Chapter 16 Biodiversity

This chapter evaluates the impacts to biodiversity values within and around the Western Sydney International (Nancy-Bird Walton) Airport (WSI) potentially affected by the preliminary flight paths and airspace design (the project). The impacts of the project on Greater Blue Mountains Area biodiversity values are addressed in Chapter 23 (Matters of National Environmental Significance).

The full assessment of impacts to biodiversity values is provided in Technical paper 8: Biodiversity (Technical paper 8). Other EIS studies informed the assessment, notably Technical paper 1: Aircraft noise (Technical paper 1) and Technical paper 5: Wildlife strike risk (Technical paper 5).

Background and method

The biodiversity study area (study area) was comprised of a nominal 45 nautical miles (83 kilometre (km)) radius from WSI to capture the general features of the environment where the project would take place.

The assessment has considered potential direct impacts due to wildlife strike, and potential indirect impacts associated with the project, such as aircraft noise, changes in air and water quality, increased light and fuel jettisoning. To inform the assessment of these impacts, the assessment has considered the land uses relative to the Airport Site (site as defined in the *Airports Act 1996*), flight paths and associated predicted noise levels, and biodiversity values contained within these areas. For aircraft noise, the 2055 assessment year was selected as it represents the worst-case scenario for aircraft noise when the single runway is operating close to capacity.

The impact assessment approach included a desktop review of databases, relevant literature including research papers, spatial data and an assessment of the significance of potential impacts.

Existing environment

There are a wide variety of habitats that support biodiversity values in the study area, including the Greater Blue Mountains Area and other large tracts and isolated pockets of native vegetation (predominantly Dry Sclerophyll Forests), wildlife corridors and wetlands. These provide habitat for *Environment Protection and Biodiversity Act 1999* (EPBC Act) listed threatened species including 92 fauna species such as the Regent Honeyeater, Swift Parrot and Grey-headed Flying-fox and 79 migratory species including migratory shorebirds.

Fifty-eight wildlife attractants (such as permanent basins, ponds, non-native ecosystems, waste management facilities, Flying-fox camps and Ibis colonies) were identified within a 30 km buffer of the airport runway boundary.

Key findings

The key potential impacts on biodiversity values and measures to address them are:

- Direct impacts from wildlife strike leading to mortality. Impacts associated with wildlife strike are likely to be intermittent during the airport's operation but this would not significantly affect the viability of local populations of any species. Flying-foxes are particularly susceptible to wildlife strike. There would be no other direct impacts on biodiversity values.
- Indirect impacts including potential changes to noise, light, air quality, water quality and ecosystems associated with aircraft overflight:
  - Noise can impact behavioural changes and communication interference in wildlife. Most noise related impacts on biodiversity would be concentrated in proximity to the airport (where the highest noise impacts are) and to a lesser degree areas where aircraft are at higher altitudes at distances from the airport. Overall, impacts from noise were assessed as low and unlikely to significantly modify species behaviours or use of habitats that are locally or regionally available.

- Light spill and pollution can have adverse impacts on wildlife including behavioural and physiological changes which make them more prone to predation or wildlife strike. The project's operational light would be limited to lights on aircraft as they travel along the flight paths during nocturnal hours. This slight increase in light is unlikely to significantly affect biodiversity.
- Emissions from aircraft operating along the flight paths could result in local and regional reductions in air quality. Habitats for wildlife in proximity to the Airport Site are already highly disturbed and likely to be subject to similar emission types associated with urban development and other aircraft. Any alterations to air quality would be temporary, localised and unlikely to impact biodiversity values.
- Deposition of aircraft pollutants and subsequent potential impacts on water quality are unlikely and negligible.
- Fuel dumping has the potential to introduce harmful contaminants into the sensitive environments within the study area such as native terrestrial and aquatic ecosystems, if not appropriately managed. Fuel dumping can be carried out safely and without any impacts at ground level when appropriate procedures are followed. Fuel jettisoning would occur in accordance with the Manual of Air Traffic Services (MATS) – Section 4.2.11 Fuel Dumping (Airservices Australia, 2023). Fuel jettisoned at a sufficient altitude would volatise (change from liquid to vapour) as it falls and is completely dispersed as vapour before any liquid reaches ground level.

In addition, the project:

- is unlikely to have a significant impact on Commonwealth heritage places listed under the EPBC Act
- is unlikely to have a significant impact on threatened or migratory species listed under the EPBC Act or on native plants and animals
- would not breach or raise inconsistences with any of Australia's obligations under the various biodiversity related international agreements to which it is a signatory
- is unlikely to compound impacts on biodiversity associated with the 2019-2020 bushfires.

Significance of impacts

The project is not likely to have significant impacts (residual or otherwise) in relation to biodiversity.

Aircraft strike risk from WSI traffic can be minimised through measures such as continuing work with planning authorities to minimise wildlife attraction; preparation of regional species management plans and implementation of a bird and bat monitoring program. However, residual impacts associated with the project would include occasional aircraft strike and alterations to existing noise levels. These cannot be avoided or minimised due to the nature and extent of the project, other airport flight paths requirements and the design specifications required to safely operate aircraft associated with WSI.

As the project is not likely to have significant impacts the project is not obligated to provide offsets in accordance with the EPBC Act Offsets Policy.

The biodiversity offsets already provided for Stage 1 are adequate for all components of the airport.

16.1 Introduction

This chapter outlines the existing biodiversity values within and around the Western Sydney International (Nancy-Bird Walton) Airport (WSI) potentially affected by the preliminary flight paths and airspace design (the project). Biodiversity values are defined by flora and fauna habitats and communities, threatened species, and migratory species, including entities listed as Matters of National Environmental Significance (MNES) under the EPBC Act. The full assessment of impacts to biodiversity values is provided in Technical paper 8.

Elsewhere in this Draft EIS, the wildlife hazard risk to aircraft operations is addressed in Chapter 13 (Aircraft hazard and risk) and impacts on the Greater Blue Mountains Area (GBMA) including biodiversity attributes are described in Chapter 23 (Matters of National Environmental Significance). This chapter has been developed to specifically address the remaining biodiversity assessment requirements of the EIS Guidelines (Appendix C), notably impacts to fauna.

An overall account of biodiversity impacts associated with Stage 1 Development of WSI (as described in Chapter 1 (Introduction)) was provided in the 2016 EIS. This included the anticipated extent of vegetation clearing and grubbing, earthworks, drainage works and the permanent infrastructure that would be constructed for the Stage 1 Development. The 2016 EIS also provided a high-level assessment of operational impacts including bird and bat strike, noise, light and fuel jettisoning associated with aircraft flight for Stage 1 Development scenario (nominally 2030) and a longer-term dual-runway scenario (nominally 2063). A biodiversity offset delivery plan (BODP) was developed to compensate for residual significant impacts associated with the Stage 1 Development. The BODP takes into account specific species (such as the Southern Myotis (*Myotis macropus*) roosting habitat, the Cumberland Land Snail (*Meridolum corneovirens*) and various species of flora.

In line with the EIS Guidelines, this assessment considers the direct and indirect impacts the project would have, or is likely to have on biodiversity values for the preliminary flight paths for single runway operations consistent with the Stage 1 Development of WSI.

Facilitated and cumulative impacts on biodiversity impacts are discussed in Chapter 21 (Facilitated impacts) and Chapter 22 (Cumulative impacts) respectively.

16.1.1 Assessment years

The 2055 assessment year was selected to assess impacts to biodiversity values from aircraft noise. This assessment year represents the worst-case scenario for biodiversity as it is when the single runway is operating close to capacity.

Refer to Chapter 7 (The project) for further information on assessment years.

16.2 Legislative and policy context

The relevant legislation, guidelines and standards for the assessment of biodiversity include:

- EPBC Act (Section 16.2.1) and associated significant impact guidelines and policies:
  - 'Matters of National Environmental Significance, Significant impact guidelines 1.1 Environment Protection and Biodiversity Conservation Act 1999' (Significant impact guidelines 1.1) (Commonwealth of Australia, 2013a).
  - 'Actions on, or impacting upon Commonwealth land, and actions by Commonwealth agencies, Significant impact guidelines 1.2 Environment Protection and Biodiversity Conservation Act 1999' (Significant impact guidelines 1.2) (Commonwealth of Australia, 2013b).
  - EPBC Act Environmental Offsets Policy (EPBC Act Offsets Policy) (Department of Sustainability, Environment, Water, Population and Communities, 2012).
- National Airports Safeguarding Framework (NASF) *Managing the Risk of Wildlife Strikes in the Vicinity of Airports* – provides guidelines to land users and planners regarding the management of wildlife hazards.

- ICAO Annex 14, Volume 1 (Aerodrome Design and Operation); ICAO Airport Services Manual Doc. 9184: Part 2 Land Use and Environmental Control; ICAO Airport Services Manual Doc. 9137: Airport Services Manual Part 3, Wildlife Control and Reduction (ICAO Guidelines) – all relate to the wildlife management responsibilities of airports.
- Environmental Management of Changes to Aircraft Operations standard (NOS) – AA-NOS-ENV2.100 Version 16: Effective 08 March 2022) (Airservices Australia, 2022b) – prescribes the requirements for environmental impact assessment of changes to aircraft operations, including criteria for assessing the significance of impacts to biodiversity sensitive receptors (BSRs) (refer to Section 16.3.3.4) as a result of a change in aircraft overflights.
- *Biodiversity Conservation Act 2016* (NSW) (BC Act) – allows breeding disruption and lethal control of hazardous native wildlife (by means of shooting by authorised shooters) for the purpose of aircraft hazard reduction under a 'Licence to Harm Protected Animal'.
- *Environmental Planning and Assessment Act 1979* (NSW) – describes the Ministerial Directions that relate to safeguarding aviation and the Western Sydney Aerotropolis, including the implementation of an interim land use and infrastructure plan (Direction 7.8).
- State Environmental Planning Policy (Resilience and Hazards) 2021 (NSW) (Resilience and Hazards SEPP) – identifies coastal wetlands and proximity area for coastal wetlands on the Coastal Wetlands and Littoral Rainforests Area Map. These areas were used to identify potential suitable habitat for MNES biodiversity entities as part of this assessment.

16.2.1 EPBC Act

The EPBC Act provides the national framework for protecting and managing nationally (and internationally) important flora and fauna, ecological communities and heritage places (including World heritage) that are defined under the EPBC Act as MNES. An overview of the EPBC Act, including MNES and relevance to the project is provided in Chapter 5 (Statutory context).

In accordance with the EPBC Act and the EIS Guidelines, this Draft EIS requires an assessment of impacts on biodiversity to provide an understanding of the nature, extent and significance of potential impacts on the environment associated with the project. As the project is being undertaken by a Commonwealth agency, this includes consideration of the impacts on the 'whole of the environment'. That is, the assessment will assess impacts to MNES but it will not be limited to those considerations.

The MNES biodiversity entities (biodiversity MNES) considered in this chapter are:

- nationally threatened flora and fauna species
- nationally threatened ecological communities
- species listed under international agreements including:
  - Japan-Australia Migratory Bird Agreement (JAMBA)
  - China-Australia Migratory Bird Agreement (CAMBA)
  - Korea-Australia Migratory Bird Agreement (ROKAMBA)
  - Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
  - Biodiversity Convention, the Convention on Conservation of Nature in the South Pacific (Apia Convention)
  - Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- wetlands of international importance listed under the Ramsar Convention (Ramsar wetlands)
- biodiversity attributes contained within world heritage areas (for the purposes of determining habitat value).

The assessment considers these treaties and whether the project may breach any of the agreements signed by Australia. It also assesses the impacts on plants and animals as part of the whole of the environment.

16.2.1.1 Part 13 Permit

A permit may be required under Part 13 of the EPBC Act if a project occurring on Commonwealth land may impact a listed threatened species, ecological community, migratory species or marine species, regardless of whether that impact is significant or not.

Potential impacts on biodiversity relating to the project are consistent with those assessed as part of the 2016 EIS. The Part 13 Permit applied for and approved as part of the Stage 1 development (E2017-0138) is considered adequate to address the project's impacts.

16.3 Methodology

To assess impacts on biodiversity, the key tasks were to:

- ascertain dependencies and interactions with other Draft EIS technical papers (Section 16.3.1)
- determine appropriate study area/assessment zone for the assessment of direct and indirect impacts on biodiversity (Section 16.3.2)
- complete a desktop assessment including research to describe the biodiversity values of the assessment zone, including native vegetation types, flora and fauna species and their habitats (Section 16.3.3)
- develop suitable severity assessment criteria for the assessment of biodiversity (Section 16.3.3.7)
- identify and describe suitable and preferred habitat that supports biodiversity values relevant to the project (Section 16.5)
- assess the direct and indirect impacts of the project on biodiversity values relevant to the project (Sections 16.6.1 and 16.6.2), consistency with Australia's international agreements (Sections 16.6.3 and 16.6.4) and bushfire impacts (Section 16.6.5)
- complete significant impact assessments (SIAs) pursuant to Significant impact guidelines 1.1 and 1.2 (Section 16.7)
- recommend mitigation measures to assist in further minimising impacts to biodiversity values (Section 16.8)
- identify appropriate biodiversity offsets to compensate for residual significant impacts on protected matters arising from the proposed airport in accordance with the Offsets Policy (Section 16.8.3).

16.3.1 Dependencies and interactions with other studies

Other EIS studies were reviewed to scope and inform the biodiversity assessment as described in Table 16.1.

Table 16.1 Dependencies and interactions with other Technical papers

Technical paper	Relevance
Technical paper 1: Aircraft noise	To inform the study area for this assessment and assess the noise impacts on biodiversity.
Technical paper 2: Air quality	To inform the assessment of air quality on biodiversity.
Technical Paper 3: Greenhouse gas emissions	Assesses potential impacts relating to greenhouse gases and climate change and therefore biodiversity.
Technical paper 4: Hazard and risk	To inform the mitigation measures for wildlife strike.
Technical paper 5: Wildlife strike risk	To inform the study area, to inform biodiversity impacts arising from wildlife strike within a 13 kilometre (km) radius of the runway and to inform the effects of aircraft noise on wildlife.

Technical paper	Relevance
Technical Paper 7: Landscape and visual amenity	To inform the assessment of light impacts on biodiversity.
Technical paper 12: Human health	Assesses potential impacts relating to water quality and therefore biodiversity.
Technical paper 14: Greater Blue Mountains World Heritage Area	To inform the description of the existing environment. Technical paper 8 informs the assessment of biodiversity attributes in Technical paper 14.

16.3.2 Study area

The biodiversity study area (study area) is comprised of a nominal 45 nautical miles (83 km) radius from WSI to capture the general features of the environment where the action would take place (refer to Figure 16.1).

Four separate components within the study area were used to determine an 'assessment zone' for capturing the extent and nature of likely impacts on biodiversity values. These are described in Table 16.2. Justification for the extent of impacts is provided in Section 16.3.3.5.

Table 16.2 Study area components

Components	Description	Purpose
Wildlife buffer (Figure 16.1)	Includes any natural or anthropogenic (created by people or caused by human activity) structure or land use within 13 km of the airport runway boundary, including the airport's landside areas identified as an actual or potential wildlife attractant (as per Technical paper 5). Technical paper 5 also identified additional wildlife attractants outside the 13 km buffer (up to 30 km buffer). These values occur within, and are included in the flight path buffer component for this assessment.	Evaluates extent of **direct** impacts on biodiversity values.
Flying-fox camps and buffers	All remnant vegetation mapped (NSW DPE, 2022f) within a 1 km buffer of the 8 flying-fox colonies, or 'camps' that were monitored to inform Technical paper 5. Mapped in Figure 16.4.	Evaluates extent of **direct** impacts on biodiversity values.
Noise contours	Defined by 2055 N60 24-hour and N70 24-hour composite contours from Technical paper 1. Mapped in Figure 1.1 of Technical paper 8. Refer to Section 16.3.3.5 for justification.	Evaluates extent of **indirect** impacts on biodiversity values from aircraft noise.
Flight path buffer (Figure 16.1)	The concept of flight paths is introduced in Section 3.3.2 of Chapter 3 (Introduction to airspace). WSI flight path descriptions are provided in Chapter 7 (The project). A 10 km buffer around each flight path's centreline is included to define the locality of the project's impacts on BSRs in accordance with the NOS (refer to Section 16.3.3.4).	Determines the extent of **direct** and **indirect** impacts on biodiversity values.

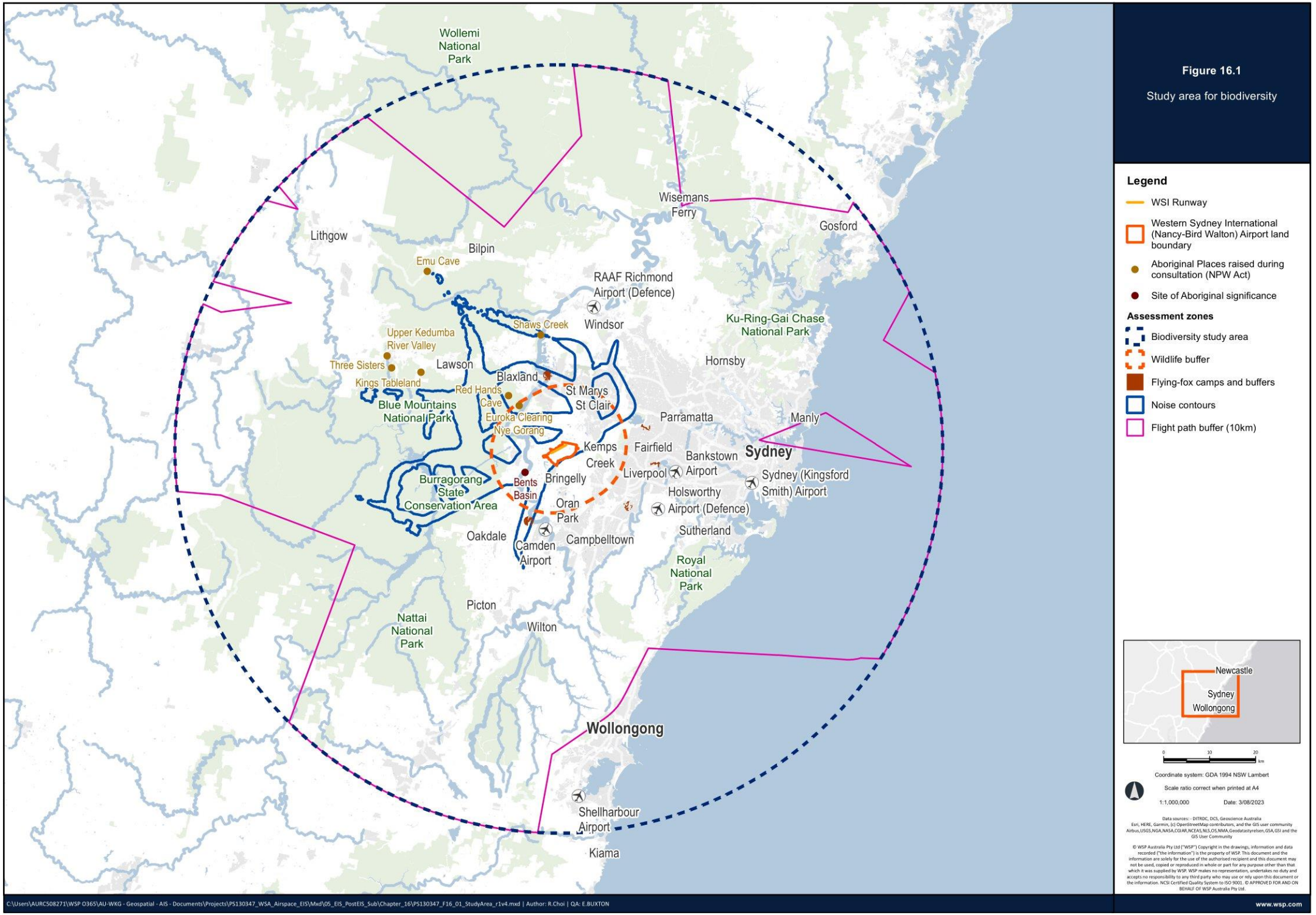


Figure 16.1

Study area for biodiversity

Legend

- WSI Runway
- Western Sydney International (Nancy-Bird Walton) Airport land boundary
- Aboriginal Places raised during consultation (NPW Act)
- Site of Aboriginal significance

Assessment zones

- Biodiversity study area
- Wildlife buffer
- Flying-fox camps and buffers
- Noise contours
- Flight path buffer (10km)

0 10 20 km

Coordinate system: GDA 1994 NSW Lambert

Scale ratio correct when printed at A4

1:1,000,000 Date: 3/08/2023

16.3.3 Impact assessment approach

The assessment included a desktop review of databases, relevant literature, and spatial data. Impact calculations and an assessment of the significance of impacts were undertaken to determine the effect of the project on biodiversity values.

16.3.3.1 Desktop review

Existing information relating to biodiversity values was assessed during a desktop review, including:

- relevant legislation, guidelines and standards as listed in Section 16.2
- previous biodiversity studies undertaken for WSI or related to the GBMA
- previous studies and plans relating to the Cumberland Plain
- other relevant technical papers prepared for the project (Section 16.3.1)
- searches of existing databases including the EPBC Act Protected Matters Search Tool (PMST) (DCCEEW, 2022a) and the BioNet Atlas of NSW Wildlife (NSW DPE, 2022d) to identify biodiversity values relating to the study area
- plant community type profiles contained in the BioNet Vegetation Classification Database (NSW DPE, 2022e)
- spatial data, including on vegetation and habitat mapping (Section 16.5.2) and fire extent and severity (Section 16.6.5)
- national recovery plans, threat abatement plans and conservation advice for MNES (Section 16.6.3)
- research papers on the various impacts of aircraft operations on biodiversity (as referenced throughout).

The complete list of data and documents reviewed for this assessment is in Appendix A and Chapter 12 of Technical paper 8.

16.3.3.2 Likelihood of occurrence

Following the desktop review, 'likelihood of occurrence' assessments were prepared for EPBC Act threatened flora, threatened ecological communities and threatened fauna and migratory species to determine 'candidate' species or communities (those with potential to be impacted upon by the project and requiring further assessment).

Likelihood of occurrence assessments for threatened flora and threatened ecological communities were limited to those with potential to occur within the wildlife buffer. Outside of the wildlife buffer within the assessment zone, these entities are unlikely to be impacted due to their location in relation to the proposed flight paths and the altitudes at which aircraft would be flying.

Likelihood of occurrence assessments for threatened fauna and migratory species were conducted for the assessment zone as a whole and separately for the wildlife buffer. These threatened species were appropriate surrogates for NSW listed threatened species and other non-threatened native species which may be sensitive to impacts associated with the project.

The likelihood of occurrence for these entities was classified as 'recorded', 'high', 'moderate' or 'low' using criteria and based on desktop review in Section 16.3.3.1 above, Appendix A of Technical paper 8, and the assessor's professional judgement. Candidate species were those determined as having 'moderate' to 'high' likelihood of occurrence or utilising habitats available. The approach is detailed in Section 4.4.2 of Technical paper 7.

16.3.3.3 Vegetation communities and habitat determination

Vegetation communities and associated habitat types for the wildlife buffer were determined during the desktop review (refer to Section 16.3.3.1). The NSW State Vegetation Type Map (NSW DPE, 2022f) was primarily used to determine the Plant Community Types (PCTs) considered likely to be present. As the suitability, size and configuration of fauna habitat types correlate broadly with the structure of PCTs, each PCT was assigned a surrogate broad fauna habitat type. Habitat types for flora species and threatened ecological communities were determined using each PCT's profile contained in the BioNet Vegetation Classification Database (NSW DPE, 2022e).

16.3.3.4 Biodiversity sensitive receptors

BSRs as defined by the NOS includes:

- MNES listed under the EPBC Act. These are considered as surrogates for other non-EPBC Act threatened native species which may be sensitive to impacts associated with the project
- other sensitive areas which are likely to contain important habitat for EPBC Act listed threatened biota and migratory species or state-listed threatened biota (including nationally important wetlands, State forests, national parks, other conservation reserves listed under State legislation).

These have been located and classified using a 10 km buffer on flight paths (as guided by the NOS) as the basis to assess the extent of noise impacts and presence or otherwise of key potential habitats (refer to Table 16.2).

16.3.3.5 Consultation

Extensive consultation was undertaken to identify key heritage values, including those relating to biodiversity, and their importance to the community. The consultation completed for the project is detailed in Chapter 9 (Consultation and stakeholder engagement) and Chapter 17 (Heritage).

16.3.3.6 Determining the extent of impacts

This section outlines the extent of the direct and indirect project impacts relevant to biodiversity values.

Direct impacts

Direct impacts on biodiversity values are limited to wildlife strike leading to injury or mortality of fauna species. The extent of direct impacts is restricted to 3 components of the assessment zone (Table 16.2) for reasons described below. The methodology and assessment of the risk of bird and bat strike is provided in Technical paper 5 as summarised in Chapter 13 (Aircraft hazard and risk).

Wildlife buffer

International Civil Aviation Organization (ICAO) guidelines relating to radial distances from an airport, Civil Aviation Safety Authority (CASA) and the NASF recognise land uses within 13 km of an airport are potential risk contributors. As such, biodiversity values within this distance that attract, or have the potential to attract, wildlife relevant to the project may contribute to the airport's potential wildlife strike risk/direct impact potential.

In civil aviation, 93 per cent of wildlife strikes occur at or below 3,500 feet (ft) (1 km) Above Ground Level (AGL) (Dolbeer, 2011). The project's flight paths typically reach 3,500 ft (1 km) AGL within 13 km of the Airport Site, as captured by the wildlife buffer.

Flying-fox camps and buffers

The flying-fox hazard risk to aircraft, and the reasons for including flying-fox camps outside the 13 km wildlife buffer are described in Chapter 13 (Aircraft hazard and risk).

The 'National Flying-fox monitoring viewer' (DCCEEW, 2022b) only provides a centre point of each camp. Using a 1 km buffer from each centre point ensures that the entirety of each camp is included in the flying-fox camps and buffers.

Flight paths

While direct impacts to wildlife below 3,500 ft AGL (1 km) were assessed using the wildlife buffer and flying-fox camps and buffers, direct impacts to bird species known to occur at altitudes of greater than 3,500 ft AGL (1 km), such as Australian Pelican and Wedge-tailed Eagle, were assessed using the flight path buffer. This is where aircraft may intersect with aerial habitats for these species.

Indirect impacts

Indirect impacts on biodiversity values include potential changes to noise, light, air quality, water quality and ecosystems associated with aircraft overflight. The extent of indirect impacts was limited to the noise contours and flight path buffer for reasons described below.

Noise contours

The N60 24-hour and N70 24-hour noise contours were used as a proxy to assess the extent of aircraft noise impacts on biodiversity values as they reflect the proposed number of aircraft movements where a BSR is exposed to noise levels at or above 60 dB(A) and 70 dB(A) within the flight path buffer. This is considered an appropriate approach given the literature reviewed as provided in Technical paper 8 and summarised as below:

- The N60 and N70 noise thresholds represent levels above which aircraft noise would be considered a regular feature of the ambient noise environment. N70 values of 5 or more are considered to provide sufficient resolution for describing aircraft noise in areas currently experiencing aircraft noise, as well as areas which would be newly affected by aircraft overflights. Therefore, changes in existing noise levels will be concentrated within these contours and other areas (beyond these contours) should remain relatively unaffected (or affected to a less degree) by noise associated with the project (refer to Chapter 11 (Aircraft noise).
- Literature based on 20 years of international research documenting the effects of anthropogenic noise suggests that the range of noise levels, including aircraft noise, reported to induce annoyance in humans and trigger responses in terrestrial wildlife are similar, that is, between 40 and 100 dB(A) (Shannon et al. 2016). Limitations of the literature are discussed in Section 16.3.4.
- The noise level threshold of 60 dB(A) represents a reasonably conservative noise threshold based on the findings of the published literature (that is, this threshold captures 60 per cent of studies that have shown adverse responses in terrestrial wildlife, including impacts on physiology and fitness) and given the large variability in responses between species and individuals and at different locations (Shannon et al. 2016).
- It has been found that the lateral distance between aircraft and wildlife is an important parameter when predicting animal behaviour due to aircraft noise exposure. For example, Delaney et al. (1999) noted that Mexican Spotted Owls were not flushed or visibly irritated by aircraft noise stimuli if they were located 100 m or further away from the airport runway. The assessment zones encompass all areas within the locality of the project including the wildlife buffer (representing 13 km from the airport runway).
- The NOS methods (which apply N60 and N70 noise thresholds) have been validated through consultation and negotiations with key stakeholders and ongoing analysis of Airservices Australia aviation noise complaint data and flight path changes since 2013.

Given the above, the 2055 N60 24-hour and N70 24-hour noise contours are considered an appropriate approach to determining the extent and concentration of changes in noise levels associated with the project. Further information on research findings is found in Section 4.7.1 of Technical paper 8.

Flight path buffer

The flight path buffer was used to determine the extent of light, air quality and fuel dumping indirect impacts on biodiversity values as this area would be the primary source of such impacts.

Quantification

Given the nature of these direct and indirect impacts, their extent cannot be quantified by the area of impacted habitat, nor can the total number of individuals affected be reliably estimated without long term baseline studies and operational monitoring (refer to Technical paper 5). As such, the direct and indirect impact extent is limited to qualitative extents.

For this assessment, the extent of indirect impacts was used to inform the SIAs and whether biodiversity offsetting would be required for the project.

Other factors

There were a range of other factors considered to determine the extent of the project's impacts on biodiversity values. These included whether the impact is likely to be temporary, permanent, direct, indirect, unknown, unpredictable or irreversible, altitudinal ranges of aircraft (refer to Section 16.5.4) and the results of the project's other environmental assessments to inform impacts on biodiversity values (refer to Section 16.3.1). Further detail is provided in Section 4.6.1.3 of Technical paper 8.

16.3.3.7 Significance criteria

SIAs must consider the likelihood of an impact occurring, in addition to the severity of the impact if the impact were to occur. Under the EPBC Act, significant impact criteria are provided in Significant impact guidelines 1.1 and 1.2. This criterion has been integrated into project's impact significance assessment framework as presented in Chapter 10 (Approach to impact assessment) and below.

Likelihood of a significant impact

An action is considered 'likely' to have a significant impact if there is a real or not remote chance or possibility of a significant impact. The likelihood of an impact is deemed 'possible' if it could occur during the lifetime of the project (probability 70–90 per cent) and 'unlikely' if the impact is unlikely to occur, but is possible during periods of the project (probability 10–30 per cent).

Severity of impact

A set of impact severity assessment criteria were developed taking into consideration the Significant impact guidelines 1.1 and 1.2 to identify and evaluate the scale, intensity, timing, duration and frequency of the project's impacts on biodiversity. The severity criteria were aligned to an impact order of magnitude which acted as a threshold to assist in determining whether the project was likely to have a significant impact on a biodiversity value (whether on MNES or the environment as a whole).

For the purposes of this assessment impacts with a major impact severity were considered to have a significant impact. A description of the significance criteria used for this assessment is provided in Table 16.3.

Table 16.3 Severity assessment criteria for assessing impacts on biodiversity

Severity	Description
Major	Detectable adverse impacts considered likely to result in a significant impact on a biodiversity value in accordance with the Significant impact guidelines 1.1 and 1.2. These impacts could include a potential decline of a population and/or reduction in an area of occupancy such that it would affect a species status under the EPBC Act or International Agreements. These effects tend to be permanent, or irreversible, or otherwise long term of high intensity.
High	Detectable adverse impact on a biodiversity value protected under state, federal or international legislation/agreements that is not considered to be significant in accordance with the Significant impact guidelines 1.1 and 1.2. These impacts tend to be permanent, or otherwise medium to long-term of high intensity.
Moderate	Detectable adverse impact on a biodiversity value not protected under state, federal or internal legislation/agreements that is not considered to be potentially significant at a local, regional, state or federal level. These impacts tend to range from short to long-term and be of medium intensity. Nevertheless, the cumulative effects of such impacts may lead to an increase in the overall effect upon a biodiversity value.
Minor	Minor adverse impacts that are detectable at a local scale only but not significant at a regional, state or federal level. These impacts tend to be short term or of low intensity.
Negligible	No or minimal adverse impacts on biodiversity values within the normal bounds of variation or below levels of detection that are not significant at a local, regional, state or federal level. These impacts tend to be short term, temporary or of low intensity.

16.3.4 Assumptions and limitations

This assessment, including determining the extent of impacts (Section 16.3.3.5) has relied upon data, surveys, analyses, designs, plans and other information provided by DITRDCA and other organisations. Wildlife surveys including monitoring of 8 flying-fox camps were undertaken to inform Technical paper 5, as described in Chapter 13 (Aircraft hazard and risk).

No other ecological field surveys were conducted to verify data for this assessment. This is because the biodiversity of the assessment zone has been intensively surveyed over decades due to its occurrence within and adjoining the urban area of western Sydney and is well understood. Together with the wildlife strike surveys undertaken in Technical paper 5, this survey effort is considered to provide a sufficient and appropriate level of baseline knowledge to inform the assessment, particularly given the aerial nature of the impacts and that only highly mobile aerial fauna species are likely to be impacted directly.

There are no thresholds strictly identified for assessing aircraft noise, light, air quality and water quality impacts on biodiversity values and there is limited research of these impacts on individual Australian species likely to be impacted by the project. Further, past research in wildlife responses to noise have shown large variability between species and individuals at different locations even between individuals in the same population, making multi-species-based risk assessments difficult (Busnel and Fletcher, 1978; Radle, 2007; Duquette et al. 2021). Where possible, available guidelines, standards and literature have been used to determine an appropriate approach to assessing the extent, concentration and severity of these impacts associated with the project.

Limitations of the wildlife surveys are described in Appendix B of Technical paper 5. Databases used have inherent limitations that must be considered when interpreting the results of database searches, and site conditions, including the presence of threatened species, can change with time.

16.4 Avoidance and minimisation of impacts

The development of the preliminary airspace and flight path design is described in Chapter 6 (Project development and alternatives). This included the avoidance and minimisation of impacts to biodiversity through early consideration of environmental constraints in the planning phase, including the GBMA and associated sensitive recreation/wilderness areas, as input into the initial concept design options.

Further opportunities to minimise impacts to biodiversity are considered in this chapter (refer to Section 16.8).

16.5 Existing environment

This section describes the existing biodiversity values across the study area, including:

- interim Biogeographic Regionalisation for Australia (IBRA) region characteristics (Section 16.5.1)
- World heritage, National heritage and Commonwealth heritage places, notably the Greater Blue Mountains Area (GBMA) (Section 16.5.2.1)
- vegetation communities and associated broad fauna habitat types (Section 16.5.2.2)
- important habitats, for Regent Honeyeater, Swift Parrot, migratory shorebirds and the flying-fox (Section 16.5.2.3).
- wetlands, including Ramsar wetlands, SEPP coastal wetlands and nationally important wetlands (Section 16.5.2.4)
- key local and regional wildlife corridors (Section 16.5.2.5)
- conservation initiatives (Section 16.5.2.6)
- wildlife attractants (Section 16.5.2.7).

These attributes are mapped across the study area as presented in in the following sections.

16.5.1 Regional overview

The study area extends across 2 IBRA regions (Sydney Basin and South Eastern Highlands) and their associated 16 IBRA subregions (refer to Figure 16.2). The extent of this figure also captures another IBRA region/subregion – NSW South Western Slopes/Capertee Valley – which occurs outside the north-west of the study area.

A general description of the regions within the study area is provided in Table 16.4.

Key characteristics of ecosystems which occur within these IBRA subregions are provided in Appendix A3 of Technical paper 8.

Table 16.4 Overview of IBRA bioregions in the study area (Australian Government 2019)

IBRA bioregion	Description	Biodiversity	Associated bioregions
Sydney Basin	Covers a large part of the catchments of the Hawkesbury-Nepean, Hunter and Shoalhaven river systems. Dominated by a temperate climate characterised by warm summers with no dry season. Areas around the Blue Mountains falls in a montane climate zone. The most significant feature is the Great Escarpment, with its reversed drainage, and entrenched meander patterns and high level terrace gravels; the Blue Mountains are part of this feature.	One of the most species diverse in Australia. This is a result of the variety of rock types, topography and climates in the bioregion. Just over 40 per cent of the bioregion is used for conservation, including the Blue Mountains National Park, Wollemi National Park and Morton National Park.	Burragorang Cumberland Illawarra Moss Vale Pittwater Sydney Cataract Wollemi Wyong Yengo
South-Eastern Highlands	Covers the dissected ranges and plateau of the Great Dividing Range that are topographically lower than the Australian Alps, which lie to the south-west. Dominated by a temperate climate characterised by warm summers and no dry season. Areas in the north and south are at higher elevations in a montane climate zone, where summers are much milder. Topographically, the dominant features are plateau remnants, granite basins with prominent ridges.	Both soils and vegetation vary across the bioregion in relation to altitude, temperature and rainfall. Temperature affects the vertical distribution of species and can be observed in inverted sequences in frost hollows.	Bathurst Bungonia Capertee Uplands Crookwell Hill End Kanangra Oberon

The wildlife buffer and flying-fox camps and buffers occur within the Cumberland Plain of western Sydney and the wildlife buffer extends west to Nepean-Hawkesbury River before intersecting the foothills of the Blue Mountains National Park and the Burragorang State Conservation Area. The existing land uses within the wildlife buffer largely consist of urban development including a combination of residential development, commercial development, agriculture, town centres, parklands, reserves and supporting road, rail, waste and power infrastructure. A large portion of the area occurs as a highly fragmented mosaic landscape retaining small to medium sized vegetation remnants and waterbodies having been subjected to pressures associated with urban development.

The Great Dividing Range occurs to the immediate west of the wildlife buffer and includes the vast wild remnant native forests and native vegetation of the GBMA and surrounds, which extend from the Hunter Valley in the north (Wollemi National Park) to the Shoalhaven in the south (Morton National Park) and the western edge of Blue Mountains National Park. Further afield and generally on the flat plains and valleys is dominated by agriculture in all directions except to the east, which are purely oceanic environments off the NSW coast.

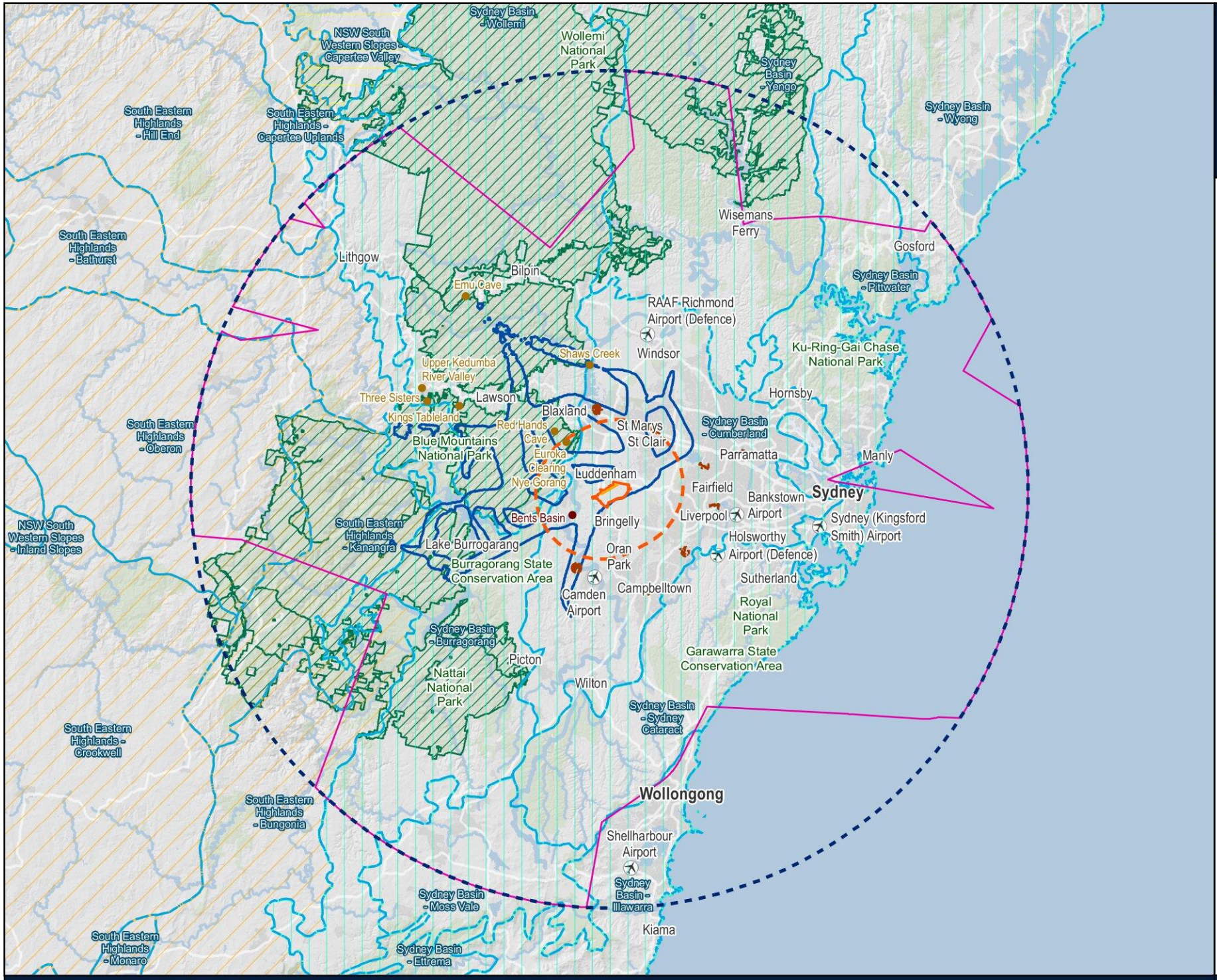


Figure 16.2

IBRA bioregions and heritage values across the study area

Legend

- WSI Runway
- Western Sydney International (Nancy-Bird Walton) Airport land boundary
- Greater Blue Mountains World Heritage Area
- IBRA Subregions
- Aboriginal Places raised during consultation (NPW Act)
- Site of Aboriginal significance

IBRA Regions

- NSW South Western Slopes
- South Eastern Highlands
- Sydney Basin

Assessment zones

- Biodiversity study area
- Wildlife buffer
- Flying-fox camps and buffers
- Noise contours
- Flight path buffer (10km)

0 10 20 km

Coordinate system: GDA 1994 NSW Lambert

Scale ratio correct when printed at A4

1:1,000,000 Date: 7/08/2023

16.5.2 Habitat values

This section identifies the suitable and preferred habitat that supports biodiversity values in the study area.

16.5.2.1 World heritage, National heritage and Commonwealth heritage places

The PMST search (refer to Section 16.3.3.1) identified one World Heritage Area, 3 'natural' National Heritage places and 3 'natural' Commonwealth Heritage Places as occurring within the study area (refer to Figure 16.2).

The Greater Blue Mountains Area (GBMA) was identified as a World Heritage Area and a National Heritage Place. The National Heritage values identified for the GBMA listing are the same as the values recognised for the World Heritage Area.

The GBMA makes up a significant representation of Australia's biodiversity supporting 10 per cent of the country's vascular flora and significant numbers of rare or threatened species, including endemic and evolutionary relict species within its boundaries (UNESCO, 2022b). It is large and botanically diverse representing a wide range of eucalypts habitats that support approximately 152 plant families, 484 genera and approximately 1,500 species.

Most of the remnant vegetation and associated habitats within the GBMA is of high wilderness quality and remains close to pristine. The impacts to its World Heritage and Natural Heritage values from the project, including its biodiversity, are assessed in Chapter 23 (Matters of National Environmental Significance).

The 2 remaining Natural Heritage Places identified within the study area were: Ku-ring-gai Chase National Park, Lion, Long and Spectacle Islands Nature Reserves; and the Royal National Park and Garawarra State Conservation Area. These are not considered further as they occur outside the wildlife buffer and flying-fox camps and buffers and are unlikely to be directly affected by the project. They are unlikely to be indirectly affected as they would be overflown by WSI aircraft at high altitudes and are already substantially overflown by Sydney (Kingsford Smith) Airport activity (refer to Chapter 23 (Matters of National Environmental Significance)).

Two of the Commonwealth Heritage Places identified by the PMST are considered likely to be potentially influenced by the project being the Orchard Hills Cumberland Plain Woodland and the Shale Woodland Llandilo.

The Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place is comprised of some of the largest, least disturbed, and regenerating remnants of Cumberland Plain vegetation communities. It has been listed for its outstanding examples of Cumberland Plain Woodland and Sydney Coastal River-flat Forest threatened ecological communities, large area of continuous habitat, among the least disturbed catchments in western Sydney (primarily Blaxland Creek and its tributaries) and populations and/or habitat for regionally significant flora and fauna species. The low disturbance of Blaxland Creek has been identified as containing a high representation of macro-invertebrate genera including some disturbance-sensitive species that appear to be confined to Orchard Hills such as stoneflies, leptophlebiid mayflies and pollution-sensitive caddisflies. Due to this, it sets a valuable benchmark to measure water quality degradation in western Sydney (DCCEEW, 2023).

The Shale Woodland Llandilo Commonwealth Heritage Place is comprised of one of the largest remnants of Cumberland Plain vegetation characteristic of Wianamatta shale, Tertiary alluvium and low-lying recent alluvium that support large areas of Cumberland Plain Woodland, Coastal River-flat Eucalypt Forest, Cooks River Ironbark Forest and Shale Gravel Transition Forest which are all listed under both the BC Act and EPBC Act as threatened. These areas comprise populations of many threatened flora species and provide habitat for threatened fauna species (DCCEEW, 2023).

16.5.2.2 Vegetation communities and associated broad fauna habitat types

A review of DPE's NSW State Vegetation Type Map (NSW DPE, 2022f) identified 312 PCTs within the assessment zone. These PCTs were aligned to 12 broad fauna habitat types using the vegetation formations described by Keith (2004) to assess potential impacts and risks associated with the project on fauna species. The total extent of these fauna habitat types in the assessment zone was around 1,471,441 hectares (ha) – with the breakdown across assessment zone categories provided in Table 16.5.

Table 16.5 Broad habitat classifications located within assessment zone

Broad habitat classification	Extent within wildlife buffer (ha)	Extent within flying-fox camps and buffers (ha)	Extent within noise contours (ha)	Extent within assessment zone (ha)*
Dry Sclerophyll Forests (Shrub/grass sub-formation)	619	–	6,130	122,325
Dry Sclerophyll Forests (Shrubby sub-formation)	5,438	–	34,313	557,032
Forested Wetlands	3,566	219	3,399	24,715
Freshwater Wetlands	13	7	257	17,616
Grasslands	–	–	–	183
Grassy Woodlands	12,164	70	6,900	88,026
Heathlands	–	–	821	38,963
Rainforests	72	1	601	25,788
Saline Wetlands	–	–	–	2,568
Wet Sclerophyll Forests (Grassy sub-formation)	1,042	–	1,143	49,220
Wet Sclerophyll Forests (Shrubby sub-formation)	379	59	5,121	74,702
Non-native/unattributed	39,511	2,157	29,067	470,303
Total	**62,804**	**2,513**	**87,752**	**1,471,441**

*Equates to the extent of the flight path buffer

The percentage portion of these broad fauna habitat types in the assessment zone is presented in Figure 16.3.

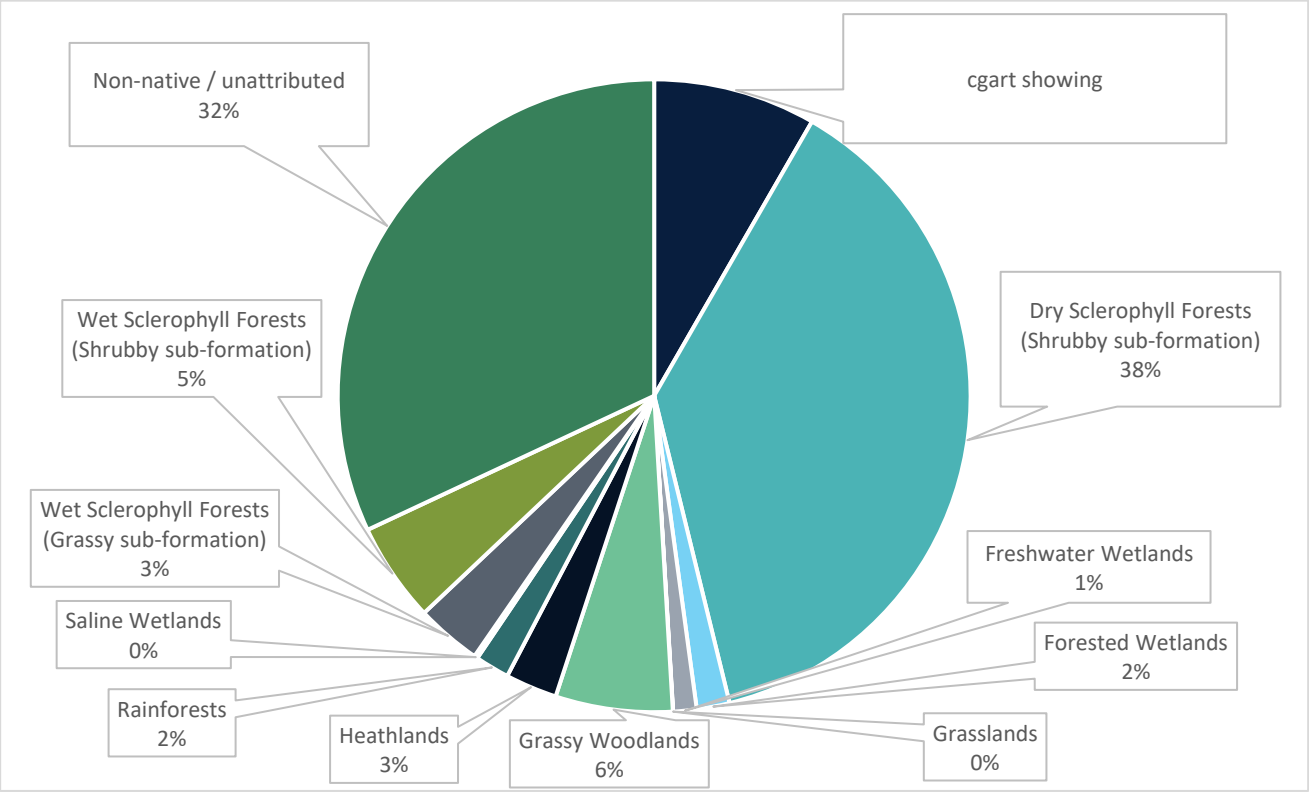


Figure 16.3 Percentage portion of broad fauna habitat types in the assessment zone

The dominant fauna habitat types mapped by NSW DPE (2022f) within the assessment zone include Dry Sclerophyll Forest (Shrub/grass sub-formation) followed by Non-native/unattributed disturbed areas each occupying approximately 557,000 ha (38 per cent) and 470,000 ha (32 per cent) respectively of the assessment zone. The Dry Sclerophyll Forest (Shrub/grass sub-formation) was predominantly located within the GBMA and the Non-native/unattributed disturbed areas were predominantly located in the wildlife buffer.

All other broad fauna habitat types typically equated to less than 10 per cent of the assessment zone, with 2 equating to between 0–0.2 per cent. These habitats are likely to provide a range of microhabitats for all fauna guilds including birds, reptiles, amphibians, fish, invertebrates and mammals.

16.5.2.3 Important habitats and breeding and foraging habitats

Important habitat

Important habitat maps have been developed by NSW DPE for a subset of threatened species which have habitat constraints essential to support critical life stages for the species, for example breeding areas or locations important for foraging/over-wintering of migratory species.

Of these maps, important habitat for the Regent Honeyeater, Swift Parrot and Migratory shorebird species exists and has been mapped across the proximity of the airport in Figure 16.4. The extent within the assessment zone and 2 of its components is provided in Table 16.7.

Table 16.6 Important habitat mapped within the assessment zone

Species	Extent within wildlife buffer (ha)	Extent within flying-fox camps and buffers (ha)	Extent within noise contours (ha)	Extent within assessment zone (ha)*
Regent Honeyeater	149	–	149	8,496.01
Swift Parrot	3,269	92	2,672	15,495.43
Migratory Shorebirds	–	–	–	13,145

*Equates to the extent of the flight path buffer

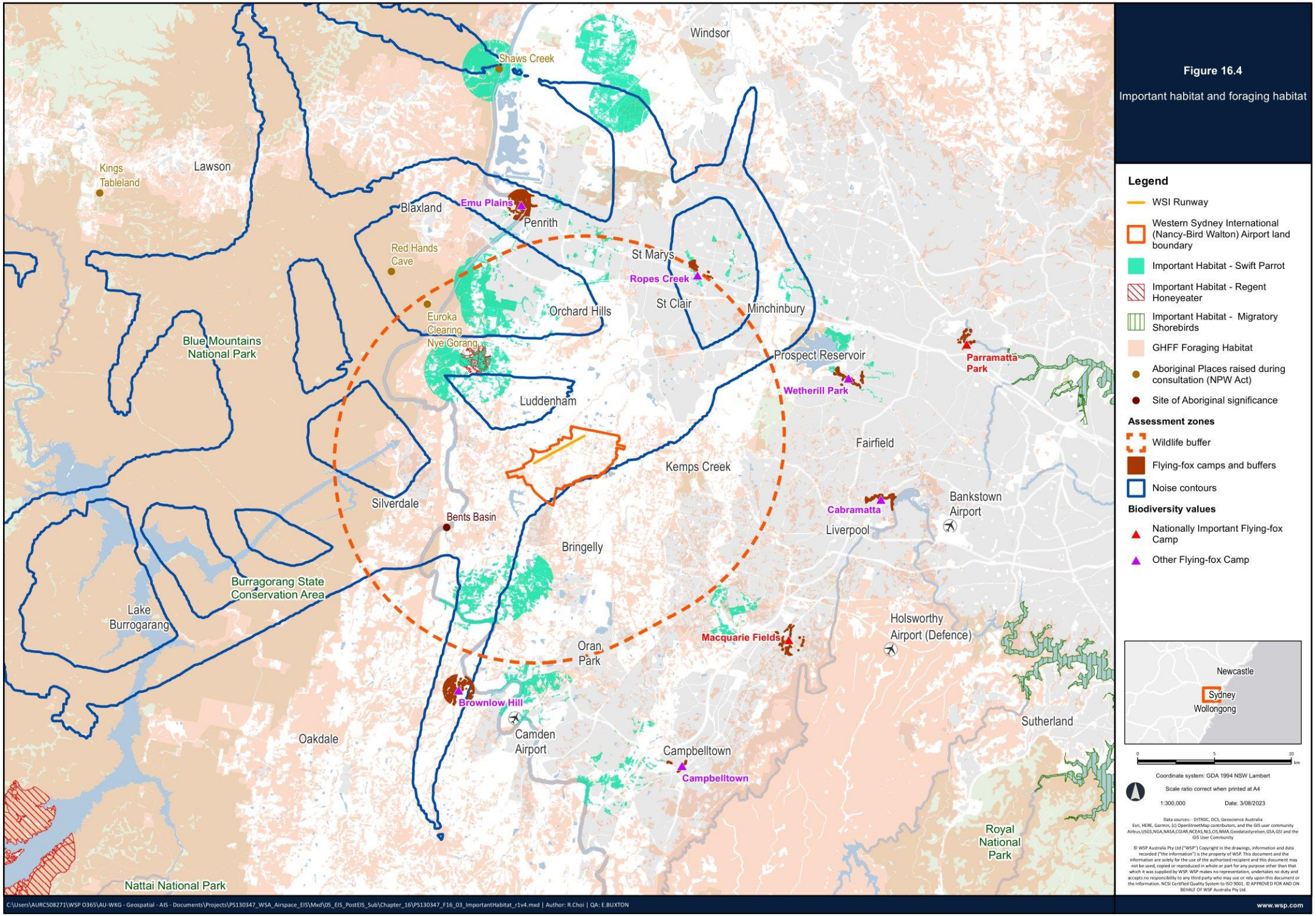
Breeding and foraging habitat

There are 8 flying-fox camps included in the flying-fox camps and buffers as shown in Figure 16.4.

As of October 2022, 6 of the 8 flying-fox camps monitored were active. Full details on the activity and numbers of individuals recorded within each monitored camp are provided in Technical paper 5. While individual species of flying-fox were not identified, according to the National flying-fox monitoring viewer (DCCEEW, 2022b), these particular camps contain, or did contain Grey-headed Flying-fox and Black Flying-fox (not threatened) co-occurring, and numbers and proportion fluctuate over time.

Two of the camps monitored (Parramatta Park and Macquarie Fields Flying-fox camps) are classified as nationally important camps (DCCEEW, 2022b). These are defined as camps containing ‘greater than 10,000 Grey-headed Flying-foxes in more than a single year in the last 10 years or being occupied by more than 2,500 Grey-headed Flying-foxes permanently or seasonally every year for at least 10 years’ (Department of the Environment, 2015). These 2 camps occur outside the wildlife buffer.

Approximately 872,651 ha of Grey-headed Flying-fox foraging habitat has been mapped as occurring within the assessment zone, of which 46,434 ha occurs within the wildlife buffer, 232 ha occurs within the flying-fox camps and buffers and 68,540 ha has been mapped within the noise contours (NSW DPE, 2011).


Windsor
Shaws Creek
Kings Tableland
Lawson
Blaxland
Emu Plains
Penrith
Red Hands Cave
St Marys
Ropes Creek
St Clair
Minchinbury
Orchard Hills
Euroka Clearing
Nye Gorang
Blue Mountains National Park
Prospect Reservoir
Parramatta Park
Wetherill Park
Luddenham
Fairfield
Kemps Creek
Silverdale
Bents Basin
Cabramatta
Bankstown Airport
Liverpool
Bringelly
Burragorang State Conservation Area
Lake Burrogarang
Holsworthy Airport (Defence)
Macquarie Fields
Oran Park
Brownlow Hill
Sutherland
Oakdale
Camden Airport
Campbelltown
Campbelltown
Royal National Park
Nattai National Park
Figure 16.4
Important habitat and foraging habitat
Legend
WSI Runway
Western Sydney International (Nancy-Bird Walton) Airport land boundary
Important Habitat - Swift Parrot
Important Habitat - Regent Honeyeater
Important Habitat - Migratory Shorebirds
GHFF Foraging Habitat
Aboriginal Places raised during consultation (NPW Act)
Site of Aboriginal significance
Assessment zones
Wildlife buffer
Flying-fox camps and buffers
Noise contours
Biodiversity values
Nationally Important Flying-fox Camp
Other Flying-fox Camp
Newcastle
Sydney
Wollongong
0
5
10
km
Coordinate system: GDA 1994 NSW Lambert
Scale ratio correct when printed at A4
1:300,000
Date: 3/08/2023
Data sources: - DITRDC, DCS, Geoscience Australia
Esri, HERE, Garmin, (c) OpenStreetMap contributors, and the GIS user community
Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community
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16.5.2.4 Wetlands

Approximately 5,436 ha of coastal wetlands protected under the Resilience and Hazards SEPP occurs within the assessment zone, mapped as SEPP Coastal Wetlands (refer to Figure 16.5). Of this total, 3.70 ha occurs within the wildlife buffer, 7.15 ha occurs within the flying-fox camps and buffers and none occurs within the noise contours. These areas are likely to provide suitable roosting and foraging habitat for many MNES threatened and Migratory fauna species. No direct impacts to these areas would occur.

The PMST search (refer to Section 16.3.3.1) did not identify any Ramsar wetlands included on the List of Wetlands of International Importance developed under the Ramsar Convention as having potential to occur within or in proximity to the wildlife buffer. The closest Ramsar wetlands are the Towra Point Estuarine Wetlands, located 45 km to the east of the airport runway, and at which point WSI aircraft would be in excess of 10,000 ft (3 km). These Ramsar wetlands are also directly across Botany Bay from Sydney (Kingsford Smith) Airport, whose operation is likely to affect the wetlands and associated species to a much greater degree than the operation of WSI (refer to Chapter 23 (Matters of National Environmental Significance)).

A wetland may be considered nationally important if it meets criteria agreed to by the ANZECC Wetlands Network in 1994, including being a wetland which plays an important ecological or hydrological role in the natural functioning of a major wetland system/complex (DAWE, 2021). These important wetlands are primarily located outside of the wildlife buffer and in the coastal regions of the assessment zone (refer to Figure 16.5 and Figure 5.2 of Technical paper 8).

16.5.2.5 Local and regional wildlife corridors

Wildlife corridors can be defined as ‘retained and/or restored systems of (linear) habitat which, at a minimum enhances connectivity of wildlife populations and may help them overcome the main consequences of habitat fragmentation’ (Wilson and Lindenmayer, 1995). Corridors can provide a range of ecological functions such as providing increased foraging areas for wide-ranging species, providing refuge from disturbances such as fire and reducing genetic isolation.

The functionality of wildlife corridors for different fauna (that is, the degree to which a corridor fulfils the abovementioned roles) will depend on a range of factors including dispersal behaviour, mode of movement (for example, flying, crawling, hopping, etc.), predation risk, and how these interact with landscape attributes (for example topography, vegetation cover and density) (Recher et al., 1987). In most cases this will differ between species, so that not all corridors will function equally well for all species. Inter-specific interactions, such as competition and/or predation, can also affect corridor function differently in different species (Catteral et al., 1991).

The wildlife buffer occurs within a generally open, highly degraded landscape comprised of agricultural pastures as well as land occupied by residential and urban development which is intersected by occasional patches of moderately to highly disturbed vegetation. The exception to this is along the western boundary of the wildlife buffer which intersects with the Great Dividing Range (along which the GBMA exists). This forms part of a large remnant tract of high condition vegetation that creates a large wildlife corridor providing connectivity with other remnants along the east coast and into central parts of NSW.

Key local and regional wildlife corridors which occur across the study area (refer to Figure 16.6) include:

- Biodiversity Investment Map (BIO Map) Cumberland Subregion Regional Corridors
- Cumberland Plain Priority Conservation Lands (Priority Conservation Lands).

Approximately 40,289 ha of BIO Map Cumberland Subregion Regional Corridors and 25,515 ha of Priority Conservation Lands occur within the assessment zone. These considerable areas are largely confined to linear areas of riparian remnant vegetation that intersect a landscape which is otherwise cleared and fragmented. Other patches of remnant vegetation within these corridors of the assessment zone include the large parcel at Defence Establishment Orchard Hills (refer to Section 16.5.2.6).

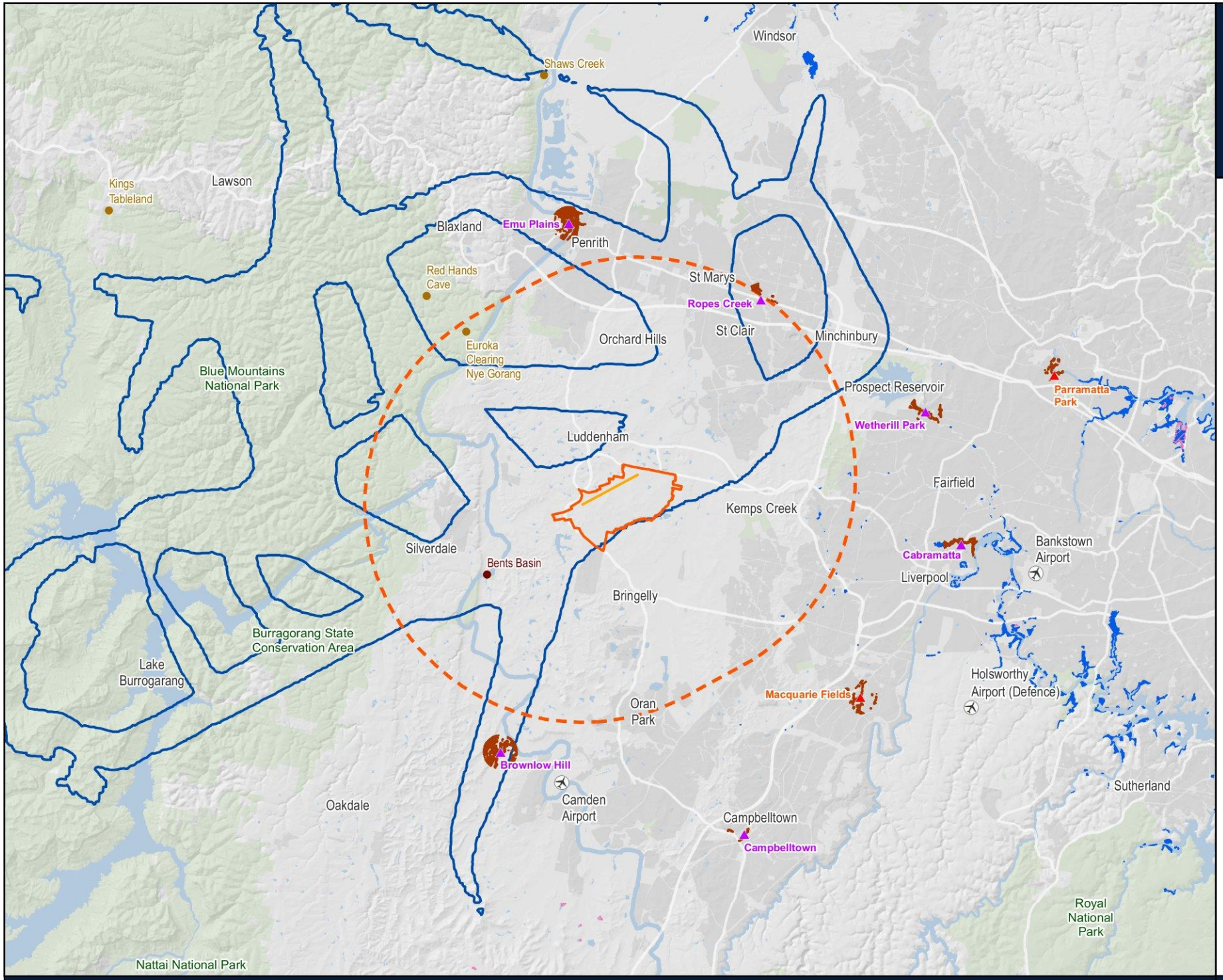

Figure 16.5

Wetland values

Legend

- WSI Runway
- Western Sydney International (Nancy-Bird Walton) Airport land boundary
- Important Wetlands
- SEPP Coastal Wetlands
- Aboriginal Places raised during consultation (NPW Act)
- Site of Aboriginal significance

Assessment zones

- Wildlife buffer
- Flying-fox camps and buffers
- Noise contours

Biodiversity values

- Nationally Important Flying-fox Camp
- Other Flying-fox Camp

Coordinate system: GDA 1994 NSW Lambert

Scale ratio correct when printed at A4

1:300,000 Date: 7/08/2023

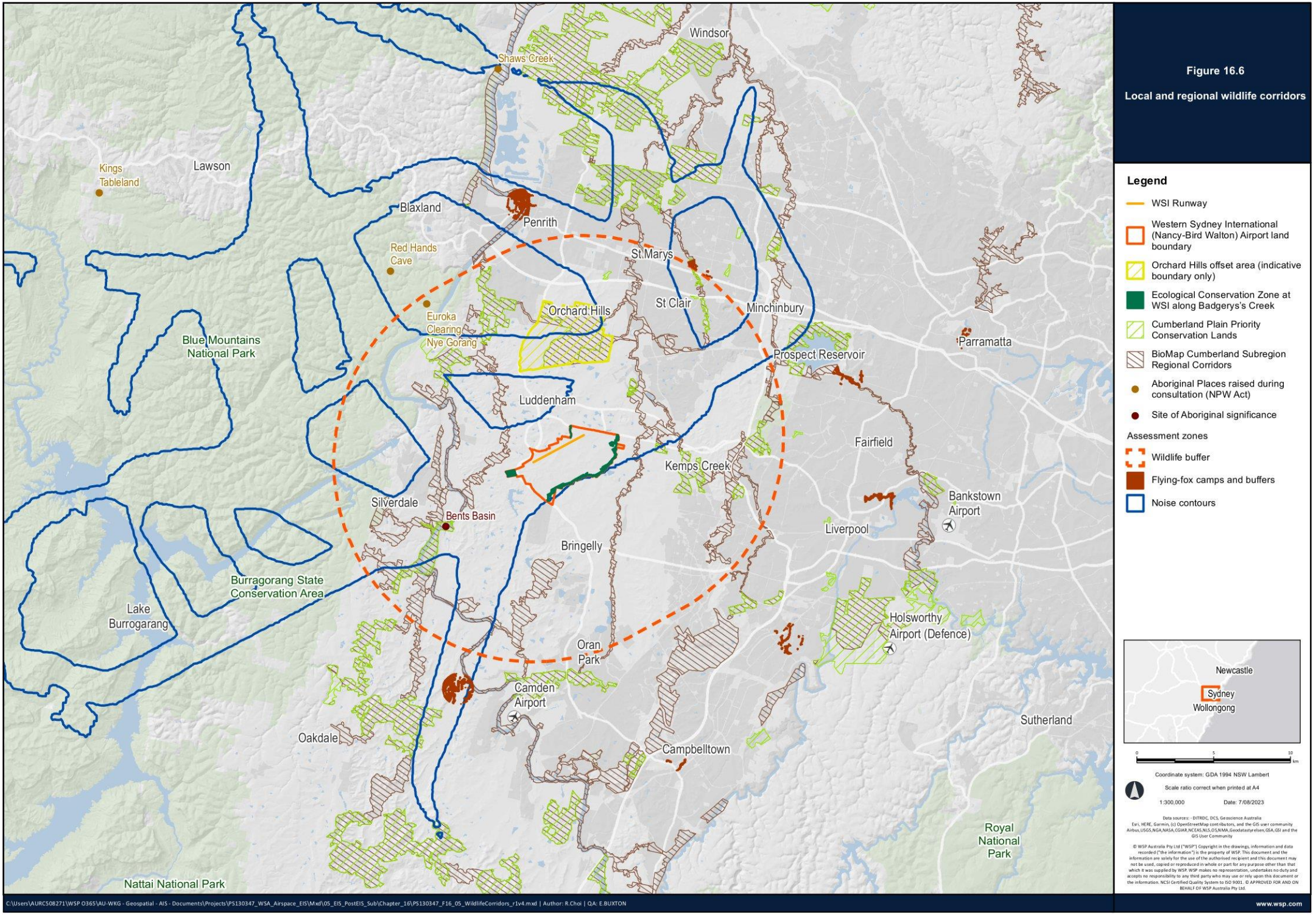

Figure 16.6

Local and regional wildlife corridors

Legend

- WSI Runway
- Western Sydney International (Nancy-Bird Walton) Airport land boundary
- Orchard Hills offset area (indicative boundary only)
- Ecological Conservation Zone at WSI along Badgerys's Creek
- Cumberland Plain Priority Conservation Lands
- BioMap Cumberland Subregion Regional Corridors
- Aboriginal Places raised during consultation (NPW Act)
- Site of Aboriginal significance

Assessment zones

- Wildlife buffer
- Flying-fox camps and buffers
- Noise contours

0 5 10 km

Coordinate system: GDA 1994 NSW Lambert

Scale ratio correct when printed at A4

1:300,000 Date: 7/08/2023

16.5.2.6 Conservation initiatives

Two conservation initiatives that occurred as part of the Stage 1 Development were:

- Environmental Conservation Zone (ECZ) – consisting of 117 ha of retained native vegetation around the perimeter of the Airport Site to mitigate potential impacts on habitat fragmentation. This area will remain undeveloped and managed for biodiversity conservation through the Land Use Plan detailed in the Airport Plan. The ECZ includes large areas of Cumberland Plain Woodland and riparian habitats.
- Biodiversity Offset Delivery Plan – this includes approximately 979 ha of land at the Defence Establishment Orchard Hills set aside as a biodiversity offset to compensate for the airport's residual impacts on biodiversity on the ground. The site is being managed by the Department of Defence under a Memorandum of Understanding and in accordance with the Orchard Hills Offset Area Offset Plan (GHD, 2022).

These conservation initiatives occur within the wildlife buffer and their areas form part of local and regional wildlife corridors and values, as captured in Section 16.5.2.5.

16.5.2.7 Wildlife attractants

Wildlife attractants identified as potential risk contributors for the project include all biodiversity values and other land uses with potential to provide suitable habitat within a 13 km buffer of the runway in accordance with the ICAO guidelines (the wildlife buffer). Within the wildlife buffer there were 58 sites identified as mapped in Appendix E of Technical paper 5, including permanent basins, ponds, non-native ecosystems, waste management facilities and Ropes Creek Flying-fox camp.

Technical paper 5 also identifies 15 additional sites (greater than 13 km up to 30 km of the runway) that act as wildlife attractants based on wildlife present and capacity of the species utilising these sites to travel more than the 13 km to access foraging and roosting/breeding habitat. Among these are 7 Flying-fox camps, 2 Ibis colonies and Prospect Reservoir.

16.5.3 Nationally listed threatened species and ecological communities

16.5.3.1 Threatened ecological communities

The PMST search identified 15 threatened ecological communities listed under the EPBC Act that are known or predicted to occur within the wildlife buffer. Of these, 10 are considered to have a moderate to high likelihood of occurring based on the broadscale vegetation mapping (NSW DPE, 2022f) and likelihood of occurrence assessment (refer to Table 5.4 of Technical paper 8).

The project would not have any direct impacts on any of these communities in the wildlife buffer as the project is limited to the above airspaces (that is, no vegetation or habitats would be removed) and indirect impacts would be negligible. As such, these threatened ecological communities have not been considered further in this report because none are considered candidate communities requiring further assessment.

A further 20 EPBC Act listed threatened ecological communities were predicted to occur across the remainder of the assessment zone. Impacts on threatened ecological communities within the remainder of the assessment zone are expected to be negligible due to their location in relation to the proposed flight paths and the altitudes at which aircraft would be. They were deemed to not require further assessment.

While the impacts to threatened ecological communities would be negligible, the assessment considers the impacts to fauna species (and their habitats).

16.5.3.2 Threatened fauna species

The database searches identified 92 threatened fauna species listed under the EPBC Act that are known or predicted to occur within the study area and wildlife buffer. Of these, 16 are considered to have a moderate to high likelihood of occurring or utilising the habitats available within the assessment zone and have been determined as candidate species requiring further assessment (refer to Table 16.7). An additional species, Red Knot, has been included as it has a high likelihood of occurring outside the wildlife buffer but within the assessment zone.

Table 16.7 Candidate EPBC Act listed threatened fauna species

Common name	Scientific name	EPBC Act Status	Likelihood of occurrence within assessment zone	Likelihood of occurrence within wildlife buffer
Alaskan Bar-tailed Godwit	*Limosa lapponica baueri*	Vulnerable	High	Moderate
Australian Painted Snipe	*Sternula nereis nereis*	Endangered	High	Moderate
Australasian Bittern	*Botaurus poiciloptilus*	Endangered	High	High
Curlew Sandpiper	*Calidiris ferruginea*	Critically Endangered	High	Moderate
Eastern Curlew	*Numenius madagascariensis*	Critically Endangered	High	Moderate
Eastern Hooded Plover	*Thinornis cucullatus cucullatus*	Vulnerable	High	Moderate
Gang Gang Cockatoo	*Callocephalon fimbriatum*	Endangered	High	Moderate
Greater Sand Plover	*Charadrius leschenaultii*	Vulnerable	High	Moderate
Great Knot	*Calidris tenuirostris*	Critically Endangered	High	Moderate
Grey-Headed Flying Fox	*Pteropus poliocephalus*	Vulnerable	High	High
Large-eared Pied Bat	*Chalinolobus dwyeri*	Vulnerable	High	High
Painted Honeyeater	*Grantiella picta*	Vulnerable	High	High
Red Knot	*Calidiris canutus*	Endangered	High	Low
Regent Honeyeater	*Anthochaera phrygia*	Critically Endangered	High	Moderate
South -eastern Glossy Black-Cockatoo	*Calyptorhynchus lathami lathami*	Vulnerable	High	Moderate
Swift Parrot	*Lathamus discolor*	Critically Endangered	High	Moderate
White -throated Needletail	*Hirundapus caudacutus*	Vulnerable	High	Moderate

A detailed description of these candidate threatened fauna species characteristics, and suitable and preferred habitat within the assessment zone under the EPBC Act is provided in Appendix B of Technical paper 8.

The preferred altitudinal range of select candidate species is provided in Section 16.5.4.

16.5.3.3 Threatened flora species

The database searches identified 46 threatened flora species listed under the EPBC Act that are known or predicted to occur within the wildlife buffer. Of these, 17 are considered to have a moderate to high likelihood of occurring and utilising habitats available (refer to Appendix B of Technical paper 8). Although these species are likely to occur within the wildlife buffer, none are considered candidate species requiring further assessment due to similar reasons to threatened ecological communities being excluded (refer to Section 16.5.3.1).

16.5.3.4 Migratory species

The desktop assessment identified 79 migratory species listed under the EPBC Act that are known or predicted to occur within the study area and wildlife buffer. Of these, 28 are considered to have a moderate to high likelihood of occurring or utilising the habitats available within the assessment zone and have been determined as candidate species requiring further assessment (refer to Table 16.8). An additional species, Red Knot, has been included as it has a high likelihood of occurring outside the wildlife buffer but within the study area.

Table 16.8 Candidate EPBC Act listed migratory species

Common name	Scientific name	EPBC Act status	Likelihood of occurrence in assessment zone	Likelihood of occurrence in wildlife buffer
Bar-tailed Godwit	*Limosa lapponica*	Migratory	High	Moderate
Black-faced Monarch	*Monarcha melanopsis*	Migratory	High	Moderate
Black-tailed Godwit	*Limosa limosa*	Migratory	High	Moderate
Caspian Tern	*Hydroprogne caspia*	Migratory	High	Moderate
Common Greenshank	*Tringa nebularia*	Migratory	High	Moderate
Common Sandpiper	*Actitis hypoleucos*	Migratory	High	Moderate
Curlew Sandpiper	*Calidiris ferruginea*	Migratory	High	Moderate
Double Banded Plover	*Charadrius bicinctus*	Migratory	High	Moderate
Eastern Curlew	*Numenius madagascariensis*	Migratory	High	Moderate
Fork-tailed Swift	*Apus pacificus*	Migratory	High	Moderate
Glossy Ibis	*Plegadis falcinellus*	Migratory	High	High
Great Knot	*Calidris tenuirostris*	Migratory	High	Moderate
Greater Sand Plover	*Charadrius leschenaultii*	Migratory	High	Moderate
Grey-tailed Tattler	*Tringa brevipes*	Migratory	High	Moderate
Gull-billed Tern	*Gelochelidon nilotica*	Migratory	High	Moderate
Lathams Snipe	*Gallinago hardwickii*	Migratory	High	Moderate
Little Curlew	*Numenius minutus*	Migratory	High	Moderate
Marsh Sandpiper	*Tringa stagnatilis*	Migratory	High	Moderate
Oriental Plover	*Charadrius veredus*	Migratory	High	Moderate

Common name	Scientific name	EPBC Act status	Likelihood of occurrence in assessment zone	Likelihood of occurrence in wildlife buffer
Osprey	*Pandion haliaetus*	Migratory	High	High
Pacific Golden Plover	*Pluvialis fulva*	Migratory	High	Moderate
Pectoral Sandpiper	*Calidiris melanotos*	Migratory	High	Moderate
Red Knot	*Calidiris canutus*	Migratory	High	Low
Red-necked Stint	*Calidiris ruficollis*	Migratory	High	Moderate
Rufous Fantail	*Rhipidura rufifrons*	Migratory	High	High
Satin Flycatcher	*Myiagra cyanoleuca*	Migratory	High	Moderate
Sharp-tailed Sandpiper	*Calidiris acuminata*	Migratory	High	High
White-throated Needletail	*Hirundapus caudacutus*	Migratory	High	Moderate
Wood Sandpiper	*Tringa glareola*	Migratory	High	Moderate

A detailed description of these candidate migratory species characteristics, suitable and preferred habitat within the assessment zone under the EPBC Act is provided in Appendix B of Technical paper 8.

The preferred altitudinal range of select migratory species is provided in Section 16.5.4.

16.5.4 Altitudinal range of fauna species

Chapter 7 (The project) presents the flight path figures which depict the altitude ranges of each WSI flight path during the day and night. The altitude range was used to determine species with potential to be impacted by wildlife strike within and outside of the wildlife buffer.

The aircraft altitudinal ranges can be categorised as:

- 0 to 1,000 ft (0 to 300 m) AGL: take-off and wheels up (96 per cent of flying-fox strikes recorded at or below 1,000 ft (300 m) AGL (Parsons et al. 2008))
- >1,000 to 3,500 ft AGL (>300 to 1 km): initial ascent (3,500 ft (1 km) AGL is the height at which 93 per cent of strikes occur at or below (Dolbeer, 2011)) – species could include Fork-tailed Swift
- >3,500 to 10,000 ft (> 1 km to 3 km) AGL: final ascent to cruising altitude – thermalling species such as Australian Pelican and Wedge-tailed Eagle
- >10,000 to 20,000 ft (>3 km to 6 km) AGL: cruising and maximum altitude.

The altitude figures show that aircraft take off and ascend relatively quickly in the scale of the assessment zone and that aircraft take-off and ascend primarily within the wildlife buffer and the immediately adjoining environs.

16.6 Assessment of impacts

16.6.1 Direct impacts

Direct impacts of the project are limited to wildlife strike on biodiversity values as summarised in Table 16.9 and described in Section 16.3.3.5. This impact is discussed in this section and detailed in Technical paper 5.

Table 16.9 Impact summary – direct

Impact	Nature	Term of impact	Extent of impact	Likelihood	Impact severity	Impact rating
Wildlife strike	Direct – intermittent	Ongoing	Known, unpredictable/ irreversible	Possible	Minor	Low/not significant

16.6.1.1 Overview

Wildlife strike potential and risk are directly linked to the habitat values present within the vicinity of the WSI which would attract species to the location, such as for roosting and foraging opportunities (refer to Section 16.5.2.7). Within the wildlife buffer, these would include several waterbodies and the Elizabeth Drive Resource Recovery Facility (approximately 2 km to the north-east of the runway). In the future, the Western Sydney Aerotropolis would also increase tree canopy cover to 40 per cent, enhance riparian zones and wetlands and generally increase biodiversity values across the area which will further attract wildlife.

Technical paper 5 identified that the species with the highest overall risk of being impacted by wildlife strike are common (not listed under the EPBC Act) mammal and bird species such as Eastern Grey Kangaroos and waterfowl. The report does however identify one threatened (Grey-headed Flying-fox) and one Migratory (Glossy Ibis) species as having potential to be affected. Additional threatened and migratory species considered to have a moderate to high likelihood of occurrence are summarised in Section 16.5.3.2 and Section 16.5.3.4.

Flying-foxes

As a group, Flying-foxes are particularly susceptible to wildlife strike due to their large body mass and their tendency to fly out from camps in large groups which increases the risk of multi-strike events. The highest risk for flying-foxes is being struck when enroute to and from foraging and roosting sites within the locality of WSI.

Around 96 per cent of flying-fox collisions occur below 1,000 ft AGL (300 m) , with most strikes occurring below 500 ft AGL (150 m) (Parsons et al. 2008). Further, flying-foxes were reported as being the most struck fauna species group at Australian airports between 2008 and 2017 (1,240 strikes nationally) (ATSB, 2019). This indicates that these species have a higher risk of wildlife strike within the flight paths of airports.

As of October 2022, airside (on-airport) surveys conducted for Technical paper 5 recorded no flying-foxes using WSI airspace as part of the 4 field survey sessions completed (in July, August, September and October 2022). These surveys were completed during early morning, middle of the day, late afternoon, and post-dusk over a single day at 15 survey points within the Airport Site.

However, survey limitations (4 surveys over 4 months using human observation from static locations) mean the use of WSI airspace by flying foxes cannot be excluded as flying-foxes (likely comprised of Grey-headed Flying-fox and other non-threatened flying-foxes) were observed in the fly-out surveys (off-airport) from the flying fox camps and buffers. Due to this, existing available information relating to impacts to flying-foxes from other airports in the Sydney Basin have been used to assess the impacts of the project on these species.

The impacts of the project on the flying-fox behaviour, reproduction and nutritional status and the overall population is difficult to predict without long term baseline studies of movement and foraging ecology. Past strike data from Sydney (Kingsford Smith) Airport and Bankstown Airport, which are surrounded by similar foraging and roosting habitats, can be used to provide an indication of future WSI wildlife strike impacts.

Technical paper 5 details that over the past 5 years around 75 flying-foxes (including an estimated 13 Grey-headed Flying-foxes listed as Vulnerable under the EPBC Act) have been struck by aircraft arriving and departing from the Sydney (Kingsford Smith) Airport. This averages out to around 15 flying-foxes (including 2–3 Grey-headed Flying-fox) strikes a year. Comparatively, at Bankstown Airport 2 flying-foxes have been recorded as being struck over the past 5 years, and none of these were identified as Grey-headed Flying-foxes. There is high potential that additional Grey-headed Flying-fox strike at Sydney (Kingsford Smith) Airport occurs amongst the data for unidentified flying foxes, however the overall strike rate is still relatively low compared to overall populations of flying-foxes in these areas.

Aircraft wildlife strike typically results in the mortality of a flying-fox. For species that disperse in flocks, such as the Grey-headed Flying-fox, there is the rare occasion when more than one individual may be hit. Based on past strike data however it has been observed that these events are still limited to only a couple of individuals being hit.

The limited use of WSI airspace by flying-foxes observed to date and the low mortality rate of the species at other Sydney based airports indicate that while wildlife strike impacts are likely to be possible, the impact would be low/ not significant.

Ibis species

Ibis species include the Straw-necked Ibis, Australian White Ibis and the Glossy Ibis, the latter of which is listed as a migratory species under the EPBC Act and assessed under Section 16.7.1.

As with Flying-foxes, Ibis species are particularly susceptible to wildlife strike due to their large body mass, their tendency to fly out from areas of suitable habitat in large groups and suitable habitat being in aircraft movement areas. These areas include the key foraging and roosting sites for Australian White Ibis within the locality of the WSI runway (refer to Section 16.5.2.7).

Technical paper 5 identified the Australian White Ibis and Straw-necked Ibis as having a high risk of wildlife strike as surveys conducted for that paper recorded high numbers of Australian White Ibis and Straw-necked Ibis transitioning through the WSI airspace representing the 2 most observed species during the diurnal (day-time) airside (on-airport) surveys.

These Ibis species have historically been recorded to be less susceptible to aircraft strike than Flying-foxes (ATSB, 2019). The low mortality rate at other Sydney based airports indicate that while wildlife strike impacts to these species are likely to be possible, the impact would low/not significant.

Additional species

While some other native or introduced species are likely to be struck on occasion by aircraft (for example, Eastern Grey Kangaroo, microchiropteran bats, waterfowl or raptors), these impacts would be minimised by implementing the recommended mitigation measures proposed in Technical paper 5. Land use controls and requirements have also been set in the SEPP Western Sydney Parklands and associated DCP for the Aerotropolis, which would assist in managing the risk of wildlife strike (refer to Section 16.8).

Wildlife strikes above 3,500 ft AGL (1 km) can occur with thermalling species such as Australian Pelican and Wedge-tailed Eagle, however according to Technical paper 5 the frequency of high-altitude strikes is comparatively low. It is estimated that approximately 7 per cent of wildlife strikes occur above this altitude (Dolbeer, 2011). This suggests that wildlife strike would be largely limited to the wildlife buffer however it is possible that it may occasionally occur to thermalling species within the greater assessment zone. This impact, however, would be low.

Impacts are unlikely to be of a magnitude that would threaten the viability of local populations of any species.

16.6.2 Indirect impacts

Indirect impacts are summarised in Table 16.10 most impacts associated with the project would be minor or negligible in severity.

Table 16.10 Impact summary – indirect

Impact	Nature	Term of impact	Extent of impact	Likelihood	Impact severity	Impact rating
Noise	Indirect – intermittent/ continuous	Ongoing	Known – nocturnal and diurnal periods	Possible	Minor	Low/ not significant
Light spill and pollution	Indirect – intermittent	Ongoing	Known – limited to nocturnal hours only	Possible	Negligible	Negligible/ not significant
Air quality	Indirect – intermittent/ continuous	Ongoing	Known – nocturnal and diurnal periods	Possible	Negligible	Negligible/ not significant
Water quality	Indirect – intermittent/ continuous	Ongoing	Known – nocturnal and diurnal periods	Possible	Negligible	Negligible/ not significant
Fuel jettisoning	Indirect – intermittent/ rare	Temporary	Unpredictable however scarce in occurrence (limited to emergency situations) and localised	Unlikely	Negligible	Negligible/ not significant

16.6.2.1 Aircraft noise

Alterations to existing noise levels would occur during the operation of the project's flight paths. The nature of noise and potential noise impacts on the environment are described in Chapter 11 (Aircraft noise) as supported by Technical paper 1. A literature review of the effects of noise impacts on wildlife is provided in Section 16.3.3.5, expanded on in this section and detailed by Technical paper 5.

Key impacts of noise on wildlife that have been observed include (Ecosure, 2021):

- behavioural changes such as avoidance of areas affected by noise
- communication interference such as hindering of signals
- physiological impacts such as elevated levels of stress hormones that may affect breeding
- hearing loss.

Existing ambient noise levels within vicinity of the Airport Site would be influenced by surrounding land uses including roads, agriculture and other aircraft operating in the airspace within the locality (refer to Chapter 11 (Aircraft noise)). As such, the biodiversity values in the region are already subject to current low to moderate levels of ambient anthropogenic noise. Literature suggests that some species are susceptible to disturbance from noise and will become habituated to the change over time while others less tolerant may be displaced as a result of the constant aircraft noise (refer to Section 7.4.1 of Technical paper 5). It is likely that species present have already become habituated to current levels of aircraft noise and some species may have already relocated into adjacent habitat due to vegetation clearing associated with Stage 1 Development.

WSI would operate 24-hours a day, 7 days a week. It therefore has potential to impact both diurnal and nocturnal species. Noise would be generated by aircraft arriving and taking-off, ascending and cruising at various altitudes along the WSI flight paths. The periods of noise are also highly predictable, with a sudden peak when aircraft arrive and depart (Mato and Mufuruki, 1999). Research by Pepper et al. (2003) indicates that the most important consideration with regard to aircraft noise and wildlife is proximity to the airport (where the highest noise impacts are) and frequency of overflights.

Wildlife previously exposed to noise may be less affected than those who have not, and the time it takes for wildlife to adapt to noise is species-specific. Therefore, species considered most likely to be impacted by the project's aircraft noise would be those that occur or utilise habitats in proximity to the Airport Site and those less tolerant of changes to noise.

Most of the habitats within the locality of the airport have been heavily modified and fragmented. Most of the remnant vegetation that remains occur as linear patches of vegetation along riparian areas that form corridors to adjoining larger remnants. The exception to this is to the west where the subject site encroaches on the GBMA. Given this, the key biodiversity values likely to be affected by aircraft noise include but are not limited to:

- Wildlife corridors – noise from the project would not cause significant indirect impacts to wildlife corridors. The value of these habitats would remain, and the wildlife corridors would continue to function so that fauna species are able to disperse between remnants throughout the region.
- Orchard Hills Offset Area would be directly overflown at an altitude of approximately 3,500 to 5,000 ft (1–1.5 km) AGL, experiencing noise levels of around 70–80 dB(A) (the sound of a washing machine or the sound of a hair dryer respectively) in a single event. The overflight will only occur during nocturnal hours when Runway 05 is in operation. The impact from noise would have minor impacts on species that utilise habitats within this area because these species are likely to adapt to changes in noise levels given the site is already located in an area subject to aircraft overflight and is surrounded by highly disturbed areas with poorer habitat.
- Important habitat for Regent Honeyeater and Swift Parrot (refer to Table 16.6) – although there is no research on the impacts of noise on these species, these types of birds (blossom specialists) may be impacted by aircraft noise (refer to literature in Technical paper 8). Despite impacts being possible, impacts would be low as both species have been recorded using modified habitats within urban areas subject to anthropogenic noise and no habitat would be directly removed by the project. Aircraft would be too high (typically be above 1,500 ft (0.5 km) AGL for the Swift Parrot and above 8,000 ft (2.4 km) AGL for the Regent Honeyeater) at locations where flight paths intersect areas of mapped important habitat for these species to affect them. At this altitude the noise level would equate to approximately 60–80 dB(A) (the noise of a normal conversation at 1 m or the sound of a hair dryer respectively) but in a single event rather than as a constant change.
- Flying-fox camps and foraging resources – these species are likely to show resistance to noise disturbance as they have adapted well to urban environments (Coffey, 2014). Aircraft would typically fly at altitudes of greater than 3,000 ft (0.9 km) AGL equating to approximately 70 dB(A) (the sound of a washing machine) in a single event over flying-fox camps. Although noise may have minor impacts on the species, they are considered likely to continue using foraging habitats present within the locality (refer to Section 16.5.2.3) based on their presence in proximity to other airports throughout the Sydney Basin and tolerance of urban environments.
- Protected wetland habitats – these habitats occur surrounding heavily populated areas which would be subject to substantial existing anthropogenic noise levels. Further, most flight paths do not pass over these areas except for those which typically exceed 8,000 ft (2.4 km) AGL equating to approximately 60 dB(A) (normal conversation at 1 m) in single-event – where noise levels are unlikely to impact fauna within these habitats.
- Suitable habitat for numerous native animal species including urban adapted species (for example Australian Magpie), waterfowl species, and raptors (for example White-bellied Sea-eagle) – noise from the project would have minor impacts on habitats that support urban adapted species and waterfowl as these species have demonstrated their ability to adapt to changes in noise levels. This is supported by Pepper et al. 2003, who collated literature which identified waterfowl spent less than 1.4 per cent of their time responding to aircraft.
- Raptors such as White-bellied Sea-eagle and Little Eagle may abandon nest sites near the airport and relocate and breed in neighbouring areas. These impacts are likely to be localised and concentrated to areas immediately adjacent the Airport Site based on research by Pepper et al. (2003) which found that raptors have been shown to be non-responsive to aircraft when greater than 500 m away.

- Commonwealth Heritage Places - the Orchard Hills Cumberland Plain Woodland and Shale Woodland Llandilo Commonwealth Heritage Places occur within the flight path buffers of the project. Potential noise Impacts on the Orchard Hills Cumberland Plain Woodland would be consistent with those described above for the Orchard Hills Offset Area. The Shale Woodland Llandilo Commonwealth Heritage Place is located outside the wildlife buffer but within the flight path buffer and will be directly overflown at an altitude of approximately 7,000 to 8,000 ft (2.1 km to 2.4 km) AGL, experiencing noise levels of around 60 dB(A) in a single event (or a normal conversation at 1 m). No direct impacts would occur on the vegetation and associated habitats present and therefore wildlife connectivity values of the site would remain and continue to function. Similar to the Orchard Hills Offset Area, species present are likely to adapt to changes in noise levels and continue using habitats present given the site is already located in an area subject to existing flight paths and is surrounded by highly disturbed areas with poorer habitat. Given this, impacts are likely to be low on Commonwealth Heritage Places.

This assessment is detailed in Section 7.4.1 of Technical paper 8.

Literature suggests that fauna species are likely to show varying responses to these impacts between species and individuals within populations (refer to Section 16.3.4). The noise generated by the aircraft may affect less-tolerant species which may relocate or be disrupted in response to the operation of the WSI. More noise tolerant species may also be initially affected by increases in noise however are likely to become habituated over time and continue to use habitats within the assessment zones. The predicted noise levels are unlikely to result in changes at magnitudes that would threaten the viability of local populations of any species. Further assessment of impacts on these MNES and the environment is provided in the SIAs (Appendix C of Technical paper 8).

16.6.2.2 Light spill and pollution

Natural light conditions act as a stimulus that influence the behaviour and physiology of organisms (Blackwell et al. 2015). Artificial light, including sources associated with the project such as aircraft light, can have adverse impacts on wildlife. The key impacts associated with light spill are behavioural changes that may be critical for a species life cycle for example migration or breeding. Physiological changes such as delays in reproduction or feeding patterns may occur in response to changes in light levels (DEE, 2020; Ecosure, 2021). These changes can lead to some species being more vulnerable to predation, wildlife strike via disorientation or other disturbances.

Light from the project would be limited to lights on aircraft as they travel along the flight paths outside daylight hours. Technical paper 7 concluded that the magnitude of visual impacts at night (including light spill) would be experienced across a small portion of the urban area and would not contrast substantially with the surrounding landscape at night, resulting in a low magnitude of change. Nocturnal species such as possums and bats may avoid the habitat in the wildlife buffer during these periods. The severity of this impact would be negligible given the high level of light pollution already present in the locality and surrounds which has likely led to biodiversity being somewhat habituated to periodic light disturbance from human activity. Formal research is yet to confirm light impacts on blossom specialists (including the Grey-headed Flying-fox), however based on their predicted behavioural response to artificial light and their ability to camp in areas drenched in artificial light the species is considered to be a light tolerant species (DAWE, 2021).

Within the intrinsically dark landscapes, aircraft may be viewed occasionally from these locations as a series of small moving lights in the sky. For example, Murphys Glen campground (a location within the GBMA) would be overflown by one arrival flight path, including up to about 6 and 27 flights per night in total in 2033 and 2055 respectively. Aircraft along this flight path are likely to be at higher altitudes. Fauna in these areas would currently experience minimal existing light and could be sensitive to changes in light. However, noting the potential level of impact (i.e. a series of small moving lights in the sky), the severity of change and impact has been assessed as being negligible in response to the project.

In summary, even though there may be a slight increase in light in the sky in these intrinsically dark landscapes, biodiversity is unlikely to be significantly affected by the project's operational light impacts.

16.6.2.3 Air quality

Aircraft operating along the flight paths would produce emissions that could result in local and regional reductions in air quality. The most critical aircraft emission pollutants include oxides of nitrogen (NO_x) due to the transformation into nitrogen dioxide (NO_2) and ozone (O_3), and $PM_{2.5}$.

In terms of local air quality, Technical paper 2 found that elevated NO_2 levels are predicted to occur in 2055 and elevated levels would primarily occur to the north-west of the Airport Site aligning with the runway. The assessment however uses conservative assumptions, and actual NO_2 impacts are unlikely to be significant. The project's impact on the concentrations of all other assessed pollutants would be negligible (noting there are exceedances for $PM_{2.5}$ but these have no tangible impact). As it is likely there will be improvements in fuel efficiency (for aircraft and motor vehicles) and decreases in aircraft emissions in the future, no significant impacts on air quality are anticipated to arise.

Technical paper 2 found the regional air quality results aligned with those of local air quality for NO_2 in 2055 with any discernible increases NO_2 generally limited to a radius of approximately 5–6 kilometres of the airport (primarily attributable to aircraft near or at ground level, during take-off and landing). For all other pollutants the impact of emissions from the project on the existing pollutant concentrations would be negligible and would be unlikely to be discernible above background concentrations.

The results also indicate that in the locations with the maximum ozone concentrations, the project makes no significant difference to the impact that would arise in any case without the project in 2055.

Habitats for wildlife in proximity to the Airport Site are already highly disturbed and likely to be subject to similar emission types associated with urban development and other aircraft. Any alterations to air quality would be temporary, localised and unlikely to impact biodiversity values. Ecosystems in the region would not be directly impacted upon and impacts are unlikely to result in a long-term decline that would threaten the viability of any of these ecosystems.

16.6.2.4 Water quality

Aircraft pollutants are comprised of vapours, gases, and fine particles which are not expected to deposit to the ground. Despite this, there has been concerns raised relating to the deposition of these pollutants and the potential for them to impact on water quality and subsequently aquatic ecosystems including those contained within the Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place which provide habitat for disturbance-sensitive macroinvertebrate species such as stoneflies, leptophlebiid mayflies and pollution-sensitive caddisflies.

Technical paper 12 estimated the deposition rates of the key pollutants relevant to project and their potential impacts on water quality using a highly conservative approach. It identified that aircraft pollutants likely to be generated are dominated by PM2.5 which essentially act like a gas in the atmosphere with little or no deposition. Due to this, it is expected that the deposition of pollutants to the ground are highly unlikely to ever occur. Technical paper 12 identified that the project's potential impacts on water quality would be negligible and so low that they would not be measurable.

Based on the results of Technical paper 12, aquatic habitats within proximity to the Airport Site (such as those within the Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place) are considered to be negligible and unlikely to impact on aquatic biodiversity values.

16.6.2.5 Fuel jettisoning

Fuel jettisoning (also known as fuel dumping) is discussed in Chapter 13 (Aircraft hazard and risk) and Technical paper 4. This procedure may introduce harmful contaminants into the sensitive environments within the study area such as native terrestrial and aquatic ecosystems, if not appropriately managed. If required, fuel dumping can be carried out safely and without any impacts at ground level when appropriate procedures are followed. Fuel jettisoning would occur in accordance with the Manual of Air Traffic Services (MATS) – Section 4.2.11 Fuel Dumping (Airservices Australia, 2023). Given the strict regulations associated with its implementation and the high evaporation rate of the fuel at high altitudes potential impacts would be negligible and unlikely to have an immediate or future impact on biodiversity values identified in this assessment.

16.6.3 International agreements, recovery plans and threat abatement plans relating to biodiversity protection

16.6.3.1 International agreements

Australia has international obligations for EPBC listed fauna (refer to Section 16.2.1), including those under the Apia Convention and the CITES. Australia's obligations for EPBC migratory fauna are described in Section 16.6.4.

The Apia Convention safeguards the creation of protected areas, making a commitment not to alter national parks, maintain lists of indigenous flora and fauna in danger of extinction and provide these species with protection. The project is consistent with this agreement because:

- national parks in the study area, including those such as the Ku-ring-gai Chase National Park, Royal National Park and the various National Parks that make up the GBMA (refer to Figure 16.1) would not be significantly altered by the project. Refer to Section 16.5.2.1 and Chapter 23 (Matters of National Environmental Significance)
- relevant recovery and threat abatement plans for candidate species are aligned to the Apia Convention
- in accordance with the agreement, there are no known protected areas within the wildlife buffer which may lead to detrimental impacts on candidate species. Where a management plan is in place for these species, such as under the Wildlife Conservation Plan for Migratory Shorebirds (Commonwealth of Australia, 2015a), this would be aligned with the objectives of the Apia Convention
- the project is unlikely to result in any direct conflicts to any species conservation advice, and this advice is consistent with the Apia Convention.

16.6.3.2 CITES

CITES is an international agreement between governments that aims to ensure that the international trade in wildlife does not threaten wild populations of plants and animals. As the project does not involve international trade in wildlife and would not breach the CITES agreement signed by Australia in 1976, it has not been considered further in this assessment.

16.6.3.3 Recovery and threat abatement plans

Australia has National recovery plans (recovery plans) and threat abatement plans for the protection of certain species, made and adopted under the EPBC Act:

- recovery plans set out the research and management actions necessary to stop the decline of, and support the recovery of, listed threatened species or threatened ecological communities
- threat abatement plans provide for the research, management, and any other actions necessary to reduce the impact of a listed key threatening process on native species and ecological communities.

The assessment found that of the 17 candidate species, 6 were associated with either a recovery plan or threat abatement plan – the Australasian Bittern, Grey-headed Flying-fox, Painted Honeyeater, Regent Honeyeater, Swift Parrot and Large-eared Pied-Bat. The project is consistent with prescribed national recovery plans and threat abatement plans for candidate species because:

- the project would not conflict with the recovery actions outlined in the relevant national recovery plans
- the project would not lead to a change in the pre-existing distribution and density of any species covered by relevant threat abatement plans and therefore, would not be inconsistent with the management details outlined in the plans.

Full details are provided in Table 7.3 of Technical paper 8.

For the remaining species:

- there are no prescribed threat abatement plans and recovery plans are not relevant for the Alaskan Bar-tailed Godwit, Australian painted Snipe, Eastern Curlew, Gang-gang Cockatoo, Great Knot or Greater Sand Plover
- there are no prescribed threat abatement plans and a recovery plan is not required for the Curlew Sandpiper, Eastern Hooded Plover, Red Knot, and White-throated Needletail. There is deemed to be sufficient conservation advice to implement priority actions and mitigate against key threats
- for one species, the South-eastern Glossy Black-Cockatoo, a recovery plan is required, but has not yet been completed and/or published (as of 30 June 2023).

16.6.4 International agreements protecting migratory species

Australia's migratory bird agreements are listed in Section 16.2.1 and include the bilateral CAMBA, JAMBA and ROKAMBA. These agreements provide for the protection and conservation of migratory birds and their important habitats, protection from take or trade except under limited circumstances, the exchange of information, and building cooperative relationships. Details of the objectives of these agreements are provided in section 6.7 of Technical paper 8.

In addition to the bilateral migratory bird agreements, Australia has also agreed to the following multilateral agreements:

- Bonn Convention
- Ramsar Convention.

The East Asian - Australasian Flyway Partnership is a Ramsar Convention initiative which forms a voluntary collaboration of effort focusing on protecting migratory waterbirds, their habitat and the livelihoods of people dependent on them. Its objectives align with those objectives cited in the separate bilateral agreements (CAMBA, JAMBA, ROKAMBA, Bonn Convention and Ramsar Convention)

Section 7.6 of Technical paper 8 includes an assessment against the East Asian – Australasian Flyway Partnership and found the project does not raise inconsistencies with Australia's obligations under the migratory bird agreements when taking key objectives of this partnership into consideration.

16.6.5 Bushfire impacts

The 'Black Summer' bushfires of spring and summer 2019-2020 were catastrophic and unprecedented, having large impacts on the biodiversity within the GBMA (around 80 per cent burnt) and surrounds. Impacts of the fires were largely due to the drought, fire and shortage of food, shelter and water following the fire event (Smith, 2021).

The Department of Planning Industry and Environment (DPIE) (NSW DPIE, 2020) used fire extent and severity mapping to assess the status of ecological condition, carry capacity and persistence of ecosystems across NSW postfire compared to their initial assessment in 2013 as part of the NSW Biodiversity Outlook Report. The analysis identified that in fire affected areas:

- both ecological condition and ecological carrying capacity had decreased by 39 per cent since 2013 which reflects the immediate post-fire effects on vegetation condition. Regeneration and growth in subsequent years will be captured as part of future assessments by the NSW Government
- ecological persistence had decreased by 4 per cent since 2013 which reflects the loss of unique diversity which may increase in a post-fire environment.

According to the 2020 DPIE fire extent and severity mapping, approximately 2,184,952 ha of vegetation within the assessment zone was affected by the Black Summer bushfires in 2019-2020. Of this around 532,427 ha occurs within the GBMA.

Fauna species within areas subject to the 2019-2020 bushfires may have relocated or dispersed into similar neighbouring habitat within the wildlife and flying-fox buffers. As the bushfire affected areas recover and habitats regenerate these species would likely redisperse back into the burnt areas.

In considering the above and the nature of the project's impacts it is considered unlikely that the project would compound impacts on biodiversity associated with the 2019-2020 bushfires. As there would be no direct on-ground impacts, direct impacts would largely be limited to occasional wildlife strike and indirect impacts would be negligible to low, it is unlikely that the project would affect immediate or long-term post-fire recovery within these areas.

16.7 Significant impact assessments

In accordance with Significant impact guidelines 1.1, SIAs were completed for all biodiversity MNES known to occur or considered to have a moderate or higher likelihood of occurring in the assessment zone and to be impacted upon by the project as described in Section 16.3.3.2. A SIA was also completed for impacts on the whole of the environment, specifically biodiversity (plants and animals) in accordance with Significant impact guidelines 1.2.

The outcomes of the SIAs are summarised below and provided in full in Appendix C of Technical paper 8.

16.7.1 Threatened and migratory species

The SIAs completed for the 41 threatened and migratory candidate species (13 threatened, 24 migratory, 4 both threatened and migratory) concluded that the project is unlikely to have a significant impact on threatened or migratory species listed under the EPBC Act as:

- direct impacts would be restricted to occasional wildlife strike, no vegetation or associated habitats would require removal. This impact would be low, and largely limited to airspaces within the wildlife buffer
- indirect impacts are unlikely to result in the loss or significant modification of habitats or populations as:
  - potential noise impacts are unlikely to result in changes that would alter fauna species behaviour or use of habitats available
  - potential changes in light spill and pollution, air quality and water quality, are likely to be negligible.

Given the extent of potential impacts and biodiversity values within the region already being exposed to varying degrees of these impacts the project is unlikely to a lead to a long-term reduction in the size of a population, reduce the area of occupancy of a population or adversely affect critical habitat to a species. Nor would the project fragment a population in 2, disrupt the breeding cycle of a population, introduce invasive species or pathogens that may cause a species to decline, impact on habitat to the extent that it would cause a species to decline, or significantly interfere with recovery plans actions.

16.7.2 National heritage and Commonwealth heritage places

The National Heritage place determined to be of particular relevance to the project is the GBWA and this is assessed in Chapter 23 (Matters of National Environmental Significance).

The Commonwealth Heritage Places determined to be of particular relevance to the project are the Orchard Hills Cumberland Plain Woodland and Shale Woodland Llandilo (refer to Section 16.5.2.1).

For both of these properties there is unlikely to be a significant impact on the biodiversity attributes as:

- there will be no direct impact on the biodiversity attributes
- indirect impacts are unlikely to result in the loss or significant modification of biological diversity or biological process within these properties as:
  - potential wildlife strike impacts on fauna are only likely to be minor, infrequent, rare and limited to a small number of bird species which occur at altitudes greater than 1,000 ft (300 m) AGL
  - potential noise impacts are unlikely to result in changes that would alter fauna species behaviour or use of habitats available
  - potential changes in air quality and water quality are likely to be negligible.

This is consistent with the evaluation of impacts to GBWA and the whole of the environment.

In support of the protection of values of Orchard Hills Cumberland Plain Woodland Commonwealth Heritage Place is the Biodiversity Offset Delivery Plan (refer to Section 16.5.2.6).

16.7.3 Impacts on plants, animals and their habitat

The significance impact assessment on plants and animals identified that there is unlikely to be a significant impact on native plant or animal species as:

- direct impacts would be the same as for biodiversity MNES (refer to Section 16.7.1)
- air quality and water quality impacts are likely to be negligible and the project would not involve controlled burning activities that could harm native plants or animals
- given the extent and nature of potential impacts and similar impacts already existing within the study area to varying degrees, the project is unlikely to a lead to a long-term decrease in or threaten the viability of a native plant or animal species population, displace or substantially limit the movement of a species, lead to the introduction of invasive species or reduce or fragment available habitat.

16.8 Mitigation and management

This section provides information on proposed safeguards and mitigation measures to deal with the relevant impacts of the project on biodiversity. A key aspect of managing biodiversity is through the application of the 'avoid, minimise, mitigate and offset' hierarchy as follows:

- avoid and minimise impacts on biodiversity as a priority
- mitigate impacts where avoidance or minimization is not feasible or practicable given the circumstance
- offset where residual impacts are unavoidable in accordance with the relevant offset guidelines.

A description of how this hierarchy has been applied to the project is provided below.

16.8.1 Avoid and minimise

The development of the preliminary airspace and flight path design is described in Chapter 6 (Project development and alternatives). This included the avoidance and minimisation of impacts to biodiversity through:

- early consideration of environmental constraints in the planning phase, including the GBMA and associated sensitive receptors/wilderness areas, as input into the initial concept design options
- implementation of wildlife hazard safeguards prior to and during the operation of the project such as the Western Sydney Aerotropolis Development Control Plan 2 (NSW DPE, 2022g).

Not all potential impacts associated with the project could be reasonably avoided or minimised due to the nature and extent of the project, other airport flight paths requirements and the design specifications required to safely operate aircraft associated with the WSI.

16.8.2 Project specific mitigation measures

16.8.2.1 Existing management

Technical paper 5 provides existing mitigation measures in relation to wildlife management. These include off-airport requirements to mitigate wildlife strike risk for aircraft operating in and out of WSI in land use planning instruments, along with recommendations and guidelines detailed in NASF Guideline C.

Of key importance is the implementation of monitoring programs which underpin all wildlife hazard mitigation and airport safeguarding. Robust standardised monitoring programs that regularly collect meaningful data will inform decisions relating to wildlife management programs, identify emerging risks, and determine wildlife activity trends over time.

As impacts to wildlife strikes and management of wildlife buffers have been considered in Chapter 13 (Aircraft hazard and risk) and Chapter 14 (Land use) respectively, there are no other project specific mitigations related to biodiversity. The key measures identified as part of these chapters are summarised in Section 16.8.2.2.

16.8.2.2 Dependencies and interactions with other mitigation measures

Mitigation measures outlined elsewhere throughout the Draft EIS are relevant to the minimisation and management of biodiversity impacts. These relate to:

- Chapter 13 (Aircraft hazard and risk), specifically those to manage potential wildlife strike impacts - including the requirement to:
  - continue to liaise with planning authorities on matters related to the development of, or modifications to, off-airport land uses that have the potential to attract hazardous numbers or types of wildlife
  - establish a WSI Wildlife Hazard Management Committee that will contribute to the preparation of regional species management programs.

  These measures are supported by a proposed bird and bat monitoring program to monitor for the presence of wildlife on the WSI site and in vicinity of WSI in accordance with Civil Aviation Safety Regulations (CASR) Part 139 Manual of Standards (MOS) requirements and NASF Guideline C.
- Chapter 14 (Land use), specifically those related to wildlife buffers – including the requirement to:
  - liaise with State and local government agencies to establish mechanisms that will identify land uses and prevent the creation of land uses that would cause hazardous wildlife attraction within the wildlife buffers
  - negotiate with State and local government agencies and land owners if required on agreed action plans for monitoring and, where necessary, reducing wildlife attraction to areas in the vicinity of WSI.

16.8.3 Biodiversity offsets

The EPBC Act Offset Policy states that for '*assessments under the EPBC Act, offsets are only required if residual impacts are significant*' or '*could reasonably be avoided or mitigated*.'

The outcomes of the impact assessment in Section 16.6 and SIAs in Section 16.7 confirmed that the project is not likely to have a significant impact on biodiversity values or on the broader environment, specifically plants, animals and their habitat.

A description on how the project has avoided and minimised impacts to biodiversity values is provided in Sections 16.4 and 16.8. Biodiversity offsets in the form of 2 conservation initiatives (totalling approximately 1,096 ha) also occurred as part of the Stage 1 Development, as described in Section 16.5.2.6.

Residual impacts associated with the project would include occasional aircraft strike and alterations to existing noise, light, air and water quality values. These cannot be avoided or minimised due to the nature and extent of the project, other airport flight path requirements and design specifications required to safely operate aircraft associated with the WSI.

As the project is not likely to have significant impacts the project is not obligated to provide offsets in accordance with the EPBC Act Offsets Policy.

The biodiversity offsets already provided for Stage 1 are considered to be adequate for all components of the airport.

Overall, the project is not likely to have significant impacts (residual or otherwise).