated to reflect:

- Refined species 'likelihood of occurrence' and habitat suitability mapping; and
- Identification of potential 'habitat features' and 'confirmed habitat features' and recommended protective status (following current practices for protection processes as described in Section 4.5).

Table 1: Phase 2 Threatened Species Pre-Clearance Survey and Management Summary

Species	Critical Habitat Features	Survey Timing	Pre-Clearance Monitoring and Management
<i>Calyptorhynchus banksii</i> <i>naso</i> , <i>C. latirostris</i> and <i>C. baudinii</i> FRTBC Carnaby's Cockatoo Baudin's Cockatoo	PHTs	Targeted searches for PHTs – unrestricted Confirmed Habitat Trees should be monitored during the peak breeding season: <ul style="list-style-type: none"> • Carnaby's - Sept-Nov • FRTBC - April-June and Aug-Nov • Baudin's - Oct-Jan (RLA) 	<ul style="list-style-type: none"> • Targeted searches for PHTs. • Where PHTs are 'extremely high potential with evidence of historical use' or 'confirmed' then monitoring to continue for multiple seasons (2 days of monitoring at monthly intervals during breeding season). • Signs of activity should also be recorded including foraging debris (noting in particular the markings on marri nuts to support species identification) and pruning debris. • Devise management strategy (Section 4.5.1 and Section 4.7.1 [9 – 16]) with a focus on avoidance and minimisation where possible. • Feature is flagged (with buffer nominal 30m) and recorded on clearing plans • Defer harvesting and habitat disturbance within 250m until confirmed breeding site is not-occupied. • 'Confirmed Habitat Trees' must be verified as not-occupied prior to controlled felling.

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Table 1: Phase 2 Threatened Species Pre-Clearance Survey and Management Summary

Species	Critical Habitat Features	Survey Timing	Pre-Clearance Monitoring and Management
<i>Falco peregrinus</i> Peregrine Falcon	PHT, Modified hollow 'ledge', large abandoned birds nest	Aligned with targeted search for PHT. Peak breeding period: August to December	<ul style="list-style-type: none"> Targeted search effort at the same time as conducting Black Cockatoo PHT targeted searches Confirmed breeding sites to be monitored during the peak breeding period Devise management strategy (Section 4.5.1 and Section 4.7.1 [9 – 16]) with a focus on avoidance and minimisation where possible. Feature is flagged (with buffer nominal 30m) and recorded on clearing plans Defer harvesting and habitat disturbance within 250m until confirmed breeding site is not-occupied. Confirmed breeding sites must be verified as not-occupied prior to controlled felling.
<i>Dasyurus geoffroii</i> Chuditch	PHTs, hollows, denning features (hollow logs, rocks, overhangs, caves, breakaways etc)	March – August Note: Breeding occurs April-July	<ul style="list-style-type: none"> Targeted searches for PHTs and critical habitat features Assume presence of species for 'Confirmed Habitat Trees' and / or "Confirmed Habitat Features". Feature is flagged (with buffer nominal 30m) and recorded on clearing plans Undertake the harvesting and habitat disturbance while avoiding the feature and buffer (encourage dispersal) Complete a destructive search of any habitat features present with a fauna spotter/specialist to encourage dispersal and/or capture/release and ensure no individuals are present. Complete standard clearing for the remainder of the pit on a clearing front towards remnant habitat.

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Table 1: Phase 2 Threatened Species Pre-Clearance Survey and Management Summary

Species	Critical Habitat Features	Survey Timing	Pre-Clearance Monitoring and Management
<i>Bettongia penicillata ogilbyi</i> Woylie	Large intact areas of variable vegetation	March – August Note: No specific breeding period, breed every 3-4 months	<ul style="list-style-type: none"> No specific habitat features are defined for this species; however, signs of activity can be identified in the field for example nest building, recent foraging activity. Undertake the harvesting and habitat disturbance while avoiding any areas supporting evidence of nest building and recent foraging activity (encouraging dispersal) Where presence is confirmed, complete a destructive search of verified habitat with a fauna spotter/specialist to encourage dispersal and/or capture/release and ensure no individuals are present. Complete clearing of the remainder of the pit on a clearing front towards remnant habitat.
<i>Phascogale calura</i> Red Tailed Phascogale	Allocasuarina stands Tree hollows Grass tree skirts	June – August Note: breeding known to occur in July	<ul style="list-style-type: none"> Where Wandoo, Allocasuarina and grasstree dominated habitat are being cleared, undertake the harvesting and habitat modification to discourage the species from utilising these habitat types. Complete clearing of the remainder of the pit on a clearing front towards Protected Areas, ecological linkages and remnant habitat. Adaptive management for pre-clearance for the species upon review of initial clearance activities.
<i>Pseudocheirus occidentalis</i> Western Ringtail Possum	PHTs Dreys	March – August Note: breeding occurs in April-May and September-October	<ul style="list-style-type: none"> Targeted searches for PHTs (as per Black Cockatoos) and dreys/breeding habitat features. Monitor 'Confirmed Habitat Features' for 2 weeks prior to harvesting (Refinery Lease Area (RLA) only). Ensure a fauna spotter is present during clearing activities.
<i>Setonix brachyurus</i> Quokka	Often associated with riparian vegetation, dense vegetation and mid slopes.	March – August Note: Breeding occurs throughout the year on the mainland	<ul style="list-style-type: none"> No specific habitat features are defined for this species. Fauna spotter to be present during clearing activities for areas of preferred habitat types within the RLA.

4.5 PROTECTION OF THREATENED FAUNA HABITAT

4.5.1 Designated Protected Status

Mitigation Hierarchy and Assessment of Protection Status

Allocation of priority status for the protection of habitat, 'habitat features' and 'habitat trees' is to follow the South32 Environment Standard hierarchy of control as follows:

- Protect – Tree/s or habitat not to be removed. Examples may include; confirmed Black Cockatoo breeding 'habitat tree', confirmed breeding 'habitat features' for Chuditch, Western Ring-tailed Possum, Peregrine Falcon etc., specific areas of habitat supporting multiple confirmed Black Cockatoo breeding 'habitat trees', areas identified providing multiple confirmed 'habitat trees' and/or confirmed 'habitat features' for multiple Threatened species, local and regionally significant night roost.
- Avoid – Mitigation and management actions should prioritise impact avoidance over impact reduction measures. Where possible, avoid breeding sites, potential and confirmed 'habitat features' or PHTs (avoid development of the area or develop in the area while protecting the habitat or 'habitat tree' with an appropriate development buffer and consider timing to avoid peak Black Cockatoo and other Threatened species breeding/activity periods).
- Minimise – Minimise the removal of Threatened species breeding (nesting and denning), roosting and/or refuge habitat.
- Compensatory action – Compensatory actions are as agreed under Worsley regulatory environmental approvals. Where the removal of a confirmed 'habitat tree' or habitat considered of significance to Threatened species is unavoidable, appropriate compensatory actions will be required.

In order to make an informed decision with input from Mine Planning and Environmental Specialists with regard to the significance and/or protected status of 'habitat features' and 'habitat trees', assessment must apply consideration for each individual feature on a 'case by case' basis. Consideration must include:

- Where in the landscape the feature is, compared to that of other confirmed breeding (nesting and denning), roosting, refuge habitat **and remnant habitat**;
- The significance of the habitat, 'habitat feature' or 'habitat tree' at a local and regional level;
- **Recommendations from fauna experts/specialists**;
- Breeding/roosting status of the 'habitat feature' or 'habitat tree' i.e. confirmed, high potential, actively used;
- Condition of the feature or tree;
- Location in the pit i.e. edge vs central; and
- Mineral value – grade of ore to be lost, depth, quantity (tonnage).

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Habitat Feature and Habitat Tree Status Allocation

Potential and confirmed 'habitat features' or potential 'habitat trees' are assigned 'Monitor' status where decision on development is pending or where status is unconfirmed.

The WME (Revised Proposal) ERD includes a Protection Commitment that >90% of all Confirmed Habitat Trees or High Potential Habitat Trees supporting Black Cockatoo Hollows will be protected from disturbance with a 30m buffer applied from the base of the tree. This Protection Commitment is managed in accordance with the Protected Areas Plan (01013619).

Where no alternative to removal of a potential or confirmed 'habitat feature' or potential 'habitat tree' can be identified, the feature or tree should be assigned 'Controlled-Fell' status. This implies that the feature or tree will require monitoring again prior to disturbance (at 2-6 months, preferably during breeding or nesting periods) and again immediately before disturbance to determine whether the tree or feature is actively in use. Removal should be undertaken outside of the specific Threatened species or Black Cockatoo peak breeding and nesting periods.

Where a feature or tree is identified to be in use, the tree must be assigned 'Keep' status and monitored until use ceases, as required by the BC Act for Disturbance of Fauna. Once the feature or tree has been vacated, it triggers the mitigation hierarchy and assessment process again.

Once a feature or tree has been removed for mining requirements, the feature or tree is then assigned a 'Removed' status. GIS information is retained for understanding of total disturbance of 'habitat features' and potential/confirmed 'habitat trees'.

Compensatory Actions – Black Cockatoos

Where 'Confirmed Habitat Trees' for Black Cockatoos cannot be protected, Black Cockatoo artificial hollows will be installed. The installation of artificial Black Cockatoo hollows will require the location, number, positioning and monitoring to be aligned with the proposed Worsley Black Cockatoo Artificial Hollow Plan.

Removal of a single 'Confirmed Habitat Tree' (once the tree has been vacated), requires the compensation action of installing 3 artificial hollows in locations aligned with the Worsley Black Cockatoo Artificial Hollow Plan described within the proposed Worsley Offset Implementation Plan.

Establishment of artificial hollows must be aligned with the proposed Worsley Black Cockatoo Artificial Hollow Plan described within the proposed Worsley Offset Implementation Plan. Establishment locations are selected which may best replace or improve areas identified as breeding habitat or close to other confirmed breeding hollows, developed under consultation with DBCA, WA Museum and fauna experts. Locations must consider:

- Avoidance of areas that may be disturbed for future mining (requires consultation with Mine Planning);
- The location of other confirmed hollows;
- Commitments made under the Biodiversity Offset Plan and Worsley Black Cockatoo Artificial Hollow Plan described within the proposed Worsley Offset Implementation Plan;
- Habitat considered of high value to Black Cockatoos for breeding (i.e. Wandoo);
- Availability of water sources (drinking resource) within a 1km radius;
- Any known roosting sites; and
- Access for maintenance.

Locations of all artificial hollows must be captured via GIS once established and monitoring for use must be completed annually during the peak Black Cockatoo breeding period. Artificial hollows will also require inspections and maintenance to provide the best available conditions for use (in accordance with the Worsley Black Cockatoo Artificial Hollow Plan described within the proposed Worsley Offset Implementation Plan). Inspection notes are collected via GIS.

The number and location of Black Cockatoo artificial hollows installed each financial year will be reported in the Worsley Annual Environmental Report.

4.6 GIS DATA MANAGEMENT

The results of the Phase 1 Habitat Assessment mapping and Phase 2 Targeted Surveys are to be documented in GIS format using standardised naming and symbology conventions. This will capture baseline Black Cockatoo and Threatened species habitat data and allow tracking of the designated protected status of Black Cockatoo and Threatened species 'habitat trees' and 'habitat features'.

To ensure appropriate management of Black Cockatoo and Threatened species habitat, tracking of the priority status of 'habitat features' and 'habitat trees' is to be regularly updated within dedicated GIS Layers available for use by Mine Planning. Regular consultation between Environmental personnel and Mine Planning is essential to ensure GIS layers are accurately maintained.

4.7 THREATENED FAUNA PRE-CLEARANCE SURVEY

4.7.1 Process Steps

[1] Area Identified for Clearing	The Lead Design and Land Management coordinates the development and submission of the Annual Bauxite Operations Plan (10 Year Plan), which is submitted annually to the Worsley Environmental Management Liaison Group for review. The Plan includes clearing identified in the 2 year forecast and the Life of Operations Plan clearing.
[2] Pre-clearance Survey Required	Pre-clearance survey requirement is identified by the BBM Environment team in accordance with Section 4.4 of this procedure.
[3] Prepare Survey Maps	The Environment Specialist creates maps using relevant shapefiles in ArcGIS provided by Mine Planning and from historical biodiversity data (vegetation complex mapping, Level 1 and Level 2 fauna habitat mapping).
[4] Prepare Survey Plan	The Environmental Specialist will determine: <ul style="list-style-type: none"> • The location of surveys required for Phase 1 habitat assessment; • Access to study areas; and • A suitable provision for buffers to study areas, if required.
[5] Engage/Appoint Ecological Surveyor	The Environment Specialist will engage an ecological surveyor or appropriately qualified and experienced environmental employee for the relevant work. Site based members of the Environmental Team may conduct this survey if experienced.
[6] Coordinate Survey	The Environment Specialist will coordinate the required survey. This includes: <ul style="list-style-type: none"> • Ensuring all work is conducted in accordance with site requirements; • Providing maps and other material support onsite; • Ensuring access to mining areas in collaboration with Mining Execution and Mine Services Supervisors; and • Ensuring GIS applications are field ready and accessible.

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[7] Review Draft Phase 1 Survey Documentation and Mapping

Draft documentation and mapping are submitted to the Environment Specialist by the ecological surveyor.

The Environment Specialist, and the Environmental Supervisor will review draft documents and provide comments to the ecological surveyor prior to the issue of final documentation.

The final drafts must be provided as two electronic versions (Adobe and Microsoft Word) with all raw data, maps and appendices included. GIS shape files in GDA 1994 MGA z50 must also be provided.

[8] Update GIS Layer

The Environment Specialist will update the GIS layers with updated locations of pre-clearance surveys undertaken, designated 'habitat feature' and 'habitat tree' status and the location of any new (or altered) confirmed and potential 'habitat features' or 'habitat trees'.

The Environment Specialist will advise Mine Planning when the GIS layers has been updated to ensure that layers in Vulcan are also updated for use by Mine Planning.

[9] Devise Management Strategy

The Environment Specialist, with the support of Mine Planning, follows the Mitigation Hierarchy and Assessment of Protection Status process and develops a strategy for the management of each identified potential or confirmed 'habitat feature' or 'habitat tree'. Those that require deferment from mining will require management under the **Protected Areas Implementation and Management Procedure (200000484)** and associated GIS layers will require update. All changes must be communicated to applicable internal stakeholders.

[10] Determine Requirement for Phase 2 Survey

Environmental Specialist to determine requirement and scope of the Phase 2 targeted survey and monitoring.

[11] Prepare Phase 2 Survey Plan

Environment Specialist will determine:

- The location of surveys required for the Phase 2 targeted survey;
- Access to study areas; and
- A suitable provision for additional unplanned work to be undertaken if required.

[12] Engage/Appoint Ecological Surveyor

The Environment Specialist may engage an ecological surveyor or appropriately qualified and experienced Environment Specialist for the relevant work. **Site based members of the Environmental Team may conduct this survey if experienced.**

[13] Coordinate Phase 2 Survey

The Environment Specialist will coordinate the required pre-clearance survey.

Refer to Step 6 for details on the requirements of this step.

[14] Review Draft Phase 2 Survey Documents

Draft documents are submitted to the Environment Specialist by the ecological surveyor. **This may be developed into internal forms, if future surveys are conducted by appropriately experience Worsley employees**

The Environment Specialist and the Environmental Supervisor may review draft reports and provide comments to the ecological surveyor prior to the issue of final documents.

The final documents must be provided as two electronic versions (Adobe and Microsoft Word) with all raw data, maps and appendices included. GIS shape files in GDA 1994 MGA z50 must also be provided. **For internally conducted surveys this information must be captured formally and recorded as with externally provided surveys.**

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[15] Update GIS Layer

The Environment Specialist will update the pre-clearance GIS layers, with updated locations of pre-clearance surveys undertaken, designated habitat status, the location of any new or altered confirmed and potential 'habitat features' or 'habitat trees', and any areas that may require protection via the Protected Areas Management & Implementation Procedure (200000484).
The Environment Specialist will advise Mine Planning when the pre-clearance GIS layers have been updated to ensure that layers in Vulcan are also updated for use by Mine Planning.

[16] Devise Monitoring and Management Strategy

Environment Specialist to determine requirement of any further high value habitat, 'habitat feature' and 'habitat tree' monitoring. Management strategy to be devised considering:

- Threatened species habitat identified in the Phase 1 assessment;
- The location of potential and confirmed 'habitat features', 'habitat trees' and habitat considered of high conservation value for Threatened fauna species; and
- Mine development requirements.

Environment Specialist, with support of Mine Planning, must develop a strategy for the management of each confirmed Threatened species habitat.

[17] Ongoing Monitoring and Data Management

Ongoing monitoring and update of the status of priority Threatened fauna habitat, potential and confirmed 'habitat features' and 'habitat trees' by the Environment Specialist.
Habitat that requires deferment from mining will be implemented in accordance with the Biodiversity and Forest Management Plan (01012523) and follow the requirements of the Protected Areas Implementation and Management Procedure (200000484) and will be updated in GIS layers with any changes communicated to internal stakeholders.
Any confirmed habitat features identified must undergo a destructive search process during any disturbance processes. The Environmental Specialist or other qualified fauna specialist as appointed by the Environmental Specialist must act as the fauna spotter and document any outcomes.

[18] Mine Plan Process

Clearing must take into consideration Protected Areas. All potential and confirmed habitat identified during this process that is considered protectable is to be managed in accordance with the Protected Areas Implementation and Management Procedure (200000484) communicated to internal stakeholders. This will ensure clearing is planned with due consideration. Flagging and signage in the field, where appropriate, will assist to protect the areas during operations.

[19] Establish and Maintain Artificial Hollows

The Environmental Specialist must utilise the Worsley Black Cockatoo Artificial Hollow Plan described within the proposed Worsley Offset Implementation Plan and available mine planning (10 Year Plan) data to establish artificial hollows for any removed confirmed Black Cockatoo 'habitat trees'.
Artificial hollows will require annual inspections and maintenance to provide the best available conditions for use as instructed under the Worsley Black Cockatoo Artificial Hollow Plan.

5 DEFINITIONS, TERMS AND ABBREVIATIONS

Term	Description
ArcGIS	Geographic information system used by the Environmental and Mine Planning departments.
BBM	Boddington Bauxite Mine
BC Act	Biodiversity Conservation Act 2016
DAWE	Department of Agriculture, Water and the Environment (formerly Department of the Environment and Energy (DoEE)), Commonwealth Government.

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DBCA	Department of Biodiversity, Conservation and Attractions
DBH	Diameter at breast height
Destructive Search	To search through a specific habitat immediately prior to the habitat being removed.
DoEE	Department of the Environment and Energy
EA	Environmental Impact Assessment
EP Act	Environmental Protection Act 1986
EPBC Act	Environmental Protection and Biodiversity Conservation Act 1999
FRTBC	Forest Red-Tailed Black Cockatoo
Habitat feature	<p>Specific features that offer potentially suitable breeding habitat (nesting, denning), roosting and refuge for Threatened fauna species. 'Habitat features' include:</p> <ul style="list-style-type: none"> • high quality hollows; • bird nests; • ground logs with suitable hollows; • dreys; • burrows; • significant rocky outcrops; • breakaway; and • caves and overhangs. <p>Any 'habitat features' identified to be in use or recently used by Threatened fauna is then labelled as a 'Confirmed Habitat Feature'.</p>
Habitat tree	<ul style="list-style-type: none"> • Large hollow-bearing trees, generally within woodlands or forests that are suitable for Black Cockatoo breeding, • Significant trees utilised by Black Cockatoos as night roosting sites, or • Confirmed significant trees that has been utilised by other threatened or priority species
IUCN	International Union for the Conservation of Nature
MS719	Ministerial Statement 719
PBA	Primary Bauxite Area
PHT	Potential Habitat Trees
RLA	Refinery Lease Area
SPRAT Profile	Species Profile and Threats Database Profile
WME	Worsley Mine Expansion
Worsley	Worsley Alumina Pty Ltd

6 REFERENCES

	Alumina Refinery (Worsley) Agreement Act 1973 (WA)
	Biodiversity Conservation Act 2016 (WA)
	Environment Protection and Biodiversity Conservation Act 1999 (Cth)
	Ministerial Statement 719
	DBCA (2017) [online] Western Ringtail Possum <i>Pseudocheirus occidentalis</i> , Fauna Profile.

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	DSEWPaC (2012) [online] Revised draft referral guideline for three threatened Black Cockatoo species: Carnaby's Cockatoo (Endangered) <i>Calyptorhynchus latirostris</i> , Baudin's Cockatoo (Vulnerable) <i>Calyptorhynchus baudinii</i> , Forest Red-tailed Black Cockatoo (Vulnerable) <i>Calyptorhynchus banksii naso</i> .
	DSEWPaC (2011) [online] Survey guidelines for Australia's Threatened mammals. Accessed 5 January 2020.
	DoE (2021a) [online] <i>Calyptorhynchus banksii naso</i> in Species Profile and Threats Database. Department of the Environment, Canberra Available from: https://www.environment.gov.au/sprat Accessed January 2021.
	DoE (2021b) [online] <i>Calyptorhynchus baudinii</i> in Species Profile and Threats Database. Department of the Environment, Canberra Available from: https://www.environment.gov.au/sprat Accessed January 2021.
	DoE (2017). Revised referral guidelines for three threatened black cockatoo species: Carnaby's Cockatoo (endangered) <i>Calyptorhynchus latirostris</i> , Baudin's Cockatoo (vulnerable) <i>Calyptorhynchus baudinii</i> , Forest Red-Tailed Black-Cockatoo (vulnerable) <i>Calyptorhynchus banksii naso</i> , Department of Environment, Canberra.
	DoE (2021c) [online] <i>Calyptorhynchus latirostris</i> in Species Profile and Threats Database. Department of the Environment, Canberra Available from: https://www.environment.gov.au/sprat Accessed January 2021.
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	Environmental Protection Authority (EPA) (2004) Guidance Statement for Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia, Guidance Statement, 56, Guidance for the Assessment of Environmental Factors Western Australia (in accordance with the Environmental Protection Act 1986), Environmental Protection Authority, Perth.
	Environmental Protection Authority (EPA) (2016), Terrestrial Fauna Survey, Technical Guidance, Environmental Protection Authority, Perth.
	Environmental Protection Authority (EPA) (2020), Terrestrial vertebrate fauna surveys for environmental impact assessment, Technical Guidance, Environmental Protection Authority, Perth.
	Environment Standard – South32
	Forest Management Plan 2014 – 2023
	IUCN Red List of Threatened Species
	Johnstone, R E, Kirkby, T (2008) Carnaby's Cockatoo, Baudin's Cockatoo and the Forest Red-tailed Black Cockatoo on the Swan Coastal Plain, Western Australia. Studies on Distribution, Status, Breeding, Food, Movements and Historical Changes. Department of Planning, Perth.
	Johnstone, R E, Kirkby, T; and Sarti, K. (2013) The breeding biology of the Forest Red-tailed Black Cockatoo <i>Calyptorhynchus banksii naso</i> Gould in south-western Australia. I. Characteristics of nest trees and nest hollows. Pacific Conservation Biology 19: 121 – 142. Surrey Beatty & Sons, Sydney.
	Johnstone, R E; Storr, G M (1998) Handbook of Western Australian Birds. Volume I – Non-passerines (Emu to Dollarbird). Western Australian Museum, Perth.
	Murdoch (2019) Black Cockatoo Tracking and Ecology Project, 2018 Summary Data.
	Project Number website. Available from: www.numbat.org.au/thenumbat . Accessed 1 July 2021.
	Short, J, Hide, A & Stone, M 2011, 'Habitat requirements of the endangered red-tailed phascogale, <i>Phascogale calura</i> ', Wildlife Research, vol. 38, no. 5, pp. 359–369.
	Western Australian Environmental Protection (Clearing of Native Vegetation) Regulations 2004

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00100863	Clearing Planning Procedure
00100943	Flora and Fauna Conservation Procedure
00101051	Rehabilitation Research
00112994	Recommendation for Area Protection Form
00112995	Request to Disturb a Protected Area Form
00113130	Fauna Management - Animal Handling Procedure
00113396	Contractor Management Procedure
00119146	Refinery Native Vegetation Clearing Procedure
01005994	Biodiversity and Forest Management Plan Business Blueprint
01013619	Protected Areas Plan
200000484	Protected Areas Implementation and Management Procedure (200000484)

7 DOCUMENT CONTROL

Endorsement Circulation

Role	Name	Endorsed	Date
Environment Specialist	Paul Bullock	✓	26.11.2021
Environmental Supervisor	Craig Kimpton	✓	03.12.2021
Principal Environment Biodiversity & Conservation	Rory Swiderski	✓	01.12.2021

Approval Circulation

Role	Name	Approved	Date
Manager HSERT	Dale McAtee	✓	03.12.2021
Manager Planning	Cameron McKean	✓	07.12.2021

8 APPENDICES

8.1 APPENDIX 1: SURVEY METHODOLOGY GUIDANCE

Black Cockatoos

Survey Method	Habitat Assessment	Targeted Habitat Trees (Breeding Habitat)	Targeted Habitat Trees (Night Roosting)	Surveys for foraging birds and/or habitat
Aim	<ol style="list-style-type: none"> 1) Identify habitat suitable for Black Cockatoos 2) Record the presence and extent of breeding, foraging and roosting habitat (including contiguous offsite areas). 3) Map the extent, type and quality of the vegetation present. 4) Identify and record 'habitat trees' and potential to support Black Cockatoos 	<ol style="list-style-type: none"> 1) Identify likelihood of 'Potential Habitat Tree(s)' supporting breeding Black Cockatoos. 2) To detect Black Cockatoos, especially (but not exclusively) nesting females to confirm that breeding is taking place on the site. 3) Assess tree hollows for their future potential to support Black Cockatoo breeding. 	<ol style="list-style-type: none"> 1) Search for evidence that a roost site occurs and is utilised by Black Cockatoos. The presence of cockatoo droppings and feathers, or 'chewed' Banksia cones or Marri nuts, can indicate feeding by Black Cockatoos with indicative species bite patterns. 2) Detect Black Cockatoos roosting at the site. 3) Estimate the number of birds using the roost. 	<ol style="list-style-type: none"> 1) To detect Black Cockatoo foraging habitat. 2) Record the presence and extent of foraging habitat (including contiguous offsite areas). 3) Identify conservation significant areas. 4) Estimate the number of birds using the site.
Timing	<p>Habitat assessment may be performed at any time of the year.</p> <p>Ideally surveys should be complete at least 2 years prior to any clearing to allow survey of potential 'habitat trees' over at least two breeding seasons.</p>	<p>Preliminary hollow assessment can be undertaken at any time of the year.</p> <p>Breeding surveys to be conducted during the peak breeding period.*</p>	<p>Daytime surveys can occur any time of the year.</p> <p>Dawn visits should be made at all likely roost sites in both breeding* and non-breeding season</p>	<p>One survey in winter. Two further surveys in spring. In Marri habitats, the preferred time to survey for Black Cockatoo foraging is December to April (three surveys conducted during this period (DoE, 2015b).</p>
Effort	<p>As required to adequately survey, with sufficiently close transects, covering the entire development area.</p>	<p>Survey effort is required for at least two suitable days, at approximately monthly intervals.</p>	<p>A minimum of two dawn surveys per season, at approximately monthly intervals over at least one hour during breeding and non-breeding seasons.</p>	<p>Survey effort as per habitat assessment.</p> <p>Requires a total of three surveys with two hour visits in both the morning and evening.</p>
Methods	<ol style="list-style-type: none"> 1) Desktop assessment 2) Reconnaissance – assess habitat via vehicle track and walking transects giving coverage of the entire survey area. 3) Map the survey area according to Black Cockatoo habitat use. 4) Search and record evidence of Black Cockatoo feeding, breeding, roosting and identification of individuals/groups. 5) Identify habitat considered to be of high 	<ol style="list-style-type: none"> 1) Visual assessment of potential breeding hollows externally i.e. evidence of chewing around entrance. 2) Identify the presence of Black Cockatoos at any potential hollows. 3) Visual camera assessment – use of pole-mounted camera (refer to Section 4.4.1). Document hollow attributes - dimensions, evidence of breeding. 4) For hollows that are considered suitable or show evidence of previous 	<ol style="list-style-type: none"> 1) Visit site at least 30 minutes before sunrise. Record Black Cockatoo calls until at least 30 minutes after sunrise in order to estimate the number of birds as they leave the roost. 2) Counts are best made by standing under a flight path (e.g. a road, track or open area that the birds cross) and looking towards the roost against an open skyline. 3) Subsequent visits may be required to count the 	<p>Refer to habitat assessment method for survey and mapping of Black Cockatoo foraging habitat.</p> <p>Foraging bird surveys:</p> <ol style="list-style-type: none"> 1) 20 minute targeted searches of food resource areas. 2) Systematic area and transect searches combined with point surveys providing adequate coverage of the survey area. Area searches 20 minutes covering 2ha areas. Transects by vehicle

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conservation significance to Black Cockatoos and 'Potential Habitat Trees' following assessment protocol (Section 4.4.1).	breeding, undertake survey to identify use of the hollow at monthly intervals during the peak breeding season	birds as they leave the roost. Roost sites may also be located by following birds returning to the roost in the evening.	and by foot for 20 minute periods. 20 minute point surveys.
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*Peak breeding – Carnaby Black Cockatoo – September to November, Baudin Black Cockatoo - October to January and FRTBC – April to June and August to November

Other Avian Species (including Peregrine Falcon)

Other Avian Species survey methods

Survey Method	Habitat Assessment
Aim	<ol style="list-style-type: none"> 1) Identify habitat potential for survey 2) Record the presence and extent of breeding locations (including contiguous offsite areas). 3) Map the extent, type and quality of the vegetation present. 4) Identify and record 'habitat trees' with potential to support significant avian species (other than Black Cockatoos).
Timing	Habitat assessment may be performed at any time of the year. Time of year may influence breeding timeframes and species identification and interaction.
Effort	As required to adequately survey, covering the entire proposed disturbance area. Examine for breeding locations depending on the targeted species. Review potential breeding habitat feature and immediate surrounds for evidence of use or activity
Methods	<ol style="list-style-type: none"> 1) Opportunistic search during other field based targeted surveys. Noting large nests, platforms and bird activity, 2) Identify habitat considered to be of high conservation significance and 'Potential Habitat Trees' following assessment protocol (Section 4.1.4).

Mammal Species

Mammal survey methods

Survey Method	Habitat Assessment
Aim	<ol style="list-style-type: none"> 1) Identify habitat potential for survey 2) Record the presence and extent of breeding locations (including contiguous offsite areas). 3) Map the extent, type and quality of the vegetation present. 4) Identify and record 'habitat trees' or 'habitat features' with potential to support significant mammal species.
Timing	Habitat assessment may be performed at any time of the year. Where undertaken during breeding periods for the species, this may increase detection likelihood, species identification and interaction.
Effort	As required to adequately survey, covering the entire proposed pre-clearance area. Examining for 'habitat trees' and 'habitat features' suitable for the targeted species.
Methods	<ol style="list-style-type: none"> 1) Opportunistic search during other field based targeted surveys. Noting 'habitat features' and mature trees with suitable hollows for potential use by medium to large mammal species, 2) Identify habitat considered to be of high conservation value and potential 'habitat trees' following assessment protocol (Section 4.1.4).