Australian Government

Department of Infrastructure, Transport, Regional Development, Communications and the Arts

Western Sydney International (Nancy-Bird Walton) Airport – Airspace and flight path design

Environmental Impact Statement

Technical paper 9: Heritage

October 2024

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Terms and abbreviations

Term/abbreviation	Definition
2016 EIS	2015-2016 Western Sydney Airport Environmental Impact Statement
Aboriginal Cultural Values Focus Area	That part of the airspace study area that falls within the Deerubbin, Tharawal and Gandangara LALC boundaries as identified in Figure 1.10
AGL	above ground level. Altitude information is shown with reference to AGL which is taken to be at runway level, which is approximately 260 feet or 80 metres above sea level
AHIMS	Aboriginal Heritage Information Management System – the database of known Aboriginal sites
Airspace Study Area	The area identified in Figure 1.9 being the EIS study area
ANSP	Air Navigation Services Provider
AP	Aboriginal Place – a place of special significance gazetted under the *National Park and Wildlife Act 1974* (NSW)
ATC	Air Traffic Control
ATSIHP Act	*Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth)
BMCC	Blue Mountains City Council
BP	Before Present. A term used in radiocarbon dating of archaeological sites to mean a specified point in time before A.D. 1950 (the origin of practical radiocarbon dating techniques)
CHL	Commonwealth Heritage List
Cth	Commonwealth of Australia
Darug	Alternative spelling 'Dharug'. The name of the people who are the traditional owners of the area now known as the Cumberland Plain
DAWE	[Former] Department of Agriculture, Water and the Environment (Australian Government)
DEOH	Defence Establishment Orchard Hills
Dharug	Alternative spellings 'Darug'. The name of the people who are the traditional owners of the area now known as the Cumberland Plain. Also, the name of the language spoken by these people
DITRDC	Department of Infrastructure, Transport, Regional Development and Communications (Australian Government)
EPA Act	*Environmental Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement

Term/abbreviation	Definition
EPA	Environment Protection Authority
First Nations	Aboriginal and Torres Strait Islander People
Gandangara	Alternative spellings Gundungurra, Gundungara, Gandangarra, Gandangara. The Aboriginal traditional owners of land that includes present day Goulburn, Wollondilly Shire, parts of the Blue Mountains and the Southern Highlands. They are the southwestern neighbours of the Dharug
GBMA	Greater Blue Mountains Area (World Heritage and National Heritage Place)
GIS	Geographical information systems
Gundungurra	Alternative spellings Gundungara, Gandangarra, Gandangara. The Aboriginal traditional owners of land that includes present day Goulburn, Wollondilly Shire, parts of the Blue Mountains and the Southern Highlands. They are the southwestern neighbours of the Dharug
ha	hectare
HIAL	high intensity approach lighting
HNSW	Heritage NSW
ICOMOS	International Council on Monuments and Sites
ILS	instrument landing systems
km	kilometre
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan
LGA	Local Government Area
m	metre
MAP	Million Annual Passengers
MNES	Matters of National Environmental Significance
MSL	Mean Sea Level
NDB	Non-Directional Beacon
NHL	National Heritage List
NP	National Park
NPW Act	*National Park and Wildlife Act 1974* (NSW)
NPWS	National Parks and Wildlife Service, NSW
NSW	New South Wales
OHS	Occupational Health and Safety
OUV	Outstanding Universal Value

Term/abbreviation	Definition
PAAM	Plan for Aviation Airspace Management
RAAF	Royal Australian Air Force
RRO	Reciprocal Runway Operations
SHI	State Heritage Inventory
SHR	State Heritage Register
SIA	social impact analysis
Study Area	Refer to Airspace Study Area and Aboriginal Cultural Values Focus Area
Tharawal	Aboriginal group traditionally from the south-eastern and southern Sydney Basin identified by the Dharawal language
TMA	terminal manoeuvring area
WHA	World Heritage Area
WHL	World Heritage List
WSI	Western Sydney International (Nancy-Bird Walton) Airport

Executive summary

The project

The Western Sydney International (Nancy-Bird Walton) Airport (WSI) Airspace and Flight Path Design is being developed to facilitate aircraft operations at WSI. This report investigates the potential impact of the preliminary flight paths on cultural values associated with heritage places and practices within the WSI airspace study area.

Legislation/policy/guidelines

This technical paper has been prepared to address the requirements of the Guidelines in relation to cultural heritage, as shown in Table ES.1. The requirements primarily relating to heritage are outlined in section 7.3 of the Minister's Guidelines (EPBC 2022/9143).

This technical paper will inform the Environmental Impact Statement (EIS) to be prepared in accordance with Section 87 of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) (EPBC 2022/9143). The EIS will assess the noise and visual impacts on communities, ecological and heritage impacts, and the effects on local air quality and impacts of aircraft emissions arising from the Action. The project will be assessed to meet the requirements of the EPBC Act and Regulations, Condition 16 of the Airport Plan, and the Minister's Guidelines.

The heritage sites and places considered have been identified through statutory lists compiled under Commonwealth and New South Wales (NSW) State legislation including:

Table ES.1 Commonwealth and New South Wales (NSW) State legislation and resulting heritage listings

Legislation	List
Environment Protection and Biodiversity Conservation Act 1999 (Cth)	World Heritage List National Heritage List Commonwealth Heritage List
National Parks and Wildlife Act 1974 (NSW)	Aboriginal Heritage Information Management System Aboriginal Places (gazetted under s84)
Heritage Act 1977 (NSW)	State Heritage Register
Environmental Planning and Assessment Act 1979 (NSW)	Local Environmental Plans (heritage schedules)

Existing environment

Much of the airspace study area is already overflown by aircraft from Sydney (Kingsford Smith) Airport but also from Royal Australian Air Force (RAAF) Base Richmond and Bankstown Airport, however despite this there is little or no baseline information on the impacts to underlying heritage places. Additional areas will be overflown by large aircraft at lower altitudes as aircraft approach and depart from the WSI airport. Key concerns raised by First Nations knowledge holders and by owners and managers of heritage properties include:

- the potential for increased noise at heritage places especially where the cultural values relate to connecting with nature, spirituality (including but not limited to connections between the skyscape and landscape), experiencing a sense of serenity and wellbeing, and
- the potential for long term, as yet unquantifiable impacts to heritage fabric particularly in relation to Aboriginal rock art and historic sandstone buildings.

Assessment methodology

The assessment involved a desk top review of the range and nature of heritage places in the study area as well as consultation with Dharug, Gundungurra and Tharawal First Nations knowledge holders and a range of Aboriginal organisations including Local Aboriginal Land Councils (LALCs) with a mandate for cultural heritage protection.

There are 13,538 Aboriginal sites within the airspace study area that are recorded in Aboriginal Heritage Information Management System (AHIMS), and this number is likely to be a substantial under estimation as the Greater Blue Mountains Area (GBMA) and other National Parks within the airspace study area have never been systematically surveyed for Aboriginal sites. Consultation with First Nations knowledge holders and stakeholders assisted in identifying places of particular cultural value. This consultation resulted in a list of places of particular cultural value that were considered in the design of the flight paths and where possible, direct over flight of these places has been avoided. Sites of archaeological value such as artefact scatters were not carried forward for assessment as these would not be directly or indirectly impacted by the project.

A review of all available statutory lists revealed over 19,000 historical heritage places in the airspace study area. The assessed values of these sites were considered along with a consideration of their fabric and likely vulnerability to impact from the flight paths. There are 2 World Heritage Areas (WHAs): the GBMA and the Opera House, in addition to 4 properties (Hyde Park Barracks, Cockatoo Island, old Government House and Domain, and the Great North Road) that form the NSW component of the Australian Convict WHA. All WHAs apart from the GBMA have been avoided by the flight paths. Impact to the Outstanding Universal Value of the GBMA is specifically assessed in WSP 2023.

There are 19 places on the National Heritage List, a further 89 places on the Commonwealth List, and 273 places on the NSW State Heritage Register. Of all these places, most occur at a distance greater than 10 kilometres (km) from WSI. A total of 18,888 heritage places are included on Local Environmental Plans as places of cultural value to local communities.

Main findings

Aboriginal Cultural Heritage

Several key places of concern were identified by the First Nations knowledge holders. These places were:

- Shaws Creek Aboriginal Place, Yellomundee Regional Park
- Red Hands Cave Aboriginal Place
- Emu engraving sites, Faulconbridge
- Bents Basin State Conservation Area
- Linden Ridge (multiple sites)
- The Three Sisters (Seven sisters) Aboriginal Place
- Upper Kedumba Valley Aboriginal Place
- Kings Tableland – rock art
- Emu Cave Aboriginal Place
- Traditional walking tracks (now roads, often connecting significant sites) and one described as a ceremonial circuit is articulated in Appendix C and which connects several of the places listed above (see Figure 7.2)
- Appin Massacre Site – now protected as the Appin Massacre Cultural Landscape on the SHR (just outside the airspace study area)
- Shaws Creek Rock Shelter Aboriginal Place
- Euroka near Glenbrook Aboriginal Place
- Mt Yengo (outside the airspace study area)

- Mermaid Pools Women's site on the southern edge of the airspace study area)
- Thirlmere Lakes
- Cubbitch Barta National Estate Area.

Of these places, Appin massacre site are outside the airspaces study area and will not be adversely affected by the preliminary flight paths which does not directly overfly the place. Mt Yengo is outside the airspace study area and the mountain peak itself will not be overflown, however, it is within 2.7 km of a flight path. Aircraft will be high at an altitude of 20,000 ft descending to 17,500 ft however concerns were raised during First Nations consultation regarding the proximity of the flight paths to the many ceremonial and spiritual sites associated with Mt Yengo and it was requested that consideration be given during detailed design to moving the flight path slightly to the west as it passes Mt Yengo.

The preliminary flight paths have avoided overflying the following Aboriginal Places (APs): The Three Sisters, Red Hands Cave, Kings Tableland, the Upper Kedumba Valley and the Emu engraving at Faulconbridge. Potential impact to the cultural values of Thirlmere Lakes and Mermaid Pools is considered to be negligible. These places are on the southern edge of the airspace study area and are not directly overflown.

While aircraft avoid direct over flight of the Three Sisters formation, aircraft will be visible crossing through the expansive vistas viewed from Echo Point. It is estimated that they will be over 10,000 feet (ft) above Mean Sea Level (MSL) as they pass over Mt Solitary. In experiential terms this means that they will appear as small and distant; however, they are likely to still be heard from Echo Point.

There are many sites in the Sydney Basin sandstone that depict emus, and these include several recorded sites in the Blue Mountains that depict emus including the sites reported at Faulconbridge. The emu rock engraving site at Faulconbridge (AHIMS #45-5-4910) is not directly under the preliminary flight paths however the location is close to a proposed departure transition area for WSI which means that it could be overflown depending on conditions. The emu engraving site at Ticehurst Park, Faulconbridge (AHIMS #45-5-0015) would be directly under the preliminary flight paths during the day-evening period and night. The frequency of flight would be greater during the day-evening period with an average of 18 departures up to a maximum of 36 aircraft (in 2033). During the night, an average of 3 arrivals up to a maximum of 8 arrivals (in 2033), depending on the runway mode of operation. Aircraft would be relatively high climbing between 10,500 ft and 13,300 ft. Noise is expected to around 60–65 dBA. Knowledge holders noted that around March to May was the most important time for the connection between the emu in the sky and this site. Aircraft flying over this site during this time would be a moderate detrimental indirect impact to the cultural values of the site.

There are many Aboriginal sites that are located along Linden Ridge. The expected frequency of flights varies between the various flight paths however most flights are expected during the day i.e. an average of 18 departures up to a maximum of 36 during the day - evening period when Runway 23 is used (in 2033). The maximum noise level would be around 60–65 dB(A), with around 10–19 movements at or above 60 dB(A) by 2055 (over a 24 hour period). The visual and noise disruption at these sites would be moderate, increasing to severe as the frequency overflight increases over time.

Bents Basin is a culturally significant spiritual or Dreaming site it is also a contemporary gathering place for the Gundungurra, Tharawal and Dharug families. The preliminary flight paths pose an unacceptable, severe impact on the cultural values of the place. The site will be directly overflown and combined with the height of aircraft and the expected frequency of aircraft arrival and departures (over 200 flights per day by 2055) will have a severe impact on the peace and tranquillity of this significant cultural place. There is also potential for impact from emissions on the rock art in this area and on the water body that is the home of Gurungaty a Dreamtime being whose story line journeys from the south coast through the southern highlands and across the GBA to the western side of the mountains. The scour pool at Bents Basin, known to its First Nation owners as Gulguer is a sacred site and part of an Aboriginal creation story that traverses the lands of Tharawal, Gundungurra and Dharug people form the south coast through the southern highlands and westward from Bents Basin through the GBMA. The impacts on Bents Basin will severely impact the cultural values of the place and without removing flight paths from this area it is unlikely that minor changes at the detailed design phase will be able to effectively mitigate the impacts on the cultural values of this place.

The current proposal does not avoid impact to Euroka/Nye Gnorang, the Emu Cave AP, Shaws Creek AP in Yellomundee Regional Park and Bents Basin. These are sacred sites that knowledge holders have advised are culturally significant to them, both in terms of their spiritual meaning, and also the contemporary practices carried out at these places. The likely impacts to these places are expected to be moderate to severe and it is therefore recommended that adjustments to the preliminary flight paths are made to avoid these significant places. It seems likely that the impact due particularly to noise and frequency of aircraft traffic will have a substantial impact on the values of the Shaws Creek – Yellomundee area and on Bents Basin which are important places for Dharug women and in the case of Bents Basin to Tharawal and Gundungurra women as well.

The airspace study area contains an extensive suite of Aboriginal rock art which is concentrated in the areas dominated by sandstone geology. However, while there is general understanding that airborne pollution can impact both sandstone and traditional pigments used in rock art, the desktop review revealed little specific research into the impacts of aircraft emissions on Aboriginal rock art. Multiyear research is recommended to monitor and understand conservation issues related to emissions associated with the arrival and departure flight paths for WSI. A number of recommendations are made to mitigate potential impacts.

Historic heritage

A large number of historic places of primarily non-Indigenous cultural value were also identified in the airspace study area. Many of these are already overflown by existing flight paths. Many others are clustered in residential areas such as Katoomba, and are, to the extent possible, avoided by the preliminary future flight paths. However, questions remain regarding the long-term impacts of emissions (or cumulative impacts given existing flight paths) on the fabric of some historic structures, particularly sandstone structures and historic gardens. For the most part, a meaningful understanding of cumulative impacts especially from noise and emissions on heritage places is not possible because despite these factors impacting many heritage sites and places since at least 1924 (with the inception of the Kingsford Smith Airport, no specific or long-term research could be found documenting such impacts.

Many historic properties are located in town centres. The fact that many historic heritage places occur in populated areas such as Katoomba means that the first principle of flight path design has served to protect them from direct overflight, although in some cases aircraft may still be visible in the distance and will be heard. Windsor and Richmond townships are exception to this. While the Richmond township contains a number of locally significant heritage items, there are a range of factors such as the proximity of the RAAF base that restrains the flight path options in this area. Aircraft will be relatively high by this point, however, at greater than 10,000 ft (above MSL) and there is expected to be less than 10 flights per day by 2055.

It is inevitable that some properties would suffer some impact from noise, given that in many cases to the west and south-west of WSI, the properties are located in rural contexts. This includes properties within Mulgoa, Luddenham and Wallacia. These towns contain several local heritage items, and in the case of Mulgoa, several significant historic heritage properties such as Fernhill Estate and St Thomas's Church. Impacts to these heritage properties would range from no impact to moderate impact, depending on the values for which the places are listed for, and the indirect visual and noise impacts from the project. The exception is for heritage listed schools in Luddenham and Wallacia. The continuous use as a school forms part of its heritage value and noise disruptions during the day would be frequent and are expected to increase in frequency over time, noting the internal noise levels would be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. The impact of high noise events on the heritage value is assessed as moderate to severe, depending on any modifications that the asset owner may implement in response to aircraft noise. Any such modifications would be subject to heritage approvals.

Unfortunately, as with the case of Aboriginal rock art there is little available information about the impacts of aircraft emissions on heritage building fabric. In particular, emissions may be expected to have some impact over the long term on sandstone heritage items and possibly other building fabric such as traditional limestone mortars, but such impact is currently unable to be quantified.

Conclusion

The WSI flight paths will fly over a large number of significant sites and places, however in many cases existing flight paths already traverse the airspace above these sites and places. In addition, many types of heritage places are considered robust in the face of impacts such as air pollution, noise and visual impacts. In most cases aircraft will be at such a distance as to render the impact from these factors as minimal. However, the places closest to the Airport Site are likely to experience higher impacts. A range of recommendations have been made to understand the long-term cumulative impacts, mitigate likely impacts and maximise the retention of cultural values and these are described in Chapter 7. Developing our understanding of long-term impacts will assist property managers and owners to adapt management of heritage places to ensure sustainability and will enable planners and regulators to more effectively assess future cumulative impacts.

Many historic properties are located in towns centres. The flight path design principles seek to avoid population centres and the flight paths design has sought to protect such places from major impact. It is inevitable that some properties however will suffer some impact from noise given that in many cases to the west and southwest of WSI the properties are located in rural contexts. Any noise mitigation modifications of heritage buildings may involve secondary impacts to their heritage values and individual building assessments and heritage approvals from Heritage NSW may be required prior to such adaptive works.

Several sites of particular significance to Aboriginal stakeholders were identified in the course of this study. Recommendations have been made to avoid direct flight over these places so that any impacts from noise, visual intrusion and emissions are minimised.

There will also be impact to the land–sky connection of the 'Emu in the Sky' story. Although direct overflight of the Emu engraving at Faulconbridge has been avoided, there would be physical intrusion of aircraft between the engraving and the constellation at the engraving at Ticehurst Park when the constellation is directly overhead. The flight paths also transect Emu Cave AP.

By far the greatest impact to Aboriginal cultural values identified occurs outside the GBMA at Bents Basin and Yellomundee. The impacts on Bents Basin and the Shaws Creek Yellomundee AP will be of major concern to First Nations people and particularly the Dharug, Gundungurra and Tharawal women who have stressed the cultural importance of these places and the requirement for peace, tranquillity and connection to nature to maintain the cultural values of these places. The impacts on Bents Basin will severely impact the cultural values of the place and without removing flight paths from this area it is unlikely that minor changes at the detailed design phase will be able to effectively mitigate the impacts on the cultural values of this place. It is noted that while outside the GBMA Bents Basin is connected to sites within the WHA through a creation story that connects sites that are of significance to Gundungurra, Tharawal and Dharug First Nations.

In relation to the cultural values of the GBMA this report notes that the internationally recognised values (or the Outstanding Universal Values) are the natural values of the property, and these have been assessed elsewhere (WSP 2023b Technical paper 14: Greater Blue Mountains World Heritage Area (Technical paper 14)). However, there are increasing calls to recognise the cultural values, some of which are referred to in the statement of integrity for the GBMA, and many of which have been subject to assessment over the past several decades. Unfortunately, the baseline data needed to assess the likely cumulative impact of aircraft emissions on the valuable and finite suite of Aboriginal rock within the GBMA is not available and it is recommended that specimen sites are identified prior to flight commencing which can be used to establish the baseline data necessary to track any related changes.

Chapter 1 Introduction

This chapter provides an overview of the preliminary airspace and flight path design for the Western Sydney International (Nancy-Bird Walton) Airport (WSI). This includes the background to WSI and its accompanying airspace and flight path design (the project) which impacts on the existing Sydney Basin airspace. It describes the key features and objectives of the project and identifies the purpose and structure of this this technical paper.

1.1 Western Sydney International (Nancy-Bird Walton) Airport

1.1.1 Background

In 2016, the then Australian Minister for Urban Infrastructure approved development for a new airport for Western Sydney, now known as the Western Sydney International (Nancy-Bird Walton) Airport (WSI), under the *Airports Act 1996* (Commonwealth). The site of the new airport (the Airport Site) covers approximately 1,780 hectares (ha) at Badgerys Creek, as shown in Figure 1.1. The Airport Site is located within the Liverpool local government area (LGA).

Following the finalisation of the *Western Sydney Airport – Environmental Impact Statement* (2016 EIS), the Western Sydney Airport – Airport Plan (Airport Plan) was approved in December 2016. The Airport Plan authorised the construction and operation of the Stage 1 Development. It also set the requirements for the further development and assessment of the preliminary airspace design for WSI. The Australian Government has committed to developing and delivering WSI by the end of 2026.

The 2016 approval provided for the on-ground development of Stage 1 Development of WSI (a single runway and terminal facility capable of initially handling up to 10 million passengers per year) utilising indicative 'proof of concept' flight paths. These flight paths, presented in the 2016 EIS demonstrated that WSI could operate safely and efficiently in the Sydney Basin. WSI will be a 24-hour international airport and will:

- cater for ongoing growth in demand for air travel, particularly in the rapidly expanding Western Sydney region, as well as providing additional aviation capacity in the Sydney region more broadly
- provide a more accessible and convenient international and domestic airport facility for the large and growing population of Western Sydney
- provide long term economic and employment opportunities in the surrounding area
- accelerate the development of critical infrastructure and urban development.

The Australian Government has committed to developing and delivering WSI by the end of 2026.

The design and assessment process for the next phase of the airspace design (referred to as the preliminary airspace design) was set by Condition 16 of the Airport Plan. This included the future airspace design principles and the establishment of an Expert Steering Group. Key to these design principles was the need to minimise the impact on the community and other airspace users while maximising safety, efficiency and capacity of WSI and the Sydney Basin airspace. The airspace design must also meet the requirements of Airservices Australia and civil aviation safety regulatory standards.

Led by the Australian Government Department of Infrastructure, Transport, Regional Development, Communications and the Arts (DITRDCA), the Expert Steering Group has developed the preliminary flight paths and airspace arrangements for WSI (the project). The preliminary airspace design is the subject of the EIS.

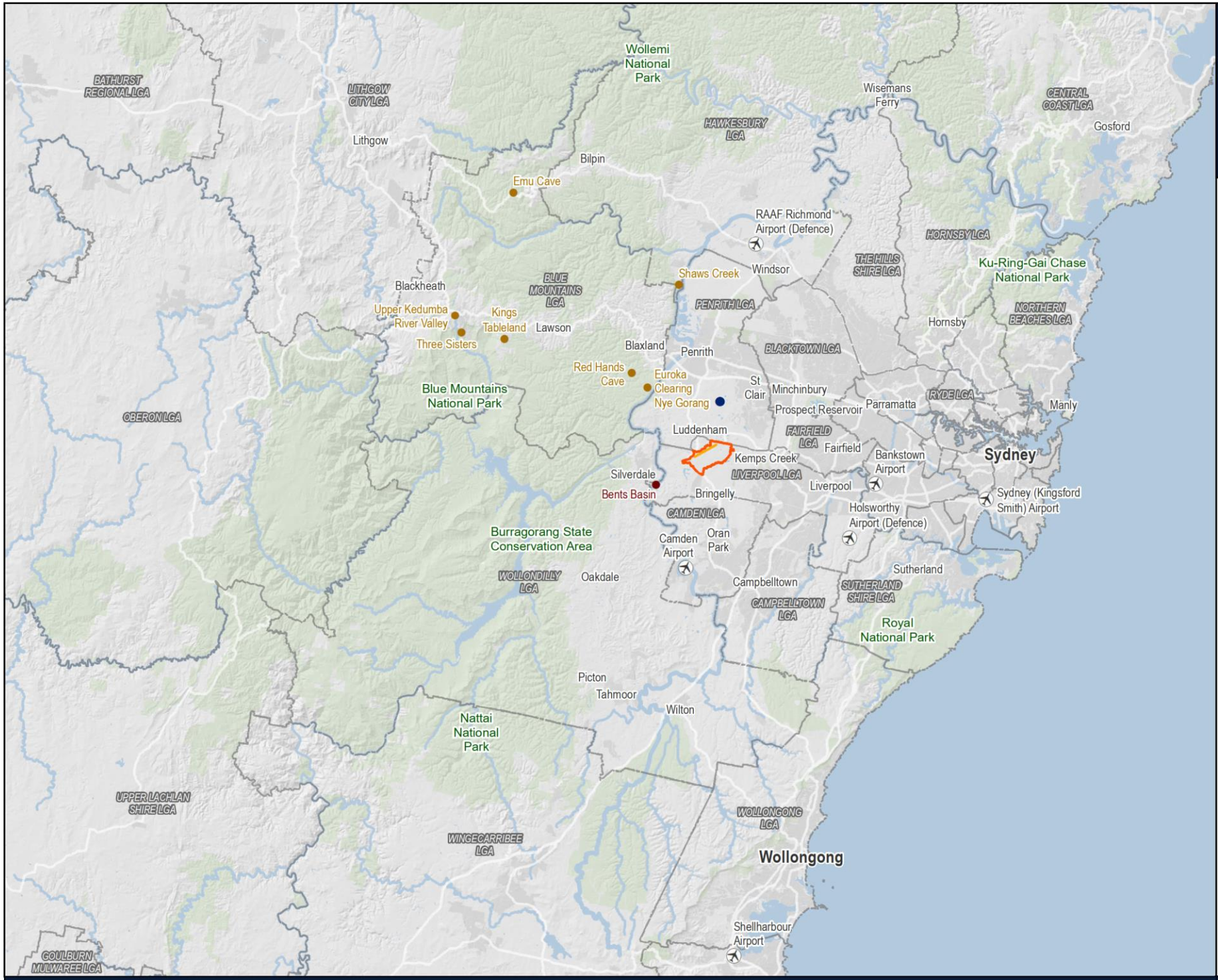

Figure 1.1

Regional Context of the Western Sydney International (Nancy-Bird Walton) Airport

Legend

- WSI Runway
- Western Sydney International (Nancy-Bird Walton) Airport land boundary
- State local government area (LGA)
- Orchard Hills Defence Establishment
- Aboriginal Places raised during consultation (NPW Act)
- Site of Aboriginal significance

0 10 20 km

Coordinate system: GDA 1994 NSW Lambert

Scale ratio correct when printed at A4

1:750,000 Date: 27/06/2023

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

1.1.2 The Airport

1.1.2.1 Stage 1 Development

The Stage 1 Development of WSI has been approved and is limited to single runway operations. It will handle up to 10 million annual passengers and around 81,000 air traffic movements per year by 2033 including freight operations (a movement being a single aircraft arrival or departure). Single runway operations are expected to reach capacity at around 37 million annual passengers and around 226,000 air traffic movements per year in 2055.

The approval provides for the construction of the aerodrome (including the single runway), terminal and landside layout and facilities, and ground infrastructure such as the instrument landing systems and high intensity approach lighting arrays. Construction of the Stage 1 Development commenced in 2018. Figure 1.2 shows location of the single runway within the Airport Site.

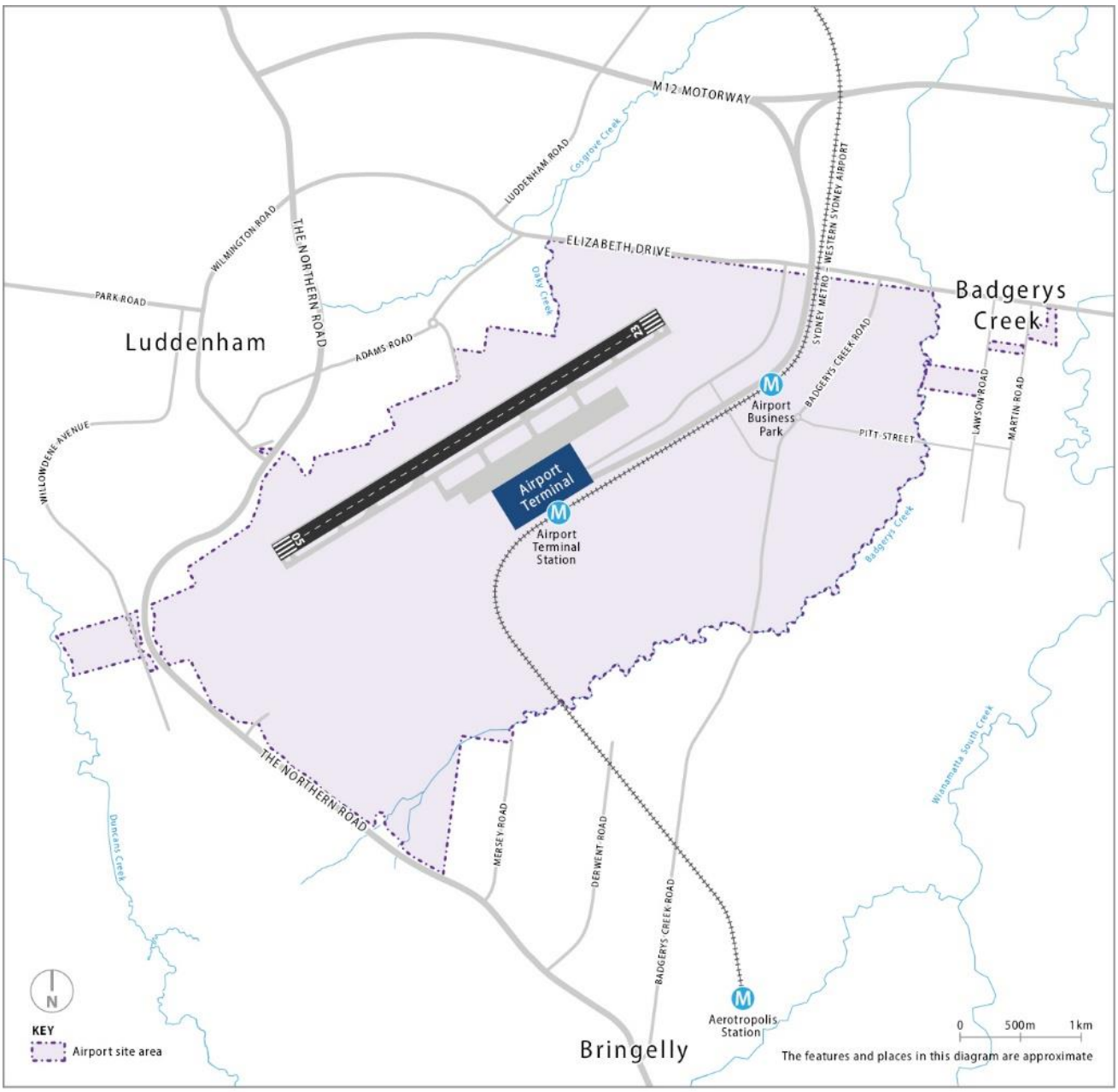

Figure 1.2 Western Sydney International Stage 1 Development

1.2 The project

The project consists of the development and implementation of preliminary flight paths and a new controlled airspace volume for single runway operations at WSI. The project also includes the associated air traffic control and noise abatement procedures for eventual use by civil, commercial passenger and freight aircraft. The airspace and flight paths would be managed by the Air Navigation Services Provider (ANSP), Airservices Australia.

The project involves preliminary flight paths for all-weather operations on Runway 05 and Runway 23 during the day (5:30 am to 11 pm) and night (11 pm to 5:30 am), as well as head-to-head Reciprocal Runway Operations (RRO) during night-time periods (when meteorological conditions and low flight demand permit) to minimise the number of residences subjected to potential noise disturbance.

The preliminary flight paths differ during the day and night. The preliminary flight paths at night differ to take advantage of the additional airspace capacity offered when the curfew for Sydney (Kingsford Smith) Airport is in force. The preliminary flight paths (as exhibited) are depicted in Figure 1.3 to Figure 1.7.

The project does not include any physical infrastructure or construction work.

Since the exhibition of the Draft EIS, refinements to the project have been incorporated into the preliminary flight path design. The final preliminary flight path design is presented in Chapter 7 (The Project) of the EIS.

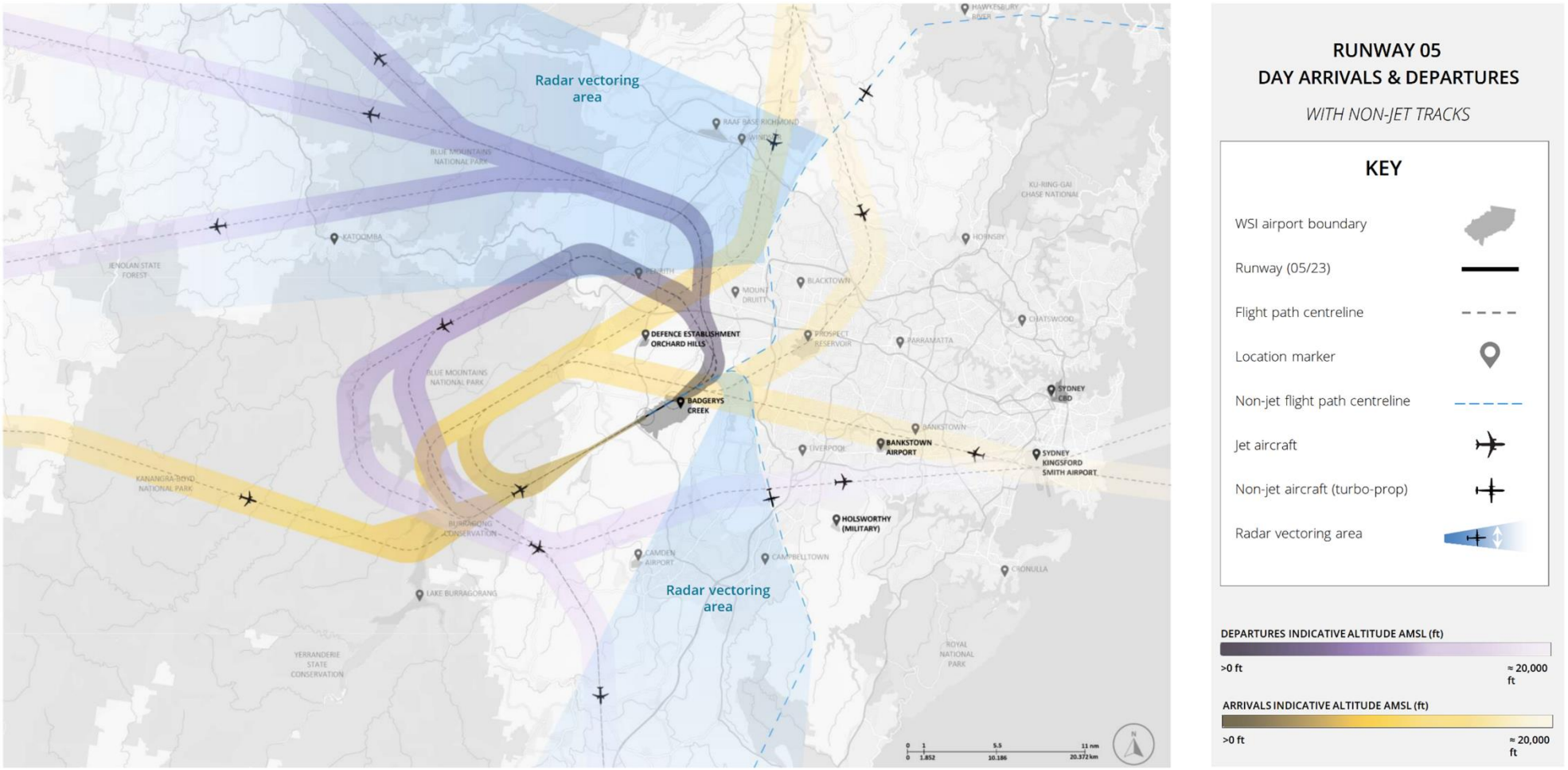

Figure 1.3 Proposed flight paths for Runway 05 (day)

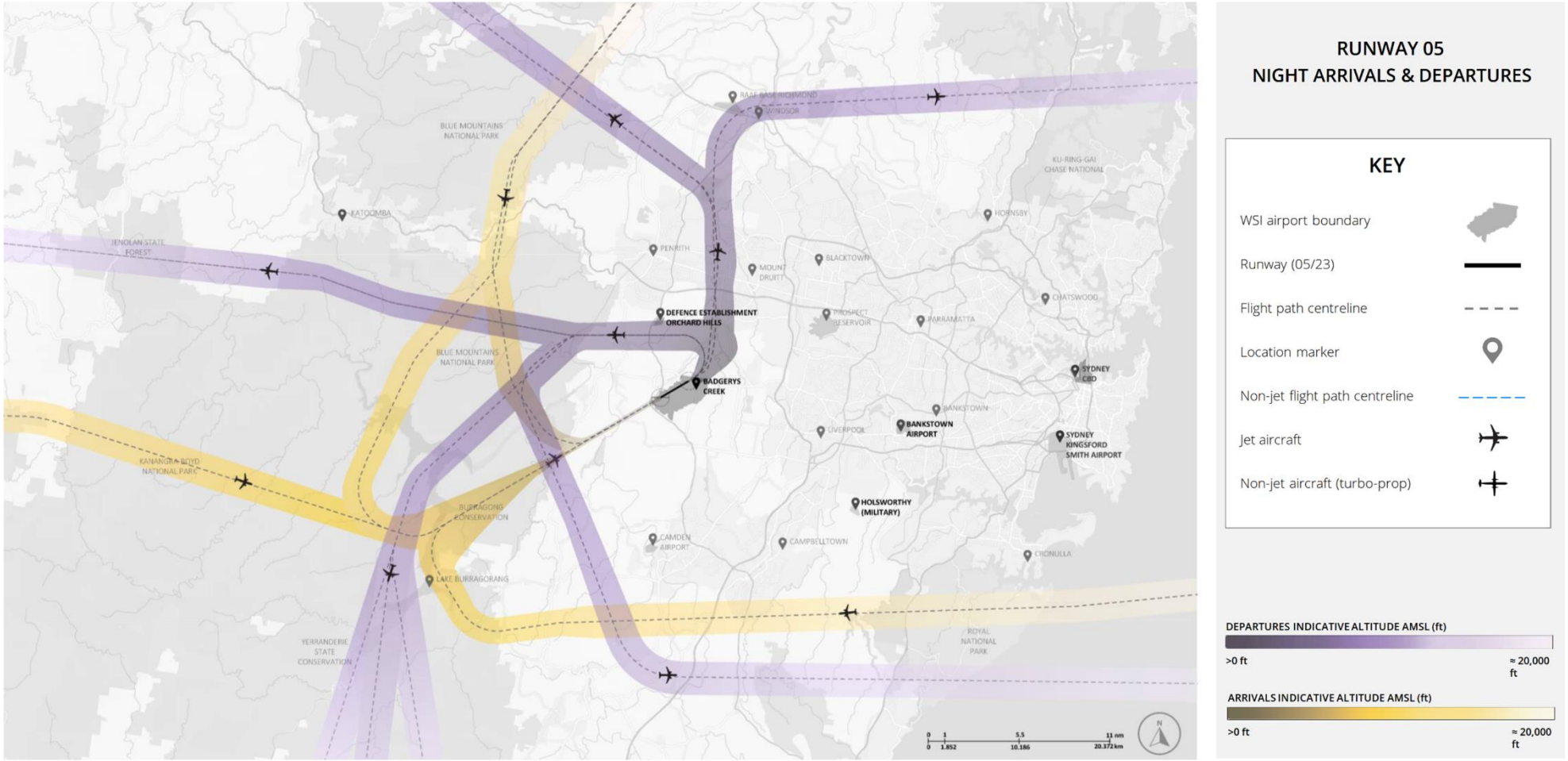

Figure 1.4 Proposed flight paths for Runway 05 (night)

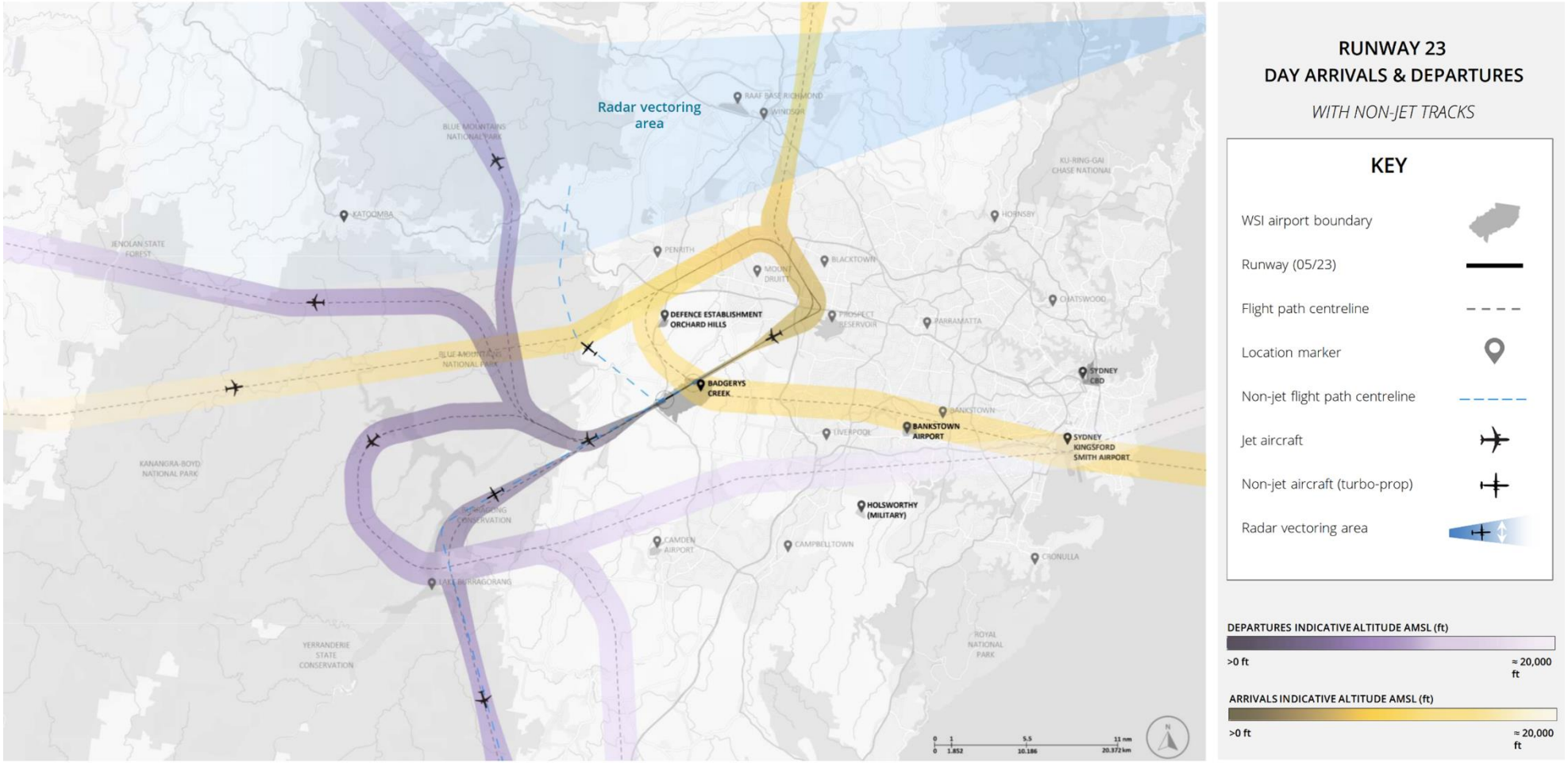

Figure 1.5 Proposed flight paths for Runway 23 (day)

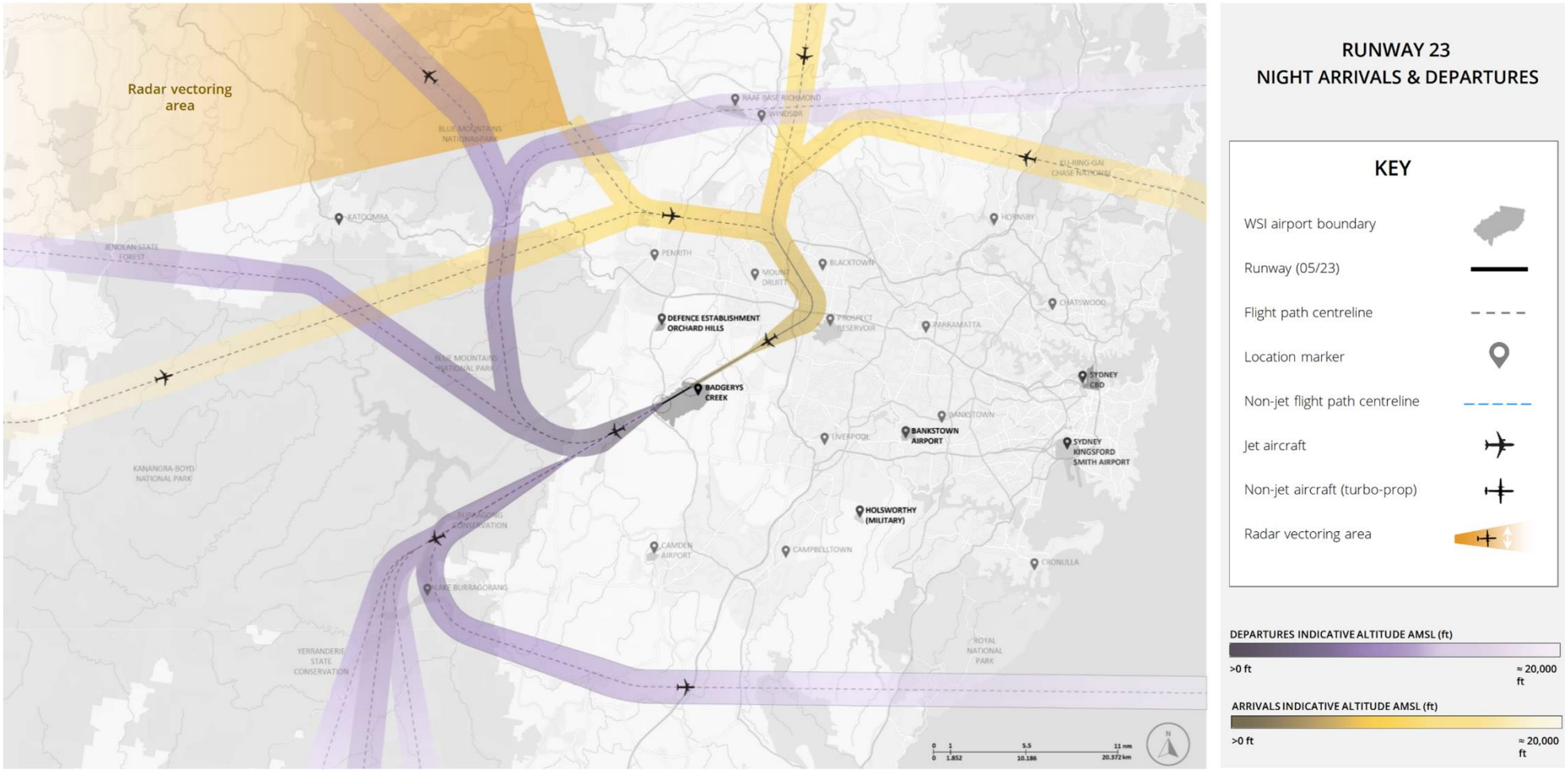

Figure 1.6 Proposed flight paths for Runway 23 (night)

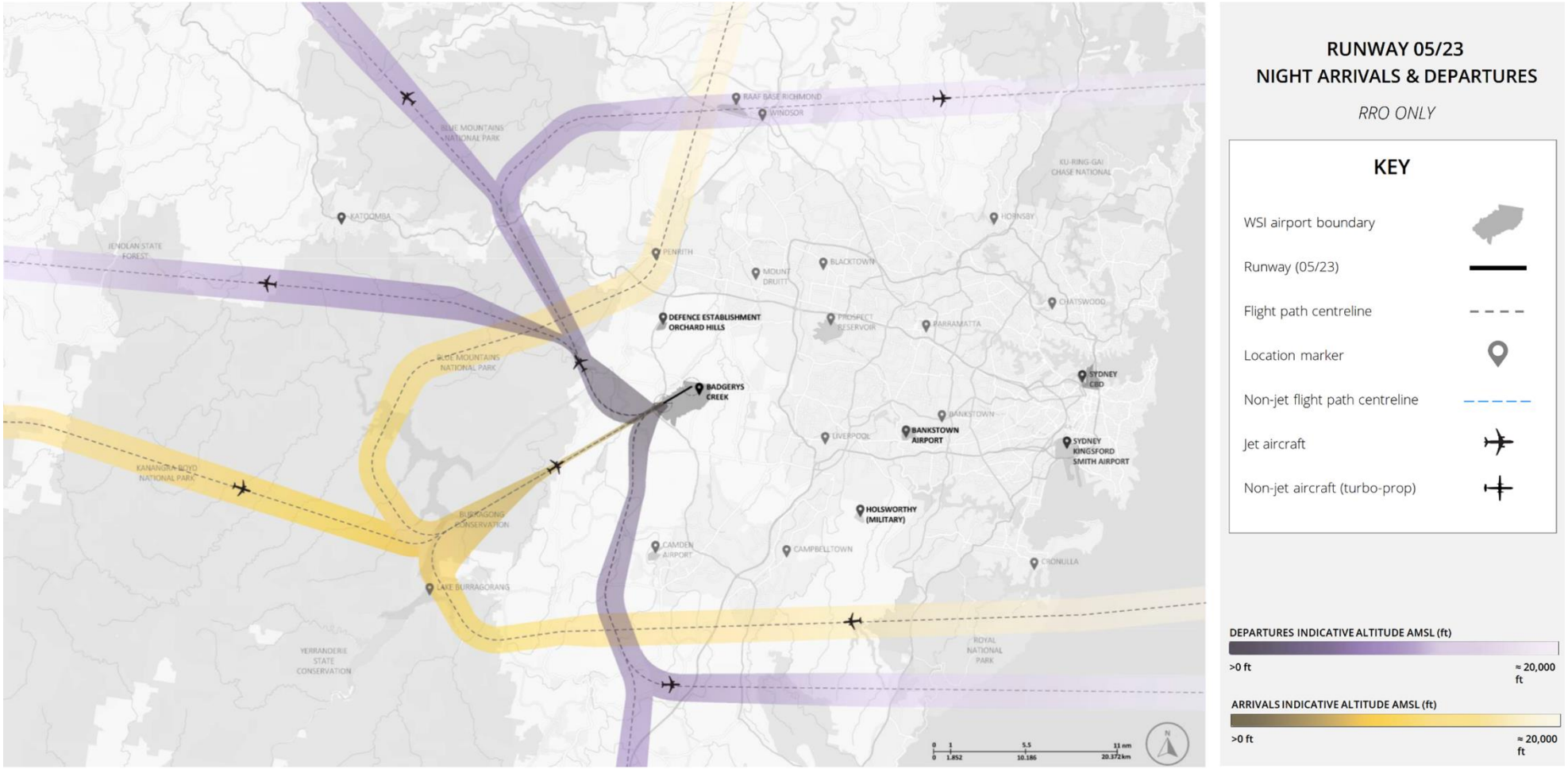

Figure 1.7 Proposed flight paths for Runway 05/23 (night)

1.2.1 Objectives of the project

The overall objectives for WSI are to:

- improve access to aviation services for Western Sydney
- resolve the long-term aviation capacity constraints in the Sydney Basin
- maximise the economic benefit for Australia by maximising the value of WSI as a national asset
- optimise the benefit of WSI for employment and investment in Western Sydney
- deliver sound financial, environmental and social outcomes for the Australian community.

The project will assist in achieving these overall objectives as it would enable single runway operations to commence at WSI through the introduction of new flight paths and a new controlled airspace volume.

The Western Sydney Airport Plan sets out 12 airspace design principles that the design process is required to follow (see Figure 1.8). The principles were informed by and reflect community and industry feedback on the 2016 EIS. The principles seek to maximise safety, efficiency and capacity, while minimising impacts on the community and the environment. For further information on the airspace design principles refer to the EIS.

The following principles will apply to the comprehensive airspace design process for single runway operations:

1. Overflights of residential areas and noise sensitive facilities will be avoided to the maximum extent possible.

– The most advanced satellite-based navigation technologies will be used to guide the design of flight paths that avoid residential and other noise sensitive areas as far as it is possible to do so.

2. Where flight paths are unable to avoid residential areas:

– to the extent practicable, residential areas overflown by aircraft arrivals should not also be overflown by aircraft departing the airport; and

– noise abatement procedures should be optimised to achieve the lowest possible overall impact on the affected community, taking into account safety and other operational factors.

3. Specific noise abatement procedures will be developed to minimise the community impacts of aircraft operations at night while not constraining airport operations and the economic benefits they would bring for Western Sydney.

– When comparing options, operations that are conducted at night or on weekends will be treated as being more sensitive than those that occur during the daytime or on weekdays.

– The use of head-to-head operations to and from the south-west, when it is safe to do so, is an important preferred option for managing aircraft noise at night. This preferred option will be thoroughly evaluated through further detailed assessment.

4. Noise mitigation measures will be developed consistent with Airservices commitment to aircraft noise management and the strategies developed by ICAO in its B*alanced Approach to Aircraft Noise Management.*

5. Aircraft arrivals will use a continuous descent approach where possible to keep aircraft at higher altitudes with low power settings and reduced noise (and greenhouse) emissions.

6. Aircraft arrivals will not converge through a single merge point over any single residential area.

7. Consideration will be given to the impacts of aircraft operations on natural and visually sensitive areas such as the Greater Blue Mountains World Heritage Area.

8. In determining the final flight paths, the community, aerodrome operators and airspace users will be consulted extensively, and flight path designs will be subject to referral under the EPBC Act.

9. Changes to current noise sharing arrangements at Sydney Airport will be avoided.

10. Current airspace restrictions such as those associated with military establishments will be reviewed to improve efficiency and environmental impacts from commercial operations, while meeting Australia's future defence requirements.

11. The Australian Government will work with the New South Wales and local governments to ensure land use planning continues to prevent noise sensitive development in the highest noise exposure areas.

12. Safety is non-negotiable – only practical solutions that uphold Australia's long tradition of world-leading aviation safety will be implemented.

Figure 1.8 Future airspace design principles (Airport Plan – Western Sydney International (Nancy Bird Walton) Airport September 2021:46

1.3 Purpose of this technical paper

This technical paper investigates the potential impact of the preliminary flight paths on cultural values associated with heritage places and practices within the WSI airspace study area.

It considers the likely and potential environmental (heritage) impacts of the operation of flight paths on the cultural heritage values of the airspace study area including on the cultural values of specific significant heritage places. This information will be one of the technical inputs that inform the final flight path design.

As identified in Section 1.2, refinements to the project have been incorporated into the preliminary flight path design. The assessment of these changes has been presented in Appendix G (Assessment of the refinements to the project) of the EIS.

Supplementary assessment has also been completed in response to submissions. This is presented in Appendix D (Supplementary assessment) of this technical paper.

1.3.1 Assessment requirements

The project was referred to the Minister for the Environment and Water in 2021 (EPBC 2022/9143) in accordance with Section 161 of the EPBC Act and Condition 16 of the Airport Plan. In response, the delegate for the Minister for the Environment and Water determined that an EIS would be required and issued the EIS Guidelines on 26 April 2022.

This technical paper has been prepared to address the requirements of the Guidelines, as shown in Table 1.1. The requirements primarily relating to heritage are outlined in section 7.3 of the EIS Guidelines.

Table 1.1 Summary of Minister's EIS Requirements (EPBC 2022/9143)

EIS Guidelines reference	Information required	Location in this report
7.3.1	Detailed assessment of any likely impact that the proposed action may facilitate on the natural, cultural, heritage and socio-economic values of the GBMA, (WHA), and any other World Heritage properties or National Heritage places identified as relevant to the impacts of the proposed action. Include explicit assessment against the Outstanding Universal Value, including the integrity of the property. This should be based on (but is not limited to) the following: • noise and light assessments • visual assessment of representative viewpoint locations and visual amenity impact on tourist drives • impacts on biological attributes of the GBMA • assessment of risks to heritage associated with the proposed action (such as contamination risk from fuel jettisoning or increased risk of bushfire).	This assessment focuses on the cultural values of the GBMA and the airspace study area see: • Sections 5.4 and 5.5 regarding the impact of emissions • Section 5.4.6.1 re fuel jettisoning • Section 5.6 with regard to noise and visual intrusion
7.3.2	A description of how the design of the proposed action was selected to avoid and minimise impacts on the GBMA and any other World Heritage properties or National Heritage places.	The process of design of the flight paths is described in Chapter 6 (Project development and alternatives) of the EIS

EIS Guidelines reference	Information required	Location in this report
7.3.3	Assessment of impacts to any places in the area surrounding the airport with heritage value as a component of the whole of the environment, with reference to consultation undertaken to identify values and their importance to the community.	Chapter 5 But also, Section 3.2 and Section 4.2
7.3.4	A discussion of impacts on the natural, cultural, heritage and socio-economic values of the GBMA. This discussion must include, but not limited to, the consideration of: • habitats, species and ecological communities within the GBMA, and the processes that support their connectivity, productivity and function • the benefit of national parks for people, businesses and the economy • living and historic cultural heritage recognising Indigenous beliefs, practices and obligations for country, places of cultural significance and cultural heritage sites • non-Indigenous heritage that has aesthetic, historic, scientific or social significance.	As regard cultural values this is included in Section 5.2.1
7.3.5	For World Heritage, discuss how the proposed action adheres to, and is not inconsistent with: • Australia's obligations under the World Heritage Convention and the provisions in the 2021 Operational Guidelines for the Implementation of the World Heritage Convention • the Australian World Heritage management principles (Schedule 5 of the EPBC Regulations) • the 2009 Greater Blue Mountains World Heritage Area Strategic Plan and 2016 Addendum and any future iterations in place at time of report preparation • the 2013 IUCN advice note on environmental assessments.	See Section 8.1
7.3.6	For National Heritage, discuss how the proposed action adheres to, and is not inconsistent with: • the National Heritage management principles (Schedule 5B of the EPBC Regulations) • an agreement to which the Commonwealth is party in relation to the National Heritage place • the 2009 Greater Blue Mountains World Heritage Area Strategic Plan and 2016 Addendum and any future iterations in place at time of report preparation.	See Section 8.2

The impact on the GBMA (see point 7.3.4 in Table 1.1 above) is explicitly dealt with in Technical paper 14. Also related to heritage are the EIS requirements outlined in section 7.4 of the EIS guidelines for the assessment of impacts on and engagement with people and communities (see EPBC 2022/9143). In this regard, assessments have been prepared (refer to Technical Paper on Social Impacts (WSP 2023c) and Economic Impacts (WSP 2003c). The requirements have influenced the approach to consultation undertaken in this heritage assessment and the outcomes of consultation in both assessments have been shared.

1.4 Study area

The lateral extent of the EIS study area is the WSI-specific aviation airspace contained within the north-western quadrant of the Sydney Basin. This is defined generally from Runway 05/23 to joining the enroute airways beyond the WSI terminal airspace control area, often referred to as the terminal manoeuvring area (TMA). The TMA is a notionally circular configuration centred on the Airport Site. The boundaries of the airspace study area are:

- North – Hawkesbury River in the vicinity of Pitt Town, Wilberforce and East Kurrajong
- Northeast – coast in the vicinity of Palm Beach and Barrenjoey Headland
- East – the coastline where aircraft on WSI flight paths operate at altitudes generally above below aircraft from other Sydney Basin airports
- Southeast – Bargo River in the vicinity of Tahmoor
- South – as above
- Southwest – western boundary of the GBMA
- West – as above
- Northwest – as above.

The study area is shown in Figure 1.9.

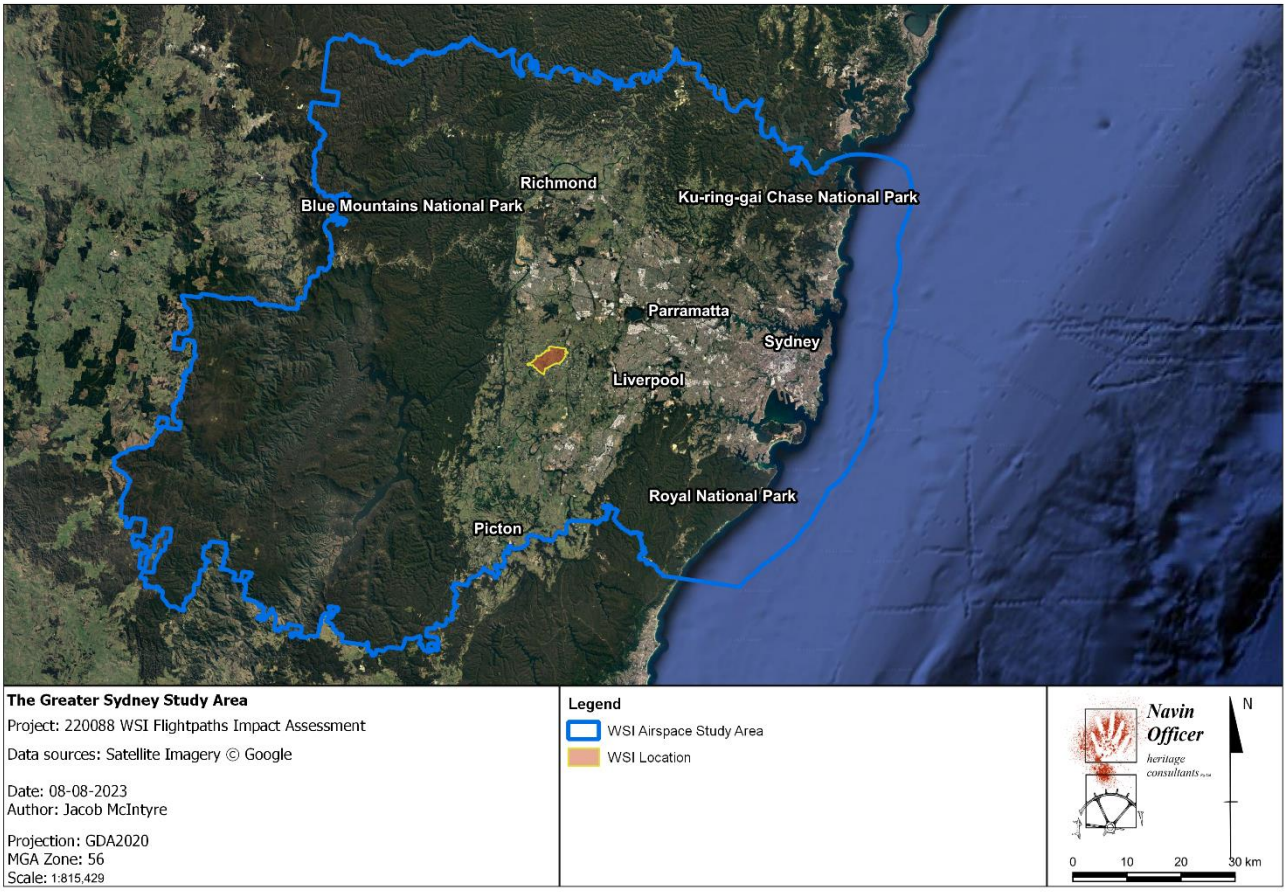

Figure 1.9 The airspace study area for the flight paths assessment project encompasses the Greater Sydney Basin

When flying at altitudes above 10,000ft, it is unlikely that aircraft noise levels heard on the ground would be above 60 dBA. Nevertheless, there is potential for aircraft overflights to result in environmental effects between 10,000–20,000ft in altitude above ground level (AGL). Aircraft could be audible and/or visible beyond these notional study area boundaries. Due to low ambient noise levels during night-time hours or in rural (residential) communities or non-residential areas under some flight paths, aircraft noise is likely to be noticeable and, combined with visual contact, could be a source of annoyance for some people. For this reason, the assessment will consider the potential of such impacts to determine their materiality to the EIS.

1.4.1 Focus area for First Nations engagement

Much of the eastern portion of this broad study area is already overflown by aircraft leaving from and arriving at Sydney (Kingsford Smith) Airport. Any new impact to cultural values from flight paths associated with WSI is likely to be focused on the western part of the airspace study area where there are extensive areas of undeveloped protected areas that are not currently overflown at low heights or in the same density as the eastern part of the study area. For this reason, a focus area was adopted for the Aboriginal cultural values assessment that generally followed the combined boundaries of the Deerubbin, Gandangara and Tharawal LALC areas (see Figure 1.10). It is from this area that knowledge holders were sought and interviewed.

The adoption of this area did not preclude stakeholders from raising concerns about the impact of sites outside the focus area, or from recommending other knowledge holders who might currently live outside this area. The adjacent LALCs (Metropolitan LALC and La Perouse LALC), whose areas of responsibility lie within the airspace study area and adjacent to the Aboriginal heritage focus area, were consulted to identify any cultural heritage values of concern.

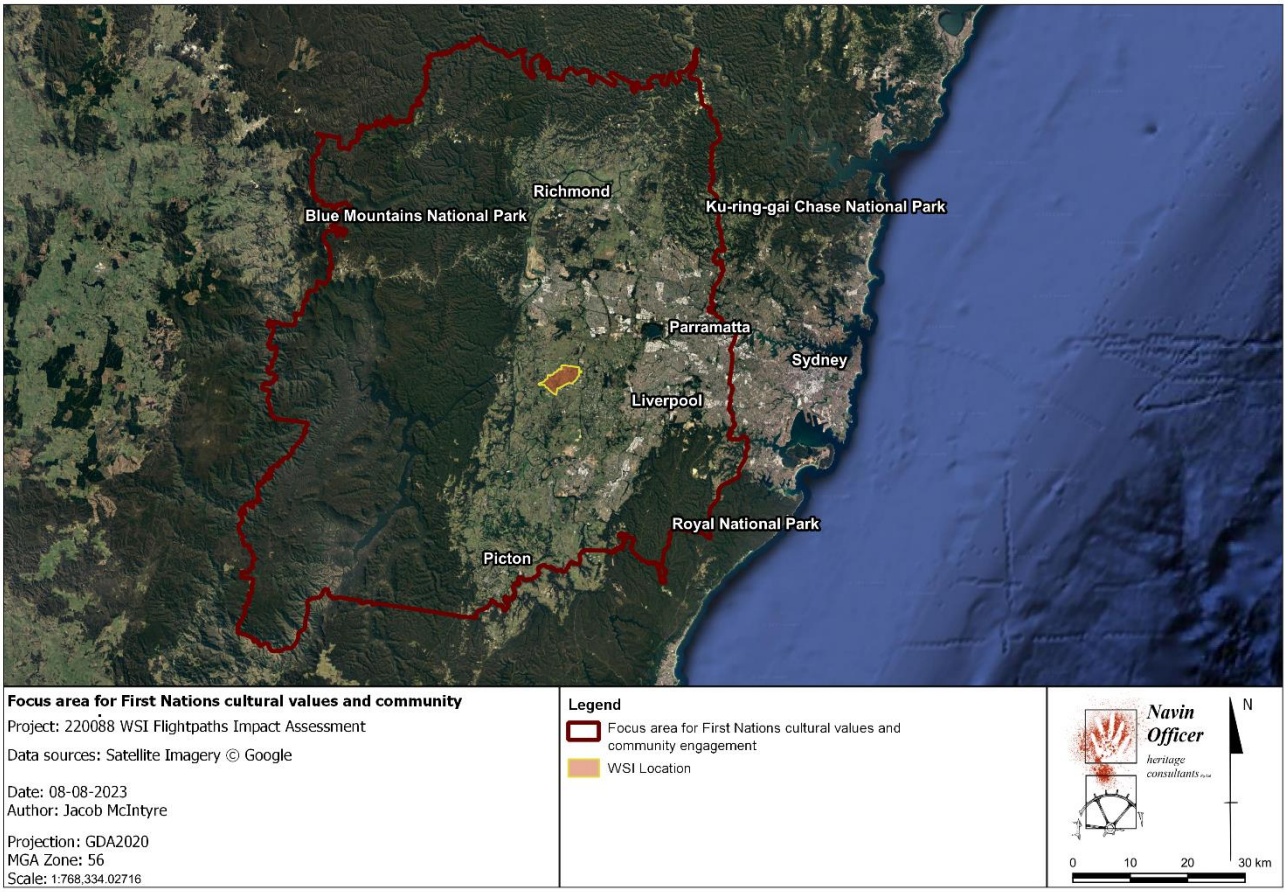

Figure 1.10 The focus area for First Nations' Engagement – area covered by Deerubbin, Tharawal and Gandangara Local Aboriginal Land Councils

Chapter 2 Legislation and strategic context

This chapter provides an overview of the broader heritage policies, legislation and strategies relevant to the project and considered in this technical paper.

In Australia there is a tiered regime for the protection of heritage places and values, which aligns across local, State and Commonwealth governments so that heritage of local, state and national significance is recognised and managed at the appropriate level. Many cultural heritage places within the airspace study area have been identified and recorded on the various lists and registers established under Commonwealth and State legislation and their associated regulations, strategies and policies. International conventions, the Australian Heritage Strategy (Commonwealth 2015) and the Australia ICOMOS Burra Charter, 2013 (Burra Charter) provide guidance on how our heritage places should be managed.

While the approval process for this project is subject to Commonwealth legislation and national guidelines the tiered system of heritage protection in Australia means that local and state governments play an important role in the identification of places of cultural heritage value. The need to work in partnership across all levels of government is a stated objective of the Commonwealth government (Commonwealth 2015: Outcome 2 Objective 5). The primary legislation and associated guidelines are outlined below.

2.1 Commonwealth legislation and national guidelines

Specifically, the significance of any potential environmental effects will be assessed by an EIS for the activity issued in accordance with Section 87 of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) (EPBC 2022/9143). The EIS will assess the noise and visual impacts on communities, ecological and heritage impacts, and the effects on local air quality and impacts of aircraft emissions arising from the Action. The project will be assessed to meet the requirements of the EPBC Act and Regulations, Condition 16 of the Airport Plan, and the Minister's Guidelines.

The relevant legislation, conventions and guidelines applying to the impact of the activity are as noted below.

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act together with the National Heritage management principles set out in the Regulations (Schedule 5B) of the Act, is the Australian Government's national environmental legislation. It provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, and heritage places – defined in the EPBC Act as matters of national environmental significance (MNES). To this end, it establishes:

- the National Heritage List – a list of Indigenous, historic and natural places of outstanding significance to the nation, and
- the Commonwealth Heritage List – a list of Indigenous, historic and natural heritage places owned or controlled by the Australian Government.

The EPBC Act also establishes requirements for environmental approval of activities that will have a significant impact on a declared World Heritage property – heritage places of Outstanding Universal Value (OUV) included in the World Heritage List established by UNESCO and recognised under the 1972 World Heritage Convention.

The EPBC Act requires activities with a significant impact on declared World Heritage properties or a National Heritage place to be approved.

The GBMA lies within the airspace study area for WSI and the potential impact of the project on the OUV of the GBMA is the subject of a separate assessment (see Technical paper 14).

This report addresses the potential for the project to impact the heritage values of specific cultural heritage sites which are within or adjacent to the GBMA.

2.1.1.1 The World Heritage management principles

The Australian government has established a set of principles to guide the management of World Heritage properties across Australia. These are outlined in Schedule 5 of the EPBC Act Regulations. Of relevance to this current assessment are the General Principles and those relating to environmental impact assessment and approval.

General principles

- The primary purpose of management of natural heritage and cultural heritage of a declared World Heritage property must be, in accordance with Australia's obligations under the World Heritage Convention, to identify, protect, conserve, present, transmit to future generations and, if appropriate, rehabilitate the World Heritage values of the property.
- The management should provide for public consultation on decisions and actions that may have a significant impact on the property.
- The management should make special provision, if appropriate, for the involvement in managing the property of people who:
  - have a particular interest in the property; and
  - may be affected by the management of the property.
- The management should provide for continuing community and technical input in managing the property.

Environmental Impact Assessment and Approval

- This principle applies to the assessment of an action that is likely to have a significant impact on the World Heritage values of a property (whether the action is to occur inside the property or not).
- Before the action is taken, the likely impact of the action on the World Heritage values of the property should be assessed under a statutory environmental impact assessment and approval process.
- The assessment process should:
  - identify the World Heritage values of the property that are likely to be affected by the action; and
  - examine how the World Heritage values of the property might be affected; and
  - provide for adequate opportunity for public consultation.
- An action should not be approved if it would be inconsistent with the protection, conservation, presentation or transmission to future generations of the World Heritage values of the property.
- Approval of the action should be subject to conditions that are necessary to ensure protection, conservation, presentation or transmission to future generations of the World Heritage values of the property.
- The action should be monitored by the authority responsible for giving the approval (or another appropriate authority) and, if necessary, enforcement action should be taken to ensure compliance with the conditions of the approval.

2.1.1.2 The National Heritage management principles

The National Heritage management principles provide a litmus test for actions that are proposed that may impact the heritage values of national heritage places. The principles are set out in the Regulations (Schedule 5B) of the EPBC Act and are as follows:

1. The objective in managing National Heritage places is to identify, protect, conserve, present and transmit, to all generations, their National Heritage values.
2. The management of National Heritage places should use the best available knowledge, skills and standards for those places, and include ongoing technical and community input to decisions and actions that may have a significant impact on their National Heritage values.

3. The management of National Heritage places should respect all heritage values of the place and seek to integrate, where appropriate, Commonwealth, state, territory and local government responsibilities for those places.
4. The management of National Heritage places should ensure that their use and presentation is consistent with the conservation of their National Heritage values.
5. The management of National Heritage places should make timely and appropriate provisions for community involvement, especially by people who:
   a. Have a particular interest in, or associations with, the place; and
   b. May be affected by the management of the place.
6. Indigenous people are the primary source of information on the value of their heritage. The active participation of Indigenous people in identification, assessment and management is integral to the effective protection of Indigenous heritage values.
7. The management of National Heritage places should provide for regular monitoring, review and reporting on the conservation of National Heritage values.

2.1.2 Commonwealth National Heritage Strategy 2015

The Commonwealth National Heritage Strategy 2015 (the Strategy) applies to the identification, protection and management of heritage places across all jurisdictions. The Strategy presents the Australian governments vision for heritage in Australia.

> **Our natural, historic and Indigenous heritage places are valued by Australians, protected for future generations and cared for by the community (Commonwealth 2015:4).**

The Strategy recognises that heritage conservation is not just a government function but requires strong partnerships and community involvement. The strategy supports broad community consultation on heritage values and management.

> **It is clear that while specific groups can claim ownership of specific parts of Australia's heritage, all Australians have rights to have a say in protection and management of the nation's heritage. A shared responsibility approach to heritage protection and management can deliberately recognise all the relevant stakeholders – community, organisations and government agencies; at all relevant levels—local, regional, state, national and international. It is a deliberate multi-party relationships approach to managing the heritage (James and Schmider 2012 cited in Commonwealth 2015:29).**

2.1.3 Engage Early – Guidance for proponents on best practice Indigenous engagement for environmental assessments under the EPBC Act

The *Engage Early – Guidance for proponents on best practice Indigenous engagement for environmental assessments under the EPBC Act* (Department of the Environment 2016) (Engage Early) guideline was prepared to:

- improve how proponents engaged and consult with Indigenous peoples during the environmental assessment process under the EPBC Act
- provide guidance on when communities should be consulted in addition to the statutory periods set in the EPBC Act for comments
- establish DCCEEW's expectations on how engagement should occur and what best practice consultation includes.

Engagement completed for the project has followed this guideline.

Since the issue of the EIS guidelines and during the preparation of the Draft EIS, DCCEEW released an *Interim Engaging with First Nations People and Communities on Assessment and Approvals under the EPBC Act* (DCCEEW 2023). This interim guideline updates the Engage Early guideline. The interim guideline advocates for consultation processes that ensure cultural safety, build and maintain trust, engage often and early, negotiates suitable timeframes, negotiate suitable submission formats. The heritage assessment for the project incorporated these principles into the methodology and implementation of the project to the extent possible.

2.1.4 Ask First: A guide to respecting Indigenous heritage places and values

'Ask First' (Australian Heritage Commission 2002) was developed to provide guidance on appropriate consultation with First Nations people in order to determine the significance of places in accordance with their culture as the first step in achieving agreements between parties on how places and heritage values should be managed. The guide notes that Indigenous heritage is dynamic and includes tangible and intangible expressions of culture that link generations. It promotes an inclusive approach to heritage consultation including Traditional Owners with rights and interests, as well as acknowledging that there may be other Indigenous people with historical connections to heritage places.

This document provides guidance for the consultation methodology on this project and complements the guidance provided by the Burra Charter.

2.1.5 Airservices Australia's Environmental Management of Changes to Aircraft Operations 2022

Airservices Australia's Environmental Management of Changes to Aircraft Operations 2022 (AA-NOS-ENV2.100) (Airservices Australia, 2022b) prescribes the requirements for environmental impact assessment (EIA), social impact analysis (SIA) and community engagement prior to implementing changes to aircraft operations.

2.1.6 The Aboriginal and Torres Strait Islander Heritage Protection Act

The *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* (Cth) (ATSIHP Act) can protect areas and objects that are of particular significance to Aboriginal and Torres Strait Islander people. The ATSIHP Act allows the Minister for the Environment to make a declaration to protect an area, object or class of objects which have been identified by First Nations people (or person) as being of particular significance and which is under threat of injury or desecration.

Aboriginal and Torres Strait Islander people or their representatives can apply to protect a specified area or objects under the ATSIHP Act (DAWE 2021).

2.1.7 The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance 2013

Australia ICOMOS is the national chapter of the International Council on Monuments and Sites (ICOMOS). The Burra Charter and its associated series of Practice Notes provides the best practice standards for managing cultural places in Australia. The Charter has been adopted by the Commonwealth, the NSW government and most local governments including those within the airspace study area. The Burra Charter is formally acknowledged as a guiding document for heritage management in the Australian Heritage Strategy (Commonwealth 2015:9).

2.2 New South Wales legislation

2.2.1 The National Parks and Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NPW Act) is the primary legislation protecting Aboriginal cultural heritage objects and places in NSW. The Act and associated Regulations require consideration of harm that may be caused by the project to Aboriginal objects and places. Harm is defined to mean destroying, defacing, damaging or moving an object from the land. The Act also provides protection for non -indigenous heritage Items owned and managed by the National Parks Wildlife Service.

All Aboriginal sites are protected in NSW whether they are known or as yet undiscovered. Heritage NSW maintains the Aboriginal Heritage and Information Management System (AHIMS) which is a database of known and recorded sites. However, it is important to understand that as many of these sites are recorded and registered during the course of various impact assessment processes, large parts of the airspace study area including most of the National Parks, which have not been subjected to development pressure have not been systematically surveyed for sites. Therefore, while 13,538 Aboriginal sites are registered on AHIMs within the airspace study area, the distribution of known sites can only be used as an indicator of the range and geographic spread of Aboriginal sites and many more are likely to exist. Unlike the *Heritage Act 1977*, listing on AHIMS is not subject to meeting significance thresholds. All sites are recorded regardless of the type or degree of cultural value.

The airspace study area (see Figure 1.9) encompasses in whole or part, the following National Parks as well as a number of nature reserves and state conservation areas:

- Berowra Valley National Park
- Blue Mountains National Park
- Garigal National Park
- Georges River National Park
- Kamay Botany Bay National Park
- Kanangra Boyd National Park
- Kuringai Chase National Park
- Lane Cove National Park
- Nattai National Park
- Marramarra National Park
- Muogamarra National Park
- Royal National Park
- Western Sydney Regional Park.

The Act (s84) also provides for the declaration of places that are of special significance with respect to Aboriginal culture. These places are referred to as Aboriginal Places (APs). The curtilage of each AP is published in the NSW Government Gazette, and it is an offence to carry out any activity that might harm them without an Aboriginal Heritage Impact Permit. For the purpose of this assessment, which is undertaken in accordance with Commonwealth guidelines, APs may be understood to be places of demonstrable high cultural value to NSW First Nations people.

2.2.2 The Heritage Act 1977

The *Heritage Act 1977* (Heritage Act) is intended to promote understanding and conservation of the State's heritage and provides for identifying and registering items of State heritage significance. It protects items of environmental heritage which are defined as 'those places, buildings, works, relics, moveable objects, and precincts, of State or local heritage significance'. The Act, the Heritage Regulations 2012, and Heritage Compliance Policy 2017 require the protection and conservation of archaeological relics in NSW and apply to a place, building, work, relic, moveable object or precinct of State heritage or Local heritage significance.

Items that have been identified by the Heritage Council of NSW as being of significance to the State are listed on the State Heritage Register (SHR). Any impacts to such items are closely regulated through permits.

In addition, to the protection offered to items of recognised State heritage significance, the Heritage Act also requires government instrumentalities (NSW government agencies and State-owned corporations) to establish and maintain a register of their heritage assets, known as a Section 170 Heritage and Conservation Register.

The Act also protects archaeological relics. A 'relic' is defined as:

> *any deposit, artefact, object or material evidence that:*
>
> *(a) relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and*
>
> *(b) is of State or local heritage significance.*

As noted above the archaeological protections under the Heritage Act specifically exclude Aboriginal archaeological deposits as these are protected under the NPW Act, whether known and registered or not.

It should also be noted that some historic places also have Aboriginal cultural values associated with them which may not have been identified.

There are 273 places listed on the SHR within the airspace study area and there are a further 18,888 places listed on the SHI for their local heritage value.

2.2.3 Environmental Planning and Assessment Act 1979

The relevant provision of this Act relates to the Local Environmental Plans made under the *Environmental Planning and Assessment Act 1979* (NSW) (EPA Act), which include schedules of local heritage items and historical archaeology, recorded as heritage items of local environmental significance. Standard provisions for local environmental plans are set out in the Standard Instrument – Principal Local Environmental Plan (2006 EPI 155a). Section 5.10 provides for the conservation and management of environmental heritage, which can include buildings, works, places, relics, trees, objects or archaeological sites. Heritage items and heritage conservation areas on the land to which the Local Environmental Plan (LEP) applies are identified and described in Schedule 5 environmental heritage. As noted above there are 18,888 items listed for their local heritage value on LEPs within the airspace study area.

Chapter 3 Methodology

This chapter provides an overview of the methodology for the heritage assessment, including the approach to assessment, consultation carried out, dependencies with other studies and any limitations and assumptions.

3.1 Impact assessment approach

The project seeks to understand if there are cultural values that will be impacted by flight paths. These values may be associated with places on the ground which will not be physically impacted by the development of WSI. The study seeks to understand if the action of aircraft flying overhead is likely to negatively impact traditional spiritual values, impact the continuation of cultural practices and uses of places, and/or physically exacerbate conservation issues that will ultimately result in a loss of values.

The airspace study area is described in Section 1.4, however most potential impacts to cultural heritage places will occur relatively close to the WSI, where emissions, noise and visual impacts from the take-off and landing of aircraft may pose a new impact to cultural places and their values. Therefore, our assessment focused on:

- places within a 5 km and 10 km radius of the Airport Site
- places in the Blue Mountains LGA that are vulnerable to impacts
- Aboriginal rock art sites were also investigated as a specific site type potentially vulnerable to atmospheric pollution.

Recognising that Sydney Basin's airspace is the most complex and busiest airspace in Australia involving an extensive network of flight paths and operational procedures associated with existing civil airports (Sydney (Kingsford Smith), Bankstown, Camden, Shellharbour); Defence facilities (RAAF Base Richmond, Holsworthy Military Airport); overflight restrictions at the Defence Establishment Orchard Hills (DEOH); recreational aviation activities (gliders, ballooning, parachuting); and transiting flights. This assessment sought to ascertain from technical experts the likely additional noise, vibration and pollution effects within the radii noted above (see DITRDCA, 2023c).

In relation to Aboriginal sites, discussions with Aboriginal stakeholders did not exclude places of concern to them outside these areas and included consideration of the type or nature of the Aboriginal site and whether or not it had a particular spiritual significance or current use that might be impacted by flight paths overhead.

3.1.1 Desktop assessment

The desktop component of the project involved:

- reviewing existing information relating to the Indigenous and non-indigenous cultural heritage values of the airspace study area; noting that these categories are not mutually exclusive. The range of documentary sources that were reviewed included:
  - previous cultural heritage studies undertaken for the WSI
  - previous cultural heritage studies related to the GBMA
  - selected heritage assessments and heritage values studies related to the airspace study area
  - existing databases such as AHIMS, State Heritage Inventory (SHI), National Heritage List (NHL), Commonwealth Heritage List (CHL), National Trust (NSW) database
  - previous studies relating to the potential impact of atmospheric pollution on Aboriginal rock art sites, specifically within the airspace study area and more generally across Australia
- compiling and identifying a list of Knowledge Holders i.e., those people likely to have specific information relating to the range of cultural heritage values that might be impacted.

3.1.2 Historic heritage places and their values

The NHL, CHL, and SHR were each reviewed to identify places with significant cultural values. All LGAs within the airspace study area have had LGA-wide heritage studies completed which have resulted in a large number of places listed on the heritage schedule of LEPs and the SHI.

In Australia, accepted heritage best practice involves the assessment of a place against value-based criteria. In relation to the NHL[1] these are:

a. the place has outstanding heritage value to the nation because of the place's importance in the course, or pattern, of Australia's natural or cultural history

b. the place has outstanding heritage value to the nation because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history

c. the place has outstanding heritage value to the nation because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history

d. the place has outstanding heritage value to the nation because of the place's importance in demonstrating the principal characteristics of:

   – a class of Australia's natural or cultural places; or

   – a class of Australia's natural or cultural environments

e. the place has outstanding heritage value to the nation because of the place's importance in exhibiting particular aesthetic characteristics valued by a community or cultural group

f. the place has outstanding heritage value to the nation because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period

g. the place has outstanding heritage value to the nation because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons

h. the place has outstanding heritage value to the nation because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history

i. the place has outstanding heritage value to the nation because of the place's importance as part of Indigenous tradition.

Note: The cultural aspect of a criterion means the Indigenous cultural aspect, the non-Indigenous cultural aspect, or both.

NSW employs a similar set of criteria against which heritage places are assessed, however there are 2 threshold levels – one to meet the requirements for listing on the SHR as a place that is significant to the State, and another to be listed on an LEP as a place of significance to the local community.

The 7 value-based criteria used in NSW are (NSW Heritage Office 2001:9):

- Criterion (a) An item is important in the course, or pattern, of NSW's cultural or natural history (or the cultural or natural history of the local area)
- Criterion (b) An item has strong or special association with the life or works of a person, or group of persons, of importance in NSW's cultural or natural history (or the cultural or natural history of the local area)
- Criterion (c) An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area)
- Criterion (d) An item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons

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1 National Heritage List criteria - DCCEEW viewed 27/01/2022

- Criterion (e) An item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area)
- Criterion (f) An item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area)
- Criterion (g) An item is important in demonstrating the principal characteristics of a class of NSW's:
  - cultural or natural places; or
  - cultural or natural environments or a class of the local area's cultural or natural places; or cultural or natural environments.

This means that each listed item includes documentation of the cultural values which contribute to its significance, although the quality and depth of that documentation varies depending on the thoroughness of the original nomination dossier. Unfortunately, listings are rarely updated if new values are identified, or existing ones are found to be compromised after listing.

For the purpose of this assessment the identified significant cultural values of those heritage items under the preliminary flight paths were accepted as they have been recorded and considered to identify those values that might potentially be impacted by the flight paths.

3.1.3 Aboriginal cultural places and their values

Most Aboriginal sites in NSW are recorded and lodged with the State's Aboriginal Heritage Information Management System (AHIMS) and most have not been assessed against any specific values-based criteria unless the place is a gazetted AP under s84 of the NPW Act or has been listed on the SHR. While there already exists a wealth of information about the diversity and nature of Aboriginal cultural places in the airspace study area, there is less comprehensive information about the cultural values associated with those places. The majority of sites listed in the airspace study area consist of isolated artefacts and artefact scatters many of which have since been destroyed by development and expansion of the cities and suburbs in the greater Sydney area. While all sites including archaeological sites such as artefacts scatters are important to First Nations people in NSW as evidence of the lives of their ancestors, certain sites hold deep cultural values linked to spirituality and contemporary practices. Such sites are likely to include natural landforms that depict activities and beings from the creation period (the Dreamtime), ceremonial sites such as stone arrangements, bora grounds, burial and massacre sites, rock art sites including shelters with pigment art and rock engravings. Places of contemporary use for family or clan gatherings, places where contemporary practices and trans-generational learning occur are also likely to be of high cultural value.

Select publications and accessible unpublished reports were reviewed to identify the range and types of places that may have Aboriginal cultural values in order to foster and prompt discussions with Aboriginal stakeholders.

Due to the size of the airspace study area, the nature of the project (i.e., aircraft flying above sites) and the number of recorded sites within it, it was considered helpful to focus discussions with knowledge holders. For this reason, 2 levels of maps were generated as visual aids used in consultation. Firstly, a map of the overall airspace study area and secondly a series of maps that covered much of the sandstone-based terrain and forested areas where shelters with rock art, rock engravings and ceremonial sites are known to occur, referred to in this report as the Aboriginal cultural values focus area.

In order to avoid excessive amounts of data with limited application, a search of the AHIMS for the location of Aboriginal rock art sites was undertaken within a subset of the airspace study area (refer Figure 5.10). The search area included all site distributions within relative proximity to the WSI and all of the GBMA within the study area, excepting the most distant western and southern portions.

The Aboriginal Nations closest to the Airport Site are the Dharug, Tharawal and Gundungurra nations and for this reason a focus area (the Aboriginal cultural values focus area) equivalent to the combined lands of the Deerubbin, Gandangara and Tharawal LALCs, was adopted to focus one-on-one discussions. Direct engagement with individuals and organisations from across this area provided information about the cultural values, the places associated with them and concerns about perceived impacts.

The 2021 census noted the Aboriginal population of Greater Sydney to be 87,140 people.[2] Generally, in the airspace study area there is a large Aboriginal population dominated by people who have migrated to or who are descended from people who migrated to the area from other Aboriginal traditional lands for work, education or other reasons. In some cases, families may have lived in the area for several generations and may therefore have developed historical connections to country, even though it may be outside their traditional country. For this reason, each of LALCs in the Sydney Basin (the Deerubbin, Gandangara, Tharawal, Metropolitan and La Perouse) were contacted about the project and consulted regarding any known individual Knowledge Holders. To the extent possible, given the timeframe for consultation, the project ensured that multiple interests were considered in the methodology and opportunity was given to individuals and organisations to identify others that may hold cultural knowledge relevant to this project.

Each of the organisations listed in Table 3.1 was contacted by email and provided the opportunity to identify relevant knowledge holders, who were then contacted and if available and willing, interviewed regarding cultural values and concerns regarding perceived impacts to those values. Multiple opportunities for engagement were provided to individuals regarding opportunities to meet and have input. Over the course of the assessment in excess of 120 phone calls, emails, virtual meetings and face to face meetings with First Nations people and organisations were held.

Table 3.1 Aboriginal engagement approach

Who to engage	How to engage
Traditional Owners, Native Title claimants or Indigenous land use agreement parties. Individual knowledge holders recognised as native title claimants with cultural heritage knowledge. Knowledge holders (descended from other Nations, but who have lived in the area a long time and who have the cultural authority to speak). Individuals recognised as holding cultural heritage knowledge from previous studies and who are accepted as such by at least one of the organisations listed below.	Seek advice from relevant organisations to identify individuals who are likely to hold such knowledge. One-on-one interviews to ascertain values and significant sites within the airspace study area (interviewees are paid; some may be small group interviews, depending on stakeholder preference).
Local Aboriginal Land Councils: • Tharawal LALC • Deerubbin LALC • Gandangarra LALC • Metropolitan LALC • La Perouse LALC. Local Government Advisory committees Other organisations: • Murru Mittigar • Darug Tribal Aboriginal Corporation • Darug Custodian Aboriginal Corporation • Dharug Ngurra Aboriginal Corporation • Western Sydney Aboriginal Regional Alliance • Tharawal Aboriginal Corporation • Cubbitch Barta • Gundungurra Tribal Council Aboriginal Corporation • Gundungurra Aboriginal Heritage Association • Blue Mountains Aboriginal Culture and Resource Centre.	Briefing letters requesting suggestions regarding knowledge holders. Offers to present at group meetings. Follow up phone calls were made offering further information sharing opportunities.
Broader Aboriginal community (anyone with an interest in the area)	As per the project's broader community engagement approach.

[2] https://abs.gov.au/census/find-census-data/quickstats/2021/IQS1GSYD viewed 20/12/2022

Through the consultation process a number of people with knowledge or interests in the cultural values of the WSI airspace study area, and particularly the focus area identified in Section 1.4.1, were contacted about the project and if available, interviewed with a view to identifying places of particular cultural value and to gain and understanding of how such values may or may not be impacted by the preliminary flight paths.

Table 3.2 In addition to briefing letters to organisations a number of individuals were interviewed or otherwise contacted directing by phone or email about the project

Group	Individuals interviewed	Other individuals contacted
Dharug	• Uncle Shane Smithers • Jacinta Tobin • Corina Norman • Vanessa Possum • Julie Jones • Raelene Lock	• Leanne Watson
Tharawal/Dharawal	• Aunty Glenda Chalker • Rebecca Chalker • Peter Williams • Barbara Simms • Yvonne Simms	• Uncle Ivan Wellington
Gundungarra	• Kazan Brown	• David King • Uncle Greg Simms • Aunty Sharon Hall • Aunty Edna Watson • Aunty Carol Cooper
Others	• Steve Randall (Deerubbin LALC)	• Nathan Moran (Metropolitan LALC)

3.2 Field work, gathering data

3.2.1 First Nations heritage

All individuals noted in Table 3.2 were contacted and offered an opportunity to meet with the team one-on-one. Where acceptable to the stakeholder, the interviews were recorded to allow the researchers to review and identify places of high cultural value. Transcripts were returned to the stakeholder and recordings were not retained permanently by the researchers. In general, each meeting and interview involved multiple follow up phone calls with the First Nation participant. In cases where individuals had other commitments alternative opportunities were provided including phone calls, the opportunity to email the team, face to face meeting on alternative days and virtual meetings.

All organisations noted in Table 3.2 were contacted by email, provided information about the project and invited to advise of any members who may hold relevant cultural knowledge. An offer to provide a group briefing to members or a briefing to the board was made.

Following the launch of the WSI Flightpaths Tool (wsiflightpaths.gov.au) an online briefing of First Nations people who had been involved in the project was held and a demonstration of the tool was provided. That online briefing was also open to friends and colleagues of those who had participated. Further contact was made following the release of the Draft EIS, providing information on the exhibition period, how the Draft EIS could be viewed and how submissions could be made.

3.2.2 Non-Indigenous heritage

This component relied largely on desk top assessments but also involved collecting any information gathered through the WSI community consultation strategy including the pop-up community forums. Consultation with heritage officers at Heritage NSW was undertaken by phone to clarify if any relevant studies or initiatives are underway and to gather insights into vulnerable cultural values.

3.3 Dependencies and interactions with other technical papers

The information presented in this paper has been informed by the following:

Table 3.3 Dependencies and interactions with other Technical Papers

Technical Paper	Relevance
Technical paper 1: Aircraft noise (Technical paper 1)	This technical paper was used to understand the likely impact to cultural values caused by noise related to the preliminary flight paths.
Technical paper 2: Air quality (Technical paper 2)	This technical paper was used to understand the likely impact to cultural values caused by emissions related to aircraft using the preliminary flight paths.
Technical paper 4: Hazards and risk (Technical paper 4)	This technical paper was used to understand the likely incidence and potential impact to cultural values caused by fuel jettisoning related to aircraft using the WSI.
Technical paper 10: Social (Technical paper 10)	This technical paper was reviewed to determine potential impacts to cultural values which were raised in other forums.
Technical paper 11: Economic (Technical paper 11)	This assessment provided context regarding the dependency between heritage values and the local economic drivers.
Technical paper 14: Greater Blue Mountains World Heritage Area (Technical paper 14)	The technical paper was used to understand the specific impacts associated with the GBMA.

Advice from other technical specialists engaged in the assessment process was sought to address concerns raised about potential impacts arising related to impact from emissions, noise and visual intrusion to ascertain whether these perceived impacts are likely to be real; if so, to what degree they might impair the cultural values of the place.

Similarly, feedback from the social assessment team's community pop up consultation meetings was reviewed to identify any heritage concerns raised.

3.4 Analysis of information gathered and reporting

Information from the desktop research and that received from stakeholders was analysed with a view to:

- identifying places of high cultural value
- identifying potential risks to such places and concerns re the impact of the project on cultural values and practices.

Perceived threats were investigated and where possible clarified as real or negligible.

Given the large number and wide distribution of known and recorded cultural heritage places several strategies were used to sort data into:

- areas that were more likely to be overflown by aircraft at lower altitudes and/or
- types of places where cultural values might be more vulnerable.

For this reason, non-indigenous places while also considered over the entire airspace study area were also sorted into those places located within a 5 km radius of WSI and 10 km radius of the centre point of WSI. In relation to recorded Aboriginal cultural values a focus area corresponding to the land within the boundaries of Deerubbin, Gandangara and Tharawal LALCs was selected as a focus for interviews with First Nations knowledge holders. In relation to known and recorded Aboriginal sites, those site types generally known to have cultural values, other than archaeological values, were discussed. These included rock art sites (both painted and engraved), stone arrangements (often associated with ceremony), burials, massacre sites, dreaming or spiritual sites and places of contemporary use.

3.4.1 Assessing impact

Assessing impact on cultural values is somewhat easier when dealing with physical impacts that can be measured and seen. However, when considering intangible values, such as spirituality, wellbeing, connectedness with nature, a more qualitative approach is needed. A consideration of impact must consider what the tipping point might be in determining whether or not a place remains suitable for or can sustain the cultural practices and belief systems that are associated with that place. For the purpose of this assessment the following terms have been used to describe the potential impacts:

- Negligible to low – an impact on the cultural value of a place is considered negligible to low where those impacts will not cause physical damage and are unlikely to affect the cultural practices undertaken at a place.
- Moderate – an impact is considered moderate where it may have an impact on the values of the place, or the cultural practices carried out at the place but where these impacts may be tolerated or mitigated in some way.
- Severe – an impact is considered severe where it would damage or compromise the values of the place or heritage item and/or render the cultural practices associated with the place no longer practical or possible.

This report articulates the range of heritage values discussed, considers how they might be impacted and suggests mitigation actions. Figure 3.1 is provided as a framework for understanding in assessing the likely impact of noise levels at heritage places. For the purposes of this assessment a predicted noise level of 70dBA and above is classed as a severe impact, particularly where those heritage places were otherwise located in a tranquil rural or bushland location. The N70 contour is typically used to assess day-time noise impacts. Other factors that may affect the severity of noise related impact relate to the frequency of flights (and therefore frequency of disturbance) and whether or night flights occur at night when background noise in rural areas is at its lowest. The impact level/rating also considered other factors in additional to noise, such as visual intrusion.

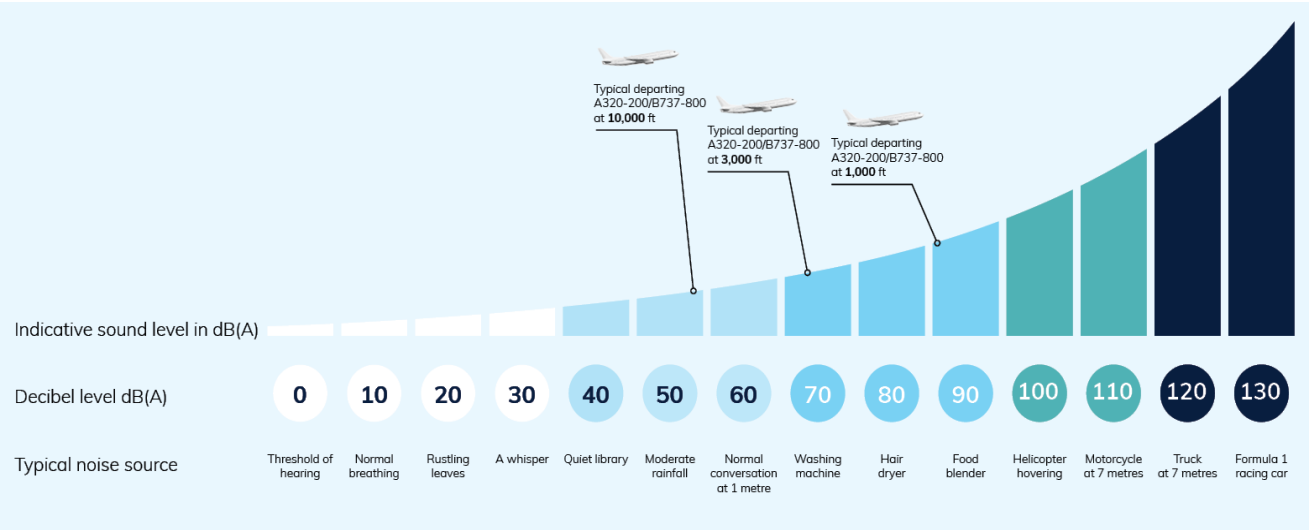

Figure 3.1 Understanding indicative noise levels

3.5 Limitations and assumptions

While all stakeholders were asked if they knew of other knowledge holders that they thought should be consulted, it is acknowledged that there may be people identified who were not available for interview within the project timeframe. To address this, multiple opportunities were provided to the First Nation knowledge holders to connect with the study team and to provide input (as discussed in this chapter). Multiple opportunities for engagement were provided to individuals regarding opportunities to meet and have input. Over the course of the project in excess of 120 phone calls, emails, virtual meetings and face to face meetings with First Nations people and organisations were held. (see Section 3.2).

While theoretically the process of identification and assessment of heritage places for listing on the NHL, CHL, SHR and LEPs should result in all cultural values being identified and robustly substantiated; this is dependent on the quality and depth of the associated documentation and the thoroughness of the original nomination dossier. Unfortunately, listings are rarely updated if new values are identified, or subsequent studies reveal different heritage values, or if the integrity of the site has been affected by events or actions which have occurred after listing. For the purpose of this study, we have relied on the recorded heritage values and any values reported to us by stakeholders.

The GBMA is subject to a separate technical paper (Technical paper 14) which focuses on the OUV for which the property is recognised and the potential impacts arising from the Action. The property is listed for its natural values under the following criteria:

> **ix) to be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals and**
>
> **x) to contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.**[3]

While the property is listed for its natural values only there is a growing call for some of the cultural values of the property to be recognised at the national level in the first instance and eventually to be considered in a renomination of the property for additional areas and values.

This report considers the cultural values of Aboriginal and non-Aboriginal sites within and adjacent to the GBMA which are of local or state significance. Therefore, to get a complete understanding of heritage impacts both technical reports need to be considered.

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[3] https://whc.unesco.org/en/list/917/ viewed 25/1/2023

Chapter 4 Existing conditions

This chapter describes the existing conditions and features of the study area to provide a baseline against which the project's impacts can be assessed.

There are a number of properties within the airspace study area that are on the World Heritage, National Heritage and Commonwealth Heritage Lists. These lists are established under the EPBC Act. This section describes the range of heritage sites and places that are known to occur within the airspace study area. These include 2 WHAs: the GBMA and the Sydney Opera House, as well as elements of a third WHA – the Australian Convict Sites (Hyde Park Barracks, Cockatoo Island, Old Government House, Old Great North Road).

Within the airspace study area there are also a number of nationally listed places and several places on the Commonwealth Heritage List. There are many more places protected under NSW legislation including those on the SHR protected under the *Heritage Act 1977*, those on LEPs, and Aboriginal sites protected under the NPW Act.

Aboriginal sites abound throughout the study area with 13,538 such sites having been recorded on AHIMS. Most of these comprise stone artefacts scatters and isolated finds and have been recorded in the course of environmental impact assessments associated with urban and industrial expansion of the greater Sydney area.

These sites and their vulnerabilities to impact are discussed in the sections below.

4.1 Known heritage places and values

4.1.1 World Heritage Areas

World Heritage Areas are properties which have been recognised as having OUV which go beyond the values that they hold for a single nation. The airspace study area for WSI contains 2 WHAs: the GBMA and the Opera House, in addition to 4 properties (Hyde Park Barracks, Cockatoo Island, old Government House and Domain and the Great North Road) that form the NSW component of the Australian Convict WHA. All are also listed as National Heritage places (Table 4.1).

Flight paths for the project do not fly directly over the Sydney Opera House or the Australia Convict Sites located within the study area. As such, these sites are not considered further in the assessment.

4.1.1.1 The GBMA

The GBMA is in closest proximity to WSI and is therefore the most likely to experience an increase in overhead air traffic compared to the other World Heritage Areas. A detailed assessment of the potential impact of the project on the OUV of the GBMA is subject of a separate technical paper (Technical paper 14).

The OUV for which the WHA is recognised are natural values, and the boundary of the WHA excludes the existing townships and settlements; nevertheless, within the boundaries of the GBMA there are many Aboriginal sites. There are also several historic heritage places, although most recorded significant historic heritage places lie outside the WHA boundary in the adjacent townships. The cultural values of these places fall within the remit of this technical report.

The GBMA was inscribed on the World Heritage List (WHL) in 2000 and comprises the Wollemi National Park (NP), Yengo NP, Gardens of Stone NP, Blue Mountains NP, Jenolan Karst Conservation Reserve, Kanangra-Boyd NP, Nattai NP and Thirlmere NP and covers more than 1,000,000ha. The property is listed for its natural values, and it is these natural values that are recognised as having OUV.

> **Criterion (ix): The Greater Blue Mountains include outstanding and representative examples in a relatively small area of the evolution and adaptation of the genus Eucalyptus and eucalypt-dominated vegetation on the Australian continent. The site contains a wide and balanced representation of eucalypt habitats including wet and dry sclerophyll forests and mallee heathlands, as well as localised swamps, wetlands and grassland. It is a centre of diversification for the Australian scleromorphic flora, including significant aspects of eucalypt evolution and radiation. Representative examples of the dynamic processes in its eucalypt-dominated ecosystems cover the full range of interactions between eucalypts, understorey, fauna, environment and fire. The site includes primitive species of outstanding significance to the evolution of the earth's plant life, such as the highly restricted Wollemi pine (Wollemia nobilis) and the Blue Mountains pine (*Pherosphaera fitzgeraldii*). These are examples of ancient, relict species with Gondwanan affinities that have survived past climatic changes and demonstrate the highly unusual juxtaposition of Gondwanan taxa with the diverse scleromorphic flora.**
>
> **Criterion (x): The site includes an outstanding diversity of habitats and plant communities that support its globally significant species and ecosystem diversity (152 plant families, 484 genera and c. 1,500 species). A significant proportion of the Australian continent's biodiversity, especially its scleromorphic flora, occur in the area. Plant families represented by exceptionally high levels of species diversity here include *Myrtaceae* (150 species), Fabaceae (149 species), and *Proteaeceae* (77 species). Eucalypts (Eucalyptus, Angophora and *Corymbia,* all in the family *Myrtaceae*) which dominate the Australian continent are well represented by more than 90 species (13% of the global total). The genus Acacia (in the family Fabaceae) is represented by 64 species. The site includes primitive and relictual species with Gondwanan affinities (Wollemia, *Pherosphaera*, Lomatia, *Dracophyllum*, *Acrophyllum*, Podocarpus and *Atkinsonia*) and supports many plants of conservation significance including 114 endemic species and 177 threatened species.**[4]

While the focus of the World Heritage recognition is on natural values and the boundary of the WHA excludes the townships and settlements there are nevertheless many sites, places and constructed features within the boundaries of the GBMA that have cultural value. Over the years since its inscription on the World Heritage List for its natural values there has been an unwavering call for the area to be renominated for its cultural values. Indeed, the area was originally nominated by the Australian Government for both its natural and cultural values, although at the time the World Heritage Committee concluded that the case had not yet been made to substantiate a claim of OUV under the cultural criteria. Substantial work has been done since inscription to more comprehensively document and understand the cultural values of the area (Mackay 2015; McGrath 2015) including geoheritage values (Washington and Wray 2015:33-34) all supporting a cultural landscape approach to understanding the values. Proposals have also been developed to advocate for extensions to the WHA.

The evidence for cultural values includes many Aboriginal sites including occupation sites, stone arrangements, Aboriginal rock art sites and dreaming sites to which contemporary First Nations people have a deep connection. The Aboriginal cultural values within the Greater Blue Mountains are embodied in the rich resources of rock art and occupation sites scattered across the area.

There are also historic heritage places, many of which have not been formally recorded on lists and registers, which have cultural values. These include places connected with the early conservation movement in Australia such as the early network of cliff-face walking tracks linking the east-west chain of Blue Mountains towns to their adjacent protected valleys and gorges, staircases and lookouts. Most recorded significant historic heritage places lie outside the WHA boundary in the adjacent townships. The cultural values of these places fall within the remit of this technical report.

Given the size of the GBMA and the many hundreds of known Aboriginal and historic heritage places plus the understanding that there will be hundreds of others that exist but have not been recorded, this assessment does not claim to have assessed impacts on each site individually. Instead, this assessment has focused on understanding what sort of impacts flight paths could possibly have on heritage values of the range of heritage places that occur. Some types of heritage items are likely to be robust in the face of those impacts. For example, the heritage values of Aboriginal stone artefact scatters are unlikely to be impacted by the flight paths, unless those places also hold other values; whereas

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4 https://whc.unesco.org/en/list/917/ viewed 10/01/2023

Aboriginal rock art sites often have a spiritual value and sometimes a ceremonial value that might be affected by noise, visual intrusion and or physically by emissions.

Similarly historic heritage places range from places of memory and commemoration to heritage gardens and physical buildings some of which may be susceptible to emissions and some of which may not. While heritage items may be subjected to increased noise, they may or may not have current or proposed compatible uses that are sensitive to noise impacts.

A values-based approach is consistent with the Burra Charter (Australia ICOMOS 2013)

Cultural significance means aesthetic, historic, scientific, social or spiritual value for past, present or future generations. Cultural significance is embodied in the place itself, its fabric, setting, use, associations, meanings, records, related places and related objects. (Article 1.2)

4.1.1.2 The Sydney Opera House

The Sydney Opera House was inscribed on the WHL in 2007 under criterion *(i) to represent a masterpiece of human creative genius.*

> **Criterion (i): The Sydney Opera House is a great architectural work of the 20th century. It represents multiple strands of creativity, both in architectural form and structural design, a great urban sculpture carefully set in a remarkable waterscape and a world-famous iconic building.**[5]

4.1.1.3 The Australian Convict Sites

The Australian Convict Sites was inscribed on the WHL in 2010 and consists of 11 complementary sites. Four of these occur within the airspace study area; they are The Old Great North Road, Cockatoo Island, Hyde Park Barracks, Old Government House and Domain (Parramatta Park). It constitutes an outstanding and large-scale example of the forced migration of convicts, who were condemned to transportation to distant colonies of the British Empire; the same method was also used by other colonial states. The property is recognised as having OUV under criterion iv) and vi).

> **Criterion (iv): The Australian convict sites constitute an outstanding example of the way in which conventional forced labour and national prison systems were transformed, in major European nations in the 18th and 19th centuries, into a system of deportation and forced labour forming part of the British Empire's vast colonial project. They illustrate the variety of the creation of penal colonies to serve the many material needs created by the development of a new territory. They bear witness to a penitentiary system which had many objectives, ranging from severe punishment used as a deterrent to forced-labour for men, women and children, and the rehabilitation of the convicts through labour and discipline.**
>
> **Criterion (vi): The transportation of criminals, delinquents, and political prisoners to colonial lands by the great nation states between the 18th and 20th centuries is an important aspect of human history, especially with regard to its penal, political and colonial dimensions. The Australian convict settlements provide a particularly complete example of this history and the associated symbolic values derived from discussions in modern and contemporary European society. They illustrate an active phase in the occupation of colonial lands to the detriment of the Aboriginal peoples, and the process of creating a colonial population of European origin through the dialectic of punishment and transportation followed by forced labour and social rehabilitation to the eventual social integration of convicts as settlers.**[6]

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5 https://whc.unesco.org/en/list/166/ accessed 10/01/2023
6 https://whc.unesco.org/en/list/1306/ accessed 10/01/2023

4.1.2 Nationally listed heritage places

Australia's most valued Indigenous and historic heritage sites are listed on the NHL in accordance with the criteria contained in the statutory provisions of the EPBC Act and Regulations. These places reflect the richness of Australia's heritage and the story of its development, from its original inhabitants to present day, and its unique landscapes. The places that are included on the NHL which are located within the airspace study area for WSI are provided in Table 4.1.

Table 4.1 Places on the National Heritage List which are located within the airspace study area for WSI

Nationally listed place	Distance from WSI (km)
Bondi Beach Campbell Parade/Bondi Surf Pavilion	51
Cockatoo Island	42
First Government House Site	45
Hyde Park Barracks	45
Ku-ring-gai Chase National Park, Lion, Long and Spectacle Island Nature Reserves	55
North Head – Sydney North Head Scenic Drive	54
Old Great North Road/The Old Great Northern Road	62
Royal National Park and Garawarra State Conservation Area	40
Sydney Opera House 2 Circular Quay East	46
Centennial Park Oxford Street	47
Cyprus Hellene Club – Australian Hall	45
Governors' Domain and Civic Precinct	46
Kamay Botany Bay: botanical collections sites	46
Kurnell Peninsula Headland	49
Old Government House and the Government Domain Parramatta	27
Parramatta Female Factory and Institutions	27
Sydney Harbour Bridge Bradfield Highway	45
The Greater Blue Mountains Area	10

4.1.3 Places on the Commonwealth Heritage List

The CHL is a list of Indigenous, historic and natural heritage places owned or controlled by the Australian Government. These include places connected to defence, maritime safety, communications, customs and other government activities that also reflect Australia's development as a nation. Places on the CHL are protected by the EPBC Act and Regulations.

Table 4.2 shows those places on the CHL within the airspace study area. Most are located east of WSI along the east coast. Only one of these heritage items on the CHL is within 10 km of the Airport Site.

Most of the places on the CHL are located well to the east of WSI (see Table 4.2). The closest places are:

- Orchard Hills Cumberland Plain Woodland, The Northern Rd, Orchard Hills, NSW, Australia (4.1 km)
- Shale Woodland Llandilo Stony Creek Rd, Shanes Park, NSW, Australia (17.3 km)
- Cubbitch Barta National Estate Area Old Illawarra Rd, Holsworthy, NSW, Australia (17.7 km)
- North Base Trig Station Dight St, Richmond RAAF Base, NSW, Australia (30.6 km)
- Old Army/Internment Camp Group Holsworthy Artillery Rd, Holsworthy, NSW, Australia (21.5 km).

Table 4.2 Properties listed on the Commonwealth Heritage List within the airspace study area

Heritage places on the Commonwealth Heritage List	Suburb
Admiralty House Garden and Fortifications 109 Kirribilli Ave	Kirribilli, NSW, Australia
Admiralty House and Lodge 109 Kirribilli Av	Kirribilli, NSW, Australia
Army Cottage with return verandah Old South Head Rd	Vaucluse, NSW, Australia
Bankstown Airport Air Traffic Control Tower Tower Rd	Bankstown, NSW, Australia
Barracks Block	Cockatoo Island, NSW, Australia
Barracks Group HMAS Watson Hornby Light Rd	Watsons Bay, NSW, Australia
Batteries A83 and C9A Suakin Dr	Georges Heights, NSW, Australia
Battery B42 Middle Head Rd	Georges Heights, NSW, Australia
Battery for Five Guns Suakin Dr	Georges Heights, NSW, Australia
Biloela Group	Cockatoo Island, NSW, Australia
Bondi Beach Post Office 20 Hall St	Bondi, NSW, Australia
Botany Post Office 2 Banksia St	Botany, NSW, Australia
Building VB1 and Parade Ground Oxford St	Paddington, NSW, Australia
Building VB2 Guard House Oxford St	Paddington, NSW, Australia
Buildings 31 and 32 Endeavour Rd North	Garden Island, NSW, Australia
Buildings MQVB16 and VB56 Oxford St	Paddington, NSW, Australia
Buildings VB13, 15, 16 & 17 Oxford St	Paddington, NSW, Australia
Buildings VB41, 45 & 53 Oxford St	Paddington, NSW, Australia
Buildings VB60 and VB62 Oxford St	Paddington, NSW, Australia
Buildings VB69, 75 & 76 including Garden Oxford St	Paddington, NSW, Australia
Buildings VB83, 84, 85, 87 & 89 Oxford St	Paddington, NSW, Australia
Buildings VB90, 91, 91A & 92 Oxford St	Paddington, NSW, Australia

Heritage places on the Commonwealth Heritage List	Suburb
Camden Post Office 135 Argyle St	Camden, NSW, Australia
Cape Baily Lighthouse Sir Joseph Banks Dr	Kurnell, NSW, Australia
Chain and Anchor Store (former) West Rd	Garden Island, NSW, Australia
Chowder Bay Barracks Group Chowder Bay Rd	Georges Heights, NSW, Australia
Cliff House Hornby Light Rd, HMAS Watson	Watsons Bay, NSW, Australia
Cockatoo Island Industrial Conservation Area	Cockatoo Island, NSW, Australia
Commonwealth Avenue Defence Housing Commonwealth Av	Georges Heights, NSW, Australia
Cottage at Macquarie Lighthouse Old South Head Rd	Vaucluse, NSW, Australia
Cronulla Post Office 41 Cronulla St	Cronulla, NSW, Australia
Cubbitch Barta National Estate Area Old Illawarra Rd	Holsworthy, NSW, Australia
Customs Marine Centre Ben Boyd Rd	Neutral Bay, NSW, Australia
Defence site - Georges Heights and Middle Head Middle Head Rd	Georges Heights, NSW, Australia
Factory West Rd	Garden Island, NSW, Australia
Fitzroy Dock	Cockatoo Island, NSW, Australia
Garden Island Precinct Cowper Wharf Rd	Garden Island, NSW, Australia
Gazebo Wylde St	Potts Point, NSW, Australia
General Post Office 1 Martin Pl	Sydney, NSW, Australia
Golf Clubhouse (former) Middle Head Rd	Georges Heights, NSW, Australia
HMAS Penguin Middle Head Rd	Georges Heights, NSW, Australia
Headquarters 8th Brigade Precinct Cross St	Clifton Gardens, NSW, Australia
Headquarters Training Command Precinct Middle Head Rd	Georges Heights, NSW, Australia
Kirribilli House 111 Kirribilli Av	Kirribilli, NSW, Australia
Kirribilli House Garden & Grounds 111 Kirribilli Av	Kirribilli, NSW, Australia
Lancer Barracks Smith St	Parramatta, NSW, Australia
Lancer Barracks Precinct Smith St	Parramatta, NSW, Australia
Macquarie Lighthouse Old South Head Rd	Vaucluse, NSW, Australia
Macquarie Lighthouse Group Old South Head Rd	Vaucluse, NSW, Australia
Macquarie Lighthouse Surrounding Wall Old South Head Rd	Vaucluse, NSW, Australia
Malabar Headland Franklin St	Malabar, NSW, Australia
Marine Biological Station (former) 31 Pacific St	Watsons Bay, NSW, Australia
Marrickville Post Office 274A Marrickville Rd	Marrickville, NSW, Australia
Mess Hall (former)	Cockatoo Island, NSW, Australia
Military Guard Room	Cockatoo Island, NSW, Australia
Military Road Framework - Defence Land Middle Head Rd	Georges Heights, NSW, Australia

Heritage places on the Commonwealth Heritage List	Suburb
Naval Store Return Stores La	Garden Island, NSW, Australia
Navy Refuelling Depot and Caretakers House Chowder Bay Rd	Georges Heights, NSW, Australia
North Base Trig Station Dight St	Richmond RAAF Base, NSW, Australia
North Head Artillery Barracks North Head Scenic Dr	Manly, NSW, Australia
North Sydney Post Office 92-94 Pacific Hwy	North Sydney, NSW, Australia
Office Building Office Sq	Garden Island, NSW, Australia
Officers Mess, HQ Training Command Suakin Dr	Georges Heights, NSW, Australia
Old Army / Internment Camp Group Holsworthy Artillery Rd	Holsworthy, NSW, Australia
Orchard Hills Cumberland Plain Woodland The Northern Rd	Orchard Hills, NSW, Australia
Paddington Post Office 246 Oxford St	Paddington, NSW, Australia
Powerhouse / Pump House	Cockatoo Island, NSW, Australia
Prison Barracks Precinct	Cockatoo Island, NSW, Australia
Pyrmont Post Office 148 Harris St	Pyrmont, NSW, Australia
RAAF Base Richmond McNamara Av	Richmond RAAF Base, NSW, Australia
Reserve Bank 65 Martin Pl	Sydney, NSW, Australia
Residences Group Hill Rd	Garden Island, NSW, Australia
Rigging Shed and Chapel Riggers La	Garden Island, NSW, Australia
School of Musketry and Officers Mess, Randwick Army Barracks Bundock St	Kingsford, NSW, Australia
Shale Woodland Llandilo Stony Creek Rd	Shanes Park, NSW, Australia
Shark Point Battery Vaucluse Rd	Vaucluse, NSW, Australia
Snapper Island	Drummoyne, NSW, Australia
Spectacle Island Explosives Complex	Drummoyne, NSW, Australia
Sutherland Dock	Cockatoo Island, NSW, Australia
Sydney Airport Air Traffic Control Tower General Holmes Dr	Sydney Airport, NSW, Australia
Sydney Customs House (former) 31 Alfred St	Sydney, NSW, Australia
Ten Terminal Regiment Headquarters and AusAid Training Centre Middle Head Rd	Georges Heights, NSW, Australia
Thirty Terminal Squadron Precinct Middle Head Rd	Georges Heights, NSW, Australia
Underground Grain Silos	Cockatoo Island, NSW, Australia
Victoria Barracks Perimeter Wall and Gates Oxford St	Paddington, NSW, Australia
Victoria Barracks Precinct Oxford St	Paddington, NSW, Australia
Victoria Barracks Squash Courts Oxford St	Paddington, NSW, Australia
Villawood Immigration Centre Miowera Rd	Villawood, NSW, Australia
Woolwich Dock Clarke Rd	Woolwich, NSW, Australia

4.1.4 Places on the State Heritage Register

State listed heritage places are properties of special significance to NSW. The NSW SHR currently has 273 records of heritage places which have been assessed as meeting the threshold of State significance located within the airspace study area for WSI (Figure 4.6 and Appendix A, Table A.1). Many of these places occur towards the coast, none occur within 5 km of WSI (see Section 5.1.2), however 10 heritage items occur between 5 and 10 km of WSI. Table 4.3 list those heritage items within a 10 km radius of WSI.

Table 4.3 SHR items within 10 km radius of WSI

Heritage Item Name	SHR #	Address	LGA
Coxs Cottage	00171	2 St Thomas Road Mulgoa	Penrith
Fernhill Estate	00054	Mulgoa Road, Mulgoa	Penrith
St Thomas' Anglican Church Mulgoa	00426	St Thomas Road, Mulgoa	Penrith
Fairlight Homestead and Barn	00262	Fairlight Road, Mulgoa	Penrith
Megarritys Bridge	01367	Warragamba Dam, Warragamba	Wollondilly
Warragamba Emergency Scheme	01376	Warragamba Dam, Warragamba	Wollondilly
Warragamba Dam – Haviland Park	01375	Warragamba Dam, Warragamba	Wollondilly
The Church of the Holy Innocents, Churchyard and Cemetery	02005	130 Rossmore Avenue West, Rossmore	Liverpool
Kelvin	00046	30 The Retreat, Bringelly	Liverpool
Maryland	01690	773 The Northern Road, Bringelly	Camden

Of the 273 SHR heritage items in the airspace study area, 72 heritage items listed on the SHR are located under the preliminary flight paths (see Figure 5.6).

Twenty-eight places occur within that part of the study area that falls within the Blue Mountains LGA (Table 4.4). The concentration of significant heritage places in the LGA reflects not only the rich history of the area but also the community's appreciation of that heritage. Narratives about early crossing of the mountains are linked to stories of early exploration, convict labour and discovery, and there is a rich heritage of art and literature linked to places and vistas in the Blue Mountains (see Figure 4.2 and Figure 4.3) that adds depth to the historical record. Many heritage places also relate to tourism and leisure pursuits of a more affluent 19th and early 20th Century Sydney (see Figure 4.4 and Figure 4.5). The Blue Mountains and the GBMA remain a place of escape, respite and recreation for the people of Sydney (Stanbury and Bushell 1985; Szafraniec 2019: Low 2019) and this is reflected in the range of listed heritage places.

Figure 4.1 Convicts building road over the Blue Mountains, New South Wales, 1833 (Source: Water colour by Charles Rodius, 1833, National Library of Austtralia)

Figure 4.2 View from the Summit of Mt York, looking towards the Bathurst Plains, Convicts breaking stones NSW (Source: Watercolour by Augustus Earle c.1826, National Library of Australia)

Figure 4.3 Kings Table Land, Blue Mountains, New South Wales, 'the appearance of the new road', c.1826 (Source: Water colour by Augustus Earle, National Library of Australia)

Figure 4.4 Bush walking couple in the Blue Mountains c.1912 (Source: Black and white photos by G.A. Druce, Blue Mountains City Library)

Figure 4.5 **Sun Bath Road, Hydro Majestic (Source: Black and White print unknown photographer, Blue Mountains City Library)**

Table 4.4 **Places listed on the State Heritage Register within the Blue Mountains LGA and their present use**

Name	Current use
Linden Observatory Complex	Observatory and visitor centre
Mount St Marys College and Convent	Unoccupied
Valley Heights Railway Station and Locomotive Depot	Heritage Museum
Carrington Hotel	Carrington Hotel
Glenbrook Railway Residence	Unoccupied
Cox's Road and Early Deviations – Linden, Linden Precinct	Unused road
Cox's Road and Early Deviations – Woodford, Appian Way Precinct	Unused road
Norman Lindsay Gallery	Norman Lindsay Gallery
Christ Church Anglican Church	Christ Church Anglican Church
Railway Gatehouse	Private Residence
Valley Heights Steam Tram Rolling Stock	Valley Heights Railway Museum
Woodford Academy	National Trust Museum
Buckland Convalescent Home & Garden	Aged care complex
Weatherboard Inn Archaeological Site	Recreation area and park

Name	Current use
Lennox Bridge	Lennox Bridge
Cox's Road and Early Deviations – Woodford, Old Bathurst Road Precinct	Unused road
Springwood Railway Station Group	Springwood Railway Station
Davisville	Private Residence
Wynstay Estate	Museum
Lilianfels	Lilianfels Resort and Spa
Lawson Railway Station Group	Lawson Railway Station
Blue Mountains Walking tracks	Blue Mountains Walking tracks
Glenbrook Railway and World War Two Mustard Gas Storage Tunnel	Glenbrook Railway & Museum
The Paragon	The Paragon Café – currently unoccupied
Katoomba Railway Station and yard group	Katoomba Railway Station
Medlow Dam	Medlow Dam
Katoomba Post Office (former)	Retail Building
Everglades	National Trust House and Gardens

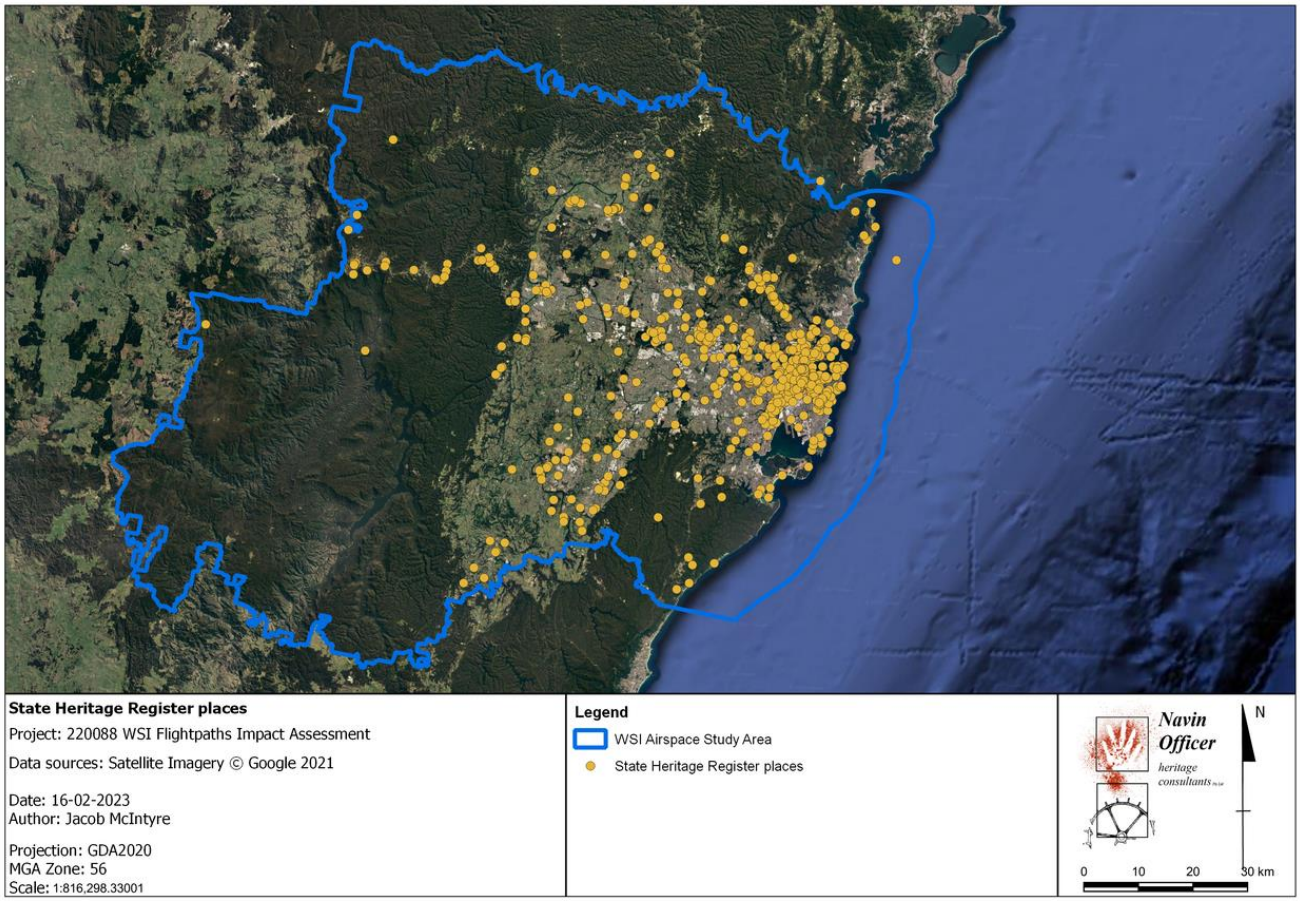

Figure 4.6 Distribution of places of State heritage significance included on the NSW State Heritage Register that occur within the airspace study area

4.1.5 Locally listed heritage places

Locally listed heritage places are significant within the context of a local area, contributing to the uniqueness of a streetscape, townscape or landscape of a region or community. The NSW SHI contains around 18,888 heritage places listed predominantly in the heritage schedule of LEPs and on s170 register of state government entities within the airspace study area (Figure 4.7). This represents more than one-third of all heritage places listed in LEPs in NSW.

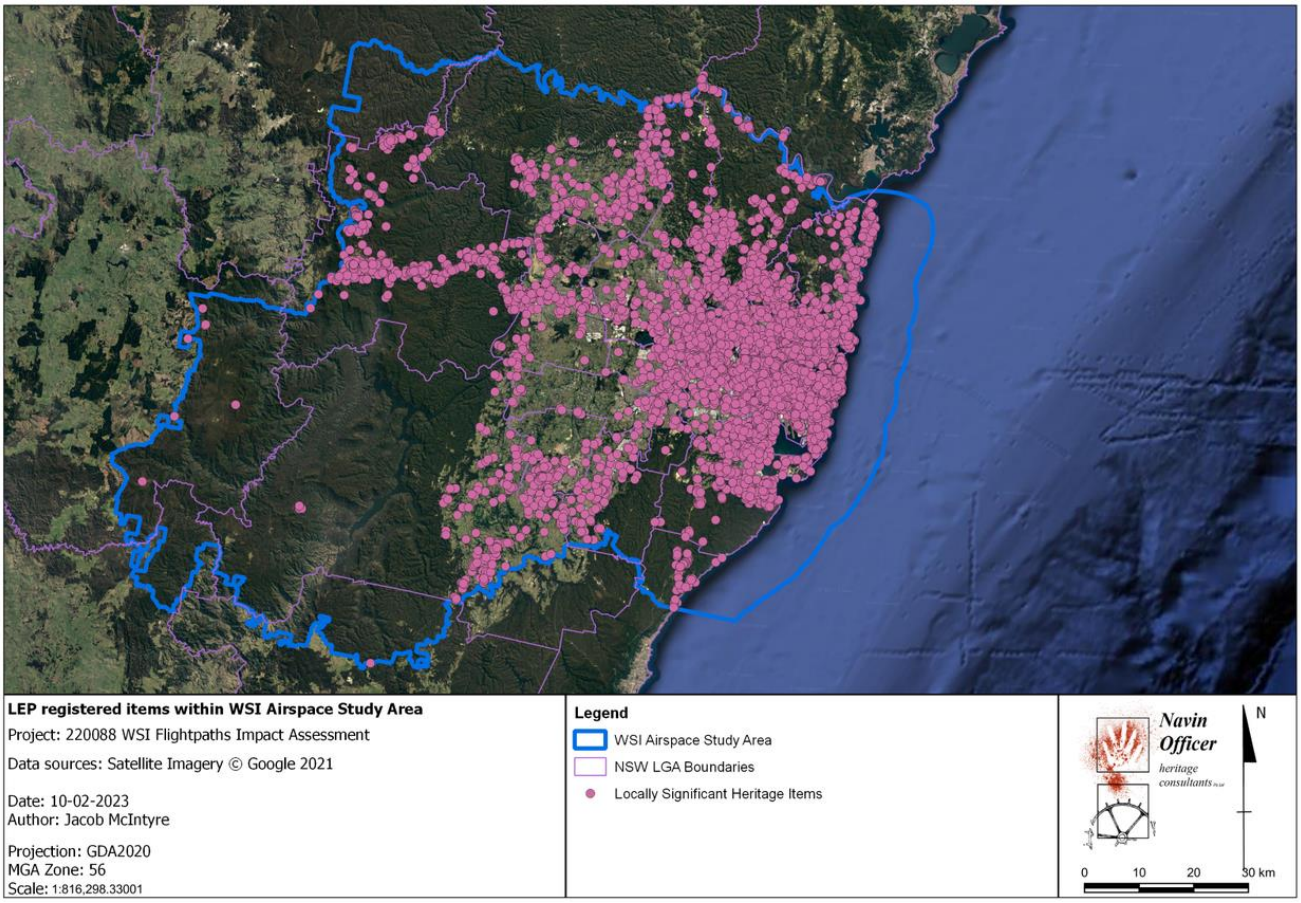

Figure 4.7 All locally significant items listed on LEPs within the airspace study area

4.1.6 Aboriginal heritage sites

There are many thousands of Aboriginal sites within the airspace study area, with 13,538 sites recorded on the AHIMS. However, it is important to note that not all sites are likely to have been recorded. As most sites have been identified during archaeological surveys which are routinely undertaken as a part of development assessment, there is a bias in the data towards those places in the developed area of the Cumberland Plain. The majority of the sites in this area comprise artefact scatters and isolated finds and many recorded sites have since been destroyed and/or subject to archaeological salvage to make way for the expanding cities and suburbs. The Sydney Basin is surrounded on 3 sides by national parks which largely coincide with the distribution of Hawkesbury sandstone geology. The Hawkesbury sandstone country is known to contain a wide range of Aboriginal sites as it provides a combination of rich food resources, freshwater, and shelter, the latter in the form of sandstone overhangs or rock shelters. The rugged nature of some of the landscape and the fact that it was relatively undesirable to the early colonial invaders whose focus was on arable land, meant that it also served as refugia for First Nations people in the first few decades of European settlement. Shell middens occur along the coastal areas and along the riverbanks and occasional burial sites have been recorded associated with both shell middens and in rock shelters.

Some Aboriginal sites may have no visible objects or modification but may be landscape features of sacred or mythological significance and some places with objects of technical or scientific value may also have special significance to First Nations people in terms of intangible or spiritual values. Under s84 of the NPW Act, the Minister may '*declare any place specified or described in the order, being a place that, in the opinion of the Minister, is or was of special significance with respect to Aboriginal culture, to be an Aboriginal place for the purposes of this Act'*.

The APs range from small ceremonial sites to lagoons and mountains of spiritual significance and can include to repatriation sites for ancestral remains. Often the recognition of such places comes after extensive Aboriginal community consultation and a significance assessment process. These places can therefore be assumed to be of the utmost importance to First Nations people. Within the airspace study area there are 21 gazetted APs.

Table 4.5 Gazetted Aboriginal Places within the airspace study area

Name of Aboriginal Place	LGA	LALC	NSW Gov. Gazette Reference
Upper Kedumba River Valley	Blue Mountains City Council (BMCC)	Deerubbin	17/05/2022 #87 pp3120-3121
Kings Tableland	BMCC	Deerubbin	4/11/2011 #106 p6537
Three Sisters	BMCC	Deerubbin	17/01/2014 #7 p86
Red Hands Cave	BMCC	Deerubbin	26/06/2015 #52 pp1801-1802
Euroka Clearing Nye Gnorang	BMCC	Deerubbin	30/09/2015 #79 p2936
Emu Cave	BMCC	Deerubbin	24/04/2020 #85 p1515
Collingwood precinct	Liverpool	Tharawal	6/03/2009 #50 p1338
Shaws Cave Yellomundee	Hawkesbury	Deerubbin	18/03/2022 #118
Bujiwa Bay Resting Place	Hornsby	Metropolitan	30/09/2005 #120 p8036
Guragalung Gayanayung (Maroota Historic Site)	Hornsby	Metropolitan	26/06/2015 #52 pp1800-1801
Towlers Bay Resting Place	Northern Beaches	Metropolitan	30/09/2005 #120 p8038
Reef Beach Resting Place	Northern Beaches	Metropolitan	30/09/2005 #120 p8036
Quarantine Station Resting Places	Northern Beaches	Metropolitan	30/09/2005 #120 p8037
Moon Rock	Northern Beaches	Metropolitan	14/10/2016 #82 p2770
Cromer Heights Rock Engraving and Shelter	Northern Beaches	Metropolitan	6/02/2020 #21 p374
Coast Hospital Cemetery resting Place	Randwick	La Perouse	30/09/2005 #120 p8037
Camp Wonawong Resting Place	Sutherland	Gandangara	19/12/2003 #197 p 11534
Towra Point Resting Place	Sutherland	La Perouse	3/01/2003 #6 p40
Costens Point Resting Place	Sutherland	La Perouse	30/09/2005 #120 p8036
Dharawal Resting Place, Middle Rill	Sutherland	La Perouse	16/07/2010 #92 p3564
Era Beach Resting Place	Wollongong	Illawarra	30/09/2005 #120 p8036

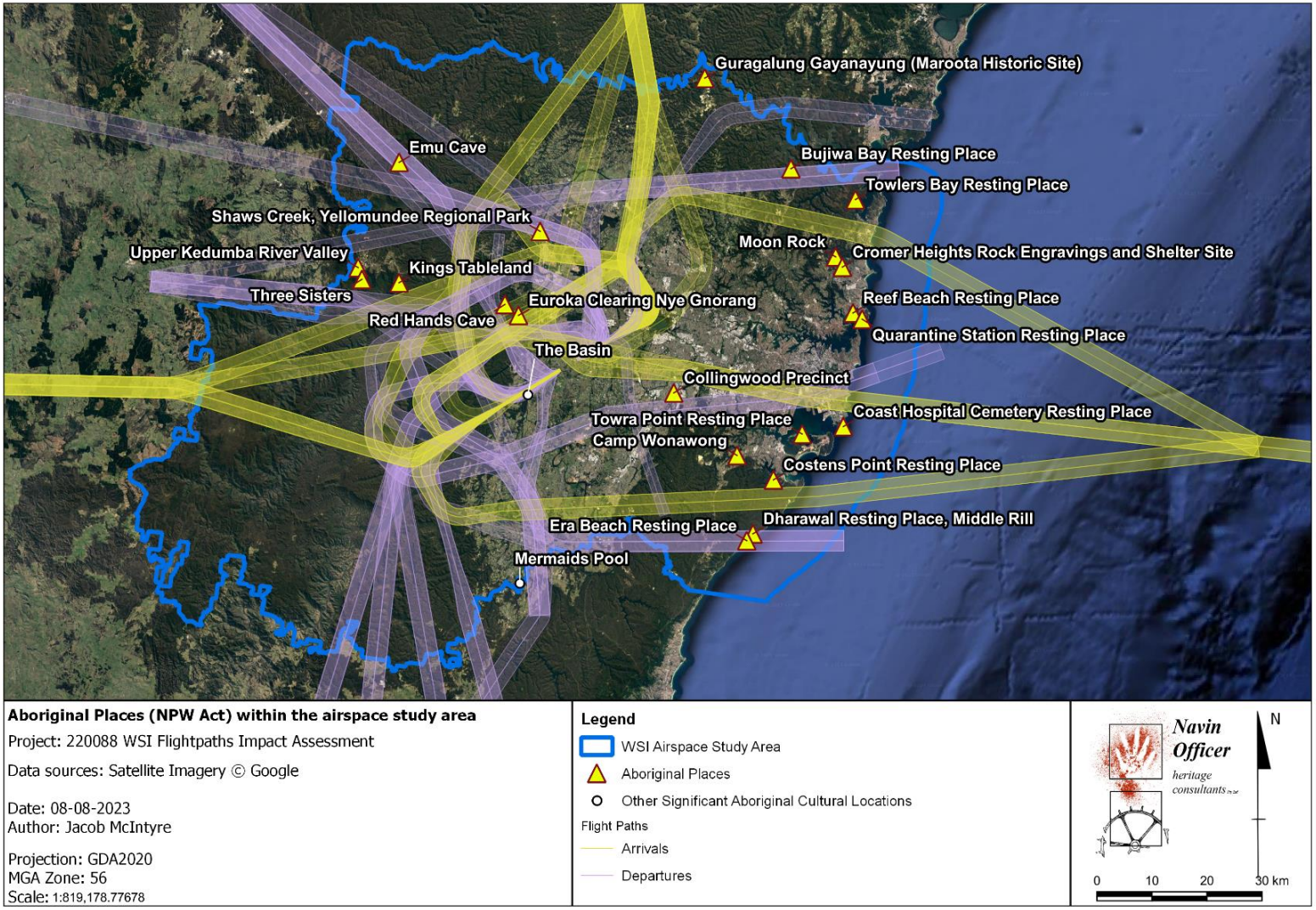

Figure 4.8 All Aboriginal Places (gazetted under the NPW Act) within the airspace study area

4.1.6.1 Aboriginal heritage sites – subset Blue Mountains

The Greater Blue Mountains region contains 1,400 recorded Aboriginal sites. This number is likely to be an under-representation of the actual sites that exist as the majority of the area which comprises the GBMA has not been systematically surveyed. Where surveys have occurred a wide range of site types have been identified including a number of sites that are often associated with spiritual and/or ceremonial values. These sites include shelters with pigment rock art, rock engravings, mythological sites or story places that are linked to Dreamtime beings, and ceremonial sites. Since inscription of the GBMA in 2000 there has been a growing recognition that the Aboriginal heritage values of the WHA are greater than were represented when the area was originally nominated (Mackay 2015:79). While the area has always been known to contain rock art sites the range, quantity and complexity of the art has been further documented through discoveries and documentation of new sites (Tacon 2002, 2011; Tacon et al. 2007, Tacon et al. 2008).

Those within the focus area for First Nations Engagement (see Figure 1.10) are closest to the WSI and include the 6 APs within the Blue Mountains City LGA (see Section 4.1.4) and another located nearby adjacent to the Nepean River at Yellomundee within the Hawkesbury LGA.

These 7 APs are:

The Three Sisters Katoomba: The Three Sisters are connected to Aboriginal spirituality and ceremony and provide a visual testament to the dreamtime stories. The statement of significance supporting the nomination notes that:

> **For Gundungurra, Darug, Wiradjuri and Tharawal people the Three Sisters is a spiritual place of ancestors and a mythical site of legends and stories telling how the Three Sisters came to command a view of the valley in traditional times. The Gundungurra tell one story of how the three sisters fell in love against traditional lore, and another that tells how there were originally seven sisters and not just the three seen here today.**
>
> **Another story associated with the Legend of Three Sisters has a warning for youngsters and warns them not to stray too far from their homes. This kind of warning runs through many versions of stories told to the Gundungurra young.**
>
> **The view over the valley and down to the Kedumba Creek is part of the Three Sisters story.**
>
> **This is an educational place that demonstrates a traditional era of ceremony and custom. The area has great beauty, and the magnificent Three Sisters rock formation stands as testament to traditional times. The valley below the Three Sisters and down to the Kedumba Creek line has many sites as testament to the ceremonies and traditional stories that have been passed down to present day Aboriginal educators. (www.hms.heritage.nsw.gov.au SHI place record viewed 17/01/2023)**

Emu Cave: Emu Cave is an important rock art site that continues to be of special significance to First Nations people. The AP protects the exact location of the cave within a general buffered area. Emu Cave is actually a deep sandstone shelter, in open eucalypt forest. The innermost recess and entire western wall are covered with track-like engravings. A recording of the site undertaken in 2003 recorded 172 engraved figures as well as 5 faint red hand stencils. Most engravings resemble bird tracks but there are also macropod tracks (kangaroo and wallaby), grooves, ovals, Y-shapes and a single U-shape.

Emu Cave is one of at least 31 art sites within the GBMA evoking the emu. The cave's panel of mostly emu tracks is of a distinctive style of engraving, which contributes to the very diverse body of art sites within the Greater Blue Mountains World Heritage Area (Tacon et al 2007). The statement of significance notes:

> **Located above Bells Line of Road on a north-south ridge between Lithgow and Richmond, Emu Cave is of special significance to multiple Aboriginal groups including the Darug, Darkinjung, Gundungurra and Wiradjuri peoples, as a significant marker on a Dreaming track which passes through an inter-tribal boundary. This area connects Aboriginal people with the Dreaming, the landscape and each other.**

> **Aboriginal people believe Emu Cave was a ceremonial site where people were taught sacred stories, spiritual lore and the sacred practice of art along the Dreaming track. Some also believe it was a place-marker which indicated the location of hunting groups or the boundary between totem groups. The site retains cultural significance to Aboriginal people today and provides an ongoing link to Ancestral beings and the Dreaming, past cultural practices and belief systems, and current understandings of Country and shared Country.**
>
> **The cave contains 172 engraved figures, mostly of emu tracks, which have been dated using radiocarbon dating to be at least 1900 years old (1900 + 220 BP). The cave also features red stencils and paintings, and contains an ochre pit (red and yellow, with several possible exhausted pits) which explains its rich rock art. It is widely recognised as the oldest dated example of rock art in the Greater Blue Mountains World Heritage Area (GBMWHA). Emu Cave has significant research potential, with detailed research on rock art, artefacts and landscape features continuing in this special part of the world to continue the story of Aboriginal Australia. (www.hms.heritage.nsw.gov.au SHI Place record viewed 18/01/2023)**

Euroka Clearing Nye Gnorang is located at Glenbrook within the Blue Mountains National Park. The statement of significance notes that it is significant to the Dharug people because:

> **… of their continued connection to the area. They have visited the area in the National Park for many years for cultural ceremonies and to pass on their cultural knowledge to their younger generations. They have collected ochre, rejuvenated their sites, held their smoking ceremonies for mourning and healing, and naming ceremonies for children and adults. In Euroka Clearing, on Appletree Flat, the Darug community and family members have for many years carved burial trees that represent their connection to their past. (*www.hms.heritage.nsw.gov.au* SHI Place record viewed 18/01/2023)**

Kings Tableland near Wentworth Falls is a camping and meeting place of significance to Gundungurra people. The statement of significance for this place is as follows:

> **Kings Tableland Aboriginal Place is significant to Aboriginal culture because it includes, but is not limited to, a sandstone rock platform with extensive grinding and other grooves, a shelter with rock art that has been recorded as being the oldest Aboriginal site in the Blue Mountains region and containing unique vertically engraved depictions of kangaroo and bird tracks.**
>
> **It also provides the Gundungurra peoples with a traditional and historical connection to the Blue Mountains area. The area was used as a camping and meeting place where connections with neighbouring Aboriginal groups travelling through their Country and along the traditional walking tracks (now known as the Great Western Highway and the Ingar Fire Trail) occurred. The Kings Tableland was historically used as a camping site by Aboriginal residents of the Burragorang Valley Aboriginal camp who would walk to Wentworth Falls and Katoomba for employment purposes until the early 1900s (www.hms.heritage.nsw.gov.au SHI Place record viewed 18/01/2023).**

Red Hands Cave near Glenbrook: Red Hands Cave is situated within the Blue Mountains National Park and was named because of red, orange and white First Nations people's hand stencils located within the cave.

> **According to Aboriginal stories the cave was the abode of Aboriginal ghosts that represented the children left there by the Great Spirit. There are 45 hand markings both left and right and some of these are children. There is also documented evidence that there was a Bora Ring on the top of the cave. Over the years there has been significant vandalism to the cave. (www.hms.heritage.nsw.gov.au SHI Place record viewed 18/01/2023).**

The cave was badly vandalised before it was gazetted as an AP, and this caused distress to First Nations people and resulted in the cave being enclosed.

Shaws Creek AP in Yellomundee Regional Park: Unfortunately, the significance of this site in the SHI is poorly articulated being a general description of the place rather than focusing on the cultural values for which it is important, but it does notes that:

> **The place has a natural beauty where the elements of vegetation, rock formations and river created a highly aesthetic landscape; it was also a place that could sustain great numbers of people with ample water available from the river and having root vegetable harvests readily on hand, as well as animal foods.**

The place is known for a number of Aboriginal engravings and significant cultural values are associated with the rock engravings and rock shelters/occupation sites (Kohen et al. 1984; Stockton 1973, 1977a). One of these rock shelters, KI, was found to have a subsurface artefact density of 6,000/m^3, and both KI and KII were key sites in the development of the timeframe and description of the Bondaian stone tool tradition and the Australian Eastern Regional Sequence (of stone tools) and are thus important archaeologically. These sites are located in a resource rich environment with easy access to raw materials in the Nepean gravels for stone tool making and plentiful food resources. The long occupation sequences at the excavated sites (i.e., back to around 13,00BP), the variety of site types and numbers of artefacts within the AP all attest to this place being an enduring and important gathering and/or ceremonial place for First Nations people in the past. For First Nations people today it has become an important place evidencing the connection with their ancestors and Yellomundee Regional Park is used as a contemporary place to camps, gather resources and teach younger generations about their culture.

Upper Kedumba River Valley -The Gully is a former Aboriginal fringe settlement. The statement of significance is as follows:

> **In the pre-1788 era, the Gully was an important meeting and camping place for Aboriginal people.**
>
> **Gundungurra people established a permanent residential settlement in the Gully from at least 1894. The Aboriginal settlement at the Gully was outside the control of the NSW Government's Aboriginal Protection Board, which meant that residents were relatively independent, built their own huts, and established a strong community. A culture of sharing was an important feature of life in the Gully: residents shared resources and helped each other, especially during the Depression in the 1930s. Lyn Stranger remembers the Mission Church, which members of the Aboriginal community helped build in 1910, as being 'very important in the community life of the Gully'. It was a meeting place for local Aboriginal and non-Aboriginal people.**
>
> **In 1957 the residents of the Gully were forcibly evicted to make way for the construction of a car racing track. The eviction caused emotional distress and upheaval for the local Aboriginal community.**
>
> **Local Gundungurra and Darug ex-residents and their descendants continue to visit the former settlement because many of their relatives were born, grew up, or lived at the Gully. Dawn Colless, a Gundungurra woman, who lived at the Gully as a child, describes her relationship to the place: 'when I go there, I feel the people who have lived there... it is such a special place - a sacred place' (www.hms.heritage.nsw.gov.au SHI Place record viewed 18/01/2023).**

4.2 Aboriginal community values

On one level it should be noted that all Aboriginal sites have cultural value for First Nations people as tangible connections to their ancestors and that Aboriginal sites (both recorded and yet to be recorded) are present across the entirety of the NSW landscape except where they have been removed by development activity. This project however is seeking to identify places of high cultural value to First Nations people either in terms of spiritual values or contemporary use that are likely to be negatively impacted by the flight paths passing over them. Given that the flight paths are in the air above sites, most of the sites in the airspace study area will not be physically impacted by them.

Many Aboriginal cultural sites that result from pre-invasion traditional activities such as campsites, quarries and artefacts scatters are robust to the impacts of noise and emissions and will not be affected by flight paths overhead. For example, stone tools which are a primary signature of Aboriginal activity across the Cumberland Plain are very unlikely to be impacted by noise or aircraft emissions. While the locations of some of these sites may once have held other intangible values to the people who lived there and created them, in the main the intangible values that these places may once have held have been lost over time or have been overwritten by post invasion land use activities that have modified the former cultural landscape.

There are many types of Aboriginal sites in NSW that are of cultural value but may not be of substantial scientific or archaeological value. These are sites that are important to First Nations people as places of current or past ceremonial activity, or places that are spiritually important as places created during the Dreaming associated with creation stories (Organ 1994, Johnson2014, Reed 1982, Robinson 1966, Smyth 1878,1972). In some cases, there may be no humanly modified elements such as the presence of artefacts or other physical changes, and the place may comprise a natural

landscape feature or a place where ceremonial practice has imbued the place with spiritual energy. Other places that may have important cultural values include burials, or massacre sites associated with spirits of ancestors, and places currently used by members of the Aboriginal community for resource gathering and culture camps. Both of these activities work to refresh and maintain cultural connections and their locations are important places for cultural revival and intergenerational transmission of culture to current and future generations.

Within the airspace study area an overview of such places which have been recorded was considered. To aid discussion with knowledge holders' maps were prepared that showed the distribution of known and recorded rock art sites, stone arrangements, natural mythological sites, burial sites and massacres within the focus area for Aboriginal consultation.

During consultation with First Nations knowledge holders there was robust and broad ranging discussion about what constitutes impact from activity associated with flight paths. Stakeholders were asked:

Are there places that you currently visit for cultural purposes? Including for example:

- *Places where your family and/or community meet for regular gatherings.*
- *Places where you fish or collect other resources.*
- *Places that you use to teach others/family about your culture.*
- *Are there places of spiritual significance to you, your family or community?*

The following places were identified as being of particular importance to the Aboriginal community:

- Emu rock engraving sites, Faulconbridge, including Ticehurst Park
- Shaws Creek AP, Yellomundee Regional Park
- Bents Basin
- Linden Ridge (multiple sites)
- The Three Sisters (Seven sisters)
- Kings Tableland – rock art – Eagle site
- Mt Yengo
- Emu Cave AP
- Balgenny Farm – Koobawilla – place where stars are reflected in the water at South Camden
- Walls Cave, Blackheath
- Red Hands Cave (AHIMS #45-5-0103)
- Wianamatta (South Creek)
- The Nepean River
- Traditional walking tracks (now often developed into road corridors, often connecting significant sites) e.g.:
  - especially the ceremonial circuit encompassing Bells Line of Road (see Appendix C)
  - Bells Line of Road
  - The Northern Road
  - Putty Road
  - Parramatta Road
  - Cowpastures Road
  - Blacktown Road
  - Queens Road Lawson
- Possum dreaming site at Little Hartley (outside the airspace study area)
- The Mirror Shelter, Woodhouse Creek, near Mt Gilead (where the sky is reflected in the water)

- Appin Massacre Site – now protected as the Appin Massacre Cultural Landscape (outside the airspace study area)
- Thirlmere Lakes
- Mermaid Pools.

In relation to these sites the knowledge holders interviewed were asked:

> *Thinking about these places, do you think a flight path overhead would affect your cultural use of or practices carried out at the place? And if so, how?*

This was a complex question for people to address. In some case people said no, or only marginally if the aircraft were intermittent and so high that noise was not a factor. Others responded that any flights over the place would impact its values and affects its use, however this was more of a generic answer, and they could not explain why. However, several places were clearly of a particular concern and for specific reasons.

In terms of the nature of the values embodied in these places these could be broadly considered in terms of:

- cultural values which relate to concepts of peace, tranquillity, and connecting with nature, and
- spiritual places and places associated with the Dreaming.

4.2.1 Cultural values relate to concepts of peace, tranquillity, connecting with nature

Consultation with knowledge holders revealed a number of places where visual and/or noise intrusions were considered likely to impact the cultural values of the place. For example: Shaws Creek AP, Yellomundee.

> **Well see, we married into Burraburongal, so it's really Burraburongal people's land. But we've been considered the caretakers over time for that space from Burraburongal. So, we have some sort of custodianship with, with the blessing of Burraburongal people now, of today. Yeah. And they all come down too, and we all care for the site.**
>
> **That's one of the places, where when you talk about flight paths and the sorts of things that happen on that country, it would be very disruptive. It is a gathering place for lot of mobs to come together and we do different cultural camps there. It's really, taken a long time and a lot of work from people who have gone before me that I respect, to enable that. And I just think it would be very sad for everybody, not just us, if we were sitting there and we had a plane going over our head, that would be terrible. Especially when you think about how long that it's taken for us to be able to get permission to use the place for our culture camps in this place that was so significant. So, if we were there teaching or learning and you know, trying to speak, and to hold space in a cultural way. It would be, very disruptive to have the noise of a big engine and 'Wait, hang on, we'll just wait now talk', you know? It's not proper way. (Dharug Aboriginal women 15/11/2022 pers. comm.)**

The Shaws Creek AP has a number of very important rockshelter sites with Art and occupation deposit e.g., AHIMS 45-5-54 (McCarthy 1948:28, Fig 92).

In recognition of the special significance of the Shaws Creek area to the Dharug people, the NSW Minister for the Environment declared the area an AP (see NSW Gov., Gazette 118 18/03/2022). The statement of significance notes in part that the place is significant in part because:

> **The Darug people used the place then, and now, as an educational place and a resource rich place where children and young people could learn from Elders about traditional practices, such as fishing, collecting and using the readily available bush foods and natural medicines in the area. The area acted and still acts as a bush school room, where today's children also learn about their history and are taught traditional stories. Part of their story includes the frontier violence that took place across this site and across the region as colonists settled along the rivers. Its story tells of resistance as Aboriginal warriors fought to hold onto their lands and to find justice for their people. It is a story of resilience as Aboriginal people survived. The story of their leaders, their warriors, and their resilience should be told and recognised. (Statement of Significance www.hms.heritage.nsw.gov.au)**

Figure 4.9 Yellow Rock lookout escarpment, Yellomundee Regional Park (Image: John Yurasek/Department of Planning and Environment (DPE))

Bents Basin is another place where clans are reported as coming together in the past and where Aboriginal families from Dharug, Gundungurra and Tharawal people still gather today to renew their cultural ties to each other and to country. Interviewees from each of the 3 nations referred to Bents Basin, noting that in addition to the sacred basin itself there are a number of important art sites and women's sites in the surrounding area.

> **Bents Basin is another shared space that's really important for our people to come together for ceremony, so I really want that noted (Dharug informant #1 pers. comm. 15/11/2022)**
>
> **That's an important song line for the Eel Dreaming. It's a primordial waterhole its very significant (Dharug informant #2 pers. comm. 15/11/2022).**

The Aboriginal women consulted about this site were concerned that visual and noise intrusion from aircraft flying overhead would have a serious impact on the cultural values of this place where currently they take Aboriginal youth to camp and reconnect with nature and their culture. Part of this transgenerational sharing of culture relies on the feeling of tranquillity and isolation from urban life.

Figure 4.10 Bents Basin State Conservation Area, Nepean River (Image: Kevin McGrath/DPE)

4.2.2 Spiritual/Dreaming cultural values

The Three Sisters Dreaming site, set within its cultural landscape including the vistas from Echo Point is a site which typifies this category for natural places with spiritual and Dreaming values. While the 3 rock formations at this point may be central to the story, knowledge holders pointed out that they were part of a much larger storyline. The relatively unmarred view of the cultural landscape as viewed from the lookout was important to an appreciation and understanding of the cultural values of the site. It was noted that occasionally aircraft were visible in the distance and while this was not ideal, they were relatively infrequent, at a high altitude and some distance way, and so did not pose a significant impact. The current level of tourism impact, noise and traffic at Echo Point were noted as existing impacts detrimental to heritage values. However, all knowledge holders were united in the view that any future increases in visual intrusion or aircraft noise would have a severe impact on the cultural values of the site.

Figure 4.11 The Three Sisters and cultural landscape context (Image: Louise Clifton/DPE)

The Emu rock engravings at Faulconbridge and Emu Cave are both associated with Dreaming stories related to Emu. The engraving site is reportedly linked to the 'Emu in the Sky' constellation. The First Nations people were concerned particularly with disruption to the airspace above the site during the period when the Emu in the Sky constellation is most visible. Emu Cave is said to be part of a dreaming track that extends

Red Hands Cave is another site with spiritual connections and an early recording of the beliefs associated with the site maintain that:

> **This cave was the abode of the blackfellows [sic] ghosts. The hands [stencils] represented the children left there by the Great Spirit. If the hand of a living youth corresponded to one of the stencilled hands, he was believed to be re-incarnated and was in time to become the local chief. (pers. com. Miss Daisy Booth to S. Erickson and recorded on AHIMS # 45-5-0103)**

Even though there has been substantial conservation intervention at Red Hands Cave to protect it from vandalism it remains an important place for Dharug people.

Figure 4.12 Red Hands rock shelter (Image: Nick Cubbin/DPE)

Bents Basin or 'Gulguer' is particularly important to Dharug, Gundungurra and Tharawal First Nations people. First Nations Women currently use this place a safe place for family gatherings and passing on cultural knowledge to their children. The actual basin or scour pool is considered a sacred place and is home to a dangerous being called variously Gurungadge, Gurangatch or Gurungaty. This creature travelled to and created many places in the Dreamtime and is linked to other places including a freshwater spring (the Gurungaty Water Place) Wollongong and further along the south coast; and from the southern highlands along the Wollondilly to the Wombeyan Caves and across the GBMA to the Jenolan Caves and waterholes on the Fish River.

Stories about Gurungaty were recorded by ethnographer R.H. Mathews' (1904:35)

> **Gu-ru-ngaty is the name of an aquatic monster among the Thurrawal and Gundungarra tribes. He resides in deep waterholes, and would drown and eat strange blacks, but would not harm his own people. He usually climbed a tree near the water, from which he kept a look out. If he saw a stranger approaching, he slid down and dived into the water, without making a splash, or leaving any ripples on the surface. As soon as the individual began to drink, he was caught by Gurungaty.**

Dharug traditions include stories of Gurangatch and Mirragan , beings who link places along a Dreaming trail from Joadja in the southern highlands to Jooliundoo a waterhole in the Upper Fish River (Smith 1992)

> **The pursuit of Gurangatch a 'dreamtime serpent' with some of the qualities of the Murray Cod, by Mirragan, a Quoll, passes through areas, such as Wombeyan Caves, the Jamison Valley and Jenolan Caves, associated with the cultural routes of non-Aboriginal tourism. From the 1830s cattlemen used part of the Gurangatch and Mirragan track to move stock between the Burragorang and Megalong Valleys. (Smith 1992)**

First Nations people continue to recount these Dreamtime stories and to teach their children to respect the place created by these beings. A contemporary version of the story of Gurungatch and Mirragang is told by Aunty Val Mulcahy and can be heard at this link https://youtu.be/e-g98I2s11E.

4.2.3 Places of memory and family experiences

Some places are culturally significance because of the connection they provide to the recent historical past. Such connections sometimes be traumatic or bittersweet. One example is the Upper Kedumba River Valley AP, also known as 'The Gully'. This is an example of a place that prior to invasion served a popular camping place for First Nations people and there are sites that physically attest to this early occupation of the area. Post invasion it evolved into a place of refuge for First Nations people avoiding and resisting government control. It is a former fringe settlement of the Gundungurra people.

> **Gundungurra people established a permanent residential settlement in the Gully from at least 1894. The Aboriginal settlement at the Gully was outside the control of the NSW Government's Aboriginal Protection Board, which meant that residents were relatively independent, built their own huts, and established a strong community. A culture of sharing was an important feature of life in the Gully: residents shared resources and helped each other, especially during the Depression in the 1930s.**[7]

The settlement continued until residents were forcibly evicted in 1957 to make way for a car racing track. First Nations people maintain a strong connection to this place.

Figure 4.13 Kedumba Valley, GBMA (Image: Craig Marshall/DPE)

[7] https://www.hms.heritage.nsw.gov.au/ Heritage Item ID: 5062893

Chapter 5 Impact assessment

5.1 Perceived and potential impacts

The potential impact to cultural heritage impact place associated with the preliminary flight paths is indirect in that there is no associated mechanical destruction of sites or heritage items. In Section 5.1.1 and 5.1.2 below the perceived and potential impacts of the flight paths on cultural heritage values are outlined. These are then discussed in more detail in the following sections which consider the impact of emissions on Aboriginal rock site and on non-indigenous heritage items and the potential impacts of noise and visual intrusion on cultural heritage values. The assessment of noise impacts is based on composite contours and reflects 3 different runway operating scenarios. Actual impacts at a given location may be lower, depending on the operating scenario that is ultimately adopted.

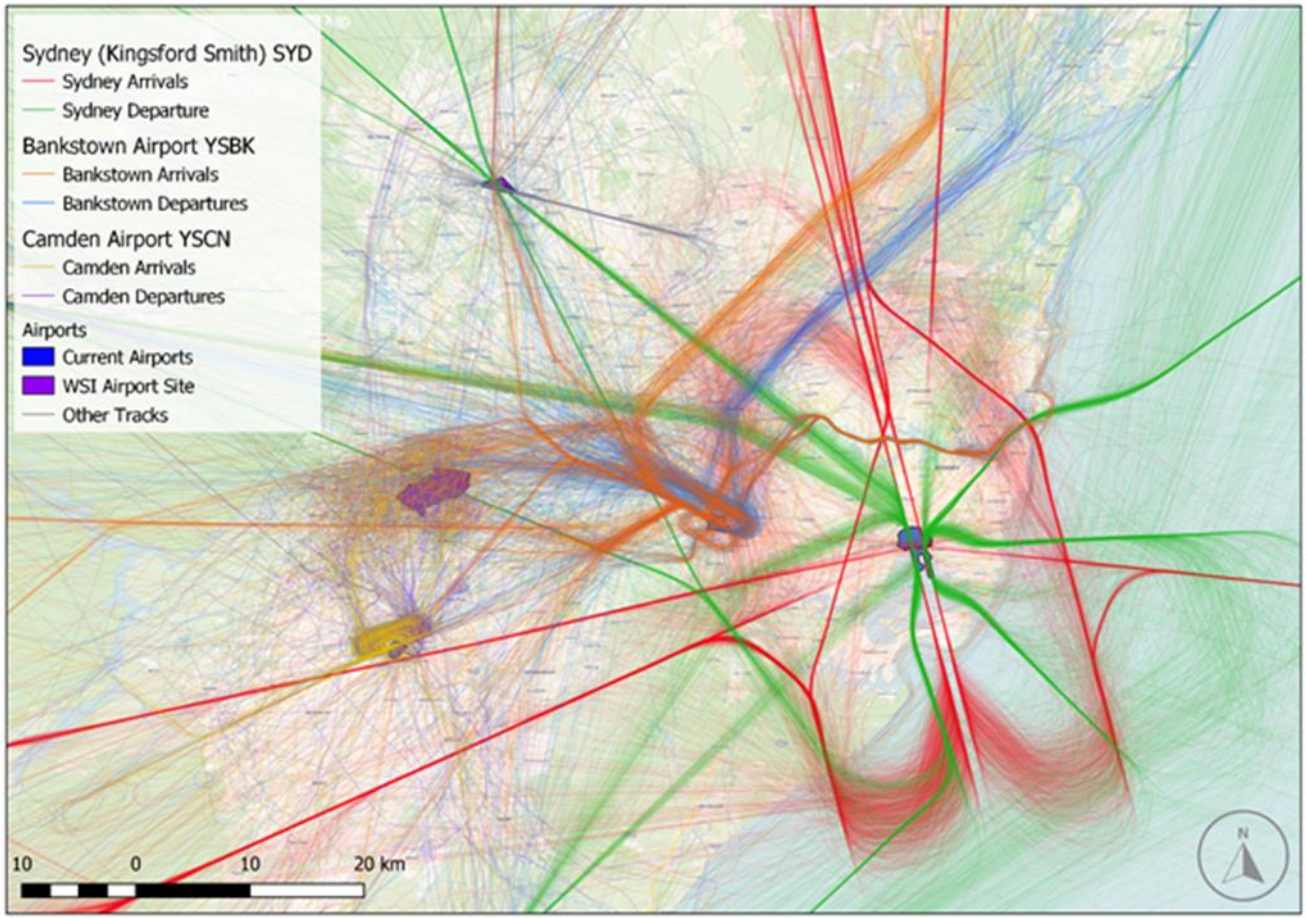

Figure 5.1 Example of flight paths from existing airports over a one-week period in 2019 (source Airservices 2023)

5.1.1 Aboriginal cultural places and values that may be impacted

As noted in Chapter 4, many Aboriginal sites such as artefact occurrences (including 'isolated finds' 'artefact scatters', 'open camp sites' and sub-surface artefact distributions) will not be physically impacted by the preliminary flight paths. However, there are places where the physical fabric of the place may potentially be impacted. These include Aboriginal rock engravings, and pigment art, which in the study area occur on sandstone surfaces. These places may be affected physically through dust or chemical interaction of pollutants on rock surfaces. Some rock engravings and pigment art sites along with stone arrangements, ceremonial sites, and natural mythological sites may also have intangible spiritual values that may be vulnerable to noise or visual intrusion.

Noise can impact cultural values where for example those values include the need for peace, tranquillity, and spiritual connection. Noise can also impact values where those values are rooted in the role of the place as a site of intergenerational cultural education e.g., at Shaws Creek AP, Yellomundee Regional Park which is used as a venue for cultural education of Aboriginal youth.

Some places are significant for their spiritual values, and these were of particular concern to the knowledge holders interviewed. For example, the Emu in the Sky constellation is associated with several places on the ground and this connection is potentially disrupted by the intrusion of aircraft (see Chapter 4).

It was acknowledged by the knowledge holders interviewed, that designing flight paths to avoid all Aboriginal sites of cultural value would be impossible, however the places referred to in their discussions (see Section 4.2) were places of particular concern.

5.1.2 Non-Aboriginal heritage places and values

Most of the listed non-Indigenous heritage places consist of built heritage structures which will be relatively robust in the face of impacts caused by noise and pollution. Perceived impacts relate to increased grime build up on buildings from aircraft emissions, citing for example existing air borne pollution under Sydney (Kingsford Smith) Airport flight paths close to the airport; and noise that will diminish the values associated with peace, serenity and wellbeing of some sites that currently have such values, such as those associated with the GBMA and other rural and bushland settings.

In most cases, listed heritage items are already under the myriad of flight paths into and out of Sydney (Kingsford Smith) Airport and other airports (Figure 5.1); this example of flight paths from existing airports over a one-week period in 2019 provides an understanding of both the areas overflown by existing flight paths and the complexity involved in adding new flight paths. It is reasonable to assume that those places most likely to be subject to appreciable impact are in close proximity to WSI as this will be where arriving and departing aircraft would be at lower altitudes and over different places than those currently subjected to low flying aircraft. Visual and noise intrusions and any emissions reaching the heritage item would be greater than at places further away where aircraft would be higher. In general, the noise from departing aircraft can be expected to be louder close to the Airport Site as they are climbing. For this reason, consideration was given to places that occurred within a 5 km radius of the Airport Site and then within a 10 km radius of the Airport Site.

5.1.3 Listed heritage places

Most statutory heritage registers, apart from AHIMS, list significant assessed places of Indigenous and non- Indigenous values and/or natural values.

The assessment of cultural values in NSW (and Australia generally) follows the principles of the Burra Charter (Australia ICOMOS 2013). The records for places that meet the threshold for listing on the SHR, NHL and WHL include a statement of significance against set criteria. This is ideally, but not always, done for locally significant places listed on LEPs also. The following sections consider the potential impact to places on those lists.

It should be noted that the lists are not mutually exclusive. For example, a place that is of World Heritage significance will also be of national significance and usually also recognised as having state and local significance. In this way the lists get larger as one moves down the tiers to places that are significant to local communities and smaller or more exclusive as one moves up through higher thresholds of significance.

Table 5.2 provides a summary of all heritage listed places within a 10 km radius of WSI.

5.2 Potential impact to World heritage listed sites

The airspace study area for WSI encompasses parts of 3 WHAs: the GBMA and the Opera House, and parts of the Australian Convict WHA (Hyde Park Barracks, Cockatoo Island, old Government House and Domain and the Great North Road). Of these it is the GBMA that is the closest, and the only property overflown by the preliminary flight paths. It is also the largest and most complex, consisting of multiple national parks with a diversity of flora and fauna, international significant geological features, hundreds of Aboriginal sites and important historical sites both within and adjacent to the WHA.

The assessment of impact on the natural values for which the GBMA is listed is outside the scope of this technical report, however there are a range of important cultural values that are relevant to proposals for additional areas and values to be added to the listing.

5.2.1 The Greater Blue Mountains Area

The proceeding discussion about impacts has focused on individual cultural sites or categories of cultural sites and much of it is also relevant to the GBMA. Only part of the WHA is included within the airspace study area (refer to Figure 1.9) and it is also relevant to note that the GBMA is already overflown by aircraft flying into and out of Sydney (Kingsford Smith) Airport; to date this has not been raised as an issue that negatively impacts the World Heritage values of the property.

As noted in Section 4.1.1.1 the recognised OUV for which the GBMA was listed are natural values rather than cultural values; however, there has been a long call from within Australia to renominate the property for its cultural values and there is a current review underway of the national listing to consider which cultural values may meet the threshold for NHL. There are a range of significant cultural values of the property which are widely recognised within the Australian community including the aesthetic, historic and Indigenous heritage values of the area. Some of these values are robust in relation to the potential impact of aircraft flying overhead. For example, one of the additional cultural values being considered is historic value related to the historic crossing of the Blue Mountains by Blaxland, Lawson and Wentworth in 1813.

> **The Mt York sector, one of the additional areas under assessment, may have outstanding value to the nation under National Heritage criterion (a) for its historic values. The Blue Mountains Crossing place is associated with an enduring story of exploration. On 28 May 1813 the Blaxland, Lawson and Wentworth expeditionary party reached Mt York on the western flank of the Blue Mountain ranges. From this mountain vantage point they were able to see large areas of land considered suitable for grazing. They had also identified, marked and surveyed a route across the Blue Mountains which enabled the development of a transport corridor for commerce and initiated a new phase of colonial expansion west over the mountains. This achievement has been recognised as a turning point in the development of the early colony in NSW. Access across the mountains to new territory and the economic opportunities it provided enhanced the colony's capacity to grow and develop beyond its then primary function as a penal colony. Features expressing this explorer legend and significant turning point in Australia's colonial history include the 1813 explorer route, the remnant historic road fabric and rock markings associated with Cox's 1814 road, and the historic fabric and rock markings associated with Macquarie's 1815 excursion along Cox's Road. The view of the landscape west from Mt York and of the River Lett is also significant for its ability to demonstrate the potential of the land for expansion of the colony that the Blaxland, Lawson and Wentworth expedition identified in 1813.**[8]

This value will not be impacted by the flight paths as the historic feat remains unaltered and inarguable, regardless of any consideration of noise or emission and is not dependent in any way on the uninterrupted connections between land and sky. However other values are more vulnerable to potential impacts, and these are considered below.

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[8] https://www.dcceew.gov.au/parks-heritage/heritage/places/world/blue-mountains/additional-values-areas#national-heritage-criterion-e viewed 07/06/2023

5.2.1.1 Aesthetic values

The GBMA is comprised of over 862,00ha of bush land across a geographically rugged and awe-inspiring landscape. It is a powerful, spectacular and distinctive landscape that is highly valued by the Australian community generally and by many community and cultural groups. This landscape has been a source of inspiration for art and literature since the early days of the colony (see for example Figure 4.1, Figure 4.2 and Figure 4.3) and while Aboriginal rock art should not be assumed to equate in any direct way to European art, it is clear that the landscape and artistic expression were inextricably linked long before the arrival of European invaders.

> **Recognition and appreciation of these aesthetic values and natural beauty are evidenced in high visitation rates to parts of the place and extensive representation and acknowledgement in paintings, photographs, books, journals, poems, and films. Specific awe-inspiring landscapes include those from Govetts Leap Lookout of the Grose Valley and associated bluffs and peaks; Wentworth Falls; the Three Sisters and Mt Solitary; Kanangra Walls; and high cliffs in the Capertee Valley at Glen Davis. Stunning geographical features of the GBMA include panoramic valley views, such as the Jamison and Megalong valleys from high ridge line or cliff top vantage points; gorges and valleys of the Grose, Wollangambe and Colo Rivers; many undisturbed skylines; long cliff lines; sandstone escarpments; and pagoda rock formations. Other features demonstrating particularly high aesthetic values within a more limited view field include slot canyons and karst cave formations and arches at Jenolan Caves.**[9]

Should flight paths disrupt these significant view lines they would potentially have a negative impact on them. The impact would to some extent be dependent on the height of the aircraft as this would have a bearing on the visual and noise impact.

5.2.1.2 Aboriginal heritage values

Since the GBMA was added to the WHL in the year 2000, there has been a growing body of work documenting the Aboriginal values of the WHA, along with a recognition that the cultural values are more substantial than reflected in the original nomination dossier (see NSW NPWS 1998). Amongst other changes, The Three Sisters, Kings Tableland, Red Hands Cave, Euroka and Mt Yengo have each received statutory recognition as 'Aboriginal Places' (i.e., places of particular cultural significance to First Nations people) under the NPW Act. Of these all are within the airspace study area with the exception of Mt Yengo, which is further to the north, beyond the airspace study area, in Darkinjung country. Mt Yengo is significant as the places where the Dreamtime being, Baiame, left the earth after creating the world (NPWS 2009).

The existing statement of integrity recognises the interconnectedness of Aboriginal values, traditional custodial relationship and the rich cultural landscape comprised of rock art and other sites.

> **An understanding of the cultural context of the GBMA is fundamental to the protection of its integrity. Aboriginal people from six language groups, through ongoing practices that reflect both traditional and contemporary presence, continue to have a custodial relationship with the area. Occupation sites and rock art provide physical evidence of the longevity of the strong Aboriginal cultural connections with the land. The conservation of these associations, together with the elements of the property's natural beauty, contributes to its integrity.**

Contemporary First Nations people have a relationship with the landscape of the GBMA that has been shaped and influenced by more than 200 years of post-colonial impact. Traditional mechanisms of transmission of knowledge and information have been disrupted, and meanings and practices have been at times informed by new discoveries and historical research and cultural renewal. Sometimes the very act of dislocation and dispossession resulted in the development of new places of cultural significance. One example of this is the Gully in Katoomba which before 1788 was a meeting and camping place. Gundungurra and Dharug people re-established settlement here circa 1894, when it was outside the jurisdiction of the Aboriginal Protection Board and the place grew in significance as a place of community strength and freedom.

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9 https://www.dcceew.gov.au/parks-heritage/heritage/places/world/blue-mountains/additional-values-areas#national-heritage-criterion-e viewed 07/06/2023

Many of the traditional stories of the creation of the landscape are still actively shared by First Nations people today. For example:

> **the Gundungurra story about the creation beings, serpent Gurangatch and quoll like Mirrigan, tells the tale of their fight across and under the landscape, resulting in the creation of the Wollondilly and Coxs River valleys, its waterholes and pools, and the caves of Jenolan (see Matthews in Stockton and Merriman 2009) (Mackay 2015:87).**

Other places that have active stories include The Three Sisters rock formation which is a focus of both Dharug and Gundungurra legends. Traditional stories also connect this place to the Seven Sisters stories linked to the Pleiades, an important group of stars which form the basis of a similar Dreamtime connection across Australia.

Consultation within this report has focused on Dharug, Gundungurra and Tharawal people because these are the 3 groups that cover that area where the airspace study area and the GBMA, however when considering the whole of the WHA there are 6 Aboriginal language groups that have cultural interest in the area. They are the Darkinjung, Dharug, Gundungurra, Tharawal, Wanaruah and Wiradjuri people.

While there are likely to be many places that individuals and families visit to continue and deepen their relationship with the country and the spirits, there are some that have become important places for contemporary ceremony and practice. These include Kings Tableland AP, Euroka Clearing, 'Nye Gnorang' AP, Red Hands Cave, and Mt Yengo. Activities at each of these places would be sensitive to noise volume and frequency. Direct flights over Mt Yengo should be strictly avoided as this is the site of Baiame's ascension and there is a direct connection between the mountain and the sky. As has previously been discussed at length, there is a lack of the data needed to assess the long-term impact of emissions on Aboriginal rock art of the region and this is an issue to consider for Kings Tableland, Red Hands Cave and Mt Yengo NP.

5.2.2 The Sydney Opera House

The preliminary flight paths do not overfly the Sydney Opera House and there is no anticipated impact on the cultural values of this property.

5.2.3 The Australian Convict Sites WHA

With the exception of the Great North Road, the preliminary flight paths do not fly over the properties that make up this world heritage site. Aircraft flying over the Great North Road will be at a height that precludes significant noise or visual impact.

5.3 Potential impact to National Heritage listed sites

The closest nationally listed site is the GBMA which at its closest point is approximately 10 km to the west of the centre point of WSI. The flight paths do cross over parts of the GBMA and the implications of this are discussed in Section 5.2.1 above). The flight paths avoid impact to other properties on the NHL (see Figure 5.2) either because they either avoid direct overflight and/or because the distance from WSI means that aircraft will be much higher.

5.3.1 Royal National Park and Garawarra State Conservation Area

This protected area was inscribed on the NHL in 2006. Royal National Park was Australia's first official national park, proclaimed in 1879. Together Royal NP and Garawarra State Conservation Area are part of the lands of the Dharawal speaking First Nations people who continue to have a strong connection to these lands. While its identified national values related to is plant species richness and intangible historical and social values associated with the history of the conservation movement (Hutton and Connors 1999) it has well documented tangible cultural values that are evident in its many Aboriginal sites (see for example Attenbrow 2012; Bursill 1993; Megaw 1965; Cox et al 1968; Stockton 1977b) and its historic structures and physical remnants (NPWS 1992; Holloway 2019) and intangible social values for many sectors of the Community (see for example Thomas 2001; Prinsen 2013).

This place is currently overflown by some arrivals and departures from Sydney (Kingsford Smith) Airport, for example, in March 2023 there was an average of 11 flights per day arriving or departing from Sydney (Kingsford Smith) Airport[10]. These flights come from different direction and are at a range of heights:

- Arrivals into Sydney (Kingsford Smith) Airport from the north travel southwards across the city of Sydney to join the final approach that begins over water. Aircraft using this flight path will generally be at altitudes within the range of 5,000 to 7,000 ft as they pass over the NP.
- Aircraft arriving into Sydney from the south-west will pass over suburbs such as Barden Ridge and Yarrawarrah before turning southwards and flying over the Royal National Park to cross the coast. They will be generally within the altitude range of 6000 to 8,000 ft.
- Aircraft coming from the west will turn southwards over suburbs such as Illawong, Bangor, Jannali and Loftus as they head towards the coast. They will be generally within the altitude range of 6000 to 8,000 ft.
- As aircraft fly past Kurnell or Gamay (also known as Cook's Landing Place) on their final approach to KS's east runway they will be around 1000 ft and descending those approaching the western runway will be at around 1200 ft.

By contrast proposed aircraft arriving at night (between 11:00 pm and 5:30 am) into Runway 05 at WSI will be travelling across the NP at between 13,300 and 17,500 ft. Departures from runway 05 and 23 overnight would overfly Garawarra NP at 20,000 ft and climbing.

In terms of noise impacts the area is outside the N70 noise contours for WSI, however aircraft may still be visible and heard at a noise level of about 42 decibels.

As noted in Section 5.4.5 Royal National Park has suite of Aboriginal rock art sites (including both painted art and engravings). It also has several places of local and State heritage significance as well (see Table 5.1). No publicly available research or monitoring of the impact of aircraft emissions on these places over the past 123 years that Sydney (Kingsford Smith) Airport has been operational, has been located although such impacts have been speculated (see Bursill 1993 referred to in Section 5.4.4). However, it is arguable that given the height of aircraft associated with WSI any additional emissions impacting cultural heritage at ground level would be negligible and negative impact if any would be associated with aircraft using Sydney (Kingsford Smith) Airport.

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[10] https://aircraftnoise.airservicesaustralia.com/2020/04/30/sydney-how-many-aircraft-fly-near-me/#

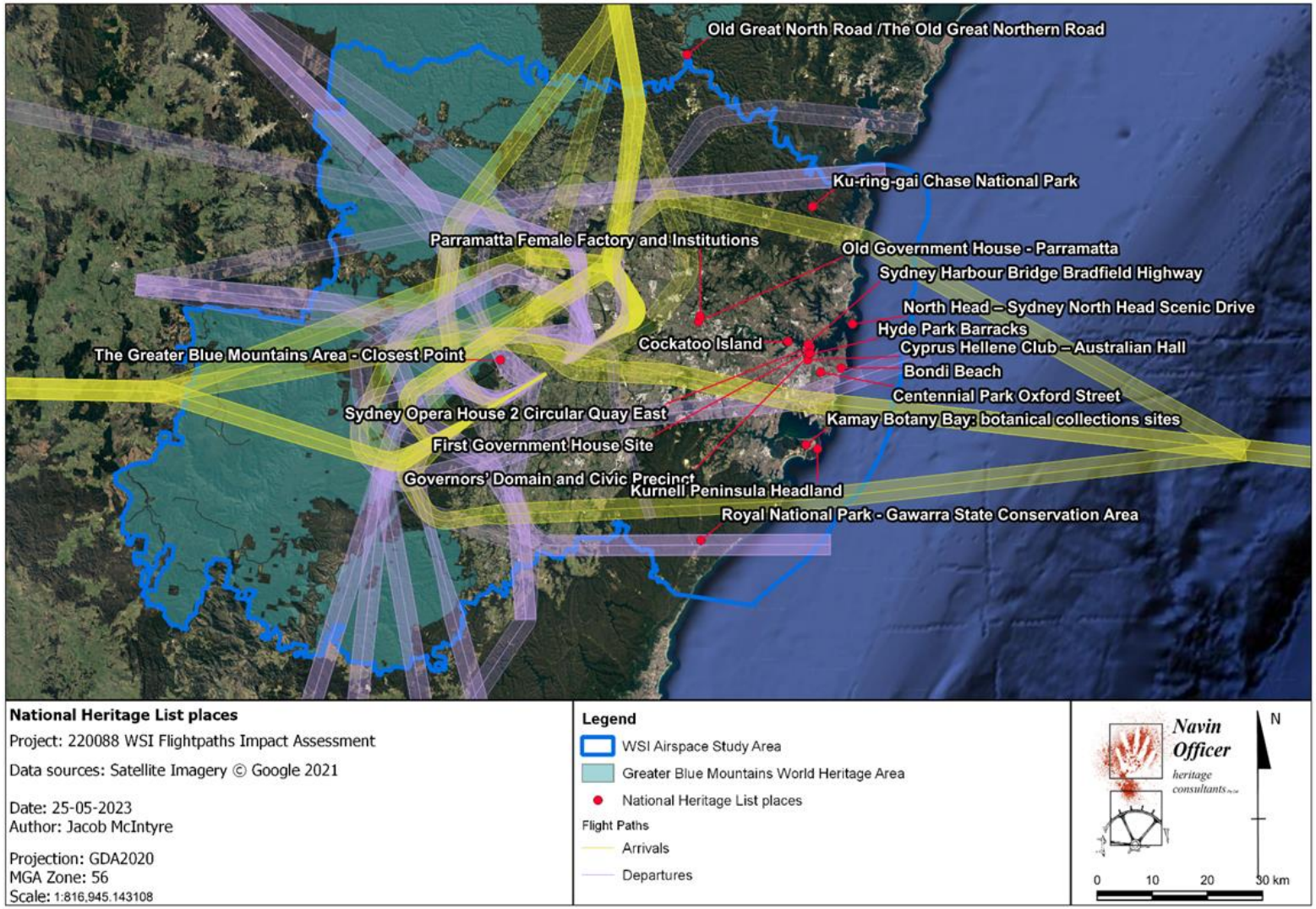

Figure 5.2 Nationally listed heritage places in relation to preliminary flight paths (Note: this includes those places which are also WHAs)

5.3.1.1 Commonwealth Heritage List

There is one heritage item on the CHL within a 10km radius of the Airport Site. This is the Orchard Hills Cumberland Plain Woodland.

The next closest CHL listed places are the Shale Woodland Llandilo followed by the North Base Trig station and the RAAF Base Richmond both located at Richmond; and the Old Army internment Camp Group and the Cubbitch Barta National Estate both located within the Holsworthy Army land. These latter 4 places are already overflown by military craft.

Of these places the 2 woodlands will be impacted by multiple flight paths.

Orchard Hills Cumberland Plain Woodland (Place ID 105317) is located approximately 4.1 km north of WSI**.** It is listed for its natural values which are well documented (Benson and Howell 1990; French et al. 2000; NPWS 1997, 2000).

> **Orchard Hills is almost entirely vegetated with remnants and regenerating areas of Cumberland Plain Woodland and Sydney Coastal River Flat Forest. Cumberland Plain Woodland is listed as an endangered ecological community at both State and Commonwealth level. At State level, Sydney Coastal River Flat Forest is regarded as an endangered ecological community that is underrepresented in reserves. Orchard Hills is regarded as a core biodiversity area for conservation of both these communities.**
>
> **The place comprises the least disturbed and largest remaining remnant of Cumberland Plain Woodland. The size of the Orchard Hills remnant provides a comparatively large area of continuous habitat for species likely to be excluded from small and isolated remnants, particularly the Cumberland Plain Woodland bird community. Mature tree heights at Orchard Hills reach 50 metres and include some of the most outstanding examples of Forest Red gum trees remaining in western Sydney.**
>
> **The tributaries of Blaxland Creek at Orchard Hills are among the least disturbed catchments remaining on the Cumberland Plain and on Wianamatta Shale in western Sydney. Blaxland Creek tributaries are richer in aquatic macro-invertebrate genera than most other creeks in western Sydney. The macro-invertebrate community of this catchment has a high representation of disturbance-sensitive species. Stoneflies, LEPTOPHLEBIID mayflies and pollution-sensitive families of caddisflies appear to be confined to such streams within the Cumberland Plain. Orchard Hills therefore acts as a refuge and reservoir of regional conservation significance for such species that are dependent on low levels of agricultural and urban development.**
>
> **The bush thickknee (*Burrhinus grallirius*), a rare bird, is listed as endangered in NSW and is regarded as a species of the greatest conservation concern in the Cumberland region. It has been recorded at Orchard Hills.**
>
> **Orchard Hills has one plant listed as vulnerable in NSW, prickly spider-flower (GREVILLEA JUNIPERINA). Six other plant species are found in the place which are regarded as being of regional conservation significance. These are spreading bush-pea (*Pultenaea microphylla*), fuzzweed (*Vittadina pustulata*), watermilfoil (*Myriophyllum simulans*), dwarf skullcap (*Scutellaria humilis*), early nancy (*Wurmbea biglandulosa*) and the grass (*Panicum obseptum*). An additional 32 plant species are found at Orchard Hills which are regarded as inadequately conserved in western Sydney.**
>
> **The low level of disturbance in the tributaries of Blaxland Creek within Orchard Hills provide a valuable benchmark to measure the degradation of creek systems generally in western Sydney. The absence of fire at Orchard Hills for approximately 50 years provides an opportunity for ecological research on regenerating Cumberland Plain Woodland.**[11]

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[11] Summary statement of significance https://www.environment.gov.au/cgi-bin/ahdb/search.pl?mode=place_detail;search=state%3DNSW%3Blist_code%3DCHL%3Blegal_status%3D35%3Bkeyword_PD%3D0%3Bkeyword_SS%3D0%3Bkeyword_PH%3D0;place_id=105317

It is noted that there are potential historic heritage values (in remnants of the Mulgoa Irrigation Scheme 1890) and Aboriginal heritage values on the property, however these have not been assessed.

The Shale Woodland Llandilo (Place ID 105534) is located approximately 17.3 km north-northwest of WSI (see Figure 5.3). It is recognised for its natural values as,

> **…one of the largest remnants of the natural vegetation of the Cumberland Plain. It includes communities that are characteristic of Wianamatta shale, Tertiary alluvium, and low-lying recent alluvium, including the nationally endangered Cumberland Plain Woodland which is also endangered in NSW, Sydney Coastal River-flat Forest which is endangered in NSW, Castlereagh Ironbark Forest and Shale/Gravel Transition Forest. The co-occurrence of these community types and the relatively large size of the remnants within the place highlight its significance in the western Sydney region. The significance of the place is enhanced by its contiguity with remnant ecological communities contained within the Western Sydney Shale Woodland – St Marys RNE place.**
>
> **The remnant vegetation contains populations of a nationally endangered plant species, PERSOONIA NUTANS, three nationally vulnerable plant species PULTENEA PARVIFLORA, DILLWYNNIA TENUIFOLIA and MICROMYRTUS MINUTIFLORA, and two regionally significant species GREVILLEA JUNIPERINA and DODONAEA FALCATA. PERSOONIA NUTANS and PULTENEA PARVIFLORA are also endangered in NSW, and DILLWYNNIA TENUIFOLIA, GREVILLEA JUNIPERINA and MICROMYRTUS MINUTIFLORA are vulnerable in NSW.**
>
> **The diversity and large size of the vegetation remnants at this place provide important habitat for native flora and fauna. Llandilo Natural Area is recognised as being of regional significance for fauna, especially Castlereagh Woodland birds.**[12]

While there are multiple studies that attest to its natural values (Benson 1986; Dames and Moore Pty Ltd 1988; Fox 1992; Kinhill 1955; NPWS 1997; James et al. 1999) the area has not been surveyed or assessed for its cultural values. It is highly likely however to contain Aboriginal archaeological sites typical of the Cumberland Plain.

As noted above, multiple preliminary flight paths are proposed which would overfly these 2 CHL places (see Figure 5.3). Cultural values associated with these 2 places have not been assessed but those that are referred to in the place descriptions – that is, remnants of historic irrigation works, and Aboriginal campsites/artefact scatters – are likely to be robust in relation to the impacts from non-physical disturbance associated with the preliminary flight paths. The values at most risk are the natural values and assessment of impact to these values is outside the scope of this report and will be addressed in the ecological assessment technical report (Technical paper 8: Biodiversity). Impact assessment should consider the impact of emission on flora and noise on the fauna, including the rare birds referred to. The cumulative impact from ongoing development of the Cumberland Plain and the interactions with the stresses of climate change are also relevant considerations.

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[12] Summary statement of significance https://www.environment.gov.au/cgi-bin/ahdb/search.pl?mode=place_detail;search=state%3DNSW%3Blist_code%3DCHL%3Blegal_status%3D35%3Bkeyword_PD%3D0%3Bkeyword_SS%3D0%3Bkeyword_PH%3D0;place_id=105534

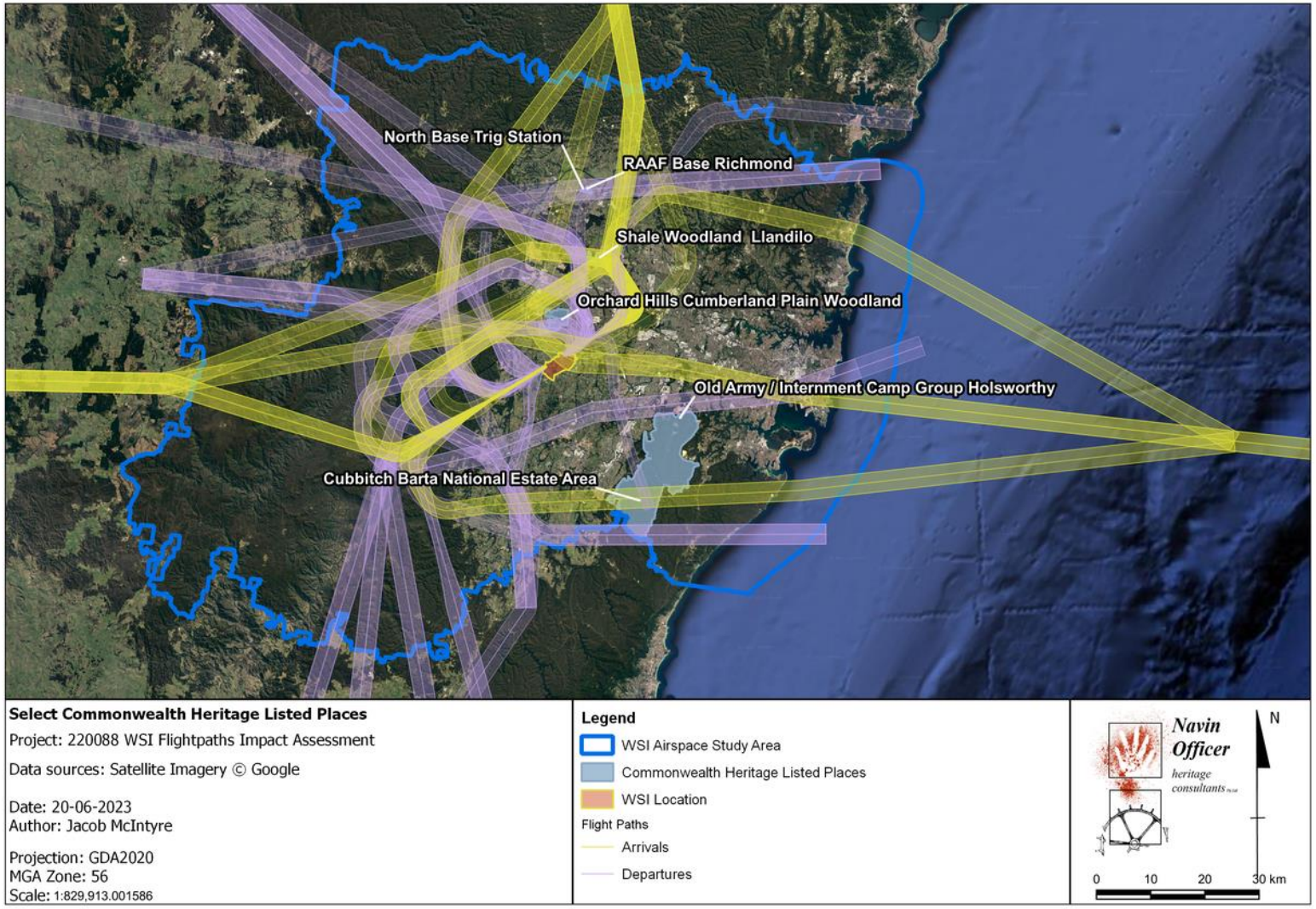

Figure 5.3 Selected places included on the Commonwealth Heritage List in closest proximity to WSI

5.3.1.2 NSW State heritage register

There are no SHR listed places within the 5 km radius of WSI (see Figure 5.4); and only 10 SHR listed heritage items within a 10 km radius of WSI (see Figure 5.5). These are:

- Coxs Cottage
- Fernhill Estate
- St Thomas' Church Mulgoa
- Fairlight Homestead and Barn
- Megarritys Bridge
- Warragamba Emergency Scheme
- Warragamba Dam – Haviland Park
- The Church of the Holy Innocents
- Kelvin
- Maryland.

There are 72 places of State significance listed on the SHR which are located under the preliminary flight paths (see Table 5.1 and Figure 5.6). For a full list of SHR items within the airspace study area see Appendix A.

Most places listed on the SHR have a detailed statement of significance which refers to the specific criteria which have met the threshold for State significance. There are exceptions to this detailed significance assessment process as some older entries were registered before this became standard practice. Where the values are described, these have been included in Table 5.2 for those places within a 10 km radius of WSI.

At greater distances from WSI, noise and eventually the visibility of aircraft begins to diminish, and emissions are likely to disperse over a greater area and therefore be less concentrated. However, some cultural values remain sensitive to any additional noise and the frequency of flights can exacerbate this. This applies to the GBMA and those Indigenous and non-Indigenous places within it that are valued for their serenity and their ability to connect people to the spirituality of nature. The significant value of other heritage places lies primarily in the fabric of the building or structure and such values would not be impacted directly by noise. The degree to which the fabric of heritage places would be directly impacted by aircraft emissions is expected to be low as it is anticipated that few (if any) emissions would reach the ground surface. A long-term research program has been recommended to gather quantitative data on this possible impact (see mitigation measure H2).

There are 37 walking tracks listed on the SHR under the collective name of Blue Mountains walking tracks (SHR #00980). These are:

- Causeway to Red Hands Cave Glenbrook
- Grotto Tracks Springwood
- Florabella Pass Warrimoo & Blaxland
- Kings Cave Track Linden
- Princes Rock Track Wentworth Falls
- Den Fenella Track Wentworth Falls
- Jamison Creek Corridor/Darwin's Walk Wentworth Falls
- Valley of the Waters Track Wentworth Falls
- National Pass Wentworth Falls
- Federal Pass Katoomba/Leura
- Giant Stairway Katoomba

- Orphan Rock Track Katoomba
- Prince Henry Cliff Walk Katoomba/Leura
- Track from Lilianfels Park to Lady Darleys Lookout Katoomba
- O'Sullivan's Road Katoomba
- Grand Canyon Track Blackheath
- Point Pilcher Track Blackheath/Medlow Bath
- Perrys Lookdown to Blue Gum Forest Blackheath
- Engineers Track Grose Valley (Darling Causeway to Nepean River)
- Bruce's Walk Lawson to Mt Victoria
- Six Foot Track Katoomba to Jenolan Caves
- Lawsons Long Alley Mt Victoria
- Lockyers Road Mt Victoria
- Berghofers Pass Mt Victoria
- Section of Bells Line of Road Mt Tomah
- Kanangra Walls Cattle Track Oberon
- Megalong Valley Aboriginal Routes Katoomba
- Mount Victoria Escarpment Complex Mt Victoria
- Mt York Roads Complex Mt Victoria
- Wentworth Falls Complex Wentworth Falls
- Cox's Road Complex Faulconbridge to Mt York
- Parkes Garden Tracks Complex Faulconbridge
- 33 3900332 Wolgan Railway Complex Newnes Railway
- 34 3900333 Upper Grose Valley Aboriginal Passes – Complex Blackheath
- 35 3900334 Track to Base of Govetts Leap – Complex Blackheath
- 36 3900335 Tracks to Ruined Castle – Complex Katoomba
- 37 3900336 Grose Valley Cliff Edge – Complex Blackheath.

This collection of walking tracks is of demonstrable State significance (claims have been made for National significance). While the fabric and functionality of the tracks will not be impacted by overhead flight paths, it is important to note that these tracks are a key to facilitating visitor access and are how most visitors experience those other intangible values imbued in the GBMA – that is, serenity, connection to nature and spirituality. They are a way for many to escape the noise, stress and pressure of busy urban lives. Any intrusion particularly noise but also to some extent visual intrusion will impair the effectiveness of these track as gateways to the intangible values of the GBMA.

Walking tracks within the GBMA have been further considered in Technical paper 10 and Technical paper 14, and these assessments found that visitors may experience some changes to the use and enjoyment of walking tracks within the Blue Mountains. People who visit and use walking tracks in the N60 and N70 contours are likely to experience moderate changes to their use and enjoyment. The majority of the broader GBMA is largely outside the area predicted to experience aircraft noise at or above 60 and 70 dB(A) (as per Technical paper 1). There are no walking tracks in the GBMA within the N70 contours, however some tracks have been identified to be within N60 contours.

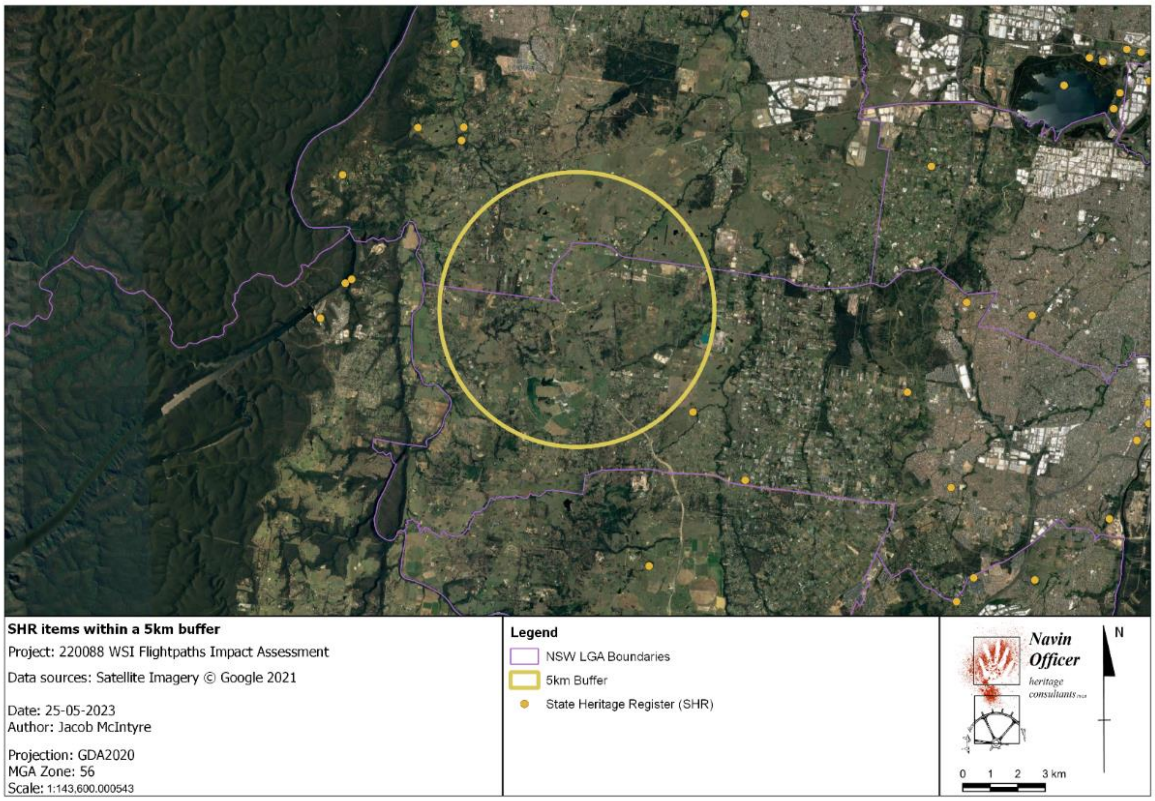

Figure 5.4 There are no cultural heritage places of State significance listed on the SHR within 5km of WSI

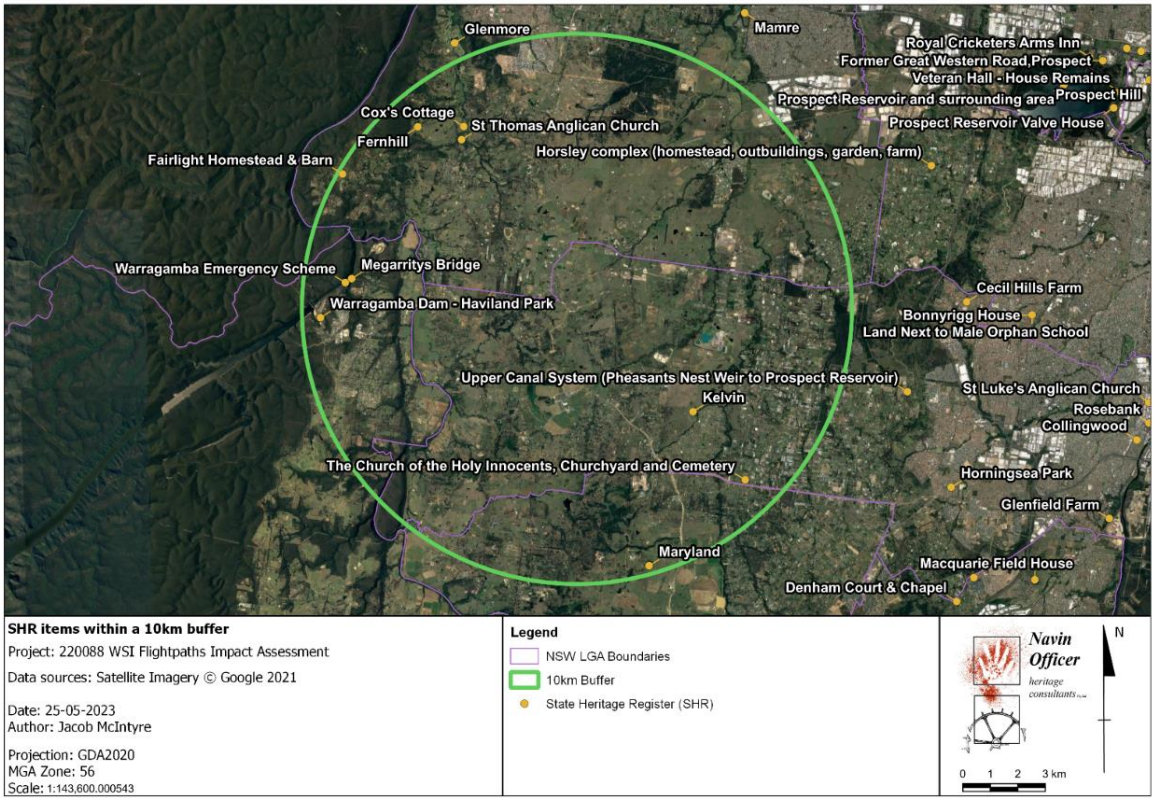

Figure 5.5 There are 10 cultural heritage places of State significance listed on the SHR within 10 km of WSI

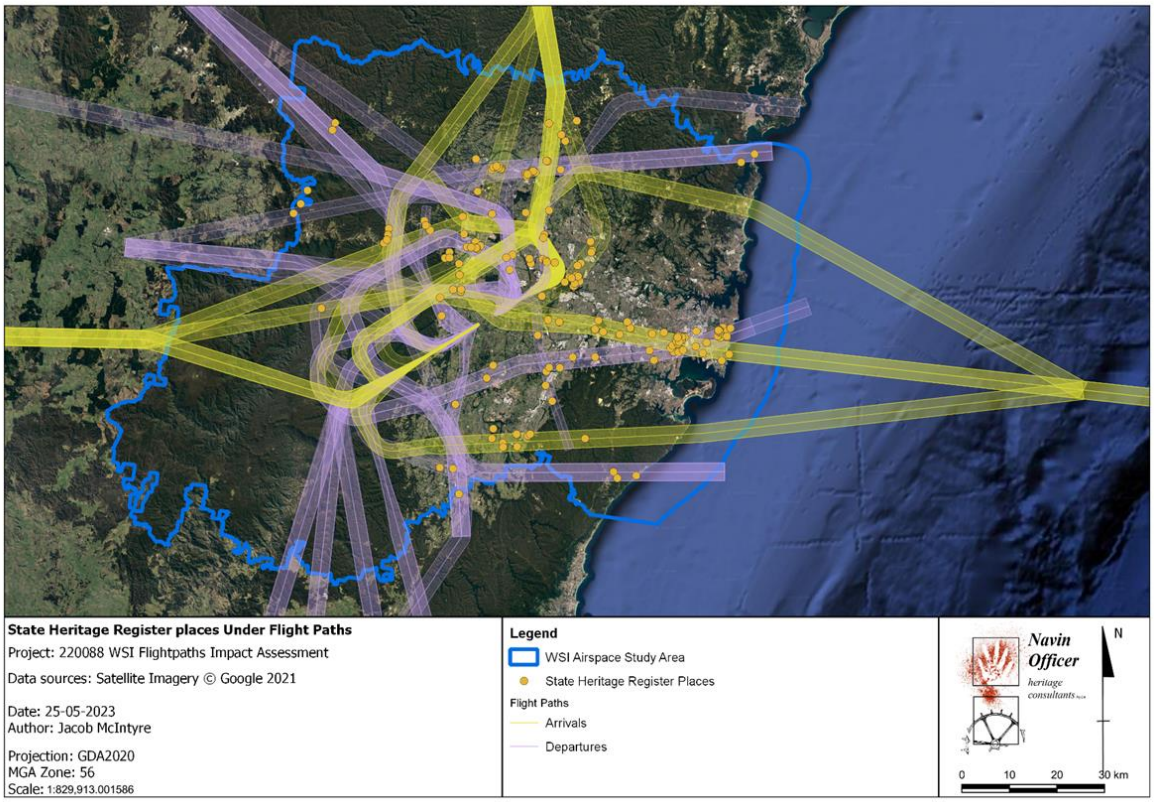

Figure 5.6 Cultural heritage places of State significance (listed on the State Heritage Register) in relation to the preliminary flight paths

Table 5.1 There are 72 State Heritage Register places under flight paths

Place name	Listing #
Mountain View	44
Prospect Reservoir and surrounding area	1370
Jarvisfield	305
Botany Water Reserves	1317
Mamre	264
Shand Mason Curricle Ladders (1898)	1899
Menangle rail bridge over Nepean River	1047
Camden Park Estate and Belgenny Farm	1697
Fire and Rescue Fleet	1902
Glenleigh Estate	346
Fernhill	54
Grantham Poultry Research Station (former)	1382

Place name	Listing #
Craithes House	378
St Bartholomew's Anglican Church & Cemetery	37
McIver Women's Baths	1869
NSW Fire Brigades No 10 Vehicle Number Plates	1519
Victoria Bridge	1950
Upper Canal System (Pheasants Nest Weir to Prospect Reservoir)	1373
Hadley Park	2009
Brownlow Hill Estate	1489
Horsley complex (homestead, outbuildings, garden, farm)	30
Ancient Aboriginal and Early Colonial Landscape	1863
Building, outbuildings, grounds, trees	753
Bowman House	468
Scheyville National Park	1817
Fairlight Homestead & Barn	262
Bungarribee Homestead Complex - Archaeological Site	1428
Buckland Convalescent Home & Garden	371
Substation	935
Royal National Park Coastal Cabin Communities	1878
Lower Prospect Canal Reserve	1945
Arncliffe Railway Station	1076
Helensburgh Railway Station group	1168
Rydalmere Hospital Precinct (former)	749
Rooty Hill, The	1756
Track	1372
Richmond Park	1808
Emu Plains (Nepean River) Underbridge	1830
Arncliffe Market Gardens	1395
Richmond Railway Station and yard group	1236
Edward Smith Headquarters Switchboard (1909)	1901
Western Outfall Main Sewer (Rockdale to Homebush)	1647
Mount Gilead	2020

Place name	Listing #
Pearce Family Cemetery	593
Ahrens Fox PS2 Fire Engine (1929)	1717
Woronora Dam	1378
Cox's Cottage	171
Rose Cottage and Early Slab Hut	1392
Bird In The Hand Inn (former)	373
Maryland	1690
Sewage Pumping Station 38	1344
Bonnyrigg House	281
St Thomas Anglican Church	426
Shand 7 Inch Manual Fire Engine	1717
Dennis Big 6 Fire Engine (1939)	1718
Shand Mason Fire Engine (1891)	1716
Former Great Western Road, Prospect	1911
Land Next to Male Orphan School	1390
Penrith Railway Station group	1222
Glenfield Farm	25
St Andrew's Anglican Church, Hall & Rectory	57
Glenmore	74
Seymours House	681
Malabar Headland	1741
Hobartville, including outbuildings	35
House	45
Lydham Hall	477
Beverly Hills Railway Station group	1086
Natural Area	649
Ford 21W Fire Brigade	1900
St Peters Anglican Church Group	2028
Cattai Estate	982

5.3.1.3 Locally listed places on local environmental plans

There are thousands of places listed on the heritage schedules of LEPs within the airspace study areas. There are no heritage places identified as having local heritage significance on LEPs within 5km radius of the Airport Site however there are 63 within a 10 km radius. There are also 664 heritage items listed on LEPs located under the preliminary flight paths. Figure 5.7 shows those heritage items listed on LEPs that occur under the preliminary flight paths. Figure 5.8 and Figure 5.9 shows the locally significant places within a 5 km and 10 km radius of WSI and includes heritage items identified in the Western Parkland City SEPP.

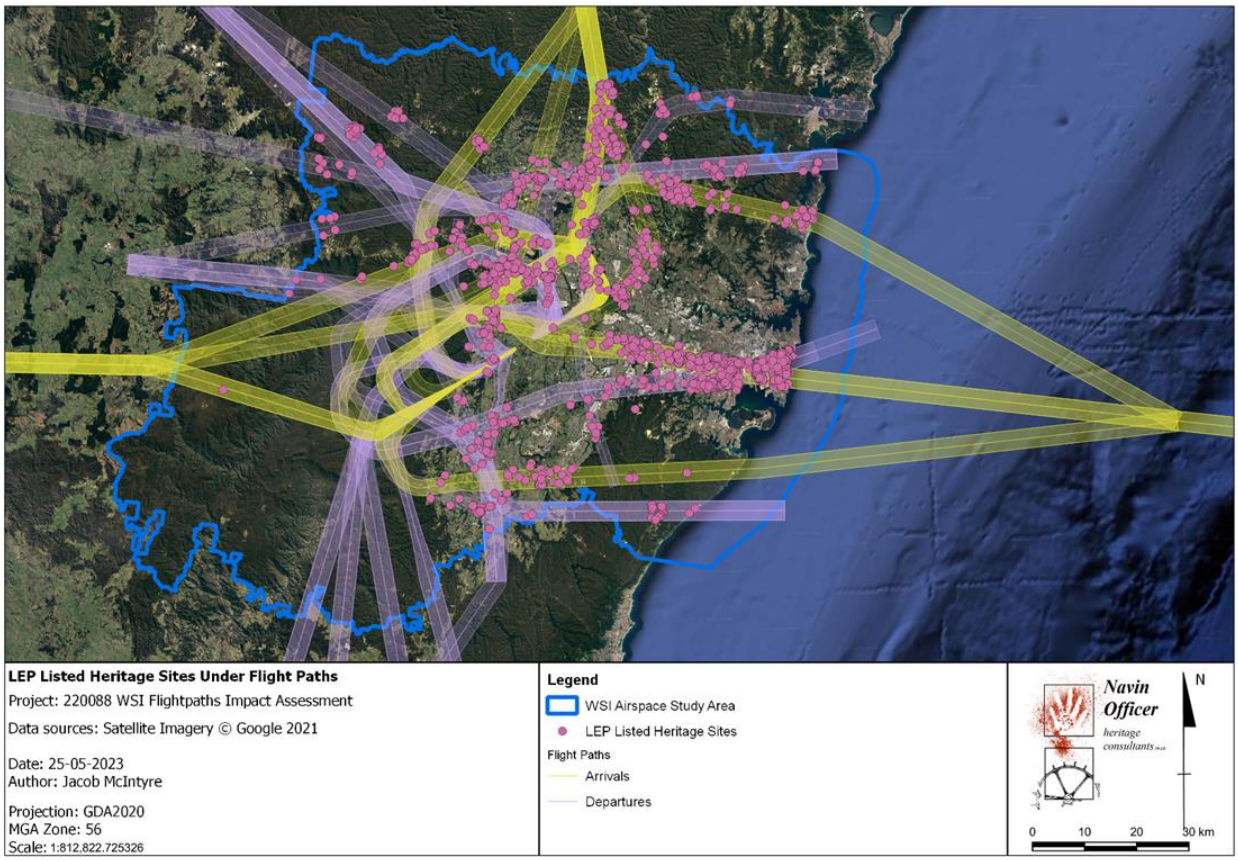

Figure 5.7 Places listed on a Local Environment Plan under the preliminary flight paths

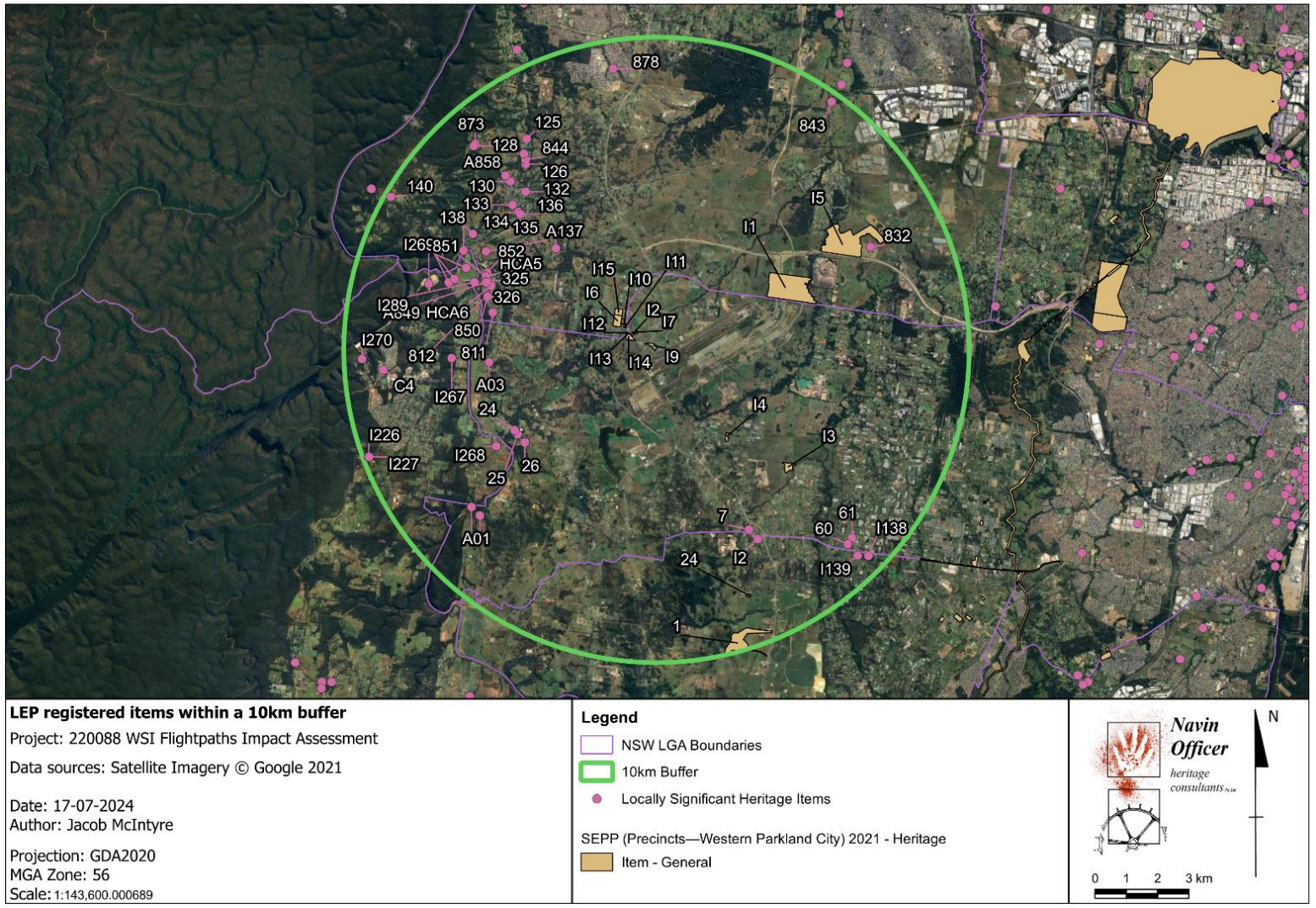

Figure 5.8 Locally significant places within 10 km of WSI including heritage items identified in the Western Parkland City SEPP

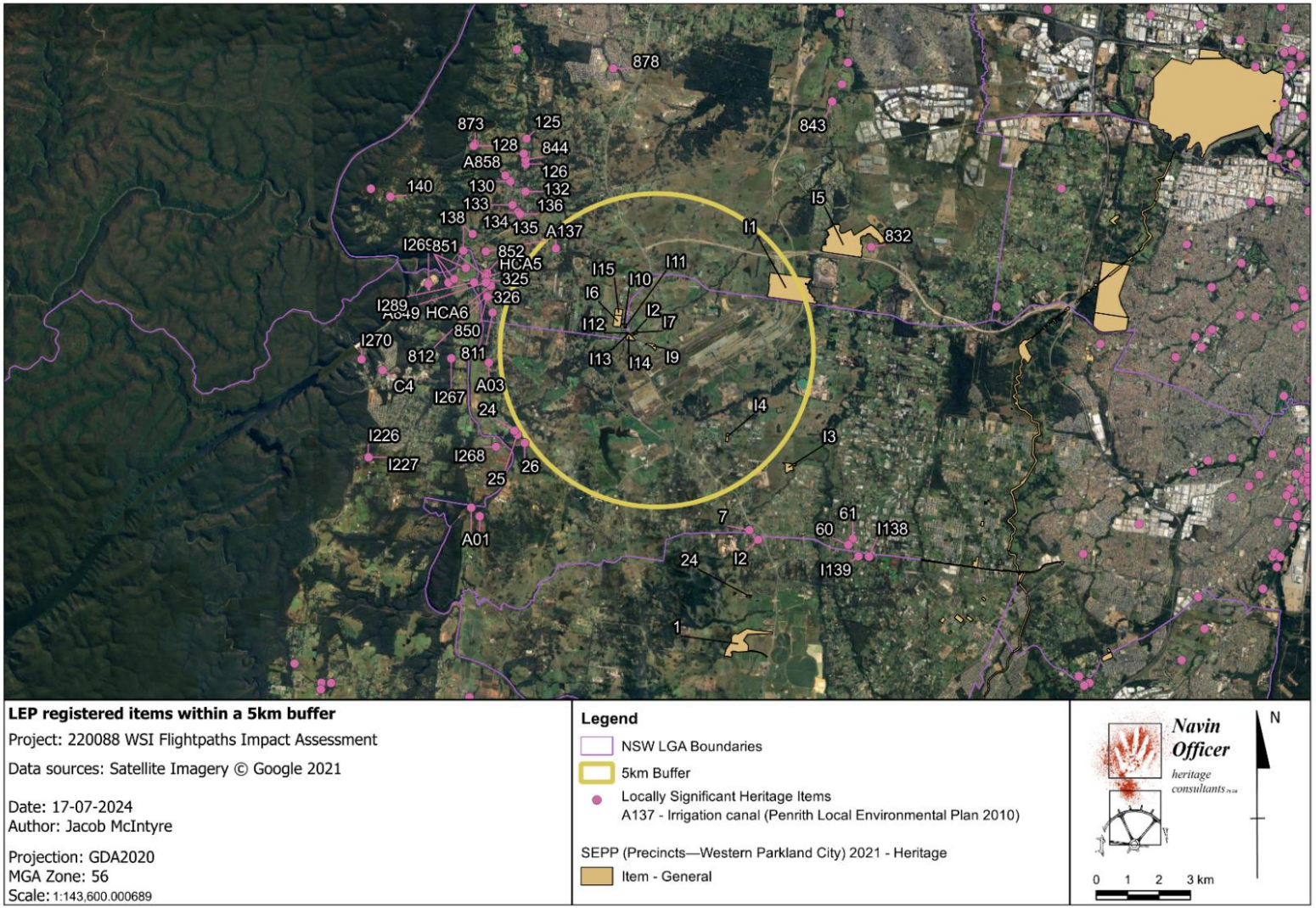

Figure 5.9 Locally significant places within 5 km of WSI including heritage items identified in the Western Parkland City SEPP

Table 5.2 Cultural heritage items listed on a statutory list within a 10 km radius of WSI

Statutory list	Item	Listing number	LGA	Criterion: cultural values
NHL	Nil			
CHL	Orchard Hills Cumberland Plain Woodland, The Northern Rd Orchard Hills	105317	PENRITH	Listed for natural values under outdated Commonwealth criteria. Now likely criteria 1 (natural history), 2 (rare and uncommon natural history) and 4b (a class of natural environment). Not assessed for cultural values – possibly a. Historical – rare or endangered cultural history e. Research – Potential to yield Information re cultural history.
SHR	Kelvin (rural estate various buildings colonial, Georgian stuccoed brick bungalow, brick and timber slab outbuildings)	46	LIVERPOOL	Not assessed against criteria Likely values Historic, Aesthetic This item is also listed in the Western Parkland City SEPP (below)
	Fernhill (Sandstone buildings)	54	PENRITH	a. Historical c. Aesthetic
	The Church of the Holy Innocents, Churchyard and Cemetery (early gothic revival brick building)	2005	LIVERPOOL	a. Historical b. Historical association c. Aesthetic e. Research Also rare f. and representative
	Fairlight Homestead & Barn	262	PENRITH	Not assessed against criteria. Appears a. Historical b. Historical Association c. Aesthetic
	Cox's Cottage	171	PENRITH	a. Historical b. Historical association c. Aesthetic d. Social e. Research Also rare f. and representative g.

Statutory list	Item	Listing number	LGA	Criterion: cultural values
	Maryland (highly intact major mid-19th Century rural estate, built on an 1816 grant of 3000 acres within the Cumberland Plain which continues as a working estate. Sandstone buildings)	1690	CAMDEN	a. Historical b. Historical association c. Aesthetic d. Social e. Research Also rare f. and representative g. This item is also listed in the Western Parkland City SEPP (below)
	St Thomas Anglican Church (sandstone)	426	PENRITH	Not assessed against criteria Architectural, aesthetic
	Warragamba Dam – Haviland Park	1375	WOLLONDILLY	f. Rare (aesthetically) which implies it also meets criterion c.
	Megarritys Bridge	1367	WOLLONDILLY	f. Rare (historically) which implies it also meets criterion a.
	Warragamba Emergency Scheme	1376	WOLLONDILLY	f. Rare (historically) which implies it also meets criterion a.
LEP	St Thomas Anglican Church and Cemetery	126	PENRITH	Local assessment: a. Historical c. Aesthetic d. Social e. Research Also rare f.
	Winbourne (Sandstone colonial estate buildings)	138	PENRITH	Local Assessment a. Historical b. Historical association c. Aesthetic Also rare f. and representative g.
	Former irrigation office & police station (brick cottages)	135	PENRITH	Local assessment a. Historical c. Aesthetic representative g.
	Cottage 96-100 Greendale Rd Wallacia	811	PENRITH	a. Historical c. Aesthetic Also rare f.

Statutory list	Item	Listing number	LGA	Criterion: cultural values
	Former Mulgoa Road	844	PENRITH	Local assessment: a. Historical b. Historical associations c. Aesthetic Also rare f.
	Blaxland's Farm	I269	WOLLONDILLY	Local assessment: a. Historical c. Aesthetic e. Research Also rare f. and representative g.
	Former St. Andrews Anglican Church (weatherboard)	326	PENRITH	Local assessment: a. Historical c. Aesthetic Also rare f.
	Blaxland's Crossing at Nepean River	I289	WOLLONDILLY	Local Assessment: a. Historical Also rare f.
	School (Wallacia Public School weatherboard)	852	PENRITH	a. Historical d. Social Also representative g.
	Bellfield Farm Group, including homestead, slab kitchen, slab cottage, smoke house and interiors (brick, timber slab buildings)	61	LIVERPOOL	Local assessment: a. Historical b. Historical association c. Aesthetic d. Social e. Research Also rare f. and representative g.
	Charleville	I267	WOLLONDILLY	Local assessment: a. Historical c. Aesthetic Also rare f. and representative g.
	Irrigation canal	A137	PENRITH	No assessment
	Post Office – Wallacia	851	PENRITH	Local assessment: a. Historical Also representative g.
	Winbourne	138	PENRITH	As for SHR above

Statutory list	Item	Listing number	LGA	Criterion: cultural values
	Fernhill, curtilage (listing says see 128)	873	PENRITH	Local assessment: a. Historical c. Aesthetic Also rare f.
	Warragamba Conservation Area (township)	C4	WOLLONDILLY	Local Assessment: a. Historical c. Aesthetic d. Social Also rare f. and representative g.
	Greendale Roman Catholic Cemetery (brick church)	26	LIVERPOOL	Not assessed against criteria but assumed a. Historical and d. Social
	Allenby	I139	CAMDEN	Not assessed against criteria but assumed a. Historical and also locally rare f.
	Rossmore Public School (weatherboard buildings)	I138	CAMDEN	Local Assessment: a. Historical c. Aesthetic d. Social e. Research
	Cottage 1296 Mulgoa Road	134	PENRITH	Local assessment: a. Historical c. Aesthetic Also representative g.
	Former St Marks Anglican Church Group, including cottage, church cemetery and interiors (Victorian Gothic Revival stone church with a slate roof- now private residence & cemetery)	25	LIVERPOOL	Local assessment: a. Historical b. Historical associations c. Aesthetic e. Research

Statutory list	Item	Listing number	LGA	Criterion: cultural values
	The Fleurs Radio Telescope Site	832	PENRITH	Local assessment: a. Historical b. Historical associations e. Research Also rare f. This item is also listed in the Western Parkland City SEPP (below)
	Passadena – House (weatherboard cottage)	132	PENRITH	Local assessment: a. Historical b. Historical association c. Aesthetic Also rare f.
	Bents Basin Inn site (archaeological site)	A01	LIVERPOOL	Local assessment: a. Historical e. Research Also representative g.
	All Saints Anglican Church (Weatherboard)	I226	WOLLONDILLY	Local Assessment: a. Historical c. Aesthetic d. Social Also rare f. and representative g.
	Luddenham Road Alignment	843	PENRITH	Local Assessment: a. Historical c. Aesthetic
	Bringelly Public School Group, including schoolhouse and former headmaster's residence (weatherboard)	7	LIVERPOOL	Local Assessment: a. Historical c. Aesthetic e. Research Also representative g.
	House (Californian Brick Bungalow) 38 Greendale Rd, Wallacia	812	PENRITH	Local Assessment: a. Historical c. Aesthetic Also rare f.

Statutory list	Item	Listing number	LGA	Criterion: cultural values
	Church of the Holy Innocents Group, including church, interior and churchyard	60	LIVERPOOL	See also SHR above. Local assessment: a. Historical b. Historical association c. Aesthetic e. Research Also rare f.
	Remnants of former farm homestead ("Pemberton") – archaeological site	A03	LIVERPOOL	Local assessment: a. Historical e. Research
	Mulgoa Road Conservation Area	HCA5	PENRITH	Local assessment: a. Historical c. Aesthetic Also representative g.
	Cottage – 1186 Northern Road Bringelly	I2	CAMDEN	Not assessed against criteria
	Mulgoa Public School Building, hall residence and trees (Brick teacher's residence and classroom block)	130	PENRITH	Local assessment: a. Historical c. Aesthetic Also rare f. and representative g.
	Warragamba Supply Scheme and Warragamba Emergency Scheme	I270	WOLLONDILLY	See SHR above a. Historical
	Fernhill, outbuildings, landscape & curtilage (Sandstone house and outbuildings)	128	PENRITH	See also SHR above. Local assessment: a. Historical c. Aesthetic Also rare f.
	Wallacia Hotel (brick interwar)	325	PENRITH	Local assessment: a. Historical c. Aesthetic Also rare f.
	Scarred tree and Aboriginal artefact scatter	878	PENRITH	No assessment

Statutory list	Item	Listing number	LGA	Criterion: cultural values
	Cottage 1306 Mulgoa Road, Mulgoa (weatherboard)	136	PENRITH	Local assessment: a. Historical c. Aesthetic Also representative g.
	Park Road Conservation Area (interwar cottages)	HCA6	PENRITH	Local assessment: a. Historical c. Aesthetic Also representative g.
	Blaxland's Farm	I269	WOLLONDILLY	Local assessment: a. Historical b. Historical association c. Aesthetic e. Research Also rare f. and representative g.
	Ravenswood brick cottage and outbuildings	I268	WOLLONDILLY	Local assessment: a. Historical c. Aesthetic Also rare f. and representative g.
	Slab cottage site – archaeological site	A858	PENRITH	Local assessment: a. Historical c. Aesthetic
	The Cottage	125	PENRITH	No information
	Irrigation canal	A137	PENRITH	Not assessed against criteria – archaeological site
	Fairlight (Brick farmhouse)	140	PENRITH	Local assessment: a. Historical b. Historical association c. Aesthetic
	Luddenham Homestead Site – archaeological site	A849	PENRITH	Local assessment: a. Historical b. Historical association e. Research Also rare f.

Statutory list	Item	Listing number	LGA	Criterion: cultural values
	St. Marys Catholic Church	133	PENRITH	Local Assessment: a. Historical c. Aesthetic d. Social Also rare f. and representative g.
	Hall – 40 Greendale Rd Wallacia (weatherboard)	850	PENRITH	Local assessment: d. Social Also representative g)
	Silverdale Progress Hall (timber)	I227	WOLLONDILLY	Local Assessment: a. Historical d. Social Also rare f. and representative g.
	Shadforth Monument (former pioneer's monument)	24	LIVERPOOL	Local assessment: a. Historical b. Historical association c. Aesthetic e. Research Also rare f.
SEPP (Precincts Western Parklands City) 2021	Kelvin (Bringelly)	I3	Western Sydney Precinct: Aerotropolis	Note also on the SHR (see above)
	Luddenham Public School (Luddenham)	I2	Western Sydney Precinct: Aerotropolis	Local significance/assessment against criteria not available
	Wilmington Reserve (Luddenham)	I7	Western Sydney Precinct: Aerotropolis	Local significance/assessment against criteria not available
	Mount Pleasant Homestead (Bringelly)	I4	Western Sydney Precinct: Aerotropolis	Local significance/assessment against criteria not available
	Weatherboard Cottage (Luddenham)	I10	Western Sydney Precinct: Aerotropolis	Local significance/assessment against criteria not available
	Brick Cottage (Luddenham)	I6	Western Sydney Precinct: Aerotropolis	Local significance/assessment against criteria not available
	Luddenham Progress Hall (Luddenham)	I12	Western Sydney Precinct: Aerotropolis	Local significance/assessment against criteria not available

Statutory list	Item	Listing number	LGA	Criterion: cultural values
	Showground (Luddenham)	I15	Western Sydney Precinct: Aerotropolis	Local significance/assessment against criteria not available
	St James Anglican Church and cemetery (Luddenham)	I14	Western Sydney Precinct: Aerotropolis	Local significance/assessment against criteria not available
	The Fleurs Radio Telescope Site (Kemps Creek)		Western Sydney Precinct: Aerotropolis	Also Penrith LEP Local assessment: a. Historical b. Historical associations e. Research Also rare f.
	Weatherboard cottage (Luddenham)	I11	Western Sydney Precinct: Aerotropolis	Local significance/assessment against criteria not available
	Luddenham Uniting Church and cemetery (Luddenham)	I13	Western Sydney Precinct: Aerotropolis	Local significance/assessment against criteria not available
	McGarvie Smith Farm (Badgerys Creek)	I1	Western Sydney Precinct: Aerotropolis	Local significance/assessment against criteria not available
	Lawson's Inn site (former "The Thistle" site) (Luddenham)	I9	Western Sydney Precinct: Aerotropolis	Local significance/assessment against criteria not available
	Maryland Homestead, including homestead, grounds, outbuildings, stone cottage, former winery, stone store and gatekeeper's cottage	I1	Western Sydney Precinct: Campbelltown Growth Centres/ Lowes Creek Maryland	Note also on SHR #1690, and Camden LEP – see above. State significance a. Historical b. Historical association c. Aesthetic d. Social e. Research Also rare f. and representative g.
	Birling 1937 – Bringelly	I24	Western Sydney Precinct: Camden Growth Centres/Lowes Creek Maryland	Local significance/assessment against criteria not available

5.4 Air pollution and impacts to Aboriginal rock art sites

There is general acknowledgement that air pollution is likely to be detrimental to Aboriginal rock art (MacLeod 2014; Smith et al. 2022; Sundstrom and Hayes-Gilpin 2011); however, there has been little direct research on sites within or close to Sydney. Internationally, research findings suggest that air pollution can accelerate the rate of stone deterioration in urban settings, by weakening the fabric of the stone, making it more susceptible to other stresses such as physical weathering (Giesen et al. 2014; Tzanis et al. 2009).

Since the 2000s, Australian research has focused on the potential impact of airborne pollutants on painted and engraved rock art from an industrial complex on Murujuga ('Burrup Peninsula') in the Dampier archipelago, Western Australia (Black et al. 2017a, 2017b; Markley et al. 2015; Smith et al. 2022). Murujuga contains the largest concentration of petroglyphs in the world (estimated at over 1,000,000). The Dampier Archipelago petroglyphs are carved into the weathered surface rind of granophyre and gabbro igneous rocks, and are situated in open contexts (that is, not in rock shelters). Also known as 'engravings' the visibility of these petroglyphs depends on the contrast of the surrounding dark rock patina or rind, with the lighter underlying rock exposed by carving. The patina, known as 'desert varnish', develops over thousands of years in environments characterised by low rainfall and arid conditions.

Although rock art involving desert varnish is not directly applicable to the Sydney Basin context, the research conducted on potential impact from nearby industrial air pollutants has identified processes of deterioration which are potentially applicable. These are the acidification of rock surfaces from airborne contaminants, largely NOx compounds (nitric oxide and nitrogen dioxide) causing acid rain, and the deposition of nitrogen (as Ammonium nitrate PM_{10} dust). Depending on the chemical composition of the rock, increased acid levels will accelerate the erosion of constituent minerals both in the rock substrate as well as the patina or rind. Increased nitrogen in the form of surface dust will encourage the growth of micro-organics, which in turn can increase surface deterioration and chemical processes of deposition and erosion (Rosenfeld 1985; Black et al. 2017b; MacLeod 2005; Smith et al. 2022).

Another source of potentially applicable research is the impact of air pollution on building materials, and in particular, stone masonry. Although the substantial differences in the environmental context and surface condition of building masonry compared to Aboriginal rock art makes this research not directly applicable, many of the identified processes of deterioration may still be relevant (Ip et al. 2011; Doehne and Price 2010). A counter view is suggested by a recent comparison of pollution effected weathering crusts on masonry and natural outcrops of Carpathian sandstone (in Central Europe) by Marszalek et al. (2014). This study found that the crusts on natural outcrops were hardened with silica and iron and consequently less porous and better protected from atmospheric agents than their masonry counterparts. This suggests that the analysis of the erosion of building masonry may not be directly applicable to natural outcrops of sandstone, which constitutes the predominant support and matrix for Sydney Basin rock art.

The following is a summary of potential processes of rock art deterioration which be caused by or contributed to by air contaminants resulting from burning aircraft fuel. Further research is required to address questions relating to the role (if any) that aircraft fuel plays in the deterioration of rock art in the Sydney Basin.

5.4.1 Oxides of nitrogen, sulphur and carbon

Sulphur oxides, nitrogen oxides and carbon dioxide are all soluble in water and create an acidic solution which can then react with calcareous materials (including sandstones). The creation of Carbonic acid from the solution of carbon dioxide is responsible for the normally weak acid nature of rainwater, giving it a pH of around 5.5 (Bell 1982). Much lower and damaging pH levels are created by the solution of sulphur dioxide (to form Sulphuric acid) and nitrogen oxides (to form nitric acid). These oxides are created by burning fossil fuels and are the main sources of acid rain in the Sydney metropolitan area and its surrounding regions (Bell 1982; Sesana et al. 2020). Acid rain has a pH of between 1.5 and 5.6. Measurements of acid rain in Sydney in 1980–1981 resulted in an average pH measurement of 4.4 (Bridgman 1989; Ayers and Gillett 1984).

Acid rain can also be caused by emissions of volatile organic acids from natural vegetation, and possibly from sea salt aerosols in onshore winds (Bridgman 1989; Ayers and Gillett 1983, 1984).

Acidity in rainwater has the potential to dissolve constituent minerals from rock art supports and substrates, as well as the products of weathering and patinas on the rock surface, with the effect of weakening the rock matrix and increasing erosion rates and the loss of rock or pigment surfaces.

Sulphur oxides dissolve in rain to form sulphuric acid, which when in contact with carbonate containing rock, such as in sandstone, forms Gypsum (calcium sulphate). The formation and crystallisation of Gypsum (often described as efflorescence) is a major cause of stone decay in Sydney masonry (Gordon 1978). The formation of salts (including Gypsum) within a rock matrix involves considerable expansion and the consequential stresses fracture and separate the rock grains.

Carbon dioxide is more soluble in cold water, meaning that cold moist environments and seasons are more likely to be associated with carbolic acid than dry hot environments.

The formation of acid rain in the Sydney context cannot be understood solely in chemical terms and must be appreciated as a complex interplay of meteorological and physical, as well as chemical factors, including wind speed, wind direction, time of day and rainwater deposition per event (Ayers and Gillett 1984).

The impact of pollution related acid rain in the erosion and deterioration of Sydney Basin rock art is poorly understood, especially compared to natural sources of acidity in rock art sites, such as ground water, soil chemistry, and the effect of micro-topography and micro-climates.

5.4.2 Dust accumulation and surface nutrients

The settlement of airborne dust particles onto rock art panels situated in rock shelters has a range of potentially detrimental impacts (NOHC 2016; Silver 2008):

- visual obscurement of the art pigments or marks, so that they appear to fade. Over the long term, dust deposits may bond permanently to the surface through mineralisation
- in some cases, dust can be chemically reactive and even corrosive, causing chemical decay of the pigment or the underlying rock substrate
- dust deposits may become hydroscopic and as a result of water retention:
  - weaken underlying pigment layers through differential expansion and contraction, or
  - create environments for destructive organics or micro-organisms.

The growth of organics, such as bacteria, yeasts, fungi and lichens are associated with the release of metabolites which are organic acids and similarly, increase the chemical decay of pigments and/or the underlying rock substrate (Rosenfeld 1985).

The most numerous studies in regard to the effects of dust on rock art panels have been conducted in Europe over the last 40 years and relate to the parietal art of the Upper Palaeolithic (Silver 2008:12). These studies deal with geologies and micro-climatic environments that are significantly different to the Sydney Basin and are therefore not directly applicable to its open and siliceous geological contexts.

A number of studies of dust deposits at rock art sites have been conducted in Australia (Watchman 1998; Gillet et al. 2006; Wallis et al. 2015; NOHC 2016, 2020). These studies are characterised by the analysis of both environmental aerosol dust samples and in-situ rock surface deposits to identify the source of the dust. Most have identified anthropogenic origins such as nearby roads, industrial complexes, and mining/quarrying as significant and recent dust sources. Methodologies included scanning electron microscopy, aerosol spectrometry, particle induced X-Ray emission spectroscopy, energy dispersive X-Ray analysis, and portable X-Ray fluorescence.

Studies in the Hunter Valley have identified recent visual changes in the colour and density of dust on rock shelter panels to be a consequence of aerosol dust deposition from nearby open cut coal mining and associated vehicle haulage (NOHC 2016, 2020). Similar dust deposits have been identified in rock shelter sites throughout the upper Hunter and are postulated to be a result of regional fallout of coal mine derived aerosol dusts (pers. comm. David Lambert 2020).

5.4.3 Contributors to climate change

Anthropogenic generation of carbon dioxide is regarded as a primary cause of climate change which is now recognised to include increases in the rate and severity of wildfire, fluctuations and extremes in temperature, humidity, precipitation, and storm events (IPCC 2022). All of these are key factors in the natural erosional processes of rock art and increases in their frequency and severity will increase the rate of rock art erosion and deterioration. These processes involve differential expansion of the rock constituents due to thermal, hydration and chemical changes.

Extreme changes in temperature during wildfire events is a documented cause for the loss of rock art from rock panel exfoliation (Lambert and Welsh 2011; Gunn 2011; Sefton 2011). Wildfire is also a major source of atmospheric dust which can be deposited on rock art panels in the still air within rock shelters (DECC 2007).

Increased precipitation, acidity, and subsurface water flow is likely to mobilise more dissolved salts in the substrates of rock art sites. When combined with climate change related increases in temperature, greater airflow and greater surface evaporation, the impact of salt crystallisation caused by the evaporation or cooling of salt solutions in both rock shelters and open sites, is likely to increase (Lambert 1989; Doehne and Price 2010). Expansion from the crystallisation of salts, within rock pores, can generate stresses that are sufficient to overcome the stone's tensile strength, causing areas of granular decay, and surface blistering and spalling (Rosenfeld 1985; Lewin 1982). Lambert has estimated the rate of erosion of sandstone surfaces in rock shelters from salt decay is in the order of 0.1mm per year (Lambert 1980). The salt is postulated to come from both rainwater and groundwater and thought to build up in surface areas subject to evaporation and a lack of flushing from rainwater (Lambert 1989). Lambert states that the impact of erosion by salt action at open sites such as sandstone engravings (petroglyphs) is unknown, however notes that erosion from salt spray in coastal areas may take place in a different form to that evident in rock shelters (Lambert 1989:15).

The expansion of clay minerals in the matrix of sandstone due to hydration is also a postulated process of surface erosion in Sydney Basin rock shelters (Hughes 1976). Pressures exerted by hydration within the rock tend to enlarge cracks or pores and can cause either flaking, spalling or grain-by-grain attrition (Rosenfeld 1985).

The formation of salts and their impact is likely to be a complex process in which the presence of water flushing, the persistence of moisture, and the surrounding soil chemistry and micro-climate are critical factors.

5.4.4 The Sydney Basin – air pollution and rock art

Although considerable resources are expended on the conservation of rock art in the Sydney Basin, most of these are focused on managing the direct impacts of natural erosion processes such as from water, organics and animals, or the management of human visitation (including site interpretation) and the consequences of visitation, such as graffiti and physical erosion (Sullivan 1977; Lambert 1989, 2007; NPWS NSW 2011). The potential impact of air pollution is sometimes acknowledged as a self-evident source of erosion and deterioration, however the research required to demonstrate this is yet to be conducted (Bursill 1993; Korff 2020). The extent to which air pollution may contribute to processes of rock art deterioration in the Sydney Basin remains unquantified and largely unresearched.

Bursill has argued that the effects of airborne pollution are a major factor in the reduction of the depth of grooves in open site petroglyphs, noting the corrosive effect and acidity of exhaust emissions (Bursill 1993:86-88). By comparing historical notes on groove depth with contemporary field measurements, Bursill considered that a substantial reduction in depth has occurred since the turn of the century and that this corresponds with local industrialisation (Bursill 1993:95). An analysis of petroglyph groove depth, relative to rock panel slope, at sites situated in Royal National Park led Bursill to consider that greater weathering rates in level contexts was a consequence of extended exposure to the acid products of local air pollution (Bursill 1993:94).

Bursill noted the results of an air quality study by Hyde and Johnson (1990) which found that parts of southern Sydney and suburbs to the west are subject to a very high degree of airborne pollution, mainly of an acidic nature, particularly during the summer months, and derived from motor vehicle exhausts, industrial plumes and the emissions from aircraft using Sydney (Kingsford Smith) Airport.

Bursill's conclusions regarding the impact of acidic air pollution on open petroglyph sites must remain tentative until further research can rule out alternative explanations, such as natural weathering processes, the impact of local topography, micro-climates, soils and site visitation patterns. The lack of applicable data underlines the need for research in this area. The lack of research on chemical and atmospheric weathering of open context petroglyph sites (excepting Murujuga) and compared to rock shelter and pigmented sites has been noted as an international bias not peculiar to Australia (Darvill and Fernandes 2014). It seems likely that past conclusions that acid rain in relation to health standards and ecological damage was not a significant problem in Australian metropolitan areas (compared to the European experience of burning coals with higher sulphur contents), has hidden this as a potential issue (c.f. Bell 1982; DECC 2007).

5.4.5 The distribution of rock art sites relative to the WSI site and flight path emissions

Figure 5.10 shows the distribution of Aboriginal rock art sites within the study area boundaries. Site proximity to WSI is in the range of 11 km to 64 km, depending on direction (refer Section 1.4 for an explanation of the study area boundaries). In the Sydney Basin, art sites only occur in sandstone-based topographies (formed on the Hawkesbury and Narrabeen sandstones) which support open sandstone platforms and overhangs. Rock art sites do not occur on the Cumberland Plain bedrock shales on which the WSI site is largely situated. The closest rock art sites occur approximately 11 km to the west and southwest where sandstone ranges rise above the plain or incised valleys have exposed the sandstones underlying the shale.

The distribution of the majority of known rock art sites occurs in 3 major groupings relative to the WSI (Figure 5.10):

- to the northwest and southwest, within the GBMA, extending from the WSI starting from a distance of approximately 18 km and 11 km respectively
- to the southeast on the Woronora Ramp (southeast of Campbelltown), extending from approximately 36 km away, and
- to the northeast in the Lower Hawkesbury catchments extending from approximately 55 km to the north.

It should be noted that the actual number and incidence of rock art sites within the GBMA is likely to be greater and higher than that shown in Figure 5.10. This is because the conduct of archaeological recording (and the number of resulting site recordings) in these environmental reserves is much lower than on the Cumberland Plain where development proposals require archaeological assessments. For this reason, it should be assumed that the number of rock art sites across the sandstone topographies of the GBMA are likely to be much greater than indicated by the current database of known sites, upon which Figure 5.10 is based. However, the distances to the nearest rock art sites from the WSI, across the Cumberland Plain shale topographies (see above), are likely to be accurate, given the absence of suitable sandstone exposures for rock art across these trajectories.

As a consequence of the relative location of the WSI on the Cumberland Plain and its spatial separation from the nearest distributions of rock art sites, it can be concluded that any local concentrations of atmospheric pollutants associated with WSI (such as within a 5 km radius) will not be situated in the proximity of rock art sites (DITRDCA 2023a, Appendix B).

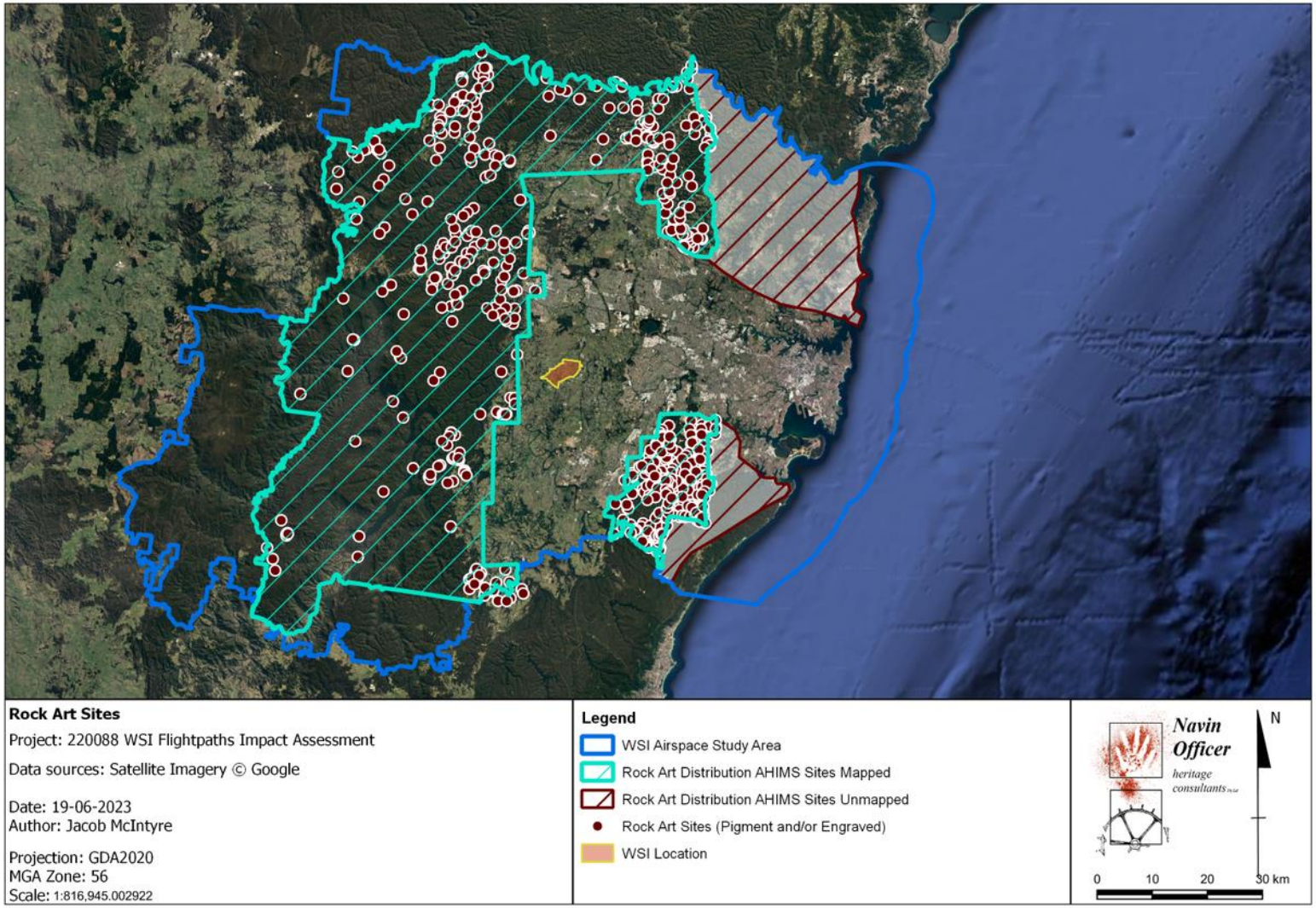

Figure 5.10 Location of Aboriginal rock art sites relative to the WSI site (Note: separate mapped and unmapped site distribution areas within the study area)

Figure 5.11 shows period and seasonal windroses for Badgerys Creek (2014–2021). From these it can be observed that winds are varied but predominantly occur from the southwest and the west-southwest. In the summer, winds of lesser speed predominantly occur from the east. This demonstrates that the prevailing trend is for potential airborne pollutants to remain close to the Airport Site or be moved away from the closest rock art sites which are situated in the Blue Mountain range lands to the west.

Elevated off-site concentrations of air pollutants (such as NO_2) are generally predicted to occur to the north, northeast and southwest of the Airport Site (DITRDCA 2023a). Figure 5.12 and Figure 5.13 present a selection of predicted contour plots of various emissions and dispersion across the WSI local and regional areas showing the focus of higher concentrations in the immediate proximity of the Airport Site, and the associated influence of the prevailing winds (DITRDCA 2023a).

The air quality assessment (DITRDCA 2023a, Section 10) for the local area around WSI has concluded that predicted levels of the assessed air pollutants would be below (regulatory) criteria except for $PM_{2.5}$ and NO_2 during 2055 at several receptors located immediately northwest of the runway. The particulate matter (PM) finding is a consequence of predicted elevated background particulate levels at the time and it is concluded that the project effect would be intangible and insignificant. The assessment of the regional area found similar small scale NO_2 impacts with predicted levels above criteria in close vicinity to WSI in 2055. The project's assessed impact on concentrations of all other assessed pollutants was found to be negligible and unlikely to be discernible within existing background concentrations (DITRDCA 2023a, Section 10).

It is unknown how the regulatory criteria (air quality standards) used in making the above conclusions about air quality may relate to levels of pollutants that effect rock art deterioration. This is because of the lack of research on the potential impact of air pollutants on rock art in comparable contexts. In the absence of relevant or comparable data, there is an obligation to generate and compile data to test if flight-path pollutants contribute towards rock art deterioration.

Apart from prevailing winds, the location of flight paths and associated low aircraft elevations during arrival-descent and departure-ascent could be expected to have a significant role in the incidence and distribution of aircraft emissions. Figure 5.11 provides a visualisation of flight paths to and from the WSI runways. It can be seen that a significant proportion of both arrival and departure flight paths overfly the sandstone ranges to the west of Sydney within the GBMA. The location of these flight paths and associated low approach and leaving aircraft elevations provide a basis for positioning transects and test locations for the monitoring and testing of aircraft emissions with reference to their potential impact on rock art sites.

Away from the immediate potential of emission impacts under and near flight paths, WSI aircraft emissions will also contribute to the general air quality of the Sydney Basin. International studies have shown that emissions from airport operations are small when compared to the regional context of emission inventories (Ratliff et al. 2009). This is supported in the Sydney context by the air emissions inventory for the Greater Metropolitan Region in NSW (EPA 2012) which shows that emissions from existing airport operations in Sydney in 2008 were less than 3% of total emissions for the region. However, in relation to the western side of the airspace study area where there are large tracts of national park and minimal industrial development in the past, the potential impact of new or increased emissions from the preliminary flight paths to these environments requires consideration.

It can be concluded that any potential for WSI aircraft emissions to impact upon rock art sites is probably situated:

- under the more frequently flown sections of flight paths, especially close to the WSI, notably to the west of the WSI, and
- to a lesser extent, WSI emissions will contribute to the potential impact of the net air pollution from the Sydney Metropolitan area on Sydney Basin rock art sites.

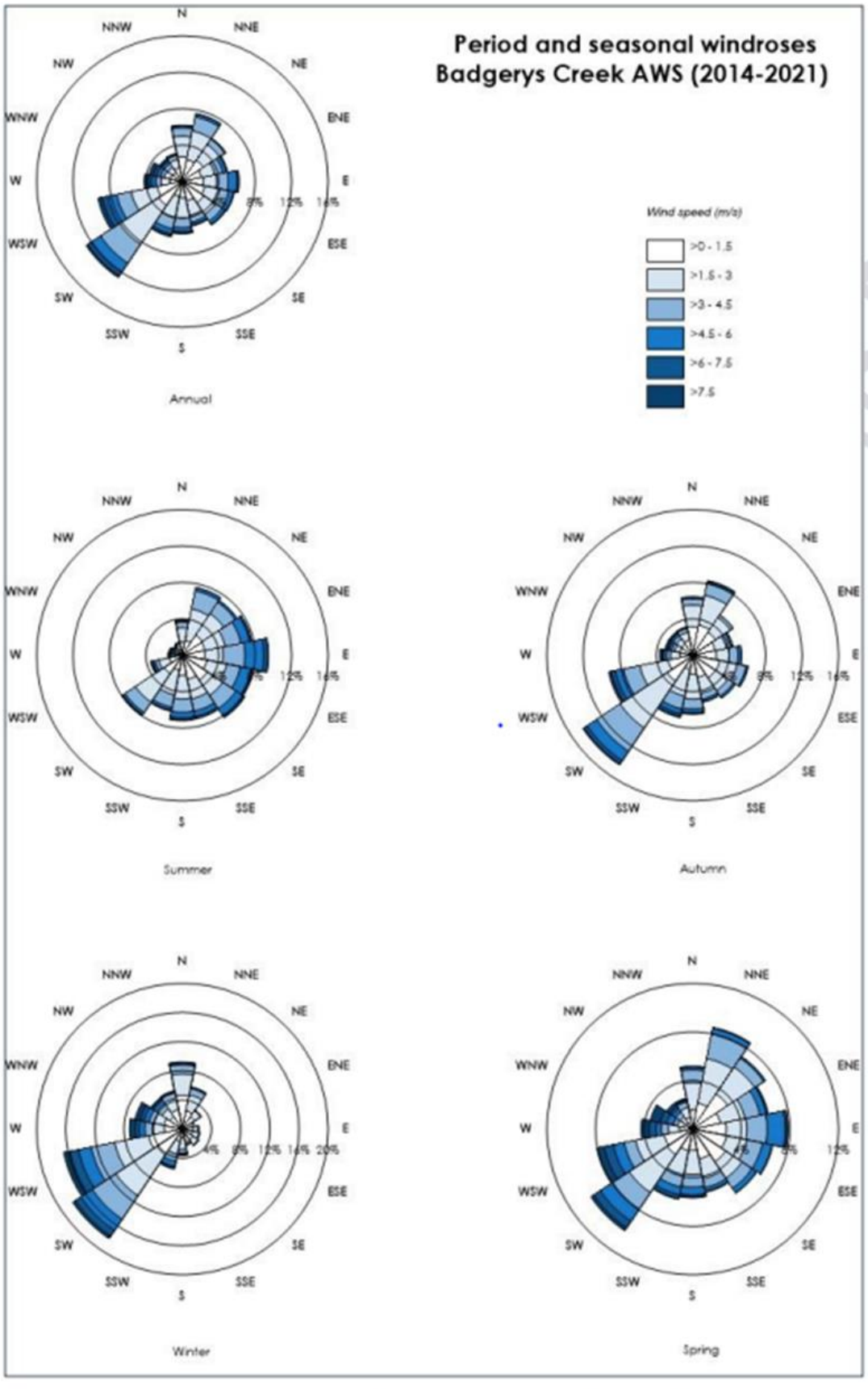

Figure 5.11 Period and seasonal windroses for Badgerys Creek AWS (2014–2021) (DITRDCA 2023a:Figure 4-4)

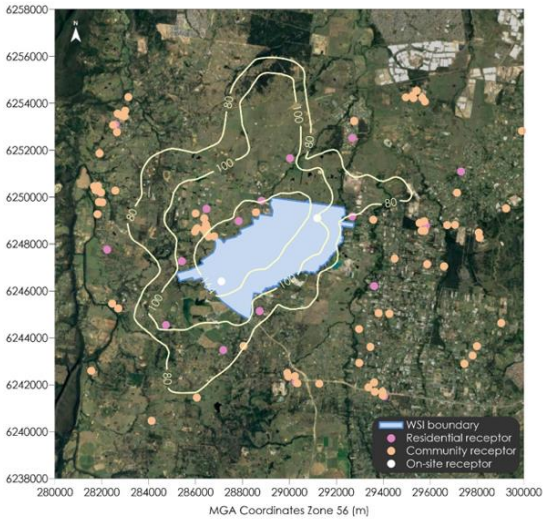

Figure 7-1 Predicted maximum 1-hour average NO_2 concentrations (µg/m³) for 2055 – S3

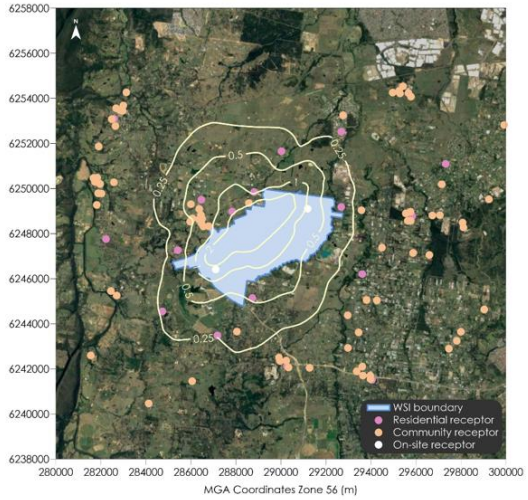

Figure 12-33 Predicted incremental maximum 24-hour average $PM_{2.5}$ concentrations (µg/m³) for 2055 - S4

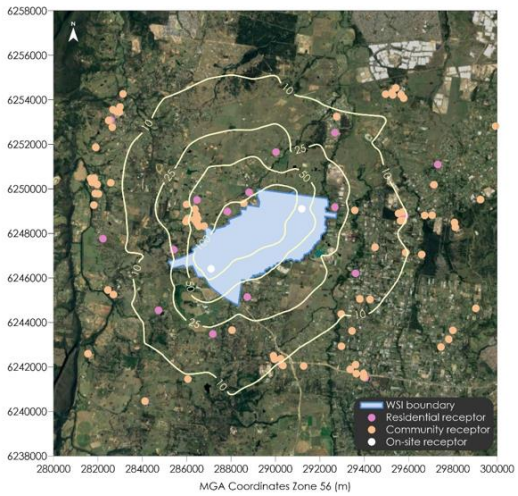

Figure 12-53 Predicted incremental maximum 1-hour average SO_2 concentrations (µg/m³) for 2055 – S4

Figure 5.12 A selection of predicted contour plots of various emissions and their dispersion across the WSI local area showing the local focus of higher concentrations, and the influence of the prevailing winds (DITRDCA 2023a [Figure nos. and captions retained from original source])

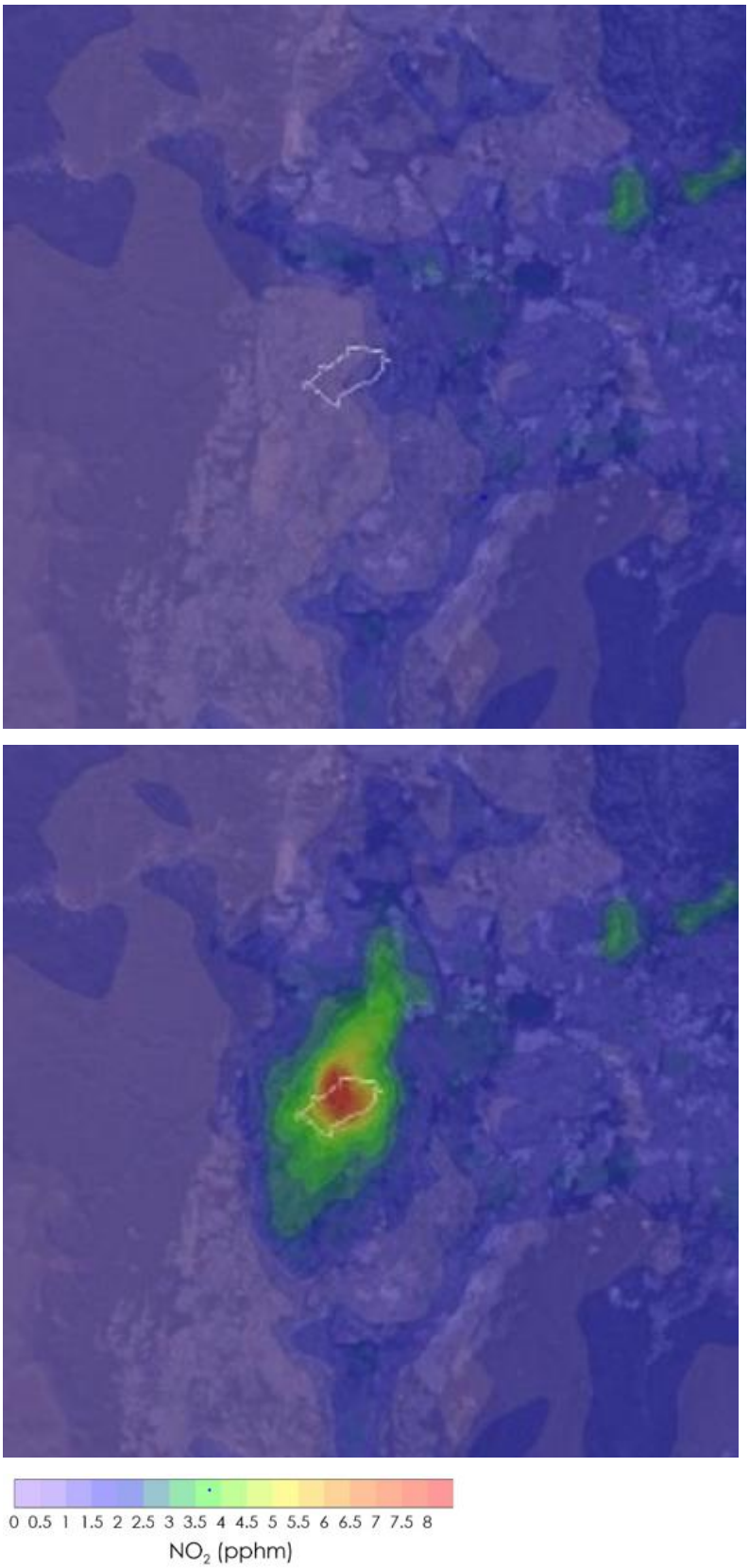

Figure 5.13 **Maximum predicted 1-hour NO_2 concentrations for base case (above) and 2055 Scenario 3 (below) (DITRDCA 2023a: Figure 7-13)**

5.4.6 The impact of WSI aircraft emissions

Although it is possible to outline processes of potential rock art deterioration related to aircraft emissions, it is as yet, impossible to evaluate the risk presented by these processes, or indeed to identify and quantify resulting damage. This is due to a lack of previous research and comparative data, as well as the difficulty in differentiating aircraft emission derived deterioration from other anthropogenic pollution sources via the same processes (such as acidity, nutrients and dust). Many of the subject processes of deterioration are also naturally present or are pre-existing phenomena of metropolitan and industrial areas (such as dust deposition), and the proportional contribution of aircraft emissions is difficult to quantify.

Air pollution standards and thresholds have mostly been developed in relation to human health requirements, or human perceptions of environmental toxicity (refer Chapter 3 of the Technical paper 3: Greenhouse gas emissions). It remains unknown how these relate to conditions which may or may not be conducive to the conservation of rock art.

In these circumstances, reasonable strategies to pursue are:

- the promotion of research and monitoring to gain a better understanding of processes and impacts, and
- adopt a precautionary approach and where possible meet existing emission control guidelines and minimise emissions that may contribute towards the acidification of rain and aerosols, increases in surface nutrients, and airborne dust.

The need to reduce the generation of greenhouse gases and their role in promoting climate change are now established principles of State and Federal policy. The rock art conservation imperatives to reduce the frequency of storm events, and the extent and duration of climatic humidity and temperature variations are shared with many other environmental and ecological fields of concern.

5.4.6.1 Fuel jettisoning

If required for operational safety purposes, the dumping (or jettisoning) of aircraft fuel is typically undertaken in a controlled manner and in accordance with established procedures so as to eliminate any risk to sites on the ground (Technical paper 4). Civil Aviation Regulation 150 allows ‘in an emergency, the jettisoning of liquid fuel or cargo over areas where hazard to persons or property on the ground or water is not created’ (1988 No.158 Civil Aviation Regulations).

The ability to dump fuel in flight is limited to wide-body aircraft. The need to dump fuel is a very rare occurrence, normally involving the requirement for an aircraft to return to its airport of origin soon after take-off because of a mechanical or passenger incident. Fuel jettisoning would occur in accordance with the Aeronautical Information Package Australia, Part 2 – En Route (AIP ENR) (Airservices Australia, 2022b). If required, fuel jettisoning would occur at an altitude of at least 6,000 ft (around 1.8 km) above ground level to ensure total dissipation into the atmosphere prior to contacting the ground, except in the case of emergencies (Airservices Australia, 2022b).

Most fuel evaporates within the first few hundred metres. Most jet fuel is highly volatile and when jettisoned readily breaks up into small droplets which subsequently vaporise. Clewell found that the type of fuel, height of jettisoning and ground temperature all affect the proportion of fuel to evaporate prior to reaching the ground (Clewell 1980). The evaporation of unburnt fuel droplets releases volatile organic compounds, such as benzene (and carbon dioxide) into the atmosphere, some of which can remain in a vapour phase with a residence time of between 1 day and 2 weeks, depending on climate and other pollutants present (PEL 2016:82). Although fuel jettisoning is extremely rare and the likelihood of fuel reaching the ground is very low, its potential impact on the ground, to the environment and the micro-climate of Aboriginal rock art sites would be detrimental. No occurrences of jettisoned fuel reaching the ground have been recorded in the history of commercial jet aviation in Australia.

Based on the National Aviation Occurrence Database (Australian Transport Safety Bureau), a total of 144 events involving fuel dumping or burn offs have occurred since 2010 when systematic reporting commenced. Of these, 43% involved fuel dumping, and 77% were a consequence of an incident occurring on take-off (necessitating fuel reduction prior to a return to the airport). This corresponds to 48 fuel dumping incidences. Over the period 2010–2020, there were an estimated 9,281,707 commercial air transport take-off operations, providing a fuel dumping incident rate of 5.17×10^{-6} per take-off movement (DITRDCA 2023b, Section 9.1.2). The risk assessment conducted for this EIS concluded that a fuel dumping incident giving rise to impacts at ground level anywhere in the vicinity of WSI is estimated to be extremely remote

(DITRDCA 2023b: Section 9.1.2). Consequently, the likelihood of a fuel jettisoning occurrence related to the use of WSI impacting upon an Aboriginal rock art site is also extremely remote.

5.5 Air pollution impacts to non-Indigenous heritage places

Despite the cost of maintenance of some historic structures and in particular Sydney's historical sandstone structures, there are few studies on the impact of air pollution and its mitigation. While some studies have looked at air pollution generally, little specific information is available in the public domain regarding the contributary impact of aviation pollution. No Australian studies could be located that consider the potential impacts on other types of building fabric, although some studies have focused on impacts on other types of stone building materials (e.g., Basu et al. 2020) and limestone mortars (Martinez-Ramirez et al. 1998). The following points summarise the information available:

- Anthropogenic air pollution is a major cause of damage to heritage buildings including 19th Century sandstone structures in Sydney.
- The principal sources of anthropogenic ambient pollution in Sydney are emissions from motor vehicles and coal fired power stations.
- No known published studies have linked pollution from aircraft directly to the destruction of heritage items.
- Aircraft engines produce pollution over urban areas making them contributors to ambient air pollution in general, especially when flying at altitudes below 1 km.
- The presence of air pollution is generally known to increase the rate of natural weathering by about one to 2 times, regardless of the stone used for construction.
- Sydney (yellow block) sandstone, a building material employed in many 19th Century buildings in Sydney, is a highly porous and friable building material vulnerable to weathering from natural and anthropogenic pollution.
- Sulfuric and nitric acid, deriving from sulphur dioxide (SO_2) and nitrogen oxides (NOx) in air pollution from motor vehicles and aircraft, decreases the pH of rain causing acid rain and contributing to the precipitation of secondary minerals in sandstone building materials.
- Acid rain and secondary minerals (salts) are major contributors to the destruction of the outer layers of sandstone architecture in urban areas.
- Recent changes in air pollution standards internationally have led to a shift in the causes of damage to stone heritage buildings away from traditional sources of air pollution, such as diesel vehicle emission, to increased activity by algae.
- The growing impacts of climate change provide an important backdrop to the possible enhanced impacts of pollution, including exaggerated cycles of wet/dry climate, humidity and increasing threats from micro-organisms.

Air pollution has long been considered a cause of damage to built heritage in both urban and rural areas (e.g. Inkpen 2004; Watt et al. 2009). The principal sources of ambient air pollution globally are industrial activities and vehicle emissions, while in Sydney they are motor vehicle exhaust and to a lesser extent coal fired power stations (Paton-Walsh et al. 2019).

Atmospheric conditions mean that air pollution impacting cultural heritage sites can travel long distances and is not restricted to local sources (Stray and Dahli 1999). This phenomenon explains the contributions of fine atmospheric particles made by power stations to Sydney's pollution levels (Paton-Walsh et al. 2019), despite the fact they are largely located in the Hunter Region to Sydney's north or west of the Blue Mountains to Sydney's west.

There appear to be no published studies investigating the impacts of air pollution directly from the aviation sector on heritage items. However, it is well understood that aircraft produce large amounts of pollution, especially beneath flight paths and around airports, and are an important contributor to ambient air pollution in urban areas generally. For example, 5–7% of total jet fuel is consumed within 1 km above ground level during airport operations (Masiol and Harrison, 2014).

Many 19th Century buildings in Sydney were constructed from locally quarried (yellow block) Sydney sandstone. Sandstone is a highly porous and friable building material which makes it vulnerable to the impacts of natural and anthropogenic air pollution. Sydney sandstone contains a large amount of sand (60–68%) which is bound together by 16–25% clay matrix (Stuart et al. 2008). The loose arrangement of sand grains, high porosity and clay mineral content make Sydney sandstone highly susceptible to weathering.

Recession (erosion) rates of architectural sandstone vary considerably according to the physical and chemical composition of the rock and the location of the heritage item. Buildings situated in urban areas generally experience accelerated rates of damage compared with their rural counterparts (Varotsos et al. 2009). Sandstone heritage items in Sydney are especially vulnerable to damage due to the combined impacts of salt in the coastal air, humidity, wet/dry climate phases (such as La Nina/El Nino cycles), and natural (bushfires) and anthropogenic air pollution.

In general, the presence of air pollution is known to increase the rate of natural weathering by about one to 2 times, regardless of the architectural stone used (Varotsos et al. 2009). The presence of air pollution results in the formation of secondary minerals, principally through increased acid concentrations, and exfoliation of the outer layers of sandstone which are typically loose and friable (Marszalek et al. 2014).

Notably, air pollution from motor vehicles and aircraft contains sulphur dioxide (SO_2) and nitrogen oxides (NOx) which reacts with water to produce sulfuric and nitric acid (Sesana et al. 2020). Their presence can further decrease the pH of rain causing acid rain (Sesana et al. 2020) which also causes the precipitation of secondary minerals, chiefly salts, which are a commonly used marker of the level of environmental pollution in sandstone buildings (Marszalek et al. 2014).

Smith et al. 2008 note that weathering crusts contain secondary salt minerals, mainly gypsum, which reduces the resistance of surface stone to weathering. It also has the side effect of lowering the stone's aesthetic quality. Crust layers caused by pollution seal in airborne particulates, hampering the free exchange of stone moisture with the air, and increasing the migration of soluble salts from inner parts of the stone (Smith et al. 2008). This leads to the loosening of the rock structure, and ultimately, granular disintegration of the stone.

Studies on sandstone buildings and natural sources of similar sandstone overseas have demonstrated that the outer crust that develops on natural sandstone surfaces such as tors and boulders operates to protect the inner rock from decay but the crust that forms on building sandstone in cities operates differently and does not protect the inner stone. This may mean that similar levels of pollution will have less severe physical impact on natural stone surfaces such as in rock shelters and sandstone exposures used for Aboriginal engravings and a more severe impact on sandstone buildings similarly exposed. Further research in the Australian context is needed to understand this.

> **The mechanism of developing weathering crust is similar on the surfaces of sandstone tors and of architectonic sandstone elements. The course of weathering of rock surfaces depends besides inherent petrographic features (mineral composition, texture, structure) also upon environmental conditions, being particularly affected by atmospheric pollution. In the regions of low pollution, the sandstone surfaces become covered with the natural weathering crust that provides a long-term protection of inner rock layers from further alterations.**
>
> **The weathering crust developed as an effect of pollution in urban areas contains considerable amounts of secondary salt minerals, mainly gypsum, reduces the resistance of surface stone layers to weathering and, as a side effect, lowers the stone aesthetic quality. The crust layer additionally sealed with airborne particulates hampers a free exchange of stone moisture with the air, a migration of soluble salts from inner parts of stones outwards and their crystallisation on the surface. All this leads to the loosening of the rock structure and finally, to the granular disintegration of the stone (Marszalek et al. 2014:14033-4).**

Particulate pollution, especially from diesel vehicles, has long been responsible for the deposition of a black coating on urban heritage buildings. This coating of potentially soluble gypsum and soot particles comprises mostly salts (Smith et al. 2008; Marszalek et al. 2014) and is seen commonly on sandstone in urban areas. In Sydney, this weathering crust can be easily observed, for example, on the sandstone buildings at the University of Sydney, St Mary's Cathedral, St Andrew's Cathedral, Central Station, the Rocks, and other 19th Century sandstone buildings around Sydney.

Changes in vehicle emission standards in developed economies over recent decades have also led to a shift in the major causes of damage to heritage buildings. These resulted in changes to the composition of air pollution, with fewer diesel and lead emissions and increased ethanol, enhancing the effects of biological (algal) precipitated weathering (Smith et al. 2008). This has led to changes in the distribution and colour of soiling (weathering crusts), specifically increased amounts of complex biomineralogic crusting due to elevated ambient nitrogen levels (Smith et al. 2008), on the stone of heritage buildings.

Studies of the impacts of climate change on stone heritage buildings in London considered a broad range of stone materials including limestone, marble, granite, sandstone, slate, flint as well as bricks.

> **In the urban environment of London, with progressive build up in the concentration of atmospheric nitrogen oxides leading to an increasingly acidic environment and, with predicted climate change, the diverse stone-built heritage will be affected. (Basu et al. 2020:788)**

From the discussion above it is clear that emissions have an impact on the physical fabric of buildings and in particular are known to have an impact on sandstone (see for example Figure 5.14), which is a material used in many of Sydney's significant historical buildings. It is likely that other fabrics and finishes are also affected over time (Building Effects Review Group 1989; Sharma et al. 2023).

Glass can undergo chemical alteration in polluted environments. Sodium can be leached out of the surface layers of modern glass in atmospheres rich in sulphur and carbon dioxide. Overseas studies have shown that medieval glass can be leached of its potassium and calcium content, weakening the structure and durability (Inkpen 2004).

Metals can also be chemically altered within a polluted atmosphere. The degree of alteration depends to a great extent on the presence of moisture (and how long the metal remains wet), the concentration of pollutants present and the supply of oxygen to the reacting surface (Inkpen 2004).

However, it is not currently possible from the available data to quantify the contributory impact of emissions from aircraft as there have been no long-term baseline studies undertaken to monitor long term impacts of such industrial emissions (see Chapter 6 for discussion of cumulative impacts). Additional work is needed in this area especially in view of the potential increased maintenance costs for heritage structures over time as they deteriorate.

Figure 5.14 A gargoyle damaged by acid rain (Image: Nino Barbieri via Wikimedia Commons)

5.6 The impact of noise and visual intrusion

The impact on cultural values of both Aboriginal and non-indigenous places of noise and visual intrusion is dependent on a combination of the expected type of aircraft, height of the aircraft above the ground surface, the position of the heritage item in relation to topographic features that might mitigate noise or shield from site, the frequency of flights and whether an aircraft might be expected to be climbing in altitude, cruising or idling. While it is not possible to give precise predictions for every heritage item under the preliminary flight paths some estimations are provided in Table 5.3 and Table 5.4.

In response to submissions, further discussion on additional heritage items identified in submissions including the potential impacts to heritage items in Mulgoa, Luddenham Village and Wallacia is provided in Appendix D (Supplementary information).

5.6.1 In relation to significant non-indigenous heritage items

The flight paths avoid all of the WHAs and the Nationally listed sites, except for the GBMA and the Royal National Park – Garawarra State Conservation Area. In relation to the Royal National Park – Garawarra State Conservation Area, while aircraft will be visible, they will be much higher than the current aircraft overflying the area to and from Sydney (Kingsford Smith) Airport and noise is not expected to be significant at 42 decibels or lower (see Section 5.3.1). While aircraft might still be visible from the other sites (see Figure 5.6) even though they are not directly overflown, it is expected that noise and visual intrusion to these places will be minimal and have a negligible impact on their values.

The 2016 EIS noted that:

> **...Aircraft technology is continually evolving to improve noise performance of aircraft, with the latest generation of aircraft being about 75% quieter than those designed 40 years ago. Given that the full operating capacity of the long-term development is not anticipated to be achieved for close to 50 years, it is likely that older generation aircraft, including the Boeing 747 would have been replaced by quieter and more efficient aircraft as technology continue to improve**[13]

The long-term impact of cultural values due to noise is difficult to determine. If the noise is such that it disrupts the cultural practices at a site to the extent that its use is discontinued, then this would have a profound impact on the cultural values associated with the place. This can be particularly important to historic heritage items such as buildings and building complexes which have existing sympathetic uses that are noise sensitive. Such heritage items often require a substantial income stream to help fund their long-term maintenance.

Considering the high number of non-Indigenous heritage places within the study areas, a selection of State heritage places were considered in detail as exemplars. These are shown in Table 5.3. The rationale for selecting these examples is as follows:

- Fernhill Estate is located in Mulgoa. The village of Mulgoa and surrounds has a number of items of local and State significance. Potential impacts on Fernhill Estate are likely to apply to these other nearby places. The Estate comprises an extensive area of modified and natural landscape that provides a picturesque setting for the house completed in 1842 for Edward Cox. The house itself was built in the Greek revival style by indentured Irish stonemasons from stone quarried on the site (JPA & D 2019). It is currently described as *A place of natural beauty. A place of quiet contemplation and to feel part of nature*[14]. There are a number of other historic places of State and local significance located in Mulgoa. Impacts as described for Fernhill will be similar for those other heritage places. Fernhill was purchased in 2017 by the NSW government for $27mil, since then conservation and maintenance works have been carried out on the property. Western Sydney Parklands has detailed some of their broad aspirations for the property in the plan of management for the property (Greater Sydney Parklands 2021). The property is no longer a residential home and therefore night time noise may not pose a negative impact on the use of the historic property, however proposed future uses include hiring of the venue for weddings and similar events and it is advertised as a place for tranquil rural enjoyment so daytime noise and visual intrusion is a consideration. The principle potential impact however relates to the impact of emission on the building fabric particularly the sandstone.
- Lilianfels in the Blue Mountains is an example of an historic property in Katoomba whose heritage conservation is funded through its commercial use as a wellness spa; any impact to its commercial viability will have a flow on impact on its cultural values. The impact on Lilianfels is considered as indicative of the impact on other heritage properties in Katoomba, particularly those at the edge of the urban sprawl at the junctions with the GBMA forests.
- The Carrington is a heritage listed hotel in the centre of Katoomba. Currently a hotel, it was built as a 19th Century grand resort built in 1883 to take advantage of the healthy mountain air. The building is sprawling complex which includes not only the original spa and hotel with music room, ornate stained-glass windows and numerous original features. It also includes the remains of a power station built in 1910 at the back of the Carrington Hotel to provide the first electricity supply, not only to the Carrington Hotel but also to Katoomba and other Blue Mountains towns. Katoomba is comprised of many historic buildings, many of which rely on the hospitality/tourism sector. Any issues and potential impacts facing the Carrington are likely also relevant to other heritage items within Katoomba township.
- Everglades house and gardens was selected as an example of a heritage garden. Heritage gardens in the Blue Mountains are currently subject to a range of existing and emerging pressures related to climate change. They are often maintained in part through the revenue from tourism and that tourism is based on their ability to showcase established cool climate gardens and offer tranquil walks and idyllic photo opportunities.

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13 WSA-EIS-Volume-3-Chapter-38-Greater-Blue-Mountains World Area p 151 https://www.westernsydneyairport.gov.au/sites/default/files/WSA-EIS-Volume-3-Chapter-38-Greater-Blue-Mountains-World-Heritage-Area.pdf

14 https://www.westernsydneyparklands.com.au/about-us/fernhill-estate/

- Linden Observatory is a unique heritage place that is used as a dark sky site by amateur astronomers. It is managed by a private Trust. There are also a number of Aboriginal sites along Linden Ridge.
- Wynstay Estate is located at Mt Wilson in the Blue Mountains. This privately-owned property, originally conceived as a park-like estate in the English picturesque tradition, is much older than the current homestead. The original cottage was built in 1875 by Richard Wynne, while the current Wynstay, a large sandstone house in the Georgian Revival style, was built by his grandson in 1923. The property is a good example of a heritage complex rather than a single building. As well as the main house there are the 2 earlier houses, the Turkish Bath, the Lodge/gatehouse, the stables and extensive heritage gardens.
- Kirkham Stables and Precinct c1816 is located in Narellan and provides an example of a large, early colonial property south of WSI. The property was originally part a 243ha grant to John Oxley. The buildings relate to the former horse stud and dairy. The property is currently a beef cattle farm. This heritage complex includes multiple buildings including homestead, workers cottage, managers cottage, stud breeding building, small stables building, horse stables, garages and other outbuildings. Any potential impacts to this property can be seen as typical of the potential impacts to other local and State heritage listed places in the Narellan/Camden area.
- Camden Park Estate and Belgenny Farm. This heritage item is an important cultural landscape comprised of multiple historical features. Camden Park House itself is an outstanding exemplar of Australia's Colonial Regency style of architecture designed by John Verge. Belgenny Farm was originally the home farm within Camden Park estate and was established by John and Elizabeth Macarthur in 1805. It contains the earliest collection of colonial farm buildings in Australia. Many of these are vernacular timber buildings. The property is currently an educational centre. Due to its picturesque setting, it is also a venue for weddings and corporate events.
- Thompson Square Conservation Area, Windsor. The 'square' itself is a small area recognised as one of Australia's earliest surviving public spaces and is surrounded by a number of State and locally significant heritage places. Those heritage places are built form a range of building materials including old sandstock bricks, sandstone and lime mortar. Windsor is comprised of many State, and locally significant heritage buildings and any potential impacts to Thompson Square Conservation Area features may be considered applicable to these other heritage items. In addition, the heritage item suffered recent impacts from the construction of the new Windsor Bridge and so it highlights the need to consider cumulative impacts to heritage places.
- Hobartville Estate, Richmond, is a substantially intact early colonial homestead group, featuring one of the finest pre-1830 houses in the country. The property is owned and managed by the National Trust of Australia (NSW). The house itself is a two-story sandstock brick mansion with sandstone features such as the front portico. It was built by William M. Cox junior and is reputed to be designed by Francis Greenway. Richmond is an historic town comprised of a number of State and locally listed heritage items. Richmond is already overflown by aircraft from Richmond RAAF Base and will also be overflown albeit at a much higher altitude by the new flight paths. Impacts and issues relating to Hobartville Estate can be expected to apply to other places in Richmond.

Table 5.3 Estimated noise and visual instrusion at a selection of historic heritage items of cultural value[15]

Item name	Sensitivity issues	Noise range modelled average sound levels) L_{Amax} (dB(A))	N60 (24-hours) number of movements	Potential impacts	Image
Fernhill Mulgoa SHR 54	Sandstone buildings – possible impact of emissions on building fabric. Noise Visual Emissions – effect on sandstone	~70 dB(A)	10–20 movements per 24-hrs at or above 60 dB(A)	The homestead is currently in a quiet rural setting. The property will be directly overflown by aircraft departing overnight from Runway 05. Approximate altitude of aircraft 2,500–5,000 ft. There will be some day-evening incoming flights to Runway 05 descending from 8,000 ft to 5,000 ft. Some aircraft (overnight or day-evening) may fly lower altitude depending on weather and operations conditions. Likely impact of noise on the cultural values will be moderate given the tranquil rural setting. The impact of emissions on physical fabric is undetermined but of concern. Impacts will be similar to St Thomas Church (SHR 426) and locally significant places in Mulgoa.	

[15] The estimated noise and visual intrusion assessment does not account for off-procedure manoeuvring areas. Sites within a departure or arrival transition area may sometimes be overflown as runway modes of operation change.

Item name	Sensitivity issues	Noise range modelled average sound levels) L_{Amax} (dB(A))	N60 (24-hours) number of movements	Potential impacts	Image
Lilianfels SHR 431	The maintenance is supported through its sympathetic reuse as a wellness spa. Noise, Visual	50–55 dB(A)	No movements at or above 60 dB(A)	Not underneath the flight paths but less than 5 km away. The altitude of aircraft will be >10,000 ft (MSL) Impact low.	
Everglades gardens SHR 1498	Air pollution/cumulative pressures added emissions and climate change	50–55 dB(A)	No movements at or above 60 dB(A)	Not underneath the flight paths but less than 5 km away. The altitude of aircraft will be >10,000 ft (MSL) Sydney (Kingsford Smith) Airport already overflies the property. Noise and visual impacts expected to be low. Cumulative impact emissions and climate change undetermined.	
Linden Observatory SHR 1807	Dark sky proposal; visual, sensitive to noise night-time flights	60–65 dB(A)	10–20 flights per 24-hrs at or above 60 dB(A)	Day and night flight path corridors pass over this heritage item. Aircraft will be visible. The altitude of aircraft will be 5,000–13,300 ft (MSL), depending on the flight path. Noise levels and visual impacts are expected to impact cultural values especially 'dark sky' and amateur astronomy. Impact expected to be moderate. Some aircraft may fly at a lower altitude depending on weather and operational conditions.	

Item name	Sensitivity issues	Noise range modelled average sound levels) L_{Amax} (dB(A))	N60 (24-hours) number of movements	Potential impacts	Image
				Further assessment of the impacts to activities at this observatory has been completed since exhibition of the Draft EIS. This found that most of the activities at the Linden Observatory should still be able to occur, potentially at a reduced capacity. Most of the impacts of the project would require a temporary pause in activities on a given night and/or adaptation to activities conducted at the site. The light emitted by passing aircraft is short-term with the sky reverting to being dark once the aircraft passes. The entire sky would not be impacted. The project is not anticipated to result in the loss of the State Heritage listing for this item or significantly diminish the significant values for which the site is recognised.	
Wynstay Estate 1875 68–78 The Ave Mt Wilson SHR 1520	Significant buildings; combination of materials brick, sandstone, corrugated iron	Under 60 dB(A)	No movements at or above 60 dB(A)	Aircraft will be less than 2 km away to the southwest and flying at more than 10,000 ft (MSL). Noise and visual impact – low	 [Image Heritage NSW]

Item name	Sensitivity issues	Noise range modelled average sound levels) L_{Amax} (dB(A))	N60 (24-hours) number of movements	Potential impacts	Image
Kirkham Stables and Precinct c1816 130 Kirkham Ln, Kirkham New South Wales 2570 (Camden) SHR 1411	Building complex Masonry, iron roof, rough cast cement on stone foundations Effects of emissions on building fabric and treatments	Under 60 dB(A)	No movements at or above 60 dB(A)	Flight path avoids direct over flight but will be distantly visible less than 5 km away to the north. The altitude of aircraft will be greater than 10,000 ft (MSL). Likely impact negligible	 [Image Heritage NSW]
Thompson Square Windsor SHR 126	Cumulative impacts after major impact of TfNSW – Windsor Bridge	Under 60 dB(A)	No movements at or above 60 dB(A)	Thompson Square will be directly overflown. The expected altitude of aircraft will be greater than 10,000 ft (MSL). Proposal impact alone is likely to be minor but cumulative impact on liveability of historic homes may be significant given other recent impacts.	

Item name	Sensitivity issues	Noise range modelled average sound levels) L_{Amax} (dB(A))	N60 (24-hours) number of movements	Potential impacts	Image
The Carrington, Katoomba SHR 00280	Building fabric - unknown impacts of emissions on building fabrics Noise sensitivity for patron/guests	50–55 dB(A)	No movements at or above 60 dB(A)	Katoomba Township will be avoided as a residential area. Flight path avoids direct over flight but will be distantly visible less than 5 km away to east and north. The altitude of aircraft will be greater than 10,0000 ft (MSL). Impact negligible to low.	 [Image: NSW Gov photo G Hicks 1984]
Hobartville, Richmond SHR 00035	Complex of buildings from early colonial period. Sandstock brick mansion, slate roof, stone elements	Under 60 dB(A)	No movements at or above 60 dB(A)	Example for Richmond township Due to restrictions posed by RAAF Base Richmond, the township will be overflown as main north–south flight path. Flight paths run above the RAAF flight paths. The property will be directly overflown. Aircraft are expected to be at an altitude of greater than 10,000 ft (MSL) Noise and visual impacts expected to be minor. Cumulative impact of emissions on building fabric undetermined.	

Item name	Sensitivity issues	Noise range modelled average sound levels) L_{Amax} (dB(A))	N60 (24-hours) number of movements	Potential impacts	Image
Camden Park Estate/Belgenny Farm SHR 01697	Cultural landscape/ cultural complex – any features. Camden Park house – stuccoed sandstock brick, local cut stone detail, sandstone Effects of emissions on building fabric and treatments Noise visual	Under 60 dB(A)	No movements at or above 60 dB(A)	Will not be overflown. Flight path avoids direct over flight but will be distantly visible less than 5 km. The altitude of aircraft will be greater than 10,000 ft (MSL) Low impact	

5.6.2 In relation to Aboriginal sites

One of the most common concerns raised by Aboriginal stakeholders consulted was the impact of the noise of aircraft on their spiritual connection with the landscape and/or the disruption that aircraft noise would have on their continuing cultural practices. For instance, if they were running a camp for young people to connect with country at Shaws Creek AP, Yellomundee, having loud aircraft noise passing over would disrupt the connection between people and country and impair their ability to transmit culture to the younger generations.

To identify those places most likely to be impacted in any of the above ways, the sites nominated by stakeholders and those identified as being of a type that have potential cultural value (i.e., rock art, stone arrangements, burials and massacre sites, ceremonial sites, and spiritual mythological sites) were reviewed and mapped in relation to the preliminary flight paths. The distance from WSI and likely height above ground (the later as a range) was noted (see Appendix B for a list of such places).

In order to determine those places where noise and visual intrusion might impact cultural practices and/or current usage the discussions with the knowledge holders were reviewed. Six places particularly stand out as places where noise and visual intrusions should be minimised to avoid detrimental impact to the significant cultural values. Of the 6 places noted below, the last 2 are assessed as likely to suffer no or negligible adverse impacts from the current proposal:

- The Three Sisters rock formation
- Bents Basin in Bents Basin Conservation area (see Figure 5.16)
- Yellomundee including Shaws Creek rock shelters and the camping area (see Figure 5.15)
- Emu engraving sites at Faulconbridge, including Ticehurst Park – particularly at night, March–May when the constellation is most visible
- Thirlmere Lakes – there is some evidence that the lakes are home to a dangerous creature (Brodie ND in DPE 2022:5), possibly the Gurugaty also at Bents Basin. Thirlmere Lakes will not be negatively impacted by the preliminary flight paths
- The Mermaid Pools – women's site is located on the boundary of the study area and will not be impacted by the current proposal (see Figure 7.1).

Table 5.4 lists the modelled average sound levels expected at these locations or the nearest location referred to in Technical paper 1. Where quantitative data was not available some estimates of impact have been given based on expected height of aircraft in the vicinity of the heritage item.

The 2 places that stand out as subject to severe negative impacts are Yellomundee which includes the Shaws Creek AP and Bents Basin State Recreation Area. While Yellomundee is currently overflown by aircraft departing Sydney (Kingsford Smith) Airport those aircraft are almost all non-jet aircraft at approximately 10,000 ft. The current proposal from WSI will significantly increase the number of daytime flights over this area.

At Bents Basin (refer Table 5.4) the height of departing and arriving flights is much lower than any current flight passing over this area. Due to the proximity to WSI aircraft will be either accelerating (departure) or decelerating (arrivals) increasing the noise impacts. The frequency of expected flights is also an issue. The impact on Aboriginal cultural values will be severe.

Bents Basin or 'Gulguer' is particularly important to Dharug, Gundungurra and Tharawal First Nations women and is currently used a safe place for family gatherings and passing on cultural knowledge to their daughters. The actual basin or scour pool is considered a sacred place and is home to a dangerous being called variously Gurungadge, Gurangatch or Gurungaty (Section 4.2.2).

There are many Aboriginal sites that are located along Linden Ridge. The expected frequency of flights varies between the various flight paths however most flights are expected during the day i.e. an average of 18 departures up to a maximum of 36 during the day - evening period when Runway 23 is used (in 2033). The maximum noise level would be around 60–65 dB(A), with around 10–19 movements at or above 60 dB(A) by 2055 (over a 24 hour period). The visual and noise disruption at these sites would be moderate, increasing to severe as the frequency overflight increases over time.

Table 5.4 Estimated noise and visual instrusion at a selection of First Nation sites of high cultural value[16]

Heritage item	Noise range L_{Amax} (dB(A))	Visual intrusion	N60 (24-hours) – number of movements in 2055	Comment
The Three Sisters	50–55 dB(A)	Aircraft would be visible in the distance less than 5 km away. They would be at an approximate height greater than 10,000 ft (3 km) (above runway).	No movements at or above 60 dB(A)	While the expected noise levels are low, given the sweeping views from the lookout the visual impact is likely to be more noticeable than for other parts of the Blue Mountains. First Nations participants were concerned about any increase in noise or visual intrusion. Impact on cultural values is expected to be low to moderate given expected altitude and noise projections.
Bents Basin	80–85 dB(A)	The area would be directly overflown. Aircraft would be relatively low. Aircraft arriving into WSI Runway 05 during the day – evening period and overnight will be descending between 2,500 ft (760 m) and 750 ft (230 m). Aircraft departing from WSI Runway 23 during the day-evening period and overnight will be climbing between 2,500 ft (760 m) and 5,000 ft (1.5 km). Some aircraft may fly at a lower altitude depending on weather and operational conditions.	>200 movements above 60 dB(A)	The impact on values is expected to be extremely high. The frequency of flights during peak hours (6–8 am and 4–6 pm) is expected to be every 3 minutes. Impact on cultural values is severe.

[16] The estimated noise and visual intrusion assessment does not account for off-procedure manoeuvring areas. Sites within a departure or arrival transition area may sometimes be overflown as runway modes of operation change.

Heritage item	Noise range L_{Amax} (dB(A))	Visual intrusion	N60 (24-hours) – number of movements in 2055	Comment
Shaws Creek Aboriginal Place, Yellomundee Regional Park	60–65 dB(A)	The place will be directly overflown when Runway 05 is in use. Aircraft would be frequent and visible (approx. 8,000 ft (2.4 km) to 10,500 ft (3.2 km) (above runway) and climbing). Overnight aircraft into WSI on Runway 23 will be descending between 8,000 ft (2.4 km) and 5,000 ft (1.5 km) above runway level at this location. Some aircraft may fly at a lower altitude depending on weather and operational conditions.	10–20 movements above 60 dB(A)	The main north south flight paths overfly Yellomundee. It is expected that only 1–2 overnight flights into Runway 23 would occur. Departing from Runway 05 an average of 23, up to a maximum of 55, departures could overfly this location during the day – evening period. The impact on cultural values is expected to be severe.
Emu Engraving Ticehurst Park AHIMS 45-5-0015	60–65 dB(A)	This site would be directly overflown when Runway 23 is in use (day and night) and when Runway 05 is in use (night). Aircraft would be visible (between 8,000 ft (2.4 km) and 13,300 ft (4 km) above the runway level). The frequency of overflight would be higher during the day (an average of 18 departures up to a maximum of 36 departures in 2033, increasing over time) than during the night (11 pm – 5:30 am) (an average of 3 aircraft, up to a maximum of 8 aircraft in 2033, depending on the runway in use and increasing over time).	<10 movements at or above 60 dB(A) over a 24 hour period. However, 10–19 movements at above 60 dB(A) would occur during the day (N60 (Day)), and 2–4 movements at or above 60 dB(A) at night (N60 (Night)).	Noise is likely to be a minor issue, however the link to the Emu in the Sky constellation is strongest in March–May, and likely to be impacted by night-time flights during this time. Expected impact is moderate.

Heritage item	Noise range L_{Amax} (dB(A))	Visual intrusion	N60 (24-hours) – number of movements in 2055	Comment
Emu Engraving Faulconbridge (AHIMS 45-5-4910)	~42 dB(A)	The site would not be directly overflown, with the closest flight paths being approximately one km to 2 km away. Aircraft would be visible. Altitude of aircraft at 8,000 ft AMSL or higher.	No movements above 60 dB(A)	Noise is likely to be a minor issue, however the link to the Emu in the Sky constellation is strongest March–May; likely to be impacted by night-time flights during this time. Impact – low.
The Mermaid Pools	Under 60 dB(A)	Aircraft would be less than 5 km away but flying at greater than 10,000 ft (3 km) (AMSL).	No movements at or above 60 dB(A)	Aircraft may be visible but noise would be relatively low. The expected impact on cultural values is negligible to low.
Red Hands Cave Aboriginal Place	60–65 dB(A)	At night, a flight path for Runway 05 RRO would directly fly above this location. In 2033, there would be an average of 4 arrivals up to a maximum of 8 during the overnight period, increasing over time. Aircraft would be at 10,500 ft (3.2 km) to 13,300 ft (4 km) above runway level. During the day (5:30 am – 11 pm), flight paths would not fly directly over this site. The nearest flight path (Runway 23 departure) is around one km away, and aircraft would be visible.	<10 movements at or above 60 dB(A)	The park gates are closed during the evening and therefore the expected impact from noise and visibility is low to moderate. The long-term impact of emissions on pigment and engraved art is currently unable to be estimated.

Heritage item	Noise range L_{Amax} (dB(A))	Visual intrusion	N60 (24-hours) – number of movements in 2055	Comment
Euroka Clearing	~42 dB(A)	The site would be directly overflown with aircraft at an expected height ranging from 8,000 (2.4 km) to 13,300 ft (4 km) above runway level. In 2033, an average of 24 arrivals up to a maximum of 51 arrivals when Runway 23 Arrival West (Day) flight path is in use during the day-evening period, increasing over time. At night when Runway 05 Arrival North Night (RRO) is in use, an average of 4 flights and up to 8 arrivals could overfly this location in 2033, increasing over time.	No movements at or above 60 dB(A)	Even though noise levels are not expected to be high, overflight is expected to be relatively frequent and impact to the current First Nations cultural use of the site which includes mourning and smoking ceremonies is likely to be noticeable. Impact to cultural values is expected to be low to moderate.
Linden Ridge sites	60–65 dB(A)	Linden Ridge is overflown by Runway 23 Departure North Day, Runway 05 Arrival North Night, Runway 23 Departure North Night, Runway 05 Arrival (RNP) North Night and Runway 23 Departure North RRO Night. Aircraft on flight paths during the day would be at an altitude between 10,500 (3.2 km) and 13,300 ft (4 km) above runway. At night, aircraft would be at an altitude of 5,000 ft (1.5 km) to 13,300 ft (4 km).	Various according to the location of the site and the runway mode of operation. In 2055, this area ranges from <10 movements at or above 60 dB(A) during the No preference scenario, and up to 20–49 movements at or above 60 dB(A) during the Prefer Runway 23.	There are many Aboriginal sites that are located along the Linden Ridge walking trail. The expected frequency of flights varies between the various flight paths however most flights are expected during the day. Given that the sites are located along an elevated ridgeline, the visual and noise disruption at these sites is likely to be significant and with the impact increasing by 2055. There are multiple rock shelters with pigment art e.g. AHIMS #45-4-0220, and AHIMS #45-4-0244; and ridge top engravings sites e.g. AHIMS #45-5-0008, and AHIMS #45-5-2272; stone arrangements e.g. AHIMS #45-4-0222, AHIMS #45-4-0223 as well as other site types including artefact scatters and axe grinding grove sites. Impact is expected to be moderate increasing to severe by 2055. The long-term impact of emissions on pigment and engraved art is currently unable to be estimated.

Heritage item	Noise range L_{Amax} (dB(A))	Visual intrusion	N60 (24-hours) – number of movements in 2055	Comment
		In 2033, an average of 18 departures up to a maximum of 36 departures when Runway 23 Departure North Day is in use during the day-evening period, increasing over time. At night, depending on the runway mode of operation, an average of 3–4 aircraft would fly above the sites, up to a maximum of 8 aircraft in 2033, increasing, increasing over time Aircraft would be visible.		
Emu Cave Aboriginal Place AHIMS #45-4-0018	60 dB(A)	The Aboriginal Place is directly overflown by aircraft on the following flight paths: Runway 05 Departure North Day, Runway 23 Departure North Day, Runway 23 Departure North Night. Aircraft would be visible but relatively high climbing between 13,300 ft (4 km) and 17,500 ft (5.3 km) above runway.	<10 movements at or above 60 dB(A)	This site is a deep rockshelter, with the engravings inside on the cave walls. There is no direct visual connection between the engraved emu tracks and the sky as is the case with the emu engraving. The site is of spiritual significance – and given the frequency of flights the impact is expected to be low to moderate.
Kings Tableland Aboriginal Place	~42 dB(A)	Aircraft would be less than 5 km away and visible from this Aboriginal Place but do not fly overhead. Aircraft would be at an altitude of greater than 10,500 ft (3.2 km) above runway.	No movements at or above 60 dB(A)	Impact is expected to be negligible to low.

Heritage item	Noise range L_{Amax} (dB(A))	Visual intrusion	N60 (24-hours) – number of movements in 2055	Comment
Mt Yengo sacred site	Negligible ~42 dB(A)	The nearest flight path (Runway 23 Arrival North Day) is 2.8 km away and aircraft will be high descending between 20,000 ft (6 km) and 17,500 ft (5.3 km) above runway.	No movements at or above 60 dB(A)	Aircraft may be visible but at high altitude, and noise will be negligible ~42 decibels. First Nations knowledge holders expressed concern over disruption of spiritual values if overflown – however the Aboriginal Place/sacred site is not overflown. There is expected to be no impact.
Thirlmere Lakes	~42 dB(A)	The lakes are not directly over flown. The closest flight path to the lakes is 3.1 km away. Aircraft departing Runway 23 during the day – evening will also fly over this area at an altitude of between 13,300 ft (4 km) and 17,500 ft (5.3 km).	No movements at or above 60 dB(A)	The closest flight paths are Runway 23 Departure south (Hot) Day, and Runway 23 Departure south day. Aircraft may be visible but at a high altitude. Impact is expected to be no impact to cultural values.

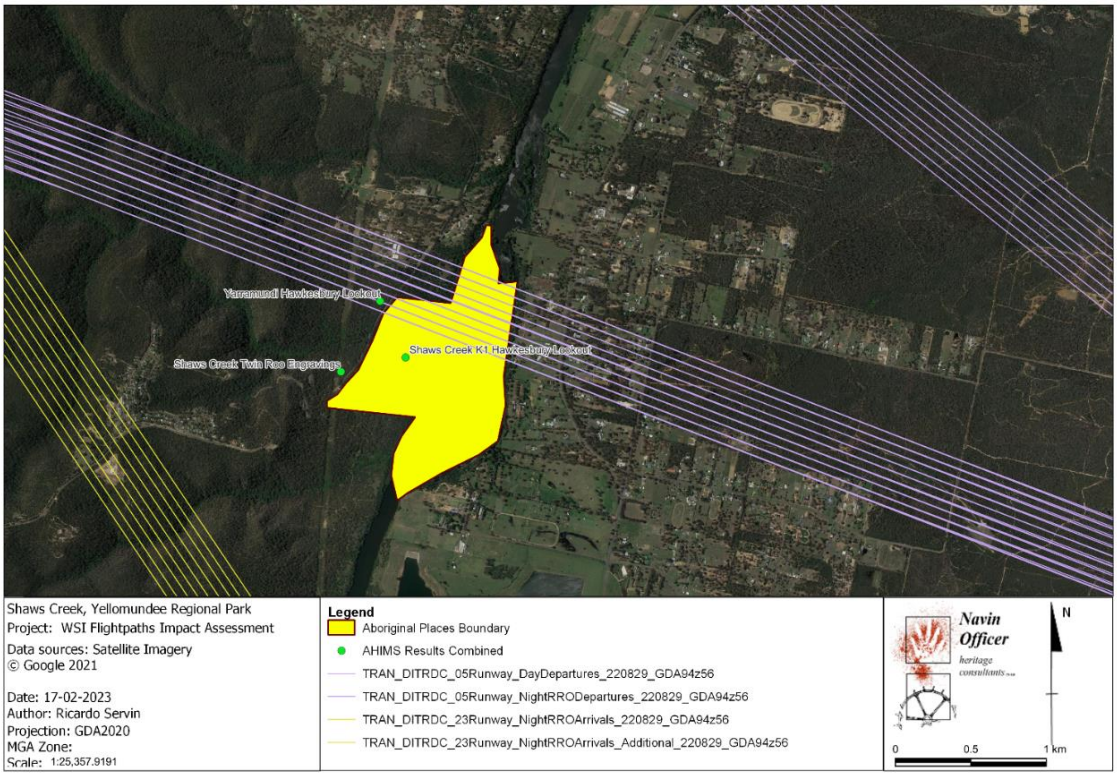

Figure 5.15 Shaws Creek Aboriginal Place, in Yellomundee Regional Park crossed by preliminary flight paths; this was a particular concern of the Dharug women interviewed

Figure 5.16 Bents Basin State Conservation Area in relation to the preliminary flight paths

Bents Basin is an important cultural place that lies under the preliminary flight paths (Figure 5.16) and by 2055 it is expected that more than 200 flights throughout the day and night will pass over it. The noise is expected to be 80–85 dBA. The aircraft will be low at around 2,500–3,500 ft MSL and noise of aircraft, particularly departing aircraft, is expected to be significant. The frequency of aircraft will give little respite, with an estimated aircraft every 3 minutes during morning and evening peak hours. The impact to the cultural values of this spiritual place will be severe and it seems unlikely that the impact can be reasonably mitigated given other flight path design parameters. The current flight path is incompatible with respecting the cultural values of the place.

All gazetted APs within the airspace study area are places of high cultural value. Specifically, those in that part of the Blue Mountains that fall within the airspace study area should be avoided by flight paths:

- Shaws Creek, Yellomundee
- Upper Kedumba Valley
- Kings Tableland
- The Three Sisters
- Emu Cave
- Euroka Clearing Nye Gnorang
- Red Hands Cave.

In most cases the flight path design has sought to avoid impacts on APs however further adjustments should be considered to reduce the impacts on Emu Cave AP, Euroka Clearing Nye Gnorang and at Shaws Creek in Yellomundee.

Flight paths have been designed to avoid flying over the following additional sites of high cultural values:

- Emu engraving site (AHIMS 45-5-4910), Faulconbridge, especially in March–May when the connection between this site and the constellation known as the ‘Emu in the Sky’ is strongest.

While the recommendation is that flight paths should be designed so that they do not fly over the following places of high cultural value; if approval is given to flight paths that pass close to them then these sites (not exclusively but as a minimum) should be included in a long-term monitoring program aimed at understanding the impacts of aviation related air pollution on rock art sites (see Recommended Mitigation Measures):

- Red Hands Cave
- Linden Ridge (multiple sites)
- Art sites at Bents Basin.

There was a strong call from the First Nations knowledge holders that participated in the project that the Commonwealth promote the efforts to avoid and mitigate impact on Aboriginal heritage. Even if all sites could not be avoided, they considered it important to acknowledge both their concerns and the efforts undertaken to consider cultural heritage values in the design of the flight paths.

5.7 Disruption of land–sky connection

Some Aboriginal sites are connected to the Dreaming and have a spiritual value that extends beyond their physical fabric. Perhaps this is most clearly reflected in sites that are connected to stories that link places on the land with the stories about the constellations. One such place raised by the stakeholders who provided cultural information for this project is the Emu engraving at Faulconbridge. This engraving is reported by knowledge holders to be related to the Emu in the Sky.

The astronomical sites associated with Aboriginal cosmology have received renewed research attention in the past 15 years with a resurgence in the field of cultural astronomy since the International Year of Astronomy in 2009 (Bhathal 2010; Bhathal and Mason 2011; Fuller et al. 2014a, 2014b). They have always been of high importance to First Nations people as part of their complex cosmology and knowledge system. The Dreaming is not simply in the past; rather it continues to guide, influence and impact the day-to-day lives of First Nations people.

Stories about the Emu and the corresponding constellation are held by several First Nations peoples across Australia. The sites on the ground associated with these stories include engravings, stone arrangements and rock painting sites that are often associated with ceremony, initiation and the seasonal abundance of Emu eggs or the life cycle of the bird. The earliest known references by European observers to the Emu in the Sky story come from diverse geographic locations in the late 19th Century from across Victoria, NSW, Qld and South Australia (Stanbridge 1857; Ridley 1873; Palmer 1885 and Bates 1904; Smyth 1972 [1876]). The Emu is seen in the Coalsack nebula, dark spaces of the Milky Way under the Southern Cross (Stanbridge 1857; Basedow 1925; Bhathal and Mason 2011; Norris and Norris 2009; Raven et al. 2021). The head and neck of the Emu can be seen in the sky as early as March, it reaches its first appearance in full length after sunset in April and May, when it is seen stretching from the south to the southeast. The description below comes from northern NSW but is generally known by different Aboriginal groups throughout NSW, although ceremonies at associated with these sites vary:

> **At this time, the Kamilaroi and Euahlayi say the Emu has legs, and appears to be running. This reflects the behaviour of female emus, who chase the males during the mating season. Because emus are laying their eggs at this time, the appearance of the celestial Emu is a strong reminder to the Kamilaroi and Euahlayi people that eggs are available. In June and July, the appearance of the Emu changes. The legs disappear, and the Emu, which is now seen as male, is sitting on its nest, hatching the new chicks. After female emus lay the eggs, it is the males that broods the eggs. At this time, the eggs are still an available resource, and can be taken from the nest (Fuller 2014b:6).**

The emu transforms as the seasons progress, becoming smaller and less discernible as it sits closer to the horizon (Fuller et al. 2014a, 2014b; Leaman and Hamacher 2019; Leaman 2019).

5.7.1 Emu engraving (AHIMS #45-5-4910 and #45-5-0015)

Several Emu engraving sites in the greater Sydney have been recorded as associated with this story including one in Ku-ring-gai Chase NP and the two at Faulconbridge in the Blue Mountains. Knowledge holders interviewed stated that around March–May was the most important time for the connection between the emu and the sky and the engraving sites at Faulconbridge, including at Ticehurst Park (AHIMS # 45-5-0015). During March to May when the Emu in the Sky constellation is most visible, the visual intrusion is likely to have a negative cultural impact, disrupting the direct connection between the constellation and the land surface at the engraving.

The intrusion of aircraft overhead at this time would be most detrimental indirect impact to the cultural values of the site at Ticehurst Park. At this location Flight path corridors pass directly above this site when Runway 23 is in use (day and night) and when Runway 05 is in use (night). Aircraft would be visible (between 10,500 (3.2 km) and 13,300 ft (4 km) above the runway level). The predicted maximum noise levels due to aircraft overflight would be around 60 dB(A) – 65 dB(A), with less than 10 movements at or above 60 dB(A) over a 24 hour period (in 2055). There would be an average of 18 and a maximum of 36 departures during the day evening period in 2033, however, it is the nighttime visual intrusion that will have the most impact on the heritage values of the property. When Runway 05 is in use it is anticipated that there will be an average of 3 and a maximum of 8 arrivals at night and when Runway 23 is in use an average of 3 and up to 6 departures overnight (in 2033). This would increase over time. Overall, the impact on cultural values is expected be moderate.

The Emu engraving in Faulconbridge (AHIMS #45-5-4910) would not be directly overflown, but aircraft would be visible and may be heard. As such, the preliminary flight paths would have a low impact.

5.7.2 Emu Cave (AHIMS #45-4-0018) and Emu Cave Aboriginal Place

There is also a rock shelter #45-4-0018 associated with the emu story (see Section 4.1.6.1). The wall of this rock shelter is engraved with numerous emu footprints and there are axe grinding grooves on the stone surface above the cave. Early excavations were undertaken in the mid-1930s led by F.D. McCarthy of the Australian Museum (McCarthy 1948:978); and the deposit was later dated to 3650 + 100 BP (ANU 010 in McCarthy 1978:55). The Emu Cave AP was gazetted to protect associated sites. This cave is believed by contemporary knowledge holders to be an important spiritual site associated with the Emu dreaming. The rock shelter itself is close to a road cutting and local folklore says it was used by convicts and other people in the past. It has been subject to various disturbances, although the depth of the rock shelter has served to protect the emu track engravings from weathering. This factor is also likely to provide protection from any impact from emissions.

Three preliminary flight paths pass over this site. Due to its accessible location the cave is relatively well-known and highly visited.

Chapter 6 Cumulative impacts

Cumulative impacts are a result of incremental, sustained and combined effects of human action and natural variations over time and can be both positive and negative. They can be caused by the compounding effects of a single project or multiple projects in an area, and by the accumulation of effects from past, current and future activities as they arise (DPE 2023).

Despite a number of significant heritage sites existing for many years under the Sydney (Kingsford Smith) Airport flight paths there has been no specific consideration of the physical impacts of emissions on heritage items. Undertaking a study to consider this issue near Sydney (Kingsford Smith) Airport would be complex given the other contributors to airborne pollution nearby and the lack of a pre Sydney (Kingsford Smith) Airport baseline. The WSI provides an opportunity to investigate the impacts of aircraft emissions, if any, and thereby develop effective mitigation strategies.

Given the size of the study area and operational timeframes of the project, other relevant projects or developments considered likely to contribute to cumulative impacts have been restricted to those of sufficient scale to contribute materially to cumulative impacts at a regional level with similar or overlapping spatial or temporal characteristics. A list of major projects and strategic developments considered for cumulative impacts is provided in the EIS.

Potential cumulative impacts related to Aboriginal and historic heritage places and values would result from the project operating in the study area in conjunction with other major developments and existing airports in the study area. Potential cumulative impacts include:

- increased impact to Aboriginal and non-Aboriginal cultural places and values
- cumulative impacts of new emissions and climate change on heritage gardens
- cumulative impacts to cultural values due to additional noise and visual intrusion
- further disruption to land–sky connection.

6.1 Increased impact to Aboriginal and non-Aboriginal cultural places and values

Given the range of current and proposed developments in western Sydney it is difficult to calculate cumulative impacts with any degree of accuracy. This is exacerbated in the case of Aboriginal sites because for some decades Heritage NSW has not maintained an accurate record of destroyed sites as area-wide Aboriginal Heritage Impact Permits are granted for development that cover the destruction of known and unknown sites within the area. It may be assumed that despite the large number of sites within the airspace study area, many of these have been destroyed since they were recorded. This means that it is important to take a precautionary approach to approving impacts to Aboriginal heritage rather than basing assessment on the perceived commonness of site type.

6.1.1 Cumulative impacts of new emissions to Aboriginal rock art sites

The cumulative impacts of WSI related air pollution across WSI airspace are best understood as a contributing factor to the totality of air pollution present across the Sydney airshed.

- The air emissions inventory for the Greater Metropolitan Region in NSW (EPA 2012) showed that emissions from existing airport operations in Sydney in 2008 were less than 3% of total emissions for the region.
- In 2019, off-road transport, including ships and aircraft were estimated to contribute 10% of the total human made PM2.5 emissions across Sydney (TfNSW 2019).
- Motor vehicles, by comparison were found to contribute 13% of PM2.5 and 55% of Nitrogen oxides. Other major contributors include wood heaters (50% of PM2.5) and industry (18% of PM2.5 and 13% of oxides of Nitrogen) (TfNSW 2019).
- The 2016 EIS assessment for WSI found that, during operation, Stage One airport emissions would represent an increase of 0.1% to 0.7% of predicted total emissions in the Sydney Airshed in 2030 (DITRDC 2016).

Despite the low estimates of the proportional contribution of WSI airspace emissions to the totality of air pollution within the Sydney Airshed, there remains the possibility that the cumulative impact of locally increased emission levels, such as for particulate matter, or the precursors of acid rain, in the proximity of flight paths with lower altitude aircraft, will have an impact on nearby rock art sites over time.

There is currently no comparative data or research to test this possibility. It is not known, for example, if airborne pollutants from lower-altitude aircraft could raise rock-surface acidity levels at nearby or over-flown rock art sites beyond the natural acidity expected from the surrounding groundwater, soil and bedrock chemistry. Distinguishing local area aircraft from other more generalised airshed sources of pollutants is also an issue in this context. Similarly, natural processes of surface mineralisation and case-hardening across natural rock surfaces may also offer some protection against raised acidity.

The deposition of airborne particulate matter onto rock art panels appears a more clearly defined contender for a significant cumulative impact over time. Any increase in airborne dust content, whether above or below acceptable thresholds determined by human health risks, provides an opportunity for increased deposition of dust onto rock art panels. This will gradually impact their visibility and long-term conservation. It can be expected that all rock shelter sites within and around the Greater Sydney Metropolitan Region will be impacted by accumulated deposits of dust from the aerosol particulate matter of the Sydney airshed. It would be expected that within this general fall-out, and subject to local climatic conditions, heavier particulate matter may settle closer to its source than lighter fractions. A consequence of this expectation is that rock shelters under or close to flight paths used by low-altitude aircraft (such as during descent/arrival and ascent/departure), may experience greater dust fall-out, and therefore cumulative impacts.

In order to evaluate the role which WSI airspace emissions may have in cumulative impacts on rock art, a research program is required to both collect baseline and monitoring data in comparative locations, and to investigate possible processes of deterioration related to air pollution.

This research can be used to identify any significant impacts and to draft appropriate management strategies. In the case of impact from dust deposition, this can be partially reversed through the careful and controlled removal of dust from effected surfaces panels using dry brushing techniques (NOHC 2020).

6.1.2 Cumulative impacts to historic heritage fabric

As noted in the discussion in Section 5.5, while it is known that air pollution has a negative impact on some historical building fabric such as sandstone there has been little research into understanding the sources and contributory impact of emissions from industrial generators. It can be expected that not only will additional emissions add to the general impact on stone buildings and there is growing evidence that the deterioration will be accelerated by other anthropogenic factors such as climate change (Basu et al. 2020). Contemporary weathering is dependent on the constituents of the building materials and the past weathering history of the material, as well as on current pollution (Inkpen 2004:1).

Given the cost, on both the State and private owners, of managing our built heritage resource it is important to gain an understanding of the contributory impact of emissions on the deterioration of significant building fabric.

6.2 Cumulative impacts of new emissions and climate change on heritage gardens

While we know that the climate of Sydney and the Blue Mountains is already changing (see Office of Environment and Heritage and Adapt NSW, 2014) it is not currently possible to provide any quantifiable assessment of the likely cumulative impact of any emission related to the preliminary WSI flight paths in addition to the existing and emerging climate change impacts on heritage gardens (see for example Figure 6.1 and Figure 6.2) because no baseline data exists regarding the current climate change impacts (see Department of Planning and Environment NSW 2023: Case study Everglades historic garden). Little research has been undertaken regarding climate change impacts on the heritage gardens of the Blue Mountains area despite the focus on gardens as part of Blue Mountains tourism. Several of the SHR listed sites include significant gardens e.g., Everglades and Lilianfels. Heritage gardens in the Blue Mountains are particularly vulnerable to the impacts of climate change such as a warming environment (Bramwell 2007). The Blue Mountains region is predicted to experience fewer cold nights and frosty mornings and increased autumn rainfall. Daytime temperatures in the region will become increasingly warmer. Wet and dry spells are likely to be longer and more severe (Office of Environment and Heritage and Adapt NSW 2014). These changes will not only increase risks associated with bushfires but are likely to also lead to plant disease and mildew and rust on leaves of exotic species like the rhododendrons, for which the gardens of the area are famous. The introduction of new or increased airborne pollutants will have an unknown impact on the ability of these gardens to cope and adapt to environmental changes.

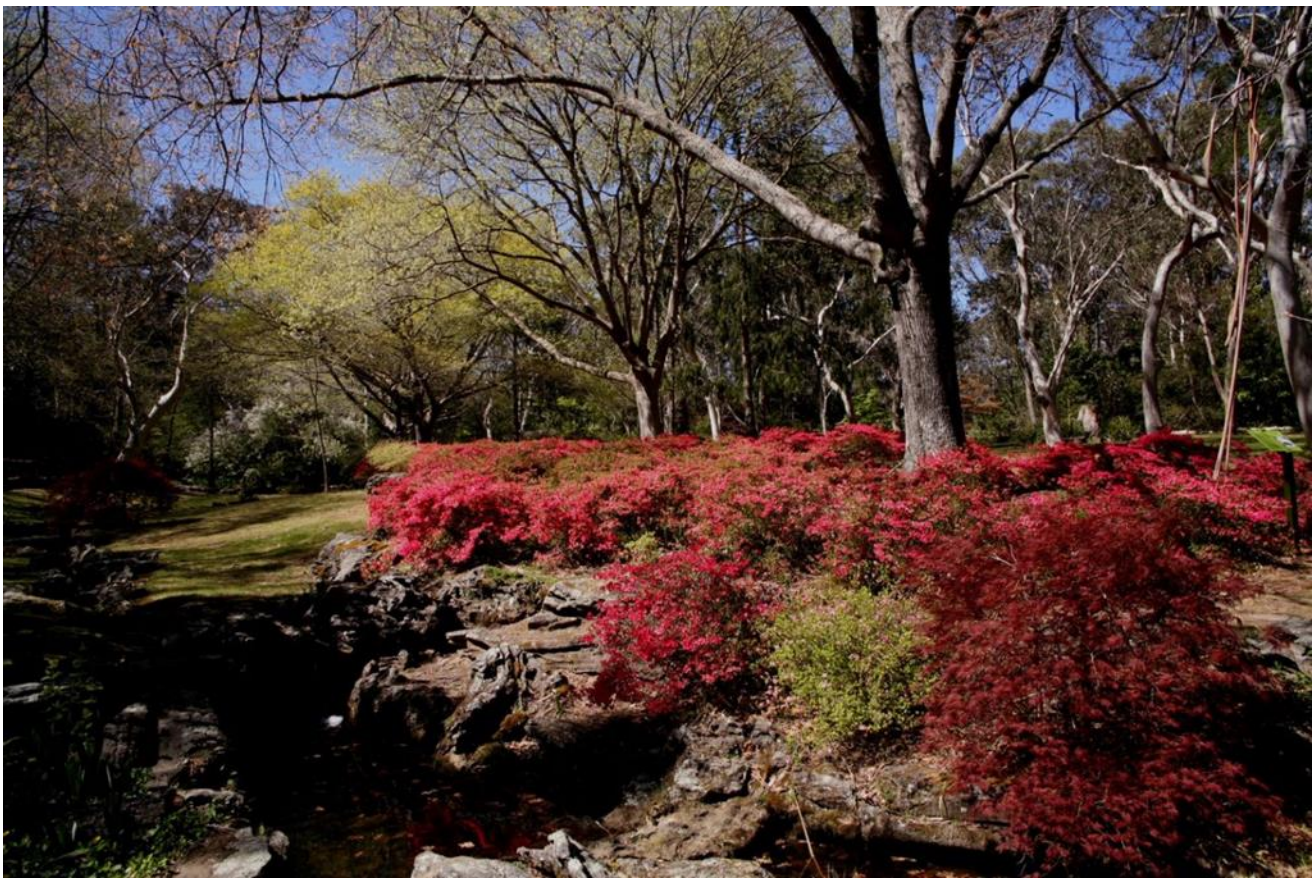

Figure 6.1 Everglades National Trust Garden, Leura NSW (Image: Christine Osborne)

Figure 6.2 Lilianfels is another property with significant heritage gardens

6.3 Cumulative impact to cultural values due to additional noise and visual intrusion

During the discussions with First Nations Knowledge holders, it was clear that community accessibility of sites and places played a large part in the selection of the cultural places people were most concerned about. First Nations people carry out contemporary gatherings, ceremonies and transgenerational training at places that are historically important to them, provide the suitable mental and physical landscape conditions i.e., connection to nature, sense of remoteness from urban life and tranquillity; and which are accessible to them. For this reason, should the visual noise and frequency of aircraft render treasured places unsuitable for cultural practice then this will further restrict First Nations people from accessing country and revitalising their heritage. As accessible places become rarer, the cumulative impact caused by the loss of such places becomes severe. This is a concern in the case of Shaws Creek AP in Yellomundee Regional Park and Bents Basin where predicted impacts particularly from noise and frequency of flights poses a real risk that these places will no longer be suitable for the cultural practices for which they are currently used.

In relation to historic heritage items again human tolerance for episodic noise and/or visual intrusion is variable. The acoustical environment of national park cultural and historic sites is an important part of the setting and helps create meaningful connections for park visitors. In some places where there has previously been little noise such as those heritage items set in tranquil bushland or rural settings even less frequent intrusions may be less tolerable than in places already experiencing anthropogenic noise pollution. In particular, noise may be a factor that could affect the sustainable

use of an historic place if that use was predicted on a tranquil setting e.g., such as well-being retreat or guesthouse. While there has been some research on heritage soundscapes and the impact of noise on tourist experiences these have tended to focus on either maintaining soundscapes associated with heritage items (Bartalucci and Luzzi 2020;Ednie et al 2022), tourist experience in environments that are already noisy (see for example Oquendo and Santos 2020; Merchan et al., 2014) or the issue of sustainable tourism and the impact of tourism including noise on host communities at heritage places (see for example Latip et al 2020; Sheng and Tang 2015).

While there is research on the impacts of intrusive noise on visitor experience to national parks and protected areas (Miller et al 2018; Manning et. Al 2006; Benfield et al 2010) there is little research available regarding the tipping point, or guest tolerance for cumulative changes in noise at such places and such impacts may only become apparent after some time has elapsed from the addition of the new noise source.

6.4 Further disruption to land–sky connection

The preliminary new flight paths will be visible from several spiritual sites. For example, while flights at high altitude can already been seen crossing the vista of the Three Sisters in their dramatic cultural landscape, adding more visual intrusions will over time continue to erode this iconic scene and produce a disconnect between the spiritual values and the landscape. If aircraft must fly here, then it will be important to ensure that they are at a sufficient altitude to reduce the visual intrusion.

As noted in Section 4.2.2 and Section 5.7 there is one significant story from within the airspace study area that involves a direct spiritual link between the land surface and the sky and this is the story of the emu. The Emu is seen in the Coalsack nebula, dark spaces of the Milky Way under the Southern Cross (Stanbridge 1857; Basedow 1925; Bhathal and Mason 2011; Norris and Norris 2009; Raven et al. 2021). The head and neck of the Emu can be seen in the sky as early as March, it reaches its first appearance in full length after sunset in April and May, when it is seen stretching from the south to the southeast. Progressive light pollution of the night sky reduces the visibility of the Emu. The preliminary flight paths do not fly directly over the Emu engraving at Faulconbridge (AHIMS #45-5-4910) but would fly above the site at Ticehurst Park (AHIMS #45-5-0015) that is said to be directly connected to the astronomical feature which are likely to disrupt the visual connection.

Chapter 7 Management and mitigation measures

The design of the flight paths has been an iterative process with consideration being given to significant cultural places and the values which might be impacted by aircraft flying overhead. Further consideration has been given to avoid and minimise impacts on Aboriginal cultural heritage and historic heritage sites during detailed design and operation. Mitigation measures to address the key impacts identified in the assessment are summarised in Table 7.1. Separate mitigation measures have been identified to manage risks of aircraft noise, wildlife strike and fuel jettisoning, and further detail on these measures can be found in Chapter 24 of the EIS.

7.1 Mitigating the impact of emissions on rock art

While many flight paths do pass over rock art sites, and areas of relatively high rock art site density (see Figure 5.10) this is a consequence of the incidence of rock art sites in unavoidable sandstone-based topographies.

Given the absence of both previous research and comparative data regarding safe or acceptable emission levels regarding the deterioration of rock art in the Sydney Basin, it remains prudent to at least comply with current air pollution standards (which are based on human health requirements and environmental toxicity), until a better understanding can be gained through monitoring and research. Where feasible, the generation of fine particulate matter (PM10) and airborne pollutants which generate acid rain or acidic aerosols (including SOx and NOx), should be reduced and minimised.

Based on the relative proximity, and the significance of Aboriginal rock art sites in the GBMA, the conduct of research and monitoring programs within these areas is justifiable, both in terms of sampling methodology and obligations to conserve and manage world heritage values.

Monitoring of rain acidity (and its precursors: NOx and SO_2) both prior to and following airport operation, along controlled transects and test locations relevant to rock art sites, will assist in determining if this is a significant issue for their conservation management. The inclusion of control sites and baseline conditions (such as soil and ground water chemistry) would be an important component of such a study. This research should be paired with monitoring of the surface condition and chemistry of rock art surfaces, including any change in nutrient levels and organics. In the absence of air quality standards which reference the conservation management of rock art, it remains prudent to at least comply with current State and Commonwealth air quality standards, until a better understanding can be gained through monitoring and research.

Unlike the management of acidity, which requires the control of precursor emissions, and the physical impacts of which cannot be reversed, the management of dust deposition on rock art panels includes a number of directly effective strategies, including reversal of impact. These are: testing the distribution, nature and chemistry of dust particles to determine origin; and where feasible and advantageous, the removal of dust deposits (Lambert 1994; NOHC 2016, 2020).

A program of dust monitoring, including the conduct of baseline studies, to determine dust deposition prior to and during WSI operation, could be used to analyse the potential contribution of aircraft emissions to rock art surfaces in rock shelters, and to identify where and if dust removal is feasible and constitutes a positive management intervention. This could be done along transects under selected flight paths, and within and around selected art sites. Again, inclusion of control sites and baseline studies would be an important component of such a program.

In the design and conduct of all monitoring and research programs, the integration of Aboriginal stakeholder consultation and participation is a critical and necessary factor. Actions need to be compatible with cultural values and focused with reference to traditional owner knowledge and priorities. A program of monitoring and research should investigate:

- the potential impact of acid rain and acidic aerosols derived from WSI aircraft emissions on rock art
- the potential impact of rock art surface micro-nutrients derived from WSI aircraft emissions on rock art
- the potential impact of airborne dust derived from WSI aircraft emissions on rock art surfaces.

Such a program should focus on, but not be limited to, locations and impact closest to WSI and within the GBMA and include pre WSI operational baseline and control studies. The results of such research would provide valuable information to guide future decision making in relation to flight paths. This program should commence prior to the commencement of

flights to and from WSI so that baseline data can be established. Monitoring of WSI airspace emissions and potential impacts should extend over a period of at least 5 years, and further where justifiable by research objectives.

In the eventuality of a very rare and extreme emergency involving a fuel dumping event with the potential to impact rock art sites (that is, contrary to established procedure, and over sandstone dominated topography and below 6,000 ft), the condition of any potentially effected rock art sites should be monitored and assessed for any required conservation actions.

Consultation with, and participation of, local Aboriginal stakeholders must be an integral component of the program.

7.1.1 Mitigating impact on sites of spiritual and high cultural significance

During consultation with the Aboriginal community, key places were repeatedly identified as having particular significance for spiritual values. Several of these places were also important places for intergenerational transmission of cultural knowledge and practice. These places included:

- Shaws Creek Aboriginal Park, Yellomundee Regional Park
- Red Hands Cave AP
- Emu engraving sites, Faulconbridge (AHIMS #45-5-4910, and AHIMS #45-5-0015 (located at Ticehurst Park))
- Bents Basin State Conservation Area
- Linden Ridge (multiple sites)
- The Three Sisters (Seven sisters) AP
- Upper Kedumba Valley AP
- Kings Tableland – rock art
- Emu Cave AP
- Traditional walking tracks (now roads, often connecting significant sites) in particular one described as a ceremonial circuit is articulated in Appendix C and which connects several of the places listed above (see Figure 7.2)
- Appin Massacre Site – now protected as the Appin Massacre Cultural Landscape on the SHR (just outside the airspace study area)
- Shaws Creek Rock Shelter AP
- Euroka near Glenbrook AP
- Mt Yengo (outside the airspace study area and confirmed not overflown)
- Mermaid Pools Women's site (at the boundary of the airspace study area and confirmed not directly overflown).

In line with the flight path principles (see Figure 1.8), these sites to the extent possible should be avoided and in the case of the Emu Engraving site, consideration should be given to restricting night flights between March and May at the least.

In most cases the flight path design has sought to avoid impacts on APs however further adjustments should be considered to reduce the impacts on Emu Cave AP, Euroka Clearing Nye Gnorang and at Shaws Creek in Yellomundee.

Flight paths have been designed to avoid flying over the following additional sites of high cultural values:

- Emu rock engraving site (AHIMS 45-5-4910), Faulconbridge, especially in March–May when the connection between this site and the constellation known as the 'Emu in the Sky' is strongest.

While the recommendation is that flight paths should be designed so that they do not fly over the following places of high cultural value; if approval is given to flight paths that pass close to them then these sites (not exclusively but as a minimum) should be included in a long-term monitoring program aimed at understanding the impacts of aviation related air pollution on rock art sites (see Recommended Mitigation Measures): Red Hands Cave, Linden Ridge (multiple sites), art sites at Bents Basin.

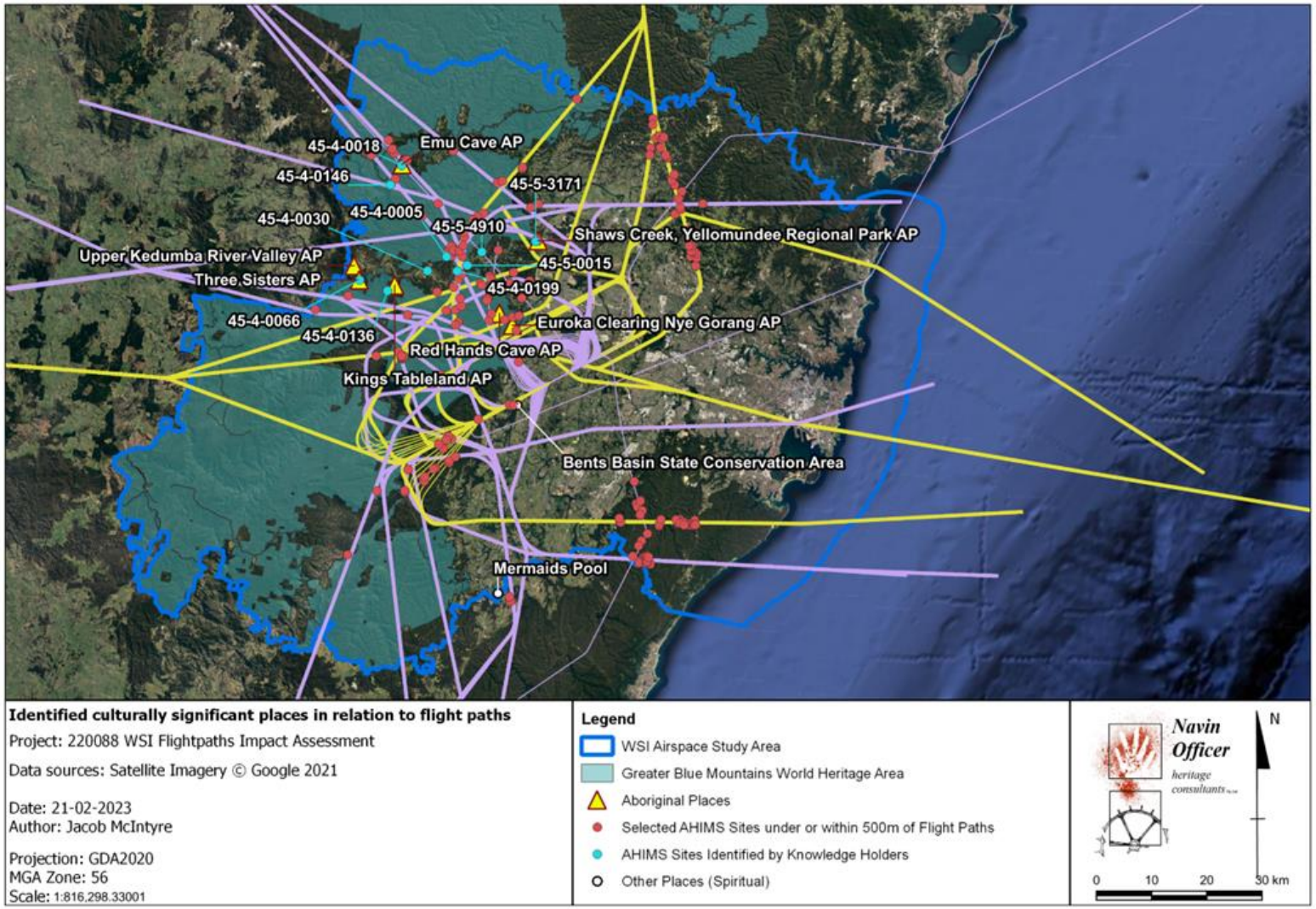

Figure 7.1 Preliminary flight paths overlying the subset of culturally significant AHIMS sites, and gazetted Aboriginal Places

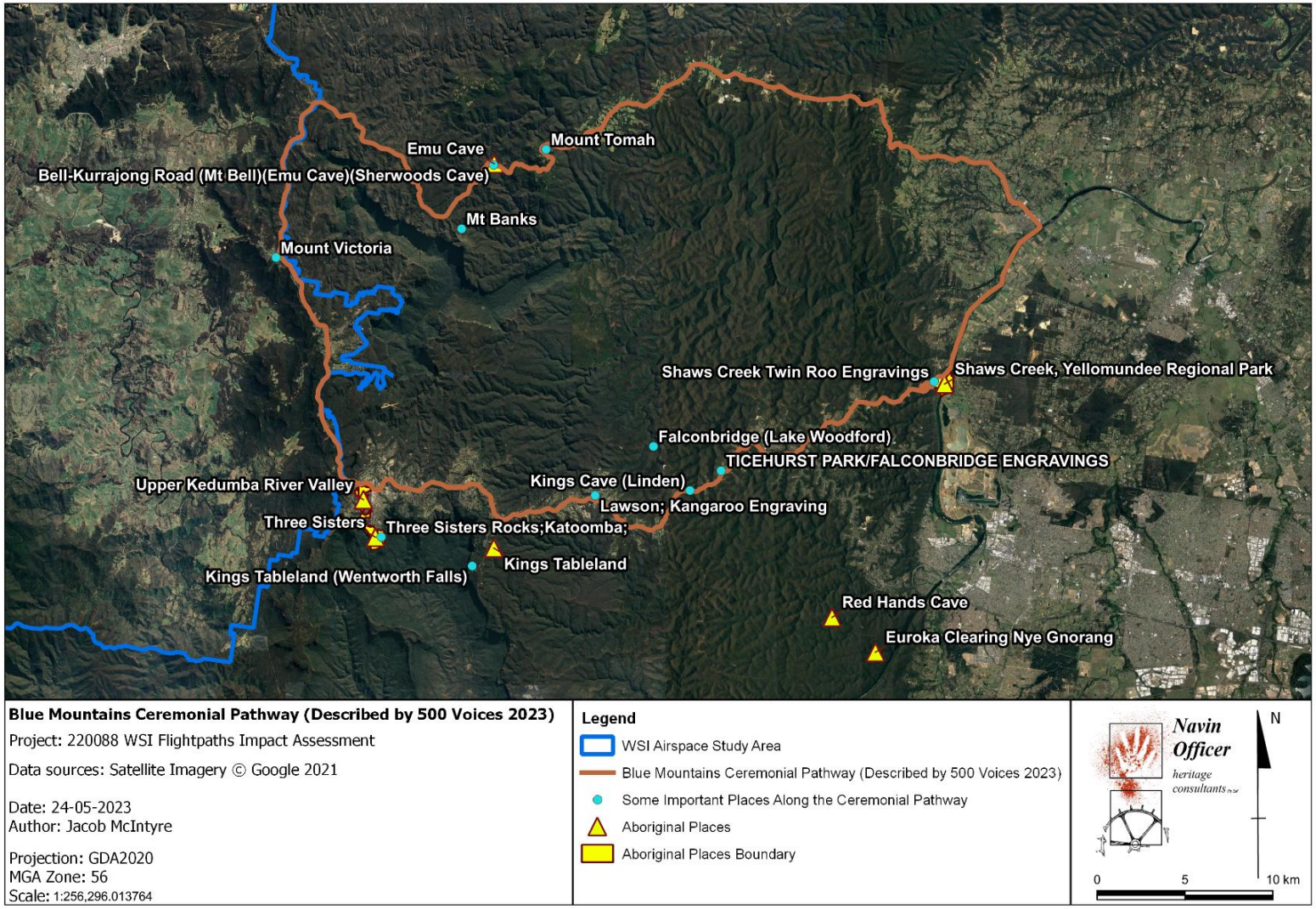

Figure 7.2 An approximation of the ceremonial pathway that follows key ridgetops (now roads) as described by Shane Smithers of 500 Voices (see Appendix C)

While all knowledge holders expressed that they felt emotionally drained and, in some cases, overwhelmed by the cumulative impacts of successive developments in western Sydney, they did see some potential benefits associated with WSI if suitable initiatives were in place. They were quick to stress that this should not be trade-off for protection of the significant places they had identified:

1. Opportunities for First Nations employment should be maximised and in particular long-term permanent employment opportunities for First Nations people at WSI.
2. Opportunities to interpret and promote the local Aboriginal culture and history should be maximised at WSI itself and through new indigenous tourism opportunities, while at the same time recognising that tourism impacts on cultural heritage places needs to be carefully managed.

7.1.2 Mitigating the impacts on the cultural values of historical sites

Despite a number of significant heritage sites existing for many years under the Sydney (Kingsford Smith) Airport flight paths there has been no specific consideration of the physical impacts of emissions on heritage items. Undertaking a study to consider this issue near Sydney (Kingsford Smith) Airport would be complex given the other contributors to airborne pollution nearby and the lack of a pre Sydney (Kingsford Smith) Airport baseline. The WSI provides an opportunity to investigate the impacts of aircraft emissions, if any, and thereby develop effective mitigation strategies.

Heritage gardens are an important element of many Blue Mountains heritage properties e.g., Lilianfels, Mt Annan Botanic Gardens. It is predicted many of these cool climate, historically significant gardens will come under increased pressure as the climate changes[17], any added pressure from additional pollutants may affect the tipping point for such heritage places. The collection of specific data over several years will allow this issue to be appropriately addressed in the Sydney Basin-wide review of flight paths planned for 2030.

There are a number of sandstone heritage properties close to WSI that could be potentially included in a monitoring program aimed at quantifying the impacts of aircraft emissions on sandstone buildings. For example, St Mark's Anglican Church Group, Winbourne, Fernhill, Maryland, St Thomas' Anglican Church, and Cemetery (see Table 5.2).

The flight paths have been designed according to the flight path design principles, the first of which states *'Overflights of residential areas and noise sensitive facilities will be avoided to the maximum extent possible*'. However, for some historic properties especially those in rural contexts where night-time noise has been low, noise may be a consideration for historic buildings that are used as residences. It should be noted that any adaptations to listed heritage properties to mitigate noise impacts may require non-standard methods that protect heritage values and are likely to require permits and approval from Heritage NSW. In particular it is recommended that the flight paths in the vicinity of Fernhill Estate are altered to avoid impact to the property

A program of monitoring and research similar to that for Aboriginal rock art sites is needed for heritage buildings. This should investigate:

- the potential impact of acid rain and acidic aerosols derived from WSI aircraft emissions on the fabric of heritage buildings, including on timber, stonework paint finishes and roofing materials
- the potential impact of micro-nutrients derived from WSI aircraft emissions on stonework, lime mortars and timber fretwork
- the potential impact of airborne dust derived from WSI aircraft emissions on heritage structure surfaces.

The program should include several sites under or close to flight paths and several control sites outside flight paths and should include pre WSI operational baseline and control studies. The study should commence as soon as possible and before the commencement of flights to and from WSI and extend over a period of at least 5 years.

A program of monitoring and research should be undertaken to quantify and understand the impact of aircraft emissions on heritage gardens in the Blue Mountains. This should also consider the cumulative impact of stress from emissions and climate change in the area.

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[17] Everglades historic garden case study | NSW Environment and Heritage

Where significant impact from WSI operation is detected, the program should make recommendations about appropriate mitigation and management strategies. The information would usefully contribute to future decision-making regarding flight paths including the next whole-of-basin flight path review scheduled for 2030.

Table 7.1 Recommended impact mitigation measures

ID No.	Issue	Suggested mitigation measures	Owner	Timing
Aboriginal Heritage				
H1	Aboriginal heritage	DITRDCA will ensure that the detailed design phase considers Aboriginal cultural places and values, noting that safety is not negotiable and that capacity, environment and efficiency factors must also be considered in the flight path design.	DITRDCA	**Pre-operation** (Detailed design, 2024–2026)
H2	Heritage	A research program will be undertaken to investigate the potential impact of aircraft emissions on historic and Aboriginal heritage sites (including rock art sites), with a particular focus on sites within the Greater Blue Mountains Area. The research program will be designed and implemented in consultation with Heritage NSW and include participation of local First Nations stakeholders.	DITRDCA/ Airservices Australia/ WSA Co	**Pre-operation** (Detailed design, 2024–2026) and **Operation** (Implementation, 2026–ongoing)
H3	Heritage consultation	WSA Co will establish a CACG for WSI which will facilitate consultation with stakeholders and community on a range of matters including heritage issues.	WSA Co	**Pre-operation** (Detailed design, 2024–2026)

Chapter 8 Conclusion

The WSI flight paths will fly over many significant sites and places, however in many cases existing flight paths already traverse the airspace above sites. In addition, many types of heritage places are considered robust in the face of any impacts such as air pollution, noise, and vibrations and/or aircraft will be at such a distance as to render the impact from these factors as minimal. Generally, the places closest to the Airport Site are likely to experience higher impacts.

However, there is little data on the impact of aviation emissions on specific heritage places and their fabric in the Sydney Basin despite the years of operation of Sydney (Kingsford Smith) Airport and flight paths that cross Sydney's historic sandstone buildings and the sandstone art sites within nearby Royal National Park. It is possible that while such impacts may be minor in the short-term, they may have an incremental impact over time and also when compounded by other emerging impacts such as those associated with climate change. Therefore, it is important to gather data to gain a better understanding that can inform future decision-making. A range of recommendations have been made to understand any long-term cumulative impacts, mitigate likely impacts and maximise the retention of cultural values and these are described in Chapter 7. Developing our understanding of long-term impacts will assist property managers and owners to adapt management of heritage places to ensure sustainability and will enable planners and regulators to more effectively assess future cumulative impacts.

The commencement of a new airport in western Sydney provides an opportunity to gather baseline data on the pollutants affecting both Aboriginal art sites and significant heritage structures in the Blue Mountains by selecting several sites to monitor over time, commencing before WSI begins operation and then for a period of time afterward. This will provide a better understanding of the impacts of such emissions on the fabric of significant sites. The sample of sites selected for monitoring should include at least Aboriginal rock engraving sites (both under and outside a flight path), an Aboriginal rock shelter with art (both under and outside a flight path), a significant historic building(s) with a variety of building fabrics, and a heritage garden.

Many historic properties are located in towns centres. The flight path design principles seek to avoid population centres and the flight paths design has sought to protect such places from major impact. It is inevitable that some properties however will suffer some impact from noise given that in many cases to the west and southwest of WSI the properties are located in rural contexts. Any noise mitigation modifications of heritage buildings may involve secondary impacts to their heritage values and individual building assessments and heritage approvals from Heritage NSW may be required prior to such adaptive works.

It is inevitable that visual impacts and noise will affect some Aboriginal sites within the Greater Blue Mountains area. While flight paths already cross the Blue Mountains, they currently do so at heights that minimise these intrusions. The new flight paths will mean that aircraft are lower than before over the western side of the airspace study area, as they approach and depart the new airport. However, many Aboriginal sites are located in protected valleys and due to the complexity of terrain height and orientation of rock shelters in the rugged sandstone country it is not possible to predict to what extent this will be an issue for many of the sites. Several measures have been proposed to mitigate the impacts identified and it is recommended that the results of the further research inform the decision making around the basin-wide flight path review scheduled for 2030.

Several sites of particular significance to Aboriginal stakeholders were identified in the course of this study. Recommendations have been made to avoid direct flight over these places so that any impacts from noise, visual intrusion and emissions are minimised.

Mt Yengo is outside the airspace study area and the mountain peak itself will not be overflown. However, it is within 2.7 km of a flight path. Aircraft will be high at an altitude of 20,000 ft descending to 17,500 ft however concerns were raised during First Nations consultation regarding the proximity of the flight paths to the many ceremonial and spiritual sites associated with Mt Yengo and it was requested that consideration be given during detailed design to moving the flight path slightly to the west as it passes Mt Yengo.

The preliminary flight paths have avoided overflying the following Aboriginal Places (APs): The Three Sisters, Red Hands Cave, Kings Tableland, the Upper Kedumba Valley, and the Emu engraving at Faulconbridge (#45-5-4910). Potential impact to the cultural values of Thirlmere Lakes and Mermaid Pool is considered to be negligible as these latter places are on the southern edge of the airspace study area and are not directly overflown.

The impacts on Bents Basin and the Shaws Creek Yellomundee AP will be of major concern to First Nations people, and particularly the Dharug, Gundungurra and Tharawal women who have stressed the cultural importance of these places and the requirement for peace, tranquillity, and connection to nature to sustain the cultural values of these places.

The scour pool at Bents Basin, known to its First Nation owners as Gulguer is a sacred site and part of an Aboriginal creation story that traverses the lands of Tharawal, Gundungurra and Dharug people form the south coast through the southern highlands and westward from Bents Basin through the GBMA. The impacts on Bents Basin will severely impact the cultural values of the place and without removing flight paths from this area it is unlikely that minor changes at the detailed design phase will be able to effectively mitigate the impacts on the cultural values of this place.

There will also be impact to the land–sky connection of the 'Emu in the Sky' story. There are many sites in the Sydney Basin sandstone that depict emus, and these include several recorded sites in the Blue Mountains that depict emus including the sites reported at Faulconbridge. The emu rock engraving site at Faulconbridge (AHIMS #45-5-4910) is not directly under the preliminary flight paths

There are many sites in the Sydney Basin sandstone that depict emus, and these include several recorded sites in the Blue Mountains that depict emus including the sites reported at Faulconbridge. Although direct overflight of the Emu engraving at Faulconbridge has been avoided (AHIMS #45-5-4910), the emu engraving site at Ticehurst Park (AHIMS #45-5-0015) would be within the flight path corridor and there will be physical intrusion of aircraft between the engraving and the constellation except when the constellation is directly overhead. The flight paths also transects the Emu Cave AP and although aircraft will generally be between heights of 13300 ft MSL – 17500 MSL First Nations people are concerned about disruption between the land and sky at this significant site.

8.1 World Heritage

Australia, as a signatory to the World Heritage Convention has an agreed obligation to identify, protect, conserve, and present World Heritage properties. Once listed, world heritage properties require ongoing management to ensure that the OUV for which they have been recognised are conserved and managed for present and future generations. To do this the Commonwealth has adopted a set of principles to guide the management of World Heritage Places. These are outlined in Schedule 5 of the EPBC Act Regulations (see Section 2.1.1.1 and include. These include principles to guide environmental impacts assessment and approval. The principles relating to environmental impact assessment are consistent with the 'World Heritage Advice note: Environmental Assessment (IUCN 18 November 2013).

The airspace study area for WSI encompasses the whole or part of 3 WHAs: the GBMA and the Opera House, and parts of the Australian Convict WHA (Hyde Park Barracks, Cockatoo Island, old Government House and Domain and the Great North Road). The current report has considered the cultural values of the identified world heritage places that are likely to be impacted by the proposal and where relevant proposed monitoring and mitigation measures relevant to perceived impacts. These are summarised in Section 5.2.

This technical report contributes to that assessment and demonstrates that there will be no impact to Opera House or to the Australian Convict sites posed by the preliminary flight paths.

Integrity is a measure of the wholeness and intactness of the heritage site and its attributes for which it has been listed. In determining integrity, consideration is given to:

- the extent in which the area includes all elements necessary to express is OUV
- whether the area is of adequate size to ensure the complete representation of the features and processes which convey the area's significance, and
- whether or not the property suffers from the adverse effects of development and/or neglect.

The statement of integrity for the GBMA also included a component connected to cultural associations, specifically the need to conserve:

- the ongoing cultural practices by First Nations people and their continuing custodial relationship with the GBMA
- physical evidence of the longevity of the strong Aboriginal cultural connections to the land.

The project would not have a direct impact on the physical evidence of the cultural connection to the GBMA. Although it is possible to outline processes of potential rock art deterioration related to aircraft emissions, it is as yet, impossible to evaluate the risk presented by these processes, or indeed to identify and quantify any resulting damage as a result of the project. This is due to a lack of available research and comparative data, as well as the difficulty in differentiating aircraft emission derived deterioration from other anthropogenic pollution sources via the same processes (such as acidity, nutrients and dust). However, there remains a potential impact that the introduction of new or increased emissions from the preliminary flight paths to these environments may potentially result in some impact to known (or previously undiscovered) rock art, in particular in areas under the more frequently flown sections of flight paths, though the likelihood of this is considered to be generally minimal. This is why the identification of test sites and the taking of baselines measurements and recordings has been recommended prior to flights commencing. Fuel jettisoning, should it impact rock art sites or other natural values within the GBMA, would be in contradiction of established procedures and likely the result of a rare and extreme emergency. Should such emergency occur immediate assessment of impacts to rock art should be considered in the environmental response.

It is inevitable that visual presence and aircraft noise would impact some Aboriginal sites within the GBMA, and the integrity of these areas with respect to custodial relationships. While flight paths associated with Sydney (Kingsford Smith) Airport already cross the Greater Blue Mountains Area, they currently do so at heights that minimise these intrusions. The preliminary flight paths would mean that aircraft are lower over areas of the Blue Mountains National Park, as they approach and depart WSI. The project would not affect all Aboriginal cultural places and practices throughout the much larger expanse of the GBMA, and First Nations people will continue to have a custodial relationship with the area. Sites considered in this assessment that are located within the GBMA (identified through engagement with stakeholders on sites of high cultural value) would not be severely impacted (with the exception of Linden Ridge sites), and assessed sites would not be comprised to the level that comprises the values of the place, or would result in discontinuation of cultural practices at these sites. Mitigation measures have been developed that require DITRDCA to ensure that the detailed design phase for flight paths considers Aboriginal places and values, where safe and feasible. As such, it not expected that the project would have a significant impact on the overall integrity of the GBMA, with respect to ongoing custodial relationship with the GBMA. Many other Aboriginal sites are located in protected valleys that are overflown by WSI aircraft. Due to the complexity of terrain height and orientation of rock shelters in the rugged sandstone country it is not possible to predict to what extent noise and visual impact this will be an issue for many of sites.

In relation to the question of integrity of Aboriginal cultural values and connection to the landscape of the GBMA it is important to note that boundaries of protected areas do not neatly contain cultural practices and/or belief systems. Many of the Aboriginal sites within the GBMA will be connected to places outside the boundaries of the WHA. One example is Bents Basin known as Guluguer to First Nations people. This site is part of a much large creation story that traverses the GBMA and extends well beyond it.

8.2 National Heritage

The WSI flight paths proposal has considered potential impacts to national heritage places. This assessment has been undertaken with reference for the National Heritage management principles and is consistent with those principles. It has considered a broad range of values and the possible impacts on them arising from the preliminary flight paths. This has included both direct and indirect impacts which have not previously been considered. Consistent with the principles, First Nations people have been consulted over those places of particular significance to them and the range of potential impacts has been explored with them. This assessment has integrated the information available on the heritage values of places across Commonwealth, State and local government jurisdictions.

Outside the GBMA there is no discernible impact on the cultural values of nationally listed places. Most such places occur towards the east coast and the flight paths avoid them (see Figure 5.2).

In relation to the GBMA, while the Commonwealth's reassessment of the Indigenous national heritage values of the GBMA has not been completed, the preliminary flight paths avoid or minimise potential impacts on several places likely to have national values i.e., Kings Tableland AP and the Three Sisters AP.

While some known places of spiritual significance have been avoided in the design of the flight paths, others will be impacted to some extent. This includes:

- disruption to the connection between the Emu in the Sky constellation and the Emu engravings at Faulconbridge
- overflight of the Linden Ridge sites
- some overlap of flight paths and the Emu Cave AP.

Concern remains around the long-term impacts of additional aircraft emissions on the significant suite of rock art in the GBMA. There is insufficient date available to quantity this impact, but this question will only become more urgent as time, development, and climate change progress. To address this, targeted long-term research has been recommended (see Section 7.1.2). Establishment of specimen sites and the collection of baseline data should take place prior to flights commencing from WSI.

8.3 Commonwealth Heritage

Of the 89 places on the CHL, only 2 are within close proximity to WSI and/or are likely to be adversely impacted by the flight paths. These are:

- Orchard Hills Cumberland Plain Woodland, and
- Shale Woodland Llandilo.

Both of these places have been listed for their natural values including both flora and fauna and potential impact on these values are addressed elsewhere (WSP 2023b). These properties have not formally been assessed by the Australian Heritage Council for their cultural values, but reference is made in the listings to the probability of historical and Aboriginal cultural values. However, the features noted in relation to possible cultural values are industrial features and archaeological sites which are robust in relation to any likely impacts from the preliminary flight paths.

8.4 State Heritage listed places

There are 273 State Heritage listed places within the airspace study area, again many of these sites are located to the east of the airspace study area and are unlikely to be noticeably impacted by the preliminary flight paths. Only 10 of Sites listed on the SHR are within a 10km radius of WSI. Many listed places will be relatively robust in relation to the impact of flight paths but there are some areas of concern. Fernhill Estate and other heritage items in Mulgoa will be moderately impacted and cumulative impact to heritage places in Windsor and Richmond is also of concern.

It is recommended in Section 7.1.2 that flight paths in the vicinity of Fernhill Estate are reconsidered during detailed design to reduce impact.

Concern remains around the long-term impacts of additional aircraft emissions on the significant heritage building fabric and on significant heritage gardens in the Blue Mountains. There is insufficient date available to quantity this impact, but this question will only become more urgent as time, development and climate change progress. To address this, targeted long-term research has been recommended (see Section 7.1.2). This should commence prior to the commencement of flights to and from WSI so that baseline data can be established.

Chapter 9 References

AAJV (an Austral & Extent Joint Venture), 2017. Windsor Bridge Replacement Project – Hawkesbury Region Sand Bodies Study. NSW Roads and Maritime Services.

Airservices Australia, 2022a.

Airservices Australia (2022b) *Aeronautical Information Publication Australia Book*, https://www.airservicesaustralia.com/aip/aip.asp?pg=20&vdate=15JUN2023&ver=1, accessed 1 August 2024.

Andrews, A.E.J., 1998. *Earliest Monaro and Burragorang 1790–1840*. Tabletop Press, Canberra ACT.

ANON, 1974. The Wonga and the white waratah: Aboriginal myth from the Blue Mountains, NSW. Smoke Signal, Palm Is. 1974 vol 4.

Archaeological & Heritage Management Solutions (AHMS), 2007. Blackheath Memorial Park: Non-Aboriginal Heritage Assessment. Blue Mountains City Council.

Artefact Heritage, 2021. Environmental Impact Statement – Appendix I: Non-Aboriginal Heritage Assessment Report Warragamba Dam Raising (Non-Aboriginal Heritage Impact Assessment), Warragamba Dam Raising. WaterNSW, Warragamba, NSW.

Attenbrow, V. 2012 The Aboriginal prehistory and archaeology of Royal National Park and surrounding country: A review. *Proceedings of the Linnean Society of New south Wales Volume B39-B64.*

Australia ICOMOS, 2013. *The Burra Charter: the Australia ICOMOS Charter for Places of Cultural Significance, 2013*, Deakin Victoria.

Australian Heritage Commission, 2002. *Ask First: a guide to respecting Indigenous heritage places and values*, The Australian Heritage Commission, Canberra. http://www.environment.gov.au/resource/ask-first-guide-respecting-indigenous-heritage-places-and-values.

Australian Museum Business Services, 2006. Wolgan Valley Aboriginal Heritage Study Stage II Survey Final Report. Clifton Coney Group for Emirates Hotels Australia Pty Ltd.

Australian Museum Business Services, 2014. Badgerys Creek Initial Environmental Survey: Historic Heritage. For SMEC Australia.

Ayers, G.P. and Gillett, R.W., 1983. 'Acidity of Summer rainfall in Sydney, In J.N. Carras and G.M. Johnson (eds) The Urban Atmosphere – Sydney, a case study. Proceedings of a conference organized by the CSIRO Division of Fossil Fuels, Leura May 1982, CSIRO Melbourne.

Ayers, G.P. and Gillett, R.W., 1984. 'Some Observations on the Acidity and Composition of Rainwater in Sydney, Australia, During the Summer of 1980-81', *Journal of Atmospheric Chemistry* 2: 25-46.

Barrett, J., 1995. *Life in the Burragorang*. J. Barrett, Glenbrook NSW.

Barry, L., Graham, I.T., Mooney, S.D., Toms, P.S., Wood, J.C., and Williams, A.N., 2020. 'Tracking an exotic raw material: Aboriginal movement through the Blue Mountains, Sydney, NSW during the Terminal Pleistocene', *Australian Archaeology* 1–12. https://doi.org/10.1080/03122417.2020.1823086.

Chiara Bartalucci and Sergio Luzzi 2020 The soundscape in cultural heritage, *IOP Conf. Ser.: Mater. Sci. Eng*. 949 012050.

Basedow, H., 1925. *The Australian Aboriginal.* F.W. Preece and Sons, Adelaide.

Basu, S., Orr, S.A. and Aktas, Y.D., 2020. 'A Geological Perspective on Climate Change and Building Stone Deterioration in London: Implications for Urban Stone-Built Heritage Research and Management', *Atmosphere* 11: 788. https://doi.org/10.3390/atmos11080788.

Bates, D. and Wilson, B., 1972. *Tales Told to Kabbarli: Aboriginal Legends Collected by Daisy Bates*. Sydney, Angus and Robertson.

Bell, A. 1982 'The Acidity of Sydney's Rain', *Ecos* 34: 21-22. http://www.ecosmagazine.com/?act=view_file&file_id=EC34p21.pdf.

Bell, D., 1980. 45-5-0234 Warragamba. AHIMS site card.

Benfield, J. A., Bell, P. A., Troup, L. J., & Soderstrom, N. C., 2010. Aesthetic and affective effects of vocal and traffic noise on natural landscape assessment. *Journal of Environmental Psychology*, 30(1), 103–111. https://doi.org/10.1016/j.jenvp.2009.10.002.

Benson, D.H. 1986. Vegetation survey – International Radio receiving Station Llandilo. Unpublished report. Royal Botanic Gardens, Sydney.

Benson, D. (ed) 2015. *Values for a new generation: Greater Blue Mountains World Heritage Area*. Greater Blue Mountains World Heritage Area Advisory Committee.

Benson, D. & Howell, J., 1990. 'Sydney's vegetation 1788–1988: Utilization, degradation and rehabilitation', *Proceedings Ecological Society of Australia* 16: 115-127.

Black, J.L, Box, I. and Diffey, S., 2017a. 'Inadequacies of Research used to monitor change to rock art and regulate industry on Murujuga ('Burrup Peninsula'), Australia', *Rock Art Research* 34 (2): 130-148.

Black, J.L, MacLeod, I.D. and Smith, B.W., 2017b. 'Theoretical effects of Industrial emissions on colour change at rock art sites on Burrup Peninsula, Western Australia', *Journal of Archaeological Science Reports* 12: 457-462.

Blue Mountains Association of Cultural Heritage Organisations, 2019. *Blue Mountains History Journal*. Issue 9 (Nov).

Blue Mountains Heritage Institute, n.d. Mapping Country Project Overview.

Bramwell D., 2007. 'The response of botanic gardens to climate change', *BGjournal* 4(2): 3–8.

Brayshaw, H., 1989. Warragamba Dam – Archaeological Study Sample Investigation of Areas Upstream to be Affected by Increased Water Retention. (Archaeological study No. AHIMS #1720). NSW.

Breckell, M., 1993. 'Shades of Grey Early Contact in the Blue Mountain's, in: Stockton, E. (Ed.), *Blue Mountains Dreaming: The Aboriginal Heritage.* Three Sisters Productions Pty Ltd, Winmalee, pp. 114–121.

Bridgman, H.A., 1989. 'Acid rain studies in Australia and New Zealand', *Archives of Environmental Contamination and Toxicology* 19: 137-146.

Building Effects Review Group Report, 1989. *The effects of acid deposition on buildings and building materials in the United Kingdom*. HMSO, London.

Bursill, L., 1993. The Paintings, Engravings, Drawings and Stencils (P.E.D.S.) of Southern Sydney Aborigines to determine (a) type, representations of form, species and location, (b) the effects of pollutants and visitor pressure on such works. MLitt Thesis. University of New England, Armidale, NSW.

Cameron, B., 2014. *A history of the Blue Labyrinth: Blue Mountains National Park*. 2nd ed. Sun Valley, NSW.

Clewell, H.J., 1980. 'Ground Contamination by Fuel Jettisoned from Aircraft in Flight', *Journal of Aircraft* 20(4): 382-384.

Commonwealth of Australia, 2015. *Australian Heritage Strategy.*

Commonwealth of Australia, 2021. (September) *Western Sydney Airport – Airport Plan*.

Cox, J., Maynard, L., and J. V. S. Megaw 1968. The Excavation of a Rock Shelter at Audley, Royal National Park, N.S.W. Archaeology & Physical Anthropology in *Oceania*, Jul., 1968, Vol. 3, No. 2 (Jul.,1968), pp. 94-104.

Cunningham, C., 1996. *The Blue Mountains Rediscovered,* Kangaroo Press, Sydney.

Dames & Moore Pty Ltd, 1998. Environmental Management Plan – International Radio Transmitting Station, Shanes Park. Unpublished report for Airservices Australia.

Darvill, T. and A.B. Fernandes, 2014. 'Open-air rock art preservation and conservation: A current state of affairs' https://www.researchgate.net/publication/298713392_Open-air_rock-art_preservation_and_conservation_A_current_state_of_affairs.

Department of Agriculture, Water and the Environment (DAWE), 2021. The Aboriginal and Torres Strait Islander Heritage Protection Act 1984: General guide, Canberra, October. CC BY 4.0.

Department of Climate Change, Energy, the Environment and Water (DCCEEW), 2023. *Interim Engaging with First Nations People and Communities on Assessment and Approvals under the Environment Protection and Biodiversity Conservation Act 1999*. https://www.dcceew.gov.au/sites/default/files/documents/interim-engaging-with-first-nations-people-and-communities-assessments-and-approvals-under-epbc-act.pdf

Department of Environment and Climate Change NSW, 2007. Current and projected air quality in NSW A technical paper supporting the Clean Air Forum 2007. Sydney.

Department of Environment and Climate Change NSW, 2009. Yengo National Park, Parr State Conservation Area and Finchley Aboriginal Area, Plan of Management.

Department of the Environment, 2016. *Engage Early – Guidance for proponents on best practice Indigenous engagement for environmental assessments under the EPBC Act*.

Department of Infrastructure, Transport, Regional Development, Communities, and the Arts (DITRDCA), 2023a. Technical Paper – Air Quality, *EIS Western Sydney International Airport – Airspace and flight paths design*, Australian Government, Canberra.

Department of Infrastructure, Transport, Regional Development, Communities, and the Arts (DITRDCA), 2023b. Technical Paper – Hazards and Risks, *EIS Western Sydney International Airport – Airspace and flight paths design*, Australian Government, Canberra.

Department of Infrastructure, Transport, Regional Development, Communities, and the Arts (DITRDCA), 2023c. Technical paper– *Aircraft Noise Western Sydney International Airport.*

Department of Infrastructure, Transport, Regional Development and Communications (DITRDC), 2016. *Western Sydney Fact Sheet – Air Quality and the airport*, Australian Government, Canberra.

Department of Planning and Environment 2022. *Thirlmere Lakes – A Synthesis of Current Research*. NSW government.

Department of Planning and Environment (DPE) 2023. Everglades historic garden case study Preparing your heritage property for the impacts of climate change. https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Heritage/everglades-historic-garden-case-study-230047.pdf viewed 26/04/2023.

Doehne E. and Price, C.A., 2010. *Stone Conservation An overview of Current Research,* 2nd ed., The Getty Conservation Institute Los Angeles.

Domingo Sanz, Ines., Fiore, Danae., May, S.K., 2016. '9 Eagle's Reach: A Focal Point for Past and Present Social Identity within the Northern Blue Mountains World Heritage Area, Australia', in: *Archaeologies of Art: Time, Place, and Identity*, One World Archaeology Series; 55. Routledge, London. https://doi.org/10.4324/9781315434339.

Ednie, A., Gale, T., Beeftink, K., & Adiego, A., 2022. Connecting protected area visitor experiences, wellness motivations, and soundscape perceptions in Chilean Patagonia, Journal of Leisure Research, 53:3, 377-403, DOI:10.1080/00222216.2020.1814177.

EPA, 2012. 'Air emissions inventory for the Greater Metropolitan Region in New South Wales. 2008 Calendar Year'. Consolidated Natural and Human-Made Emissions: Results. NSW Environment Protection Authority August 2012.

Extent Heritage Pty Ltd, 2017. Glenbrook Park, Glenbrook: Historical Archaeological Assessment and Impact Statement. Blue Mountains City Council.

Fox M., 1992. Assessor's Report – Proposed Heritage Listing, Llandilo Natural Area Report prepared for the Australian Heritage Commission by Marilyn Fox, School of Geography, University of NSW.

French, K., Calligan, B., and Hill, S., 2000. Classifying endangered vegetation communities: A case study of Cumberland Plain Woodlands. Janet Cosh Herbarium, Department of Biological Sciences, University of Wollongong.

Fuller, R.S., Norris, R.P. and Trudgett, M., 2014a. The Astronomy of the Kamilaroi People and Their Neighbours, submitted to the journal *Australian Aboriginal Studies* on 1 November 2013. Preprint: http://arXiv.org/abs/1311.0076.

Fuller, R.S., Anderson, M.G., Norris, R.P. and Trudgett, M., 2014b. 'The Emu Sky Knowledge of the Kamilaroi and Euahlayi peoples', *Journal of Astronomical History and Heritage*, 17(2): 171–179.

GHD, 2015. Western Sydney Airport Biodiversity Assessment. GHD, Australia.

Giesen, M.J., Ung, A., Warke, P.A., Christgen, B., Mazel, A.D. and Graham, D.W., 2014. 'Condition assessment and preservation of open-air rock art panels during environmental change', *Journal of Cultural Heritage* 15(1): 49-56.

Gillett, R., Selleck, P., Kregor, G., Lawson, S., Boast, K., Powell, J., Carr B. and Ayers, G., 2006. Burrup Peninsula Air Pollution Study: Final Report. Unpublished report to the Western Australian Department of Industry and Resources Rock Art Committee by the CSIRO.

GML Heritage, 2017. Site 5 – Wallarah Darkinjung Land Rezoning Site Aboriginal Heritage, Due Diligence Assessment. Surry Hills, NSW.

Greater Sydney Parklands, 2021. Fernhill Estate: Foundation Plan of Management to 2026.

Gundungurra Indigenous Land Use Agreement, n.d. 56.

Guth, S., 1976. *Over the Blue Mountains*. Jacaranda, Brisbane.

Gordon, J., 1978. *Processes of Stone Deterioratio*n. National Trust of NSW.

Gunn, R.G., 2011. 'The impact of bushfires and fuel reduction burning on the preservation of shelter rock art', *Rock Art Research* 28(1): 53-69.

Holloway, G., 2019. Maintaining Heritage: understanding the importance of shack maintenance practices within the Royal National Park coastal cabin communities. Thesis BSc. University of Wollongong.

Hutton, D. and Connors, L. 1999. A history of the Australian Environment Movement. Cambridge University Press. Cambridge. United Kingdom.

Hyde, R. and Johnson, G.M., 1990. *Pilot Study; Evaluation of Air Quality issues for the development of Macarthur South and South Creek Valley Regions of Sydney*. CSIRO Second Printing 1990.

Inkpen, R., 2004. Atmospheric Pollution, Climate Change and Historic Buildings, *Building Conservation Directory*, Cathedral Communications Ltd.

Intergovernmental Panel on Climate Change (IPCC) 2022 Climate Change 2022: Impacts, Adaptation and Vulnerability. Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. https://report.ipcc.ch/ar6/wg2/IPCC_AR6_WGII_FullReport.pdf.

Ip, K.H., Stuart, B.H., Ray, A.S. and Thomas, P.S., 2008. 'A spectroscopic investigation of the weathering of a heritage Sydney sandstone', *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* 71(3): 1032-1035.

Ip, K.H., Stuart, B., Ray, A. and Thomas, P., 2011. 'ESEM-EDS investigation of the weathering of a heritage Sydney sandstone.', *Microscopy and Microanalysis* 17(2): 292-295.

Jackson, M., 2013. Inaugural Gundungurra Ancestral Pathways Walk – The Bunburang Trail. Gundungurra Aboriginal Heritage Association Incorporated; Office of Environment and Heritage, Blue Mountains/Lithgow/Oberon Tourism and Royal Australian Historical Society.

James, T., McDougall, L. and Benson, D., 1999. *Rare Bushland Plants of Western Sydney*. 2nd ed. Royal Botanic Gardens, Sydney.

Jelinek, A., 1979. 45-1-0046 Wolgan Gap, Blue Mountains Ranges, AHIMS site card.

Jervis, J., 1934. 'The Discovery and Settlement of Burragorang Valley', *The Proceeding and Journal of the Royal Australian Historical Society* 20:164–208.

Johnson, D., 2014. *Night Skies of Aboriginal Australia: A Noctuary*, Sydney University Press.

JPA&D 2019 Fernhill Estate Conservation Management Plan. Prepared for the NSW Department of Planning, Industry and Environment (DPIE).

Kelleher, M., Hooper, S., Brennan, W., Tacon, P.S.C. and Pross, D., 2006. 'Wollemi petroglyphs, N.S.W., Australia: an unusual assemblage with rare motifs.', *Rock Art Research* 23: 227–238. https://doi.org/10.3316/ielapa.200612820.

Kelleher, M.H., 2009. Aboriginal art in the Blue Mountains in Stockton, E., and Merriman J., 2009. *Blue Mountains Dreaming: The Aboriginal Heritage*. 2nd ed. Blue Mountains Educational and Research Trust, Lawson, pp. 73-102.

Kinhill Engineers, 1995. Australian Defence Industries Site - St Marys. Regional Environmental Study Technical Report No. 4. Characteristics of the site. Prepared for the Joint Planning Team, Department of Urban Affairs and Planning.

Kohen, J., Stockton, E. and Williams, M., 1984. 'Shaws Creek KII rockshelter: a prehistoric occupation site in the Blue Mountains piedmont, eastern New South Wales', *Archaeology in Oceania* 19: 57–73.

Kohen, J.L., 1993. The Darug and their neighbours: the traditional Aboriginal owners of the Sydney region. Darug Link in association with the Blacktown and District Historical Society, Blacktown, NSW.

Kohen, J.L., 2006. *Darugnora: Darug Country – the place and the people*. Darug Tribal Aboriginal Corporation.

Korff, J., 2020. 'Why Australia's Aboriginal rock art will disappear', <https://www.creativespirits.info/aboriginalculture/arts/why-australias-aboriginal-rock-art-will-disappear>, retrieved 11 December 2022.

Lambert, D., 1980. 'The influence of Groundwater salts in the formation of Sandstone Shelters Near Gosford, NSW', *Institute for the Conservation of Cultural Material Bulletin* 6: 29-34.

Lambert, D., 1989 [revised 1994]. Conserving Australian Rock Art. A manual for site managers. *The Institute Report Series* edited by G. Ward, Australian Institute of Aboriginal Studies, Aboriginal Studies Press, Canberra.

Lambert, D., 2007. Introduction to rock art conservation: a guide to the preservation of Aboriginal rock art. Department of Environment and Climate Change, Sydney South.

Lambert, D. and Welsh, B., 2011. 'Fire and Rock Art', *Rock Art Research* 28(1): 45-48.

Latip, N.A., Jaafar, M., Marzuki, A., Roufechaei, K.M., Umar, M.U., Karim R.,2020. The Impact of Tourism Activities on the Environment of Mount Kinabalu, UNESCO World Heritage Site, *Planning Malaysia: Journal of the Malaysian Institute of Planners*. Vol 18, Iss. 4, pp 399 – 413.

Leaman, T., 2019. Reading the indigenous night sky to interpret wildlife patterns. *Wildlife Australia* 18–20. https://doi.org/10.3316/informit.464600210168545.

Leaman, T. and Hamacher D.W., 2019. 'Baiami and the Emu Chase: An Astronomical Interpretation of a Wiradjuri Dreaming associated with the Burbun', *Journal of Astronomical History and Heritage* 22(2): 225-237.

Lewin, S.Z. 1982. 'The mechanism of masonry decay through civilization'. In N.S. Baer (ed) *Conservation of Historic Stone Buildings and Monuments*, 120-144. National Academy Press, New York.

Low, J., 2019 Travelling To Wonderland: The Emergence of Coach Services from the Blue Mountains to Jenolan Caves in the Pre-Motor Era in *Blue Mountains History Journal Issue 9* pp 1-14.

Lunney, D., Hutchings, P., Hochuli, D. (Eds.), 2010. Aboriginal Rock Art Depictions of Fauna: What Can They Tell Us about the Natural History of the Greater Blue Mountains World Heritage Area, in: *The Natural History of Sydney*. Royal Zoological Society of New South Wales, P.O. Box 20, Mosman NSW 2088, Australia. https://doi.org/10.7882/9780980327236.

Mackay, R., 2015. The Contemporary Aboriginal Heritage Value of the Greater Blue Mountains. Chapter 3 in V*alues for a new generation: Greater Blue Mountains World Heritage Area.* Greater Blue Mountains World Heritage Area Advisory Committee.

MacLeod, I., 2014. 'Rock art conservation and management: the past, present and future options', *Studies in Conservation* 45: sup3, 32-45 DOI: 10.1179/sic.2000.45. s3.005.

Manning, R., Valliere, W., Hallo, J., Newman, P., Pilcher, E., Savidge, M., & Dugan, D., 2006. From landscapes to soundscapes: Understanding and managing natural quiet in the national parks. In R. Burns & K. Robinson (Eds.), *Proceedings of the 2006 Northeastern Recreation Research Symposium* (pp. 601–606). U.S. Forest Service, Northern Research Station.

Marymor, L., 2019. 'Australian rock art bibliography extracted from the rock art studies bibliographic database for the years 1841 to 2018 – part 1', *Rock Art Research* 35: 188–248. https://doi.org/10.3316/ielapa.918728671397869.

Macleod, I., 2005. 'Effects of moisture, micronutrient supplies and microbiological activity on the surface pH or rocks in the Burrup Peninsula.' Triennial meeting (14th), The Hague, 12-16 September 2005 pp.386-393. James and James, London.

Markley, T., Wells M., Ramanaidou, E., Lau, D. and Alexander, D., 2015. 'Burrup Peninsula Aboriginal petroglyphs: colour change & spectral mineralogy' 2004–2014, No. EP1410003, CSIRO, https://www.der.wa.gov.au/images/documents/our-work/ programs/Burrup-Penninsula-Aboriginal-PetroglyphsReport-2004-2014.pdf.

Marszałek, M., Alexandrowicz, Z. and Rzepa, G., 2014. Composition of weathering crusts on sandstones from natural outcrops and architectonic elements in an urban environment. *Environmental Science and Pollution Research*, 21(24): 14023-14036.

Martınez-Ramırez, S. Puertas, F., Blanco-Varela, B., M.T., Thompson, G.E., 1998. 'Effect of Dry Deposition of Pollutants on the Degradation of Lime Mortars with Sepiolite', *Cement and Concrete Research* 28(1): 125-133.

Masiol, M. and Harrison, R.M., 2014. Aircraft engine exhaust emissions and other airport-related contributions to ambient air pollution: A review. *Atmospheric Environment*, 95: 409-455.

Matthews, R.H., 1905. *Ethnological notes on the Aboriginal tribes of New South Wales and Victoria*. F. W. White, General Printer, 344 Kent Street.

McCarthy, F.D., 1948. 'Lapstone Creek Excavation', *Records of the Australian Museum* 2: 1-34.

McCarthy, F.D., 1978. 'New Light on the Lapstone Creek Excavation', *Australian Archaeology* 8: 49–60. https://doi.org/10.1080/03122417.1978.12093341.

McGrath, A., 2015. Crossing History's Mountains: The Historic Values of the Greater Blue Mountains in *Values for a new generation: Greater Blue Mountains World Heritage Area.* The Greater Blue Mountains World Heritage Area Advisory Committee, Katoomba, NSW.

McSkimming, E., 2015. 'Weathering effects on the engineering properties of Sydney (Yellow Block) sandstone when used as a building material', *International Journal of Architectural Heritage* 9(4): 497-509.

Megaw, J.V.S., 1965. Excavations in the Royal National Park, New South Wales: A First Series of Radiocarbon Dates from the Sydney District *Oceania*, Vol. 35, No. 3 (March 1965), pp. 202-207.

Merchan, C.I., Diaz-Balteiro, L., and Solino, M., 2014. Noise pollution in national parks: Soundscape and economic valuation, *Landscape and Urban Planning* 123 (2014) 1– 9.

Meredith, J., 1989. *The last Kooradgie Moyengully, chief man of the Gundungurra people*. Kangaroo Press, Kenthurst, NSW.

Miller, Z. D., Taff, B. D., & Newman, P., 2018. Visitor experiences of wilderness soundscapes in Denali National Park and Preserve. *International Journal of Wilderness,* 24(2), 32–43.

NSW National Parks and Wildlife Service 1992 Royal National Park: Draft Cabins Conservation Plan. Unpub. report for National Parks and Wildlife Service.

National Parks and Wildlife Service, 1997. Urban Bushland Biodiversity Study. Unpublished report (5 volumes), NPWS Sydney.

NSW National Parks and Wildlife Service, 2000. Native Vegetation Maps of the Cumberland Plain, Western Sydney, Interpretation Guidelines, NSW Government.

National Parks and Wildlife Service NSW (NPWS NSW), 2011. *Aboriginal Rock Art Management*. Video https://www.environment.nsw.gov.au/news/managing-aboriginal-rock-art.

Navin, K., 2002. Aboriginal Archaeological Assessment of Two Sewer Pipelines Blue Mountains Sites, Navin Officer Heritage Consultants. SewerFix Pumping Stations Program, Blue Mountains NSW.

Navin, K. and Officer, K., 2005. Euroka Precinct Blue Mountains National Park NSW Aboriginal Heritage Assessment, Navin Officer Heritage Consultants. NSW National Parks & Wildlife Service Department of Environment and Conservation, Blue Mountains NSW.

Navin Officer Archaeological Resource Management, 1995. Archaeological Survey Vodafone Tower Site Faulconbridge NSW. Hassell Pty Ltd, Faulconbridge NSW.

Navin Officer Archaeological Resource Management, 1993a. Archaeological Survey of Proposed Sewage Pipeline From Glenbrook and Mt. Riverview to Penrith, NSW. Mitchell McCotter Associates Pty Ltd, Glenbrook Blue Mountains/Mt Riverview to Penrith NSW.

Navin Officer Archaeological Resource Management, 1993b. Reconnaissance Level Archaeological Investigation of Proposed Urban Infill Areas – Nth Duffy & Holder, ACT. CMPS&F Scott & Furphy Pty Ltd, North Duffy & Holder, Canberra ACT.

Navin Officer Archaeological Resource Management, 1993c. Water Supply Strategy - Environmental Baseline Review Aboriginal Archaeological Component, Water Board, Warragamba/Welcome Reef NSW.

Navin Officer Heritage Consultants (NOHC), 2002. Aboriginal Archaeological Assessment of Two Sewer Pipelines, Blue Mountains Sites. SewerFix Pumping Stations Program, Blue Mountains NSW.

Navin Officer Heritage Consultants (NOHC), 2016 Analysis of Dust and Other Surface Deposits within Aboriginal Rock Art Site WCP72, Wilpinjong NSW. Report to Wilpinjong Coal Pty Ltd, Peabody Australia.

Navin Officer Heritage Consultants (NOHC), 2020 Pilot Study Trial of Methods for Removal of Surface Dust Deposits from 'The Castle' Aboriginal Rock Art Site WCP72, Wilpinjong NSW, Wilpinjong Coal Mine Aboriginal rock art monitoring and assessment program. Report to Wilpinjong Coal Pty Ltd, Peabody Australia.

Niche Environment and Heritage Pty Ltd, 2021a. Aboriginal Cultural Heritage Assessment Report Warragamba Dam Raising Project Warragamba NSW Warragamba Dam Raising. SMEC Australia Pty Ltd, Warragamba NSW.

Niche Environment and Heritage Pty Ltd, 2021b. Archaeological Assessment Report Warragamba Dam Raising Project Warragamba NSW, Warragamba Dam Raising. WaterNSW & SMEC Australia Pty Ltd, Warragamba, NSW.

Norris, R.P. and Norris C.M., 2009. *Emu Dreaming: An Introduction to Australian Aboriginal Astronomy*. Emu Dreaming, North Rocks, NSW.

NSW Heritage Office, 2001. *Assessing heritage significance- A NSW heritage Manual Update*. ISBN 1 876415 53 3.

NSW National Parks & Wildlife Service and Environment Australia, 1998. The Greater Blue Mountains Area World Heritage Nomination. New South Wales National Parks & Wildlife Service in association with Environment Australia.

Office of Environment and Heritage and Adapt NSW, 2014. *Metropolitan Sydney Climate Change Snapshot*, Office of Environment and Heritage, NSW Government, accessed 8 April 2022.

Organ, M.K., 1994. 'Australian Aboriginal Dreaming Stories: A Chronological Bibliography of Published Works 1789-1991', *Aboriginal History*, 18(2): 123-144.

Oquendo, V. J., and Rodriguez Santos, M., 2020. Foreign Tourists During the Operation of a City Tour in the Historic Center of Quito in Advances in International Conference on 'Knowledge Society: Technology, Sustainability and Educational Innovation' *TSIE 2019: Technology, Sustainability and Educational Innovation (TSIE)* pp 469–479.

Pacific Environment Limited (PEL), 2016. Western Sydney Airport EIS – Local Air Quality and Greenhouse Gas Assessment. Appendix F1 'Local air quality and greenhouse gas', In Dept of Infrastructure and Regional Development 2016 Western Sydney Airport Environmental Impact Statement, Volume 4, Commonwealth of Australia.

Palmer, E., 1885. Concerning Some Superstitions of North Queensland Aborigines. *The Proceedings of the Royal Society of Queensland*, 2(2), 1-13.

Paton-Walsh, C., Rayner, P., Simmons, J., Fiddes, S.L., Schofield, R., Bridgman, H., Beaupark, S., Broome, R., Chambers, S.D., Chang, L.T.C. and Cope, M., 2019. 'A clean air plan for Sydney: An overview of the special issue on air quality in New South Wales', *Atmosphere*, 10(12): 774.

Penrith City Council (2010) Penrith Local Environmental Plan 2010, https://legislation.nsw.gov.au/view/whole/html/inforce/current/epi-2010-0540, accessed 1 July 2024.

Prinsen, D., 2013. Oral history and attachment to place in cultural heritage management: a case study of the shack community at Era, Royal National Park, NSW in *'She said: He said:' Reading, Writing and Recording History Oral History Association of Australia Journal* no. 35 pp77-85.

Quality Environmental Management Pty Limited, 1993. Progress Report: Literature Evaluation Criteria (Water Supply Strategy – Environmental Baseline Review). Quality Environmental Management P/L, Shoalhaven River.

Ramboll Environ Australia, 2016. Western Sydney Airport EIS – Regional Air Quality Assessment. Appendix F2 'Regional air quality', In Dept of Infrastructure and Regional Development 2016 Western Sydney Airport Environmental Impact Statement, Volume 4, Commonwealth of Australia.

Ratliff, G., Sequeira, C., Waltz, I., Ohsfeldt, M., Thrasher, T., Graham, M., Thompson, T., Graham, M. and Thompson, T., 2009. 'Aircraft Impacts on Local and Regional Air Quality in the United States', *PARTNER* Project 15.

Raven, M., Robinson, D. and Hunter, J., 2021. 'The Emu: More-Than-Human and More-Than-Animal Geographies', *Antipode* 53: 1526–1545. https://doi.org/10.1111/anti.12736.

Reed, A.W., 1978. *Aboriginal Myths, Legends and Fables*. A.W Reed Pty Ltd.

Ridley, W., 1873. 'Report on Australian Languages and Traditions', *The Journal of the Anthropological Institute of Great Britain and Ireland,* 2, 258-291.

Ridley, W., 1875. *Kamilaroi, and other Australian Languages. NSW,* Thomas Richards, Government Printer.

Robinson, R., 1966. *Aboriginal myths and legends*, Sun Books Melbourne.

Robinson R., 1967. [1952]. *Legends and Dreaming*, Edwards and Shaw, Sydney.

Rosenfeld, A., 1985. Rock Art Conservation in Australia. Australian Heritage Commission, Special Australian Heritage Publication Series No.2, Australian Government Publishing Service, Canberra.

RPS, 2018. Transport for NSW Transport Access Program 3 Glenbrook Station Upgrade – Statement of Heritage Impact (SOHI). Glenbrook Blue Mountains.

Sefton, C., 2011. 'The effects of fire on the rock art of the Woronora Plateau', *Rock Art Research* 28(1): 49-52.

Sesana, E., Gagnon, A.S., Ciantelli, C., Cassar, J. and Hughes, J.J., 2021. 'Climate change impacts on cultural heritage: A literature review', Wiley Interdisciplinary Reviews: Climate Change 12(4): p.e710.

Sharma, S., Murthy, D.N.R. and Sumanth C., 2023. 'Effect of air pollution on building materials'*, Materials Today: Proceedings,* 86. https://doi.org/10.1016/j.matpr.2023.04.631.

Shepherd, J., Smith, J. and Walford, F., 2003. *Legends of the Blue Mountains Valleys*. Den Fenella Press, Wentworth Falls.

Sheng, N., and Tang, U. W., 2015 Spatial Techniques to Visualize Acoustic Comfort along Cultural and Heritage Routes for a World Heritage City, Sustainability 2015, 7, 10264-10280; doi:10.3390/su70810264 pp 10265-10280.

Silver, C.S., 2008. Development, dust and rock art at Nine Mile Canyon, Utah: A preliminary report on the impact of dust generated by industrial traffic on dirt roads in Nine Mile Canyon. Unpublished report by Preservar Inc. to the Bureau of Land Management (USA), Preservar Inc.

SMEC, WaterNSW, 2021a. Environmental Impact Assessment – Appendix J: World Heritage Assessment Report Warragamba Dam Raising. Prepared for WaterNSW, Warragamba Dam Raising. WaterNSW, Warragamba, NSW.

SMEC, WaterNSW, 2021b. Environmental Impact Statement – Chapter 17: Non-Aboriginal heritage, Warragamba Dam Raising. WaterNSW, Warragamba, NSW.

SMEC, WaterNSW, 2021c. Environmental Impact Statement – Chapter 18: Aboriginal Cultural Heritage (Aboriginal Cultural Heritage Assessment), Warragamba Dam Raising. WaterNSW, Warragamba, NSW.

Smith, J., Aboriginal Legends of the Blue Mountains, Wentworth Falls: Den Fenella Press 1992.

Smith, B., Black, J., Hoerle, S., Ferland, M., Diffey, S., Neumann, J. and Geisler, T., 2022. The impact of industrial pollution on the rock art of Murujuga, Western Australia. *Rock Art Research* 39: 3–14. https://doi.org/10.3316/informit.393299089754403.

Smith, B.J., Gomez-Heras, M. and McCabe, S., 2008. 'Understanding the decay of stone-built cultural heritage', *Progress in Physical Geography* 32(4): 439-461.

Smith, J., 2016. *The Aboriginal people of the Burragorang Valley: 'if we left the valley our hearts would break'.* Blue Mountain Education and Research Trust, Lawson, NSW.

Smith, J., 1991. The Devil's Hole legends. Manuscript.

Smith, J., 1992a. *Aboriginal legends of the Blue Mountains*. Wentworth Falls, NSW.

Smith, J., 1992b. *Aborigines of the Goulburn district.* Goulburn & District Historical Society, Goulburn, NSW.

Smith, B.J. Black J.L., Hoerle, S., Ferland, M.A., Diffey, S.M., Neumann, J.T. and T. Geisler 2022 'The impact of industrial pollution on the rock art of Murujuga, Western Australia'. *Rock Art Research* 39(1): 3-14.

Smyth, R. Brough, 1878. The Aborigines of Victoria, Government Printer, Melbourne.

Smyth, R. Brough, 1972. *The Aborigines of Victoria,* Vol. 2, John Currey, O'Neil, Melbourne (First published 1876).

Stanbury, P. and Bushell, L., 1985. *The Blue Mountains: Grand adventure for all*, Macleay Museum, University of Sydney.

State of New South Wales and Office of Environment and Heritage 2018. Greater Blue Mountains World Heritage Area Strategic Plan Addendum 2016.

Stephens, S., 2001. Report on Cherry Tree (Prunus species) at 281 Great Western Highway, Lawson, Blue Mountains.

Stockton, E., 1973. 'Shaw's Creek shelter: Human displacement of artefacts and its significance', *Mankind* 9: 112-7.

Stockton, E., 1977a. 'A review of early Bondaian dates', *Mankind* 11: 48-51.

Stockton, E., 1977b. Middens of the Central Coast, New South Wales *Australian Archaeology*, Oct., 1977, No. 7 (Oct., 1977), pp. 20-31.

Stockton, E. (Ed.), 1993. *Blue Mountains dreaming: the Aboriginal heritage*. Three Sisters Productions, Winmalee, NSW.

Stockton, E., 2005. Prehistory of the Blue Mountains and the Riverlands. Mt Wilson & Mt Irvine Historical Society Inc. *Occasional Historical Papers* Number 5: 1–4.

Stockton, E., and Knox, K.J. (Eds), 2019. Aboriginal Heritage of the Blue Mountains: recent research and reflections/ edited by Kelvin Knox and Eugene Stockton. Lawson, [N.S.W.]: Blue Mountain Education & Research Trust, 2019.

Stockton, E. and Holland, W., 1974. 'Cultural sites and their environment in the Blue Mountains', *Archaeology and Physical Anthropology in Oceania* 9: 36–65.

Stockton, E.D., 1970. 'An Archaeological Survey of the Blue Mountains', *Mankind* 7: 295–301. https://doi.org/10.1111/j.1835-9310.1970.tb00423.x.

Stray, H. and Dahlin, E., 1999. 'Impact of pollution at a stone age rock art site in Oslo, Norway, studied using lead and strontium isotopes', *Journal of Archaeological Science*, 26(12): 1483-1488.

Sue Rosen and Associates, 2015. The Great Western Road from Lapstone to Mt Victoria. Blue Mountains City Council, Blue Mountains NSW.

Sullivan, S., 1977. Conservation of Aboriginal Art in New South Wales in *Conservation of Rock Art. Proceedings of the International Workshop on the Conservation of Rock Art,* Perth, September 1977 (1978): 71-74.

Sundstrom, L.., and Hays-Gilpin, K., 2011. Rock Art as Cultural Resource in King, T.F. (Ed.) *A Companion to Cultural Resource Management,* Wiley, pp. 351-370.

Szafraniec, T., 2019. George Kitch: Katoomba Photographer and Businessman (1889-1914) – Part 2in *Blue Mountains History Journal* 9 2019 (November) pp 67-107.

Tacon, P., Brennan, W., Hooper, S., Kelleher, M. and Pross, D., 2005. 'Greater Wollemi: A New Australian Rock-Art Area Bordering Sydney', *International Newsletter on Rock Art* 43.

Tacon, P., Brennan, W., King, G., Pross, D. and Kelleher, M., 2019. The contemporary cultural significance of Gallery Rock, a petroglyph complex recently found in Wollemi National Park, New South Wales, Australia, in: *Aesthetics, Applications, Artistry and Anarchy: Essays in Prehistoric and Contemporary Art. A Festschrift in Honour of John Kay Clegg* 11 January 1935–1 March 2015. Archaeopress Publishing, pp.71–84.

Taçon, P.S.C., Kelleher, M., Brennan, W., Hooper, S. and Pross, D., 2006. Wollemi petroglyphs, NSW, Australia: an unusual assemblage with rare motifs. *Rock Art Research* 23(2): 227-38.

Taçon, P., Kelleher, M., King, G. and Brennan, W., 2008. Eagles Reach: a focal point for past and present social identity within the northern Blue Mountains World Heritage Area, New South Wales, Australia. In Sanz, I., Fiore, D., and May, S.K. (eds) *Archaeologies of Art: Time Place and Identity*. Left Coast Press, Walnut Creek, pp. 195-214.

Taçon, P.S.C., 2011. Changing Perspectives in Australian Archaeology, part XI. Rare and curious thylacine depictions from Wollemi National Park, New South Wales and Arnhem Land, Northern Territory. Tech. Rep. Aust. Mus., Online 23, 165–174. https://doi.org/10.3853/j.1835-4211.23.2011.1576.

Taçon, P.S.C., Australian Museum (Eds.), 2002. *Landscape of Blue Mountains rock-art: Wollemi National Park: phase 1*. Australian Museum], Sydney, NSW.

Taçon, P.S.C., Hooper, S.B., Brennan, W., King, G., Kelleher, M., Domicelj, J., Merson, J., 2007. Assessment of the Aboriginal Cultural Heritage Values of the Greater Blue Mountains World Heritage Area. Blue Mountains World Heritage Institute & Griffith University.

Taçon, P.S.C., South, B. and Hooper, S.B., 2003. 'Depicting Cross-Cultural Interaction: Figurative Designs in Wood, Earth and Stone from South-East Australia', *Archaeology in Oceania* 38: 89–101.

Thomas, M.,2001. A multicultural landscape. National Parks and the Macedonian experience. Studies in the cultural construction of open space. NSW National Parks and Wildlife Service and Pluto Press Australia. Sydney.

Thomas, M., 2004. *The artificial horizon: Imagining the Blue Mountains*. Melbourne University Press, Carlton.

Transport for NSW (TfNSW), 2019. Fact Sheet – Sydney's air quality Summer 2019, NSW Government.

Tzanis, C. M., Varotsos, J., Ferm, M.N., Christodoulakis, C., Assimakopoulos, M. and Efthymiou, D., 2009. 'Nitric acid and particulate matter measurements at Athens, Greece, in connection with corrosion studies', *Atmospheric Chemistry and Physics* 9: 8309-8316.

Karskens, G., Burnett, G. and Ross, S., 2019. 'Traces in a Lost Landscape: Aboriginal archaeological sites, Dyarubbin/Nepean River and contiguous areas, NSW, Australia (Data Paper)', *Internet Archaeo*logy https://doi.org/10.11141/ia.52.8.

University of Sydney, 2020. Massacre of Tharawal and Gundungurra people Southwest – 1816. A history of Aboriginal Sydney. URL https://historyofaboriginalsydney.edu.au/south-west/massacre-tharawal-and-gundungurra-people (accessed 5.10.22).

Van der Have, J., 2016. *Aboriginal rock art in the Blue Mountains*. NSW Blue Mountain Education and Research Trust, Lawson, NSW.

Varotsos, C., Tzanis, C. and Cracknell, A., 2009. The enhanced deterioration of the cultural heritage monuments due to air pollution. *Environmental Science and Pollution Research* 16(5): 590-592.

Wallis, L., Huntley, J. and Watchman, A., 2015 A Study of Painted Rock Art Sites in the Central Pilbara: Final Report. Unpublished Report to BHP Billiton Iron Ore by Wallis Heritage Consulting.

Washington, H. and Wray, R. 2015. Recognising new values: the geodiversity and geoheritage of the Greater Blue Mountains. Chapter 1 in *Values for a new generation: Greater Blue Mountains World Heritage Area.* Greater Blue Mountains World Heritage Area Advisory Committee, pp. 12-49.

Watchman, A. 1998. Composition and source of dusts on Split Rock Paintings, Australia. *Rock Art Research* 15(1): 36-40.

Waters Consultancy Pty Ltd, 2021. Warragamba Dam Raising Aboriginal Cultural Values Assessment Report, Warragamba Dam Raising. WaterNSW.

Watt, J., Tidblad, J., Kucera, V. and Hamilton, R., 2009. *The effects of air pollution on cultural heritage*. Springer, Berlin, Germany.

Wheeldon, P., 2014. 'Those amazing slab huts', *HERITAGE Newsletter of the Blue Mountains Association of Cultural Heritage Organisations Inc*. 1–4.

Whittington, V., 2020. 'Bicentenaries and belonging: Public heritage of the lower Blue Mountains and the politics of place attachment', *Journal of Community Archaeology & Heritage* 7: 54–72. https://doi.org/10.1080/20518196.2019.1678812.

Woodside, 2019. Northwest Shelf Project Extension Environmental Review Document, EPA Assessment No. 2186, Revision 1, esp. Appendix H 'Synthesis of Literature on the Potential Impact of Industrial Air Emissions on Murujuga Rock Art', pp. 511ff.

WSP 2023a Technical Paper 8 – Biodiversity, Western Sydney International Airport Airspace and flight path design EIS.

WSP 2023b Technical Paper 14 – Greater Blue Mountains World Heritage Area, Western Sydney International Airport Airspace and flight path design EIS.

WSP 2023c Technical Paper 11 – Economic, Greater Blue Mountains World Heritage Area, Western Sydney International Airport Airspace and flight path design EIS.

WSP 2023d Technical Paper 10 – Social, Greater Blue Mountains World Heritage Area, Western Sydney International Airport Airspace and flight path design EIS.

Appendix A

Heritage items listed on the State Heritage Register within the airspace study area

A1 Items within airspace study area listed on the State Heritage Register

Table A.1 273 heritage items listed on the State Heritage Register for their significance to the State of NSW within the airspace study area

Item	LGA	Listing #
Wilton Park	WOLLONDILLY	00257
Mountain View	HAWKESBURY	44
Lewisham Railway viaducts over Long Cove Creek	INNER WEST	1043
Kirkham Stables and Precinct	CAMDEN	1411
Edwardian Terrace	SYDNEY	848
Cottage	HAWKESBURY	107
Linden Observatory Complex	BLUE MOUNTAINS	1807
Timber Slab Cottage	INNER WEST	1412
Yasmar	INNER WEST	1379
Gore Hill Memorial Cemetery	WILLOUGHBY	1491
North Head Quarantine Station & Reserve	NORTHERN BEACHES	1003
Pressure Tunnel Shaft No.1 & associated infrastructure	CANTERBURY-BANKSTOWN	1334
Department of Education Building	SYDNEY	726
Sugar House	SYDNEY	417
Warehouses (former)	SYDNEY	413
Prospect Reservoir and surrounding area	BLACKTOWN	1370
Avondale	CITY OF PARRAMATTA	239
Pipe Organ from Bourke Street Congregational Church (former)	HORNSBY	382
Wilberforce Park	HAWKESBURY	1868
Stone Cottage	CAMPBELLTOWN	1388
Customs House (former)	SYDNEY	727
The Chalet	HUNTERS HILL	1727
Torin Building	PENRITH	1796
Women's College, University of Sydney	SYDNEY	1726
Winsbury Terrace	SYDNEY	930
Cleveland House	SYDNEY	65

Item	LGA	Listing #
Trinity Uniting Church	BURWOOD	1671
Duncan House	WILLOUGHBY	742
Ingleholme & Garage	KU-RING-GAI	71
Jarvisfield	WOLLONDILLY	305
Tahmoor Railway Station Group	WOLLONDILLY	1258
Building	SYDNEY	647
Colebee and Nurragingy Land Grant	BLACKTOWN	1877
Petersham Service Reservoir & Site	INNER WEST	1331
Holy Trinity Greek Orthodox Church	SYDNEY	1816
Strand Arcade	SYDNEY	1864
Purulia	KU-RING-GAI	184
Mount St Marys College and Convent	BLUE MOUNTAINS	1681
Grafton Bond Store and Sandstone Wall	SYDNEY	1431
Prince Alfred Square and potential archaeological site	CITY OF PARRAMATTA	1997
Cattai Estate	THE HILLS SHIRE	982
Botany Water Reserves	BAYSIDE	1317
Liverpool Railway Station group	LIVERPOOL	1181
St Luke's Anglican Church	LIVERPOOL	86
General Post Office	SYDNEY	763
MLC Building North Sydney(former)	NORTH SYDNEY	2050
Parramatta Correctional Centre	CITY OF PARRAMATTA	812
Cumberland Place and Steps	SYDNEY	1542
Roseneath Cottage	CITY OF PARRAMATTA	42
Middle Harbour Syphon NSOOS	NORTHERN BEACHES	1628
Macquarie Arms Inn (former)	HAWKESBURY	282
Callan Park House – Rozelle Hospital	INNER WEST	823
Nutcote	NORTH SYDNEY	505
Gordon Public School	KU-RING-GAI	757
Substation	INNER WEST	941
Elizabeth Bay House Grotto Site and works	SYDNEY	116
Shops and Residences	SYDNEY	1594

Item	LGA	Listing #
Travellers Rest Inn Group	CITY OF PARRAMATTA	748
Relay Test Centre	INNER WEST	933
Homestead, The	CANTERBURY-BANKSTOWN	448
Sewer Vent (Ben Buckler)	WAVERLEY	1637
Redfern Park and Oval	SYDNEY	2016
Wahroonga Reservoir (Elevated) (WS 0124)	KU-RING-GAI	1352
Police Station (former)	RYDE	1017
Hilton	WILLOUGHBY	374
Horningsea Park	LIVERPOOL	255
Hereford House	SYDNEY	460
St James Railway Station group	SYDNEY	1248
Royal College of Radiologists	SYDNEY	522
Wyoming	INNER WEST	772
CBC Bank	CAMPBELLTOWN	499
Bare Island Fort	RANDWICK	978
Patrick White House, The	SYDNEY	1719
Jenner House	SYDNEY	776
Redfern Post Office	SYDNEY	1439
Walter Burley Griffin Lodge	NORTHERN BEACHES	1510
Bushells Building	SYDNEY	1534
GIO Building	SYDNEY	683
Mamre	PENRITH	264
NSW Housing Board Building (former)	SYDNEY	1564
Red Cross House	SYDNEY	1511
Monterey, residential apartments	MOSMAN	367
Newington Armament Depot and Nature Reserve	CITY OF PARRAMATTA	1850
Fishwick House, The	WILLOUGHBY	1751
Substation	SYDNEY	934
Sewage Pumping Station 1	SYDNEY	1336
Dawes Point Battery remains	SYDNEY	1543
Cossington	KU-RING-GAI	1763

Item	LGA	Listing #
Raby	CAMDEN	1694
Hampton Villa	INNER WEST	1725
Wentworth Mausoleum and site	WOOLLAHRA	622
Terrace House	SYDNEY	921
St John's Uniting Church, Hall and Manse	KU-RING-GAI	1670
Shand Mason Curricle Ladders (1898)	PENRITH	1899
Terraces	SYDNEY	923
Middle Head Military Fortifications	MOSMAN	999
St Marys Railway Station Group	PENRITH	1249
Marrickville Railway Station group	INNER WEST	1186
Sydney Cove West Archaeological Precinct	SYDNEY	1860
Tryon Road Uniting Church	KU-RING-GAI	1672
Menangle rail bridge over Nepean River	WOLLONDILLY	1047
Burns Philp Building	SYDNEY	347
Terrace	SYDNEY	859
Don Bank	NORTH SYDNEY	31
Railway Square road overbridge	SYDNEY	1232
Double Bay Compressed Air Ejector Station	WOOLLAHRA	1324
Waterview Wharf Workshops	INNER WEST	687
Hastings	NORTH SYDNEY	567
Federation Hall and courtyard	SYDNEY	1546
Welcome Inn Hotel	SYDNEY	408
Strickland House	WOOLLAHRA	722
Marsden Rehabilitation Centre Group	CITY OF PARRAMATTA	826
House	HAWKESBURY	150
Kelvin	LIVERPOOL	46
Babworth House	WOOLLAHRA	1300
Terrace	SYDNEY	917
Chatswood Reservoirs No. 1 and No. 2	WILLOUGHBY	1321
Camden Park Estate and Belgenny Farm	WOLLONDILLY	1697
Taylor Square Substation No.6 & Underground Public Conveniences	SYDNEY	1700

Item	LGA	Listing #
Hollowforth	NORTH SYDNEY	450
Harrisford	CITY OF PARRAMATTA	248
Barrenjoey Head Lightstation	NORTHERN BEACHES	979
Valley Heights Railway Station and Locomotive Depot	BLUE MOUNTAINS	1276
Harbour View Hotel and site	SYDNEY	634
Flats	SYDNEY	869
Shop & Residence	SYDNEY	893
Como Rail Bridge	GEORGES RIVER	1624
Conservatorium of Music	SYDNEY	1849
Windsor Railway Station Group and Former Goods Yard	HAWKESBURY	1287
McQuade Park	HAWKESBURY	1851
Rose Cottage	HAWKESBURY	358
Carrington Hotel	BLUE MOUNTAINS	280
Fire and Rescue Fleet	PENRITH	1902
Cecil Hills Farm	LIVERPOOL	774
Newtown Railway Station group and Former Newtown Tramway Depot	SYDNEY	1213
Tenements, pair three-storey brick	SYDNEY	1599
Watch House	SYDNEY	501
Argyle Cut	SYDNEY	1523
Redcoats Mess House	CITY OF PARRAMATTA	218
Yobarnie Keyline Farm	HAWKESBURY	1826
Woollahra Reservoir WS022	RANDWICK	1356
Garrison Anglican Church Precinct	SYDNEY	644
Clear Oaks Moxey's Farm House	HAWKESBURY	58
National Art School, Former Darlinghurst Gaol, Former East Sydney Technical College	SYDNEY	2048
Liner House	SYDNEY	589
Shop, Zia Pina Pizzeria	SYDNEY	1591
Terraces	SYDNEY	924
Chatswood South Uniting Church and Cemetery	LANE COVE	694
Glenbrook Railway Residence	BLUE MOUNTAINS	713

Item	LGA	Listing #
NSW Aboriginal Education Consultative Group Office	INNER WEST	1964
Building	SYDNEY	847
Undercliffe Terrace	SYDNEY	902
Merriville House & Gardens	BLACKTOWN	91
Government Cottage Archaeological Site	HAWKESBURY	1843
Nant Gwylan and Garden	CAMDEN	243
Glenleigh Estate	PENRITH	346
Reussdale	SYDNEY	292
Redstone	CITY OF PARRAMATTA	1795
St John's Anglican Cathedral	CITY OF PARRAMATTA	1805
Camelot	CAMDEN	385
Cox's Road and Early Deviations – Linden, Linden Precinct	BLUE MOUNTAINS	1953
Lucas Watermills Archaeological Sites	SUTHERLAND SHIRE	1988
Gresham Hotel	SYDNEY	291
Edwardian Shop/Residences	SYDNEY	888
Louisaville	INNER WEST	189
North Sydney Technical High School (former)	NORTH SYDNEY	517
Electricity Power House	NORTH SYDNEY	931
Railings, Sydney Cove	SYDNEY	1572
Carisbrook	LANE COVE	112
The Barn – Scout Hall	MOSMAN	188
Cox's Road and Early Deviations – Woodford, Appian Way Precinct	BLUE MOUNTAINS	1955
Sewer Vent	INNER WEST	1640
Sydney Opera House	SYDNEY	1685
Illoura Reserve	INNER WEST	1923
Iolanthe	KU-RING-GAI	227
First Government House Site	SYDNEY	1309
Terrace	SYDNEY	846
Dawn Fraser Swimming Pool	LEICHARDT	1398
Ritz Theatre	RANDWICK	348
Terraces	SYDNEY	1608

Item	LGA	Listing #
Terrace	SYDNEY	912
Terraces	SYDNEY	925
Fernhill	PENRITH	54
Waverley Cemetery	WAVERLEY	1975
Edgerley	SYDNEY	671
Kings School Group (former)	CITY OF PARRAMATTA	771
Grantham Poultry Research Station (former)	BLACKTOWN	1382
St Matthew's Anglican Church, Rectory, Stables & Cemetery	HAWKESBURY	15
Cronulla Sand Dune and Wanda Beach Coastal Landscape	SUTHERLAND SHIRE	1668
Sydney Trades Hall	SYDNEY	322
International House	SYDNEY	579
Shops	SYDNEY	870
Clydesdale – Grand House, Barn & Cottage	BLACKTOWN	674
Craithes House	PENRITH	378
BMA House	SYDNEY	252
Elizabeth Bay House	SYDNEY	6
South Head Signal Station	WOOLLAHRA	1436
Hexam Terrace	SYDNEY	872
Jack House	KU-RING-GAI	1910
Royal Naval House	SYDNEY	1574
Banco Road Court, Sydney Supreme Court House	SYDNEY	799
Parramatta Railway Station	CITY OF PARRAMATTA	696
Sewage Pumping Station 67	CITY OF PARRAMATTA	1643
Currawong Workers' Holiday Camp	NORTHERN BEACHES	1784
Townhouse	SYDNEY	880
Retreat, The	RYDE	506
Hermitage and Garden	RYDE	777
Harry and Penelope Seidler House	KU-RING-GAI	1793
Australiana Pioneer Village	HAWKESBURY	1683
Crown Hotel	SYDNEY	733
Terrace Houses	SYDNEY	415

Item	LGA	Listing #
St Bartholomew's Anglican Church & Cemetery	BLACKTOWN	37
Garibaldi, The	HUNTERS HILL	135
Norman Lindsay Gallery	BLUE MOUNTAINS	1503
Warbys Barn & Warbys Stables	CAMPBELLTOWN	497
Centennial Park, Moore Park, Queens Park	RANDWICK	1384
APA Building	SYDNEY	682
Terrace	SYDNEY	914
Woolley House	MOSMAN	1514
Box Hill Inn	THE HILLS SHIRE	724
Terrace Building	HAWKESBURY	75
Christ Church Anglican Church	BLUE MOUNTAINS	130
Cooks River Sewage Aqueduct	CANTERBURY-BANKSTOWN	1322
Bradleys Head Light Tower	MOSMAN	1430
Shop and office	CITY OF PARRAMATTA	278
McIver Women's Baths	RANDWICK	1869
Cottage	SYDNEY	443
Commercial building	SYDNEY	1540
Great Drain and two-house sites	THE HILLS SHIRE	1402
St Mary's Anglican Church and Pipe Organ	WAVERLEY	160
Sydney Water Head Office (former) (1939 building)	SYDNEY	1645
The Gunnery	SYDNEY	927
Lennox House	CITY OF PARRAMATTA	751
Lawson House	SYDNEY	1557
MLC Building	SYDNEY	597
Swifts	WOOLLAHRA	146
Undercliffe Cottage (former)	SYDNEY	929
Prince Henry Site	RANDWICK	1651
Croydon Sewer Vent	BURWOOD	1639
Merchants House	SYDNEY	1561
Playfair's Terrace	SYDNEY	1570
Wolli Creek Aqueduct	BAYSIDE	1355

Item	LGA	Listing #
St Cloud and Site	BURWOOD	564
NSW Club House Building	SYDNEY	145
Royal Cricketers Arms Inn	BLACKTOWN	660
St Anne's Church	WAVERLEY	1706
Crest Theatre	CUMBERLAND	1664
Terrace	SYDNEY	905
Rosebank	LIVERPOOL	1729
Hydraulic Pump Station (former)	SYDNEY	125
Qantas House (No. 1 Chifley Square)	SYDNEY	1512
Peninsula House, Tebbutt's Observatory	HAWKESBURY	28
Hyde Park	SYDNEY	1871
Great Synagogue	SYDNEY	1710
Coach House	SYDNEY	1539
Harris Creek Rail Bridge	LIVERPOOL	2056
Wilsons Farm House	BAYSIDE	487
Cenotaph	SYDNEY	1799
Elizabeth Farm	CITY OF PARRAMATTA	1
Priory and Grounds	BURWOOD	287
Ashfield Reservoir (Elevated) (WS 0003)	CANTERBURY-BANKSTOWN	1622
Townhouse	SYDNEY	861
Stables at rear of Police Station	HAWKESBURY	1018
NSW Fire Brigades No 10 Vehicle Number Plates	PENRITH	1519
Sydenham Pit & Drainage Pumping Station 1	INNER WEST	1644
Georges Head Military Fortifications	MOSMAN	987
Victoria Bridge	PENRITH	1950
Canterbury Railway Station group	CANTERBURY-BANKSTOWN	1109
St Patrick's Roman Catholic Cemetery	CITY OF PARRAMATTA	1880
Shops and Residences	SYDNEY	1593
Kyle House	SYDNEY	654
Holly Lea & Plough Inn	CAMPBELLTOWN	343
Robin Hood Farm	CAMPBELLTOWN	1387

Item	LGA	Listing #
Upper Canal System (Pheasants Nest Weir to Prospect Reservoir)	LIVERPOOL	1373
Bondi Beach Cultural Landscape	WAVERLEY	1786
Terrace Duplexes	SYDNEY	919
Bradleys Head Forts and HMAS Sydney 1 Mast and Associated Memorials	MOSMAN	1838
Mercantile Hotel	SYDNEY	1560
The Church of the Holy Innocents, Churchyard and Cemetery	LIVERPOOL	2005
Enginemans Resthouse	SYDNEY	723
Police Station (former)	SYDNEY	293
Raywell	INNER WEST	93
Eryldene	KU-RING-GAI	19
Macquarie Grove Cottage	CAMDEN	493
Judges House, The	SYDNEY	60
Baker's Terrace	SYDNEY	1530
Grahame's Corner	SYDNEY	736
Camden	CITY OF PARRAMATTA	250
The Metro Theatre (formerly Minerva Theatre)	SYDNEY	2049
St Helen's Park	CAMPBELLTOWN	406
Kyeemagh Market Gardens	BAYSIDE	1393
Shops and Residences, Terrace	SYDNEY	1596
St Paul's Anglican Church (former)	CITY OF PARRAMATTA	56
Hadley Park	PENRITH	2009
Engehurst	WOOLLAHRA	575
Johnson's Building	SYDNEY	1554
Circular Quay Railway Station group	SYDNEY	1112
Corn Exchange	SYDNEY	1619
Fenton and surrounds	WOOLLAHRA	249
Linsley Terrace	SYDNEY	907
Nielsen Park	WOOLLAHRA	1988
Prospect Post Office (former)	BLACKTOWN	1385
Willandra	RYDE	26

Item	LGA	Listing #
Brownlow Hill Estate	WOLLONDILLY	1489
Varroville	CAMPBELLTOWN	737
Pressure Tunnel and Shafts	INNER WEST	1630
Waverley Reservoir (Elevated) (WS 0136)	WAVERLEY	1646
Intercontinental Hotel former Treasury Building	SYDNEY	355
Shop and Residence	SYDNEY	1583
Little Hunter and Hamilton Street Precinct	SYDNEY	599
Bushells Warehouse (former) and Bushells Place	SYDNEY	1535
Epping Forest	CAMPBELLTOWN	1298
Lidcombe Hospital Precinct	CUMBERLAND	1744
Lilyvale	SYDNEY	1558
Sydney Club	SYDNEY	583
Railway Gatehouse	BLUE MOUNTAINS	220
Belmore Railway Station Group	CANTERBURY-BANKSTOWN	1081
Potts Hill Reservoirs 1 & 2 and Site	CANTERBURY-BANKSTOWN	1333
St James' Anglican Church	SYDNEY	1703
Horsley complex (homestead, outbuildings, garden, farm)	FAIRFIELD	30
Bishopscourt	WOOLLAHRA	362
Argyle Terrace – Caminetto's Restaurant	SYDNEY	1525
Ancient Aboriginal and Early Colonial Landscape	CITY OF PARRAMATTA	1863
Manly Cove Pavilion	NORTHERN BEACHES	1433
Municipal Building	SYDNEY	693
Metropolitan Hotel	SYDNEY	663
Vermont Terrace	SYDNEY	910
Sergeant Major's Row (terrace)	SYDNEY	1579
Penrhyn House	SYDNEY	1568
Gladesville Drill Hall	RYDE	782
Mount Wilga House	HORNSBY	535
Building, outbuildings, grounds, trees	HAWKESBURY	753
Houses	SYDNEY	878
Endrim	CITY OF PARRAMATTA	379

Item	LGA	Listing #
Houses	HAWKESBURY	110
West Maling (Revival Life Centre)	GEORGES RIVER	269
Olympic Cauldron at Sydney Olympic Park	CITY OF PARRAMATTA	1839
Strathfield Railway Station group	STRATHFIELD	1252
Stanwell Park Rail Viaduct over Stanwell Creek	WOLLONGONG	1054
Sandgate	RANDWICK	67
Pymble Reservoir No.1 (Covered) (WS 0097)	KU-RING-GAI	1632
Macquarie Arms Hotel	HAWKESBURY	41
Bethungra	CANTERBURY-BANKSTOWN	224
New York Hotel (former) – DFS (Duty Free Store)	SYDNEY	1563
The Priory	HUNTERS HILL	1720
Bowman House	HAWKESBURY	468
Rothwell Lodge & Factory	SYDNEY	591
Pyrmont and Glebe Railway Tunnels	SYDNEY	1225
Loder House	HAWKESBURY	3
St Peter’s Anglican Church	INNER WEST	32
Norma Parker Correctional Centre	CITY OF PARRAMATTA	811
Belvedere	NORTH SYDNEY	320
Scheyville National Park	HAWKESBURY	1817
Stanmore House	INNER WEST	662
Box Hill House in grounds of McCall gardens	THE HILLS SHIRE	613
Fairlight Homestead & Barn	PENRITH	262
Heathcote Hall	SUTHERLAND SHIRE	191
Ashton and its grounds	SYDNEY	1684
Glenmore Hotel	SYDNEY	1549
Goldfinders Inn Group	HAWKESBURY	1978
Lilyvale railway tunnels	WOLLONGONG	1179
Vienna	HUNTERS HILL	459
Queen Street Buildings Group	CAMPBELLTOWN	7
St Peters Railway Station group	INNER WEST	1250
Post Office Stores	SYDNEY	608

Item	LGA	Listing #
Monteith	SYDNEY	592
Trust Building	SYDNEY	676
Rockwall	SYDNEY	20
Hestock	HUNTERS HILL	92
Burwood Railway Station group	BURWOOD	1106
Darlinghurst Court House and Residence	SYDNEY	792
Shop and Residence – Bakers Oven	SYDNEY	1588
Ryde Pumping Station and site	RYDE	1634
Mahratta and Site	KU-RING-GAI	708
Stoneleigh	SYDNEY	187
Broughton House	CITY OF PARRAMATTA	1302
Upper Castlereagh Public School and residence	PENRITH	339
Terrace	SYDNEY	68
Tulkiyan	KU-RING-GAI	1733
Valley Heights Steam Tram Rolling Stock	BLUE MOUNTAINS	1977
Rockdale Railway Station Group	BAYSIDE	1238
Tempe Railway Station Group	INNER WEST	1266
Strathfield rail underbridges	STRATHFIELD	1055
Cumberland Street Archaeological Site	SYDNEY	1845
Hy Brasil	NORTHERN BEACHES	79
University Hall & Cottages	SYDNEY	128
Terrace	SYDNEY	879
Terrace	SYDNEY	901
Terrace	SYDNEY	853
Sydney Observatory	SYDNEY	1449
Waverton Railway Station group	NORTH SYDNEY	1284
Woodford Academy	BLUE MOUNTAINS	1509
Katoomba House	SYDNEY	890
MSB Stores Complex	SYDNEY	1435
Observer Hotel	SYDNEY	1565
Terrace	SYDNEY	896

Item	LGA	Listing #
Fenwick & Co Boat Store	INNER WEST	1396
Experiment Farm Cottage	CITY OF PARRAMATTA	768
Bungarribee Homestead Complex – Archaeological Site	BLACKTOWN	1428
Buckland Convalescent Home & Garden	BLUE MOUNTAINS	371
Substation	RANDWICK	935
Mort's Dock	INNER WEST	1854
ANZAC Memorial	SYDNEY	1822
St Stephen's Uniting Church	SYDNEY	1704
Mount Dorothy Reservoir	CITY OF PARRAMATTA	1329
Marika	HUNTERS HILL	300
Royal National Park Coastal Cabin Communities	WOLLONGONG	1878
Paddington Reservoir	SYDNEY	515
Camden Park	WOLLONDILLY	341
The Greek Orthodox Cathedral of Saint Sophia	SYDNEY	1968
Metters Building	SYDNEY	732
Building	SYDNEY	410
Warders Cottages	CITY OF PARRAMATTA	709
Weatherboard Inn Archaeological Site	BLUE MOUNTAINS	595
Darling Harbour Woodward Water Feature	SYDNEY	1933
Hardware House	SYDNEY	580
Australian Hotel	SYDNEY	1528
Terrace	SYDNEY	864
North Sydney Post Office	NORTH SYDNEY	1417
Substation – Bellevue, Cammeray	NORTH SYDNEY	937
Tarella	NORTH SYDNEY	270
Accountants House	SYDNEY	1521
Gannon House & Shop	SYDNEY	1548
Boronia	MOSMAN	69
Lower Prospect Canal Reserve	CUMBERLAND	1945
Phillip Street Terraces	SYDNEY	621
Sailor's Home (former)	SYDNEY	1576

Item	LGA	Listing #
Rose Seidler House	KU-RING-GAI	261
Lennox Bridge	BLUE MOUNTAINS	24
Rathven	RANDWICK	139
Liverpool TAFE College (former Liverpool Hospital)	LIVERPOOL	1809
Essington	CUMBERLAND	204
Carss Cottage	GEORGES RIVER	587
Arncliffe Railway Station	BAYSIDE	1076
Watson's Butchery	SYDNEY	1592
Helensburgh Railway Station group	WOLLONGONG	1168
King George Hotel (former) and Haymarket Post Office	SYDNEY	615
Commonwealth Bank	SYDNEY	1427
Rushcutters Bay and Yarranabbe Parks	SYDNEY	2041
Igloo House, The	MOSMAN	1652
Gordon Railway Station group	KU-RING-GAI	1150
Loggan Rock	NORTHERN BEACHES	1779
Royal Botanic Gardens and Domain	SYDNEY	1070
South Head General Cemetery	WAVERLEY	1991
Simpson-Lee House I	KU-RING-GAI	1800
St Anne's Roman Catholic Church (former)	STRATHFIELD	508
Toxteth	SYDNEY	928
Terraces	SYDNEY	1610
Stone House	SYDNEY	900
Picton railway viaduct over Stonequarry Creek	WOLLONDILLY	1051
Avonmore Terrace	RANDWICK	565
Susannah Place	SYDNEY	1310
Shop and Residence	SYDNEY	1586
Innisfallen Castle and Grounds	WILLOUGHBY	404
House & Outbuildings	HAWKESBURY	5
Sydney Cricket Ground – Members Stand and Lady Members Stand	SYDNEY	353
Georgian Townhouse	SYDNEY	523
Bantry Bay Explosives Depot	NORTHERN BEACHES	977

Item	LGA	Listing #
Paddington Town Hall	SYDNEY	561
Coroner's Court (former) – Shops & offices	SYDNEY	1541
Terrace	SYDNEY	858
Carousel, The	SYDNEY	1620
Argyle Street Railway Substation	SYDNEY	1022
Comfort Lodge	CITY OF PARRAMATTA	283
Building	MOSMAN	430
Cairnsfoot Special School	BAYSIDE	551
Ewenton	INNER WEST	197
Prospect Reservoir Valve House	BLACKTOWN	1371
Briars, The	KU-RING-GAI	274
Menangle Railway Station group	WOLLONDILLY	1191
Terraces	SYDNEY	926
Rydalmere Hospital Precinct (former)	CITY OF PARRAMATTA	749
Wales House	SYDNEY	586
Shop – Phillip's Foote Restaurant	SYDNEY	1580
Townhouse	SYDNEY	881
Clydebank	SYDNEY	524
Rooty Hill, The	BLACKTOWN	1756
Track	BLUE MOUNTAINS	1372
Fernleigh	SUTHERLAND SHIRE	302
Burwood Post Office (former)	BURWOOD	1490
White Hart Inn Archaeological Site	THE HILLS SHIRE	2007
Richmond Park	HAWKESBURY	1808
Emu Plains (Nepean River) Underbridge	PENRITH	1830
Dame Eadith Walker Convalescent Hospital	CANADA BAY	119
Dunbar Shipwreck Group	WOOLLAHRA	1675
Harrington Park	CAMDEN	1773
Charing Cross	WAVERLEY	449
Campbell's Stores	SYDNEY	1536
British Seamen's Hotel (former)	SYDNEY	1532

Item	LGA	Listing #
Northwood House & Cottage	LANE COVE	440
Rev. Peter Turner Cottage and Well	HAWKESBURY	202
White Bay Power Station	INNER WEST	1015
Dayton House	BLACKTOWN	325
Brush Farm	RYDE	612
Blacktown Native Institution	BLACKTOWN	1866
Rose Bay Seawall, Promenade and its Setting	WOOLLAHRA	1932
Graythwaite	NORTH SYDNEY	1617
Substation	KU-RING-GAI	940
Sydney Terminal and Central Railway Stations Group	SYDNEY	1255
European Rock carvings	CITY OF PARRAMATTA	680
House	HAWKESBURY	109
Arncliffe Market Gardens	BAYSIDE	1395
Johnston's Creek Sewer Aqueduct	INNER WEST	1325
Terraces	SYDNEY	1606
Imperial Hotel	BLACKTOWN	114
Bella Vista	THE HILLS SHIRE	754
Richmond Railway Station and yard group	HAWKESBURY	1236
Big Stable Newmarket	RANDWICK	388
The University of Sydney, University Colleges and Victoria Park	SYDNEY	1974
Cyprus-Hellene Club	SYDNEY	773
Shop and Residence – Ariel Bookshop	SYDNEY	1587
Toongabbie Government Farm Archaeological Site	CITY OF PARRAMATTA	1903
Long Bay Correctional Centre	RANDWICK	810
Building	SYDNEY	652
St Brigid's Roman Catholic Church & School	SYDNEY	645
Terrace	SYDNEY	911
Shop and Residence	SYDNEY	865
Redfern Railway Station group	SYDNEY	1234
Man O'War Steps	SYDNEY	1432
Shops, Victorian pair/Samson's Cottage	SYDNEY	1597

Item	LGA	Listing #
Edward Smith Headquarters Switchboard (1909)	PENRITH	1901
Wahroonga Railway Station group	KU-RING-GAI	1280
Eveleigh Railway Workshops	SYDNEY	1140
Australian Museum	SYDNEY	805
Baker's Terrace	SYDNEY	1531
Pymble Reservoir No.2 (Covered) (WS 0098)	KU-RING-GAI	1633
House	HAWKESBURY	108
Gladswood House	WOOLLAHRA	496
Sydney Harbour Bridge, approaches and viaducts (road and rail)	SYDNEY	781
Railway electricity tunnel under Sydney Harbour	LEICHARDT	1231
Unwin's Stores	SYDNEY	1613
Samson's Cottage (wall remains)	SYDNEY	1577
Lennox Bridge	CITY OF PARRAMATTA	750
Western Outfall Main Sewer (Rockdale to Homesbush)	BAYSIDE	1647
Liverpool Courthouse (former) and Potential Archaeological Site	LIVERPOOL	1999
BOOS (Bondi Ocean Outfall Sewer)	WAVERLEY	1623
Alma House	MOSMAN	70
Toomevara Lane Chinese Market Gardens	BAYSIDE	1394
Royal Prince Alfred Hospital – Victoria & Albert Pavilions	SYDNEY	829
CBC Bank (former)	SYDNEY	428
Stone Shop	SYDNEY	860
Mount Gilead	CAMPBELLTOWN	2020
Cox's Road and Early Deviations – Woodford, Old Bathurst Road Precinct	BLUE MOUNTAINS	1954
Wylie's Baths	RANDWICK	1677
Sydney Central Local Court House	SYDNEY	802
Shop and Residence	SYDNEY	1584
Bomera & Tarana	SYDNEY	1400
Pearce Family Cemetery	THE HILLS SHIRE	593
Juniper Hall	WOOLLAHRA	268
Government House, Movable Heritage Collection and Gardens	SYDNEY	1872

Item	LGA	Listing #
Neoblie	BLACKTOWN	245
Evatt House	KU-RING-GAI	1711
Ahrens Fox PS2 Fire Engine (1929)	PENRITH	1717
Croydon Railway Station Group	INNER WEST	1125
Big House Hotel	SYDNEY	513
Goat Island	UNINCORPORATED	989
M24 Japanese Midget Submarine wreck site	UNINCORPORATED	1785
Denfield	CAMPBELLTOWN	540
Drummoyne Reservoir	CANADA BAY	1625
Sharpies Golf House Sign (The Golf House)	SYDNEY	1655
Building	SYDNEY	842
Shipwrights Arms Inn (former)	SYDNEY	850
Building	SYDNEY	525
Fossil Collection	PENRITH	971
Randwick Presbyterian Church	RANDWICK	1777
Justice and Police Museum	SYDNEY	673
Chief Secretary's Building	SYDNEY	766
Sewage Pumping Station 18	SYDNEY	1339
Site of Ficus superba var. henneana tree	WOOLLAHRA	578
Glenlee, outbuildings, garden & gatelodge	CAMPBELLTOWN	9
Rosemont	WOOLLAHRA	294
Glebe Railway Viaduct	SYDNEY	1034
Terrace Duplexes	SYDNEY	918
Glebe Island Bridge	LEICHARDT	1914
Wentworth Memorial Church and Moveable Heritage Collection	WOOLLAHRA	1882
Residence	SYDNEY	894
Pallister	LANE COVE	574
Petrology Collection	PENRITH	973
Watch House Terrace	SYDNEY	223
Sydney Supreme Court House (Old Court House)	SYDNEY	800
Government Depot Site (former)	BLACKTOWN	345

Item	LGA	Listing #
Building	HAWKESBURY	610
Cronulla Railway Station group	SUTHERLAND SHIRE	1123
Crown Street Reservoir & Site	SYDNEY	1323
Reynolds's Cottages	SYDNEY	1573
Orielton	CAMDEN	1693
Homestead, The	LIVERPOOL	214
Marrickville Town Hall (former)	INNER WEST	573
St Paul's Anglican Church and Pipe Organ	BURWOOD	436
Terrace	SYDNEY	845
Audley historic recreational complex	SUTHERLAND SHIRE	976
Highlands	HORNSBY	34
Toxana	HAWKESBURY	14
ASN Hotel Building (former), Visa Offices	SYDNEY	1527
Alfred's Terrace	SYDNEY	837
Woronora Dam	SUTHERLAND SHIRE	1378
Stanmore Railway Station Group	INNER WEST	1251
History House	SYDNEY	692
ASN Co Building	SYDNEY	1526
Regency Townhouses	SYDNEY	887
Cox's Cottage	PENRITH	171
Housing Board Building	SYDNEY	1552
Transport House	SYDNEY	1271
Dalgety Terrace	SYDNEY	867
Springwood Railway Station Group	BLUE MOUNTAINS	1247
Rookwood Cemetery and Necropolis	CUMBERLAND	718
Ultimo Road Railway Underbridge	SYDNEY	1062
Brooklyn Hotel	SYDNEY	1533
Shops	SYDNEY	891
St Jude's Anglican Church, Cemetery, Rectory, Vergers Residence	RANDWICK	12
Terrace Cottages	SYDNEY	64
Fort Denison	UNINCORPORATED	985

Item	LGA	Listing #
Building	SYDNEY	844
Playfair Street Terraces	SYDNEY	1569
Residence	MOSMAN	210
Macquarie Field House	CAMPBELLTOWN	424
Terrace	SYDNEY	1601
Archaeological Site and associated artefacts	CITY OF PARRAMATTA	2027
Gladesville Bridge	CANADA BAY	1935
Grace Building	SYDNEY	712
Kamay Botany Bay National Park and Towra Point Reserve	SUTHERLAND SHIRE	1918
Electricity Substation No. 269	WAVERLEY	1791
Paddington Post Office	WOOLLAHRA	1418
Terrace	SYDNEY	1602
Terrace	SYDNEY	871
Silverwater Prison Complex Conservation Area	CITY OF PARRAMATTA	813
Substation	NORTHERN BEACHES	936
Sewage Pumping Station 3	SYDNEY	1343
Ivanhoe Park (including Manly Oval) cultural landscape	NORTHERN BEACHES	2029
Rose Cottage and Early Slab Hut	PENRITH	1392
Fitzroy Terrace	SYDNEY	83
Auburn Railway Signal Box	CUMBERLAND	1023
Sydney Town Hall	SYDNEY	1452
Former Health Department Building	SYDNEY	1912
Warehouses	SYDNEY	526
Campbelltown Post Office (former)	CAMPBELLTOWN	265
Durham Hall	SYDNEY	221
Union Bond Store (former), Westpac Bank	SYDNEY	1612
Cumberland District Hospital Group	CITY OF PARRAMATTA	820
St Stephen’s Anglican Church and Cemetery	INNER WEST	462
Tranby	SYDNEY	21
St John’s Anglican Church Precinct	CAMDEN	2006
Crown Street Public School	SYDNEY	562

Item	LGA	Listing #
City Mutual Life Assurance Building	SYDNEY	585
Royal Oak Inn (former)	THE HILLS SHIRE	698
Old Man's Valley Cemetery	HORNSBY	1764
Bull Cave	CAMPBELLTOWN	1993
Lewisham Sewage Aqueduct	INNER WEST	1326
Egyptian Room Scottish Temple	INNER WEST	118
Westpac Bank	SYDNEY	664
Victorian Terrace	SYDNEY	922
Substation	NORTHERN BEACHES	938
Richmond Post Office	HAWKESBURY	1410
Corana and Hygeia	RANDWICK	454
St Andrew's Anglican Cathedral and Chapter House	SYDNEY	1708
Eagleton Terrace	SYDNEY	882
Milthorpe	HUNTERS HILL	688
Alexandra Canal	SYDNEY	1621
Eveleigh Railway Workshops machinery	SYDNEY	1141
Shop and Residence	SYDNEY	1581
1st/15th Royal NSW Lancers Memorial Museum Collection	CITY OF PARRAMATTA	1824
Roxy Theatre	CITY OF PARRAMATTA	711
South Steyne (S.S.)	UNINCORPORATED	755
Dundee Arms Hotel	SYDNEY	416
Sewer Vent	NORTH SYDNEY	1641
Trocadero	SYDNEY	1380
Capitol Theatre	SYDNEY	391
Bird In The Hand Inn (former)	HAWKESBURY	373
Maryland	CAMDEN	1690
Davisville	BLUE MOUNTAINS	401
Cliffbrook	RANDWICK	609
Harts Buildings	SYDNEY	1550
Bulletin Place Restaurant	SYDNEY	651
Oran Park	CAMDEN	1695

Item	LGA	Listing #
Denham Court & Chapel	CAMPBELLTOWN	212
Sewage Pumping Station 38	BAYSIDE	1344
Old Sugarmill	CANTERBURY-BANKSTOWN	290
Sewage Pumping Station 27	INNER WEST	1341
Old Pyrmont Cottages	SYDNEY	1986
Terrace	SYDNEY	1605
Veteran Hall – House Remains	BLACKTOWN	1351
St Mary's Catholic Cathedral and Chapter House	SYDNEY	1709
Parliament House	SYDNEY	1615
Hawker & Vance Produce Exchange	SYDNEY	409
Exeter Farm	BLACKTOWN	205
St Paul's Anglican Church	THE HILLS SHIRE	332
Thompson Square Conservation Area	HAWKESBURY	126
Goodman's Buildings	INNER WEST	672
Royal George Hotel	SYDNEY	411
Houses	WOOLLAHRA	209
House of Bodleigh	SYDNEY	873
Wynstay Estate	BLUE MOUNTAINS	1520
Collingwood	LIVERPOOL	1774
Bunyas	INNER WEST	317
Lyons House	SUTHERLAND SHIRE	1930
Bonnyrigg House	FAIRFIELD	281
Yiu Ming Temple	SYDNEY	1297
Overthorpe	WOOLLAHRA	246
Shop, Ken Duncan Gallery	SYDNEY	1589
Dappeto	BAYSIDE	638
Bankstown Reservoir (Elevated)	CANTERBURY-BANKSTOWN	1316
Fortune of War Hotel	SYDNEY	1547
Woolloomooloo Finger Wharf	SYDNEY	1437
Royal College of Pathologists (former)	SYDNEY	843
Jenolan Caves Reserve	OBERON	1698

Item	LGA	Listing #
Nugal Hall	RANDWICK	173
Terrace Duplexes	SYDNEY	868
Police Station (former) – Australian Craftworks Gallery	SYDNEY	1571
Hunting Lodge (former)	THE HILLS SHIRE	632
Emu Plains Railway Station group	PENRITH	1136
Hunter Baillie Memorial Presbyterian Church	INNER WEST	11
Terrace	SYDNEY	908
Luna Park Precinct	NORTH SYDNEY	1811
Riverstone Railway Station and yard group	BLACKTOWN	1237
Uniting Church and Pipe Organ	SYDNEY	747
Terrace	SYDNEY	916
Oddfellows Arms Inn	CITY OF PARRAMATTA	276
Denbigh	CAMDEN	1691
Waimea House	WOOLLAHRA	226
Captain Tench Arcade	SYDNEY	1537
St Thomas Anglican Church	PENRITH	426
Terraces	SYDNEY	1609
Lilianfels	BLUE MOUNTAINS	431
Shand 7 Inch Manual Fire Engine	PENRITH	1717
Ahimsa	HORNSBY	1494
St David’s Uniting Church	INNER WEST	1669
Stone House	SYDNEY	876
Mosman Bay Sewage Aqueduct	MOSMAN	1328
Lawson Railway Station Group	BLUE MOUNTAINS	1177
Tank Stream	SYDNEY	636
Building	SYDNEY	854
Milsons Point Railway Station group	NORTH SYDNEY	1194
St John’s Anglican Cemetery	CITY OF PARRAMATTA	49
The Glass House	WILLOUGHBY	1981
Studley Park	CAMDEN	389
Dennis Big 6 Fire Engine (1939)	PENRITH	1718

Item	LGA	Listing #
Skinners Family Hotel	SYDNEY	584
Murphys House	CITY OF PARRAMATTA	238
Manly wharf	NORTHERN BEACHES	1434
Shand Mason Fire Engine (1891)	PENRITH	1716
Glenalvon	CAMPBELLTOWN	4
Callan Park Conservation Area & Buildings	INNER WEST	818
Russell Hotel and shop	SYDNEY	1575
State Library of NSW	SYDNEY	1071
Blue Mountains Walking tracks	BLUE MOUNTAINS	980
Lynton	BURWOOD	284
Sydney Harbour Naval Precinct	SYDNEY	1705
Pipehead, water supply canal and associated works	CUMBERLAND	1629
House	SYDNEY	1551
Lands Department Building	SYDNEY	744
ANZ Bank (former)	SYDNEY	85
Shop and Residence	SYDNEY	1582
Kailoa	NORTH SYDNEY	179
Glenbrook Railway and World War Two Mustard Gas Storage Tunnel	BLUE MOUNTAINS	1861
Petersham Railway Station group	INNER WEST	1223
Royal Prince Alfred Hospital – Admission Block	SYDNEY	830
Wesleyan Chapel	SYDNEY	457
Shop and Residence	SYDNEY	1585
Thomas Walker Convalescent Hospital	CANADA BAY	115
Waratah Park	NORTHERN BEACHES	1944
Burwood rail underbridge	BURWOOD	1030
Terrace	SYDNEY	1600
Land Titles Office	SYDNEY	962
Building	SYDNEY	849
Former Great Western Road, Prospect	BLACKTOWN	1911
Railway Institute Building	SYDNEY	1257

Item	LGA	Listing #
Kellys Bush Park	HUNTERS HILL	1391
St Peter's Church & Precinct	SYDNEY	148
Fairwater	WOOLLAHRA	1381
El Alamein Memorial Fountain	SYDNEY	1847
Terraces/Harbour Rocks Hotel	SYDNEY	1611
Balls Head Coal Loader Complex	NORTH SYDNEY	2051
Federation Pavilion, Cabarita Park	CANADA BAY	1454
Warehouse (former)	SYDNEY	653
AWA Building and Tower	SYDNEY	665
Lindesay	WOOLLAHRA	686
Avery Terrace	SYDNEY	1529
Lord Nelson Hotel	SYDNEY	509
Walter Burley Griffin Incinerator	WILLOUGHBY	84
Abbotsford	WOLLONDILLY	73
Land Next to Male Orphan School	FAIRFIELD	1390
Young Street Terraces	SYDNEY	974
Terrace	SYDNEY	856
Bronte House	WAVERLEY	55
Martin Place Railway Station	SYDNEY	1187
Windsor Court House	HAWKESBURY	804
Gledswood	CAMDEN	1692
Cranbrook Group	INNER WEST	418
Dalkeith Property	NORTH SYDNEY	310
Gilligaloola	HORNSBY	271
Argyle Bridge	SYDNEY	1522
Rouse Hill House and Farm	BLACKTOWN	2
The Paragon	BLUE MOUNTAINS	1959
Iona	SYDNEY	176
Royal Automobile Club	SYDNEY	700
St John's Uniting Church and Pipe Organ	NORTH SYDNEY	423
Sewer Vent and Cottages	INNER WEST	1636

Item	LGA	Listing #
Shubra Hall, including stables and garden	BURWOOD	1939
Burwood Sewer Vent	BURWOOD	1638
Tenements	SYDNEY	1598
Mint Building and Hyde Park Barracks Group	SYDNEY	190
Juanita Nielsen's House	SYDNEY	1929
Millers Point & Dawes Point Village Precinct	SYDNEY	1682
Captain Cook Hotel	SYDNEY	511
Uniting Church and Hall	HAWKESBURY	735
Redfern Aboriginal Childrens Services and	SYDNEY	1951
St John's Anglican Church & Rectory	SYDNEY	461
Shops	SYDNEY	863
Mackenzie House	HAWKESBURY	735
National House	SYDNEY	581
Shop, Rockpool Restaurant	SYDNEY	1590
Lake Parramatta Dam	CITY OF PARRAMATTA	1879
Loftus Junction railway signal box	SUTHERLAND SHIRE	1182
Building	SYDNEY	414
House	HAWKESBURY	142
La Perouse Mission Church	RANDWICK	1893
Linley	LANE COVE	350
Stannix Park House, cattle tanks and site	HAWKESBURY	598
Picton Railway Station group	WOLLONDILLY	1224
Oatley Railway Station group	GEORGES RIVER	1214
Windsor Gardens	WILLOUGHBY	571
Lansdowne Bridge	FAIRFIELD	1472
Hall of Champions (collection)	CITY OF PARRAMATTA	1295
Tusculum	SYDNEY	27
Public Reserve associated with Elizabeth Farm	CITY OF PARRAMATTA	285
Balmoral Bathers Pavilion	MOSMAN	760
Electricity Substation No. 349	RANDWICK	1792
Public Trust Office	SYDNEY	1019

Item	LGA	Listing #
Macquarie Lighthouse Site	WOOLLAHRA	677
Old Sydney Holiday Inn	SYDNEY	1566
Warragamba Dam – Haviland Park	WOLLONDILLY	1375
National Mutual Building	SYDNEY	234
Manly Dam	NORTHERN BEACHES	1327
Pyrmont Post Office	SYDNEY	1440
Blyth Terrace	SYDNEY	839
Oswald Bond Store	SYDNEY	527
Bridge over Tunks (Pearces) Creek	HORNSBY	1478
Liverpool Weir	LIVERPOOL	1804
Cadman's Cottage, grounds, trees, space	SYDNEY	981
The Manse	BLACKTOWN	206
Woodlands	KU-RING-GAI	1762
Premiers and Railway Commissioners Rail Car Collection	SYDNEY	1650
Waverley Reservoir No.1 (WS 0132)	WAVERLEY	1353
Rhodes Railway Station group	CANADA BAY	1235
Victoria Bridge over Stonequarry Creek	WOLLONDILLY	1484
Penrith Railway Station group	PENRITH	1222
Glenfield Farm	LIVERPOOL	25
GA Zink & Sons Building	SYDNEY	658
Busby's Bore	SYDNEY	568
Museum Railway Station	SYDNEY	1207
Laurelbank	WILLOUGHBY	657
Egglemont	NORTH SYDNEY	321
Eric Pratten House	KU-RING-GAI	1443
Cathedral of the Annunciation of Our Lady	SYDNEY	1881
Perth House and Stables	CITY OF PARRAMATTA	155
Queen Victoria Building	SYDNEY	1814
Oakleigh	SYDNEY	425
Parramatta Park and Old Government House	CITY OF PARRAMATTA	596
St Andrew's Anglican Church, Hall & Rectory	BLACKTOWN	57

Item	LGA	Listing #
Methodist Parsonage (former)	HAWKESBURY	735
Addington House	RYDE	33
Glenmore	PENRITH	74
Emanuel School	RANDWICK	386
Carthona	RANDWICK	555
Sydney School of Arts	SYDNEY	366
Science House (including original interiors)	SYDNEY	1578
Terrace	SYDNEY	897
Eagleton Terrace	SYDNEY	904
Terrace	SYDNEY	1604
Millers Point Post Office	SYDNEY	1408
Granville Town Hall	CUMBERLAND	1679
Couridjah Railway Station	WOLLONDILLY	1121
Argyle House	SYDNEY	838
Ildemere	NORTH SYDNEY	390
Rail Paybus FP1	WOLLONDILLY	1673
Seymours House	HAWKESBURY	681
Thurlow House	GEORGES RIVER	1980
Milford Haven	INNER WEST	518
Electricity Substation No. 167	CUMBERLAND	1790
Macquarie Schoolhouse/Chapel and St. John’s (Blacket) Church	HAWKESBURY	1836
Malabar Headland	RANDWICK	1741
Terrace	SYDNEY	909
Terrace	SYDNEY	906
Hobartville, including outbuildings	HAWKESBURY	35
Jobbins Terrace	SYDNEY	1553
Hawkesbury River Railway Station group	HORNSBY	1166
Katoomba Railway Station and yard group	BLUE MOUNTAINS	1174
House	HAWKESBURY	45
Mortuary Railway Station and site	SYDNEY	157
Pinnacle House	SYDNEY	582

Item	LGA	Listing #
Tresco, grounds and trees	SYDNEY	780
Building	SYDNEY	852
Dundas Railway Station group	CITY OF PARRAMATTA	1133
Linsley Terrace	SYDNEY	883
Balmain Hospital – Main Building	INNER WEST	814
Sydenham Railway Station group	INNER WEST	1254
Mary Immaculate Group	WAVERLEY	626
Julian Ashton Art School	SYDNEY	1556
Simmons Hardware Store	HAWKESBURY	667
Ben Buckler Gun Battery 1893, 9.2” Disappearing Gun	WAVERLEY	1742
Sydney Emden Memorial	SYDNEY	1946
Challis House	SYDNEY	666
Third Government Farm (former)	THE HILLS SHIRE	1448
Riverview House, Outbuildings etc	RYDE	775
St Leonards Park	NORTH SYDNEY	1941
Shops and Residences – stone	SYDNEY	1595
Hero of Waterloo Hotel	SYDNEY	633
St Patricks Estate	NORTHERN BEACHES	1724
Perpetual Trustee Company	SYDNEY	678
Vaucluse House	WOOLLAHRA	955
Terrace	SYDNEY	841
Medlow Dam	BLUE MOUNTAINS	1366
Otford railway tunnel (former)	WOLLONGONG	1219
Beulah	CAMPBELLTOWN	368
Cottage	SYDNEY	857
Homebush Railway Station group	STRATHFIELD	1170
Meadowbank rail bridge over Parramatta River	CANADA BAY	1189
Buhrich House II	WILLOUGHBY	1513
Katoomba Post Office (former)	BLUE MOUNTAINS	1453
Chinese Market Gardens	RANDWICK	1299
Air Defence Headquarters Ruin Sydney (former)	CANTERBURY-BANKSTOWN	1857

Item	LGA	Listing #
Boomerang	SYDNEY	38
Royal College of Pathologists (former)	SYDNEY	851
Evans' Stores, Harbour Rocks Hotel	SYDNEY	1545
Milton Terrace	SYDNEY	885
Parramatta District Hospital – Brislington and Landscape	CITY OF PARRAMATTA	59
Venice	RANDWICK	175
Ultimo Power House	SYDNEY	2045
Old Registry Office, Sydney Supreme Court House	SYDNEY	801
Brett Whitely House and Visual Curtilage	NORTH SYDNEY	1949
Parramatta District Hospital – Archaeology	CITY OF PARRAMATTA	828
Sugarloaf Farm	CAMPBELLTOWN	1389
Megarritys Bridge	WOLLONDILLY	1367
Lydham Hall	BAYSIDE	477
Eveleigh Chief Mechanical Engineers Office	SYDNEY	1139
Derrylyn	INNER WEST	279
Pitt Street Uniting Church	SYDNEY	22
Sewer Vent and Cottage	INNER WEST	1635
Bidura House Group	SYDNEY	1994
Pyrmont Bridge	SYDNEY	1618
Ingleburn Military Heritage Precinct and Mont St Quentin Oval	CAMPBELLTOWN	1891
Leura	WOOLLAHRA	47
Merriman Street Terraces	SYDNEY	903
Bellevue	SYDNEY	470
Orient Hotel	SYDNEY	1567
Cleland Bond Store (part of Argyle Stores)	SYDNEY	1538
Terrace Duplexes	SYDNEY	920
Hambledon Cottage, Grounds and Archaeology	CITY OF PARRAMATTA	1888
St John's Roman Catholic Church and Cemetery (former)	CAMPBELLTOWN	193
Building	SYDNEY	412
Palisade Hotel	SYDNEY	510
Mirrabooka and garden	THE HILLS SHIRE	2043

Item	LGA	Listing #
Beverly Hills Railway Station group	GEORGES RIVER	1086
Ultimo Post Office	SYDNEY	502
Royal Edward Victualling Yard	SYDNEY	1855
Salisbury Court	WOOLLAHRA	251
Sze Yup Temple & Joss House	SYDNEY	267
Cronulla Fisheries Centre	SUTHERLAND SHIRE	1011
Osborne House	SYDNEY	886
Prospect Hill	CUMBERLAND	1662
Natural Area	PENRITH	649
Tempe House & St Magdalene's Chapel	BAYSIDE	725
Penshurst Reservoirs	GEORGES RIVER	1330
Bourke Street Congregational Church & School (Former)	SYDNEY	382
Sewer Vent	SYDNEY	1642
Ozanam House	SYDNEY	701
Mining Museum (former)	SYDNEY	1555
Claremont Cottage	HAWKESBURY	738
Sir Joseph Banks Hotel (former)	BAYSIDE	76
Earlwood Aboriginal Art Site	CANTERBURY-BANKSTOWN	1801
Rozelle Hospital – Broughton Hall	INNER WEST	831
Lyndhurst	SYDNEY	158
Bank of NSW	SYDNEY	80
Metcalfe Bond Stores	SYDNEY	1562
State Theatre	SYDNEY	446
Argyle Stores	SYDNEY	1524
Walsh Bay Wharves Precinct	SYDNEY	559
White's Creek Aqueduct	INNER WEST	1354
ES & AC Bank (former) – Amo Roma Restaurant	SYDNEY	1544
Stevens Terrace	SYDNEY	862
View Terrace N & W Facades	SYDNEY	1614
Dredges Cottage	CAMPBELLTOWN	640
Fairfield Railway Station group	FAIRFIELD	1143

Item	LGA	Listing #
Dunara	WOOLLAHRA	539
Terrace	SYDNEY	895
Stone Cottage & Wall	SYDNEY	840
Linnwood	CUMBERLAND	1661
Mount St Mary Campus of the Australian Catholic University	STRATHFIELD	1965
Ford 21W Fire Brigade	PENRITH	1900
Substation	WOOLLAHRA	939
Macarthur House	CITY OF PARRAMATTA	50
St Peters Anglican Church Group	HAWKESBURY	2028
Sewage Pumping Station 271	INNER WEST	1342
Hooper Cottage	RANDWICK	87
Chinese Garden of Friendship	SYDNEY	2017
Warragamba Emergency Scheme	WOLLONDILLY	1376
Everglades	BLUE MOUNTAINS	1498
Randwick Post Office (former) and Jubilee Fountain	RANDWICK	1409
Terraces	SYDNEY	1607
Macquarie Place Precinct	SYDNEY	1759
Sydney Downing Centre	SYDNEY	393
Wilberforce Cemetery	HAWKESBURY	1837
Ebenezer Church (Uniting), Old Schoolhouse, Cemetery & Tree	HAWKESBURY	138
Centennial Park Reservoir WS001	RANDWICK	1320
Christ Church St Laurence Anglican Church and Pipe Organ	SYDNEY	123
Terrace	SYDNEY	1603
Mariners' Church	SYDNEY	1559
Millers Point Conservation Area	SYDNEY	884
Building	SYDNEY	855

Appendix B

High cultural value Aboriginal sites

B1 Analysis of Aboriginal sites of potential sensitive cultural value and proximity to preliminary flight paths

As noted in Section 4.1.6 there are many thousands of Aboriginal sites recorded within the airspace study area. Those sites considered to be potentially vulnerable to impact from overhead flight paths were considered to be rock art sites both painting in shelters and engravings on natural sandstone platforms, stone arrangements and other ceremonial sites, spiritual/mythological sites, burials and massacre sites. Table B.1 is the subset of these sites that occur under a preliminary flight path or within 500 m of one. This information is not restricted as no confidential data is shared and the maps are not at a scale that would allow the sites to be relocated. The maps were produced at a much large scale (A1) for use in the interviews with knowledge holders they are reproduced her to provide indicative locations.

Table B.1 Aboriginal sites of high Aboriginal cultural value

Place	Cultural value	Under the flight path Day departures and arrivals Runway 5 Y/N	Within 500 m	Under the flight path Night departures and arrivals Runway 5 Y/N	Within 500 m	Under flight path Day departures and arrivals Runway 23 Y/N	Within 500 m	Under flight path Night departures and arrivals Runway 23 Y/N	Within 500 m	Estimated height of aircraft when passing overhead and noise (N60 (24-hour))
The Three Sisters and The Gully at Katoomba (AP)	Spiritual, Dreaming	N ≥ 5 km south of Runway 5 departures		N		N		N		Aircraft will be at greater than 10,000 ft MSL with a frequency of less than 10 flights per day. Noise will be 50–55 dBA. Given the significant view shed the visual impact on the cultural landscape will be low- moderate.
Emu Cave (AP) (the cave is AHIMS#45-4-0018)	Spiritual, Dreaming, rock painting	Y Runway 5 departures				N but <1 km west of departures		N <500 m west of departures		Directly overflown. >10,000 ft MSL 60–65 dB(A) N60 (24-hour) less than 10 flights per day by 2055. Impact low to moderate
Kings Tableland near Wentworth Falls (AP)	Engravings, shelter with art, grinding grooves. Camping and meeting place	N ≥ 5 km south Runway 5 departures		N		N		N		Aircraft will be visible but at altitude of >10,500 ft MSL. Noise 50–55 dBA. Impact negligible to low
Emu engraving at Faulconbridge AHIMS 45-5-4910	Engraving, spiritual	N but < 2 km		N		N		N		Aircraft will be <2 km away and at an altitude of 8,000 ft MSL or more. Noise will be around 42 dB(A). Impact low
Emu engraving at Ticehurst Park AHIMS 45-5-0015	Engraving, spiritual	N		Y Runway 05 arrivals		Y Runway 23 Departures		N		Altitude of aircraft will be >10,500 ft MSL during the day and evening, and >8,000 ft during the night. Noise 60–65 dBA. Impact moderate

Place	Cultural value	Under the flight path Day departures and arrivals Runway 5 Y/N	Within 500 m	Under the flight path Night departures and arrivals Runway 5 Y/N	Within 500 m	Under flight path Day departures and arrivals Runway 23 Y/N	Within 500 m	Under flight path Night departures and arrivals Runway 23 Y/N	Within 500 m	Estimated height of aircraft when passing overhead and noise (N60 (24-hour))
Red Hands Cave (AP)	Ceremonial, story place	N		Y Runway 05 arrivals		N ~1 km from departures		N		Altitude of aircraft will be >10,500 ft MSL and noise 60 dBA. Frequency of flights is less than 10 flights per day by 2055. Impact low to moderate
Euroka near Glenbrook (AP)	Archaeological sites, contemporary use, reconnection, camping, spiritual site	N		Y		Y		N		Aircraft will be 5,500–6,500 ft with less than 10 flights per day by 2055. Noise level ~42 dBA. Given the spiritual nature of the place and burial and contemporary community use – impact low to moderate.
Shaws Creek (AP), (in Yellomundee Regional Park) Includes art sites 45-5-0054 and 45-5-0053	Cultural gatherings/archaeological sites (artefacts, fish trap, rock engravings); natural beauty; resource gathering past and contemporary; bush school-intergenerational transmission of cultural knowledge	Y Runway 5 Day departures		N		Y		Y		Directly overflown aircraft will be at 5,000–10,500 ft MSL with 10–20 flights per day by 2055. Noise 60–65 dBA Impact severe
Yengo near Wollombi	Spiritual, Dreaming	N Outside the airspace study area	N Outside the airspace study area	N Outside the airspace study area	N Outside the airspace study area	N Outside the airspace study area	N Outside the airspace study area	N Outside the airspace study area	N Outside the airspace study area	No impact. The Mountain is not overflown.
Upper Kedumba River Valley (AP)	Pre 1788 meeting and camping place Gundungurra settlement from 1894 until 1957	N > 3 km south of Runway 5 Day departures				N		N		Low impact
Bents Basin (SCA)	Spiritual, Dreaming/contemporary teaching. Meeting/trading place of the Gundungurra, Tharawal and Dharug people. Also known as Gulguer (meaning whirlpool or spinning), Bents Basin is associated with Gurungadge or Gurungaty a dangerous aquatic creature. Bents Basin and the adjoining Gulguer Aboriginal rock art and artefact sites	N		N		Y		Y		2,500–3,500 ft MSL Noise 80–85 dBA Frequency >200 Mvts @N60 by 2055 Severe impact

Place	Cultural value	Under the flight path Day departures and arrivals Runway 5 Y/N	Within 500 m	Under the flight path Night departures and arrivals Runway 5 Y/N	Within 500 m	Under flight path Day departures and arrivals Runway 23 Y/N	Within 500 m	Under flight path Night departures and arrivals Runway 23 Y/N	Within 500 m	Estimated height of aircraft when passing overhead and noise (N60 (24-hour))
Thirlmere Lakes/Couridjah	5 freshwater lakes, which are thought to be around 15 million years old Meeting place between Tharawal and Gundungurra	Outside the airspace study area	Outside the airspace study area	Outside the airspace study area	Outside the airspace study area	Outside the airspace study area	Outside the airspace study area	Outside the airspace study area	Outside the airspace study area	No impact
Mermaid pools (Tahmoor Gorge)	Spiritual/dangerous	N	N but <5 km	N but <5 km		N		N		>10,000 MSL Under 60 dBA <10 mvts@N60 Negligible to Low
45-2-0004	Rock Shelter with art	N	Y	N	N	N	Y	N	Y	
45-2-0033	Rock Shelter with art	N	Y	Y	-	N	N	N	N	
45-2-0099	Rock Shelter with art	N	Y	N	N	N	Y	N	Y	
45-2-0182	Rock Shelter with art	Y	N	N	N	N	N	N	N	
45-2-0184	Rock Shelter with art	Y	N	N	N	N	N	N	N	
45-2-0198	Rock Engraving	N	Y	N	N	N	N	N	N	
45-2-2596	Rock art or engraving	N	Y	N	N	N	Y	N	Y	
45-4-0001	Rock Shelter with art		Y							
45-4-0018	Rock engraving, shelter with deposit	Y (dep non-jet)	Y	N	N	N	Y	N	Y	
45-4-0045	Rock Shelter with art	N	Y	N	N	N	Y	N	Y	
45-4-0046	Axe grinding groove, rock engraving	N	N	Y	N	N	N	N	N	
45-4-0054	Rock Shelter with art	N	N	N	N	N	N	N	Y	
45-4-0057	Rock art	Y	N	N	N	N	N	N	N	
45-4-0069	Rock art	N	N	Y	N	N	N	N	Y	
45-4-0076	Axe Grinding Groove, Shelter with Art, Deposit	Y	N	N	N	N	N	N	N	
45-4-0078	Rock Shelter with art	Y – departures	N	N	N	Y – departures	–	Y – departures	–	
45-4-0079	Rock Shelter with art	Y – departures		N	N	Y –departures		Y – departures		
45-4-0080	Rock art	Y – departures	–	N	-	Y – departures	-	Y – departures	-	
45-4-0094	Rock art	N	Y	Y – arrivals		Y – departures		Y – departures		
45-4-0097	Rock Shelter with art	N		Y – departures						
45-4-0135	Rock Shelter with art	N	N	N	N	N	N	N	Y – departures	
45-4-0146	Rock Engraving	N	Y – departures							

Place	Cultural value	Under the flight path Day departures and arrivals Runway 5 Y/N	Within 500 m	Under the flight path Night departures and arrivals Runway 5 Y/N	Within 500 m	Under flight path Day departures and arrivals Runway 23 Y/N	Within 500 m	Under flight path Night departures and arrivals Runway 23 Y/N	Within 500 m	Estimated height of aircraft when passing overhead and noise (N60 (24-hour))
45-4-0199	Rock Shelter with art	N	N	Y – arrivals	N	N	Y – departures	N	Y – departures	
45-4-0215	Rock Engraving	N	N	N	N	N	N	N	Y – departures	
45-4-0216	Rock Engraving	N	N	N	N	N	N	N	Y – departures	
45-4-0217	Stone arrangement	N	-	Y – arrivals	-	Y – departures	-	Y	-	
45-4-0218	Stone arrangement		N	N	N	N	N	N	Y – departures	
45-4-0220	Rock Shelter with art, deposit	N	N	N	N	N	N	N	Y – departures	
45-4-0222	Stone arrangement	N	N	N	N	N	N	Y – departures	-	
45-4-0223	Stone arrangement	N	N	N	N	N	N	Y – departures	-	
45-4-0224	Stone arrangement	N	N	N	N	N	N	Y – departures	-	
45-4-0225	Stone arrangement	N	N	N	N	N	N	N	Y – departures	
45-4-0230	Stone arrangements	N	N	N	N	N	N	N	Y – departures	
45-4-0236	Stone arrangements	N	N	N	N	N	N	N	Y – departures	
45-4-0238	Axe Grinding Groove, Rock Engraving	N	Y – departures	Y – arrivals	-	N	N	N	N	
45-4-0239	Rock shelter with art	N	N	Y – arrivals		N	N	N	N	
45-4-0239				Y – arrivals						
45-4-0244	Rock shelter with art	N	N	N	N	N	N	N	Y – departures	
45-4-0905	Rock shelter with art	Y – arrivals	Y – departures	Y – departures	-	Y – departures	Y – non jet	y	-	
45-4-0907	Rock shelter with art	Y – arrivals	-	Y – arrivals	-	Y – departures	Y – non jet	Y – departures	-	
45-4-0909	Rock shelter with art	Y – arrivals	-	Y – arrivals	-	Y – departures	-	Y – departures	-	
45-4-0913	Rock shelter with art, deposit	N	Y – departures	N	Y – arrivals	Y – arrivals	-	N	N	
45-4-0956	Rock art	N	N	N	N	N	N	N	Y – departures	
45-4-0963	Rock art	N	Y – arrivals	N	N	N	N	Y	Y – departures	
45-4-1004	Rock art	N	Y – departures	N	N	N	Y – departures	N	Y – departures	
45-4-1005	Rock art	N	Y – departures	N	N	N	Y – departures	N	Y – departures	
45-4-1006	Rock art		Y – departures				Y – departures		Y – departures	
45-4-1007	Rock art	Y – departures	-	N	N	Y – departures	-	Y – departures	-	
45-4-1008	Rock Art	N	N	N	Y – arrivals	N	Y – arrivals	N	N	
45-4-1009	Rock art	N	N	N	Y – arrivals	N	Y – arrivals	N	N	

Place	Cultural value	Under the flight path Day departures and arrivals Runway 5 Y/N	Within 500 m	Under the flight path Night departures and arrivals Runway 5 Y/N	Within 500 m	Under flight path Day departures and arrivals Runway 23 Y/N	Within 500 m	Under flight path Night departures and arrivals Runway 23 Y/N	Within 500 m	Estimated height of aircraft when passing overhead and noise (N60 (24-hour))
45-4-1014	Rock art	Y – departures	-	N	Y – arrivals	N	N	N	N	
45-4-1016	Rock art	Y – departures	-	N	Y – arrivals	N	N	N	N	
45-4-1017	Rock art	Y – departures	-	N	Y – arrivals	N	N	N		
45-4-1018	Rock art	Y – departures	-	N	Y – arrivals	N	N	N	N	
45-4-1019	Rock art	Y – departures	-	N	Y – arrivals	N	N	N	N	
45-4-1020	Rock art	N	Y – departures	N	N	N	N	N	N	
45-4-1021	Rock art	N	Y – departures	N	N	N	N	N	N	
45-4-1022	Rock art	Y – departures	-	N	Y – arrivals	N	N	N	N	
45-4-1023	Rock art	N	Y – departures	N	Y – arrivals	N	N	N	N	
45-4-1024	Rock art	Y – departures	Y – arrivals	N	N	Y – arrivals	N	N	N	
45-4-1025	Rock art	N	N	N	N	Y – arrivals	N	N	N	
45-4-1053	Rock art	N	N	N	N	N	Y – departures	N	N	
45-4-1085	Stone arrangement	N	Y – departures	N	N	No	Y – departures	No	Y – departures	
45-4-1145	Rock Art	N	N	N	N	N	N	Y – departures	-	
45-4-1146	Rock Art	N	N	N	N	N	N	N	Y – departures	
45-4-1147	Rock Art	N	N	N	N	N	N	N	Y – departures	
45-4-1151	Rock art	N	N	N	N	N	N	N	Y – departures	
45-4-1155	Rock art	N	N	N	N	N	Y – departures	N	N	
45-5-0002	Rock shelter with art	Y – arrivals	-	N	N	N	N	N	N	
45-5-0003	Axe Grinding Groove, Rock Engraving	Y – arrivals	-	N	N	N	N	N	N	
45-5-0008	Rock Engraving	N	N	Y – arrivals additional	Y – arrivals	Y – departures	-	Y – departures	-	
45-5-0009	Rock art	N	N	N	Y – arrivals	Y – departures	-	Y – departures	-	
45-5-0011	Rock Art	N	N	N	Y – arrivals	Y – departures	-	Y – departures	-	
45-5-0012	Rock art	N	N	Y – arrivals	N	N	N	N	Y – departures	
45-5-0013	Axe Grinding Groove, Rock Engraving	N	N	N	Y – arrivals	N	Y – departures	N	Y – departures within 50 m	
45-5-0025	Stone arrangement	N	N	N	N	N	N	Y – arrivals	-	

Place	Cultural value	Under the flight path Day departures and arrivals Runway 5 Y/N	Within 500 m	Under the flight path Night departures and arrivals Runway 5 Y/N	Within 500 m	Under flight path Day departures and arrivals Runway 23 Y/N	Within 500 m	Under flight path Night departures and arrivals Runway 23 Y/N	Within 500 m	Estimated height of aircraft when passing overhead and noise (N60 (24-hour))
45-5-0026	Rock art	N	N	N	N	N	N	N	Y – arrivals	
45-5-0051	Rock shelter with art	N	Y – departures	N	N	N	N	N	N	
45-5-0053	Rock engraving	Y – departures	N	N	N	N	N	N	N	
45-5-0054	Rock engraving, shelter with deposit	N	Y – departures		N	N	N	N	N	
45-5-0059	Rock shelter with art and deposit	Y – arrivals	-	N	N	Y – arrivals	-	Y – arrivals	-	
45-5-0060	Rock shelter with art and deposit	Y – arrivals	-	N	N	Y – arrivals	-	Y – arrivals	-+	
45-5-0063	Rock Engraving	Y – arrivals	-	N	N	N	N	N	N	
45-5-0064	Rock Engraving	N	Y – arrivals	N	N	N	N	N	N	
45-5-0066	Rock art	N	Y – departures and departures (non-Jet)	N	N	N	N	N	N-	
45-5-0072	Stone arrangement	N	N	N	Y – arrivals (additional)	N	Y – departures	N	Y – departures	
45-5-0077	Rock art	N	N	N	N	N	N	N	Y – departures	
45-5-0080	Engraving	N	Y – departures							
45-5-0085	Rock shelter with art	N	Y – arrivals	N	Y – arrivals Y – departures	N	Y – departures	N	Y – departures	
45-5-0086	Rock shelter with art	N	Y – arrivals	N	Y – arrivals Y – departures	N	Y – departures	N	Y – departures	
45-5-0087	Stone arrangement	N	N	N	N	N	Y – departures	N	N	
45-5-0088	Stone arrangement	N	N	N	N	N	Y – departures	N	N	
45-5-0091	Stone arrangement	N	N	N	N	N	Y – departure (Non-jet)	N	N	
45-5-0092	Stone arrangements	N	N	N	N	N	Y – departures	No	Y – departures	
45-5-0109	Rock shelter with art	N	N	N	Y – arrivals	N	N	N	N	
45-5-0117	Stone arrangement	N	N	Y – arrivals	-	N	N	N	N	
45-5-0118	Rock shelter with art	N	N	Y – arrivals	-	N	N	N	N	
45-5-0120	Rock shelter with art	N	Y – departures (non-jet)	N	N	N	N	N	N	
45-5-0131	Rock shelter with art	N	N	N	N	N	Y – departures (non-jet)	N	N	

Place	Cultural value	Under the flight path Day departures and arrivals Runway 5 Y/N	Within 500 m	Under the flight path Night departures and arrivals Runway 5 Y/N	Within 500 m	Under flight path Day departures and arrivals Runway 23 Y/N	Within 500 m	Under flight path Night departures and arrivals Runway 23 Y/N	Within 500 m	Estimated height of aircraft when passing overhead and noise (N60 (24-hour))
45-5-0139	Rock shelter with art	Y – arrivals	-	N	N	N	N	N	N	
45-5-0140	Rock shelter with art	Y – arrivals	-	N	N	N	N	N	N	
45-5-0150	Rock shelter with art	N	Y – arrivals	N	N	N	N	N	N	
45-5-0161	Rock shelter with art	N	Y – arrivals	N	N	N	N	N	N	
45-5-0162	Rock shelter with art	N	Y – arrivals	N	N	N	N	N	N	
45-5-0163	Rock shelter with art	N	Y – arrivals	N	N	N	N	N	N	
45-5-0165	Rock shelter with art, deposit	N	Y – arrivals	N	N	N	N	N	N	
45-5-0166	Rock shelter with art, deposit	N	Y – arrivals	N	N	N	N	N	N	
45-5-0169	Rock shelter with art	Y – arrivals	-	N	N	N	N	N	N	
45-5-0170	Rock shelter with art	N	Y – arrivals	N	N	N	N	N	N	
45-5-0174	Rock shelter with art	Y – arrivals	N	N	N	N	N	N	N	
45-5-00175	Rock shelter with art	Y – arrivals	-	N	N	N	N	N	N	
45-5-00177	Rock shelter with art	Y – arrivals	-	N	N	N	N	N	N	
45-5-00179	Rock shelter with art	N	Y – arrivals	N	N	N	N	N	N	
45-5-0188	Rock shelter with art, deposit	N	N	N	N	N	N	Y – arrivals	-	
45-5-0191	Rock shelter with art, deposit	Y – arrivals								
45-5-0192	Rock shelter with art, deposit	Y – arrivals	-	N	Y – departures	N	N	N	Y – departures	
45-5-0193	Rock shelter with art, deposit	Y – arrivals	Y – departures (non-jet)	N	N	N	N	N	N	
45-5-0197	Rock shelter with art, deposit	N	Y – departures (non-jet)	N	N	N	N	N	N	
45-5-0199	Axe grinding groove, campsite, rock engraving	Y – arrivals	-	N	N	N	N	N	N	
45-5-0204	Rock engraving	N	Y – arrivals	N	N	N	N	N	N	
45-5-0205	Rock art	N	N	Y – arrivals	-	Y – departures	-	Y – departures	-	
45-5-0250	Rock Engraving	N	Y – departures	N	Y-Arrivals	N	N	N	N	
45-5-0295	Rock Shelter with art	N	N	N	Y-Arrivals	N	N	N	N	
45-5-0341	Stone arrangement	N	N	N	N	N	N	N	Y – departures	
45-5-0597	Rock Shelter with art	Y – arrivals	-	N	N	N	N	N	N	
45-5-0846	Rock shelter with art, deposit	N	Y – arrivals	N	Y – arrivals	N	Y – departures	N	Y – departures	

Place	Cultural value	Under the flight path Day departures and arrivals Runway 5 Y/N	Within 500 m	Under the flight path Night departures and arrivals Runway 5 Y/N	Within 500 m	Under flight path Day departures and arrivals Runway 23 Y/N	Within 500 m	Under flight path Night departures and arrivals Runway 23 Y/N	Within 500 m	Estimated height of aircraft when passing overhead and noise (N60 (24-hour))
45-5-0847	Rock shelter with art, deposit	N	Y – arrivals	N	Y – arrivals	N	Y – departures	N	Y – departures	
45-5-0978	Rock shelter with art, deposit	Y – arrivals	-	Y – arrivals	-	Y-Departures	Y – departures (non-jet)	Y – departures	-	
45-5-2049	Rock shelter with art	N	N	N	N	N	Y – departures (non-jet)	Y – arrivals	-	
45-5-2052	Rock shelter with art	N	N	N	N	N	N	Y – arrivals (additional)	Y – arrivals	
45-5-2055	Rock shelter with art	N	N	N	N	N	Y – departures (non-jet)	Y – arrivals	-	
45-5-2271	Rock shelter with art	N	Y – departures (non-Jet)	N	Y-Arrivals	N	N	N	N	
45-5-2272	Rock engraving	N	N	N	N	N	Y – departures	N	Y – departures	
45-5-2273	Rock Engraving	N	N	N	N	N	Y – departures	Y-Departures	-	
45-5-2274	Rock shelter with art	N	N	N	N	N	Y – departures	Y - Departures	-	
45-5-2311	Rock shelter with art	N	Y – arrivals Y – departures	Y – arrivals	-	N	Y – departures	N	Y – departures (within 50 m)	
45-5-2318	Rock shelter with art, deposit	Y – departures	Y – arrivals	Y – arrivals	-	N	Y – departures	N	Y – departures	
45-5-2331	Rock shelter with art	N	N	N	N	N	Y – departures (non-jet)	N	N	
45-5-2420	Rock shelter with art, deposit	N	N	N	Y – arrivals	N	N	N	N	
45-5-2422	Rock shelter with art	N	N	N	Y – arrivals	N	N	N	N	
45-5-2466	Rock shelter with art, deposit		Y – departures (non-jet)							
45-5-2485	Rock shelter with art	Y – departures (non-jet)	-	Y – arrivals	-	N	N	Y – departures	-	
45-5-2492	Rock shelter with art	N	N	N	N	N	N	Y – arrivals	-	
45-5-3171	Rock Art	N	Y – departures	N	N	N	N	N	N	
45-5-3207	Rock art	N	N	N	Y – departures	N	N	Y – departures		
45-5-3627	Rock art	N	N	N	N	Y – departures	-	Y – departures	-	
45-5-3958	Rock art	N	Y – arrivals	N	N	N	N	N	N	
45-5-3959	Rock art	N	N	N	Y – departures	N	N	N	N	
45-5-3983	Rock art			Y – departures						

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45-5-4910	Rock art – Emu Engraving Faulconbridge	N	Y – departures (non-jet)	N	N	N	N	N	N	
45-5-5220	Rock Art	N	N	N	N	Y – arrivals	-	N	N	
45-6-2412	Rock Engraving	N	N	Y – departures	-	N	N	Y – departures	N	-
52-1-0017	Burial/s, Carved tree	N	N	N	N	N	N	N	Y – departures	
52-1-0019	Rock shelter with art	N	N	N	Y – arrivals	N	N	Y – departures	-	
52-1-0020	Rock shelter with art	N	N	N	Y – arrivals	N	N	Y – departures	-	
52-1-0039	Rock shelter with art	N	N	Y – arrivals	-	N	N	N	N	
52-1-0040	Axe Grinding Groove, Shelter with Art	N	N	Y – arrivals	-	N	N	N	N	
52-1-0042	Burial/s, Carved tree	N	N	N	N	N	N	N	Y – departures	
52-1-0077	Rock shelter with art, deposit	N	N	Y – arrivals	-	N	N	N	N	
52-1-0080	Rock shelter with art	N	N	Y – arrivals	-	N	N	N	N	
52-1-0081	Rock shelter with art	N	N	Y – arrivals	-	N	N	N	N	
52-1-0087	Rock shelter with art	N	N	N	Y – departures	N	N	N	Y – departures	
52-1-0164	Rock shelter with art	N	N	Y – arrivals	N	N	N	N	N	
52-1-0165	Rock shelter with art, deposit	N	Y – arrivals	Y – arrivals	N	N	Y – departures	N	Y – departures	
52-1-0179	Rock shelter with art	N	N	N	Y – departures	N	N	N	Y – departures	
52-2-0042	Rock shelter with art	N	Y – departures (non-jet)	N	N	N	N	N	N	
52-2-0045	Rock shelter with art	N	Y – departures (non-jet)	N	N	N	N	N	N	
52-2-0046	Rock shelter with art	N	Y – departures (non-jet)	N	N	N	N	N	N	
52-2-0211	Rock engraving	N	N	N	Y – arrivals	N	N	N	N	
52-2-0212	Rock shelter with art	N	N	N	Y – arrivals	N	N	N	N	
52-2-0303	Rock shelter with art	N	N	N	Y – departures	N	N	N	Y – departures	
52-2-0312	Rock engraving	N	N	N	Y – departures	N	N	N	Y – departures	
52-2-0313	Rock shelter with art	N	N	N	Y – departures	N	N	N	Y – departures	
52-2-0314	Rock shelter with art	N	N	Y – departures	-	N	N	Y – departures	-	

Place	Cultural value	Under the flight path Day departures and arrivals Runway 5 Y/N	Within 500 m	Under the flight path Night departures and arrivals Runway 5 Y/N	Within 500 m	Under flight path Day departures and arrivals Runway 23 Y/N	Within 500 m	Under flight path Night departures and arrivals Runway 23 Y/N	Within 500 m	Estimated height of aircraft when passing overhead and noise (N60 (24-hour))
52-2-0348	Rock shelter with art	N	N	Y – departures	-	N	N	N	Y – departures	
52-2-0349	Rock shelter with art	N	N	Y – departures	-	N	N	N	Y – departures	
52-2-0350	Rock shelter with art	N	N	Y – departures	-	N	N	N	Y – departures	
52-2-0351	Rock shelter with art	N	N	Y – departures	-	N	N	N	Y – departures	
52-2-0472	Rock shelter with art	N	N	Y – arrivals	-	N	N	N		
52-2-0561	Rock shelter with art	N	N	Y – departures	-	N	N	N	Y – departures	
52-2-0597	Rock shelter with art	N	N	Y – departures	-	N	N	N	Y – departures	
52-2-0781	Rock shelter with art	N	N	Y – departures	-	N	N	N	Y – departures	
52-2-0784	Rock shelter with art	N	N	Y – departures	-	N	N	N	Y – departures	
52-2-0785	Rock shelter with art, deposit	N	N	Y – departures	-	N	N	N	Y – departures	
52-2-0787	Rock shelter with art	N	N	Y – departures	-	N	N	Y – departures	-	
52-2-0789	Rock shelter with art	N	N	N	Y – departures	N	N	N	Y – departures	
52-2-0790	Rock shelter with art, deposit	N	N	N	Y – departures	N	N	N	Y – departures	
52-2-0791	Rock shelter with art	N	N	N	Y – departures	N	N	N	Y – departures	
52-2-0793	Rock shelter with art, deposit	N	N	N	Y – departures	N	N	N	Y – departures	
52-2-0794	Rock shelter with art	N	N	Y – departures	-	-	-	Y – departures	-	
52-2-0795	Rock shelter with art	N	N	N	Y – departures	N	N	N	Y – departures	
52-2-0797	Rock shelter with art, deposit	N	N	Y – departures	-	N	N	Y – departures	-	
52-2-0965	Rock shelter with art	N	N	Y – arrivals	-	N	N	N	N	
52-2-1337	Rock shelter with art	N	Y – departures (non-jet)	N	N	N	N	N	N	
52-2-1341	Rock shelter with art	N	N	N	Y – arrivals	N	N	N	N	
52-2-1342	Rock Engraving	N	N	N	Y – arrivals	N	N	N	N	
52-2-1344	Axe Grinding Groove, Rock Engraving	N	N	N	Y – arrivals	N	N	N	N	
52-2-1347	Rock shelter with art, deposit	N	N	Y-Arrivals	-	N	N	N	N	
52-2-1389	Rock shelter with art	N	N	N	Y – departures	N	N	N	Y – departures	
52-2-1398	Rock shelter with art	N	N	N	Y – arrivals	N	N	N	N	
52-2-1399	Rock shelter with art	N	N	Y – arrivals	-	N	N	N	N	
52-2-1429	Rock shelter with art	N	N	Y – arrivals	N	N	N	N	N	

Place	Cultural value	Under the flight path Day departures and arrivals Runway 5 Y/N	Within 500 m	Under the flight path Night departures and arrivals Runway 5 Y/N	Within 500 m	Under flight path Day departures and arrivals Runway 23 Y/N	Within 500 m	Under flight path Night departures and arrivals Runway 23 Y/N	Within 500 m	Estimated height of aircraft when passing overhead and noise (N60 (24-hour))
52-2-1432	Rock shelter with art, deposit	N	N	N	Y – arrivals	N	N	N	N	
52-2-1500	Rock Engraving, Water Hole/Well	N	N	N	Y – arrivals	N	N	N	N	
52-2-1501	Rock shelter with art	N	N	N	Y – arrivals	N	N	N	N	
52-2-1502	Rock shelter with art	N	N	N	Y – arrivals	N	N	N	N	
52-2-1505	Rock shelter with art	N	N	N	Y – arrivals	N	N	N	N	
52-2-1509	Rock shelter with art, deposit	N	N	Y – arrivals	-	N	N	N	N	
52-2-1553	Rock shelter with art	N	N	N	Y – arrivals	N	N	N	N	
52-2-1554	Rock shelter with art	N	N	N	Y – arrivals	N	N	N	N	
52-2-1560	Rock art	N	N	Y – arrivals	-	N	N	N	N	
52-2-1690	Rock shelter with art, deposit	N	N	N	Y – arrivals	Y – departures	-	N	N	
52-2-1696	Rock shelter with art	N	N	Y – arrivals	-	N	N	N	N	
52-2-1698	Rock shelter with art	N	N	N	Y – arrivals	N	N	N	N	
52-2-1700	Rock shelter with art	N	N	Y – arrivals	-	N	Y – departures	N	N	
52-2-2292	Rock art	N	Y – departures (non-jet)	N	Y – departures	N	N	N	Y – departures	
52-2-2696	Rock art	N		Y – arrivals	-	N	N	N	N	
52-2-2725	Rock art	N	Y – departures (non-jet)	N	N	N	N	N	N	
52-2-2757	Rock art	N	Y – departures (non-jet)	N	N	N	N	N	N	
52-2-2932	Rock art	N	N	Y – arrivals	-	N	N	N	N	
52-2-2933	Rock art	N	N	N	Y – arrivals	N	N	N	N	
52-2-2949	Rock art	N	Y – departures (non-jet)	N	N	N	N	N	N	
52-2-3065	Rock art	N	Y – departures (non-jet)	N	N	N	N	N	N	
52-2-3180	Rock art	N	Y – departures (non-jet)	N	N	N	N	N	N	
52-2-3186	Rock art	N	Y – departures (non-jet)	N	N	N	N	N	N	
52-2-3716	Rock art	N	N	Y – departures	-	N	N	N	Y – departures	

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52-2-4055	Rock art	N	N	N	Y – arrivals	N	N	N	N	
52-2-4056	Rock art	N	N	N	Y – arrivals	N	N	N	N	
52-2-4062	Rock art	N	N	N	Y – arrivals	N	N	N	N	
52-2-4172	Rock art	N	N		Y – departures	N	N	N	Y – departures	
52-2-4697	Rock art	N	N	N	Y – arrivals	N	N	N	N	
52-2-4698	Rock shelter with art	N	N	N	Y – arrivals	N	N	N	N	
5-4-0959	Rock shelter with art	Y – departures	-	N	Y – arrivals	N	N	N	N	

Appendix C

Blue Mountains Ceremonial Pathway (prepared by 500 Voices)

11 Penault Ave
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Ceremonial pathway

Many east coast peoples live on sandstone country. Compared to basalt or granite, sandstone is relatively soft and easy to carve. This factor allowed the Dharug people to engrave patterns and figures into the sandstone. The resulting rock art or petroglyphs describe many sacred stories, compose many teaching sites and specifically hold key knowledge relied upon in the preparation of young men and boys for initiation. Some sites are chosen for their location mirroring stars in astronomical constellations and some locations are chosen as part of a ceremonial procession or pathway.

The Dharug people had composed a ceremonial pathway along which the initiates were walked. As they traversed the ceremonial pathway the initiates had to overcome certain challenges and visit teaching sites and ceremonial sites. One such ceremonial pathway starts at the meeting of the Hawkesbury/Nepean River and the Grose River at Grose Vale. The boys walked to a kangaroo site near Shaw's creek at Yarramundi for their first ceremony. The women cried as they surrendered their sons to men's ceremony. At the completion of the ceremony the boys were led away by the old men. And so, they started their ceremonial journey into manhood.

The ceremonial pathway heads up through valleys and ridges toward Springwood to Falcounbridge where they were taught at an emu/kangaroo site. They proceeded through to King's cave at Linden, to Linden ridge and then on to a teaching site at Lawson, then Bullaburra and up to Wentworth Falls where they received more teaching and entered another initiation ceremony. Ultimately, they walked on through Katoomba, Blackheath, Mt Victoria, across the Darling causeway to Bell's line of road via the Emu Cave, Mt Tomah, for yet another ceremony, and back down toward Grose Vale, to the junction of the rivers where their final ceremony was held. They completed their ceremonial walk and were introduced to the tribe as men. After this, the newly initiated men lived in the men's camp and learned men's lore and hunted with the men. They only returned to the family camp when they were given a wife.

In brief, the ceremonial pathway starts at Grose Vale proceeds along Hawkesbury Road up to Springwood, then allowing for excursions to sites along the way, the pathway follows the great western highway to Mt Victoria. Then traverses the Darling causeway and heads east along the Bell's line of road, diverting through Grose Wald and finishes at the junction of the rivers at Grose Vale.

The ceremonial pathway is important to Dharug people and Dharug men and boys in particular. Despite the fact that we no longer take our boys on a long ceremonial walk as part of their initiation, we do still take all initiates to the sites along that pathway and still use the lessons encapsulated at each site to share the lessons of manhood and lore. This makes the ceremonial pathway through the blue mountains incredibly important to our people.

Furthermore, as one of a number of men seeking to, not only use these sites as teaching sites but as part of our initiations we both keep these sites alive, and the sites keep our culture alive.

Key sites

There are many key sites along the pathway. However, not all of them can be identified. In some cases, important sites are lost or were destroyed. But in most cases, it's because these sites cannot be discussed without breaching the secret/sacred line. The following list is not exhaustive as it excludes a range of non-public ceremonial sites or places related the ceremonial practices. Nevertheless, there are enough sites listed to make a picture.

Sites:

Shaw's Creek kangaroo site

Emu/Kangaroo site at Falconbridge, behind Salvation Army Church.

Linden Ridge (Multiple sites)

King's cave (Linden)

Kangaroo street Lawson, (Kangaroo site)

Near Lawson Golf Course (scarred trees at Initiates camp site)

King's Tableland (multiple sites)

The Seven Sisters site Katoomba (wrongly named Three Sisters)

Narrow Neck, Ceremonial site

Mt Hay

Mt Banks

Dargan

Emu Cave

Mt Tomah

There are many sites along this pathway where the boys camped and could not stray. Some of these sites are still marked with carved trees. The location of these sites cannot be shared as they relate to ceremonial secrets. But they are on the pathway described, at or near the sites listed above.

Additionally, much of the mid mountains from Faulconbridge to Lawson is considered ceremonial country.

Likewise, the area around Wentworth Falls, and the eagle site at King's tableland is considered men's country (line of site to Mt Yengo), as are sites at Katoomba (where the courthouse currently stands) and while the Seven Sisters site is not strictly a men's site it was an important site along the ceremonial pathway as the boys were taught many lessons about correct marriage, the proper treatment of women and what it was to be a good man. There are also key sites around Blackheath and Mt Victoria and along the causeway and Bell's line of road (Emu Cave etc). Boys were taught about the stages of life, about walk-about, about rights and responsibilities and about certain songlines that crossed the country to the west. Mt Wilson has both cave art and ceremonial sites. Mt Tomah has a line of site to Mt Yengo and was a men's ceremonial place. There were initiation ceremonies carried out where the botanical gardens are today.

The final ceremony along this pathway took place where their journey began at Grose Vale, at the joining of the Grose and Hawkesbury rivers.

Seasonal association:

Wrongly named, the Emu hunt, the carvings at Ticeshurst park in Falconbridge include a number of emus, one of which represents the emu in the sky. Its location along the ceremonial pathway is important as it forms the basis of teachings about the seasons, and the correct time to conduct men's ceremony. This site also has carvings of Baiami's footprints (mundoes), which are used to teach the initiates lessons about growth and responsibility. Importantly, this site indicates the correct season for men's ceremony.

Overview of concerns

Writing an overview of concerns related to the proposed flight paths and their impact on the ceremonial pathway is somewhat fraught because the most convincing points are on the far side of the secret/sacred line and therefore cannot be discussed. Nevertheless, in essence, Aboriginal lore is based on a set of principles that firstly recognises the connection between all things, between sacred sites and stars, constellations and ancestral beings, whose campfires can be seen in the sky at night. Even our spiritual practice and meditation relates to our connection to the stars.

Specifically, the sites at Yarramundi, Linden Ridge, Kangaroo Street Lawson, the Eagle site at King's tableland, the Seven Sisters, Narrow neck, Mt Hay, the Emu Cave and Mt Tomah all require unbroken connection to the stars above. These sites should not be flown over as that breaches the sacred connection between those sites and the spirits that relate to them in the sky.

I cannot stress the importance of respecting these sites and many others including Mt Yengo, Devil's rock Maroota and many sites around middle harbour and the Sydney basin. These sites are significant to our Aboriginal heritage, traditional culture and maintaining our spiritual connection to our ancestral traditions and also moving forward into the 21st century as culturally engaged Aboriginal people. Please respect our culture and plan flight paths that avoid flying over these sites.

Dr Shane Smithers

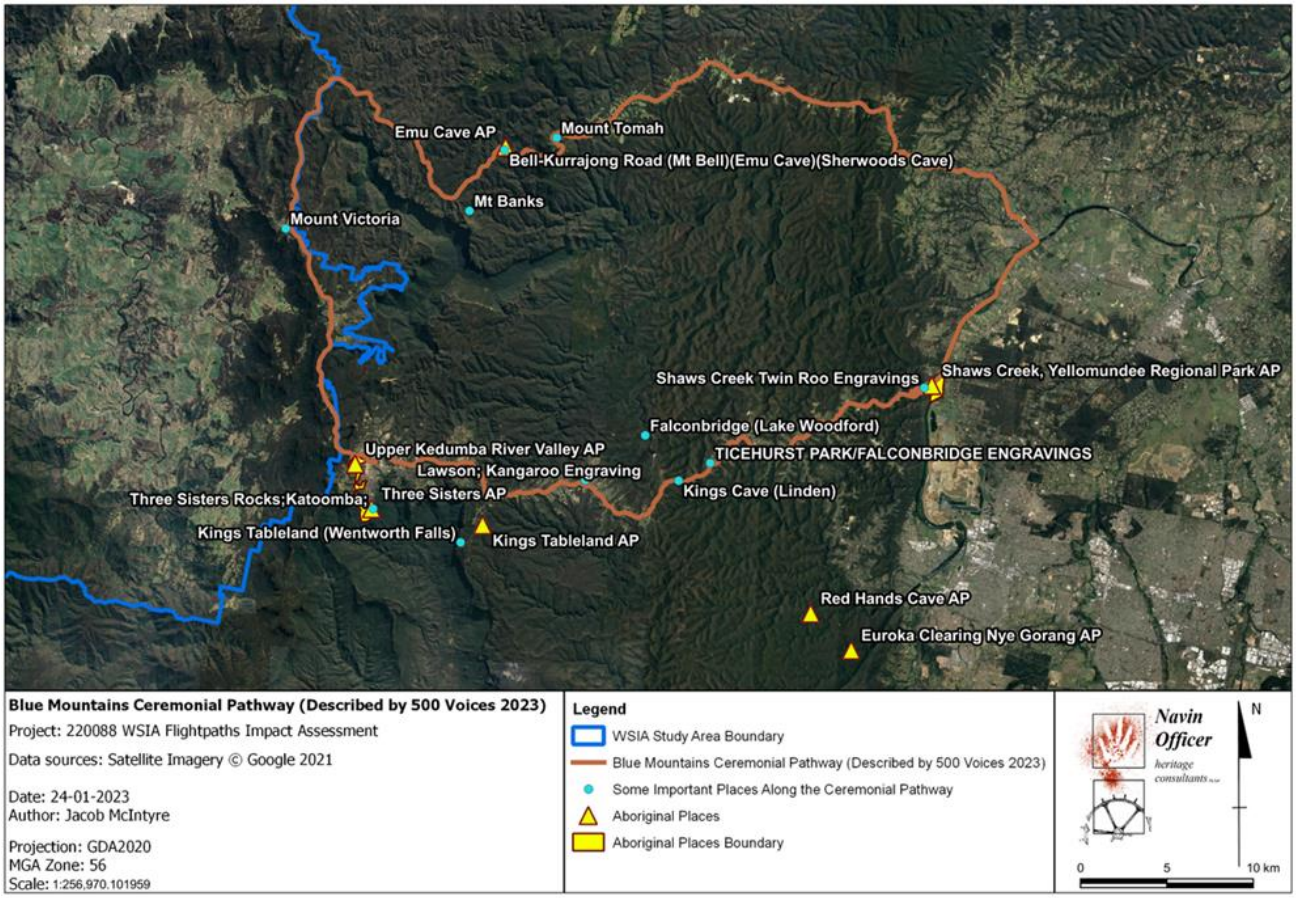

Figure C.1 An approximation of the ceremonial pathway described by Shane Smithers

Appendix D

Supplementary assessment

D1 Supplementary assessment

In response to submissions received on the Draft EIS there has been additional analysis of some historic and Aboriginal heritage sites. These sites are not considered exemplar sites, however were specifically identified in submissions and therefore this supplement to the technical paper has been prepared to consider these sites. This additional analysis of sites is included in Section D2 for historic heritage, and Section D3 for Aboriginal heritage.

D2 Historic heritage

Historic heritage sites within the Wollondilly local government area

State Heritage Register (SHR) items

Table D.1 State Heritage Register items listed within the Wollondilly local government area

Heritage item	Discussion
Brownlow Hill Estate, Brownlow Hill Loop Road, Orangeville (SHR #01489)	• Part of this property is below several preliminary flight paths: – Runway 23 Departure Southeast Night (RRO) and Runway 23 Departure South Night (RRO) - aircraft departing from WSI would be climbing between 5,000 ft (1.5 km) and 8,000 ft (2.4 km) above runway level at this location. An average of 5, up to a maximum of 10, departures could overfly this location during the night period – Runway 23 Departure East Day - aircraft departing from WSI would be climbing between 17,500 ft (5.3 km) and 20,000 ft (6 km) above runway level at this location. An average of 8, up to a maximum of 17, departures could overfly this location during the day-evening period – Runway 05 Departure East Day - aircraft departing from WSI would be climbing between 20,000 ft (6 km) above runway level and their enroute flight level at this location. An average of 6, up to a maximum of 17, departures could overfly this location during the day-evening period in 2033 and increasing over time to 2055. • The predicted noise level around 65 decibels. • Given that some flights would be at night when background noise is generally lower and this heritage property includes a residential dwelling, the potential impact on the rural landscape heritage values of the property are likely to be low to moderate.
Jarvisfield, 4 Jarvisfield Road, Antill Park Golf Club, Picton (SHR #0305)	• Several preliminary flight paths are proposed to overfly this property, and they would be at a height ranging from around 13,300 ft (4 km) to 20,000 ft (6 km). Aircraft may be seen and heard at a predicted noise level of around 42 decibels. • The property is currently a clubhouse and golf course, and the preliminary flight paths would not affect the current compatible use of this property. The impact on the cultural heritage values of the property are expected to be negligible to low.
Wilton Park (SHR #00257)	• This site is under several preliminary flight paths: – Runway 05 Departure South (Hot) Day, Runway 05 Departure South Day and Runway 05 Departure South Day – aircraft would be at a high altitude at this point. Aircraft departing from WSI would be climbing between 20,000 ft (6 km) above runway level and their enroute flight level at this location. For Runway 05, there would be an average of 9, up to a maximum of 20, departures could overfly this location during the day-evening period. For Runway 23, there would be an average of 10, up to a maximum of 20, departures could overfly this location during the day-evening period – Runway 23 Departure South Night (RRO) – aircraft departing from WSI would be climbing between 10,500 ft (3.2 km) and 13,300 ft (4 km) above runway level at this location. An average of 4, up to a maximum of 8, departures could overfly this location during the night period. • Not all flight paths would be used in the same 24-hour period. Until 2040 there are not expected to be noise levels greater than around 60 decibels. In 2040 and 2055 there may be 2–4 overflight events exceeding 60 decibels during the night period. • The impact to heritage values is considered to be low.
Upper Canal System (SHR #1373)	• The nature of the heritage values of the Upper Canal system are such that they would not be negatively impacted by the preliminary flight paths.
Menangle Railway Station Group (SHR #1191)	• This location falls outside of the N60 and N70 noise contours for WSI, however aircraft flying to and from WSI may still be seen and heard at a predicted noise level of around 42 decibels. • The impact to the heritage values of this site is assessed as negligible.
Menangle rail bridge over Nepean River (SHR #1047)	• The impact to the heritage values of this site is assessed as negligible.

Other heritage items within the Wollondilly local government area

Table D.2 Heritage items identified by local study for potential State heritage significance within the Wollondilly local government area

Heritage item	Discussion
Suspension Bridge over Nepean River	• This heritage property is currently listed as an item of local heritage significance (I78). • The following preliminary flight paths overfly this location – Runway 05 Departure South (Hot) Day, Runway 23 Departure South Day and Runway 05 Departure South Day. Aircraft passing overhead are expected to be at 20,000 ft (6 km). For Runway 05, there would be an average of 9, up to a maximum of 20, departures could overfly this location during the day-evening period in 2033 and increasing over time to 2055. For Runway 23, there would be an average of 10, up to a maximum of 20, departures could overfly this location during the day-evening period in 2033 and increasing over time to 2055. • While aircraft would be high, aircraft flying to and from WSI may still be seen and heard at a noise level of around 42 decibels. • The impact to the heritage values of this heritage item is assessed as negligible to low.
Vault Hill Cemetery	• This heritage property is currently listed as an item of Local heritage significance (I208). • The following preliminary flight paths overfly the cemetery or part of it – Runway 23 Departure Southeast Night, Runway 23 Departure South Day and Runway 05 Departure South (Hot) Day. The latter flight path is a variation of the South Day flight path, and only used on infrequent occasions when high temperatures limit aircraft climb performance on the regular track. • Aircraft would be at height ranging from around 13,300 ft (4 km) to 20,000 ft (6 km) and noise levels would be around 42 decibels. • The impact on the heritage values of this property is assessed as negligible to low.
Charleville, 258–260 Bents Basin Road, Wallacia (I267)	• This property was identified in this technical paper as being located within 10 km of the Airport Site (refer to Table 5.2). This property is beneath the following preliminary flight paths – Runway 23 Departure West Night (RRO), Runway 23 Departure Northeast Night (RRO), and Runway 23 Departure North Night (RRO). • Aircraft departing from WSI would be climbing between 2,500 ft (760 m) and 5,000 ft (1.5 km) above runway level at this location. An average of 7, up to a maximum of 10, departures could overfly this location during the night period. This location is predicted to experience a maximum noise level of 75 decibels during a typical overflight by the aircraft types expected to use WSI. By 2040 the property is predicted to also experience daytime flights, and the prediction is for both day and night-time flights to increase by 2055. • The impact to the heritage values of this property is expected to be moderate. • Interventions to the heritage building, such as double glazing and/or insulation, may require heritage approvals. • This property is a sandstone building, and could be considered for inclusion in the research program (mitigation measure H2) as an example of a sandstone heritage item within close proximity to the Airport Site, in consultation with the property owners and Heritage NSW.
Ravenswood, 543 Bents Basin Road, Wallacia (I268)	• This item is listed for its historical values, and while not specifically stated it would seem for its archaeological values. The State Heritage Inventory notes that this site consists of a number of ruins and archaeological sites. While there are multiple flight paths overhead, and both frequency of aircraft and noise would be high, the type of values for which it is currently listed are unlikely to be impacted by the preliminary flight paths. • The impact is assessed as low.
Blaxland's Farm, 2595 Silverdale Road, Wallacia (I269)	• This property was included in Table 5.2 of this technical paper. While the site is under preliminary night-time flight paths and a day-time flight path (Runway 23 Departure North (non-jet)), it is listed as a cultural landscape with archaeological remains. The remnant original farming landscape would not be impacted by the preliminary flight paths. • The impact on the heritage values for which this property is listed is assessed to be negligible.
Warragamba Supply Scheme and Warragamba Emergency Scheme (I270)	• This item is also on Water NSW s170 register. • Parts of this heritage item is listed for its State Heritage significance (as SHR # 01376), while a much larger part is listed for local heritage values. The State Heritage component was identified in Section 5.3.1.3 of this technical paper where it is identified as an item of State significance within 10 km of WSI. • The property is recognised as having State significance for its historical and scientific value under criterion f) it possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (known as rarity), and presumably (although this is not specified in the SHR entry but implied from the description) under criterion a) it is important in the course, or pattern, of NSW's cultural or natural history (known as historic significance). • The local component was acknowledged in Table 5.2 of this technical paper, where it is noted as an item of local heritage significance within a 10 km radius of WSI. • The State Heritage Inventory notes that the local listed component has been assessed as having local heritage value under criterion a) historical value; b) historical association with engineer S.T Farnsworth; c) aesthetic significance as a picturesque and modified industrial landscape; d) social significance (although noting the assessment text is unspecific and circular); e) potential archaeological research potential; and f) rarity, particularly in relation to Pumping Station Number 9. • None of the above values would be negatively impacted by the preliminary flight paths.

Heritage item	Discussion
Blaxland's Crossing (I289)	• This site was identified in Table 5.2 of this technical paper and is listed for its historical significance (criterion a) and rarity (criterion f). It is not listed for significant fabric, and its survival and maintenance is not dependent on a compatible use that might be sensitive to the types of impacts from flight paths. • The site is overflown by several preliminary flight paths: Runway 23 Departure West Night (RRO), Runway 23 Departure Northeast Night (RRO), Runway 23 Departure North Night (RRO), and Runway 23 Departure North (Non-Jet) Day. • The sites historical value and its rarity as an example of its historical value would not be diminished by the preliminary flight paths, and therefore the impact on the heritage values of this property is considered to be negligible.

Historic heritage sites within the Camden local government area

State Heritage Register (SHR) Places

Table D.3 State Heritage Register items listed within the Camden local government area

Heritage item	Discussion
Camelot, Kirkham Lane, Narellan (SHR #00385)	• The closest preliminary flight path is 2.5 km away (Runway 23 Departure East Day). This location falls outside of the N60 and N70 noise contours for WSI, however aircraft flying to and from WSI may still be seen and heard at a noise level of around 42 decibels. • The likely impact is considered negligible – low.
Denbigh, 421 The Northern Road, Cobbitty (SHR #01691)	• Two preliminary flight paths overfly this property – Runway 23 Departure East Day and Runway 05 Departure East Day. Due to the distance from the Airport Site aircraft would be relatively high (aircraft departing from WSI would be climbing between 20,000 ft (6 km) above runway level to their enroute flight level at this location). Aircraft may still be seen and heard at a noise level of around 42 decibels. • Given the values for which the property is listed and the expected height and frequency of aircraft, the potential impact on the heritage values is assessed as low.
Gledswood, 900 Camden Valley Way, Gledswood Hills (SHR #01692)	• Gledswood is an early 19th century farm estate that has close associations with the Camden area, which is the birthplace of the Australian wool industry. As well as the homestead, the listing notes the significance of the garden. • The site is not beneath a preliminary flight path, although it is within a departure transition area that may mean it is sometimes overflown as runway modes of operation change. • This site is within 1.5 km of Runway 05 Departure East Day and 1.2 km of Runway 23 Departure East Day. • The impact is assessed as low. • This site could be considered for inclusion in the research program (mitigation measure H2) as an example of a heritage garden, in consultation with the property owners and Heritage NSW.
Harrington Park, 1 Hickson Circuit, Harrington Park (SHR #01773)	• This property is not beneath a preliminary flight path, although it is within a departure transition area that may mean it is sometimes overflown as runway modes of operation change. • This location is within 2.9 km of Runway 05 Departure East Day and 2.6 km of Runway 23 Departure East Day. • The impact to heritage values is assessed as low.
Macquarie Grove Cottage, Aerodrome Road, Cobbitty (SHR #00493)	• This property is not under a flightpath, however it is on the edge of a flightpath transition zone. • This location is within 2.7 km of Runway 05 Departure East Day, 5.7 km of Runway 05 Departure Southeast Night, 2.4 km of Runway 23 Departure East Day, 4.2 km of Runway 23 Departure South Night (RRO) and 12.8 km of Runway 23 Departure Southeast Night. • This location falls outside of the N60 and N70 noise contours for WSI, however aircraft flying to and from WSI may still be seen and heard at a noise level of around 42 decibels. • The likely impact on heritage values is assessed as low.
Maryland, 773 The Northern Road, Bringelly (SHR #01690)	• This site was included in this technical paper as a site within a 10 km radius of the Airport Site. Maryland is not beneath a preliminary flight path, however aircraft may still be seen and heard at a noise level of around 42 decibels. • The likely impact on heritage values is assessed as low.
Nant Gwylan and Garden, Exeter Street, Camden (SHR #00243)	• This property is not beneath a preliminary flight path. It is within 4.7 km of Runway 23 Departure South Night (RRO), within 11.8 km of Runway 23 Departure Southeast Night, and within 5.6 km of Runway 05 Departure Southeast Night. • The likely impact to assessed heritage values is negligible to low. • The gardens at this property are referred to as part of the heritage values. The heritage values of the property are dependent on the gardens. Therefore, this site could be considered for inclusion in the research program (mitigation measure H2) as an example of a heritage garden, in consultation with the property owners and Heritage NSW.

Heritage item	Discussion
Oran Park, 112–130 Oran Park Drive, Oran Park (SHR #01695)	• This location falls outside of the N60 noise contours for WSI, however aircraft flying to and from WSI may still be seen and heard at a noise level of around 42 decibels. • The impact on heritage values is assessed as negligible to low.
Orielton, 181–183 The Northern Road, Harrington Park (SHR #01693)	• This location is not under a preliminary flight path, however it is within a Departure Transition area that may mean it is sometimes overflown as runway modes of operation change. • The closest flight past is 2.3 km away (Runway 23 Departure East Day). Aircraft at this point on this flight path would be around 20,000 ft (6 km) above runway level. • The assessed heritage impact is negligible to low.
Raby, 1025 Camden Valley Way, Catherine Field (SHR #1694)	• This property is not beneath a flight path, however it is within a departure transition area that may mean it is sometimes overflown as runway modes of operation change. • The site is only 0.3 km from Runway 23 Departure East Day and 0.6 km from Runway 05 Departure East Day. Aircraft at this point on this flight path are expected to be around 20,000 ft (6 km) and climbing. • This location falls outside of the N60 and N70 noise contours for WSI, however aircraft flying to and from WSI may still be seen and heard at a noise level of around 42 decibels. • The impact on heritage values is assessed as negligible to low.
St John's Anglican Church Precinct, 6-22 Menangle Road, Camden (SHR #02006)	• This location is not beneath a preliminary flight path, however it is within a departure transition area that may mean it is sometimes overflown as runway modes of operation change. • The site is within 4.4 km of Runway 23 Departure East Day (where aircraft would be at 20,000 ft (6 km) and climbing) and within 4.7 km of Runway 05 Departure East Day. • This location falls outside of the N60 and N70 noise contours for WSI, however aircraft flying to and from WSI may still be seen and heard at a noise level of around 42 decibels. • Impact on listed heritage values is assessed as negligible to low.
Studley Park, Camden Valley Way, Narellan (SHR #00389)	• This location is not beneath a WSI flight path, however it is within a departure transition area that may mean it is sometimes overflown as runway modes of operation change. • The site is within 4.9 km of Runway 05 Departure East Day and within 4.6 km of Runway 23 Departure East Day. • This location falls outside of the N60 and N70 noise contours for WSI, however aircraft flying to and from WSI may still be seen and heard at a noise level of around 42 decibels. • The impact on the listed heritage values is assessed as negligible to low.

Other historic sites

Table D.4 Other historic sites

Heritage item	Discussion
Horsley Homestead	State Heritage Register site Horsley complex (homestead, outbuildings, garden and farm) (SHR #30) was noted in Table 5.1 as a State Heritage Register place under a preliminary flight path. The maximum noise level (60 dB(A)) and frequency (8–19 arrivals during the day-evening period in 2033) of aircraft over Horsley Homestead is expected to have a low-moderate impact on heritage values.
Hydro Majestic	The Hydro Majestic is overflown by a preliminary flight path (Runway 05 Departure West Day), and is also located in a departure transition area. When Runway 05 is in use during the day-evening period, aircraft would be climbing between 17,500 ft (5.3 km) and 20,000 ft (6 km) above runway level, with an average of 5, up to a maximum of 11, departures that could overfly this location in 2033 and increasing over time to 2055. Aircraft from preliminary flight paths would be at relatively high altitudes over the Hydro Majestic, and the site is not located within the N60 or N70 noise contours. For this reason, the heritage values of this property would not be negatively impacted by the project.

Historic heritage sites within the Penrith local government area

Table D.5 Historic heritage items listed within the Penrith local government area

Heritage item	Discussion
Wallacia Public School Penrith LEP#825 1573-1585 Mulgoa Road WALLACIA NSW 2745	• The Runway 23 Departure North (Non-Jet) Day flight path overflies this location with an average of 3 and up to a maximum 8 of departures during the Day-evening period. Aircraft would be at 2,500–5,000 ft above the runway. It is also within 0.2 km of a WSI flightpaths: Runway 23 Departure North Night (RRO)), Runway 23 Departure West Night (RRO), Runway 23 Departure Northeast Night (RRO)). • Frequency of N60 events would be below 10 movements in 2033, and would increase to 20–49 overflight events by 2055 (under the Prefer Runway 23 scenario). The maximum noise level (external) for the school during the day would be 66 decibels. • The historic buildings are painted weather board. This historic item is used as a school and its continuous use as a school forms part of its heritage value. It is listed for the criteria a) Historical d) Social and g) representativeness. • Internal noise levels would be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. The impact of frequent high noise events is assessed as moderate to severe, depending on any required intervention the asset owner may implement in response to aircraft noise. Any such modifications would be subject to heritage approvals. • Impact of emissions (if any) on the weatherboard building fabric is unable to be determined.
Wallacia Post Office LEP #851 1589 Mulgoa Road WALLACIA NSW 2745	• Runway 23 Departure North (Non-Jet) Day overflies this location. Aircraft will be at 2,500–5,000 ft above runway. This location is predicted to experience a maximum noise level of 75 decibels during a typical overflight. Frequency of flights is expected to be an average of 3 up to a maximum of 8 departures although increasing over time to 2055. • This location is also within 0.1 km of Runway 23 Departure North Night (RRO), Runway 23 Departure West Night (RRO) and Runway 23 Departure Northeast Night (RRO). Nighttime occurrences are expected at a frequency of 50-9 occurrences but rising to 10-19 nighttime occurrences by 2055. • The item has been listed as it provides ‘evidence of the growth of Wallacia after WWII, due in large part to accommodating workers involved in the construction of the nearby Warragamba Dam’ and satisfies criteria a) historical, g) representativeness. • The historic building is painted weatherboard. • The post office has an attached residence and if the residence is in use, then the nighttime occurrences exceeding N60 may be an issue. Internal noise levels would be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. The continued historic operation of the post office is unlikely to be significantly impacted by the low frequency of daytime noise and will not be impacted by visual intrusion. • The impact on the heritage values is anticipated to be moderate. • Impact of emissions (if any) on the weatherboard building fabric is unable to be determined.
Mulgoa Road Conservation Area Penrith LEP #HCA5 1582-1586 & 1581-1587 Mulgoa Road WALLACIA NSW 2745	• Runway 23 Departure North (Non-Jet) Day overflies these properties with an average of 3, up to a maximum of 8 departures, could overfly this location during the Day – Evening period. This may increase by 2055. • This location is predicted to experience a maximum noise level of 75 decibels during a typical overflight. Occurrences over N60 are predicted to increase over time. • The conservation area is listed as ‘the houses in the Mulgoa Road Conservation Area are good examples of residential development from the interwar period in a cohesive group that make a positive contribution to the streetscape in the centre of the village’, and satisfies criteria a) historical and g) representativeness. • The conservation area is comprised of residential properties. The heritage values of heritage cottages are generally maintained through their continued use, as when left unoccupied they fall into disrepair. Nighttime occurrence of N60 and above may affect amenity. Internal noise levels would also be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. Property owners may undertake modifications to the property in response to aircraft noise, which may require heritage approvals. • The impact on the heritage values of the conservation area properties are expected to be moderate. • Modifications to manage noise may require heritage approvals.

Heritage item	Discussion
Wallacia Hotel LEP #325 1590-1594 Mulgoa Road WALLACIA NSW 2745	• Runway 23 Departure Northeast Night (RRO), Runway 23 Departure North Night (RRO), and Runway 23 Departure North (Non-Jet) Day overfly this location. Aircraft departing from WSI will be climbing between 2,500 and 5,000 ft above runway level. An average of 3 departures up to a maximum of 8 departures are expected during the Day-evening period and from 4–6 during the overnight period in 2033 and increasing over time to 2055. • This location is predicted to experience a maximum noise level of 75 decibels during a typical overflight. • The item has been listed as 'the Wallacia Hotel is an excellent example of an inter-war country resort style hotel in the Stockbroker's Tudor style. Historically the building amply demonstrates the theme of leisure which is expressed through its scale, architectural style, public bar and provision of accommodation', and satisfies criteria a) historical, c) aesthetic, f) rarity. • The hotel provides accommodation as well as public bar services. The property is not specifically listed for its social value although its historical and continuing use as for accommodation and as a social gathering spot for the local community would indicate it should be. The other heritage values will not be affected. • Nighttime occurrence of N60 and above may affect amenity. Internal noise levels would also be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. Property owners may undertake modifications to the property in response to aircraft noise, which may require heritage approvals. • The likely impact is assessed as moderate.
Luddenham Homestead site LEP #A849 1-9 Park Road WALLACIA NSW 2745	• Runway 23 Departure Northeast Night (RRO), Runway 23 Departure North Night (RRO), and Runway 23 Departure North (Non-Jet) Day overfly this location. Aircraft departing from WSI will be climbing between 2,500 ft and 5,000 ft above runway level and a maximum noise level of 75 decibels during a typical overflight is expected. • This heritage item is listed for its archaeological potential and this value will not be impacted by the proposed flight paths. • The impact would be nil.
Former St. Andrews Anglican Church LEP #326 25 Park Road WALLACIA NSW 2745	• Runway 23 Departure Northeast Night (RRO), Runway 23 Departure North Night (RRO), and Runway 23 Departure North (Non-Jet) Day overfly this location. Aircraft departing from WSI will be climbing between 2,500 ft and 5,000 ft above runway level and a maximum noise level of 66 decibels (day) and 52 decibels (evening). Internal noise levels would be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. • The item is listed as 'the former church is a good representative example of a modest rural weatherboard church which demonstrates growth in the village in the 1920s necessitating provision of community services. The compact scale and resolution of design make the church the most attractive of this type of church in Penrith LGA', and satisfies criteria a) historical c) aesthetic and f) representativeness. • The church is currently in use as a Christian Church. Internal noise levels would also be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. Property owners may undertake modifications to the property in response to aircraft noise, which may require heritage approvals. • The relatively low frequency of high noise occurrences suggests that the impact would be moderate although the maximum noise level may be disruptive if it coincides with church services given the timber and iron construction.
Park Road Conservation Area LEP #HCA6 22-26 Park Road WALLACIA NSW 2745	• Runway 23 Departure North (Non-Jet) Day overflies this location, and it is close to several other flight paths including within 0.2 km of Runway23 Departure North Night (RRO), Runway 23 Departure West Night (RRO), and Runway 23 Departure Northeast Night (RRO). Aircraft departing from WSI will be climbing between 2,500 ft and 5,000 ft and a maximum noise level of 75 decibels during a typical overflight is expected. • The Park Road Conservation Area is listed as it 'is an attractive group of Inter-War cottages that adapt the Inter-War California Bungalow style to a small cottage. Matching in original form, detail, scale and materials and located close to the street at the eastern approach to the village, the group makes a positive contribution to the streetscape. The Park Road Conservation Area relates to the Inter-War period when Wallacia was a popular tourist destination'. It satisfies criteria a) historical, c) aesthetic and g) representativeness. • The conservation area is comprised of residential properties. The heritage values of heritage cottages are generally maintained through their continued use, as when left unoccupied they fall into disrepair. • Nighttime occurrence of N60 and above may affect amenity. Internal noise levels would also be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. Property owners may undertake modifications to the property in response to aircraft noise, which may require heritage approvals. • The impact on the heritage values of the property is expected to be moderate.
Bungalow LEP #812 38 Greendale Road WALLACIA NSW 2745	• Runway 23 Departure West Night (RRO), Runway 23 Departure Northeast Night (RRO), Runway 23 Departure North Night (RRO), and Runway 23 Departure North (Non-Jet) Day overfly this location. Aircraft departing from WSI will be climbing between 2,500 ft and 5,000 ft and a maximum noise level of 75 decibels during a typical overflight is expected. In 2033, around 5-9 movements at or above 60 dB(A) would occur at night. This would increase to around 20–49 movements by 2055. By 2055, 5–9 movements at or above 70 decibels would occur. • The item is listed as it is 'unique in the local context for the quality of its design… the house is an excellent example of the popular inter-war California Bungalow within a rural context, which demonstrates an important phase in the development of Wallacia with the coming of residences and guesthouses in the 1920s', and it satisfies criteria a) historical, c) aesthetic and f) rarity. • The heritage values of heritage cottages are generally maintained through their continued use, as when left unoccupied they fall into disrepair. Nighttime occurrence of N60 and above may affect amenity. Internal noise levels would also be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. Property owners may undertake modifications to the property in response to aircraft noise, which may require heritage approvals. • The impact on the heritage values of the property is expected to be moderate.

Heritage item	Discussion
Wallacia Progress Association Hall LEP #850 40 Greendale Road WALLACIA NSW 2745	• Runway 23 Departure West Night (RRO), Runway 23 Departure Northeast Night (RRO), Runway 23 Departure North Night (RRO), and Runway 23 Departure North (Non-Jet) Day overfly this location. Aircraft departing from WSI will be climbing between 2,500 ft and 5,000 ft and a maximum noise level of 75 decibels during a typical overflight is expected. • The item has been listed as it 'is a focal point for social activities in the local community. It is a representative example of a 1940's community hall.', and it satisfies criteria d) Social and g) representativeness • This is not a residential building; however, its significance is linked to its role as a social gathering point for the community. Building function is likely to be relatively unaffected by the frequency of flights proposed, although property owners may undertake modifications to the property in response to aircraft noise, which may require heritage approvals. • Impact is likely to be moderate.
Brick house LEP #811 96-100 Greendale Road WALLACIA NSW 2745	• Runway 23 Departure West Night (RRO), Runway 23 Departure Northeast Night (RRO), Runway 23 Departure North Night (RRO) overfly this location and Runway Departure North (Non-Jet) Day is within 0.1 km of the site. Aircraft departing from WSI will be climbing between 2,500 ft and 5,000 ft and a maximum noise level of 75 decibels during a typical overflight is expected. • The item has been listed as it is 'unique in the local area… the building is an excellent and substantial example of a late nineteenth century farmhouse, which demonstrates the pastoral and agricultural economy of the area of the nineteenth century and early twentieth century.', and satisfies criteria a) historical, c) aesthetic and f) rarity. • The heritage values of heritage cottages are generally maintained through their continued use, as when left unoccupied they fall into disrepair. Nighttime occurrence of N60 and above may affect amenity. Internal noise levels would also be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. Property owners may undertake modifications to the property in response to aircraft noise, which may require heritage approvals. • The impact on the heritage values of the property is expected to be low.

Historic heritage sites within the Western Parkland City SEPP

Table D.6 Historic heritage items listed within the Western parkland City SEPP

Heritage item	Discussion
Kelvin (also on the SHR #00046) I3 30 The Retreat, Bringelly	• This location is not beneath a WSI flight path however you may still see and hear aircraft at a noise level of around 42 decibels.
Luddenham Public School I7 2158 The Northern Road, Luddenham (SHI database - Heritage Item ID: 1970085)	• This location is within 0.9 km of a WSI flight path (Runway 5 Arrival North Day, Runway 05 Arrival North (RNP) Day, Runway 05 Arrival West Day, Runway 05 Arrival East Day, Runway 05 Arrival North Day). This location is predicted to experience a maximum external noise level of 72 decibels during a typical overflight. • A high number of aircraft movements is expected i.e. between 50–99 daytime flights rising to more than 200 by 2055. • The item is listed as 'Luddenham Public School classroom is a representative example of a pre-war rural school architecture in good condition. It has been in constant educational use for 80 years and on a site that has been in educational use since 1860. The school is part of a group of early buildings on the Northern Road, including the Progress Hall, Uniting Church and St James Anglican Church (all in Penrith LGA).'. It satisifes criteria a) Historical, b) Historical association c) Aesthetic, e) Research/archaeological, g) representativeness. • The oldest building dates to 1914 and consists of weatherboard. • This historic item is used as a school and its continuous use as a school forms part of its heritage value. Its current and historic use is focused during the day when noise disruptions will be frequent and are expected to increase in frequency over time. Internal noise levels would be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. • It is also acknowledged that strategies released for Luddenham Village identify the intention for the continued use of the property for education purposes. • The impact of frequent high noise events on the heritage value is assessed as moderate to severe, depending on any modifications that the asset owner may implement in response to aircraft noise. Any such modifications would be subject to heritage approvals. • Impact of emissions (if any) on the weatherboard building fabric is unable to be determined.
Wilmington reserve I9 17 Jamison Street, Luddenham (SHI database-Heritage Item ID: 1970054)	• This location is not beneath a WSI flight path in the currently displayed runway operating mode and time of day, however you may still see and hear aircraft using WSI and other airports flying overhead. It is within 0.9 km of a WSI flight path (Runway 05 Arrival North Day, Runway 5 Arrival North (RNP) Day, Runway 5 Arrival East Day, Runway 5 Arrival North Day). • There is no readily available inventory for the item or details of its heritage value. • This location is predicted to experience a maximum noise level of 70 decibels during a typical overflight. A high number of aircraft movements is expected i.e. between 50-99 daytime flights rising to more than 200 by 2055. • The anticipated noise level and frequency of nearby aircraft movements is expected to impact its use as an area of quiet recreation but will have no impact on other heritage values.

Heritage item	Discussion
Mount Pleasant homestead I4 3 Shannon Road, Bringelly (SHI database Heritage Item ID: 1970094)	• This location is not beneath a WSI flight path however you may still see and hear aircraft using WSI and other airports flying overhead at a noise level of around 42 decibels. The closest flight path is 2.2 km away (Runway 23 Arrival East Day). • The item is listed as it is an intact example of a Federation farm cottage in the western districts of Liverpool. The form and shape of the original house are representative of a typical Australian country house with the main roof extending at a lower pitch over open verandahs. Much original fabric and detailing has been retained. There is the potential to gain more information on the site from further architectural, archaeological and documentary research' (Australian Museum Business Services, 2014). The item satisfies criteria a) historical, c) aesthetic, e) research (architectural, archaeological and documentary), f) rarity and g) representativeness. • While aircraft will be visible noise levels are expected to be low. • There will be negligible to low impact on heritage values
Weatherboard cottage I10 3065–3067 The Northern Road, Luddenham (SHI database Heritage ID 2260678)	• The following WSI flight paths overfly this location: – Runway 05 Arrival East Day – aircraft will be from 10,500–13,300 ft above runway – Runway 05 Arrival North Day – aircraft will be between 8,000 and 10500 ft above runway – Runway 23 Arrival East Day – aircraft will be between 5,000–8,000 ft above runway. • The frequency of flights when runway 05 is used is an average of 15 up to a maximum of 36 arrivals during the day-evening period in 2033 and increasing over time to 2055. When runway 23 is in use the frequency of arrivals is expected to be an average of 8 up to a maximum of 17 arrivals during the day evening period in 2033 and increasing over time to 2055. • This location is predicted to experience a maximum noise level of 60 decibels during a typical overflight. • The item is listed as it is a turn of the century weatherboard cottage that 'provides insight into the evolution of residential development in Luddenham following the release of freehold land in the 1880s. The cottage is a very good example of a Federation era cottage set within a rural village allotment. The scale and materials of the cottage and its garden setting contributes to defining Luddenham as a nineteenth century rural village in the region. The building is one of a number of structures in Luddenham village erected over the nineteenth century and early part of the twentieth century which collectively demonstrate the pattern of a village settlement at this important location on The Great Northern Road.' It satisfies criteria a) historical, c) aesthetic and g) representativeness. • The heritage values of heritage cottages are generally maintained through their continued use as when left unoccupied they fall into disrepair. • The impact on the property is not expected to affect its use and therefore the impact on heritage values is expected to be low. • Impact of emissions (if any) on the weatherboard building fabric is unable to be determined.
Brick cottage I6 21–55 Campbell Street Luddenham (SHI database - Heritage Item ID: 2260117)	• This property is not under a flight path. The closest flight path Runway 23 Arrival East Day is 1 km away; others both day and night are within 2km. This location is predicted to experience a maximum noise level of 65 decibels during a typical overflight. • The frequency of flights likely to occur above N60 particularly at night are of concern as nighttime occurrences are predicted to increase from 5–9 overflights to 10–19 overflight by 2055. Daytime occurrences are similarly expected to increase from 20–49 up to 50-99 occurrences by 2055. • The item is listed as it provides insight into the development of a rural economy in the area from the late-nineteenth century. The cottage is an excellent example of a house of its era of brick masonry construction', and it satisfies criteria a) historical, c) aesthetic. • The heritage values of heritage cottages are generally maintained through their continued use, as when left unoccupied they fall into disrepair. Aircraft noise, particularly at night may affect amenity. Internal noise levels would also be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. Property owners may undertake modifications to the property in response to aircraft noise, which may require heritage approvals. • The impact on the heritage values of the property is expected to be moderate.
Luddenham Progress Hall I12 3091–3095 The Northern Road, Luddenham	• The following WSI flight paths overfly this location: – Runway 05 Arrival East Day – Runway 05 Arrival North Day – Runway 23 Arrival East Day. • This location is predicted to experience a maximum noise level of 60 decibels during a typical overflight. • The Progress Hall, built in 1886, is rendered brick. It has been assessed as having local heritage significance (Australian Museum Business Services, 2014). Further detail on its significance is not available on the register. • The impact on heritage values from noise and visual intrusion is assessed as low. • Impact of emissions (if any) on the brick and plaster building fabric is unable to be determined.

Heritage item	Discussion
Showground I15 428–452 Park Road, Luddenham	• The heritage item is not directly under a flight path but is within 0.9 km of Runway 05 Arrival North Day and within 0.7 km of Runway 23 Arrival East Day. It is also within 2km of several nighttime flight paths. This location is predicted to experience a maximum noise level of 60 decibels during a typical overflight. • Detail on its significance is not available on the register. It satisfies criteria a) Historical value; c) aesthetic significance d) social significance g) rarity. • The daytime overflights are not likely to cause and impact to the traditional use of showground during the day. However, the number of daytimes occurrences above 60 decibels is expected to increase over time, and this may become more disruptive to some showground activities. Impact to heritage values is assessed as low to moderate.
St James Anglican Church and cemetery I14 3101–3125 The Northern Road, Luddenham (SHI database - Heritage Item ID: 2260122)	• The following WSI flight paths overfly this location: – Runway 05 Arrival East Day (10,500–13,300 ft above the runway) – Runway 05 Arrival North Day (8,000–10,500ft above the runway) – Runway 23 Arrival East Day (5,000–8,000ft above the runway) • This location is predicted to experience a maximum noise level of 75 decibels during a typical overflight. • The church is 'a simple building constructed of local stone c.1870, with the cemetery to its west, with the graves of James Lachlan Lawson (1893) and a member of the Roots family who died in battle in 1945. The stained-glass windows are predominantly geometric florals (fleur-de-lis) and shapes.' It satisfies the following criteria a) historic, b) historical association, c) aesthetic, d) social and g) representativeness. • Moderate impact to heritage values.
The Fleurs Radio Telescope Site I5 885(a) Mamre Road, Kemps Creek	• The property exists as a ruin. The proposed flightpaths will have no impact on the heritage values as listed.
Weatherboard cottage I11 3075 The Northern Road, Luddenham (SHI database - Heritage Item ID: 2260118)	• This location is not beneath a WSI flight path. It is within 1.2 km of a WSI flight path (Runway 23 Departure Northeast Night) and is within 1.5 km of several other flightpaths. This location is predicted to experience a maximum noise level of 65 decibels during a typical overflight. The number of events exceeding 60 decibels at night will rise form 5–9 flights in 2033 – 10–19 flights in 2055. Similarly the predicted daytime exceedances will rise for 50–99 flights in 2033 to 100–199 flights in 2055. • The item is listed as this 'late nineteenth century weatherboard cottage provides insight into the evolution of residential development in Luddenham following the release of freehold land in the 1880s. The cottage is a very good example of a Federation era cottage set within a rural village subdivision. The scale and materials of the cottage and its garden setting contributes to defining the village as a nineteenth century rural village in the region. The building is one of a number of structures in Luddenham village erected over the nineteenth century and early part of the twentieth century that demonstrates the pattern of a village settlement at this important location on The Great Northern Road.'. It satisfies criteria a) historical c) aesthetic g) representativeness. • The heritage values of heritage cottages are generally maintained through their continued use, as when left unoccupied they fall into disrepair. Aircraft noise, particularly at night may affect amenity. Internal noise levels would also be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. Property owners may undertake modifications to the property in response to aircraft noise, which may require heritage approvals. • The impact on the heritage values of the property is expected to be moderate.
Luddenham Uniting Church and cemetery I13 3097–3099 The Northern Road, Luddenham (SHI database- Heritage Item ID: 2260120)	• The following WSI flight paths overfly this location: – Runway 05 Arrival East Day (10,500–13,300ft above runway) – Runway 05 Arrival North Day (8,000–10,500 ft above runway) – Runway 23 Arrival East Day (5000–8,000ft above runway). • This location is predicted to experience a maximum noise level of 60 decibels during a typical overflight. • The item is listed for the following – 'Completed in 1886, the building is a unique example of an extant former Primitive Methodist Church in the LGA and demonstrates the development of a village at Luddenham in the late nineteenth century and the commencement of the provision of community services. The building is a good example of a rural church of the late nineteenth century retaining a form and detailing which provides insight into this type of building of the era, and its rural setting atop a rise on The Northern Road. The building continues in use as a Uniting Church and is one of a number of structures in Luddenham village erected over the nineteenth century and early part of the twentieth century that demonstrates the pattern of a village settlement at this important location on The Northern Road. This building is one of a contiguous group of three church related buildings. The cemetery is an important element within the Luddenham Village Centre, illustrating the development of the village in the 1870s - 80s.', It satisfies criteria a) historical c) aesthetic and d) social, f) rarity and g) representativeness. • The impact to heritage values is assessed as low. • Impact of emissions (if any) on the stone building fabric is unable to be determined.

Heritage item	Discussion
McGarvie Smith Farm I1 1793–1951 Elizabeth Drive, Badgerys Creek	• The following WSI flight paths overfly this location: – Runway 05 Arrival East Day – Runway 05 Arrival North Day – Runway 23 Arrival East Day. • Aircraft is expected to be between 10,500-13,300 ft above runway. • This location is predicted to experience a maximum noise level of 70 decibels during a typical overflight. • The item is listed for the following – 'The McGarvie Smith Farm has interest as a veterinary research centre for Sydney University since 1936. These buildings are the only known example of rural research institution buildings in the Penrith City Council area. The c.1936 buildings are representative examples of Inter-War design applied to rural research buildings. The office building uses good proportions in a symmetrical design composed of primary and secondary roof forms and regular door and window openings. The scale, proportions and regular pattern of openings is continued in the less formal student accommodation building'. It satisfies criteria a) historical, c) aesthetic, f) rarity. • The heritage site has been subject to a major impact by the construction and future operation of the M12 Motorway, including demolition of some structures and severance of the remaining portions of land. The site has also been rezoned for enterprise uses under the SEPP. Any impact on the remaining heritage values by the project is assessed as low.
Lawson's Inn site (former "The Thistle" site) I9 2155 The Northern Road, Luddenham	• This location is not beneath a WSI flight path. It is within 1.2 km of a WSI flight path (Runway 05 Arrival North Day, RUNWAY 5 Arrival North (RNP) Day, Runway 05 Arrival West Day, Runway 05 Arrival East Day, Runway 05 Arrival North Day). • This location is predicted to experience a maximum noise level of 65 decibels during a typical overflight. • The item is an archaeological site. The Inn predated the settlement of Luddenham having been built to service travellers long The Northern Road. It is estimated to have been built mid 1830s and was demolished mid twentieth century. • The archaeological values would not be impacted by the project.
Birling 1937 - I23 (Camden Growth Centres Precinct) 975 The Northern Road, Bringelly	• This location falls outside of the selected noise contours for WSI however aircraft flying to and from WSI many still be visible and heard at a noise level of around 42 decibels. • There are no details readily available on its listing but appears to be a historic location with archaeological potential. • No impact to heritage values.
Maryland Homestead, including homestead, grounds, outbuildings, stone cottage, former winery, stone store and gatekeeper's cottage Item1 Camden growth centres precinct. SHR # 01690 773 The Northern Road, Bringelly	• This location falls outside of the selected noise contours for WSI however aircraft flying to and from WSI many still be visible and heard at a noise level of around 42 decibels. It is within 0.2 km of a WSI flight path Runway 5 Departure East Day and within 0.5 km of a WSI flight path Runway 23 Departure East Day. • The impact to heritage values will be low. • Impact of emissions (if any) on the building fabric is unable to be determined.

Mulgoa, Luddenham Village and Wallacia

It is inevitable that some properties would suffer some impact from noise, given that in many cases to the west and south-west of WSI, the properties are located in rural contexts.

Mulgoa is an historic rural village with several significant historic heritage properties such as Fernhill Estate and St Thomas's Church. These properties will be directly overflown by aircraft departing overnight from Runway 05 at relatively low altitudes (2,500–5,000ft) by 10–20 flights per day by 2055. Some aircraft may fly lower altitude depending on weather and operations conditions. there will be some daytime flights at descending from 8,000 ft to 5,000 ft arriving to Runway 05. The expected noise levels will shift from the tranquillity of a rural location to disruptions of up to a maximum of approximately 70 dB(A) (external) during a typical overflight by the aircraft types expected to use WSI. Given the aircraft altitude and aircraft noise, Fernhill and other heritage places at Mulgoa would be subject to moderate impacts to any heritage values that are associated with the tranquillity of rural settings, and indirect impacts to the fabric of heritage buildings (should property owners undertake modifications to the property in response to aircraft noise). The impact of emissions on physical fabric particularly of sandstone buildings is undetermined but of concern. It is recommended that the flight paths be reconsidered, so as to avoid Fernhill Estate and Mulgoa.

Luddenham Village has several sites of local heritage significance. Impact to the majority of the heritage places range from no impact to moderate impact depending on the type of heritage values for which the properties are listed with the exception of Luddenham Public School. This historic item is used as a school and its continuous use as a school forms part of its heritage value. Noise disruptions during the day would be frequent and are expected to increase in frequency over time. Internal noise levels would be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. The impact of frequent high noise events on the heritage value is assessed as moderate to severe, depending on any modifications that the asset owner may implement in response to aircraft noise. Any such modifications would be subject to heritage approvals.

Wallacia has several sites of local heritage significance listed in the Penrith LEP 2010 (Penrith City Council, 2010), including the Luddenham Homestead and archaeological site (#A849). Impact to the majority of the heritage places range from no impact to moderate impact depending on the type of heritage values for which the properties are listed with the exception of Wallacia Public School. Similar to Luddenham Public School, noise disruptions during the day would be frequent and are expected to increase in frequency over time. Internal noise levels would be dependent on the condition of the building fabric and/or recent additions/modifications to the buildings. The impact of frequent high noise events on the heritage value is assessed as moderate to severe, depending on any modifications that the asset owner may implement in response to aircraft noise. Any such modifications would be subject to heritage approvals.

D3 Aboriginal heritage

Other historic sites

Table D.7 Aboriginal heritage sites

Heritage item	Discussion
Burragorang Valley	Impacts across this area were discussed with First Nations people using large scale photos. A number of preliminary flight paths overlap across part of the valley (for example, north of Nattai) and the altitude of aircraft would range from 5,000 to 20,000 ft (1.5 km and 6 km) above the ground surface. Noise is predicted to not exceed 65 dB(A) and the expected impact on Aboriginal sites generally is expected to be low.
Koobawilla	This site is not beneath a preliminary flight path, although it is located in a departure transition area that may mean it is sometimes overflown as runway modes of operation change. This site has a predicted noise level of around 42 dB(A). There is expected to be no disruption to the Aboriginal values associated with the reflection of the stars.
Bouddi National Park	Part of the park would be overflown by a preliminary flight path (Runway 05 Departure North-east (non-jet) Day). Aircraft are expected to be at a height of around 20,000 ft (6 km) above runway level, and the frequency of flights would be low. The impact to the park is expected to be negligible to low.

Australian Government

Department of Infrastructure, Transport,
Regional Development, Communications and the Arts