

OFFICIAL



Western Sydney Airport

**Biodiversity
Construction Environmental Management Plan
October 2021**



**Western
Sydney
Airport**

Document Control

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Plan Authorisation

Position	Name	Signature	Date
Environment Manager	L Laughton		26/10/2021

Glossary and Definitions

Item	Definition
The Act	<i>Airports Act 1996 (Cth) (Airports Act)</i>
AEPR	<i>Airports (Environment Protection) Regulations 1997</i>
Airport	Western Sydney International (Nancy-Bird Walton) Airport (WSI) located at the Airport Site. Note: The Airport is referred to in the Act as Sydney West Airport and is commonly known as Western Sydney International (Nancy-Bird Walton) Airport
Airport Lease	An airport lease for the Airport granted under section 13 of the Act
Airport Lessee Company	The company that is granted a lease over the Airport Site
Airport Plan	Means the airport plan for the Airport Site as determined by the Infrastructure Minister under section 96B of the Act in December 2016 as varied from time to time in accordance with the Act.
Airport Site	The site for Sydney West Airport as defined by the Airports Act.
Ancillary Developments	An 'ancillary development' as set out in section 96L of the Act
BoM	Bureau of Meteorology
Bulk Earthworks	The large scale earthworks required to flatten the Stage 1 area in preparation for further construction works as described in section 6 of the Construction Plan
CEMP	Construction Environmental Management Plan
Condition	A condition set out in Part 3 of the Airport Plan in accordance with section 96C of the Act
Construction Impact Zone	The part or parts of the Airport Site or an Associated Site on which Main Construction Works are planned to occur, as detailed in the Construction Plan approved in accordance with Condition 1.
CSEP	Community and Stakeholder Engagement Plan
DPI	Department of Primary Industries (including Agriculture NSW, Fisheries NSW and NSW Office of Water)
Ecological sustainable development	Using, conserving and enhancing the community's resources so that the ecological processes on which life depends are maintained and the total quality of life now and in the future, can be increased (Council of Australian Governments, 1992).
EEW	The Phase of the Stage 1 Development that involves early earthworks as described in section 6 of the Construction Plan
Environment Minister	The Minister responsible for the EPBC Act
Environmental Impact Statement	The environmental impact statement prepared in relation to the Airport under the EPBC Act
EPA	NSW Environment Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i>
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999 (Cth)</i>
ESA	Environmentally Sensitive Area
EWMS	Environmental Work Method Statement

Item	Definition
Infrastructure Department	The department responsible for administering the Act, currently the Australian Government Department of Infrastructure, Transport Regional Development and Communications (DITRDC)
ISO 14001	AS/NZS ISO 14001:2016 Environmental Management Systems
LDP	Land Disturbance Permit
Main Construction Works	Substantial physical works on a particular part of the Airport Site (including large scale vegetation clearance, bulk earthworks and the carrying out of other physical works, and the erection of buildings and structures) described in Part 3 of the Airport Plan, other than TransGrid Relocation Works or Preparatory Activities.
Non-conformance	Failure to conform to the requirements of the SEMF or supporting documentation.
Preparatory Activities	Preparatory Activities mean the following: <ul style="list-style-type: none"> a. day to day site and property management activities; b. site investigations, surveys (including dilapidation surveys), monitoring, and related works (e.g. geotechnical or other investigative drilling, excavation, or salvage); c. establishing construction work sites, site offices, plant and equipment, and related site mobilisation activities (including access points, access tracks and other minor access works, and safety and security measures such as fencing but excluding bulk earthworks); d. enabling preparatory activities such as: <ul style="list-style-type: none"> i. demolition or relocation of existing structures (including buildings, services, utilities and roads); ii. the disinterment of human remains located in grave sites identified in the European and other heritage technical report in volume 4 of the EIS; and iii. application of environmental impact mitigation measures; and e. any other activities which an Approver determines are Preparatory Activities for this definition
Project, the	Western Sydney Airport – Stage 1 development
Stage 1 Development	The Developments described in Part 3 of the Airport Plan and the Airport CIZ
SEMF	Site Environmental Management Framework
SES Officer	An SES employee under the <i>Public Service Act 1999</i> (Cth)
Sydney West Airport	The Airport. Note: this is the name used in the Act. The Airport is also commonly known as Western Sydney Airport
Terminal and Specialty Services Works	Terminal and Specialty (TSS) Works, inclusive of; <ul style="list-style-type: none"> • Domestic and International Passenger Terminal (MAP10) • Fixed Link Bridges • Airside Apron • Landside Carparks, Internal Roads and Landscaping • Aviation Fuel Lines and Ring Main Reticulation • TER – Technical Equipment Room
WSI	Western Sydney International (Nancy-Bird Walton) Airport .The Airport. Note: Under the Act the Airport is referred to as Sydney West Airport
WSA	WSA Co Limited (ACN 618 989 272), the entity responsible for constructing and operating the Airport in accordance with the Airport Plan. For the purposes of the Airports Act 1996 (Cth), WSA is the “airport-lessee company” for WSI

Acronyms and abbreviations

Item	Definition
ABGMA	Australian Botanic Gardens, Mount Annan
AEPR	Airports (Environment Protection) Regulations 1997
AFFM	Aquatic Flora and Fauna Management
ASA	Australian Standard
BEC	Bulk Earthworks Contract
BM	Bushfire Management
BODP	Biodiversity Offset Delivery Plan
CEEC	critically endangered ecological communities
CEMP	Construction Environmental Management Plan
CPLSM	Cumberland Plain Land Snail
DAWE	Department of Agriculture, Water and the Environment
ECM	Environmental Control Map
ECZ	Environmental Conservation Zone
EEC	Endangered Ecological Community
EEW	Early Earthworks Contractor
EIS	Environmental Impact Statement
EPA	NSW Environmental Protection Authority
EWMS	Environmental Work Method Statement
GGBF	<i>Green and Golden Bell Frog</i>
HM	Habitat Management
ISO 14001	AS/NZS ISO 14001:2016 – Environmental Management Systems
MI	Material Importation
MM	Microbat Management
SEMF	Site Environmental Management Framework. The SEMF is contained within the Construction Plan (included as Appendix 2).
TFPP	Threatened Flora Propagation Program
VM	Vegetation Management
WSA	WSA Co Limited (ACN 618 989 272), the entity responsible for constructing and operating the Airport in accordance with the Airport Plan. For the purposes of the Airports Act 1996 (Cth), WSA is the “airport-lessee company” for WSI
WSI	Western Sydney International (Nancy-Bird Walton) Airport

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Appendix C	Weed and Disease Management Plan
Appendix D	Threatened Flora Salvage and Translocation Plan
Appendix E	Bush Fire Management Plan



1. Introduction

1.1. Background/Context

This WSA Biodiversity Construction Environmental Management Plan (Biodiversity CEMP) (this Plan) has been prepared to satisfy the requirements of the Biodiversity CEMP set out in the Conditions for the Stage 1 development of the Western Sydney International (Nancy-Bird Walton) (WSI) Airport detailed in Section 3.10.2 of the Airport Plan. Specifically, Section 3.10.2 Condition 7(1) of the Airport Plan requires that a Biodiversity CEMP be approved under the Airport Plan prior to the commencement of Main Construction Works.

This Biodiversity CEMP provides the overarching management approach and requirements (including environmental mitigation measures, controls, monitoring and reporting) for management of flora and fauna during construction of the Stage 1 development. This Plan forms one of nine CEMPs which are collectively covered by the WSA Site Environmental Management Framework (SEMF). To ensure the environmental resources, responsibilities and management measures are implemented during the construction activities, the SEMF is contained within the Construction Plan (included as Appendix 2). The implementation of the Construction Plan, including the SEMF, sits adjacent to other Project level management plans including the Community and Stakeholder Engagement Plan and the Sustainability Plan as illustrated in Figure 1.

The Construction Plan, including the SEMF, and nine CEMPs provide the overall environmental management approach and requirements and therefore should not be read in isolation to each other due to interconnecting management outcomes and objectives. Specifically, for the Biodiversity CEMP, it is considered that the following management plan linkages can be made:

- Noise and Vibration CEMP – Management of potential noise impacts on fauna is facilitated through this CEMP.
- Soil and Water CEMP – Management of soil and water on-site will be important in preventing indirect impacts on flora and fauna.
- Waste and Resources CEMP – Management of waste and resources will also be important in minimising indirect impacts of flora and fauna.
- Community and Stakeholder Engagement Plan – The surrounding community and stakeholders are highly engaged and involved in the management of flora and fauna impacts on-site and in adjacent areas.
- Sustainability Plan – Management of biodiversity is relevant with regard to general health, wellbeing, and quality of life for surrounding communities. This linkage with the WSA Sustainability Plan extends to IS Rating discharge credit Ecology Eco-1 and Eco-2, where compliance with this CEMP will ensure the project will meet credit requirements.
- Aboriginal Cultural Heritage CEMP – management of the known and predicted Aboriginal Cultural Heritage sites within the environmental conservation zone shown in the Land Use Plan (EC1) will be addressed through measures to protect and manage the areas in the EC1.

Where relevant, linkages to other CEMPs and management objectives have been included in the risk assessment (Section 6) and the environmental control measures (Section 7).

Table 1 highlights relationships and linkages of this Biodiversity CEMP with other CEMPs within the environmental management framework, including key cross-referencing to Airport Plan and EIS requirements.



Table 1: Biodiversity CEMP relationship with other CEMP documentation

CEMP or plan	Airport Plan Condition (3.10.2)	EIS Chapter 28 Table: Management area	EIS Chapter 28 Table: Mitigation measures
Aboriginal Cultural Heritage	11	28-12	28-13
Air Quality	10	28-10	28-11
Biodiversity (this plan)	7	28-04	28-05
Community and Stakeholder Engagement Plan	15	28-20	28-21
European and other Heritage	12	28-14	28-15
Noise and Vibration	6	28-02	28-03
Soil and Water	8	28-06	28-07
Sustainability Plan	29	28-37	28-38
Traffic and Access	9	28-08	28-09
Visual and Landscape	14	28-18	28-19
Waste and Resources	13	28-16	28-17

Key
Moderate to high relevance to this CEMP
Some relevance to this CEMP

The review and document control process for this plan are described further in Section 10 of the SEMF. The context of this plan in relation to the WSA environmental management system is presented in Figure 1.

1.2. Document purpose

The purpose of this Plan is to provide the foundation for the management of biodiversity impacts in accordance with best practice and legal requirements (including environmental mitigation measures, controls, monitoring and reporting) during the construction phase of the Stage 1 development based on the assessment undertaken as part of the EIS.

This Plan details the biodiversity management requirements that must be satisfied in order to demonstrate compliance with the Condition 7 of Section 3.10.2 of the Airport Plan for the construction of the Stage 1 development of the Western Sydney Airport.

Legal and other requirements are identified and maintained in a register within the SEMF (refer SEMF Appendix L). Mitigation measures (specific to biodiversity required to satisfy these requirements are derived from the EIS and through risk assessment processes (refer Section 6.3) and included within this CEMP refer to Section 7.

Implementation of these measures is ensured through monitoring, training and competence, inspection, audit and reporting actions detailed in Sections 10 and 11, with the responsibilities for implementation identified in Section 9. Continual improvement processes in relation to compliance with regulatory requirements are detailed in the SEMF Section 10.

In summary, this plan sets out to achieve the following:

- Provision of details for the management and mitigation measures to be implemented, including timing and responsibilities;
- Ensuring the commitments of the Conditions of Approval (as set out in the Airport Plan) and regulatory requirements are met and satisfied by both WSA and contractors;
- Provision of process for monitoring implementation, reporting, and auditing of traffic and access related management and compliance related issues;
- Commitment to meeting the requirements of AS/NZS ISO 14001:2016 Environmental Management Systems, including the need for continual improvement;
- Provision of a process to be implemented for the management of complaints, for stakeholder engagement, and for the management of emerging environmental issues as they arise; and



- Provision of a system including procedures, plans and documentation for implementation by WSA personnel and contractors to enable Project completion in accordance with the environmental requirements.

Effective implementation of this plan will assist WSA and relevant contractors to achieve compliance with necessary environmental regulatory and policy requirements in a systematic manner with an outcome of continual environmental management performance.

1.3. WSA environmental management system overview

WSA operates in general accordance with AS/NZS ISO 14001 – Environmental management systems. A copy of the WSA environmental policy is provided in Appendix H of the SEMF.

The Stage 1 development will be undertaken in accordance with the Construction Plan including the SEMF and the associated CEMPs (including this Plan).

The SEMF is the overarching environmental plan for the implementation of the nine CEMPs. It provides a structured and systematic approach to environmental management and provides an expectation and guidance with regards to environmental management for the overall construction of the Stage 1 Development.

The structure of the environmental management system for the Project is shown in Figure 1.

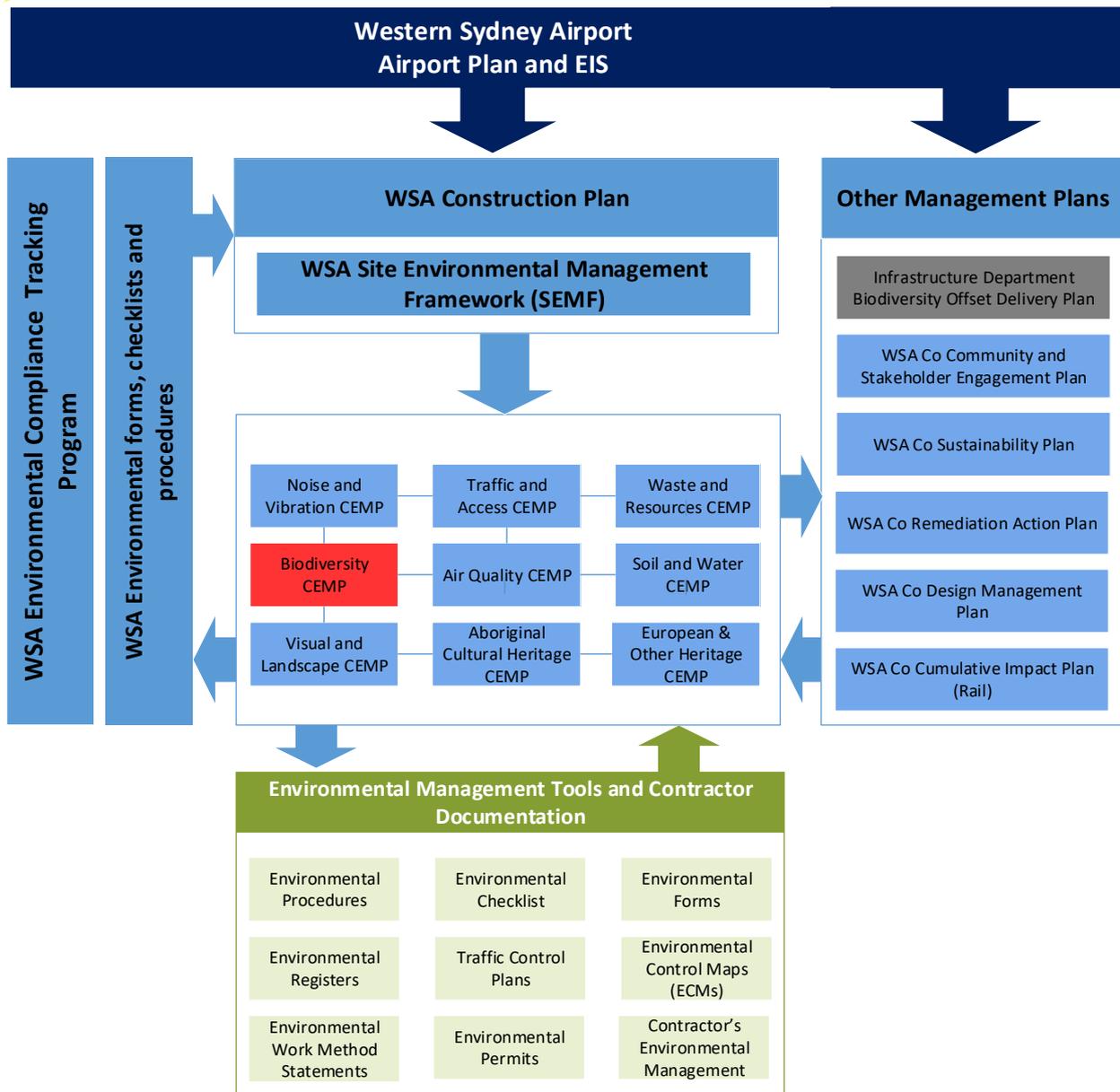


Figure 1: WSA Environmental Management System and CEMP context

1.4. Consultation requirements of this plan

Airport Plan Condition 35 outlines the consultation requirements during the preparation of the CEMP documentation and requires consultation with any NSW Government agencies as specified by the NSW Department of Premier and Cabinet as well as Department for Planning, Industry and Environment for specific CEMPs. NSW Government agencies specified by Department of Premier and Cabinet for consultation for this Biodiversity CEMP, including, Penrith City Council and Liverpool City Council.

Further, Airport Plan Condition 7(3) requires that this Biodiversity CEMP has taken into account Table 28-4 of the EIS which states the CEMP should also be prepared in consultation with the Department of Agriculture, Water and the Environment (DAWE) and the Department for Planning, Industry and Environment.

Consultation has been completed during the development of this CEMP during the review and update of Revision 0 and 1 in 2018 and Revision 2 in 2019 of this document. A summary of the stakeholder and



government authority consultation completed and used to inform the review and finalisation of Revision 3 is presented in Table 2.

Consultation will continue with agencies, councils and other relevant stakeholders throughout the Project where there is a change to a CEMP. The outcomes of this consultation will be documented in subsequent revisions of the relevant CEMPs, with details of such consultation included in the applicable document.

1.5. Consultation to inform Revision 3

A consultation plan outlining the process for engaging with stakeholders was prepared by the WSA Community and Engagement team. The plan and a scoping document outlining the works in the Construction Plan and potential modification of the CEMPs was provided to the stakeholders as required by the Airport Plan Conditions.

Details of the construction phases were described in the correspondence to provide context to the stakeholders on the level of impact that would result from the next phase of construction activities. Following Terminal Contract award, the CEMPs were updated to reflect the next stage of construction. Stakeholders were invited to attend a site visit and briefing presentation on 15th July 2021 to assist the stakeholders to understand the size and scale of the site elements. The visit scheduled for 15th July 2021 did not take place due to COVID-19 restrictions and the briefing presentation was via videoconference. On 16th July 2021, stakeholders were provided with the Construction Plan and the nine draft CEMPs to review and were requested to provide comment. A summary of the consultation is provided in Table 2.

Table 2: Biodiversity CEMP consultation summary

Activity	Date	Invitees	Summary
Consultation Summary			
Briefing presentation for stakeholders (via videoconference)	15 July 2021	<ul style="list-style-type: none"> Liverpool City Council Penrith City Council NSW Health NSW Aboriginal Affairs and Heritage Transport for NSW Sydney Metro Infrastructure Department 	As part of the continuous improvement of the consultation process, a site visit and briefing presentation for stakeholders was organised. The visit scheduled for 15th July 2021 did not take place due to COVID-19 restrictions and the briefing presentation was via videoconference. It is a useful element to assist stakeholders to understand size and scale and also have discussions related to site elements as they are seen during the site visit.
CEMPs provided to stakeholders for comment	16 July 2021	<ul style="list-style-type: none"> Department of Agriculture, Water and the Environment NSW Environment Protection Agency South Western Sydney Local Health District NSW Ambulance Rural Fire Service NSW Government Architect Traffic Management Centre Wester Parkland City Authority Greater Sydney Commission Department of Planning, Industry and Environment Western Sydney Planning Partnership 	

1.6. Certification and approval

This Biodiversity CEMP has been reviewed and approved for issue by the WSA Environment Manager prior to submission to Department of Infrastructure, Transport, Regional Development and Communications (Infrastructure Department.).

1.7. Distribution

All WSA personnel and contractors will have access to this Biodiversity CEMP via the Project document control management system. The Approved Plan must be published on WSA’s website within one month



of being approved and be available until the end of the Construction Period. An electronic copy can be found on the Project website - <https://westernsydney.com.au>

This document is uncontrolled when printed. One controlled hard copy will be maintained by the quality manager at the Project office.



2. Scope of works

The Construction Plan details the construction staging of the Stage 1 Development. The delivery of the Stage 1 Development will be through a packaging strategy with a wide variety of package sizes, risk profiles and contracting entities. Each package will have different levels of environmental risk and environmental obligations, depending on the scope of works, location of works and sensitivity of the receiving environment and cultural heritage issues and relevant statutory requirements and obligations.

Stage 1 Development of the Project comprises the following key features as described in the Construction Plan (which is consistent with the Airport Plan and EIS Chapter 5):

- Site preparation
- Utilities
- Ancillary developments
- Terminal
- Airside precinct
- Ground transport
- Other building activities
- Aviation support facilities

Details of the Project construction activities, staging and programming including the phases of works are described in Section 5 of the Construction Plan (WSA00-WSA-00000-CN-PLN-000001) as required by the Airport Plan Condition 1(5).

This Plan applies to all phases of works as described in Section 6 of the Construction Plan.

A variation to this Plan will be submitted before work other than Preparatory Activities is undertaken on any other phases of works.



3. Objectives and targets

3.1. Objectives

The key objective of this Biodiversity CEMP is to ensure that native flora and fauna, including threatened species and endangered ecological communities are protected during construction of the Project and that any potential biodiversity impacts will be minimised and managed.

To achieve this objective, the following will be undertaken:

- Ensure adverse effects on biodiversity by construction activities is limited to those predicted within Section 5 of the EIS biodiversity assessment;
- Ensure appropriate controls are implemented to address the mitigation measures detailed in Table 28-4 and Table 28-5 in Chapter 28 of the EIS; and
- Ensure appropriate controls are implemented to comply with all relevant legislation and other requirements as described in Section 4 of this Plan.

3.2. Targets and performance criteria

Targets and performance criteria have been established for the management of biodiversity impacts during the construction phase of the works which have been, in part, derived from the performance criteria identified in the EIS, Table 28-4, as presented in Table 3.

Table 3: Biodiversity targets and performance criteria

Objective	Target	Document Reference
Minimising disturbance to terrestrial and aquatic flora and fauna in the ECZ during construction	Negligible disturbance to native terrestrial and aquatic flora and fauna in the Environmental Conservation Zone.	Environmental inspection checklist Site Diary
Minimising adverse effects on terrestrial fauna by construction activities	Minimise adverse effects on terrestrial fauna by construction activities.	Environmental inspection checklist Site Diary
Protecting areas outside the ClZ that contain a listed Threatened Ecological Community or provide an important habitat for a listed threatened species during clearing activities	Ensure all areas outside the ClZ that contain a listed threatened ecological community or provide important habitat for a listed threatened species are protected.	Environmental inspection checklist Site Diary
Managing weed and pest species that may be introduced as a result of the construction programme	No introduction of weed and pest species.	Environmental inspection checklist Site Diary

The above targets in Table 3 have been set to provide a benchmark performance objective to which WSA will endeavour to achieve. Failure to achieve the targets will not be considered a non-conformance, however, will prompt internal review of environmental management (as detailed further in environmental control measures in Table) and assessment of potential improvement opportunities.

4. Legal and other requirements

Relevant environmental legislation and other requirements are identified below.

4.1. Relevant legislation and guidelines

As the Western Sydney Airport is to be developed under the Airport Plan determined under the Airports Act 1996 (The Act), some state laws will not be applicable to the Project (s112 of the Act). Where state law is applicable, this plan will set out the relevant applicable state legislation and requirements and demonstrate how compliance with those laws, including obtaining relevant permits, will be achieved. Where state laws are not applicable, there may nonetheless be a requirement to have regard to those laws, for example, through mitigation measures to be incorporated in CEMPs to satisfy conditions under the Airport Plan.



4.2. Legislation

Legislation and regulations and their relevance to biodiversity and this Plan are summarised in Table 4.

Table 4: Principal legislation and relevance

Legislation or regulation	Relevance	CEMP compliance provisions
Commonwealth		
Airports Act 1996 (Airports Act)	The Act and Airports Regulations set out the framework for the regulation and management of activities at airports that could have potential to cause environmental harm. This includes offences related to environmental harm, environmental management standards, monitoring and incident response requirements. The Airport Plan prepared under the Act covers a number of environmental matters and, in particular, details specific measures to be carried out for the purposes of preventing, controlling or reducing the environmental impact associated with the airport. Criminal offences are applicable if these measures are not complied with.	This CEMP forms part of the overall WSA environmental management system which has as a target, full compliance with the Airport Plan. Relevant mechanisms within this CEMP that will contribute to this include but are not limited to: Section 3.1 – Objectives Section 4.6 – Airport Plan Conditions Section 4.7 – Environmental Impact Statement requirements Section 6.2 – Ecological impacts Section 7 – Environmental Control Measures Section 8 – Biodiversity Management Section 9 – Environmental Roles and Responsibilities Section 10 – Environmental Inspection, Monitoring and Auditing Section 10.6 – Environmental Incidents and complaints management Section 10.5 – Review of approved plans
Airports (Environment Protection) Regulations 1997 (AEPR)	Imposes a general duty to prevent or minimise environmental pollution and preserve habitat. Promotes improved environmental management practices at airports.	Refer to commentary on Airport Plan above.
Airports (Building Control) Regulations 1996	Any conditions imposed on the ABC and ALC on their consents must be satisfied by the applicant. These conditions are additional to any requirements identified under the CEMPs	This document
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	National environment law that provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the Act as matters of national environmental significance.	Section 7 – Environmental Control Measures Section 8 – Biodiversity Management Section 10 – Environmental Inspection, Monitoring, Auditing and Reporting
NSW		
As the Airport is to be developed under the Airport Plan determined under the Airports Act, 1996 (Cth), some state laws will not be applicable to the Project (see for example S 112 of that Act). Where state laws are not applicable, it is still intended to have regards to relevant laws for example through inclusion of mitigations measures incorporated into this CEMP. These laws are identified below.		
Environmental Planning and Assessment Act 1979 (EPA Act)	Objects of the Act include the encouragement of proper management and conservation of natural and artificial resources and the promotion of the orderly and economic use and development of land in NSW. The EP&A Act also provides for the making of environmental planning instruments including State Environmental	This Project has been authorised under the Airports Act; however, a range of matters arising from the EP&A Act have been considered. Section 7 – Environmental Control Measures Section 8 – Biodiversity Management



Legislation or regulation	Relevance	CEMP compliance provisions
	Planning Policies (SEPPs) and Local Environmental Plans (LEPs), which include land use controls, such as development standards applicable to the land within the area covered by each instrument.	
Work Health and Safety Act 2011 & Work Health and Safety Regulation 2017.	The Work Health and Safety Act 2011 (NSW) provides a framework to protect the health, safety and welfare of all workers and others in relation to NSW workplaces and work activities. The Work Health and Safety Regulation 2017 set out specific requirements for particular hazards and risks, such as noise, machinery, and manual handling.	This document.
State Environmental Planning Policy No 19 – Bushland in Urban Areas (SEPP 19) Note: An explanation of intended effect for a new Environment SEPP was on exhibition between 31 October 2017 and 31 January 2018. If/when adopted, this new SEPP would consolidate SEPP 19 with 6 other existing environment SEPPs.	The purpose of SEPP 19 is to protect and preserve bushland within urban areas due to its inherent aesthetic, community and natural heritage values.	Section 7 – Environmental Control Measures Section 8 – Biodiversity Management
State Environmental Planning Policy (Koala Habitat Protection) 2021	SEPP 44 aims to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and reverse the current trend of Koala population decline.	Section 7 – Environmental Control Measures Section 8 – Biodiversity Management
Protection of the Environment Operations Act 1997 (POEO Act) and the Protection of the Environment Operations (General) Regulation 2009	The objectives of the Protection of the Environment Operations Act are to protect, restore and enhance the quality of the environment, in recognition of the need to maintain ecological sustainable development.	Section 7 – Environmental Control Measures Section 8 – Biodiversity Management
Animal Research Act 1985	The object of this Act is to protect the welfare of animals used in connection with research by requiring persons or organisations carrying out animal research or supplying animals for research to be authorised under this Act and by regulating the carrying out of animal research and the supply of animals for research by those persons or organisations.	Section 9 – Roles and Responsibilities
Biodiversity Conservation Act 2016 (BC Act)	The purpose of this Act is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of	Section 7 – Environmental Control Measures Section 8 – Biodiversity Management



Legislation or regulation	Relevance	CEMP compliance provisions
	ecologically sustainable development.	
Fisheries Management Act 1994 (FM Act) Fisheries Management Amendment Act 2015 No 59, Sch 1 [4] [72]–[91] [120]–[125] [134] [138] and [154]	The FM Act aims to conserve, develop and share the fishery resources of NSW for the benefit of present and future generations, including conserving fish stocks and fish habitat and promoting ecologically sustainable development.	Section 7 – Environmental Control Measures Section 8 – Biodiversity Management
Biosecurity Act 2015	The Biosecurity Act outlines biosecurity risks and impacts including impacts associated with weeds. The Act introduces the concept of Priority Weeds that should be prevented, managed, controlled or eradicated within particular regions.	Section 7 – Environmental Control Measures Section 8 – Biodiversity Management
Draft State Environmental Planning Policy for Strategic Conservation Planning (Applicable to off airport land only)	An Explanation of Intended Effect was on exhibition between 26 August 2020 and 2 November 2020. The purpose of the SEPP is to meet requirements for strategic certification under the BC Act and EPBC Act.	Section 7 – Environmental Control Measures Section 8 – Biodiversity Management
State Environmental Planning Policy (Western Sydney Aerotropolis) 2020 (Aerotropolis SEPP)	The Aerotropolis SEPP was made in accordance with division 3.3 of the EP&A Act and provides planning controls for development within the Western Sydney Aerotropolis. The Aerotropolis SEPP overrides any LEP provisions that apply to that land.	Section 7 – Environmental Control Measures Section 8 – Biodiversity Management
Liverpool Local Environmental Plan 2008 (Liverpool LEP)	The Liverpool LEP provides local environmental planning controls and standards for land in the Liverpool LGA in accordance with the standard environmental planning instrument under section 3.20 of the EPA Act.	Section 7 – Environmental Control Measures Section 8 – Biodiversity Management
Penrith Local Environmental Plan 2010 (Penrith LEP)	The Penrith LEP provides local environmental planning controls and standards for land in the Penrith LGA in accordance with the standard environmental planning instrument under section 3.20 of the EPA Act.	Section 7 – Environmental Control Measures Section 8 – Biodiversity Management

4.3. Guidelines and standards

Guidelines and standards that are relevant to biodiversity management and this plan are summarised in Table 5.

Table 5: Relevant guidelines and standards

Guidelines and standards
• National Standards for the Practice of Ecological Restoration in Australia (Society for Ecological Restoration Australasia, 2016)
• Guidelines for the Translocation of Threatened Plants (Vallee et al, 2004)
• Cumberland Plain Recovery Plan (DECCW, 2011)
• NSW Department of Primary Industries, Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings, Fairfull and Witheridge, 2003
• Fishnote – Policy and Guidelines for Fish Friendly Waterway Crossings – November 2003
• NSW National Parks & Wildlife Service. 2001. Policy for the Translocation of Threatened Fauna in NSW: Policy and Procedure Statement No. 9 Threatened Species Unit, Hurstville NSW
• Australian Network for Plant Conservation. 2004. Guidelines for the Translocation of Threatened Plants in Australia, 2nd Edition
• Hygiene protocol for the control of disease in frogs (DECCW, 2008)
• Cumberland Plains Recovery Plan (Department for Planning, Industry and Environment. 2011)
• Australian River Assessment System (AUSRIVAS) Sampling and Processing Manual (Turak et al, 2004)
• Survey guidelines for Australia's threatened mammals: Guidelines for detecting mammals listed as threatened under the EPBC Act (SEWPaC 2011),
• Survey guidelines for Australia's threatened birds: Guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (DEWHA 2010)
• Survey guidelines for Australia's threatened frogs: Guidelines for detecting frogs listed as threatened under the EPBC Act (DEWHA 2010)
• Survey guidelines for Australia's threatened reptiles: Guidelines for detecting reptiles listed as threatened under the EPBC Act 1999 (SEWPaC 2011)
• Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities (DEC 2004a),
• Environmental impact assessment guidelines: Cumberland Plain Large Land Snail (NPWS 2000)
• Environmental impact assessment guidelines: <i>Cynanchum elegans</i> (NPWS 2002)
• Environmental impact assessment guidelines: <i>Dillwynia tenuifolia</i> (NPWS 2002)
• Environmental impact assessment guidelines: <i>Grevillea juniperina subsp.</i> (NPWS 2002)
• Environmental impact assessment guidelines: <i>Pultenaea parviflora</i> (NPWS 2002)
• Environmental impact assessment guidelines: <i>Grevillea parviflora subsp.</i> (NPWS 2002)
• Environmental impact assessment guidelines: <i>Acacia pubescens</i> (NPWS 2003)
• National Recovery Plan for Grey-headed Flying-fox (<i>Pteropus poliocephalus</i>) (DECCW 2009)
• EPBC Act referral guidelines for the vulnerable Koala (DoE 2014)
• Western Sydney Aerotropolis Development Control Plan 2020 Phase 1



4.4. Approvals and other specifications

Functional Specifications;

- EPBC Act Part 13 Permit E2017-0138;
- Bushfire Management Plan (included as Appendix of this Biodiversity CEMP);
- Western Sydney Airport Plan;
- Western Sydney Airport Environmental Impact Statement;
- WSA Sustainability Plan;
- WSA Community and Stakeholder Engagement Plan; and
- WSA Construction Plan, including the Site Environmental Management Framework.

4.5. Part 13 Permit Conditions

The Part 13 Permit is a requirement under the EPBC Act for activities that may kill, injure, take, trade, keep or move a member of a listed threatened species or ecological community, a member of a listed migratory species, or a member of a listed marine in or on a Commonwealth area. As a condition of this Part 13 Permit WSA is required to stay within prescribed area or species number limits for the clearing/removal/impact of nominated threatened species or communities. Processes, procedures and protocols with this Biodiversity CEMP define mitigation measures to ensure ongoing compliance with the conditions of the Part 13 Permit as noted below.

Conditions of Approval attached to Part 13 Permit E2017-0138 are provided in Table 6.

Table 6: Conditions of approval attached to Part 13 Permit E2017-0138

Condition No.	Condition	Timing	Responsibility
1	In accordance with the Airport Plan, the permit holder is authorised to: <ol style="list-style-type: none"> Clear up to 160 hectares of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest; Clear habitat of, or kill, injure, take, trade, keep or move members of, the listed threatened, migratory and / or marine species specified in Part 13 Permit Table 1 (Attachment A), up to the specified maximum quantity. 	NA	WSA
2	The permit holder may give to another person written authority to take, for or on behalf of the holder, any activity authorised by the permit. When an authority is given to another person, the condition requirements also apply. The giving of an authority to another person does not prevent the permit holder from undertaking the authorised activity. The permit holder who gives an authority to another person must inform the Department of Environment and Energy in writing within fourteen (14) days after giving the authority. The permit holder may only give an authority to another person who has sufficient experience and competence in the activities of this permit.	Prior to clearing	WSA (Permit Holder)/ All Contractor
3	Within seven (7) days after the commencement of the action, the permit holder must advise the Minister in writing of the actual date of commencement of the action.		WSA
4	The permit holder must maintain accurate records substantiating all activities associated with or relevant to these permit conditions and make them available to the Department of Environment and Energy upon request. Such records may be subject to audit by the Department of Environment and Energy, or an independent auditor in accordance with section 458 of the EPBC Act or used to assess or verify	Ongoing	WSA



Condition No.	Condition	Timing	Responsibility
	compliance with the permit conditions. Summaries of audits may be published on the Department's website. The results of audit may also be publicised through the general media.		
5	Unless otherwise agreed to in writing by the Minister, within three (3) months of every 12-month anniversary of the commencement of the action, the permit holder must publish a report on their website addressing compliance with these permit conditions over the previous 12 months. Non-compliance with any of the permit conditions must be reported to the Department at the same time as the compliance report is published. Reports must remain published for the life of the permit. Reports must continue to be published until such time as advised by the Minister in writing.	Annually	WSA
6	The permit holder will be taken to comply with the requirement to publish compliance reports under permit condition 5, in relation to a 12 month or other period referred to in condition 39 of the Airport Plan, if information about compliance or non-compliance with these permit conditions, over that period, is included or is to be included in a report published by the permit holder under condition 39 of the Airport Plan. If a report published by the permit holder under condition 39 of the Airport Plan includes or is to include information about compliance with these permit conditions over a 12 month or other period, a compliance report published by the permit holder under permit condition 5 does not need to address compliance with these permit conditions over any part of the same period.	Annually	WSA
7	If, after 10 years from the date of this permit, the permit holder has not commenced the action, then the permit holder must not commence the action or continue taking the action without the written agreement of the Minister.	N/A	N/A

4.6. Airport Plan Conditions

Conditions of Approval relevant to biodiversity management during construction are provided in Table 7. Compliance with the Airport Plan conditions is a statutory requirement and as such, failure to comply may constitute a criminal offence liable to criminal prosecution under the Airports Act.

Table 7: Conditions relevant to biodiversity management

Condition No.	Condition	Timing	Responsibility	Ref in this CEMP
1.4	The Site Occupier must ensure that no CEMP is inconsistent with the approved Construction Plan	Ongoing	WSA	This document (Biodiversity CEMP)
1.5	The approved Construction Plan may provide for Main Construction Works to be carried out in phases that commence at different times for different parts of the Airport Site or an Associated Site. If it does, the Site Occupier may prepare a CEMP in relation to one or more phases, and the criteria for approval of such a CEMP are taken to exclude any matter irrelevant to the phases for which approval is sought. A variation of the CEMP must be submitted for approval in accordance with condition 41	Ongoing	WSA	This document (Biodiversity CEMP)



Condition No.	Condition	Timing	Responsibility	Ref in this CEMP
	(Variation of Approved Plans) prior to commencement of any new phase.			
5.3	In carrying out a Preparatory Activity, the Site Occupier must: <ul style="list-style-type: none"> a) implement any plan approved in accordance with sub condition (1) or (2), except to the extent that the plan is inconsistent with any subsequently approved CEMP or the approved Construction Plan; and b) not act inconsistently with any approved CEMP or the approved Construction Plan. 	Ongoing	WSA	This document (Biodiversity CEMP)
7.1	The Site Occupier must not: <ul style="list-style-type: none"> • commence Main Construction Works until a Biodiversity CEMP has been prepared and approved in accordance with this condition; or • carry out any development described in Part 3 of the Airport Plan inconsistently with the approved Biodiversity CEMP. 	Prior to Main Construction Works	WSA	This document (Biodiversity CEMP)
7.2	The Site Occupier must: <ul style="list-style-type: none"> a) Prepare, and b) Submit to an Approver for approval; A Biodiversity CEMP in relation to the carrying out of the developments described in Part 3 of the Airport Plan.	Prior to Main Construction Works	WSA	This document (Biodiversity CEMP)
7.3	The criteria for approval of the Biodiversity CEMP are that an Approver is satisfied that: <ul style="list-style-type: none"> a) in preparing the Biodiversity CEMP, the Site Occupier has taken into account Table 28-4 in Chapter 28 of the EIS; and b) the Biodiversity CEMP complies with Table 28-5 in Chapter 28 of the EIS and is otherwise appropriate. 	Prior to Main Construction Works	Approver WSA	CEMP Sections 6, 7, 8, 9 and 10
7.4	The Biodiversity CEMP must be based on and informed by a Biodiversity Assessment Report that: <ul style="list-style-type: none"> a) includes the results of an updated ecological survey that has applied the field survey methodology of the FBA for areas outside the Construction Impact Zone (but within the Airport Site); b) has had regard to the key diagnostic characteristics and condition thresholds specified in the <i>Commonwealth Listing Advice on Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest</i> (Threatened Species Scientific Committee 2008), particularly regarding patch size and contiguous native vegetation; and c) has been independently verified by a person accredited in accordance with section 142B(1)(c) of the Threatened Species Conservation Act 1995 (NSW), appointed following consultation with Department for Planning, Industry and Environment. 	Prior to Main Construction Works	WSA	This document (Biodiversity CEMP, Section 5)



Condition No.	Condition	Timing	Responsibility	Ref in this CEMP
7.5	<p>The Biodiversity CEMP must contain measures to protect and manage the areas in the environmental conservation zone shown in the Land Use Plan (EC1) along the Badgerys Creek riparian corridor including to:</p> <ul style="list-style-type: none"> a) replace exotic grasslands with suitable native vegetation; b) rehabilitate existing remnant and native vegetation; and c) provide ongoing protection of the biodiversity and environmental values. 	Prior to Main Construction Works	WSA	CEMP Sections 7 and 8
30.13	<p>If there is a change to the Construction Impact Zone after the Biodiversity Offset Delivery Plan is approved, a variation of the Biodiversity Offset Delivery Plan in relation to that change must be prepared by the Infrastructure Department and submitted for approval in accordance with condition 41 (Variation of Approved Plans), unless an Approver decides that the change is not material to biodiversity offset requirements.</p>	Prior to work occurring	WSA, Infrastructure Department, The Approver	CEMP Sections 4.1, 8 and 10
32.6	<p>Condition 32 requires the Infrastructure Department to enter into an agreement with Greening Australia to contribute funds to the organisations Native Seed Production Area program.</p> <p>Under Condition 32(6) the agreement must include provisions for Green Australia to access the Airport Site (to the greatest possible extent) for the purpose of native seed collection.</p>		Infrastructure Department	CEMP Section 8
35	<p>An Approver must not approve a plan referred to in Chapter 28 of the EIS unless he or she is satisfied that the Plan Owner:</p> <ul style="list-style-type: none"> a) in preparing the plan, has (i) consulted with any NSW Government agencies specified by the NSW Department of Premier and Cabinet; and (ii) in the case of the Biodiversity CEMP...also consulted the Department of Agriculture, Water and the Environment (DAWE) and Department for Planning, Industry and Environment.; and b) has provided: <ul style="list-style-type: none"> I the Approver; and II each consulted agency, with an explanation of how any responses have been addressed. 	Ongoing	The Approver	This document (Biodiversity CEMP)
45 to 50	<p>Set out requirements in relation to informing other parties of conditions, keeping records, publishing reports, independent audits, variation to approved plans and publication of approved plans</p>	Ongoing	WSA and the Approver	This document (Biodiversity CEMP)
42	<p>Cumulative Impacts Plan</p> <ul style="list-style-type: none"> 1) The Rail Authority must not commence Rail Construction Works until a Cumulative Impacts Plan has been approved in accordance with this condition. 2) The ALC must: <ul style="list-style-type: none"> a) prepare; and 	Prior to rail construction works occurring	WSA and the Approver	Cumulative Impacts Plan (Rail) WSA00-WSA-00400-EN-PLN-000013



Condition No.	Condition	Timing	Responsibility	Ref in this CEMP
	<p>b) submit to an Approver for approval; a Cumulative Impacts Plan in relation to cumulative impacts arising from the concurrent construction of the Airport Stage 1 Development and the Rail Development.</p> <p>3) The criteria for approval of the Cumulative Impacts Plan are that an Approver is satisfied that the Cumulative Impacts Plan:</p> <p>a) sets out:</p> <p>I. co-ordination and consultation requirements between the following stakeholders as relevant to manage the interface of projects under construction at the same time: the ALC, the Rail Authority, Transport for NSW, Western Parkland City Authority, Sydney Water, emergency service providers and utility providers; the responsibility for management of the impacts set out in the Cumulative Impacts Plan; the relevant environmental management framework relating to construction of the Airport Stage 1 Development and the Rail Development; and the process for proactively identifying and managing cumulative impacts; has been prepared in consultation with the Rail Authority; and is otherwise appropriate.</p> <p>4) Each of the Rail Authority and the ALC must not act inconsistently with the approved Cumulative Impacts Plan.</p>			

4.7. Environmental Impact Statement requirements

The requirements of biodiversity management to be taken into account and addressed during the construction phase of the Stage 1 development are included in the EIS, specifically Table 28-4. A summary of these requirements and how they have been addressed in this Biodiversity CEMP is presented in Table 8.



Table 8: Summary of biodiversity management requirements

EIS Reference	Topic	Summary	Biodiversity CEMP Reference
Table 28-4	Performance Criteria	Compliance with the approved Biodiversity CEMP	Section 3 – Objectives and Targets
		Compliance with the general duty to preserve habitat under the AEPR	Section 3 – Objectives and Targets
		Compliance with the environmental values as outlined in the Land Use Plan in the Airport Plan	Section 3 – Objectives and Targets
		Clearing of the construction impact zone is undertaken in an environmentally sensitive manner	Section 8 – Biodiversity Management
		Disturbance of fauna outside of the construction impact zone is minimised	Section 8.2.2 - Aquatic Flora and Fauna Management
		Subject to the requirements for safe airport operations, no clearance of significant vegetation occurs outside the designated Stage 1 construction impact zone prior to further approvals under the Airports Act where the vegetation: <ul style="list-style-type: none"> • Is in the Environmental Conservation Zone; or • Comprise a threatened ecological community under the EPBC Act; or • Provides important to critical habitat for a listed threatened species under the EPBC Act 	Section 3 – Objectives and Targets
		All reasonable and practicable measures are taken to ensure no weed or pest species are introduced to or from the airport site.	Appendix C - Weed and Disease Management Plan
Table 28-4	Implementation framework	A Biodiversity CEMP will be approved prior to Main Construction Works for the proposed airport. The CEMP will collate measures to mitigate and manage potential impacts to the local and regional road network, including cross-reference to other environmental management plans where they are relevant.	Section 7 - Environmental control measures
		The Biodiversity CEMP will as a minimum:	-
		Detail the management and mitigation measures to be implemented, including the measures and sub-plans, protocols, and surveys in Table 28-5	Section 8 – Biodiversity Management
		Describe the process for managing complaints, stakeholder engagement and emerging environmental management issues as they arise	Section 10.6 – Environmental Incidents and Complaints Management
		Specify the process for monitoring implementation, reporting, and auditing	Section 10 – Environmental Inspection, Monitoring and Auditing



EIS Reference	Topic	Summary	Biodiversity CEMP Reference
		Identify the party responsible for implementing the CEMP	Section 9 - Environmental Roles and responsibilities
Table 28-4	Monitoring	Monitoring requirements include that:	-
		Monitoring must take place under the direction of an appropriately qualified person.	Section 10.2 - Biodiversity Monitoring
		The results of the monitoring must be kept in a written record.	Section 10.2 - Biodiversity Monitoring
		Additional monitoring requirements for specific mitigation measures [outlined in EIS Table 28-5]	-
Table 28-4	Auditing and reporting	An annual report will be prepared and submitted to the Secretary of the Infrastructure Department in relation to compliance with the Biodiversity CEMP for the period until the airport commences operations.	Section 10.4 - Environmental reporting
		The Community and Stakeholder Engagement plan provides for the development of a complaints log and includes specific measures for how complaints will be managed.	Community and Stakeholder Engagement Plan
Table 28-4	Responsibility	The Biodiversity CEMP will be prepared in consultation with DAWE and Department for Planning, Industry and Environment.	Section 1.4 Consultation requirements of this plan
		The Biodiversity CEMP will be submitted for approval for the Infrastructure Minister or a SES Officer in the Department of Infrastructure and Regional Development	Section 1.6 – Certification and approval
		The D&C contractor will be responsible for implementing site specific environmental management arrangements and work method statements applicable to the proposed works in accordance with the requirements of the Biodiversity CEMP	Section 1.2 – Document Purpose
		The airport environment officer will be responsible for day to day regulatory oversight of AEPR compliance at the airport after an airport lease is granted.	Section 9 - Environmental Roles and responsibilities

5. Existing environment

The Airport Site is located in an area of elevated ridge systems dividing the Nepean River and South Creek catchments. Prior to construction, the site was characterised by rolling landscapes typical of Bringelly Shale. The site featured a prominent ridge in the west, reaching an elevation of about 120 metres Australian Height Datum (mAHD), and smaller ridge lines in the vicinity with elevations of about 100 mAHD. The broad topography of the Airport Site generally sloped away from the ridges in the west, with elevations generally between 40 mAHD and 90 mAHD, with the lower elevations toward Badgerys Creek.

Following bulk earthworks, the majority of the Stage 1 CIZ will be generally level (excluding drains and basins) with a surface elevation of around 90 mAHD at the western end of the runway down to 75 mAHD at the eastern end. Broadacre clearing of the CIZ footprint has been completed as a component of the Bulk Earthworks package. The area to be occupied by the terminal has an elevation of around 80 mAHD.

The following section summarises the results of ecological assessments undertaken at the Airport Site. Most of the ecological assessment undertaken at the Airport Site was reported in the EIS. Additional ecological assessments were undertaken at the Airport Site post-EIS. The existing environment information outlined below is a summary of the ecological assessment undertaken at the Airport Site both for the EIS and post-EIS.

5.1. Ecological assessments undertaken for the EIS

A range of desktop and field based ecological assessments were undertaken as part of the EIS. For more details of the ecological assessment undertaken for the EIS, refer to Volume 4, Appendix K of the EIS.

5.2. Post-EIS ecological assessment

Post-EIS, the Commonwealth prepared a Biodiversity Assessment Report and Biodiversity Assessment Report Addendum for areas directly impacted by Stage 1 works (Stage 1 Biodiversity Assessment Report (GHD 2017) and the Stage 1 Biodiversity Assessment Report Addendum (GHD 2018)). This work was undertaken as a Preparatory Activity for the following purposes:

- To refine the impact area from the indicative Construction Impact Zone (CIZ) to the approved CIZ; and
- To update the ecological information from the EIS to calculate the biodiversity offsets required for impacts on plants, animals, and their habitats.

The Commonwealth has also undertaken ecological assessments using methodologies in accordance with the Framework for Biodiversity Assessment (FBA) on the land outside the CIZ but within the Airport Site during Preparatory Activities (Biodiversity Assessment Report for Land Outside Stage 1 Development (GHD, 2018)). This work was undertaken to comply with the requirements of the Airport Plan, which specified that management actions for areas outside of the CIZ but within the Airport Site must be informed by a Biodiversity Assessment Report that has been independently verified by an accredited person (following consultation with Department for Planning, Industry and Environment.). These reports have been used to inform the below sections.

5.3. Endangered ecological communities

All the native woodland and forest vegetation at the Airport Site, including derived native grasslands, comprise local occurrences of endangered ecological communities listed under the BC Act. These endangered ecological communities are summarised in Table 9.

The critically endangered ecological communities (CEEC) listed under the EPBC Act must comply with key diagnostic characteristics and condition thresholds (such as projected foliage cover, patch size, perennial understory vegetation cover and contiguous native vegetation) as outlined in the Commonwealth Listing Advice and in EPBC Act Policy Statement 3.31 (DEWHA 2010).

As such, only CEECs in good condition comply with the EPBC Act listings for the Cumberland Plain Woodland in the Western Sydney Basin Bioregion and the Shale/ Gravel Transition Forest in the Sydney Basin Bioregion.

Refer to the Biodiversity Risk Assessment in Table 9 for more information on the management of endangered ecological communities within the Airport Site.

Table 9: **Endangered Ecological Communities - Stage 1 Construction Impact Zone**

Patch	Endangered ecological community	BC Act	EPBC Act	Good condition (ha)	Medium condition (ha)	Poor condition (ha)
Grey Box – Forest Red Gum grassy woodland on flats	Cumberland Plain Woodland in the Sydney Basin Bioregion	CEEC	CEEC ¹	104.8	6.1	113.2
Grey Box – Forest Red Gum grassy woodland on hills	Cumberland Plain Woodland in the Sydney Basin Bioregion	CEEC	CEEC ¹	35.5	-	13.2
Forest Red Gum – Rough-barked Apple grassy woodland	River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South-East Corner bioregions	EEC	CEEC ²	35.9	-	11.7
Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest	Shale/Gravel Transition Forest in the Sydney Basin Bioregion	EEC	CEEC ¹	5.5	-	0.4

¹ Only vegetation classed as in good condition. Also subject to patch size and condition criteria as documented in the listing advice for the community (TSSC 2008). Around 141.0 hectares of these vegetation zones comprises the EPBC Act-listed form of the community.

² Was not listed when the Environment Protection Biodiversity Conservation Act 1999 (EPBC Act) Part 13 Permit (E2017-0138) was issued and as such this community does not form part of this permit as a community, though is tracked as part of threatened species habitat.

5.4. Threatened or other significant flora species

Nine species of threatened flora listed under the EPBC Act and/or BC Act have been recorded or are predicted to occur within the general locality of the Airport Site. These are detailed in Table 10.

Four species that are either threatened or part of an endangered population were recorded at the Airport Site during EIS or post-EIS field surveys, while it is anticipated an additional five species may occur. The remaining species predicted to occur in the general locality of the airport side are considered unlikely to occur at the Airport Site due to a lack of suitable habitat, and therefore will not be affected by the proposed airport.

Table 10: **Threatened flora recorded or have potential to occur at the Airport Site**

Scientific name	Common name	Conservation status		Likelihood of occurrence
		EPBC Act	BC Act	
<i>Pultenaea parviflora</i>		Vulnerable	Endangered	Present
<i>Marsdenia viridiflora subsp. viridiflora</i>			Endangered population	Present
<i>Pimelea spicata</i>	Spiked Rice-flower	Endangered	Endangered	Present
<i>Dillwynia tenuifolia</i>			Vulnerable	Present
<i>Cynanchum elegans</i>	White-flowered Wax Plant	Endangered	Endangered	Possible
<i>Acacia pubescens</i>	Downy Wattle	Endangered	Vulnerable	Possible

Scientific name	Common name	Conservation status		Likelihood of occurrence
		EPBC Act	BC Act	
<i>Grevillea parviflora</i> subsp. <i>parviflora</i>	Small-flower Grevillea	Vulnerable	Vulnerable	Possible
<i>Grevillea juniperina</i> subsp. <i>juniperina</i>	Juniper-leaved Grevillea		Vulnerable	Possible
<i>Thesium austral</i>	Austral Toadflax	Vulnerable	Vulnerable	Possible

5.5. Vegetation corridors

A significant vegetation corridor occurs within the ECZ along the eastern boundary of the Airport Site in association with Badgerys's Creek riparian zone. The ECZ is predominately comprised of native grassy woodland and exotic grassland. The ECZ will be retained during the Project. The ECZ will be demarcated in the field during construction works and access will be restricted. Habitat augmentation and enhancement works will be undertaken in the ECZ during the life of the Project including nest box installations, replacing exotic vegetation with suitable native vegetation and rehabilitation of native remnant vegetation.

5.6. Threatened fauna

Two threatened fauna species listed under the EPBC Act were recorded at the Airport Site. The Grey-headed Flying-fox (*Pteropus poliocephalus*) was recorded during surveys for preparation of the EIS as well as surveys for the 1999 EIS. This species is listed as a vulnerable species under the EPBC Act and under the BC Act. There are no Grey-headed Flying-fox camps located at the Airport Site, although there are at least seven known camps within 20 kilometres. The Green and Golden Bell Frog (*Litoria aurea*) has been recorded in the vicinity of the Stage 1 CIZ and are likely to be encountered in the vicinity of the riparian habitats and drainage lines. This species is listed as vulnerable under the EPBC Act and endangered under the BC Act. Three other threatened fauna species listed under the EPBC Act may occur at the Airport Site, as identified in Table 11, although they were not detected during the field surveys.

Pre clearing ecological surveys were undertaken by the project ecologist prior to clearing works being undertaken for the Bulk Earthworks Contract. Neither the Grey-headed Flying Fox nor the Green and Golden Bell Frog were detected during these surveys.

Whilst all clearing in the CIZ is now complete, an Unexpected Finds Procedure remains current should there be an incidental interaction with a Threatened Species. All WSA relevant Threatened Species are listed in an attachment to the Unexpected Finds Procedure. In the circumstance of a change in species listing this attachment will be updated accordingly so as to ensure currency.

Table 11: Threatened species not detected during the field surveys but may be present

Threatened species	EPBC Act listing	BC Act listing	Habitat attractiveness
Swift Parrot (<i>Lathamus discolor</i>)	Critically endangered	Endangered	Shelter or supplementary foraging resources for migrating individuals
Australasian Bittern (<i>Botaurus poiciloptilus</i>)	Endangered	Endangered	Potential foraging and breeding habitat
Australian Painted Snipe (<i>Rostratula australis</i>)	Endangered	Endangered	Potential foraging and breeding habitat

Nineteen threatened fauna species listed under the BC Act or EPBC Act have been recorded at the Airport Site during current and previous surveys. These are listed in Table 12.

Table 12: Threatened fauna species listed under the BC Act or EPBC Act - within the Airport Site

Threatened fauna species	EPBC Act listing	BC Act listing	Occurrence likelihood	Document reference
Cumberland Plain Land Snail (<i>Meridolum corneovirens</i>)		Endangered	Present	Section 8.2.3 - Threatened Species Management Appendix B - Biodiversity Management Protocols B11. Cumberland Plain Land Snail Management
Little Eagle (<i>Hieraaetus morphnoides</i>)		Vulnerable	Present	Section 8.2.3 - Threatened Species Management Appendix B - Biodiversity Management Protocols B13 - Threatened Birds
Little Lorikeet (<i>Glossopsitta pusilla</i>)		Vulnerable	Present	Appendix B - Biodiversity Management Protocols B13 - Threatened Birds
Scarlet Robin (<i>Petroica boodang</i>)		Vulnerable	Present	Appendix B - Biodiversity Management Protocols B13 - Threatened Birds
Varied Sittella (<i>Daphoenositta cryoptera</i>)		Vulnerable	Present	Appendix B - Biodiversity Management Protocols B13 - Threatened Birds
Black Bittern (<i>Ixobrychus flavicollis</i>)		Vulnerable	Present	Appendix B - Biodiversity Management Protocols B13 - Threatened Birds
Blue-billed Duck (<i>Oxyura australis</i>)		Vulnerable	Present	Appendix B - Biodiversity Management Protocols B13 - Threatened Birds
Eastern Freetail-bat (<i>Mormopterus norfolkensis</i>)		Vulnerable	Present	Appendix B - Biodiversity Management Protocols B10 - Microbat management
Eastern False Pipistrelle (<i>Falsistrellus tasmaniensis</i>)		Vulnerable	Present	Appendix B - Biodiversity Management Protocols B10 - Microbat management
Eastern Bentwing Bat (<i>Minopterus schreibersii oceanensis</i>)		Vulnerable	Present	Appendix B - Biodiversity Management Protocols B10 - Microbat management
Large-footed Myotis (<i>Myotis macropus</i>)		Vulnerable	Probably recorded (anabat)	Appendix B - Biodiversity Management Protocols B10 - Microbat management
Greater Broad-nosed Bat (<i>Scoteanax rueppellii</i>)		Vulnerable	Probably recorded (anabat)	Appendix B - Biodiversity Management Protocols B10 - Microbat management

Threatened fauna species	EPBC Act listing	BC Act listing	Occurrence likelihood	Document reference
Eastern Cave Bat (<i>Vespadelus troughtoni</i>)		Vulnerable	Probably recorded (anabat)	Appendix B - Biodiversity Management Protocols B10 - Microbat management
Powerful owl (<i>Ninox strenua</i>)		Vulnerable	Present	Appendix B - Biodiversity Management Protocols B13 - Threatened Birds
Masked owl (<i>Tyto novaehollandiae</i>)		Vulnerable	Present	Appendix B - Biodiversity Management Protocols B13 - Threatened Birds
Diamond firetail (<i>Stagonopleura guttata</i>)		Vulnerable	Present	Appendix B - Biodiversity Management Protocols B13 - Threatened Birds
Flame Robin (<i>Petroica phoenicea</i> Gould)		Vulnerable	Present	Appendix B - Biodiversity Management Protocols B13 - Threatened Birds
Green and Golden Bell Frog (<i>Litoria Aurea</i>)	Vulnerable	Endangered	Present	Appendix B - Biodiversity Management Protocols B12 - Green and Golden Bell Frog Management
Grey headed flying fox (<i>Pteropus poliocephalus</i>)	Vulnerable	Vulnerable	Present	Appendix B - Biodiversity Management Protocols B14.3 - Mammals - Chiroptera (Bats)

5.7. Migratory species

A total of three migratory species listed under the EPBC Act were recorded at the Airport Site during ecological assessments for the EIS. These species are listed in Table 13.

Table 13: Migratory species listed under the EPBC Act - within the Airport Site

Migratory species	EPBC Act listing	Occurrence likelihood
Latham's snipe (<i>Gallinago hardwickii</i>)	Vulnerable, Marine; Migratory (Bonn, JAMBA, ROKAMBA)	Present
White-throated needletail (<i>Hirundapus caudacutus</i>)	Marine; Migratory (CAMBA, JAMBA, ROKAMBA))	Present
Rufous fantail (<i>Rhipidura rufifrons</i>)	Marine; Migratory (Bonn)	Present

5.8. Aquatic fauna

No threatened fish species listed under the EPBC Act and/or the FM Act that were identified in the database searches as potentially occurring in the locality were collected during the EIS surveys. No suitable habitat for these species was observed during the EIS site visits.

5.9. Aquatic flora

Thirteen aquatic plant species were recorded within the waterbodies (wetlands and creeks) sampled at the Airport Site and in the locality. Most of the aquatic flora were all native while two declared noxious weeds were

recorded during surveys, namely *Salvinia (Salvinia molesta)* and Water Hyacinth (*Eichhornia crassipes*). Where exotic or priority weed species were found, they tended to dominate the waterbody.

5.10. Pre-clearing ecological survey

Prior to the commencement of construction activities, the WSA site was characterised by undulating topography covered by extensive areas of native and exotic pastures interspersed with large native woodland areas some of which were classified as threatened communities. More than 130 dams were noted, mostly constructed for the purposes of supporting farming activities.

Prior to the commencement of site clearing the Bulk Earth Package Project Ecologist was engaged to conduct a pre-clearing survey of vegetation and habitats in the Construction Impact Zone (CIZ) for Western Sydney Airport (WSA) Stage 1. The pre-clearing survey encompassed all lands within the 'Project Area' of Western Sydney Airport.

The pre-clearing process was conducted in accordance with the Roads and Maritime Services "Biodiversity Guidelines" (RTA 2011), the Biodiversity Construction Environmental Management Plan (WSA Co 2018) and the Stage 1 Biodiversity Assessment Report Addendum: Western Sydney Airport (GHD 2018). This survey encompassed the following elements:

- Habitat trees
- Other habitat features
- Aquatic habitat
- Threatened flora
- Threatened fauna
- Confirmation of Endangered Ecological Communities
- Priority weeds.

The outcomes of this survey advised the clearing and associated translocation processes associated with the bulk earthworks clearing activities. As a result, numerous arboreal, terrestrial and aquatic species were collected and translocated to suitable alternate habitats off the WSA site or in the adjacent ECZ areas. This was undertaken by qualified ecologists. It is noted that no threatened fauna species such as the Green and Golden Bell Frog or Grey Headed Flying Fox were identified or translocated at this time.

Threatened flora species were also translocated prior to clearing.

6. Biodiversity aspects and impacts

The potential for biodiversity impacts was considered in Chapter 16 of the EIS, with further ecological assessment undertaken at the Airport Site post-EIS. The findings are summarised in the following sections.

6.1. Construction activities

Construction activities with the potential to impact terrestrial and aquatic biodiversity include:

- Clearing of native vegetation (including habitat);
- Works around watercourses;
- Noise;
- Disturbance of soils, consequential erosion and the mobilisation of sediment; and
- Use of chemicals / fuels (potential for spills).
- Revegetation, planting and soft landscaping upon construction completion
- Hard landscaping elements, including carpark asphalt, pavements upon construction completion

6.2. Ecological impacts

6.2.1. Direct impacts

Construction of the Stage 1 development will result in the removal of approximately 1,199 hectares of vegetation; 794 hectares of exotic grassland and cleared land or cropland, dominated by exotic species and priority and environmental weeds, and 359 hectares of native vegetation.

Potential direct impacts associated with construction of the Project include:

- Removal of native vegetation;
- Loss of terrestrial and wetland fauna habitat; and
- Loss of aquatic fauna habitat.

Vegetation clearing will directly impact:

- 224.1 hectares of Grey Box – Forest Red Gum grassy woodland on flats critically endangered ecological community (CEEC) (104.8 hectares good condition);
- 48.7 hectares of good condition Grey Box – Forest Red Gum grassy woodland on hills CEEC (35.5 hectares good condition);
- 47.6 hectares of Forest Red Gum – Rough-barked Apple grassy woodland endangered ecological community (CEEC) (35.9 hectares good condition);
- 5.9 hectares of Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest (5.5 hectares good condition CEEC); and
- 32.7 hectares of good artificial freshwater wetland on floodplain.

6.2.2. Indirect impacts

Potential indirect impacts associated with construction of the Project include:

- Habitat fragmentation;
- Potential fauna displacement, injury or mortality;
- Edge effects;
- Altered surface water hydrology*;
- Altered groundwater*;
- Erosion, sedimentation and contamination*;
- Dust;

- Light, noise and vibration;
- Mobilisation of legacy contaminated soils;
- Spread of pests and pathogens; and
- Fire.

*Note: These impacts will be discussed in the Soil and Water CEMP

6.3. Environmental Risk Assessment

A risk assessment has been undertaken as part of the review and development of this CEMP and in accordance with Environmental Aspects, Impact and Risk Procedure (Appendix G of the SEMF). The parts of the overall risk assessment relevant to Biodiversity have been extracted and summarised in Table 14 applies to all phases of works that the Construction Plan authorises.

The identification of construction activities and associated impacts that could eventuate during construction of the Project is central to the selection of appropriate environmental safeguards.

The risk management process involved an assessment of all specific Project activities/aspects in or near environmentally sensitive areas and resulted in the development of a list of environmental risks (effects and impacts) and a corresponding risk mitigation strategy and risk ranking.

The identification of risks included a review of the works, and review of the environmental risks identified by the EIS. The mitigations in the risk assessment are in line with the EIS mitigation measures in chapter 7, Table 14.

Table 14: Biodiversity Risk Assessment

Ref	Package	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level pre-mitigation	Mitigation measure 1	Risk level post-mitigation	Management tools
1	BEC	Site Compound establishment	Spraying weeds	Damage to flora and fauna (including threatened species/communities)	Use or accidental release of chemicals resulting in substantially stunted growth of native vegetation	Med (13)	B04 B11	Low (9)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction Erosion and Sedimentation Control Plans (ESCPs) Environmental Control Map (ECM) Exclusion Fencing Protocol Pre clearing site walks with machinery operators
	BEC		Clearing for footprint of compound	Damage to flora and fauna (including threatened species/communities)	Over clearing	Med (13)	B02 B07 B10 B11	Low (10)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM Exclusion fencing protocol Pre clearing site walks with machinery operators
	BEC		Importation of base layer materials	Damage to flora and fauna (including threatened species/communities)	Incorrect stockpiling location	Low (9)	B02 B07 B10 B11	Low (6)	Air Quality CEMP Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM Exclusion fencing protocol Pre clearing site walks with machinery operators
2	BEC	Construction of haul roads and work areas	Minor clearing and grading	Damage to flora and fauna (including	Improper material management damaging vegetation	Low (5)	B02 B07 B10	Very Low (3)	Air Quality CEMP Biodiversity CEMP (including sub-plans)

Ref	Package	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level pre-mitigation	Mitigation measure 1	Risk level post-mitigation	Management tools
				threatened species/communities)			B11		Pre clearing ecological survey and Pre clearing Survey Report EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM Exclusion fencing protocol Pre clearing site walks with machinery operators
	BEC			Damage to flora and fauna (including threatened species/communities)	Over clearing	Low (5)	B02 B07 B10 B11	Very Low (3)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM Exclusion fencing protocol Pre clearing site walks with machinery operators
	BEC			Damage to environmental conservation zone	Over clearing / incorrect stockpiling locations	Low (5)	B03 B11	Very Low (3)	Biodiversity CEMP (including sub-plans) Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM Exclusion fencing protocol Pre clearing site walks with machinery operators
4	BEC	Clearing and grubbing	Habitat removal	Damage to flora and fauna (including threatened species/communities)	Damage to retained vegetation and improper use of habitat resources	Med (14)	B02 B03 B07 B10 B11	Low (10)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs

Ref	Package	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level pre-mitigation	Mitigation measure 1	Risk level post-mitigation	Management tools
									ECM Exclusion fencing protocol Pre clearing site walks with machinery operators
	BEC		Stockpiling mulch	Damage to flora and fauna (including threatened species/communities)	Damage to retained vegetation and improper use of resources	Med (14)	B02 B03 B07 B10 B11	Low (10)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM Exclusion fencing protocol Pre clearing site walks with machinery operators
	BEC		Stockpiling trees	Damage to flora and fauna (including threatened species/communities)	Damage to retained vegetation and improper use of resources	Med (14)	B02 B03 B07 B10 B11	Low (10)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM Exclusion fencing protocol Pre clearing site walks with machinery operators
	BEC		Stockpiling topsoil	Damage to flora and fauna (including threatened species/communities)	Damage to retained vegetation and improper stockpiling location	Med (14)	B02 B03 B07 B10 B11	Low (10)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM Exclusion fencing protocol Pre clearing site walks with machinery operators

Ref	Package	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level pre-mitigation	Mitigation measure 1	Risk level post-mitigation	Management tools
5	BEC	Construction of environmental controls	Sediment basin construction	Endangerment to fauna from dam decommissioning (including threatened species such as the Green and Golden Bell Frog)	Aquatic wildlife fatality	Med (14)	B05	Low (10)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM Targeted surveys as per Biodiversity CEMP requirements Dam decommissioning protocol
			Installation of sediment fences	Damage to flora (including threatened species/communities)	Damage to retained vegetation on periphery of site	Med (14)	B02 B03 B07 B10 B11	Low (10)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM Exclusion fencing protocol Pre clearing site walks with machinery operators
6	BEC	Utility works	Potholing and trenching	Damage to flora	Damage to sensitive areas (including threatened species/communities)	Low (5)	B02 B03 B07 B10 B11	Very Low (3)	Biodiversity CEMP (including sub-plans) Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM
7	BEC	Earthworks	Excavation	Damage to flora (including threatened species/communities)	Dust drift into the environmental conservation zone	Med (17)	B02 B03 B07 B10 B11	Low (12)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs

Ref	Package	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level pre-mitigation	Mitigation measure 1	Risk level post-mitigation	Management tools
									ECM Exclusion fencing protocol Pre clearing site walks with machinery operators
			Earthworks near waterways	Water degradation	Contamination to waterways from silt, materials due to improper controls	High (21)	B01	Med (17)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM
			Embankment creation and stabilisation	Damage to fauna (including threatened species)	Potential for fauna to relocate to excavations / other areas on site	Low (9)	B01 B09 B11	Low (6)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM Threatened fauna relocation protocol as per Biodiversity CEMP
8	BEC	Infrastructure works (culverts, bridges)	Culvert construction	Damage to flora and fauna (including threatened species/communities)	Potential for over clearing	Low (9)	B07 B10 B11	Low (6)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS Soil and Water CEMP Complaints Procedure Induction ESCPs ECM Exclusion fencing protocol Pre clearing site walks with machinery operators
9	BEC	Roadworks	Excavation, compaction, asphalt works on Elizabeth Drive	Damage to flora (including threatened species/communities)	Damage to flora and fauna and spread of weeds	Low (5)	B04 B07 B10 B11	Very Low (3)	Biodiversity CEMP (including sub-plans) Pre clearing ecological survey and Pre clearing Survey Report Air Quality CEMP EWMS

Ref	Package	Activity	Construction Aspect	Environmental Aspect	Potential Impact	Risk level pre-mitigation	Mitigation measure 1	Risk level post-mitigation	Management tools
									Soil and Water CEMP Complaints Procedure Induction ESCPs ECM Exclusion fencing protocol Pre clearing site walks with machinery operators
10	Terminal	Commissioning and ongoing maintenance	Contractors entering the project to undertake building maintenance	Damage to flora	Damage to flora and spread of weeds	Low (8)	B_14 B_15	Low (5)	Air Quality CEMP Biodiversity CEMP EWMS Soil and Water CEMP ECM
11	Terminal	Landscaping	Soft and hard landscaping works at the completion of the project	Damage to flora	Damage to flora and spread of weeds	Low (8)	B_14 B_15	Low (5)	Air Quality CEMP Biodiversity CEMP EWMS Soil and Water CEMP ECM

7. Environmental control measures

Mitigation and management measures that will be implemented during construction are detailed in Table 15 and are consistent with those provided in Tables 28-4 and 28-5 in Chapter 28 of the EIS, as per condition 7.3 in the Airport Plan. The relevant control measures will be included in the site-specific Environmental Work Method Statement (EWMS) and Environmental Control Map (ECM) – refer to Section 5 of the SEMF for further detail.

Table 15: Environmental control measures

Ref.	Measure / Requirement	When to implement	How to implement	Responsibility for Implementation	Reference
BEC: Bulk Earthworks Contract EEW: Early Earthworks MI: Material Importation All Contractors: BEC, EEW, MI, Terminal and other contractors as delegated by WSA					
Waterway Crossings					
B01	New waterways crossings or upgrades of existing crossings, if required on the Airport site, will be designed and constructed to minimise potential impacts on watercourse functionality, in particular impacts on riparian and aquatic habitats and fish passage.	Pre-construction Construction	The works are to be designed and constructed by BEC Contractor and in accordance with best practice management for fish passage.	BEC Design Team	EIS Table 28-5
Pre-clearance surveys for threatened species					
B02	Pre-clearance surveys for threatened species will be undertaken by a qualified ecologist. Pre-clearance surveys will consider suitable survey conditions for the threatened species present and / or potential within the Airport Site. Specific management plans will be prepared to manage impacts on each threatened flora and fauna species. These plans would include: Additional targeted searches of the construction impact zone for the Green and Golden Bell Frog (in suitable conditions) to confirm that they are not present at the site. Should this species be located during targeted surveys, this species would be managed in accordance with the Green and Golden Bell Frog Management Plan. Frog collection and relocation would need to be conducted by appropriately experienced ecologists. Targeted searches of the construction impact zone for the Cumberland Plain Land Snail (in suitable conditions) and salvage and relocation of any snails and/or suitable shelter sites that are detected. A management plan would be prepared to provide more detail on Cumberland Plain Land Snail relocation and habitat management if snails are identified. Snails and/or suitable shelter sites would be relocated to appropriate land on or near the Airport Site. Snail collection and relocation would need to be conducted by appropriately experienced ecologists; Searches for roosting bats at any bridges or culverts that need removal;	Pre-construction Construction	Pre-clearance surveys will be undertaken before any works commence on the Project. Additional specific management plans will be developed in line with the survey findings by an ecologist. Appendix B – Biodiversity Management Protocols - Cumberland Plain Land Snail Management Consideration will be given to the local rainfall conditions and likelihood of finding some species, for example roosting bats. If weather conditions are not suitable for completing pre-clearance surveys (surveys should be undertaken during warm and windless conditions following rainfall as outlined in EPBC Act Policy Statement 3.19 (DEWHA, 2009)) vegetation removal works should be supervised by a suitably qualified ecologist in suitable habitat for the Green and Gold Bell Frog, such as during dam dewatering and vegetation removal around farm dams (as appropriate); Pimelea species included in the targeted flora surveys	All Contractors	EIS Table 28-5

Ref.	Measure / Requirement	When to implement	How to implement	Responsibility for Implementation	Reference
BEC: Bulk Earthworks Contract EEW: Early Earthworks MI: Material Importation All Contractors: BEC, EEW, MI, Terminal and other contractors as delegated by WSA					
	<p>Pre-clearing surveys for larger birds' nests, particularly the White-bellied Sea-Eagle and Little Eagle; and Targeted searches for threatened flora species in areas of appropriate habitat with attention to the vicinity of known populations of <i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> and <i>Pultenaea parviflora</i>.</p> <p>Any unexpected finds would be communicated to the Infrastructure Department and addressed in the translocation plan and/or Offset Delivery Plan as appropriate.</p>				
Habitat clearing and fauna removal plan					
B03	<p>A habitat clearing and fauna removal plan will be developed as part of the Biodiversity CEMP for the management of fauna species during clearing activities. The plan will include the following measures:</p> <p>Preparation of a nest box strategy, including provisions for the:</p> <ul style="list-style-type: none"> Installation of nest-boxes within the Environmental Conservation Zone prior to clearing areas of native vegetation on the Airport Site. This would provide a safe location for hollow-dwelling fauna to be transferred to during clearing operations; Reuse of hollows and fallen debris within conservation areas; and Salvage of native fauna from existing nest boxes in the construction impact zone prior to their removal and translocation. <p>Providing for pre-clearing surveys to be undertaken by a suitably qualified ecologist to mark and map hollow-bearing trees, logs and existing nest boxes that would require fauna management during removal;</p> <p>Establishing protocols for the staged clearing of vegetation and safe tree felling and log removal to reduce the risk of fauna mortality;</p> <p>Measures outlined in the threatened species translocation plan;</p> <p>Establishing protocols for the capture and relocation of less mobile fauna (such as nesting birds and nocturnal fauna) by a trained fauna handler; and</p> <p>Establishing protocols for the appropriate management of injured or deceased individuals.</p>	Pre-construction Construction	<p>The Habitat Clearing and Fauna Management Protocol outlined in the Habitat Management Plan is to be followed during all habitat clearing and outlines the required measures to minimise impact to fauna. See Appendix B - Biodiversity Management Protocols for further details.</p> <p>The Habitat Clearing and Fauna Management Protocol outlined in the Habitat Management Subplan is to be followed if wildlife is discovered within the CIZ during site construction activities, including clearing that may harm, or has resulted in harm, to the animal or poses a risk to site personnel.</p> <p>The Habitat Clearing and Fauna Management Protocol outlined in the Habitat Management Subplan the required measures for the safe handling of native fauna to minimise stress and/or remove the risk of further injury.</p>	BEC	EIS Table 28-5
Weed management plan					
B04	<p>A weed management plan will be developed as part of the Biodiversity CEMP and will include the following measures:</p> <p>Implementing soil erosion and sediment control measures;</p>	Pre-construction Construction	Weed and Disease management plan (WDMP) (Appendix C) outlines the biosecurity hygiene	All Contractors	EIS Table 28-5

Ref.	Measure / Requirement	When to implement	How to implement	Responsibility for Implementation	Reference
BEC: Bulk Earthworks Contract EEW: Early Earthworks MI: Material Importation All Contractors: BEC, EEW, MI, Terminal and other contractors as delegated by WSA					
	Mapping of weed infestations; Removing and controlling priority weed species; Appropriate disposal of weed and weed-infested soils; Stabilising disturbed areas following clearing to prevent weed spread; Monitoring and adaptive management of weeds; and Reporting on the extent, composition and severity of weed infestations and adaptive management measures.		protocol steps required to minimise the spread of weeds and pathogens. WDMP details the weed management actions to be undertaken prior to clearing, during construction and post construction within the Airport. It also includes recommended treatment methods for Priority weeds and environmental weeds known to occur within the Airport Site. WDMP includes information on the ongoing management of weeds		
Dam decommissioning and repurposing protocol					
B05	A protocol for the decommissioning of dams or repurposing of dams for storage and use of water during construction, will be developed as part of the Biodiversity CEMP, in consultation with relevant agencies. The measures to be implemented through the protocol include: Any requirements of a Green and Golden Bell Frog management plan; Eradication of the Alligator Weed infestation on the dammed section of Oaky Creek near Elizabeth Drive prior to any works in the vicinity; Progressively emptying dams over several days to allow fauna to relocate; Avoiding the nesting season of waterbirds, where possible. A pre-removal survey would be conducted to identify bird breeding locations; Salvaging and relocating aquatic vertebrate fauna, including frogs, turtles and eels, to areas of suitable habitat retained at the Airport Site or nearby habitats, about numbers and identification of suitable release sites; Preventing the release of Eastern Gambusia (Gambusia holbrooki) and other noxious fish into local waterways as a result of draining of farm dams. Eastern Gambusia will be eradicated from dams using humane methods; and Establishing protocols for the humane euthanasia of aquatic fauna, including fish.	Pre-construction Construction	A protocol for the decommissioning of dams has been developed and is included in the , see Appendix B - Biodiversity Management Protocols - Aquatic Flora and Fauna Management. BEC to implement.	BEC	EIS Table 28-5
Bushfire management					
B06	As part of ongoing site management activities, the Infrastructure Department has prepared and implemented a bushfire management plan for the Commonwealth owned land at Badgerys Creek. This plan addresses current bushfire risk and identifies response actions. The existing bushfire management plan has been reviewed and updated in consultation with NSW Rural Fire Service to minimise the	Pre-construction Construction	The Bushfire Management Plan has been reviewed and updated with regards to the scope of work for Rev 2, refer Appendix E. Refer to Table 2 of this CEMP for further detailed with regards to consultation with the	BEC	EIS Table 28-5

Ref.	Measure / Requirement	When to implement	How to implement	Responsibility for Implementation	Reference
BEC: Bulk Earthworks Contract EEW: Early Earthworks MI: Material Importation All Contractors: BEC, EEW, MI, Terminal and other contractors as delegated by WSA					
	<p>risk of bushfire and associated impacts on adjoining areas of native vegetation during construction and operation of the proposed airport, including the proposed environmental conservation area. This would include:</p> <p>Identifying activities likely to generate sparks and putting in place appropriate restrictions based on the forecast fire danger;</p> <p>Preparing pre-planned fire response actions plans. The action plans would be issued as part of the site induction for all site personnel;</p> <p>Developing limitations on relevant construction procedures which would be applied during the fire season based on specific fire danger ratings. An example of such restrictions would include the halting of all construction works during extreme or catastrophic fire danger days;</p> <p>Managing the Airport Site to maintain a low overall fuel hazard. Measures to achieve this would include a combination of herbicide application, slashing, low intensity burning and hand removal; and</p> <p>Ensuring that fuel-reduction measures are appropriate to biodiversity values in each area, e.g. low intensity burns rather than slashing would be used in native woodland and forest.</p>		NSW Rural Fire Service and other relevant government stakeholders.		
Clearance minimisation					
B07	The detailed design and construction planning will demonstrate when reasonable and feasible that it has sought to minimise the extent of vegetation clearing within the Project boundary.	Pre-construction Construction	n/a	All Contractors	Good Practice
Threatened flora translocation plan					
B08	<p>A threatened flora salvage and translocation plan will be developed as part of the Biodiversity CEMP, in consultation with relevant agencies and the Australia Botanic Garden at Mount Annan and with consideration of the Guidelines for the Translocation of Threatened Plants (Vallee et al 2004). The threatened flora translocation plan will specify measures for the salvage and translocation of threatened flora species. In particular, it will include:</p> <p>The salvage and transplanting of the known local populations of <i>Pultenaea parviflora</i> and <i>Marsdenia viridiflora</i> and any other threatened flora detected at the Airport Site; and</p> <p>Consideration of the suitability of sites within the Environmental Conservation Zone in order to maintain populations of these species as close to their original location as possible.</p>	Prior to the commencement of works with potential to impact threatened species	Threatened flora salvage and translocation plan has been developed, refer Section 8.6. BEC will be responsible for the implementation of the threatened flora salvage and translocation plan.	WSA BEC	EIS Table 28-5 Section 8.6

Ref.	Measure / Requirement	When to implement	How to implement	Responsibility for Implementation	Reference
BEC: Bulk Earthworks Contract EEW: Early Earthworks MI: Material Importation All Contractors: BEC, EEW, MI, Terminal and other contractors as delegated by WSA					
Threatened species management plans					
B09	Threatened species management plans will be prepared and implemented as part of the Biodiversity CEMP to reduce the potential for impacts on threatened species known to occur on the Airport Site, both inside and outside of the Construction Impact Zone. These plans will include: Maps identifying locations of threatened species; The scope and requirements for targeted surveys and pre-clearing surveys; including an unexpected finds protocol; Vegetation and habitat clearing protocols; Reporting and adaptive management measures;	Prior to the commencement of works with potential to impact threatened species	Unexpected finds protocol, detailing measures to be undertaken if threatened flora and fauna not previously recorded on site are detected during clearing or construction, and if additional occurrences of threatened species previously recorded in the broader area, but not previously recorded at a specific location, are recorded during clearing or construction activities. Threatened species management plans have been developed, works to be overseen by an ecologist, see Appendix B - Biodiversity Management Protocols.	BEC	EIS Table 28-5
Vegetation clearance and habitat loss					
B10	The following measures will be taken to reduce the potential for adverse impacts on ecologically sensitive areas due to vegetation clearance and habitat loss: Deferring vegetation removal until necessary; Locating site offices and stockpiles in already cleared and disturbed areas where possible, to avoid further unnecessary removal or disturbance of native vegetation and hollow-bearing trees; Providing maps to construction staff engaged in Main Construction Works clearly showing vegetation clearing boundaries and exclusion/no-go zones; Engaging a suitably qualified ecologist or environmental officer prior to any clearing works that form part of Main Construction Works to clearly demarcate vegetation protection areas; and Establishing an unexpected finds protocol to detail measures to be undertaken if threatened flora and fauna not previously recorded at the Airport Site are detected during Main Construction Works.	Construction	Vegetation removal will be undertaken when construction works are to be undertaken. Vegetation removal will be staged and deferred until necessary. Offices and stockpiles are planned for cleared areas. Environmental control maps to be given to all workers on Project. An ecologist is to be present during all clearing works with unexpected finds protocols in place. WSA Unexpected Finds Protocols Procedure (SEMF Appendix I).	All Contractors	EIS Table 28-5
Exclusion zones					
B11	Sensitive areas must be delineated on environmental constraints plans and EWMSs. These areas will be temporarily fenced. No materials storage or machinery entry or operation will be permitted within these areas, to ensure they are not subject to disturbance during construction. The ECZ will be demarcated in the field and access will be restricted.	Construction	ECZ has been fenced. Environmental Control Maps to be prepared and tool boxed with site personnel. The contractor to installed physical demarcation onsite as per the ECM.	All Contractors	Good Practice
Disease management protocol					

Ref.	Measure / Requirement	When to implement	How to implement	Responsibility for Implementation	Reference
BEC: Bulk Earthworks Contract EEW: Early Earthworks MI: Material Importation All Contractors: BEC, EEW, MI, Terminal and other contractors as delegated by WSA					
B12	A disease management protocol will be developed as part of the Biodiversity CEMP to minimise the potential for the spread of disease. The protocol will include procedures for the management of plant diseases (such as Phytophthora. Myrtle Rest and Chytrid fungus), as well as any other likely diseases.	Pre-construction Construction	A weed and disease management subplan has been developed, works to be overseen by an ecologist, see Appendix C.	BEC	EIS Table 28-5
Management of vegetation areas outside the construction impact zone					
B13	A vegetation management protocol will be developed as part of the Biodiversity CEMP to guide the activities for managing areas of endemic vegetation outside the Stage 1 construction impact zone. The plan will identify how environment protection objectives for the Environmental Conservation Zone shown in the Land Use Plan in the Airport Plan will be met. The plan will detail specific measures to: Avoid unnecessary disturbance in nearby areas of retained vegetation outside of the construction impact zone such as avoiding unnecessary light spill; Replace exotic grasslands with suitable native vegetation in the Environmental Conservation Zones; Rehabilitate existing remnant and native vegetation within the Environmental Conservation Zones; and Provide ongoing protection of the biodiversity and environmental values within the Environmental Conservation Zone.	Pre-construction Construction	A vegetation management plan has been developed, works to be overseen by an ecologist, see Appendix A.	WSA	EIS Table 28-5
Landscaping					
B14	Landscaping on the airport site will utilise predominantly native vegetation endemic to the region, sourced from the local area where possible. This will include: Planting of native grasses in open areas around airport infrastructure; and The use of native vegetation in decorative gardens and plant screenings used to minimise visual impacts.	Construction	All works are to be designed and constructed in accordance with best practice management.	All Contractors	EIS Table 28-5
Worker inductions					
B15	All workers are to be provided with an environmental induction prior to starting construction activities on site. This would include information on: the ecological values of the airport site; and protection measures and site procedures to be implemented to protect biodiversity during construction.	Pre-construction Construction	To be included as part of site inductions.	All Contractors	EIS Table 28-5

Pre-clearance surveys will be completed prior to the commencement of earthworks. Details on the management of the likely disease and pathogens that have the potential to be identified are included in Table 16. During clearing and other ground disturbance activities if other disease or pathogens are identified, management actions will be developed in consultation with WSA and the Project ecologist.

Table 16: Disease and pathogen management measures

Activity	Management: Myrtle Rust	Management: Phytophthora cinnamomi		Management: Frog Chytrid	Responsibility	Quality control mechanism	
Construction scheduling and works programs	Plan works to commence in low risk areas and move to medium risk areas and last in high risk areas.					All Contractors	Staging documentation Inductions/start up meetings
Inductions	Construction personnel should be made aware of this plan or its core components and include an identification/fact sheet on myrtle rust.	Construction personnel should be made aware of this plan and its core components.		Construction personnel should be made aware of this plan or its core components, with focus for personnel undertaking dust suppression and works in riparian areas.	All Contractors	Inductions 3	
Vehicles and machinery hygiene	Vehicles and machinery should arrive on site free of sources of potential contaminants including vegetative material and mud.	Vehicles and machinery should arrive on site free of sources of potential contaminants including mud. Plant is to be washed down. Appropriate wash down facilities should be provided for plant in medium to high risk areas.		Vehicles and machinery should arrive on site free of sources of potential contaminants including mud. Dust suppression operations to consider the sourcing of suitable water resources where introduction of Chytrid is unlikely.	All Contractors	Inductions/audits	
Access restrictions	Access to medium and high-risk zones where pathogens listed above are identified should be restricted with the specific control measures implemented for the disposal of material or hygiene in these zones. Medium and high-risk pathogen zones, are to be marked on relevant plans, with wash down facilities provided to prevent potential pathogens spreading beyond the area.			All Contractors	Inductions/audits		
Transport of new material	Use a certified supply of plants that is disease-free (the Australian Nursery Industry Myrtle Rust Management Plan (McDonald 2011) provides best practice Myrtle rust management that is to be expected from suppliers).	Soil and fill are to be sourced from suppliers that can provide certification that the material is free of disease.	Where works are undertaken in the vicinity (within 100 m) of waterways, the use of water externally sourced should be minimised or be potable water.		All Contractors	Inductions/start up meetings/audits	
Identification and Testing	Instances of myrtle rust on host plants identified during construction are to be verified by an ecologist or the environment manager.	If medium or high-risk areas are identified in the pathogen risk zones AND cannot be avoided during construction, testing of soils or plant material is to be undertaken to confirm the presence or absence of Phytophthora. The Plant Disease Diagnostic Service provides a range of services to assist in the identification and management of Phytophthora.		If a medium to high risk zone is identified for Chytrid AND the management measures identified herein cannot be practically achieved, then samples of water and/or testing of common frog is to be undertaken by ecologists with samples sent to a NATA accredited laboratory. The CSIRO Livestock Industries Australian Animal Health Laboratories can undertake appropriate laboratory testing.	All Contractors	Inductions/start up meetings/audits	

Activity	Management: Myrtle Rust	Management: Phytophthora cinnamomi	Management: Frog Chytrid	Responsibility	Quality control mechanism
Disposal of material	<p>Medium to high risk areas only: Plant material should be buried on site (and mapped) if possible, with care taken to ensure material does not enter adjacent areas of native vegetation. Seek advice from DPI or a licensed waste facility if material cannot be disposed on site. Local licensed waste facility</p>	<p>Medium to high risk areas only: Retain all affected materials within the contaminated area. Separate stockpiles from affected areas to avoid potential spread into unaffected adjacent areas.</p>	<p>Do not dispose of water, collected on-site, outside of the creek catchment from which it was obtained.</p>	All Contractors	Inductions/start up meetings/audits

8. Biodiversity Management

A series of protocols and plans are included as appendices of this Biodiversity CEMP. These protocols and plans are required to be developed to ensure compliance with project approvals. The subplans and protocols provide controls and actions required to manage the retained ecological features within the Airport Site (see Figure 2).

The preclearance survey report and annual reporting will be used to indicate where potential improvements can be made and where improvements are possible, measures will be implemented as part of an ongoing adaptive management strategy for the Project (as appropriate).

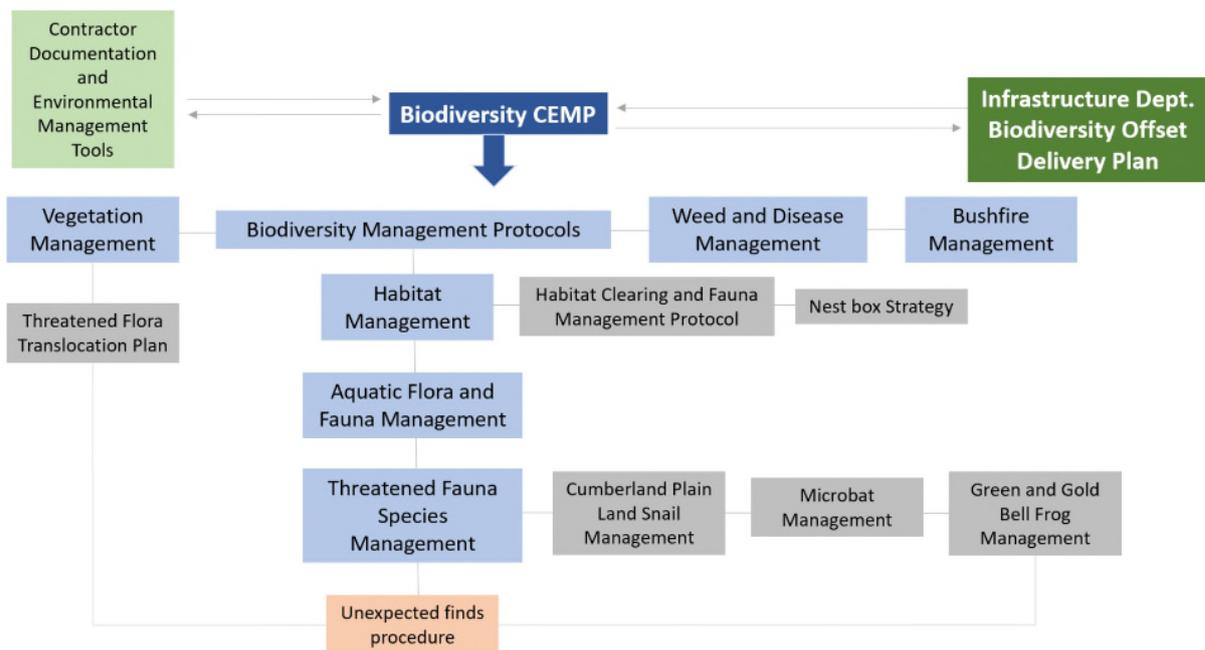


Figure 2: WSA Biodiversity Protocols

8.1. Vegetation management

Impacts within the Airport Site (including areas outside the CIZ) will be managed in accordance with the Vegetation Management Plan (VMP) (Appendix A). The following measures are included in the VMP:

- deferring vegetation removal until necessary;
- locating site offices and stockpiles in already cleared and disturbed areas where possible, to avoid further unnecessary removal or disturbance of native vegetation and hollow-bearing trees;
- requirement for providing maps to construction staff engaged in Main Construction Works clearly showing vegetation clearing boundaries and exclusion/no-go zones;
- requirement for the earthworks contractors to engage a suitably qualified ecologist or environmental officer prior to any clearing works that form part of Main Construction Works to clearly demarcate vegetation protection areas;
- implementing an unexpected finds protocol (SEMF Appendix I (WSA00-WSA-00000-EN-PRO-000001)) which details measures to be undertaken if threatened flora and fauna not previously recorded at the airport site are detected during Main Construction Works;
- requirement to avoid unnecessary disturbance in nearby areas of retained vegetation outside of the CIZ such as avoiding unnecessary light spill and noise;
- Requirement to replace exotic grasslands with suitable native vegetation within the ECZs; and
- Requirement to protect environmental values within the ECZ.

8.2. Biodiversity Management Protocols

8.2.1. Habitat Management

Impact within the Airport Site (including areas outside the CIZ) will be managed in accordance with the Habitat Management Plan (**HMP**) (refer to Appendix B - Biodiversity Management Protocols). The following is included in the plan:

- Strategies to achieve connectivity throughout the landscape and minimise the effects of habitat fragmentation and associated edge effects;
- Nest box Management Strategy, detailing:
 - Maps and data to show hollow-bearing trees proposed to be removed and the number of hollows associated with each tree
 - Provisions for the installation of nest boxes within the ECZ prior to clearing areas of native vegetation on the airport site
 - Reuse of hollows and fallen debris within conservation areas
 - The number of nest boxes to be installed, commensurate with the number of hollows proposed to be removed
 - Provisions for salvage of native fauna from existing nest boxes in the CIZ prior to their removal and translocation
 - A guide on the installation of nest boxes and the appropriate design specifications
 - A monitoring program for the monitoring of the nest boxes.
- Pre-clearance surveys to be conducted by a suitably qualified ecologist to mark and map hollow-bearing trees, logs and existing nest boxes that would require fauna management during removal;
- establishing protocols for the staged clearing of vegetation and safe tree felling and log removal to reduce the risk of fauna mortality;
- threatened species translocation requirements;
- protocols for the capture and relocation of less mobile fauna (such as nestling birds and nocturnal fauna) by a trained fauna handler;
- protocols for the appropriate management of injured or deceased individuals;
- landscaping on the Airport site will utilise predominantly native vegetation endemic to the region, sourced from the local area where possible. This will include:
 - planting of native grasses in open areas around airport infrastructure; and
 - the use of native vegetation in decorative gardens and plant screenings used to minimise visual impacts.

8.2.2. Aquatic Flora and Fauna Management

Impacts within the Stage 1 CIZ will be managed in accordance with the recommendations in the Aquatic Flora and Fauna Management (**AFFM**) Subplan (refer to Appendix B - Biodiversity Management Protocols). The following is addressed:

- Protocol for dam decommissioning/dewatering;
- Any management requirements for the Green and Golden Bell Frog (GGBF)
- Requirement to progressively emptying dams over a number of days to allow fauna to relocate
- Requirement to avoid the nesting season of waterbirds, where possible. A pre-removal survey would be conducted to identify bird breeding locations;
- Requirement to salvage and relocate aquatic vertebrate fauna, including frogs, turtles and eels, to areas of suitable habitat retained at the airport site or nearby habitats, with regard to numbers and identification of suitable release sites;
- Management measures to prevent the release of Eastern Gambusia (*Gambusia holbrooki*) and other noxious fish into local waterways as a result of the draining of farm dams. Eastern Gambusia will be eradicated from dams using humane methods; and

- Establishing protocols for the humane euthanasia of aquatic fauna, including fish.
- Identification of potential risks and mitigation measures for watercourse functionality, riparian and aquatic habitat and fish passage as a result of the design and construction of waterway crossings;
- Describes the weed management activities (i.e. the eradication of Alligator Weed on the dammed section of Oaky Creek near Elizabeth Drive prior to any works in the vicinity) (also see WBMP); and
- Provide schedules for inspection, monitoring, management and corrective actions.

Construction in Stage 1 development would comprise of the infilling of stream outlets, including the upper reaches of Oaky Creek and smaller drainage lines that feed into Badgerys, Cosgroves and Duncans Creeks, which are currently situated within the Stage 1 Construction Impact Zone.

The existing tributaries are highly modified (high levels of eutrophication as a result of runoff from nearby urbanisation and domination by environmental and priority weeds) and in poor condition as a result of historical and current land uses. The current aquatic fauna assemblage within these creeks is indicative of its poor quality. Water quality parameters and background levels are documented in the Soil and Water CEMP.

Badgerys Creek will be retained within an environmental conservation zone, as outlined in the revised draft Airport Plan.

8.2.3. Threatened Species Management

The threatened species management protocols detail the requirements for Microbat; Cumberland Plain Land Snail (**CPLS**); and GGBF (refer to Appendix B - Biodiversity Management Protocols).

Targeted surveys (in suitable conditions) will be undertaken by a suitably qualified ecologist as part of the preclearance surveys to determine the presence of threatened microbats, CPLS and GGBF within the Airport Site. If present or likely to be present, the following will be addressed in the respective Management Protocols:

- Maps identifying locations of threatened species;
- the scope and requirements for targeted surveys and pre-clearing surveys; including an Unexpected Finds Protocol (SEMF Appendix I (WSA00-WSA-00000-EN-PRO-000001));
- relocation to suitable habitat on or near the Airport site;
- searches for roosting bats at any bridges or culverts that need removal;
- pre-clearing surveys for larger birds' nests, particularly the White-bellied Sea-Eagle, and Little Eagle;
- targeted searches for threatened flora species in areas of appropriate habitat with particular attention to the vicinity of known populations of *Marsdenia viridiflora subsp. viridiflora* and *Pultenaea parviflora*.
- vegetation and habitat clearing protocols; and
- reporting and adaptive management measures.

8.2.4. Unexpected Finds Protocol

All Contractors will be responsible for implementing the WSA Unexpected Finds Protocol (SEMF Appendix I (WSA00-WSA-00000-EN-PRO-000001) which details measures to be undertaken if flora and fauna not previously recorded at the airport site are detected during Main Construction Works.

8.3. Weed and Disease Management

Impacts within the Airport site (including areas outside the CIZ) will be managed in accordance with the Weed and Disease Management Plan (**WDMP**) (Appendix C). The following is addressed in the WDMP:

- requirement for implementing soil erosion and sediment control measures;
- mapping of weed infestations;
- removing and controlling noxious weed species;
- requirement for the appropriate disposal of weeds and weed-infested soils;
- stabilising disturbed areas following clearing to prevent weed spread;
- monitoring and adaptive management of weeds; and

- reporting on the extent, composition and severity of weed infestations and adaptive management measures.

8.4. Bushfire Management

Impacts within the Airport Site (including areas outside the CIZ) will be managed in accordance with the Bushfire Management Plan (**BMP**) (Appendix E).

8.5. Threatened flora propagation program

A Threatened Flora Propagation Program (**TFPP**) developed in consultation with the Dawe, Department for Planning, Industry and Environment., and the Australian Botanic Gardens, Mount Annan (**ABGMA**) is required under Condition 33 of the Airport Plan. This activity was presented as a mitigation measure (through the development of a threatened flora translocation plan) in the EIS. The offset package in the EIS also recommended that the Infrastructure Department's Biodiversity Offset Delivery Plan (**BODP**) include consideration of the salvage and propagation of the known local populations of *Pultenaea parviflora* and *Marsdenia viridiflora* subsp. *viridiflora* and any other threatened plants detected at the Airport Site.

As part of the work required to meet the biodiversity conditions in the Airport Plan, ABGMA has been engaged to deliver a TFPP on behalf of the Infrastructure Department. Located in Western Sydney, ABGMA is the native plant garden of the Royal Botanic Garden, Sydney, and specialises in the conservation and seed storage of New South Wales's threatened species. Operating out of PlantBank, a state-of-the art \$20 million purpose-built seed storage and research centre, staff have extensive experience in collecting and conserving Western Sydney flora.

The TFPP will directly contribute to translocation and ecosystem restoration activities by providing source populations of these threatened plants. Outcomes of the propagation program and the end use of the plants have been reported on in the Infrastructure Department's BODP.

8.6. Threatened flora salvage and translocation plan

A Threatened Flora Salvage and Translocation Plan (**TFSTP**) has been developed as part of this CEMP (Appendix E). The TFSTP has been developed in consultation with relevant agencies and the Australian Botanic Garden at Mount Annan and with consideration of the Guidelines for the Translocation of Threatened Plants (Vallee et al 2004).

The TFSTP specifies measures for the salvage and translocation of threatened flora species and includes:

- The salvage and propagation or transplanting of the know local populations of *Pultenaea parviflora* and *Marsdenia viridiflora* subsp. *viridiflora* and any other threatened flora detected at the airport site.
- Consideration of the suitability of sites within the ECZ in order to maintain populations of these species as close to their original location as possible.

8.7. Biodiversity offsets

Biodiversity offsets are proposed as required by Conditions of Approval 30. These are documented separately in the BODP prepared by the Infrastructure Department.

Biodiversity offsets to compensate for significant residual impacts on threatened species and communities listed under the EPBC Act were calculated using the offset assessment guide under the EPBC Act Environmental Offset Policy (DSEWPaC 2012). Biodiversity offsets to compensate for significant residual impacts on other features of the natural environment on Commonwealth land, plants, animals and their habitat, including threatened species, populations and communities listed under the BC Act (refer to Section 16.2.9 Offsetting Impacts in Western Sydney Airport Environmental Impact Statement, Volume 2A).

8.8. Native Seed Collection

Greening Australia undertook native seed collection at the Airport Site to support the organisations Native Seed Production Area (**SPA**) program (in accordance with Condition 32 of the Airport Plan). WSA facilitated this access.

9. Environmental roles and responsibilities

The key environmental management roles and responsibilities for the construction phase of the work are detailed in Section 4.4 of the SEMF.

WSA will ensure sufficient resources are allocated on an ongoing basis to ensure effective implementation by both WSA and the responsible contractors.

Ecologist

The role of the appointed ecologist will be to undertake ecology surveys, advise and undertake translocation (if required), install and monitor nest boxes and supervise dam dewatering in accordance with the Biodiversity CEMP. Ecology surveys will be undertaken for threatened species and ahead of vegetation clearing, recording all instances of noxious weeds and threatened species. The collection, handling and storing of aquatic fauna will be undertaken by experienced aquatic ecologists and operate under an approved Animal Research Authority scientific collection permit issued by the Secretary NSW Department of Industry.

10. Environmental inspection, monitoring and auditing

Monitoring, inspection and auditing will be undertaken to measure effectiveness and facilitate continuous improvement of biodiversity management.

General environmental monitoring, inspection and auditing requirements are summarised in Section 9 of the SEMF.

A summary of the environmental inspection, monitoring and auditing requirements is provided below, with details of how they apply to biodiversity management where applicable.

10.1. Environmental Inspections

10.1.1. WSA environmental inspections

Environmental site inspections at active, exposed work sites will be undertaken by the WSA Environment Manager (or delegate) on a monthly basis to evaluate the effectiveness of environmental controls implemented by the contractor.

The monthly site inspection is to include a visual check of all biodiversity management control measures including but not limited to the following:

- Adherence to the designated traffic access and transport routes (this may include observation from strategic locations); and
- Ensuring that all vehicle movements (including contractors and sub-contractors) are compliant with the approved routes.

The findings of the WSA site environmental inspection will be recorded on a WSA Site Environmental Inspection Checklist with an accompanying photographic style inspection report.

Refer to Appendix K of the SEMF for further details with regards to completing the Site Environmental Inspection Checklist.

10.1.2. Contractor environmental inspections

Regular site inspections will be undertaken to monitor compliance with this plan at active, exposed work sites. Inspection results will be recorded, and the inspection log made available upon request. Any improvement opportunities or non-conformances will be reported in the monthly report and discussed at the Environmental Coordination meeting.

More frequent site inspections by the site environmental coordinator will be conducted onsite when activities with many vehicle movements are underway.

The Contractor's Environmental Manager and/or Environmental Coordinators will undertake inspections in accordance with the Contractor Environmental Management Framework. The Contractor Environmental Coordinators will record inspection findings on an inspection checklist form.

If any maintenance and/or deficiencies in environmental controls or in the standard of environmental performance are observed, they will be recorded on the checklist form. Records will also include details of any maintenance required, the nature of the deficiency, any actions required and an implementation priority.

10.1.3. Pre-start inspection

Prior to the commencement of works on each shift, an informal inspection will be carried out by the relevant contractor and will include a check of relevant environmental controls, and allocate resources required to ensure effective operation and maintenance. This is to include an inspection of relevant biodiversity management mitigation measures and controls, where applicable. Works are not to commence unless inspections are found to be satisfactory.

The foreman will undertake the pre-work inspections.

10.2. Biodiversity monitoring

General environmental monitoring requirements are set out in the AEPR which will include the following:

- Monitoring must take place under the direction of an appropriately qualified person; and
- The results of the monitoring must be kept in a written record.

Specific biodiversity monitoring requirements, including timing and responsibilities, are included in Table 17.

Table 17: Biodiversity monitoring requirements

Reference	Requirement	Timing	Responsibility
B_M_01	Vegetation retention and restoration monitoring (refer to VMP for detail)	Prior to vegetation removal and establishment of no-go zones AND Ongoing post vegetation removal through to site operation.	All Contractors To be undertaken under the direction of an appropriately qualified person
B_M_02	Monitoring of Weeds (refer to Weed Management Plan for detail)	Prior to implementation of control measures AND Ongoing post weed control through to site operation.	All Contractors To be undertaken under the direction of an appropriately qualified person
B_M_03	Monitoring of vegetation clearing (refer to VMP for detail)	Prior to vegetation removal and establishment of no-go zones AND Ongoing post vegetation removal through to the cessation of construction activities.	All Contractors To be undertaken under the direction of an appropriately qualified person

Aquatic flora and fauna management performance measures are detailed in Table 18.

Table 18: Aquatic flora and fauna management performance measures

Performance indicator	Corrective actions	Responsibility
Mortalities of native aquatic fauna identified during dewatering activities.	Monitor levels of dissolved oxygen during draining of the dams and undertake aeration of the waterbodies as necessary.	The contractor is responsible for engaging suitably qualified aquatic ecologists to undertake the monitoring and suitably qualified contractors to undertake the operation of the draining of the dams.
Dam bed deemed unsafe to undertake fauna salvage.	Excavate sumps/pits in the dam bed and drain water to the base level of the dam bed. Project ecologist (Aquatic) is to instruct excavator operators on the correct procedures to undertake the aquatic fauna salvage using the sumps/pits.	
Aquatic fauna is identified by construction personnel following dam dewatering and salvage.	Contact the project ecologist (Aquatic) to provide advice or attend the site to relocate	

Where required, targeted surveys for Green and Golden Bell Frog will be completed in accordance with the requirements outlined in Table 19.

Table 19: Proposed methodology for Green and Golden Bell Frog targeted surveys

Species	Threat status	Timing	Monitoring type	Methodology
Green and Golden Bell Frog	Endangered (BC Act) Vulnerable (EPBC Act)	Oct-Jan after a minimum 50 millimetres of rainfall in seven days	Call survey, including call playback	Call playback over four consecutive nights. The methodology will follow the static call survey method with individual points predetermined and 5 minutes of the call will be broadcast followed by 5 minutes of listening. A suitably qualified ecologist will also liaise with relevant landholders to confirm the species is calling at a known reference site prior to targeted surveys.
			Nocturnal spotlighting surveys	Nocturnal spotlighting searches over four consecutive nights using a visual encounter survey with a randomise walk design. This will be conducted immediately after the call surveys detailed above.

Monitoring for weeds and pathogens will be completed as outlined in Table 20.

Table 20: Weed and pathogen monitoring schedule and performance indicators

Action	Description	Timing of action	Reporting	Responsibility	Performance Parameters / Assessment Criteria
Mapping of Priority Weeds and Pathogens	Priority weed mapping will occur prior to clearing works.	Priority weed mapping to be undertaken: Prior to construction.	Any additional instances of weeds or pathogens that are identified are to be provided, with co-ordinates and species identification to ensure weed and pathogen mapping remains current.	Contractor (CIZ) WSA (all other areas)	Indicators of success of the Weed Management Procedure include: <ul style="list-style-type: none"> No new noxious weed and pathogen infestations within the Airport site and in adjacent bushland as a result of the Project. Assessment criteria: <ul style="list-style-type: none"> No new priority weed species (in addition species list within this plan) to establish in the Airport.
Implementation of weed and pathogen management measures	Weed and pathogen management measures will occur throughout the extent and duration of the project in accordance with this plan.	Noxious weed management to be undertaken: <ul style="list-style-type: none"> 1. Prior to construction. 2. During construction. 	The Airport site would be monitored for weed invasion during weekly site inspections, and any other inspections or audits undertaken as part of CEMP requirements. The presence of weed infestations would be reported as part of the inspection process, and include actions to be undertaken to	Contractor (CIZ) WSA (all other areas)	Indicators of success of the Weed Management Procedure include: <ul style="list-style-type: none"> A reduction in the area of priority weed and pathogen infestations within the Airport site. Assessment criteria: <ul style="list-style-type: none"> A 50% reduction in identified weed infestations to be achieved in year 1 within the CIZ, with gradual improvement for the following two years.

Action	Description	Timing of action	Reporting	Responsibility	Performance Parameters / Assessment Criteria
			manage these infestations		
Weed and pathogen management during rehabilitation	Rehabilitated sites	Stabilisation of catchments	Rehabilitated sites would be monitored during inspections, with weed management to be undertaken if required to manage any new infestations.	WSA	Indicators of success of the Weed Management Procedure include: <ul style="list-style-type: none"> • Control of weed infestation during rehabilitation of sites. • Assessment criteria: • No uncontrolled weed infestations.

Where a non-conformance or an improvement opportunity is identified, the non-conformance and improvement opportunity process described in SEMF Section 10 will be implemented.

10.3. Environmental auditing

Refer to Section 9.2 of the SEMF for environmental auditing requirements, including internal audits, independent audits and audits to be undertaken by contractors.

Auditing and subsequent reporting will be undertaken annually to ensure compliance with this BCEMP, Airport Plan Conditions of Approval and Part 13 Permit Conditions of Approval, as identified in Section 4 of this CEMP.

10.4. Environmental reporting

General environmental reporting requirements are detailed in Section 9.3 of the SEMF.

In addition, a summary of reporting requirements required under this Biodiversity CEMP (including environmental reporting requirements required under the Airport Plan specific to the Biodiversity CEMP) is provided in Table 21.

Table 21: Biodiversity management reporting

Action	Scope	Timing / Frequency	Responsibility
Annual reporting	Unless otherwise agreed in writing by an Approver, an annual report will be prepared in relation to compliance with this Biodiversity CEMP (Condition 39). In accordance with Condition 39 (2) WSA will publish each of the annual reports on its website within three months of the end of the period in respect of which the report was prepared, with evidence providing proof of the date of publication to the Infrastructure Department with a copy to the Environment Department. The report must remain on the website for a period of at least 12 months. An annual report is also to be prepared and managed in accordance with section 6.03 of the AEPR.	Annual	WSA Environment Manager.
Part 13 Report	Document compliance with the conditions for the Environment Protection Biodiversity Conservation Act 1999 (EPBC Act) Part 13 Permit (E2017-0138). Published on WSA website.	Annual	WSA Environment Manager All Contractor
Reporting pollution incidents (required under the Airport Act)	Report pollution incidents resulting in offsite impacts to the NSW Environment Protection Authority – refer to	As required	All

Action	Scope	Timing / Frequency	Responsibility
	WSA <i>Environmental Non-conformance Classification and Reporting Procedure</i> .		
Complaints reporting	Recording of complaints and stakeholder interactions	As required	WSA Environment Manager WSA Community and Stakeholder Manager All Contractors
Environmental Site Register (required under the 6.02(3) of the AEPR)	Environmental Site Register to be kept and maintained to include written record of environmental conditions of the Airport and its environmental management generally.	As required	WSA Environment Manager
General environmental inspection	Inspection of environmental management controls on site and sighting of site documentation as required by the contractor's CEMP.	Weekly	WSA
General environmental inspection	Inspection of environmental management controls and site documentation for contractor works (as required by the contractor's CEMP).	As per Contractor environmental management system (minimum weekly)	All Contractors
Reporting of non-conformances and improvement opportunities	The management and reporting requirements of environmental non-conformances and improvement opportunities will be in accordance with Section 9 of the SEMF.	As required	WSA All Contractor
Survey reporting	Following the completion of the targeted Green and Golden Bell Frog surveys, a report or brief letter will be submitted five working days detailing the results of the survey.	5 working days after survey	All Contractors

10.5. Review of approved plans

WSA will review each approved plan at least every five years (from the date of approval) as required by the Airport Plan. A review will also be completed annually to ensure that it continues to meet the approval criteria. Details of the review will be included in the annual report (refer to Section 9.3 of the SEMF). If the review identifies areas where the plan does not continue to meet the approval criteria for that plan, a variation to the approved plan will be prepared and submitted for approval.

WSA may initiate reviews of Approved Plans at other times in response to improvement opportunities, non-conformances, and changes to scope of work or construction methodology or alterations to legal or contractual requirements.

Any changes identified and implemented through the variation and review process identified above will be communicated to relevant contractors through re-issue of the revised WSA Approved Plan and subsequent training and awareness (refer to refer to Section 4 of the SEMF).

10.6. Environmental Incidents and complaints management

The management and reporting of environmental incidents shall be undertaken by the appropriate person as detailed in Section 7 of the SEMF.

All communications and complaints management will be implemented and managed in accordance with Section 8 of the SEMF and the Communities and Stakeholder Engagement Plan.

11. Competence, training and awareness

To ensure this Biodiversity CEMP is effectively implemented, each level of management is responsible for ensuring that all personnel reporting to them are aware of the requirements within. The WSA Environment Manager will coordinate the necessary and relevant environmental training in conjunction with other training and development activities.

All competence, training and awareness requirements will be implemented as detailed in Section 6 of the SEMF.

12. References

Commonwealth Department of Infrastructure and Regional Development, 2016. *Airport Plan (December 2016)*

Commonwealth Department of Infrastructure and Regional Development, 2016. *Western Sydney Airport Environmental Impact Statement, 2016 Standards Australia 2001. Australian and New Zealand environmental management international standard (AS/NZS ISO 14001)*

Department of the Environment, Water, Heritage and the Arts, 2010. Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest EPBC Act Policy Statement 3.31.

<http://www.environment.gov.au/system/files/resources/3c01d3d1-c135-4d91-a605-f5730975d78c/files/cumberland-plain-shale-woodlands.pdf>.

Department of the Environment, Water, Heritage and the Arts, 2009. Significant impact guidelines for the vulnerable green and golden bell frog (*Litoria aurea*) EPBC Act policy station 3.19. <

<http://www.environment.gov.au/system/files/resources/e882f6c7-a511-4fba-9116-2f2f7ef941aa/files/litoria-aurea-policy.pdf>>.

DPI 2011. Noxious and Environmental Weed Control Handbook. A Guide to Weed Control in Non-crop, Aquatic and Bushland Situations, 5th Edition. NSW Department of Primary Industries.

Landcom Managing Urban Stormwater: Soils and Construction (2004).

McNaught, I, Thackway, R, Brown, L. and Parsons, M. (2006). A field manual for surveying and mapping nationally significant weeds. Bureau of Rural Sciences, Canberra

Department for Planning, Industry and Environment. 2011. Conservation Management Notes, Seed Collecting. NSW Office of Environment and Heritage.

Department for Planning, Industry and Environment. 2011b. Conservation Management Notes, Managing bushland and wildlife habitat – Revegetation.

NSW Office of Environment and Heritage.

Ralph, M. 1993. Seed Collection of Australian Native Plants – For Revegetation, Tree Planting and Direct Seeding. Bushland Horticulture, Fitzroy.

Sydney Weeds Committee 2013. High Risk Weeds in the Sydney and Blue Mountains Region.

Gibbons, P and Lindenmayer, D. 1997. Conserving Hollow-dependent Fauna in Timber Production Forest. Environmental Heritage Monograph 3: 110.

Gibbons, P and Lindenmayer, D. 2002. Tree Hollows and Wildlife Conservation in Australia. CSIRO Publishing, Collingwood, Australia.

Goldingay RL. 2011. Characteristics of tree hollows used by Australian arboreal and scansorial mammals. Australian Journal of Zoology 59: 277-294.

Beyer & Goldingay. 2006. The value of nest boxes in the research and management of Australian hollow-using arboreal marsupials. Wildlife Research 33: 161-174.

Commonwealth Department of Infrastructure and Regional Development, 2016. *Western Sydney Airport Environmental Impact Statement, 2016 Standards Australia 2001. Australian and New Zealand environmental management international standard (AS/NZS ISO 14001)*

CPB Lend Lease Joint Venture 2018. Biodiversity Construction and Environment Management Plan. Report For WSA.

Gleeson J and Gleeson D. 2012. Reducing the Impacts of Development on Wildlife. CSIRO Publishing, Collingwood.

Lindenmayer DB, MacGregor CI, Cunningham RB, Incoll RD, Crane M, Rawlins D, and Michael DR. 2003. The use of nest boxes by arboreal marsupials in the forests of the Central Highlands of Victoria. *Wildlife Research* 30: 259-264.

NPWS 2001. Threatened Species Management Information Circular No. 6 – Hygiene Protocol for the Control of Disease in Frogs. National Parks and Wildlife Service, Hurstville.

Phillott, A. D., R. Speare, H. B. Hines, E. Meyer, L. F. Skerratt, K. R. McDonald, S. D. Cashins, D. Mendez and L. Berger (2010). "Minimising exposure of amphibians to pathogens during field studies." *Diseases of Aquatic Organisms*.

Western Sydney Airport Environmental Impact Statement Volume 2a: Stage 1 Development, Chapter 16 – Biodiversity (DIRD 2016).

DPI 2014. *Noxious and environmental weed control handbook. A guide to weed control in non-crop, aquatic and bushland situations, 6th edition*, NSW Department of Primary Industries. Accessed via- http://www.dpi.nsw.gov.au/_data/assets/pdf_file/0017/123317/noxious-and-environ-weed-control-handbook.pdf.

NSW Scientific Committee 2003a. *Infection of frogs by amphibian chytrid causing the disease chytridiomycosis - key threatening process listing* Final Determination.

NSW Scientific Committee 2003b. *Invasion of native plant communities by exotic perennial grasses - key threatening process listing* Final determination.

NSW Scientific Committee 2006a. *Exotic vines and scramblers - key threatening process listing* Final determination.

NSW Scientific Committee 2006b. *Lantana camara - key threatening process listing* Final determination.

NSW Scientific Committee 2007. *Invasion and establishment of Scotch broom - key threatening process declaration* Final determination.

NSW Scientific Committee 2010. *Invasion of Native Plant Communities by African Olive *Olea europaea* L. subsp. *cuspidata* (Wall ex G. Don Ciferri) - key threatening process listing* Final determination.

NSW Scientific Committee 1999. *Invasion of Native Plant Communities by *Chrysanthemoides monilifera* - key threatening process listing* Final determination.

Roads & Traffic Authority 2011. *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects*. Guide 6: Weed management and Guide 7: Pathogen Management. New South Wales Roads and Traffic Authority.

Appendix A

Vegetation Management Plan

A1. Scope

The scope of this Vegetation Management Plan (VMP) is to develop a framework for the management of vegetation to be retained, vegetation to be removed, and the ongoing management of weeds within the airport. The VMP also outlines ongoing management actions required for successful establishment of native plants (where applicable) within the ECZ, and actions to protect the surrounding vegetation from future negative pressures.

A2. Objectives

The specific objectives for the implementation of this VMP are to:

- Outline strategies to avoid or minimise impacts on vegetation where possible.
- Outline the management requirements for any vegetation to be retained, including details on tree and vegetation protection measures e.g. establishment of no go fencing
- Provide schedules for inspection, monitoring, management and corrective actions.
- Describe weed management activities.

A3. Methods

A3.1 Desktop Research

A review of all available design plans and reports relating to WSI and adjacent areas will be conducted, as well as relevant legislation, recent vegetation mapping and other documentation relevant including;

- Western Sydney Airport Environmental Impact Assessment (GHD 2016)
- Proposed Site Plans
- The Native Vegetation of the Sydney Metropolitan Area (Department for Planning, Industry and Environment. 2013)
- NSW Scientific Committee final determinations for threatened biodiversity.
- Department of the Environment and Energy (DEE) Protected Matters Search Tool for matters protected by the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Department for Planning, Industry and Environment. NSW BioNet, the database for the Atlas of NSW Wildlife, for matters protected under the *Biodiversity Conservation Act 2016* (BC Act).

A3.2 Site Assessment

A pre-clearing survey of the CIZ covered by the Biodiversity CEMP will be conducted prior to the commencement of construction works by a qualified and experienced ecologist. Investigation will involve:

- The identification of native and exotic plant species, according to Field Guide to the Native Plants of Sydney (Robinson 2003) and the Flora of NSW (Harden 1992, 1993, 2000, 2002), with reference to recent taxonomic changes.
- The identification and mapping of plant communities according to the structural definitions of Native Vegetation of the Sydney Metropolitan Area (Department for Planning, Industry and Environment. 2013).
- Targeted searches for plant species of conservation significance according to the “random meander” method (Cropper 1993).
- Identifying fauna habitats, assessing their condition and assessing their value to threatened fauna species.

- Observations of animal activity and searches for indirect evidence of fauna (such as scats, nests, burrows, hollows, tracks, scratches and diggings).
- An assessment of the natural resilience of the vegetation of the site.
- Identification of previous and current factors threatening the ecological function and survival of native vegetation within and adjacent to the Airport.
- Determination of appropriate rehabilitation and bush regeneration techniques for the native vegetation of the Airport.

The conservation significance of plant species and plant communities will be determined according to:

- *Biodiversity Conservation Act 2016* (NSW) (BC Act) for significance within NSW
- *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for significance within Australia.

A3.3 Limitations

Ecological surveys provide a sampling of flora and fauna at a given time and season. There are several reasons why not all species will be detected at a site during survey, such as species dormancy, seasonal conditions, and ephemeral status of waterbodies and migration and breeding behaviours of some fauna. In many cases these factors do not present a significant limitation to assessing the overall ecological values of a site.

A4. Vegetation communities

WSI contains seven vegetation communities that were identified during EIS investigations (GHD 2016):

- Grey Box – Forest Red Gum grassy woodland on flats (HN528)
- Grey Box – Forest Red Gum grassy woodland on hills (HN529)
- Forest Red Gum – Rough-barked Apple grassy woodland (HN526)
- Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest (HN512)
- Artificial freshwater wetland
- Exotic Grassland
- Cleared land or cropland

4A.1 Grey Box - Forest Red Gum grassy woodland on flats

The Forest Red Gum grassy woodland was found to be in moderate condition.

The canopy consisted of Grey Box *Eucalyptus moluccana*, Forest Red Gum *Eucalyptus tereticornis* and the occasional Thin-leaved stringybark *Eucalyptus eugenioides*. The canopy provided approximately 20% cover and varied from 15–25m tall.

The midstory consisted of a generally sparse cover 1- 26.5% of shrubs such as *Dilwynia sieberi* or gorse Bitter-pea *Daviesia ulicifolia*. On occasion dense patches of Native Blackthorn, Black Wattle *Acaica decurrens* or Parramatta wattle *Acacia parramattensis* growing to 5m tall providing 50-80% cover.

The ground cover consisted of Kangaroo Grass *Themeda australis*, Weeping Grass *Microlena stipoides* var. *stipoides*, Treeawn Speargrass *Aristida vagans*, Paddock Love Grass *Eragrostis leptostachya* and *Lomandra filiformis* subsp. *Filiformis*, occasional understory species such as peach heath *Lissanthe strigose*, herbs such as *Caesia parviflora* var. *vittata*, Kidney Weed *Dichondra repens*, Native Wandering Jew *Commelina cyanea* and Blue Trumpet *Brunoniella australis*.

Locally high cover of chenopods such as climbing Saltbush *Einada nutans* subsp. *Nutans* and berry saltbush *Einadia hastata* moderate cover and species richness of scramblers such as Amulla *Eremophila debilis* and Glycine species.

Exotic plants such as African Boxthorn *Lycium ferocissimum* and African olive *Olea europaea* subsp. *europaea* Cuspidate pasture grasses such as *Setaria parviflora*, Kikuyu *Pennisetum clandestinum* and Paspalum *Paspalum dilatatum*, African Lovegrass *Eragrostis curvula* and Panic Veldtgrass *Ehrharta erecta*, Fireweed *Senecio madagascariensis*, Dandelion *Taraxacum officinale*, Greater Beggar's Ticks *Bidens subalternans* Black-berry Nightshade *Solanum nigrum* and *Solanum sisymbriifolium* and climbers such as Moth Vine *Araujia sericifera* and Bridal Creeper *Asparagus asparagoides*.

This species assemblage is consistent with the CEEC Cumberland Plain Woodland, listed under the BC Act and EPBC Act.

A4.2 Grey Box – Forest Red Gum grassy woodland on hills

The Forest Red Gum grassy woodland was found to be in moderate condition.

The canopy consisted of Grey Box *Eucalyptus moluccana*, Forest Red Gum *Eucalyptus tereticornis* and the occasional Thin-leaved stringybark *Eucalyptus eugenioides*. The midstorey consisted of sparse cover with patches of dense Native Blackthorn *Acaica decurrens* or Hickory Wattle *Acacia implexa*.

The ground cover consisted of Weeping Grass *Microlena stipoides* var. *stipoides*, Two-colour panic *Panicum simile*, Red Grass *Bothriochloa macra*, Treeawn Speargrass *Aristida vagans*, Mat-rush *Lomandra multiflora* subsp. *Multiflora* and *Lomandra filiformis* subsp. *Filiformis*, Wedge Guinea Flower *Hibbertia diffusa*.

Herbs such as Indian Weed *Sigesbeckia orientalis* subsp. *Orentalis*, *Plectranthus parviflora*, Native Wandering Jew *Commelina cyanea*, Forest Nightshade *Solanum prinophyllum* and Blue Trumpet *Brunoniella australis* high cover of Climbing Saltbush *Einada nutans* subsp. *Nutans* and *Einadia trigonos* subsp. *Trigonos*, scramblers such as *Amulla Eremophila debilis* and glycine species.

Exotic plants included African Boxthorn *Lycium ferocissimum*, Lantana *Lantana camara* and African olive *Olea europaea* subsp. *Europaea*, *Setaria parviflora*, Kikuyu *Pennisetum clandestinum* and Paspalum *Paspalum dilatatum*, African Lovegrass *Eragrostis curvula* and Panic Veldtgrass *Ehrharta erecta*, Fireweed *Senecio madagascariensis*, Dandelion *Taraxacum officinale*, Greater Beggar's Ticks *Bidens subalternans*, *Solanum sisymbriifolium* and climbers such as Moth Vine *Araujia sericiferm*, Paddy's Lucerne *Sida rhombifolia*.

This species assemblage is consistent with the CEEC Cumberland Plain Woodland listed under the BC Act and EPBC Act.

A4.3 Forest Red Gum – Rough-barked Apple grassy woodland

The canopy consisted of Forest Red Gum *Eucalyptus tereticornis*, Cabbage Gum *Eucalyptus amplifolia* subsp. *amplifolia* with the occasional Thin-leaved stringybark *Eucalyptus eugenioides* and Grey Box *Eucalyptus moluccana*.

The midstorey consisted of occasional dense patches of Native Blackthorn *Acaica decurrens*, Prickly-leaved Tea Tree *Melaleuca styphelioides*, Flax-leaved Paperbark *Melaleuca linariifolia*, Swamp Oak *Casuarina glauca* or Acacia species up to ten metres. Ground cover species included moderate cover of grasses such as; Weeping Grass *Microlena stipoides* var. *stipoides*, Treeawn Speargrass *Aristida vagans*, Early Spring Grass *Eriochloa pseudoacrotricha*, *Oplismenus aemulus* and Slender Rat's Tail Grass *Sporobolus creber* locally dense patches of sedges such as Slender Flat-sedge *Cyperus gracilis*, *Cyperus polystachyos* and the occasional dense patches of Native Blackthorn, Black Wattle *Acaica decurrens*.

Herbs such as Indian Weed *Sigesbeckia orientalis* subsp. *Orentalis*, *Plectranthus parviflorus*, Native Wandering Jew *Commelina cyanea*, Forest Nightshade *Solanum prinophyllum*, Indian Pennywort *Centella asiatica* and Blue Trumpet *Brunoniella australis*.

High cover of Climbing Saltbush *Einada nutans* subsp. *Nutans* and *Einadia trigonos* subsp. *Trigonos*, other scramblers such as *Amulla Eremophila debilis*, Slender Tick-trefoil *Desmodium varians* and *Glycine* species. Native vines such as Headache Vine *Clematis glycinoides* are locally abundant.

Drainage lines through the vegetation featured high species richness and cover/abundance of native aquatic herbs and ferns such as *Marsilea mutica*, *Alternanthera denticulate*, *Eleocharis cylindrostachys*, *Triglochin microtuberosa* and *Myriophyllum variifolium*.

Exotic species such as African Boxthorn *Lycium ferocissimum*, Lantana *Lantana camara*, Green Cestrum *Cestrum parqui*, Blackberry *Solanum nigrum* and African olive *Olea europaea* subsp. *europaea*, pasture grasses such as *Setaria parviflora*, Kikuyu *Pennisetum clandestinum* and *Paspalum dilatatum*. Weedy grasses such as Panic Veldtgrass *Ehrharta erecta*, Fireweed *Senecio madagascariensis*, Maderia Winter Cherry *Solanum pseudocapsicum* and Dandelion *Taraxacum officinale*, Greater Beggar's Ticks *Bidens subalternans*, *Solanum sisymbriifolium* and Paddy's Lucerne *Sida rhombifolia*, also scramblers such as Wandering Jew *Tradescantia fluminensis*, and climbers include Moth Vine *Araujia sericifera*, Maderia Vine *Anredera cordiflora* and Bridal creeper *Asparagus asparagoides*.

This species assemblage is consistent with the EEC and CEEC River-flat Eucalypt Forest, listed under the BC Act and EPBC Act, respectively.

A4.4 Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest

The canopy consisted of Forest Red Gum *Eucalyptus tereticornis* and Broad-leaved Ironbark *Eucalyptus fibrosa* with the occasional Thin-leaved stringybark *Eucalyptus eugenioides*.

The midstorey included mature *Melaleuca decora* with the occasional dense patches of Native Blackthorn *Acaia decurrens*, or Parramatta Wattle *Acacia parramattensis*, cover from small trees such as Dwarf Cherry *Exocarpus strictus*, and Wedge-leaf hop bush *Dodonaea viscosa* subsp. *cuneata*.

Ground cover consisted of plants such as Treeawn Speargrass *Aristida vagans*, Purple Wiregrass *Aristida ramosa*, Wiry Panic *Entolasia stricta*, Kangaroo Grass *Themeda australis*, Wallaby Grass *Austrodanthonia racemosa*, Slender Chloris *Chloris divaricata* var. *divaricata*, *Lomandra filiformis* subsp. *filiformis*, localised dense patches of *Melaleuca nodosa* and other occasional shrubs such as Rough Guniea Flower *Hibbertia aspera*, Prickly Currant Bush *Coprosma quadrifida* and sticky *Cassinia uncata*, herbs such as *Pomax umbellata*, Variable stickweed *Opercularia varia*, Slender Wire Lily *Laxmannia gracilius* and *Caesia parviflora* var. *vittata*. Scramblers such as *Glycine* species.

Exotic plant species recorded include African Love Grass *Eragrostis curvula*, and windborne environmental weeds such as Dandelion *Taraxacum officinale*. This species assemblage is consistent with the EEC and CEEC Cumberland Plain Woodland, listed under the BC Act and EPBC Act respectively.

A4.5 Artificial freshwater wetland

The canopy was generally absent. Occasional isolated Cabbage Gum *Melaleuca decora*, Flax-leaved Paperbark *Melaleuca linariifolia*, or Swamp Oak *Casuarina glauca*.

The mid storey was generally absent, with occasional patches of *Melaleuca* species or Tooton *Leptospermum polygalifolium*.

The groundcover was dense, structurally complex. Common species included Common Reed *Phragmites australis*, Cumbungi *Typha orientalis*, Spike Rush *Eleocharis palustris*, and *Schoenoplectus validus*. Other wetland species include; Water Couch *Zoysia macrantha*; floating aquatic ferns such as Nardoo *Marsilea mutica* and *Azolla* species. Emergent aquatic herbs such as Woolly Frogmouth *Phylidrum lanuginosum*, *Perscaria* species and *Ludwigia peploides* subsp. *Montevidensis*, submerged aquatic herbs such as *Triglochin microtuberosum* and *Myriophyllum* species, *Centella asiatica* and Swamp Goodenia *Goodenia paniculata*.

There is generally low to moderate exotic plant cover. Herbs such as *Ludwigia peruviana* and localised dense patches of exotic sedge Sharp Rush *Juncus acutus*, also included is African Love Grass *Eragrostis curvula*. There is localised infestation of Alligator Weed *Alternanthera philoxeroides*.

A4.6 Exotic Grassland

Canopy was absent.

Midstorey was generally absent apart from the occasional Native Blackthorn *Acaica decurrens*, Swamp Oak *Casuarina glauca*, Acacia species or *Dilwinia sieberi*.

Groundcover was dominated by exotice grasses. Occasionally native species such as Peach Heath *Lissanthe strigose*, Kangaroo grass *Themeda australis*, Spear grass *Aristida* species and Common Couch *Elymus repens* were present. Sedges such as Common Fringe-sedge *Carex crinita* and scramblers included *Gylcine* species.

Exotic species dominated, pasture grasses such as Kikuyu *Seteria parviflora* and Carpet Grass *Axonopus fissifolius*. There were extensive areas dominated by weeds such as African Love Grass *Eragrostis curvula*, Khaki Weed *Alternanthera pungenes*, Blackberry *Rubus fruticosus* or Noogoora Burr *Xanthium occidentale*, Dandelion *Taraxaxum officinale*, Rhodes Grass *Chloris gayana*, *Solanum sysimbrifolium*, Stinkgrass *Eragrostis cilianensis* and Lamb;s Tongue *Plantago lanceolate*.

A4.7 Cleared land or cropland

The Canopy was absent.

Midstorey was generally absent apart from the occasional Native Blackthorn *Acaica decurrens*, Swamp Oak *Casuarina glauca*, Acacia species or *Dilwinia sieberi*.

The Ground cover was dominated by exotic crops. Patchy and variable cover of species such as Peach Heath *Lissanthe strigose*, grasses such as Kangaroo Grass *Themeda australis*, Speargrass *Aristida* species and Common Couch *Elymus*. Sedges such as *Juncus usitasis* and scramblers such as *Glycine* species.

The exotic groundcover was also patchy and variable. Extensive areas dominated by noxious weeds such as African Olive *Olea europaea* subsp. *Europaea*, Blackberry *Solanum nigrum*, Inkweed *Phytolacca octandra*. African Love Grass *Eragrostis curvula*, *Bidens* species. Rhodes grass, *Solanum sysimbrifolium* and Lamb's Tongues X throughout.

A5. Fauna Habitats

The EIS identified a range of fauna habitat features were present throughout the CIZ. Habitat within the CIZ provides potential foraging, breeding and nesting resources for a range of fauna. The habitat features relevant to each fauna group are identified in Table 22 below.

Table 22: Key fauna habitat features that may occur in the CIZ

Habitat feature	Fauna species
Vegetated areas of tall open forest	Arboreal mammals, microchiropteran bats and owls.
Hollow bearing trees	Arboreal mammals, microchiropteran bats and birds.
Watercourse	Habitat for amphibians and fish; foraging for birds, microbats, reptiles and marsupials.
Leaf litter/woody debris	Foraging resources for birds, mammals, frogs and reptiles.
Pasture	Birds, microchiropteran bats and reptiles

A6. Threatened Species Habitats

A key aim of the pre-clearance surveys is to identify and map the presence/absence of threatened biota. Additionally, the ecologist will undertake pre-clearing surveys to:

- Identify all locations of trees, habitat features (hollow bearing trees, logs and existing nest boxes) and any other plants which have been marked or otherwise identified for preservation.
- Inspect bridges and/or culverts prior to demolition for the presence of native fauna (particularly roosting bats).

- Inspect farm dams and surrounding habitat prior to dewatering for presence of aquatic fauna – including frogs, turtles and eels.
- Identify the presence or evidence of the presence (including fresh scats, scratches and remains of prey) of fauna, including threatened species.
- Identify the presence of raptor nests, particularly White-bellied Sea-Eagle *Haliaeetus leucogaster* and Little Eagle *Hieraaetus morphnoides*.
- Identify Threatened Ecological Communities (TECs), delineating areas within and outside of the CIZ.
- Mark all hollow bearing trees, potential hollow bearing trees, logs, nest boxes, and all other fauna-containing habitat trees, including trees with nests, dreys and termitaria likely to be occupied by fauna, at least seven days prior to the commencement of clearing in a manner which clearly identifies and demarcates the trees.

Following the completion of the pre-clearing surveys, the Ecologist will submit a letter report to the WSA Environment Manager within five working days detailing the management requirements and outcomes of the survey. The report will include:

- Maps identifying locations of threatened species.
- Description of the presence of threatened flora species.
- Description of the presence or evidence of fauna (including fresh scats, scratches and remains of prey), including threatened species.
- Recommended actions to avoid the potential for harm to any fauna during clearing, including protocols for staged clearing of vegetation, safe tree felling, and a two-stage tree and log removal process.
- Measures to avoid disturbance to surrounding vegetation during clearance works.
- Implementation of the Threatened Flora Translocation Plan (as applicable).

A7. Priority and Environmental Weeds

Table 23 below, outlines the weeds listed under the *Noxious Weed Act 1993* (NSW) (NW Act) at the time of completing the EIS assessment by GHD (2016) and an updated Biosecurity Duty under the *Biosecurity Act 2015* (NSW). All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable. Weeds of National Significance (WoNS) were also recorded within the subject site and are presented in Table 23.

Table 23: Priority weeds and WoNS records within the CIZ

Scientific name	Common name	Biosecurity Act 2015 Biosecurity Duty	WoNS
<i>Alternanthera philoxeroides</i>	Alligator Weed	Biosecurity Zone The Alligator Weed Biosecurity Zone is established for all land within the state except land in the following regions: Greater Sydney; Hunter (but only in the local government areas of City of Lake Macquarie, City of Maitland, City of Newcastle or Port Stephens). Within the Biosecurity Zone this weed must be eradicated where practicable, or as much of the weed destroyed as practicable, and any remaining weed suppressed.	Yes
<i>Anredera cordifolia</i>	Madeira vine	General biosecurity duty	Yes
<i>Asparagus asparagoides</i>	Bridal Creeper	General biosecurity duty	Yes
<i>Bryophyllum sp.</i>	Mother-of-millions	General biosecurity duty	No

Scientific name	Common name	Biosecurity Act 2015 Biosecurity Duty	WoNS
<i>Cestrum parqui</i>	Green Cestrum	Regional Recommended Measure Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. The plant should not be bought, sold, grown, carried or released into the environment.	No
<i>Cortaderia selloana</i>	Pampas grass	General biosecurity duty	No
<i>Lantana camara</i>	Lantana	General biosecurity duty	Yes
<i>Ligustrum lucidum</i>	Broad-leaved Privet	General biosecurity duty	No
<i>Ligustrum sinense</i>	Small-leaved Privet	General biosecurity duty	No
<i>Lycium ferocissimum</i>	African Boxthorn	General biosecurity duty	Yes
<i>Olea europa</i> subsp. <i>cuspidata</i>	African Olive	Regional Recommended Measure An exclusion zone is established for all lands in Blue Mountains City Council and Central Coast local government areas. The remainder of the region is classified as the core infestation area. Whole region: The plant or parts of the plant are not traded, carried, grown or released into the environment. Core infestation area: Land managers prevent spread from their land where feasible.	No
<i>Opuntia stricta</i>	Common Prickly pear	General biosecurity duty	Yes
<i>Ricinus communis</i>	Castor Oil Plant	General biosecurity duty	No
<i>Rubus fruticosus</i> species aggregate	Blackberry	General biosecurity duty	Yes
<i>Salvinia molesta</i>	Salvinia	Regional Recommended Measure Exclusion zone: whole region except for the core infestation area of the Georges and Hawkesbury-Nepean Rivers and their tributaries. Whole region: Land managers mitigate the risk of the plant being introduced to their land. Core infestation area: Land managers should prevent spread from their land where feasible.	Yes
<i>Senecio madagascariensis</i>	Fireweed	General biosecurity duty	Yes

A8. Vegetation Management

This VMP provides a framework for the successive restoration activities that will be undertaken at the Airport. WSA has demonstrated a long-term commitment to biodiversity through the establishment of the Environmental Conservation Zone (ECZ) and will progressively undertake activities to enhance and protect the environmental values of this area. The ECZ will be the priority area for restoration activities, with works in

this area established by applying the principles of ‘retain, regenerate and revegetate’. Inherent in this approach is the need to work from areas of more resilient bushland to areas of more degraded bushland within the ECZ (Buchanan 1989; DEC 2005).

A8.1 Environmental conservation zone

Ecological restoration activities to be undertaken in the ECZ will align with the objectives of Condition 7 (5) of the Airport Plan and EIS Table 28-5, which require that measures to protect and manage the areas in the ECZ, particularly along the Badgerys’s Creek riparian corridor are undertaken, including:

- Avoid unnecessary disturbance in nearby areas of retained vegetation outside of the CIZ such as avoiding unnecessary light spill and noise.
- Replacing exotic grasslands with suitable native vegetation;
- Rehabilitating existing remnant and native vegetation; and
- Providing ongoing protection of the biodiversity and environmental values.
- Noxious and environmental weed management and where possible eradication
- Bush fire hazard reduction

Figure 3 outlines the overview of the key items for the rehabilitation and management of the ECZ in accordance with Condition 7 (5) of the Airport Plan, EIS Table 28-5 and to ensure the objectives of the Airport Plan ECZ Land Use Plan are achieved. The rehabilitation works will be undertaken with consideration to construction works and areas adjacent to the ECZ to ensure a successful outcome. Following the rehabilitation and restoration works ongoing management, including monitoring and maintenance, will be identified and implemented.

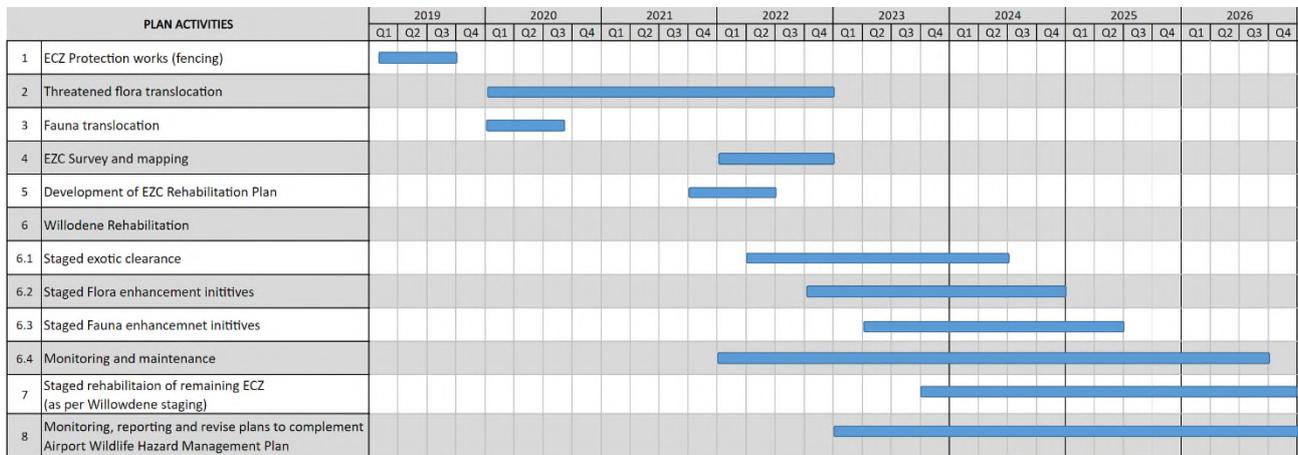


Figure 3 Overview program for delivery of rehabilitation and management of the ECZ

A9. Specific Management Actions

A9.1 Site inductions

Supervisors are required to identify all potential environmental impacts and implement and maintain control measures, procedures and constraints in accordance with the Biodiversity CEMP. Site specifics include the presence of threatened species habitat and locally significant vegetation communities. The general Project induction include hygiene protocols to reduce the potential for introduction of invasive flora and fauna species or disease into the protected vegetation at the site.

A9.2 Exclusion fencing

Exclusion fencing along the ECZ to protect the area from unauthorised entry will be progressively installed. Areas completed include where the ECZ is located adjacent to the active construction zones for early

earthworks (e.g. permanent basin). Signage has been installed to notify construction teams that the area is a no-go area and a permit to enter is required. The area is documented on the ECM and tool boxed during pre-start meetings.

The remaining fencing of the ECZ that is adjacent to the Stage 2 area will be completed by late 2019. Prior to the commencement of bulk earthworks, exclusion fencing is to be installed along the boundaries of vegetated areas (e.g. Stage 2) to be retained. The alignment of this fencing is to be in accordance with the Australian Standard *Protection of Trees on Development Sites (AS4970-2009)* and incorporate the relevant tree protection zones for trees and vegetation to be retained. The fencing should be constructed of, as a minimum, capped star pickets and high visibility para webbing and have appropriate signage stating that it is an environmentally sensitive area to inform and educate construction personnel. Exclusion zones are to be clearly marked and labelled on design drawings issued for construction and will be displayed in prominent places and provided in site inductions. No storage of materials or machinery is to be undertaken within exclusion zones or retained vegetation, no preparation of chemicals or concrete to be mixed in these areas, or adjacent, and care to avoid the compaction of soils to be observed.

A9.3 Erosion and sediment controls

Earthworks will not commence until sediment and erosion controls have been installed as per an Erosion and Sediment Control Plan. Erosion and sediment control will be observed and monitored in accordance with the Soil and Water CEMP.

A9.4 Rehabilitation Works

A9.4.1 Weed management

This proposed work has the potential to introduce and promote weeds and pathogens at the Airport as well as in the surrounding area. Environmental weeds are exotic species considered either a high risk of dispersing and becoming established in adjacent native vegetation or have the potential to cause significant ecological harm. Recommended methods for control of environmental weeds recorded on site, along with priority species, are outlined in the Appendix C Weed and Disease Management Protocol.

A9.4.2 Pest control

Predation by native macropods, introduced herbivores (rabbits and hares), insect pests and infection caused by plant diseases/pathogens can have an adverse effect on the establishment of plantings by defoliating, damaging, removing or killing young plants. To minimise the loss of plants through predation and/or disease, all new plantings will be protected by:

- Use of black plastic rigid mesh tree guards, which would be reused on new plantings once the initial planted specimens mature.
- Temporary exclusion fencing of larger areas or where initial trials indicate that the efficacy of using individual tree guards is low.

A9.4.3 Threatened Flora Salvage and Translocation Plan

The TFST Plan outlines the management measures required to establish viable (self-sustaining) populations of flora species, which reproduce through continuous generations without intervention in an area that is managed for conservation at WSI. This plan will be implemented by the BEC Contractor and ongoing monitoring will continue by WSA.

A10. Adaptive Management

An adaptive management approach is to be employed in respect of the works forming part of this VMP. An adaptive management approach involves an integrated process of monitoring, reviewing and then responding to the health and condition of the plantings as well as the status of the weed species to identify any alterations to the design and maintenance of works that may be required to ensure the objectives of the VMP are achieved.



It is important to note that any changes should comply with the aims of this VMP and any licensing or approval conditions issued before implementation. An Adaptive Management Statement (or similar) will be prepared by the ecologist and approved by the WSA Environment Manager prior to implementation of any adaptive management actions.

Habitat Management Plan

B1. Scope and Objectives

The Habitat Management Plan aims to address the requirements of the Habitat Clearing and Fauna Management Protocols and Nest box Strategy through addressing the following:

- Strategies to achieve connectivity throughout the landscape and minimise the effects of habitat fragmentation and associated edge effects
- Pre-clearance surveys to be conducted by a suitably qualified ecologist to map hollow-bearing trees, logs and existing nest boxes that would require supervision during removal
- Necessary rehabilitation activities to mitigate the risk of reduced reproductive success of biota
- Designated offset sites, with additional or alternative offset sites outlined for compensatory measures e.g. nest box installation
- Schedules for inspection, monitoring, management and corrective actions.
- A Nest box Management Strategy, including:
 - Maps and data to show hollow-bearing trees proposed to be removed and the number of hollows associated with each tree
 - Provisions for the installation of nest boxes within the Environmental Conservation Zones prior to clearing areas of native vegetation on the airport site
 - Reuse of hollows and fallen debris within conservation areas
 - The number of nest boxes to be installed, commensurate with the number of hollows proposed to be removed
 - Provisions for salvage of native fauna from existing nest boxes in the construction impact zone prior to their removal and translocation
 - A guide on the installation of nest boxes and the appropriate design specifications
 - A monitoring program for the monitoring of the nest boxes.

B2. Habitat management

B2.1 Habitat connectivity

The impacts of the construction of WSI have been specified in the project EIS, Appendix K1 Biodiversity - Table 67. It has been acknowledged that construction, lighting, aircraft movement and traffic within the 4 kilometres by 2-kilometre Airport site would represent a significant barrier to fauna species. The operation of an international airport is not conducive to improvement of fauna habitat connectivity and, as such, is not considered further in the preparation of this habitat management plan.

B2.2 Preclearance surveys

A key aim of the pre-clearance surveys is to identify and map the presence/absence of threatened biota. Additionally, a suitably qualified ecologist will undertake pre-clearing surveys to:

- Identify all locations of trees, habitat features (hollow bearing trees, logs and existing nest boxes) and any other plants which have been marked or otherwise identified for preservation
- Inspect bridges and/or culverts prior to demolition for the presence of native fauna (particularly roosting bats)

- Inspect farm dams and surrounding habitat prior to dewatering for presence of aquatic fauna – including frogs, turtles and eels
- Identify the presence or evidence of the presence (including fresh scats, scratches and remains of prey) of fauna, including threatened species
- Identify the presence of raptor nests, particularly White-bellied Sea-Eagle *Haliaeetus leucogaster* and Little Eagle *Hieraaetus morphnoides*
- Identify Threatened Ecological Communities (TECs), delineating areas within and outside of the CIZ
- Mark all hollow bearing trees, potential hollow bearing trees, logs, nest boxes, and all other fauna-containing habitat trees, including trees with nests, dreys and termitaria likely to be occupied by fauna, at least seven days prior to the commencement of clearing in a manner which clearly identifies and demarcates the trees.

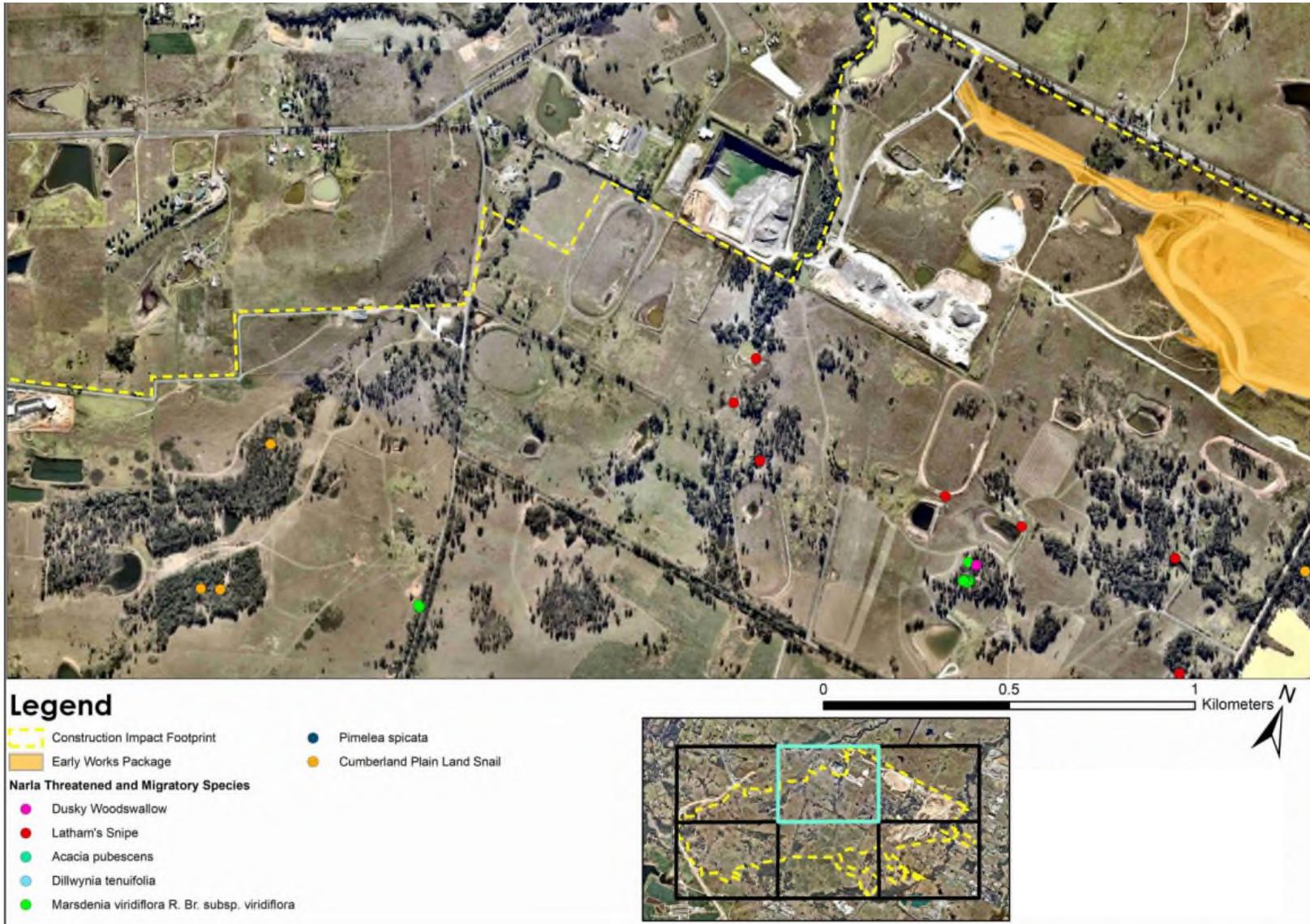
Following the completion of the pre-clearing surveys, a report or brief letter will be submitted to WSA within five working days detailing works undertaken. The report will include:

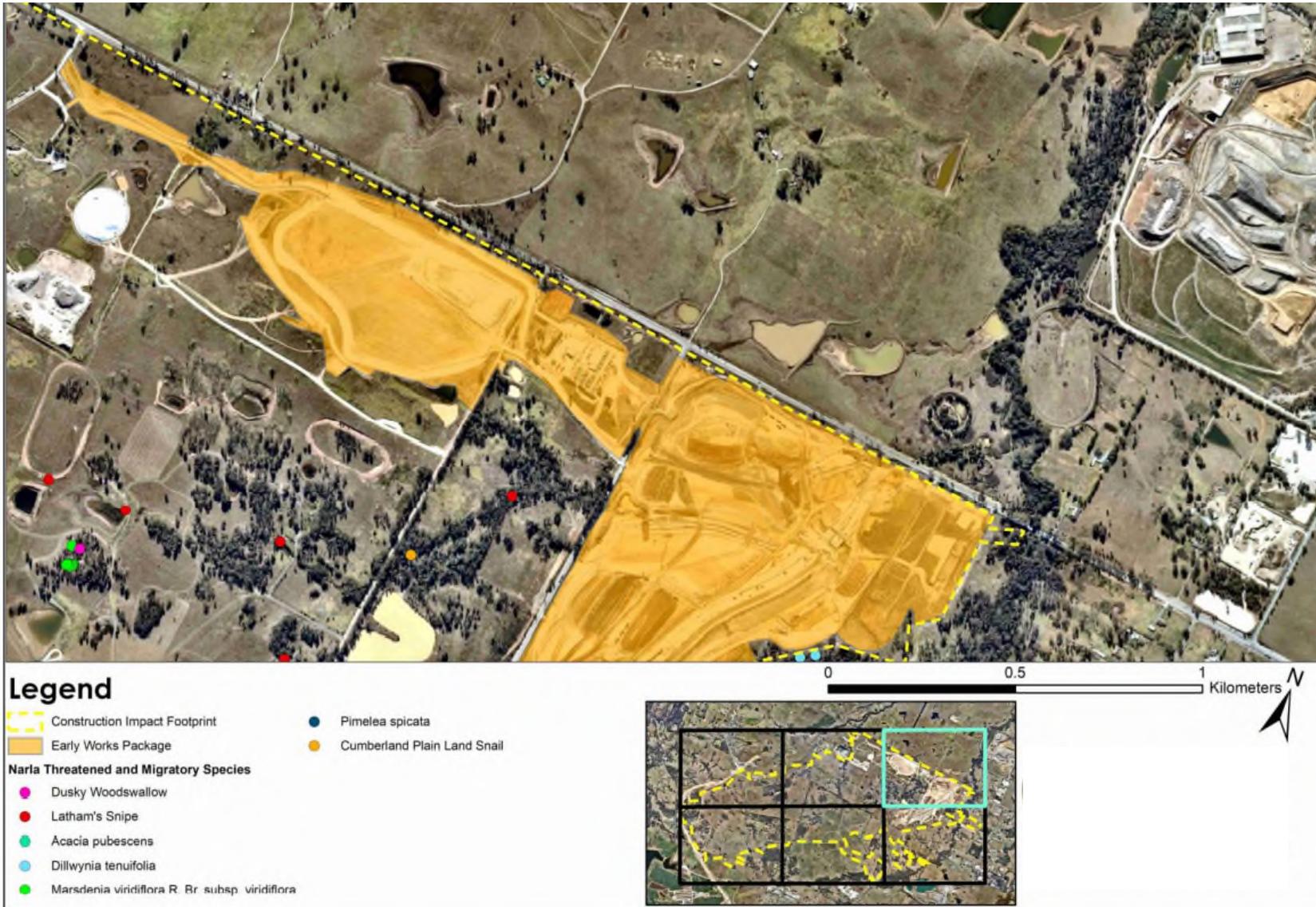
- Description of the presence of threatened flora species
- Description of the presence or evidence of fauna (including fresh scats, scratches and remains of prey), including threatened species
- Recommended actions to avoid the potential for harm to any fauna during clearing, including protocols for staged clearing of vegetation, safe tree felling, and a two-stage tree and log removal process
- Measures to avoid disturbance to surrounding vegetation during clearance works
- Measures to avoid the spread of weeds and pathogens in accordance with the weed and disease management plans
- Locations of habitat features marked during preclearance surveys and the proposed locations for the reuse of hollows and fallen debris within conservation areas.

B2.3 Threatened Species Mapping

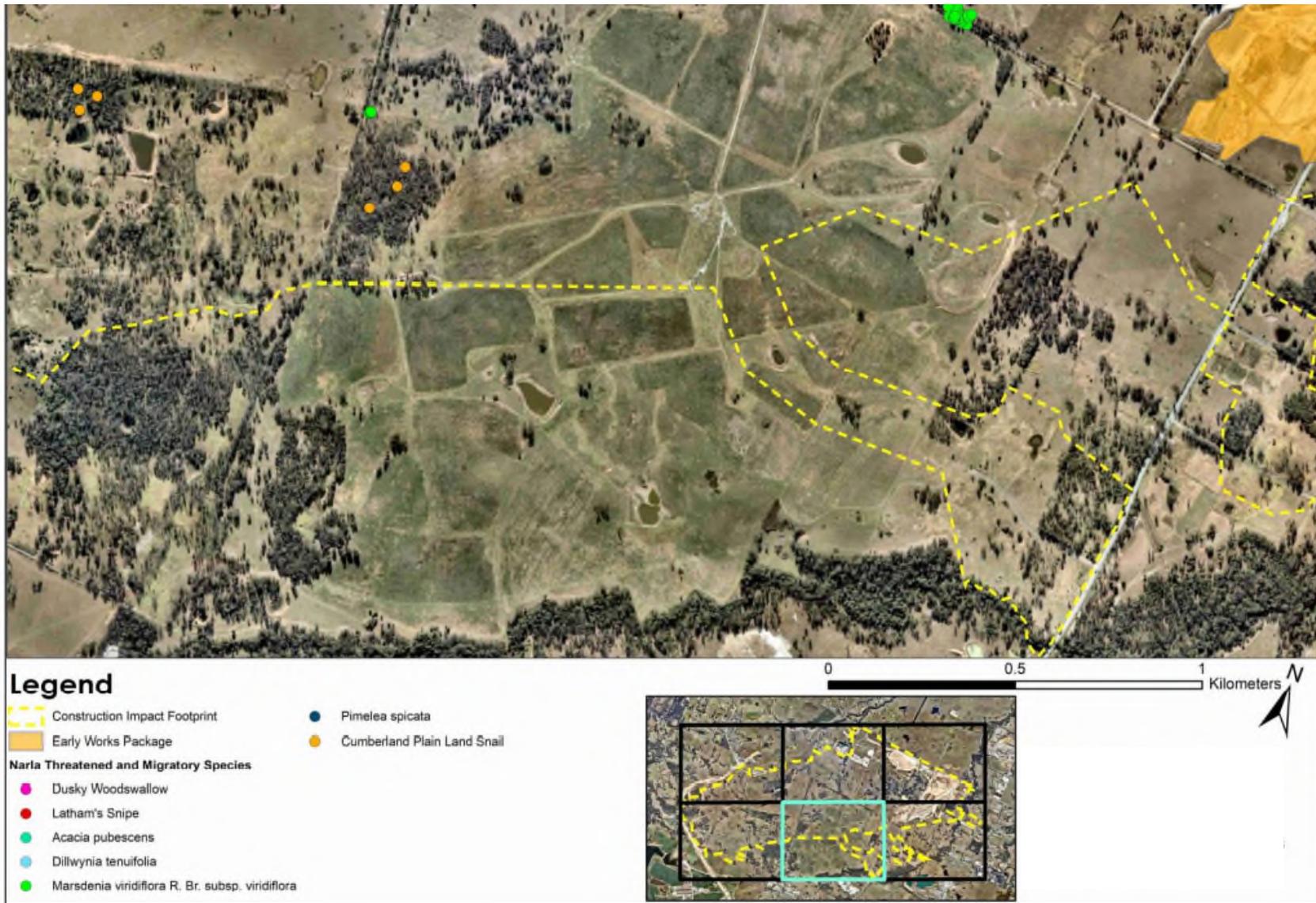
The mapping of threatened species was undertaken as a component of the pre-construction survey undertaken by the Bulk Earthworks Contractor. Maps of threatened species identified by this survey are shown below.

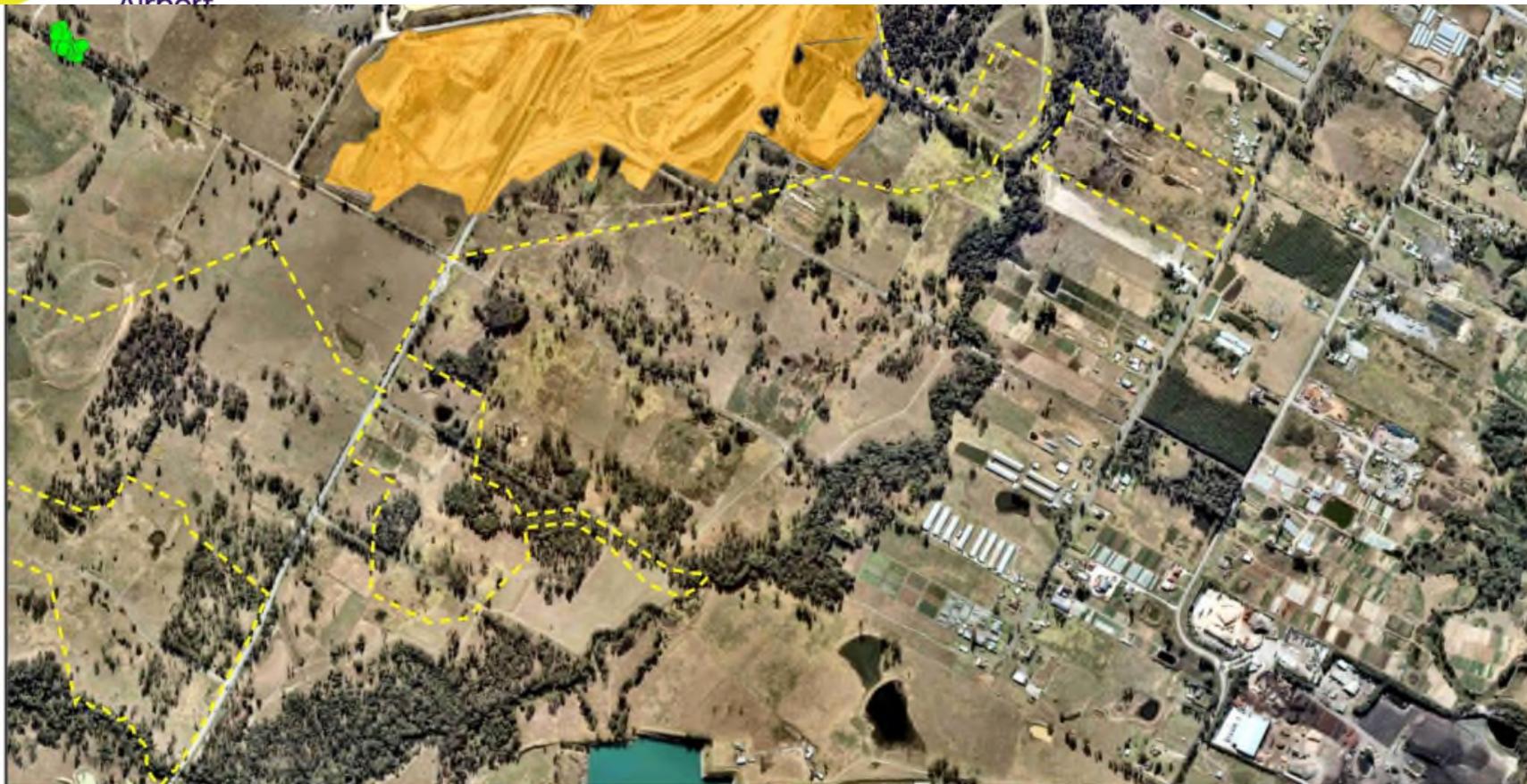










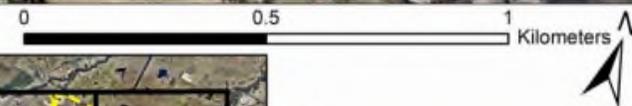


Legend

-  Construction Impact Footprint
-  Early Works Package
-  *Pimelea spicata*
-  Cumberland Plain Land Snail

Narra Threatened and Migratory Species

-  Dusky Woodswallow
-  Latham's Snipe
-  *Acacia pubescens*
-  *Dillwynia tenuifolia*
-  *Marsdenia viridiflora* R. Br. subsp. *viridiflora*



B3. Nest Box strategy

B3.1 Background

It is widely recognised that tree hollows are an important habitat source for a range of fauna. In NSW, terrestrial vertebrate species that are known to be reliant on tree hollows for shelter and/or nesting include at least 46 mammals, 81 birds, 31 reptiles and 16 frogs (Gibbons & Lindenmayer 1997, Gibbons & Lindenmayer 2002). However, tree hollows are often depleted in modified landscapes, particularly in eastern Australia, the rate of tree hollow loss is accelerating as a result of increasing urban development (Goldingay 2011).

Many hollow-dependant faunas will readily take to artificial hollows, most commonly as nest boxes attached to trees (Beyer & Goldingay 2006). The use of these hollows by fauna may depend on a number of factors, including hollow characteristics (diameter, height, depth), landscape position, tree health, location and the thermoregulatory capabilities of the hollows themselves (Gibbons & Lindenmayer 2002).

The Airport Site mainly consists of exotic grassland, with areas of Grey Box – Forest Red Gum grassy woodland, Forest Red Gum – Rough-barked Apple grassy woodland, Broad-leaved Ironbark – Grey Box – Melaleuca decora grassy open forest, artificial freshwater wetlands and cleared land. Within these vegetation zones there is suitable habitat (hollow-bearing trees) for a range of hollow-dependent fauna. In addition to natural tree hollows, several nest boxes have already been installed within the airport site. A portion of these nest boxes now fall within the boundaries of the current airport footprint and will be offset as part of this Nest box Strategy.

B3.2 Methodology

Initial hollow-bearing tree (**HBT**) surveys were conducted as part of a larger fauna habitat assessment by GHD over 18 days between February to May 2015. The results of these surveys were incorporated into the EIS (GHD 2016). The methodology (below) used for recording HBTs will also be used by a suitably qualified ecologist to undertake additional HBT surveys encompassing the CIZ.

Hollow-bearing tree inventory

Tree hollows were only recorded if:

- The entrance could be seen from the ground
- The hollow appeared to have depth
- The hollow was at least 1 metre above the ground (basal hollows were only recorded if they continued up into the tree above 1 metre).

The location of each hollow-bearing tree was recorded with a hand-held GPS unit.

Hollow characteristics

For each individual HBT, the following data was collected:

- Whether the tree was dead or alive
- The species of tree (if alive)
- Height of the tree
- Diameter at breast height (DBH) of the tree
- Approximate number of hollows
- Estimated size of hollows based upon diameter entrance.

B3.3 Results

Landscape

The majority of the CIZ contains grassland with fenced grazing land (GHD 2016). These areas would have previously supported native woodland vegetation but have been extensively modified by previous clearing and agriculture. However, there is a relatively extensive network of drainage lines and waterbodies across the airport site, and large, hollow-bearing trees occur in high densities along these riparian corridors. These hollow-bearing trees may be removed as part of the project and will require offsetting with artificial nest boxes.

Apart from riparian corridors the airport site contains only moderate quantities of pre-European occupation age trees and associated habitat resources such as tree hollows and stags. The hollow-bearing trees recorded contain hollows with a range of sizes, orientations and landscape positions, in both living and dead trees (GHD 2016).

Hollow-bearing tree inventory

GHD recorded approximately 50 hollow-bearing trees during the habitat assessment conducted in 2015 (GHD 2016). A suitably qualified ecologist will conduct a further comprehensive hollow-bearing tree survey across the CIZ. A catalogue of the hollow-bearing trees located within the CIZ during this survey will be provided in a preclearance report. Each tree will be identified to species.

Hollow characteristics

GHD reported that hollow-bearing trees recorded during the habitat assessment contained hollows of a range of sizes, orientations and landscape positions. A suitably qualified ecologist will record the number of hollows present in each hollow-bearing tree, as well their size and location. This information will be provided in a preclearance report.

Existing nest boxes

A suitably qualified ecologist will record the number, location and characteristics of nest boxes already present within the Airport Site. It is recommended that all nest boxes that will be impacted by construction should be relocated to suitable areas within the ECZ. It should be noted that some of these boxes may lie on the boundary of the CIZ and may not be impacted by construction. An assessment should be made during pre-clearing surveys prior to construction to determine which nest boxes require re-location.

B3.4 Nest box placement strategy

The installation of nest-boxes in suitable habitat within the ECZ is proposed as a compensatory mechanism for the loss of habitat trees which are to be removed for the project. The number, type and location of nest boxes required will be determined as a result of the completion of the HBT survey by a suitably qualified ecologist, and will be based on the number, quality and size of the hollows to be removed, taking into consideration the hollow-dependent fauna species identified as inhabiting the area, or likely to inhabit it.

Hollow-dependent fauna

The hollows may provide nesting/roosting habitat for a range of fauna species. For example, large hollows may provide nesting resources for owls and cockatoos, whilst smaller hollows may provide habitat for gliders or microbats.

A suitably qualified ecologist will use the HBT catalogue to determine the hollow-dependent fauna that might be using the current hollows. This may include both threatened and common species. The Nestbox Strategy will target both common and threatened species, as providing some boxes for common species in addition to threatened species ensures that nesting/roosting habitat for the range of species which may be displaced by the works will be provided. Additionally, targeting common as well as threatened species is considered to be beneficial due to the complex relationships between common and threatened species. For example, increasing nesting habitat for common arboreal mammals, such as Common Ringtail Possums (*Pseudocheirus*

peregrinus) and Common Brushtail Possums (*Trichosurus vulpecula*), has the flow-on effect of improving the foraging value of the area for Powerful Owl (*Ninox strenua*), a threatened species.

Nevertheless, as common species tend to be less particular about nest box dimensions and locations, the hollow strategy will be targeted more towards threatened species, with the expectation that a proportion of the boxes designed for threatened species will be occupied by common species. This approach is designed to facilitate an improved overall conservation outcome.

Catalogue of hollow resources

A catalogue of hollow-bearing trees and their hollow resources will be provided, as well as a description of the general locations, and conditions of these resources.

B3.5 Number and type of nest boxes required

Proposed number of nest boxes required

Information in the EIS (Appendix K) and collected from field surveys will be reviewed by the Project ecologist to determine the number of nest boxes required as a result of the clearing activities. Where feasible, a 1:1 ratio of nest boxes for each hollow removed may be installed within the ECZ or as recommended by the Project Ecologist, this is based on the Biodiversity Guidelines - Guide 8 Nest Boxes (RTA 2011). Consideration will be given to the possible indirect impacts of installing unsuitably high densities of nest boxes within the ECZ, including the potential to increase bird strikes with the airport.

Following vegetation clearing, the final number of nest boxes required (as determined by the actual number of tree hollows being removed) will be refined up or down. The final number of nest boxes and the proposed locations for the reuse of hollows and fallen debris will be recommended to WSA Environment Manager prior to installation in the ECZ. A report will be prepared once all vegetation clearing has been completed.

Types of nest boxes required

The number of each type of nest box required will be calculated on a proportional basis (i.e. reflecting the proportion of hollows likely to be used by each species known to occur in the area), with the final ratio determined based upon knowledge of hollow use in the locality. This stage of the assessment will also involve an appraisal once the clearing works have been completed and a final tally of the actual numbers of hollow-bearing trees and tree hollows to be removed based on the detailed design.

Following pre-clearing inspections, the final number of nest boxes required will be reported. The ratio of nest box types installed will reflect the types of hollows present as well as the home ranges of species being targeted. The distribution of nest boxes for each fauna group will be determined by the Project Ecologist based on the presence/absence of suitable habitats and the likelihood of occupancy by target species in any given area.

B3.6 Nest box specifications

Background

This section of the nest box strategy will provide recommendations and guidance on the provision of nest boxes as a compensatory mechanism for the loss of habitat trees within the airport site, inclusive of den, roosting and nesting resources. It will also specify nest box dimensions, installation requirements, locations of nest boxes and ongoing monitoring and maintenance.

The number and type of nest boxes required will be determined as a result of the completion of pre-clearance surveys, and will be based on the number, quality and size of the hollows to be removed, taking into consideration the threatened hollow-dependent fauna species potentially inhabiting the Airport Site (detailed above).

Nest boxes will then be installed to compensate for the loss of hollow-bearing trees within the Airport Site. Installation and maintenance will be undertaken in accordance with the Guide 8: Nest Boxes of the Biodiversity

Guidelines (RTA 2011). This plan will consider placement of nest boxes in adjacent habitats and Conservation areas, focusing effort on areas of naturally low abundance of hollows.

Nest box construction and design

The design of nest boxes will be recommended according to each target species. A table will be provided showing a summary of specifications for nest boxes targeting specific species of threatened fauna groups that are known to, or considered likely to, occur in the airport site.

While recognising the different nest box dimensions, the constructed nest boxes should also include number of additional species-specific design considerations into account. For example, the thermoregulatory capabilities of the nest boxes should be considered, particularly for bats as this is considered to significantly influence roost use (Gibbons & Lindenmayer, 2002).

Furthermore, the design of the positioning and fastening mechanism should be sturdy and stable, preferably with a slight forward lean to assist with drainage whilst allowing for growth in the host tree. The preferred option for bracketing is the Habisure system (Franks & Franks 2006). This has the advantage of allowing at least one metre growth in the diameter of the host tree before adjustment is required, is non-invasive to the tree and provides the required security. However, other suitable bracketing options will also be explored and may be used for nest box installation.

Reducing competitive interactions

Several pest species, both native and exotic, may be relevant to this plan and are known to utilise both natural hollows and nest boxes. These have been outlined in Table 24 along with measures to reduce nest occupation by these species. During monitoring of nest boxes, the ecologist will select the most appropriate measure/s for removal or deterrence of pest fauna. This may require the use of professional pest control personnel e.g. for bee hive removal, and/or the installation of a replacement box.

Table 24: Possible measures to reduce invasion by introduced/ pest species

Potential invading species	Measures to prevent or discourage use*
Ants	<ul style="list-style-type: none"> • Talcum powder applied to the entrance and edges of the nest box to deter ants. • Talcum powder sprinkled inside of the box incites ants to leave, and lanolin grease around the edges of the box prevents them from returning. • Ring of grease around trunk of smooth-skinned eucalypt encourages colony to leave the box. • Open bottom prevents ant infestations in bat boxes.
Wasps	2 cm roost spacing discourages wasp infestations in bat boxes.
European Honeybee <i>Apis mellifera</i>	<ul style="list-style-type: none"> • Insecticide strip placed inside box kills bee colonies; however, this practice is hazardous. • Lining the ceiling of nest box with carpet prior to installation may thwart attachment of wax comb to ceiling. • A small box volume reduces incidents of hive building. • Greasing the underside of the lid and top of the walls with marine grease or lanolin prevents bees from attaching honeycomb. • 2 cm roost spacing discourages bee infestations in bat boxes.
Common Myna <i>Acridotheres trisris</i>	<ul style="list-style-type: none"> • A board of ply attached to overhanging box lid and positioned approximately 10 cm parallel to the front face (i.e. side including entrance hole) of the box successfully excludes the common myna, but not native species. Rosella boxes can be purchased with an anti-myna baffle attached.

Potential invading species	Measures to prevent or discourage use*
	<ul style="list-style-type: none"> Nest removal deters nesting but may need to be repeated several times.
Common Starling <i>Sturnus vulgaris</i>	<ul style="list-style-type: none"> Starlings actively avoid nest boxes with painted white interiors.

*Adopted from Gleeson & Gleeson 2012

Installation of nest boxes

Nominated nest boxes should be installed prior to the proposed clearing works (preferably within two weeks of clearance of vegetation) with the objective of providing temporal refuge habitat for those hollow dependent fauna displaced during clearing operations. The remaining nest boxes should be installed following clearing. Occupancy rates of tree hollows during the clearing supervision may also facilitate the final number and types of nest boxes being installed. The Project Ecologist will be responsible for determining whether adjustment to nest box numbers or types is required, based upon the hollows recorded during pre-clearing assessment.

Location of nest boxes

The selected location and positioning of nest boxes is a fundamental component of this plan, given that it will ultimately determine the effectiveness of nest boxes as a mitigation tool.

As a rule, nest boxes should be installed on large mature trees (DBH > 400 mm) close to or on the main trunk. Within each of the nest box installation areas, the behavioural ecology of the target species should be considered, together with aspect, height, installation techniques and the spatial arrangement or density of nest boxes, to determine the fine-scale installation locations and specifications.

The following should be considered by the Project Ecologist when considering the fine scale locations of nest boxes.

- Studies have suggested that there is a spatial trend in the occupancy pattern of nest box use where nest boxes used for arboreal marsupials (specifically gliders) placed in a clump of four had greater occupancy rates over time (Lindenmayer et al. 2003). For this reason, it is recommended that nest boxes for glider species be installed in clumps of four boxes in some locations.
- The fine-scale position of the nest box on the host tree has also been considered, specifically in the context of predominant weather patterns and light and noise disturbances arising from the Project. It is proposed that nest boxes be installed with their entrances facing away from the lights of the traffic and from a north-west to south-easterly position on the tree trunk to provide additional shelter from the rain and wind (i.e. dominant rain is from the south-east). Where this is not possible, an alternative for some fauna groups (e.g. gliders) is to have the entrance facing the tree. This requires a gap of around 100 mm to be maintained between the nest box entrance and the tree.
- It is recommended that nest boxes be placed high off the ground (i.e. at least 2 m) to protect the occupants from predation and low enough to allow for safe monitoring and maintenance. Nest boxes should be installed by a specialist nest box contractor with appropriate tree climbing certification (i.e. Arborist Tree Climbing Certificate and Work Safely at Heights certification). Monitoring and maintenance would preferably be undertaken from the ground by ecologists using pole-mounted cameras.

B3.7 Nest Box Monitoring and Maintenance

Monitoring and maintenance has been included to evaluate the effectiveness of the nest boxes. As such, it will be important to assign each nest box a number and ensure its location is recorded using a GPS. This section details the timing, frequency and methods for monitoring. Nest box maintenance is discussed further below.

Timing and frequency

Bi-annual spring and autumn monitoring is recommended to be carried out from installation during Stage 1 Development. A brief monitoring report will be produced after the completion of each monitoring survey. This report will outline the results of the monitoring and recommendations for maintenance or replacement. It is assumed that nest boxes will be effectively utilized within the allocated monitoring period; however, a review should be undertaken to determine whether further monitoring is required.

The timing of monitoring and maintenance activities is outlined in Table 25. Further detail is provided below.

Table 25: Timing of nest box management actions

Management Action	Year 1	Year 2	Year 3	Each year until 4 years post construction	Responsibility	Documentation Requirements
Prepare Nest Box Plan	X				Contractor Ecologist	This document
Construction of Nest Boxes	X				Contractor	N/A
Install Nest Boxes	X				Contractor	This document
Post-installation Inspection	X				Ecologist	Nest box post-installation report
Spring and Autumn Monitoring		X	X	X	Ecologist	Annual reporting provided to Contractor and WSA.
Maintenance of Nest Boxes		X	X	X	Contractor	N/A

The number and type of nest boxes required for the Project will be provided following HBT surveys conducted by an ecologist. Once installed, twice-yearly monitoring will be required to determine the usage of nest boxes by the target species and inform any maintenance requirements.

During each monitoring event, a visual inspection of each nest box will be conducted from the ground (using cameras mounted on extension poles) to collect the following data using a field proforma:

- Inspection dates, weather conditions (i.e. rain, wind, cloud cover, ambient temperature) and time each box was inspected
- Nest box number
- Is the nest box currently occupied by native fauna?
If yes, which species?
If no, are there signs of use and can the species be identified or assigned to a group (i.e. bats, birds)?
- Has the nest box been used by a pest species (i.e. European Bees, Common Myna, Termites)?
- Is there any deterioration of the nest box?
- Is there any maintenance required?
- Has the surrounding landscape changed (e.g. clearing or partial clearing)?

Visual inspection would enable the observer to perform a close inspection for signs of feathers, droppings/scats, hair, nesting material or individuals themselves. At this time some maintenance considerations/actions could be undertaken. For example, aspect of nest boxes could be changed to address thermoregulatory considerations.

Nest box maintenance

It is recommended that nest box maintenance should occur following the monitoring schedule provided in Table . This allows for the monitoring activities to inform the level of maintenance that is required. Factors to be considered as part of the maintenance schedule include the following.

- The need to remove exotic pest species such as Common Mynas, Common Starlings and European Bees
- Replacement of fallen, damaged or degraded nest boxes. The location of damaged boxes would need to be reported
- Repositioning, re-installation or relocation of nest boxes
- Checking that each box is not holding water or leaking
- Removing excess nesting material, which may impede access over time.

Performance indicators and corrective actions

Determination of appropriate performance indicators will be refined following completion of clearing operations. The results of observations made of felled trees during clearing will enable final calculation of the actual number of hollows present (as opposed to the number estimated from ground-based assessments) and the number of hollows showing signs of fauna utilisation. The performance of the nest box program will be assessed against the following parameters.

- Use of nest boxes by a wide range of native fauna
- Use of nest boxes by the species they were designed for
- Low rates of exotic fauna using nest boxes
- Low maintenance requirements.

Performance Indicators and appropriate corrective actions are outlined below in Table 26.

Table 26: Nest box performance monitoring and corrective action

Performance indicator	Corrective actions	Responsibility
Nest boxes are being used by a wide range of native fauna, including target species.	Review the location, type and number of nest boxes used. Install additional boxes or relocate boxes if deemed necessary.	The lead contractor is responsible for engaging suitably qualified ecologists to undertake the monitoring and suitably qualified contractors to undertake the maintenance
A low rate (< 20%) of occupation by exotic or invasive fauna.	Review/ change nest box design and/or placement on tree to exclude undesirable species, treat if applicable or relocate those nest boxes to another location.	
A total of <5% of nest boxes requiring maintenance over a 4-year span	Identify causes of nest box failure, modify design and construct accordingly.	

Aquatic Flora and Fauna Management Plan

B4. Scope and Objectives

The Aquatic Flora and Fauna Management Plan aims to address the following:

- Protocol for dam decommissioning/dewatering
- Dewatering of dams (at the right time of year, i.e. avoid nesting season of waterbirds) to allow the relocation of fauna species
- Salvaging and relocation of aquatic vertebrate fauna, including frogs, turtles and eels, to areas of suitable habitat retained at the airport site or nearby habitats, about numbers and identification of suitable release sites
- Establishing protocols for humane euthanasia of aquatic fauna, including fish
- Identification of potential risks and mitigation measures for watercourse functionality, riparian and aquatic habitat and fish passage as a result of the design and construction of waterway crossings
- Describe weed management activities (i.e. the eradication of Alligator Weed on the dammed section of Oaky Creek near Elizabeth Drive prior to any works in the vicinity) (also see Weed and Disease Management Plan)
- Provide schedules for inspection, monitoring, management and corrective actions.

Construction in Stage 1 Development would comprise of the infilling of stream outlets, including the upper reaches of Oaky Creek and smaller drainage lines that feed into Badgerys, Cosgroves and Duncans Creeks, which are currently situated within the Stage 1 Construction Impact Zone.

The existing tributaries are highly modified (high levels of eutrophication as a result of runoff from nearby urbanisation and domination by environmental and priority weeds) and in poor condition as a result of historical and current land uses. The current aquatic fauna assemblage within these creeks is indicative of their poor quality.

Badgerys Creek will be retained within an ECZ as outlined in the Airport Plan.

B5. Protocol for dam decommissioning and dewatering

The protocols for undertaking dam dewatering and salvage of aquatic fauna have been developed with the aim of minimising harm to resident aquatic fauna, ensuring maintenance of ambient water quality and prevention of the spread of aquatic weeds.

The staging for dam decommissioning and aquatic fauna salvage will adhere to the following steps:

- Suitable recipient sites for salvaged aquatic fauna are to be determined within the locality of the Airport prior to commencement of decommissioning.
- The water quality of the recipient site is to be assessed prior to release to ensure adequacy of conditions for individuals to be released
- Implementation of the Green and Golden Bell Frog management plan requirements, as outlined in Section B12.2. This includes the implementation of appropriate hygiene practices by personnel involved decommissioning/dewatering.
- Site inspection/pre-clearance survey of each dam, one week prior to commencement of decommissioning, to record water quality measurements, identify priority aquatic weeds, presence of waterbirds (including status of breeding/nesting), determine salvage equipment requirements and site safety considerations
- Where feasible, dam decommissioning should avoid nesting season.
- Discuss and implement any weed control measures, with particular focus on the prevention of the spread of Alligator Weed *Alternanthera philoxeroides* propagative material
- Site supervisor is to coordinate the setup of pumps and commence dewatering of the dams until the maximum depth of the dam is no greater than 1.2 metres. The dewatering should occur progressively

over several days to allow fauna to relocate. The project ecologist is to be notified that dewatering has commenced and DPI Fisheries is to be notified in accordance with a current DPI Fisheries Research Permit

- The project ecologist is to undertake activities to salvage aquatic fauna using a range of equipment to be determined by the prevailing site conditions including seine nets, fyke nets, dip nets, electrofishing and hand collection
- Pumping operations are to continue until the project ecologist is satisfied that fauna salvage operations are no longer required or ineffective
- The dam wall is to be broken to drain the remaining water, with any remaining aquatic fauna to be collected in fyke nets staked at the break in the dam wall
- Aquatic fauna salvaged during dewatering is then to be relocated to the identified recipient site(s)
- Removal of silt and capping of dam bed can then commence.

B.6 Salvaging and relocation of fauna

The collection, handling and storing of aquatic fauna will be undertaken by experienced aquatic ecologists and operate under an approved DPI Fisheries scientific collection permit.

All aquatic vertebrate fauna collected will be identified to species level and any notes taken on their general condition including lesions, presence of *Lernaea*, ulcerations and fin deformities. Any species identified as Noxious under the *Fisheries Management Act 1994* (FM Act) and any moribund native species are to be euthanised, in accordance with animal ethics approvals. Animal ethics approvals (Animal Research Authority) is to have been issued by, and in accordance with, the Animal Care and Ethics Committee of the Secretary NSW Department of Primary Industry.

All aquatic fauna is to be held in appropriately sized containers, tubs and buckets, fitted with aerators and shading to prevent overheating or asphyxiation of animals.

B7. Euthanasia of fauna

Euthanasia of fish and larvae in the field is achieved by overdose of AQUI-S (175 mg/L – 20 mins). Euthanasia of crustaceans in the field is achieved by overdose of AQUI-S (250 mg/L – 20 mins). Where euthanasia using overdose of AQUI-S is infeasible, such as for larger species (e.g. Carp), then euthanasia will be achieved via blunt trauma with a fish bat. Blunt force trauma involves delivery of enough force to the brain case of the fish to cause mortality with minimal distress of the animal.

Rationale for euthanasia follows an assessment by suitably qualified aquatic ecologists on a case by case basis and includes a determination of the survival of the individual based on physical condition, level of parasitism, injury or damage to critical functions (e.g. compromised iso-osmotic barrier, gill trauma, blood loss). These assessments are continually conducted during processing identifying potentially affected individuals. These individuals are then placed in separate containers with adequate aeration to assist recovery. Affected individuals are constantly monitored and if recovery is not observed then the individual is immediately euthanised by the most appropriate method for the species.

Certain species are to be euthanised under permit restrictions (i.e. listed noxious species). Listed noxious species in New South Wales include Common Carp, Eastern Gambusia and Oriental Weatherloach. These individuals are separated from species to be returned to the water and are euthanised as soon as practicable to minimise distress associated with restraint and handling. Post-processing of euthanised fish may include length and weight measurements, gut analysis and taking of genetic samples and otoliths.

Threatened Species Management Protocol

B9. Scope and Objectives

The threatened species management protocol details the requirements for Microbat; Cumberland Plain Land Snail (CPLS); Green and Golden Bell Frog (GGBF) and Threatened Birds.

Targeted surveys will be undertaken by a suitably qualified ecologist as part of the preclearance surveys to determine the presence of threatened microbats, CPLS and GGBF within the Airport Site. If present or likely to be present, the following will be addressed in the respective Management Plans:

- Map of identified areas of occurrence
- Unexpected Finds Protocol
- Legislative requirements
- Protocols for potential relocation, habitat management and ecological supervision
- Schedules for inspection, monitoring, management and corrective actions.

B10 Microbat management

B10.1 Background

Microbat species were recorded during surveys for the Western Sydney Airport EIS. The threatened microbat species (Vulnerable, BC Act) include Eastern Freetail-bat *Mormopterus norfolkensis*, Eastern False Pipistrelle *Falsistrellus tasmaniensis*, Eastern Bentwing-bat *Miniopterus schreibersii oceanensis*, Large-footed Myotis *Myotis macropus*, Greater Broad-nosed Bat *Scoteanax rueppellii*, Eastern Cave Bat *Vespadelus troughtoni* and Yellow-bellied Sheath-tail Bat *Saccolaimus flaviventris*.

Common species were also recorded such as Chocolate Wattled-bat *Chalinolobus morio* and Eastern Little Freetail-bat *Mormopterus ridei*. Given the ecology of these species, they are likely to utilise the Badgerys Creek Corridor and the large adjacent woodland patches for foraging and breeding. Consideration for their ecology and home ranges should be shown in the Sensitive Area Mapping provided in the Threatened Species Management Plan for the project.

Potential impacts on microbat species likely to result from the Project include:

1. Direct impacts on individuals/populations/species habitat resulting from vegetation clearing and construction works on known habitat for microbats within the Project.
2. Indirect impacts on riparian foraging species (i.e. Large-footed Myotis) if run-off is a by-product of the works resulting in reduced water quality, affecting food resources.
3. Indirect impacts resultant of construction, remediation and clearing works such as light, noise and vibration causing roost disturbance, leading to potential roost exodus.

B10.2 Targeted surveys

A suitably qualified ecologist will undertake targeted surveys for microbats and potential microbat habitat (e.g. hollow-bearing trees, rock outcrops, culverts etc.) within the airport site prior to the implementation of the management plan.

Microbats identified in the Western Sydney Airport EIS (GHD 2016) as being either present, probably recorded (via Anabat) or possibly likely to occur include:

- East Coast Freetail Bat *Mormopterus norfolkensis*
- Eastern False Pipistrelle *Falsistrellus tasmaniensis*
- Eastern Bentwing Bat *Miniopterus schreibersii oceanensis*
- Large-footed Myotis *Myotis macropus*
- Greater Broad-nosed Bat *Scoteanax rueppellii*
- Eastern Cave Bat *Vespadelus troughtoni*

- Yellow-bellied Sheath-tail Bat *Saccolaimus flaviventris*.

The microbat targeted surveys will involve visual ground-based inspections using handheld ultrasonic detectors to detect potential microbat roost habitat. A suitably qualified ecologist will position themselves within 5 metres of each tree while holding a hand-held ultrasonic bat detector (e.g. Anabat, EchoMeter Touch or SongMeter) aimed at the tree trunk within preferential habitat features. Approximately 2 minutes is required to be spent scanning each tree with the detector. Collected call data will be analysed to determine species present and activity levels. Once identified, the location, species, estimated number of individuals and any evidence of breeding (e.g. presence of juveniles) will be recorded at each roost site. An ecologist may then elect to undertake stag watches using spotlights and binoculars and /or deploy stationary ultrasonic call detectors over two nights at known or suspected roosting sites, if deemed useful to further establish the importance of a given habitat structure to microbats.

Following the completion of the targeted Microbat surveys, a report or brief letter will be submitted which includes mapping of relevant ecological values and habitat features within five working days, detailing the results of the survey.

B10.3 Preclearance and exclusion

Pre-clearance surveys are to be undertaken during the day of all suitable areas with the potential to support microbat habitat prior to the commencement of works. All potential habitat is to be inspected to confirm if microbats are present.

All potential habitat found not to support microbats during pre-clearance surveys AND considered likely to be impacted by proposed works is to have temporary exclusion measures installed to prevent microbats from moving in.

Exclusion measures are to include:

- Thick tape (such as bitumen tape) or plywood installed over the habitat with the use of an emulsion fluid painted directly onto the culvert
- Expanding foam is not to be used due to difficulties in removal post-construction
- Exclusion measures are to be installed immediately following pre-clearing surveys by an ecologist to ensure microbats do not move into the habitat overnight
- Exclusion measures are to be confirmed enough and effective by a qualified ecologist prior to moving on to the next phase of works.

Habitat not considered likely to be impacted by the works are to remain available to any displaced microbats. Where exclusion measures are not practical and/or cannot be achieved a suitably qualified ecologist is required to supervise the works and relocate microbats to nearby suitable habitat if found.

If microbats are found to be present during pre-clearance inspections, temporary exclusion measures are to be installed overnight once the bats have left the roost to forage. Planned roost exclusion can be conducted from November to March under the supervision of a qualified ecologist to ensure all microbats have vacated the roost.

Roost exclusion should be undertaken in accordance with the following procedure:

1. Installation of temporary wooden roost boxes at exclusion site;
2. Inspection of the culvert/bridge to be decommissioned to be undertaken and any known roost sites that are unoccupied would be excluded on the same day;
3. Active roost sites will be identified and the species present and approximate number of individuals recorded. If bats cannot be determined to be absent, roosts will be treated as occupied.

4. Occupied roosts would be fitted with one-way valves on the same day and reinspected with an endoscope 90 minutes after nightfall to assess whether bats have left the roost. If still present the roost will be left to be re-checked the following morning and, if still present, 90 minutes after the next nightfall.
5. Once the roost has been determined to be vacated, the roost will be permanently sealed off any further access for the bats. This will prevent bats returning to them and encourages transfer to the artificial bat boxes set in place.
6. This process will be repeated each night until all roosts (and potential roost sites e.g. cracks/crevices on bridge) have been filled in.
7. 1-3 months later ecologist will inspect culvert and seal up any further unoccupied roosts.
8. Ecologist to wait until after nightfall as per existing methodology, and exclude remaining roosts in culvert and bridge (once bats have left for the night).
9. Bats take up refuge in wooden roost box in lieu of other habitat.
10. 1-3 months later bats to be sealed up using canvas material (left box in Plate 1), and relocated to an approved, pre-determined location.
11. Weekly monitoring of boxes to determine success of translocation to follow.

The following safeguards must be considered to minimise potential impacts to displaced bats:

- Ensure that this procedure is not conducted during an extensive dry period (drought) as this could be detrimental and lead to mortality, if there is no nearby suitable habitat
- Avoid conducting this procedure during windy, full-moon, cold or rainy nights, as there is a lower likelihood of roost exodus

If works and exclusion of roosting bats are required during the colder months (April to September), when many culvert roosting bats enter torpor (hibernation state), the following additional safeguards must be adhered to:

- Nocturnal monitoring of roost activity is to be undertaken by a qualified ecologist and bats must be confirmed as leaving the roost to forage on at least two separate occasions prior to installation of exclusion measures
- If bats are not confirmed as leaving the roost to forage (i.e. in winter torpor) additional monitoring is to be undertaken until regular foraging has resumed
- Works are not to impact upon culverts with bats present in winter torpor.

Additional safeguards that must be considered when exclusion devices are installed include:

- Avoid the breeding season between April and May, as this could disrupt the reproductive success of a population
- All roost exclusion should be done after dusk, once individuals have emerged to feed and an ecologist is satisfied no microbat individuals remain within the roost
- Roosting habitat that has been sealed must be regularly monitored to ensure the sealing mechanism remains intact and no microbats are able to utilise the habitat. If it is suspected that the exclusion mechanism has failed, then an ecologist must re-inspect the habitat before the seal is reapplied
- Alternative roosting habitat should be made/left available wherever possible when undertaking passive roost exclusion
- All exclusion devices must be temporary and be easily removed following completion of the works. Removal of exclusion devices is to be confirmed by an ecologist
- Potential impacts to bats in winter torpor or during breeding season must be avoided.

Reports are to be provided outlining the findings of pre-clearance assessments and detailing the exclusion measures installed (if required).

Vegetation removal surrounding any culverts should be undertaken during the day and wherever possible. Maintaining appropriate exclusion zones and managing night works by ensuring noise and light pollution is kept to a minimum through the breeding and lactation period (April and May) in the vicinity of identified microbat habitat.

Should habitat be excluded at one end of a culvert due to the need to undertake works, the opposite end of the culvert where habitat may remain un-impacted (and not excluded) should have any vegetation blocking the fly-way removed to mirror the end of the culvert known to allow entry/exit for bats i.e. ensure both ends of the culvert allow access to any habitat that remains inside. If bats are present in torpor within a structure, fortnightly winter monitoring should be conducted during upgrades or maintenance works to ensure that over-wintering roosting colonies are not being adversely impacted by ongoing maintenance works.

Monitoring reports are to be provided outlining the findings of each inspection. A conclusion must be made as to the successful removal of any installed exclusion measures.

B10..4 Management Actions

The following management actions should be followed to avoid or minimise impacts on microbat Species:

1. Where possible the CIZ should be refined to avoid direct or indirect (hollow-bearing trees).
2. Identify impacts on known microbat populations found within the CIZ.
3. A Microbat Management Plan should be prepared to provide appropriate management for the species prior to and during vegetation clearing and construction for the Project.
4. Targeted surveys by the Project Ecologist to locate all threatened microbat species present within the CIZ and provide recommendations to relocate individuals (if necessary) to suitable areas in accordance with the Microbat Management Plan.
5. Microbats should be intentionally handled by a vaccinated wildlife handler and/or Project Ecologist to ensure appropriately handling and mitigate the risk of contracting Australian Bat Lyssavirus (ABL – a rabies-like disease).
6. All personnel working on the Project should be informed of the presence of threatened microbat species and habitat within and adjacent to the Project, and how to avoid or minimise impacts. This information should be provided during site inductions, and re-iterated during pre-start meetings in areas where known records of microbats occur.
7. Appropriate run-off and sediment controls to be in place prior to any vegetation clearing/translocation and construction works for the Project.
8. Minimise construction associated disturbance near known roost sites (i.e. light pollution, noise, vibration and dust generation) and ensure the roost site is delineated from the works with the installation of signage and No-Go-Zones.
9. Inform Environmental Officer if impacts on microbats/habitat are observed or predicted.

B11. Cumberland Plain Land Snail Management

B11.1 Background

The Cumberland Plain Land Snail (CPLS) is listed as an endangered species under the *Biodiversity Conservation Act 2016* (NSW) (BC Act). The species lives in small areas on the Cumberland Plain west of Sydney, from Richmond and Windsor south to Picton and from Liverpool west to the Hawkesbury and Nepean Rivers at the base of the Blue Mountains. It faces a range of threats such as clearing of Cumberland Plain Woodland, removal of shelter material, weeds, inappropriate fire regimes and predation. (Department for Planning, Industry and Environment 2018).

The Cumberland Plain Land Snail primarily inhabits Cumberland Plain Woodland, which is a grassy, open woodland with occasional dense patches of shrubs. It is also known from Shale Gravel Transition Forests, Castlereagh Swamp Woodlands and the margins of River-flat Eucalypt Forest (Department for Planning, Industry and Environment 2018).

The snail is superficially similar to the familiar exotic Garden Snail *Helix aspera* but differs most obviously in its 25 - 30-millimetre diameter shell. While this shell may be almost any shade of brown, it is always uniform in colour, while that of the Garden Snail consists of dark patches on a pale background. A green or yellow tinge may be present. The Cumberland Plain Land Snail also has a more flattened shell that is very thin and fragile, compared with the thick shell of the Garden Snail. The underside of the shell tends to have a glossy appearance and is semitransparent, enabling the observer to see the animal colour and some internal organs. The upper side of the shell has a coarse wrinkly appearance. The Cumberland Plain Land Snail lives under litter of bark, leaves, logs or rubbish, or shelters in loose soil around grass clumps. It can dig several centimetres into the soil to escape drought (Department for Planning, Industry and Environment 2018).

Given the ecology of this species, direct impacts on Cumberland Plain Land Snail resulting from the Project are likely to occur during vegetation clearing and earthworks.

B11.2 Targeted surveys

Targeted surveys will be completed by a suitably qualified ecologist (in suitable conditions) to determine the occurrence of Cumberland Plain Land Snail habitat and individuals within the airport site. Surveys will need to be completed in accordance with the Environmental Impact Assessment Guidelines: Cumberland Plain Land Snail (NPWS 2000). Field surveys will be undertaken following a period of rain. Moist conditions are considered favourable for Cumberland Plain Land Snail searches, as the species is easily detectable. Searches will be undertaken by lightly raking at the leaf litter and soil in areas of potential habitat. Where the soil is friable, it will be raked to a few centimetres below the surface. This is because in dry conditions, the snail is known to burrow into the ground in search of moisture.

If individuals or shells are found during targeted surveys they will be relocated as per the protocol detailed below. The occurrence of both Cumberland Plain Land Snail individuals and habitat within the airport site will be mapped, to guide further pre-clearance surveys, salvage and translocation.

Cumberland Plain Land Snail habitat will be considered 'good' if the following components are present:

- Abundant logs and building refuse
- Abundant leaf litter
- Remnant vegetation
- A large patch size or connectedness to adjoining habitat
- More than 10 % open ground cover with low abundance of dense exotic grasses.

Cumberland Plain Land Snail habitat will be considered 'moderate' if the following components are present:

- A low abundance of logs or building refuse
- Moderate leaf litter
- Regrowth vegetation
- A small patch or fragmentation
- Less than 10 % open ground with a patchy mix of plant cover.

If habitat has no logs, leaf litter, natural vegetation or open ground cover it will be considered 'poor'.

B11.3 Pre-clearance

Following mapping of Cumberland Plain Land Snail individuals and habitat, any area of habitat which will be removed or impacted during works will require the following pre-clearance protocol to be undertaken:

- Searches will involve a sweeping of the area by a qualified ecologist, focusing on areas of higher quality habitats and where snails have previously been located
- Searches will target the base of native trees, accumulated leaf litter, moist areas such as drains and depressions, under fallen logs, rubbish and rubble and around clumps of grass
- Searches will involve gently scraping back the leaf litter to expose the soil profile. In dry environments, loose soil may be disturbed to a maximum depth of 10 centimetres at the base of trees using a hand trowel
- All salvaged individuals will be identified, measured (diameter), photographed, and their location recorded in a hand-held GPS. A brief description of habitat context including the location, tree species and condition the individual was captured
- The snails will be temporarily stored in moist leaf litter within a 20-litre bucket while collections are being completed
- A total number of live snails and shells will also be recorded for each pre-clearance survey.

If due to unforeseen circumstances there is a delay of more than two weeks between surveys and the clearing of vegetation, additional surveys may be required.

B11.4 Translocation

Salvaged Cumberland Plain Land Snail and suitable shelter sites will be relocated into appropriate habitat nearby the airport site on the same day as being salvaged from the area to be cleared of vegetation. Appropriate recipient sites will be discussed with Department for Planning, Industry and Environment prior to translocations. Individuals are to be transported with some moist leaf litter from the salvage site to the recipient site. Leaf litter should be taken from areas where weed densities are low. Similarly, large fallen wood debris or trees to be removed will be relocated to the recipient site prior to clearing of vegetation within the CIZ.

Relocated Cumberland Plain Land Snails should be placed under leaf litter, beneath Forest Red Gum or similar microhabitat to where the snail was located within the salvage site. Relocation of Cumberland Plain Land Snails into the recipient site is to occur within 100 metres of the captured location, where possible.

Only invertebrates listed as threatened under the BC Act (i.e. Cumberland Plain Land Snail) will be relocated into the adjacent recipient site during pre-clearance surveys. Introduced species such as the Garden Snail will be destroyed if found during the pre-clearance surveys. If identification of individuals is difficult, especially for juvenile specimens, then individuals will be recorded as Cumberland Plain Land Snail and relocated, however, a confidence assessment will be used to determine the level of accuracy (Certain, Probable or Possible).

Relocated Cumberland Plain Land Snails will be released into the recipient site at similar densities to those found during the salvage surveys. Where possible, recipient sites should include a large extent of moderate-high quality habitats to prevent overcrowding of new/existing populations. To mitigate the risk of competition between Cumberland Plain Land Snail individuals, no more two individuals may be released at the base of a native tree with a diameter at breast height (DBH) of 20 centimetres. This can be increased proportional to DBH, to up to five individuals around larger trees (e.g. 100 centimetres DBH). Where possible, individuals found at under the same tree, or structure, will be relocated together.

B11.5 Management Actions

The following management actions should be followed to avoid or minimise impacts on the Cumberland Plain Land Snail:

1. Pre-clearing surveys should be conducted by the Project Ecologist to locate all individuals present within the Project prior to each stage of vegetation clearing or construction works.
2. If individuals are located, works should be postponed within the area (including and appropriate buffer area surrounding individual/s).
3. Procedures for the translocation of Cumberland Plain Land Snail to suitable areas in accordance with the recommendations in Section B11.4 Translocation.

4. All personnel working on the Project should be informed of the potential for Cumberland Plain Land Snail within the Project, and how to avoid or minimise impacts. This information should be provided during site inductions, and re-iterated during pre-start meetings.
5. Inform Environmental Officer if Cumberland Plain Land Snail are observed on site.
6. If a CPLS individual is encountered unexpectedly during works, all activities that may affect the individual or its habitat will be ceased until an ecologist is present and can collect the individual. This would also be communicated to the Department. Any such individuals will be recorded and translocated accordingly. Refer to the Unexpected Threatened Find Protocol.

B12. Green and Golden Bell Frog Management

B12.1 Background

The Green and Golden Bell Frog is listed as Vulnerable under the Commonwealth EPBC Act, and as Endangered under the NSW BC Act. It is a relatively large frog, ranging from approximately 45 millimetres to 100 millimetres snout to vent length. Its distinguishable features include a gold or creamish white stripe running along its side, extending from the upper eyelids almost to the groin, with a narrow dark brown stripe beneath it, from nostril to eye. It also has blue or bluish-green colour on the inside of its thighs. The colour of the body varies, and is usually vivid pea-green splotched with a metallic brassy brown or gold (Department for Planning, Industry and Environment 2017).

The species were formerly distributed from the NSW north coast near Brunswick Heads, southward along the NSW coast to Victoria and into East Gippsland. Since 1990 there have been approximately 50 recorded locations in NSW, most of which are small, isolated, coastal or near-coastal populations (Department for Planning, Industry and Environment 2017).

Green and Golden Bell Frog inhabit marshes, dams and stream-sides, favouring unshaded water bodies containing bullrushes or spike rushes. Some populations occur in highly disturbed areas (Department for Planning, Industry and Environment 2017). The species will be subject to targeted surveys between the end of November and January in accordance with the *Survey Guidelines for Australia's Threatened Frogs* (CoA 2010).

B12.2 Site Hygiene Management

A water-borne fungal pathogen *Batrachochytrium dendrobatidis*, commonly known as frog chytrid fungus, is responsible for the disease Chytridiomycosis (NPWS 2001). The accidental introduction or spread of this pathogen has the potential to adversely affect frog populations and must be managed accordingly.

When travelling between potentially infected sites it is recommended in the Threatened Species Management Information Circular No. 6 – Hygiene Protocol for the Control of Disease in Frogs (NPWS 2001) that the following hygiene precautions be taken if the GGBF is determined to be present at the Airport Site:

- Hands, arms, knees etc. should be cleaned to remove debris and washed or wiped with a suitable disinfectant before entering the vehicle or moving to another site
- Footwear should be thoroughly cleaned and disinfected at the commencement of fieldwork and between each site. This can be achieved by initially scraping boots clear of mud and standing the soles in a disinfecting solution. The remainder of the boot should be rinsed or sprayed with a disinfecting solution. Clothing that has significant contact with frogs and the environment should also be subjected to changing or cleaning
- Disinfecting solutions should be prevented from entering any water bodies
- Any equipment used on site should be cleaned and disinfected before use at another site
- If a vehicle is to transverse a known frog site, the wheels and tyres should be cleaned and disinfected prior to travelling to another site.

Recommended disinfection strategies and products are detailed in Phillott et al. 2010.

B12.3 Targeted surveys

Targeted surveys for Green and Golden Bell Frog are required to confirm the species is not present within the CIZ. As Green and Golden Bell Frog is listed under the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) and BC Act, surveys will need to be completed in accordance with:

- Threatened species survey and assessment guidelines: field survey methods for fauna. Amphibians (DECC 2009)
- Survey Guidelines for Australia's Threatened Frogs (CoA 2010)

The key outcome of the targeted surveys is to determine if there are any habitat features within the CIZ being utilised by Green and Golden Bell Frog for breeding, refuge, dispersal or overwintering.

Targeted surveys must be undertaken when conditions are suitable (from October to January) after a minimum 50 millimetres of rainfall in seven days, and following confirmation of calling from known reference populations within the local area. The proposed methodology for targeted surveys for the Green and Golden Bell Frog in accordance with Commonwealth and NSW survey guidelines is outlined in Table 19.

B12.4 Pre-clearance

Prior to undertaking activities that may impact on identified habitat for Green and Golden Bell Frogs, such as broad-scale application of herbicide, and mechanical removal of vegetation, the project ecologist is to undertake a pre-clearance inspection. This will involve targeted active diurnal searches of potential Green and Golden Bell Frogs habitat located within the proposed disturbance. Following the diurnal habitat searches, a nocturnal habitat search may need to be conducted to assess nocturnal usage in the habitat area. These searches may include searching of habitat features that were searched during the day, spotlighting and/or call play-back.

B12.5 Translocation

If a GGBF is located during preclearance surveys of a proposed impact area, the following relocation procedure will be carried out:

- The qualified ecologist undertaking the preclearance assessment will capture the frog using a gloved hand or inverted plastic bag
- If the frog appears healthy, the frog will be transported and released into a pre-determined nearby relocation area. If captured during the day the individual will be held in a cool, dark and moist place until nightfall. The individual will be released nearby suitable shelter and a water source
- If the frog appears to be sick or injured and would most likely not survive transportation, it will be humanely euthanised
- If the frog appears to be sick or injured and appears likely to survive transportation, it will be placed inside a moist bag with damp leaf litter and transported to an appropriate wildlife carer or vet

All details of translocations including the location the individual was found, the sex and life stage of the individual and the release point are to be recorded.

B12.6 Management Actions

The following management actions should be followed to avoid or minimise impacts on the Green and Golden Bell Frog:

1. Where possible the CIZ should be refined to avoid direct or indirect (upstream) impacts on known populations of the Green and Golden Bell Frog.
2. Exclusion fencing and signage should be in place prior to all vegetation clearing and construction works to ensure Green and Golden Bell Frog populations adjacent to the Project, or to be retained within the Project will not be impacted by the Project.

3. Targeted surveys to locate all Green and Golden Bell Frog present within the Stage 1 construction footprint should be conducted to identify areas of sensitivity and provide recommendations to translocate individuals to suitable areas in accordance with the Green and Golden Bell Frog Management Protocol.
4. Appropriate hygiene protocol should be observed during all works within and adjacent to/upstream of all known populations of/habitat for the Green and Golden Bell Frog to avoid introducing/spreading frog Chytrid fungus in accordance with the Pathogen and Weed Management Strategy.
5. All personnel working on the Project should be informed of the presence of the Green and Golden Bell frog and habitat within and adjacent to the Project, and how to avoid or minimise impacts. This information should be provided during site inductions, and re-iterated during pre-start meetings in areas where known records of the Green and Golden Bell Frog occur.
6. No parking, digging, laydown of equipment and materials or any other activities that may impact on Green and Golden Bell Frog/habitat within exclusion fencing.
7. Appropriate run-off and sediment controls to be in place prior to any vegetation clearing/translocation and construction works for the Project.
8. Spill kits should be provided on site to avoid impacts of chemical spills on downstream populations of Green and Golden Bell Frog.
9. Inform environmental team if impacts on Green and Golden bell Frogs/habitat are observed.

B13. Threatened Birds

B13.1 Background

Various birds were recorded during surveys for the Western Sydney Airport EIS. Threatened bird species (Vulnerable, BC Act) include Varied Sitella *Daphoenositta chrysoptera*, Little Lorikeet *Glossopsitta pusilla*, Scarlet Robin *Petroica boodang*, Little Eagle, Black Bittern, Blue-billed Duck, Swift Parrot, Powerful Owl, Masked Owl, Diamond Firetail and Flame Robin. The locations of threatened bird records within the CIZ should be shown in the Sensitive Area Mapping provided in the Threatened Species Management Plan for the Project.

Given the ecology and sedentary nature of some of the above species, direct impacts on Varied Sitella *Daphoenositta chrysoptera*, Little Lorikeet *Glossopsitta pusilla* and Scarlet Robin *Petroica boodang* are likely to occur during vegetation clearing and earthworks (barrier for movement and loss of hollow-bearing trees).

B13.2 Management Actions

The following management procedures should be followed to avoid or minimise impacts on threatened birds:

1. Pre-clearing surveys should be conducted by the Project Ecologist to locate all individuals present within the Project prior to each stage of vegetation clearing or construction works.
2. If individuals or cup-shaped nests are located, works should be postponed within the area (including and appropriate buffer area surrounding the roosting individual/s) until further inspections confirm that birds are no longer present.
3. All personnel working on the Project should be informed of the potential roosting or foraging of threatened birds within the Project, and how to avoid or minimise impacts. This information should be provided during site inductions, and re-iterated during pre-start meetings.
4. Inform Environmental Officer if threatened birds are observed on site.
5. Ensure nest boxes are installed in accordance with the Nest Box Strategy to ensure adequate prey shelter habitat remains present during vegetation clearing and construction works.

B14. Fauna Handling and Rescue Procedure

This procedure explains the actions to be undertaken in the event fauna (including injured, shocked, juvenile or other animal) that require handling or rescue are discovered on the project site during vegetation and soil clearance and ongoing construction activities.

This procedure is applicable to all native and introduced species that are found on the project site.

B14.1 Frogs

Green and Golden Bell Frog has been recorded within the vicinity of the Stage 1 Construction Impact Zone and are likely to be encountered in the vicinity of riparian habitats and drainage lines. The proposed works will potentially interfere with breeding habitat for Green and Golden Bell Frog.

B14.2 Birds

Fourteen threatened bird species have been identified as likely to occur within or adjacent to the Stage 1 Construction Impact Zone. Of the species recorded within the vicinity eight are considered likely to be encountered by construction personnel during clearing of vegetation, including the removal of hollow-bearing trees, as these species utilise these nesting resources. Clearance of vegetation during late winter to spring is considered likely to substantially increase the likelihood of these species being encountered and impacted upon.

B14.3 Mammals - Chiroptera (Bats)

Eight Chiroptera species have been recorded within the vicinity of the Stage 1 Construction Impact Zone, with eight of these species regarded as microchiropteran (microbats) and one megachiroptera (megabats – Grey-headed Flying Fox) species. Some of these microbat species are considered likely to be encountered during the clearance of vegetation (roost habitat).

Encounters with native mammals will be predominantly restricted to clearing of native vegetation, and further restricted to tree dependant fauna including; Common Ringtail Possum, Common Brushtail Possum and Antechinus species. Most mammals recorded are mobile species and will evade personnel and equipment undertaking works within the CIZ. Special considerations for identified microbat roost habitats should be considered prior to works and recommendations referred to in Microbat Management Plan.

B14.4 Molluscs

Records of Cumberland Plain Land Snail *Meridolum corneovirens* have been located within the vicinity of the Airport, with this species utilising terrestrial habitat resources; woody debris, peeling bark and leaf litter. The proposed works will interfere with idealistic foraging habitat; therefore, Cumberland Plain Land Snail has the potential to be encountered during vegetation clearing works and associated earthworks within the CIZ.

B14.5 Clearing procedure

The Project Ecologist will undertake the following steps:

1. Prior to undertaking clearing at any location or time, a pre-clearing assessment must be undertaken by the Project Ecologist to identify the presence or evidence of the presence of fauna (including fresh scats, scratches and remains of prey), including threatened species. The pre-clearing assessment must also include the identification and assessment of habitat trees affected by the clearing activities, including details on the checks by the project ecologist on trees for fauna, nests and the like. The assessment must include processes and actions to protect or rescue the identified fauna including koalas, bat colonies and roosts, glider dens and frogs and address all elements of the implementation, outcomes and effectiveness of the proposed fauna rescue procedure (Section 6.6).
2. All hollow bearing trees, potential hollow bearing trees and all other fauna containing habitat trees, including trees with nests, dreys and termitaria likely to be occupied by fauna, must be marked at least 7 days prior to the commencement of clearing in a manner which clearly identifies and demarcates the trees.
3. Under-scrubbing and non-habitat tree removal. Non-habitat trees must be removed at least 48 hours before habitat trees are removed, unless otherwise agreed with the Department for Planning, Industry and Environment .

4. Habitat trees should be inspected by Project Ecologist prior to removal to ensure animal exodus. Excavator operator to knock or disturb the habitat tree prior to felling, with the intent to encourage the passive removal of fauna from hollows and nests.
5. Habitat tree removal. Habitat trees must be carefully felled at least 48 hours after Stage 1 unless otherwise agreed with the Department for Planning, Industry and Environment , to allow fauna an opportunity to move from habitat trees and allow time to concentrate rescue efforts on the trees that are most likely to be inhabited. Habitat trees must be felled using equipment that allows the trees to be lowered to the ground with minimal impact (e.g. claw extension). All habitat trees must be felled under the supervision of a suitably qualified ecologist. Felled trees must be left for a short period of time, determined by the project ecologist, on the ground to give any fauna trapped in the trees an opportunity to escape.
6. Injured fauna is to be taken to a local vet or a WIRES representative is to be contacted as soon as possible.

All fauna captured will be relocated into areas of suitable habitat adjacent to the Project site in accordance with the Rescue Procedure detailed in Section 6.6. The species, number, sex, age, class and general health of everyone is to be recorded for later reporting in accordance with the Rescue Procedure detailed in Section 6.6 below.

B14.6 Rescue procedure

If wildlife is discovered within the CIZ during site construction activities, including clearing (refer Biodiversity CEMP Section 6) that may harm, or has resulted in harm, to the animal or pose a risk to site personnel, the following steps will be taken:

1. Stop all work in the vicinity of the fauna and immediately notify project Superintendent who will notify the Environmental Manager and suitably qualified ecologist.
2. Preferably allow fauna to leave the area without intervention.
3. Use a licensed fauna ecologist or wildlife carer with specific animal handling experience to carry out any fauna handling.
4. Where necessary, to minimise stress to native fauna and/or remove the risk of further injury before a licensed fauna handler arrives onsite, the Environmental Officer will implement the Handling Procedure detailed in Section 6.7.
5. If the animal cannot be handled (i.e. venomous reptiles):
 - a. exclude all personnel from the vicinity with fencing and/or signage; and
 - b. record the exact location of the animal and provide to the suitably qualified ecologist or appropriate rescue agency.
6. Call the appropriate rescue agency immediately and follow any advice provided by the agency. Once the rescue agency arrives at the site, they are responsible for the animal. Any decisions regarding the care of the animal will be made by the rescue agency.

The contact details for the Project Ecologist will be kept at a convenient location on the project site and be available to the Contractor's personnel at all locations where clearing is being undertaken, to enable quick contact and access to the Project Ecologist.

In the event the rescue service and/or local veterinary service cannot be contacted, the injured animal will be delivered to the relevant agency as soon as practically possible.

In the event the rescue service and/or local veterinary service cannot be contacted, if required, the most appropriate euthanasia will be administered by the Project Ecologist (i.e. cervical dislocation for small vertebrates, ice slurry for introduced fish). This is to occur in accordance animal ethics approval and legislative requirements:

1. If the fauna species is identified as a threatened species that is not a species identified in the TSMP, the Project Environmental Manager must:

- immediately cease all work likely to affect the threatened species;
 - inform the WSA Environment Manager;
2. Contact the following stakeholders, in the order provided, to determine the appropriate corrective actions and additional safeguards to be undertaken:
 - Project Ecologist
 - WSA Environment Manager
 - Government agencies in consultation with WSU.
 3. Relocation of fauna captured during construction works, including clearing and associated works, will be undertaken by the Project Ecologist or wildlife rescuer. If the animal is not injured or stressed, it should be released to an area that is not to be disturbed by the project construction works, in accordance with the following:
 - sites identified as suitable release points by the Project Ecologist or wildlife rescuer;
 - release site will contain similar habitat and occur as close to the original capture location as possible;
 - if the species is nocturnal, release will be carried out at dusk;
 - release would generally not be undertaken during periods of heavy rainfall;
 - non-native fauna will not be translocated and will be euthanised.
 4. If the animal has been placed into care due to injury, age (i.e. young) or stress, upon its rehabilitation it will be released in an area that is not to be disturbed by the project construction works, at the discretion of the Project Ecologist or wildlife rescuer.
 5. Following consultation with all relevant stakeholders, the Project Ecologist/Environmental Manager will implement any corrective actions and additional safeguards.
 6. Following confirmation by the Project Ecologist/Environmental Manager that all appropriate safeguards have been implemented, construction works can recommence.
 7. Project Ecologist/Environmental Manager to record find/translocation in the WSA Environmental Incident Report or Weekly Environmental Inspection Checklist. All relevant characteristics of the fauna find should be recorded to the extent practicable (i.e. visual signs of behaviour; habitat; health signs; sex, time date, weather etc.), and capture and relocation data.

B14.7 Handling procedure

The Handling Procedure will be implemented to minimise stress to native fauna and/or remove the risk of further injury. The Project Ecologist will:

1. Cover larger animals with a towel or blanket and place in a cardboard box and/or hessian bag;
2. Place smaller animals in a cotton bag, tied at the top;
3. Keep terrestrial fauna quiet, warm, ventilated and in a dark location away from noisy construction activities;
4. Place aquatic fauna in plastic aquaria or plastic bag with enough water. Ensure enough water and adequate aeration;
5. Transport frogs without water or debris in recognition of the risk of transporting disease and the minimal transport time.
6. Animals such as venomous reptiles and raptors require handling and will only be handled by appropriately qualified personnel, i.e. Project Ecologist or wildlife rescuer.
7. If handling bats, the handler must be vaccinated against the Australian Bat Lyssavirus (ABL), which is a form of rabies.

8. Any frog handling will be undertaken in accordance with the Hygiene Protocol for the Control of Disease in Frogs (DECC 2008). This protocol recommends onsite hygiene precautions be undertaken to minimise the transfer of disease between and within wild frog populations. Measures recommended include:
- thorough cleaning/disinfecting of footwear and equipment when moving from one site to another;
 - spraying/flushing vehicle tyres with a disinfecting solution where necessary in high risk areas;
 - Cleaning/disinfecting hands between collecting samples/frogs (gloves, not bare hands, will be used to handle frogs); and limiting one frog or tadpole to a bag. Bags will not be reused.

B14.8 Deceased Fauna

If deceased wildlife is found the following will occur:

1. If animal is confirmed as a threatened species by the Project Ecologist (identified in the TSMP) the Project Environmental Manager must:
 - immediately cease all work in the area where the deceased animal was found;
 - inform the WSA Environment Manager;
 - Contact the following stakeholders, to determine the appropriate corrective actions and additional safeguards to be undertaken:
 - i. Project Ecologist
 - ii. CPBLLJV and WSA Environment Manager
 - iii. Government agencies (relevant agencies to be determined in consultation with WSA and Project Ecologist).
2. All Protected deceased fauna found on site will be recorded in a project Deceased Fauna Register. This document will include:
 - Species
 - Location and time found
 - Cause of death (if known)
 - Disposal location

B15. Adaptive Management and Contingency Measures

An adaptive management approach is to be employed in respect to the works forming part of the Biodiversity Management Protocols. An adaptive management approach involves an integrated process of monitoring, reviewing and then responding to the health and condition of the species or habitat features addressed in this Management Plan. This will identify any alterations to the design and maintenance of works that may be required to ensure the objectives of the Management Plan are achieved.

For example, the results of targeted surveys for threatened species should be considered and incorporated into the Management Plan once completed. Annual reporting shall also be provided to indicate where known or potential problems occur, and contingency measures will be implemented as part of an ongoing adaptive management strategy for the Project.

It is important to note that any changes should comply with the aims of this Management Plan, and any licensing or approval conditions issued before implementation. An Adaptive Management Statement (or similar) will be prepared and signed by both parties prior to implementation of any adaptive management actions.

A summary of potential problems that may be detected during the implementation of the management plans detailed in this document and suggested contingency measures to facilitate adaptive management of these problems are presented below:

Table 27: Adaptive Management and Contingency Measures

Action	Potential Problem	Contingency Measure
Baseline surveys	<ul style="list-style-type: none"> Detection of a threatened species not previously recorded or accounted for in management plans 	<ul style="list-style-type: none"> Implement unexpected finds procedures.
Nest box monitoring	<ul style="list-style-type: none"> Performance parameters outlined in Section 3.7 not met 	<ul style="list-style-type: none"> Review nest boxes utilised and reassess nest box recipient sites. Relocate nest boxes or source suitable additional sites outside of the conservation area and recommence nest box management plan.
Threatened species targeted surveys	<ul style="list-style-type: none"> Failure to detect threatened species or threatened species habitat during targeted surveys 	<ul style="list-style-type: none"> Follow unexpected finds procedures when working in areas identified as containing suitable habitat
Translocation of CPLS	<ul style="list-style-type: none"> Failure to detect CPLS during follow up monitoring of translocated individuals. 	<ul style="list-style-type: none"> Compare findings of monitoring with results collected at reference sites, to identify correlation with regional trends. If no regional trend is identified that correlates with failed detection, implement EPBC Act offset requirements.
Translocation of GGBF	<ul style="list-style-type: none"> Failure to detect GGBF during follow up monitoring of translocated individuals. 	<ul style="list-style-type: none"> Compare findings of monitoring with results collected at reference sites, to identify correlation with regional trends. If no regional trend is identified that correlates with failed detection, implement EPBC Act offset requirements.

Weed and Disease Management Plan

C1. Scope

This Weed and Disease Management Plan (**WDMP**) provides controls and actions required to manage the retained ecological features within the Airport. The impact within the early works footprint and retained vegetation within the site are to be managed in accordance with the WDMP.

C2. Objectives

The WDMP focuses on:

- Identification and mapping of the known extent of NSW Department of Primary Industry (DPI) listed Priority Weeds and pathogens within the construction area (to be undertaken during the preparation for the contractor site environmental management documentation, including within the Environmental Controls Maps (ECM) and or Environmental Work Method Statement (EWMS) (refer to Section 5.3 of the SEMF).
- Prevention of the introduction of the Priority Weeds and pathogens within the impact area, not limited to the 12 listed priority weeds and three potential pathogens identified in the EIS.
- Prescription of suitable control measures and means of preventing spread beyond the construction impact area during construction.
- The minimisation of impacts arising from Key Threatening Processes (KTP) listed under the *Environment Protection and Conservation Act 1999* (Cth) (EPBC Act) and *Biodiversity Conservation Act 2016* (NSW) (BC Act) as a result of the occurrence and/or spread of pathogens and weeds (GHD 2017) is also a priority to ensure the Stage 1 Development does not increase the operation of or increase impact of KTPs.

C3. Existing environment

C3.1 Key Threatening Processes

Key threatening processes listed under the EPBC Act and BC Act relevant to managing weeds and disease during construction activities associate with the construction works covered by the Biodiversity CEMP, are outlined in Table 28.

Table 28: Key threatening processes - managing weeds and disease during Stage 1

Key Threatening Process	EPBC Act	BC Act
Dieback caused by the root-rot fungus (<i>Phytophthora cinnamomi</i>)	X	
Infection of amphibians with chytrid fungus resulting in chytridiomycosis	X	
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants	X	
Novel biota and their impact on biodiversity	X	
Forest eucalypt dieback associated with over-abundant psyllids and Bell Miners		X
Infection of frogs by amphibian chytrid causing the disease chytridiomycosis		X

Key Threatening Process	EPBC Act	BC Act
Infection of native plants by <i>Phytophthora cinnamomic</i>		X
Introduction and establishment of Exotic Rust Fungi of the order Pucciniales pathogenic on plants of the family Myrtaceae		X
Invasion and establishment of exotic vines and scramblers		X
Invasion of native plant communities by African Olive <i>Olea europaea</i> subsp. <i>cuspidata</i> (Wall. ex G. Don) Cif.		X
Invasion of native plant communities by <i>Chrysanthemoides monilifera</i>		X
Invasion of native plant communities by exotic perennial grasses		X
Loss and degradation of native plant and animal habitat by invasion of escaped garden plants, including aquatic plants		X

C3.2 Priority and environmental weeds

Table 29 below, outlines the weeds listed under the *Noxious Weed Act 1993* (NSW) (NW Act) at the time of assessment by (GHD 2016) and an updated Biosecurity Duty under the *Biosecurity Act 2015* (NSW) (Biosecurity Act). All plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable. Species that are listed as Weeds of National Significance (WoNS) are also outlined below in Table 29.

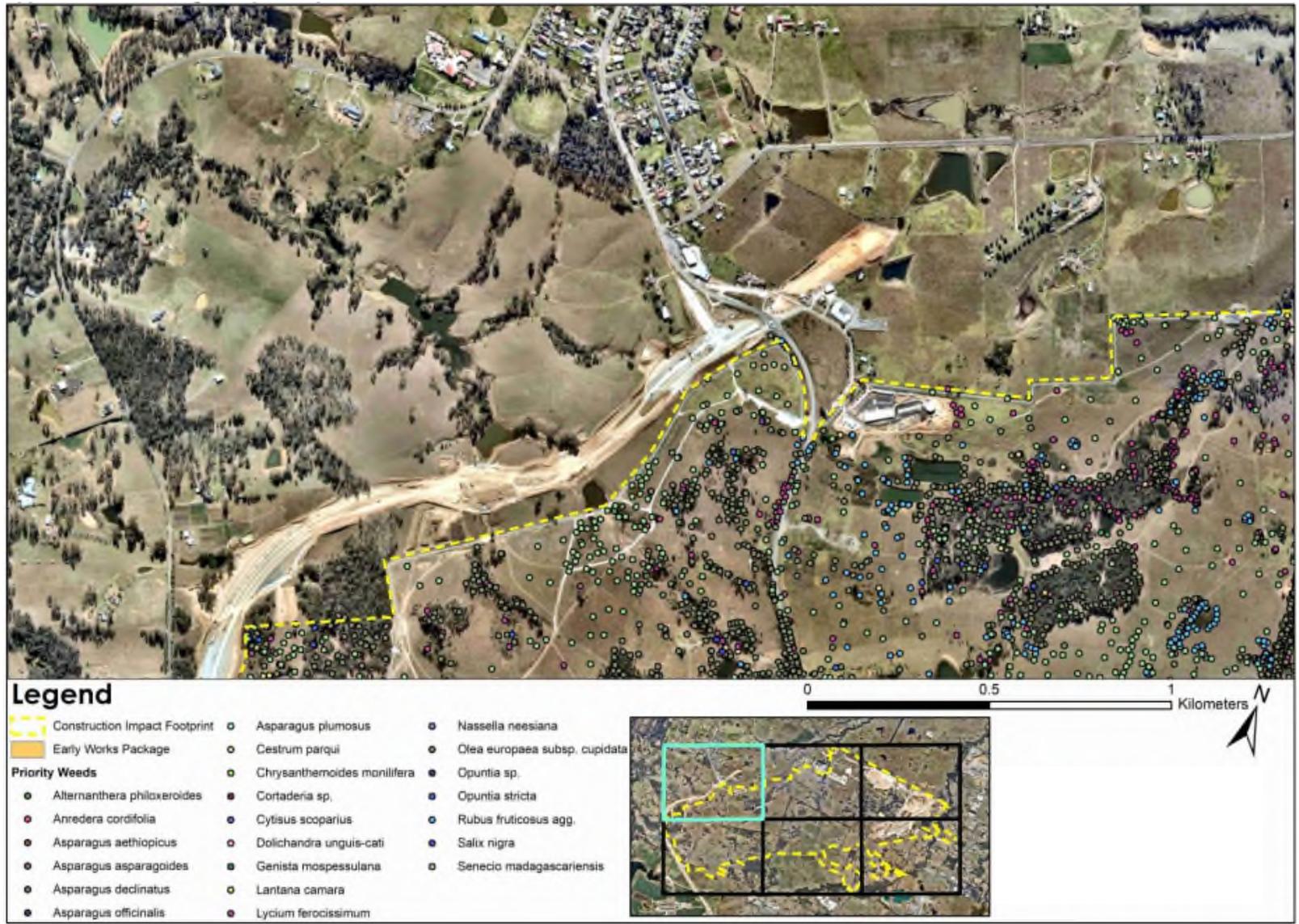
Table 29: Priority and environmental weeds recorded within the Airport

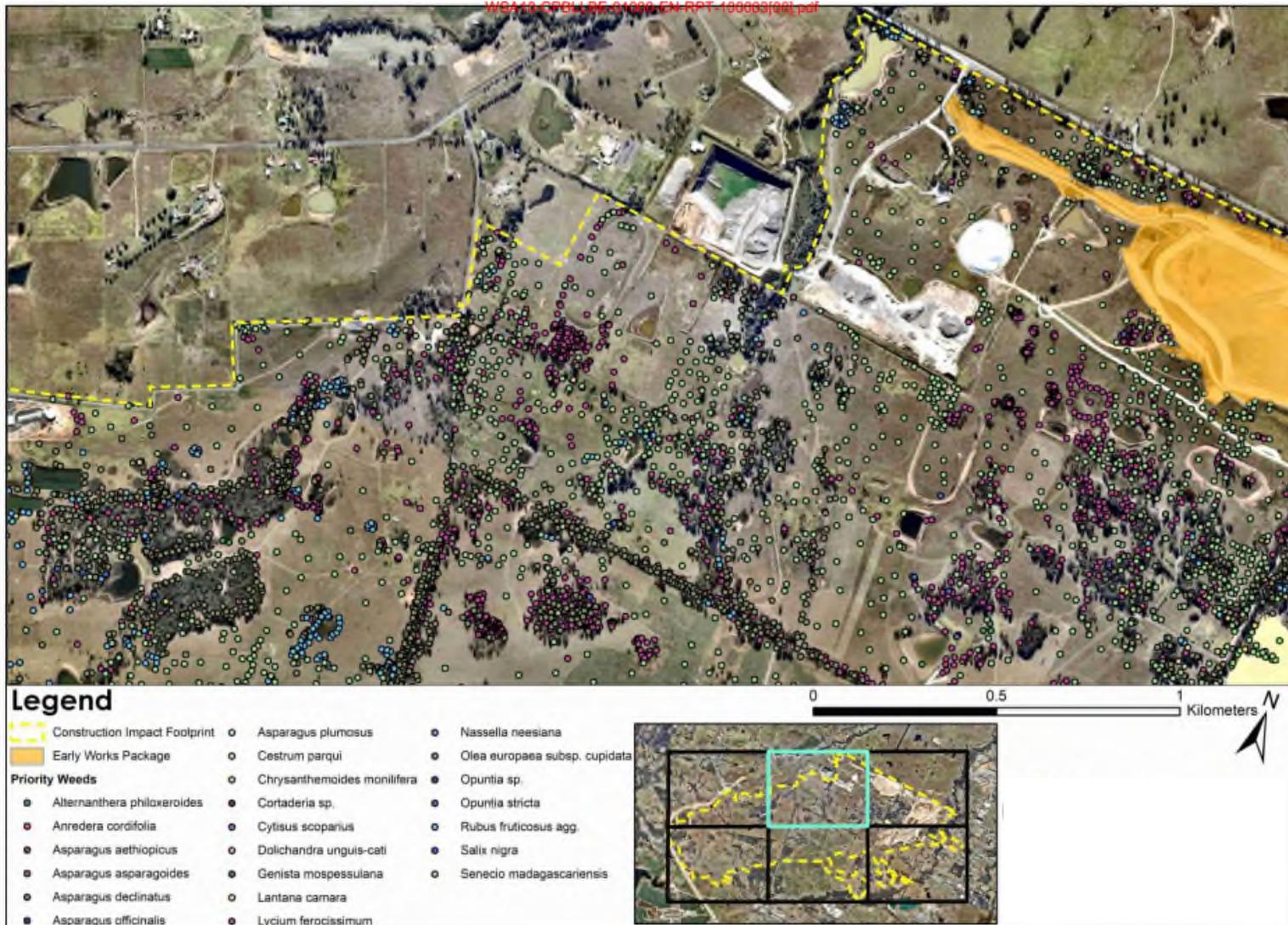
Scientific Name	Common Name	Biosecurity Act Biosecurity Duty	WoNS
<i>Alternanthera philoxeroides</i>	Alligator Weed	Biosecurity Zone The Alligator Weed Biosecurity Zone is established for all land within the state except land in the following regions: Greater Sydney; Hunter (but only in the local government areas of City of Lake Macquarie, City of Maitland, City of Newcastle or Port Stephens). Within the Biosecurity Zone this weed must be eradicated where practicable, or as much of the weed destroyed as practicable, and any remaining weed suppressed.	
<i>Anredera cordifolia</i>	Madeira vine	General biosecurity duty	
<i>Asparagus asparagoides</i>	Bridal Creeper	General biosecurity duty	
<i>Bryophyllum</i> sp.	Mother-of-millions	General biosecurity duty	
<i>Cestrum parqui</i>	Green Cestrum	Regional Recommended Measure Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. The plant should not be bought, sold, grown, carried or released into the environment.	

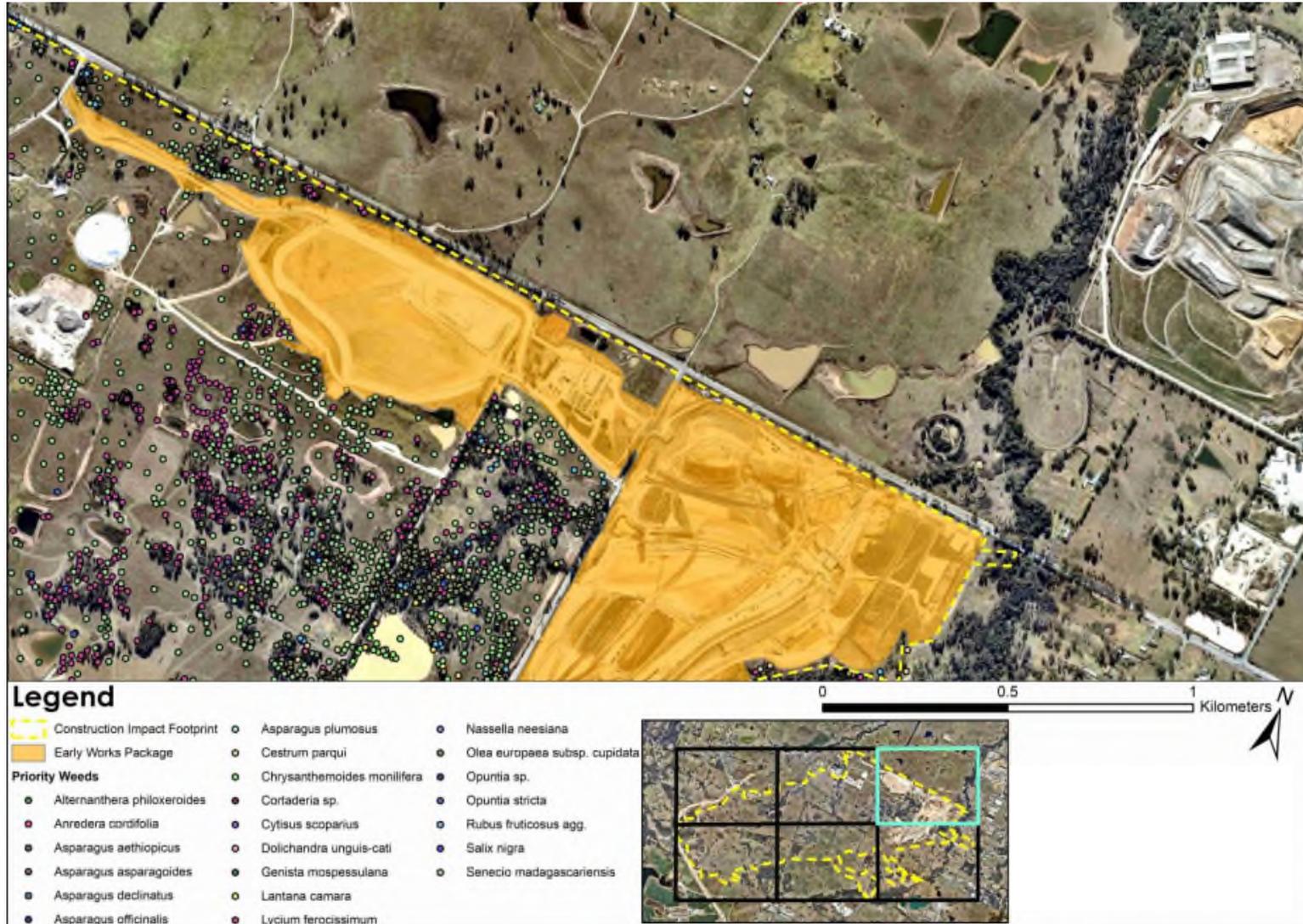
Scientific Name	Common Name	Biosecurity Act Biosecurity Duty	WoNS
<i>Cortaderia selloana</i>	Pampas grass	General biosecurity duty	
<i>Lantana camara</i>	Lantana	General biosecurity duty	
<i>Ligustrum lucidum</i>	Broad-leaved Privet	General biosecurity duty	
<i>Ligustrum sinense</i>	Small-leaved Privet	General biosecurity duty	
<i>Lycium ferocissimum</i>	African Boxthorn	General biosecurity duty	
<i>Olea europa</i> subsp. <i>cuspidata</i>	African Olive	Regional Recommended Measure An exclusion zone is established for all lands in Blue Mountains City Council and Central Coast local government areas. The remainder of the region is classified as the core infestation area. Whole region: The plant or parts of the plant are not traded, carried, grown or released into the environment. Core infestation area: Land managers prevent spread from their land where feasible.	
<i>Opuntia stricta</i>	Common Prickly pear	General biosecurity duty	
<i>Ricinus communis</i>	Castor Oil Plant	General biosecurity duty	
<i>Rubus fruticosus</i> species aggregate	Blackberry	General biosecurity duty	Yes
<i>Salvinia molesta</i>	Salvinia	Regional Recommended Measure Exclusion zone: whole region except for the core infestation area of the Georges and Hawkesbury-Nepean Rivers and their tributaries. Whole region: Land managers mitigate the risk of the plant being introduced to their land. Core infestation area: Land managers should prevent spread from their land where feasible.	Yes
<i>Senecio madagascariensis</i>	Fireweed	General biosecurity duty	Yes

C3.3 Weeds Mapping

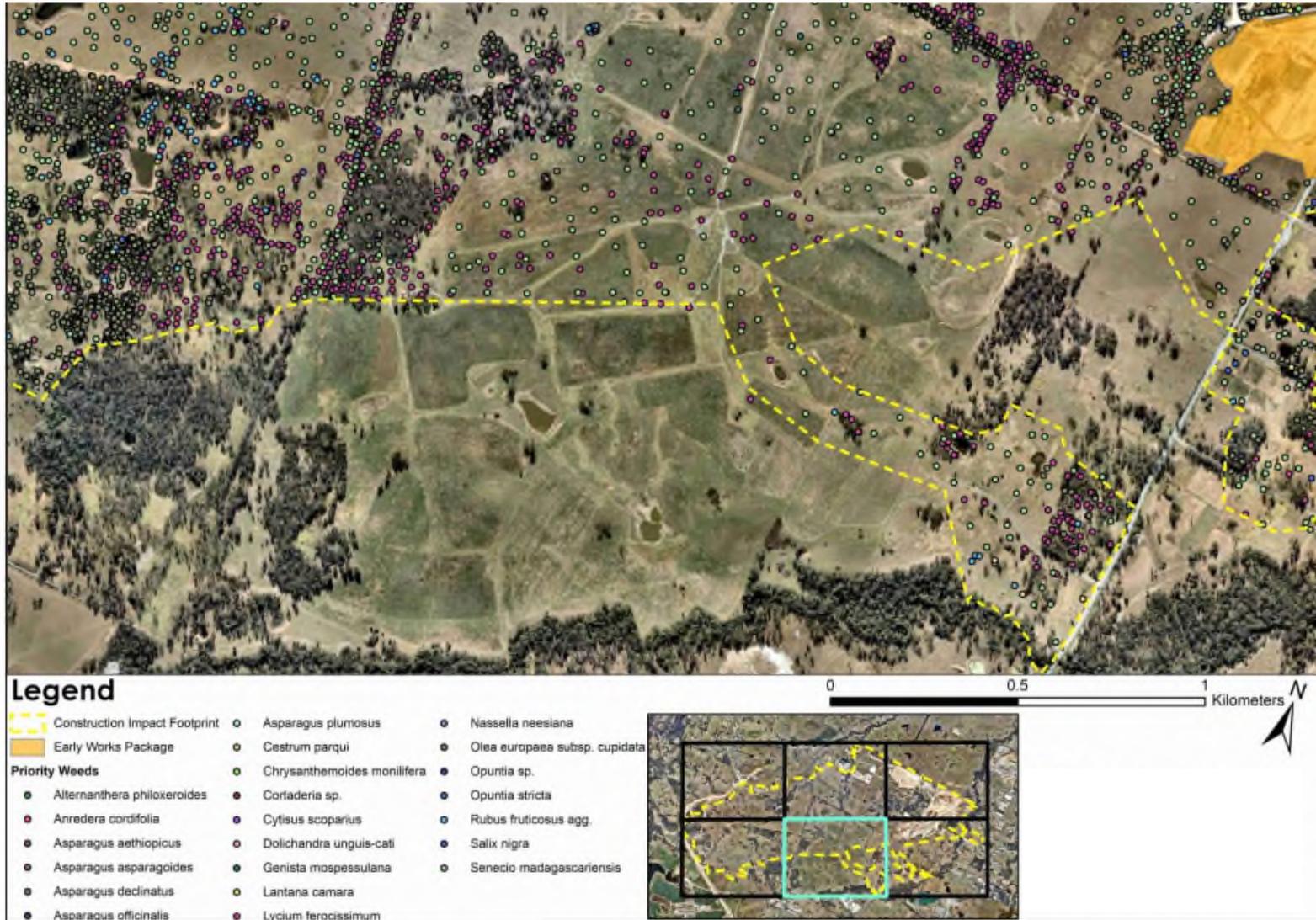
The mapping of weeds was undertaken as a component of the pre-construction survey undertaken by the Bulk Earthworks Contractor. Maps of priority weeds identified by this survey are shown below.

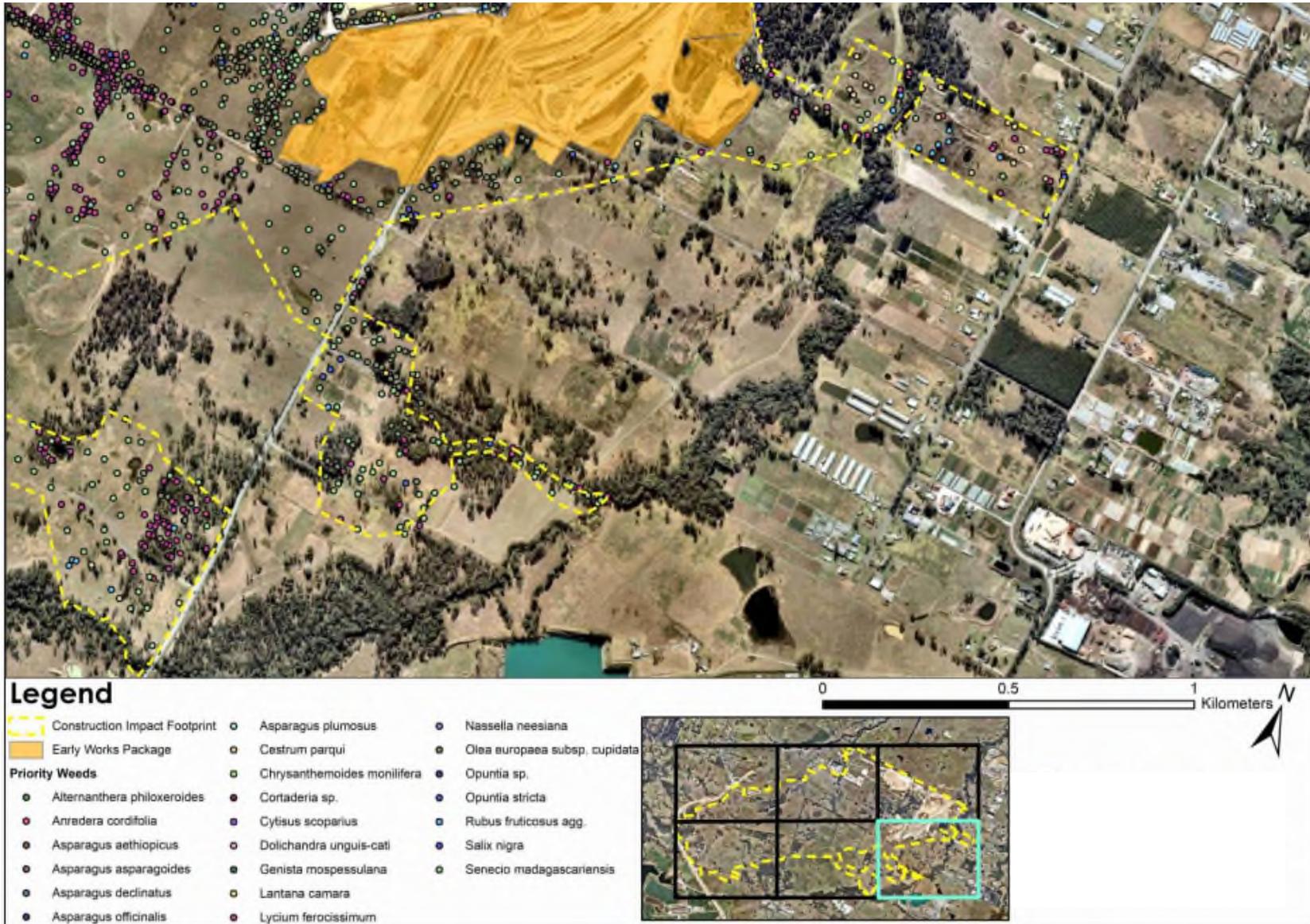












C4. Biosecurity protocol

All contractors are to follow the biosecurity hygiene protocol detailed below in Table 30 prior to clearing, during construction and post-construction.

Table 30: Biosecurity hygiene protocol

Timing	Hygiene protocol	Risk reduction
Prior to clearing	<p>Presence of biosecurity matters are to be discussed during toolbox talks.</p> <p>Tools to be cleaned free of soil and plant material prior to bring tools to site or moving between works areas.</p> <p>Vehicle/machine hygiene inspections are to be undertaken prior to works starting using the checklist in Appendix 1 to determine if vehicles are free from soil and plant material.</p> <p>Vehicles/machines must pass the hygiene inspection prior to works commencing, Additional cleaning may be required to achieve this.</p> <p>Vehicles to be parked in designated roadsides and parking spaces only.</p> <p>Completed hygiene inspection forms are to be kept within the relevant vehicle/machine during the works and provided to the relevant land access officers at completion of the works.</p> <p>Toolbox talks are to include information on potential presence of weed and methods to reduce spread</p>	Prevent import of new biosecurity items to the Airport site.
During construction	<p>Presence of biosecurity matters to be discussed during toolbox talks.</p> <p>Hygiene procedures above to be maintained.</p> <p>Avoidance or limiting vehicle / foot traffic through areas identified as having biosecurity matters present, if feasible.</p> <p>Limit access between and across vegetated areas to formed roads wherever practicable.</p> <p>Minimise entry and exit points from sites determined as supporting biosecurity matters.</p> <p>If vehicles/machines have left formed roads, or have become soiled due to wet conditions, since the last vehicle hygiene inspection, a vehicle hygiene inspection must be conducted and passed prior to accessing any additional properties.</p> <p>Vehicle/machine wash down, and completion of hygiene inspection must be undertaken prior to accessing a new vegetation clearing site.</p> <p>Regular visual checks of PPE and vehicle tyres for plant parts and seed.</p> <p>All plant material and soil removed is to be bagged and disposed of in landfill or at a registered green-waste facility.</p> <p>Tools to be cleaned free of soil and plant material upon completion of works at each property</p>	Prevent import of new biosecurity items to the Airport site.
Post-construction	<p>PPE and clothing/waders to be brushed down, plant fragments and seeds removed, soils scrubbed from footwear, inside of vehicles cleaned. Bag detritus and seal bag before depositing at a local waste cell or waste cell collection point.</p>	Prevent import of new biosecurity items to the Airport Site.

C5. Weed Management

Weeds have been recorded throughout the biodiversity assessment undertaken for the Stage 1 Development (GHD 2016). Specific locations of weeds have not been mapped to date, however mapping of occurrences is to be undertaken prior to construction and detailed on inspection form and provided to the Project Environment Manager.

C5.1 General approach

Priority weeds (as listed under the Biosecurity Act) will be treated to satisfy the requirements of the general biosecurity duty whereby the potential spread of exotic species present within the Airport site will be prevented, and the presence of weeds in the construction footprint and adjoining areas will be reduced. Weed occurrence and extent will be mapped during pre-clearance surveys and regular inspections, with infestations to be treated on an ongoing basis.

General weed management measures to be undertaken include:

- Use a range of weed management methods such as clearing, slashing or mowing (physical and mechanical control) as well as a range of herbicides (to avoid herbicide resistance).
- Mow/slash areas infested with weeds before they seed (avoiding native vegetation).
- Employ biosecurity hygiene protocols.
- Securely cover loads of weed-contaminated material.
- Dispose of weed contaminated soil at an appropriate waste management facility.
- Remove weeds immediately and dispose of without stockpiling.
- Separate weeds from native vegetation to be mulched, do not use weed material for mulch.
- Minimise soil disturbance in weed infested areas.

Application of herbicide during weed control works will depend on species targeted and the growing situation. For example, the selection of a herbicide and the application method for a particular species or class of plant will be determined by factors such as the degree of infestation of target species, limiting damage to off target native flora and preventing herbicides entering waterways. The *Noxious and Environmental Weed Control Handbook. A Guide to Weed Control in Non-crop, Aquatic and Bushland Situations, 5th Edition* (DPI 2011) should be referred to as guide for specific herbicides, record keeping and herbicide application techniques.

Use of herbicides must be according to the NSW *Pesticides Act 1999*, Material Safety Data Sheets and labelling instructions for specific trade name herbicides and off label use permits registered with the Australian Pesticides and Veterinary Medicines Association. Any contractors using herbicides on the site must be trained and appropriately qualified to do so (ChemCert Level 2 or equivalent for subordinates and ChemCert Level 3 or equivalent for supervisors). Due to the highly sensitive nature of the retained native vegetation (i.e. TECs and threatened species habitats) all weed control works are to be carried out by a qualified and experienced bush regeneration contractor.

All herbicide use must also be undertaken in accordance with the on-label requirements and site procedures for the application and storage of chemicals.

Pre-clearance weed control is required for weeds that pose a biosecurity risk to local land use and biodiversity values.

Prior to vegetation removal a pre-clearance inspection report is required to outline the recommended treatment methods for weeds present within the project site. Weed species and the required pre-clearance actions are outlined in VMP.

C5.2 Aquatic habitats

A severe infestation of Alligator Weed was identified within the dammed section of Oaky Creek during EIS investigations undertaken by GHD. Alligator Weed is identified as a WoNS and is a Priority Weed under the Biosecurity Act. The biosecurity duty as specified under the Biosecurity Act requires land managers to ensure that the risk associated with the species is prevented, eliminated or minimised as far as reasonably practical. Therefore, the management procedures prescribed herein, when implemented, will ensure compliance with this duty.

The following steps outlined in Table 31 are to be undertaken to ensure that Alligator Weed does not pose a biosecurity risk to the Stage 1 Development and surrounding lands.

Table 31: Alligator Weed management

Step	Management measure
Step 1	Dewater dam on Oaky Creek by pump fitted with an inline filter, with the water to be distributed overland (preferably a section proposed to be capped) with a silt fence installed downslope to catch any unfiltered propagules.
Step 2	Monitor site to identify growth/germination of propagules, with attention to the land that the water was discharged over. If any plants are identified, the soil is to be scraped back into the dam on Oaky Creek.
Step 3	The entire bed, bank and wall of the dam on Oaky Creek is to be excavated until biological matter is no longer present within the soil strata.
Step 4	Excavated material is to be buried at depth of approximately two metres and clay capped.
Step 5	All machinery, nets, holding tanks and footwear is to be washed down within the silt fenced area prior to leaving site.
Step 6	Site is to be monitored monthly with any emergent plants to be treated using Metsulfuron-methyl 600 g/kg-based product at a dilution rate of 10 g per 100 L water.

5.3 Weed Management Action

Table 32 outlines the recommended treatment methods for the Biosecurity Act priority weeds known to occur on site. Treatment priorities and performance criteria provided are based on WSA general biosecurity duty to prevent, eliminate or minimise the occurrence of priority weeds within the construction footprint. Table 33 provides treatment recommendations for each of the weed types known to occur within the construction footprint.

Table 32: Priority weed requirements under the Biosecurity Act

Scientific name	Common name	Biosecurity Act requirement
<i>Alternanthera philoxeroides</i>	Alligator Weed	Within the Biosecurity Zone this weed must be eradicated where practicable, or as much of the weed destroyed as practicable, and any remaining weed suppressed.
<i>Anredera cordifolia</i>	Madeira vine	Prevent spread of species – Treat occurrences where they occur within the Airport.

Scientific name	Common name	Biosecurity Act requirement
<i>Asparagus asparagoides</i>	Bridal Creeper	Prevent spread of species – Treat occurrences where they occur within the Airport.
<i>Bryophyllum sp.</i>	Mother-of-millions	Prevent spread of species – Treat occurrences where they occur within the Airport.
<i>Cestrum parqui</i>	Green Cestrum	Regional Recommended Measure Land managers should mitigate the risk of new weeds being introduced to their land. Land managers should mitigate spread from their land. The plant should not be bought, sold, grown, carried or released into the environment.
<i>Cortaderia selloana</i>	Pampas grass	Prevent spread of species – Treat occurrences where they occur within the Airport.
<i>Lantana camara</i>	Lantana	Prevent spread of species – Treat occurrences where they occur within the Airport.
<i>Ligustrum lucidum</i>	Broad-leaved Privet	Prevent spread of species – Treat occurrences where they occur within the Airport.
<i>Ligustrum sinense</i>	Small-leaved Privet	Prevent spread of species – Treat occurrences where they occur within the Airport.
<i>Lycium ferocissimum</i>	African Boxthorn	Prevent spread of species – Treat occurrences where they occur within the Airport.
<i>Olea europa</i> subsp. <i>cuspidata</i>	African Olive	Regional Recommended Measure An exclusion zone is established for all lands in Blue Mountains City Council and Central Coast local government areas. The remainder of the region is classified as the core infestation area. Whole region: The plant or parts of the plant are not traded, carried, grown or released into the environment. Exclusion zone: The plant is eradicated from the land and the land kept free of the plant. Core infestation area: Land managers prevent spread from their land where feasible.
<i>Opuntia stricta</i>	Common Prickly pear	Prevent spread of species – Treat occurrences where they occur within the Airport.
<i>Ricinus communis</i>	Castor Oil Plant	Prevent spread of species – Treat occurrences where they occur within the Airport.
<i>Rubus fruticosus</i> species aggregate	Blackberry	Prevent spread of species – Treat occurrences where they occur within the Airport.
<i>Salvinia molesta</i>	Salvinia	Regional Recommended Measure Exclusion zone: whole region except for the core infestation area of the Georges and Hawkesbury-Nepean Rivers and their tributaries. Whole region: Land managers mitigate the risk of the plant being introduced to their land. Exclusion zone: The plant is eradicated, and the land kept free of the plant. The Local Control Authority should be notified if the plant is found. Core infestation area: Land managers should prevent spread from their land where feasible.
<i>Senecio madagascariensis</i>	Fireweed	Prevent spread of species – Treat occurrences where they occur within the Airport.

Where “pre-treatments’ have been recommended following pre-clearance inspections, or weed treatments are required following ongoing monitoring inspections, weed types listed below are to be treated as detailed in Table 33. Pre-clearance inspection reports will also outline recommended treatment methods for weeds recorded on site, not listed in this Plan.

Table 33: Weed treatment recommendations

Scientific name	Common name
Woody weeds	Spot spray application of Glyphosate 360 g/L Roundup® at a rate of 1-part glyphosate to 50 parts water. Completely wet all leaves and stems. Best done during times of active growth i.e. Spring/summer. Stem injection for basal diameter up to 25 cm of Glyphosate 360 g/L Roundup® at a rate of 1-part glyphosate to 1 part water, 2 mL per cut or for basal diameter 25 cm to 60 cm undiluted, 2 mL per cut. Best done during times of active growth i.e. Spring/summer.
Perennials/ Scrambling weeds	Spot spray application of Glyphosate 360 g/L Roundup® at a rate of 1-part glyphosate to 50 parts water. Completely wet all leaves and stems. Best done during times of active growth i.e. Spring/summer.
Annual and grass weeds	Slashing for large areas of infestation.
Vines	Spot spray application Glyphosate 360 g/L Roundup® at a rate of 1-part glyphosate to 50 parts water. Best done during times of active growth i.e. Spring/summer.

C6. Pathogen management

General information on known pathogens to occur in the vicinity of the construction footprint were identified within the EIS biodiversity investigations (GHD 2016), however no testing for the occurrence of pathogens was undertaken or the identification of high pathogen risk areas. The aim of developing pathogen management protocols is to create a dynamic process that identifies the extent of pathogens within the subject site and prevents their spread outside of known infestation areas.

C6.1 General approach

The approach to managing pathogens within the CIZ to assume occurrence within suitable environments to support these pathogens. Pre-clearance assessments will then assess each of these areas following a set of criteria to determine the likely presence of pathogens within these environments. Testing will then be undertaken of these areas to resolve the occurrence of pathogens within the construction footprint and facilitate the development of mapping and establishment of exclusion zones.

C6.2 Pathogen Risk Zones and Priority Weeds

Pathogen risk zones were developed as means of identifying areas within the potential impact area that have a high, medium or low risk of spreading or disturbing pathogens. Through the development of these risk zones, management measures can be implemented which would be commensurate with the level of risk identified within an area.

Determination of risk zones for each of the pathogens identified in the EIS was undertaken by assessing vegetation for signs of infection or, in the case of Chytrid, identifying areas that within the potential impact area where a precautionary approach can be practically applied. The following criteria were applied when determining the Pathogen risk zones:

- **High** – Myrtle rust identified on host plants OR, extensive evidence of tree dieback potentially attributed to Phytophthora.
- **Medium** – Small instances of tree dieback (more than 3 trees in close proximity) potentially affected by Phytophthora OR, small drainage lines within potential impact area containing suitable frog (vector) habitat.

- **Low** – No tree dieback evident, AND no evidence of myrtle rust on host plants AND low potential for surface water to persist and maintain frog (vector) habitat.

It is important to note that there are in excess of 50 native species of *Phytophthora* in Australia, and while the occurrence of these species may be identified during the testing phase, no management measures will be proposed other than for *Phytophthora cinnamomi*.

C7. Management measures

C7.1 Pathogens

Management measures for pathogens can be split into three broad categories as follows:

- Planning or awareness measures
- Exclusion measures; and
- Containment measures

Pathogen management measures (See Table 30) have been developed in accordance with the Roads and Maritime Services *Biodiversity Guidelines – Guide 7* (RTA, 2011), and incorporate best practice measures for reducing the transport of potentially harmful pathogens throughout the construction footprint and associated surrounding landscape.

C7.2 Priority weeds

Use of herbicides must be according to the *Pesticides Act 1999* (NSW), Material Safety Data Sheets and labelling instructions for specific trade name herbicides and off label use permits registered with the Australian Pesticides and Veterinary Medicines Authority (APVMA). The use of herbicide as part of this plan will be limited to direct application to cut stumps and spot spraying. High pressure spraying may be permissible in areas located 50 metres away from waterways during favourable weather conditions (i.e. low/no wind/rain). Any contractors using herbicides on the site must be trained and appropriately qualified to do so (NSW ChemCert Level 2 or equivalent for subordinates and ChemCert Level 3 or equivalent for supervisors).

Manual and chemical options for weed control have been taken from the noxious and environmental weed control handbook *A guide to weed control in non-crop, aquatic and bushland situations, 6th edition* (DPI 2014).

The primary means of weed control during construction works (covered in the Biodiversity CEMP) will be to mechanically remove weeds with appropriate plant and machinery at the initial stages of construction, due to ease and speed of removal. The preference for the use of mechanical control measures will also reduce the development of herbicide resistances in the identified weed species. Control methods include hand removal, herbicide application, and mechanical removal. Weeds requiring hand or mechanical removal, including contaminated topsoil, would require disposal by encapsulation (deep burying) or to an approved waste management facility.

C8. Monitoring

Monitoring of the noxious weed and pathogen management measures are to be evaluated against performance targets, required to ensure the measures outlined in this plan are implemented and that performance criteria are satisfied as far as possible. The monitoring program will commence prior to weed control works and continue for the operation period i.e. pre, during and post construction. The monitoring program can draw upon the information contained in this plan and will involve reporting to assess and document outcomes, including:

- The implementation of weed and pathogen management measures.
- General condition of the Airport site including identification of additional priority weeds or reduction in the occurrence of priority weeds.
- Recommendations to undertake additional measures should these be identified as required during site inspections.

- Recommendations for corrective measures and/or revised vegetation management techniques as a result of site response to the works specified herein or other factors such as climatic conditions.

An adaptive management approach is to be employed in respect of the works forming part of this noxious weed and pathogen management plan. An adaptive management approach involves an integrated process of monitoring, reviewing and then responding to the health and condition of the measures as well as the status of the noxious weed species to identify any alterations to the design and maintenance of works that may be required to ensure the objectives of the noxious weed and pathogen plan are achieved.

Appendix D

Threatened Flora Salvage and Translocation Plan

Western Sydney Airport

Threatened Flora Salvage and Translocation Plan

Final Rev 0



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1. Introduction

1.1 Background

Western Sydney Airport (WSA) is seeking to further develop their biodiversity strategy for the Western Sydney International (Nancy Bird-Walton) Airport (WSI) through the preparation of a Threatened Flora Salvage and Translocation Plan (the Plan). The Plan responds to part of WSA's requirements set out in the Airport Plan and Environmental Impact Statement (EIS) (DIRD 2016b), and forms a sub-plan of the WSA Biodiversity Construction Environmental Management Plan (Biodiversity CEMP).

This Plan assesses the viability and provides specifications for the salvage and translocation of known local populations of four threatened flora species - *Pimelea spicata* (Spiked Rice-flower), *Marsdenia viridiflora* subsp. *viridiflora* (Native Pear), *Pultenaea parviflora* (Sydney Bush-pea) and *Dillwynia tenuifolia* - and any additional threatened flora detected, that will be directly impacted by development of Stage 1 of the WSI. The Plan has been prepared in consultation with relevant agencies and the Australian Botanic Gardens Mount Annan (ABGMA), and with consideration of the latest edition of the *Guidelines for the Translocation of Threatened Plants* (Vallee *et al* 2018).

The threatened flora salvage and translocation assessed and specified under this Plan is a biodiversity impact mitigation measure required under the Airport Plan and EIS that is additional to and independent of the delivery of biodiversity offsets for significant residual impacts of the Stage 1 development of WSI upon biodiversity. Biodiversity offsets are to be delivered in accordance with a Biodiversity Offset Delivery Plan (BODP) (GHD 2018), the Airport Plan conditions and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act) *Environmental Offsets Policy* (2012), and are the responsibility of the Commonwealth Department of Infrastructure, Transport, Regional Development and Cities.

1.2 Site description

The airport site covers an area of approximately 1,780 hectares of Commonwealth land located at Badgerys Creek, Western Sydney (see Figure 1). The airport site adjoins the Liverpool local government area, around 50 kilometres west of Sydney's Central Business District and 15 to 20 km from the major population centres of Liverpool, Fairfield, Campbelltown and Penrith. The airport site is located in undulating topography that has been extensively cleared with the exception of stands of remnant vegetation located predominately along Badgerys Creek and the south-western portion of the site.

Elizabeth Drive borders the airport site's northern boundary. Badgerys Creek forms the south-eastern boundary of the site, flowing in a north-easterly direction. The western and north-western boundary of the site runs through peri-urban agricultural lands south of the township of Luddenham. The westernmost extremity of the airport site is separated from the remaining airport lands to its east by Willowdene Avenue. Badgerys Creek Road and The Northern Road transect the eastern and western end of the airport respectively. The portion of The Northern Road that transects the site is to be decommissioned following completion of The Northern Road upgrade (see below). The Northern Road upgrade runs to the east of Willowdene Ave and will annex this small western land area from the remaining airport site.

1.3 Project context

1.3.1 Airport Plan, Environmental Impact Statement and Biodiversity Construction Environmental Management Plan

Development of WSI will be undertaken in accordance with the Airport Plan, which sets out the long-term vision for the development of the airport site over a number of stages and authorises the Stage 1 development. Development of Stage 1 of WSI comprises an approximately 1,150 hectare construction impact zone (CIZ) within the airport site. The Airport Plan provides for a Land Use Plan that includes an Environmental Conservation Zone (ECZ) (see Figure 1).

The Airport Plan contains a number of biodiversity conditions which require mitigation and management measures to be implemented to reduce the potential impacts on biodiversity values. The Airport Plan biodiversity conditions reflect the Environmental Management Framework contained within Chapter 28 of the Environmental Impact Statement (EIS) for WSI.

The biodiversity conditions require the preparation of a Biodiversity Construction Environmental Management Plan (CEMP), which is to include the preparation of a Threatened Flora Translocation Plan (this Plan) to specify measures for the salvage and translocation of threatened flora species from the Stage 1 CIZ. In addition, the biodiversity conditions require that the Biodiversity CEMP must contain measures to protect and manage the areas in the ECZ. The biodiversity conditions relevant to this Plan are provided in Table 1.

Table 1 Airport Plan biodiversity conditions relevant to the Plan

Source	Topic	Biodiversity Management / Mitigation Measures
Airport Plan (DIRD 2016a) (Section 3.10.2 Construction conditions, pp 100-101)	7. Biodiversity Management	(3) The criteria for approval of the Biodiversity CEMP are that an Approver is satisfied that: (a) in preparing the Biodiversity CEMP, the site Occupier has taken into account Table 28-4 in Chapter 28 of the EIS; and (b) the Biodiversity CEMP complies with Table 28-5 in Chapter 28 of the EIS, and is otherwise appropriate.
Airport Plan (DIRD 2016a) (Section 3.10.2 Construction conditions, p 101)	7. Biodiversity Management	(5) The Biodiversity CEMP must contain measures to protect and manage the areas in the environmental conservation zone shown in the Land Use Plan (EC1) along the Badgerys Creek riparian corridor including to: (a) replace exotic grasslands with suitable native vegetation; (b) rehabilitate existing remnant and native vegetation; and (c) provide ongoing protection of the biodiversity and environmental values.
EIS Table 28-4 (DIRD 2016b)	Implementation framework	The Biodiversity CEMP will be approved prior to Main Construction Works. The CEMP will collate measures to mitigate and minimise potential

Source	Topic	Biodiversity Management / Mitigation Measures
(Chapter 28 – Environmental Management Framework)		<p>impacts to biodiversity, including cross-reference to other environmental management plans where they are relevant.</p> <p>The Biodiversity CEMP will as a minimum:</p> <ul style="list-style-type: none"> • detail the management and mitigation measures to be implemented, including the measures and sub-plans, protocols and surveys in Table 28-5.
<p>EIS Table 28-5 (DIRD 2016b)</p> <p>(Chapter 28 – Environmental Management Framework)</p>	<p>Threatened flora translocation plan</p>	<p>A threatened flora salvage and translocation plan will be developed as part of the Biodiversity CEMP, in consultation with relevant agencies and the Australian Botanic Gardens Mount Annan and with consideration of the <i>Guidelines for the Translocation of Threatened Plants</i> (Vallee <i>et al</i> 2014).</p> <p>The threatened flora translocation plan will specify measures for the salvage and translocation of threatened flora species. In particular, it will include:</p> <ul style="list-style-type: none"> • the salvage and propagation or transplanting of the known local populations of <i>Pultenaea parviflora</i> and <i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> and any other threatened flora detected at the airport site; and • consideration of the suitability of sites within the Environmental Conservation Zone in order to maintain populations of these species as close to their original location as possible.
<p>EIS Table 28-5 (DIRD 2016b)</p> <p>(Chapter 28 – Environmental Management Framework)</p>	<p>Management of vegetation areas outside the construction impact zone</p>	<p>A vegetation management plan will be developed as part of the Biodiversity CEMP to guide the activities for managing areas of endemic vegetation outside the Stage 1 construction impact zone. The plan will identify how environmental protection objectives for the Environmental Conservation Zone shown in the Land Use Plan in the Airport Plan will be met.</p> <p>The plan will detail specific measures to:</p> <ul style="list-style-type: none"> • avoid unnecessary disturbance in nearby areas of retained vegetation outside of the construction impact zone such as avoiding unnecessary light spill; • replace exotic grasslands with suitable native vegetation in the Environmental Conservation Zones;

Source	Topic	Biodiversity Management / Mitigation Measures
		<ul style="list-style-type: none"> rehabilitate existing remnant and native vegetation within the Environmental Conservation Zones; and protect environmental values within the Environmental Conservation Zone.

Since publication of the EIS and the approved Airport Plan, the Australian Network for Plant Conservation have released a third edition of their threatened plant translocation guidelines – *Guidelines for the translocation of threatened plants in Australia* (Commander *et al* 2018). This Plan will refer to this current guideline edition. Similarly, since the publication of the approved Airport Plan and EIS, large populations of two additional threatened species – *Pimelea spicata* and *Dillwynia parviflora* - were recorded at the airport site. The Airport Plan biodiversity conditions provide for the inclusion in the threatened flora translocation plan of threatened species additional to those specifically identified (see Table 1). As such, the subject species of this Plan include known populations of *Pultenaea parviflora*, *Marsdenia viridiflora* subsp. *viridiflora*, *Pimelea spicata* and *Dillwynia parviflora* located within the Stage 1 CIZ at the airport site. Details of the ecology and location of each of these subject species at the airport site is provided in Section 3.

1.3.2 The Northern Road upgrade

Roads and Maritime Services (Roads and Maritime) propose to upgrade 16 km of The Northern Road between Mersey Road, Bringelly and Glenmore Parkway, Glenmore Park. The upgrade will include realignment of the stretch of The Northern Road that presently crosses the airport site, to the airport site's western margin, east of Willowdene Avenue.

Commencement of bulk earthworks excavations within the airport site west of the existing The Northern Road alignment will not commence until The Northern Road realignment has been completed, allowing closure and decommissioning of the existing alignment. At the time of writing, The Northern Road realignment was scheduled to open in April 2020.

1.3.3 Australian Botanic Gardens Mount Annan and expert consultation

As part of the work required to meet the Airport Plan biodiversity conditions, the Australian Botanic Gardens Mount Annan (ABGMA) was engaged to deliver a Threatened Flora Propagation Program (TFPP), targeting threatened flora within the Airport Stage 1 CIZ. As a result of the implementation of Stage 1 of the TFPP, ABGMA currently hold the following stock derived from plant populations at WSI:

- Pimelea spicata* (173 plants in 140 mm or larger pots).
- Marsdenia viridiflora* subsp. *viridiflora* (560 plants in 140 mm or larger pots).
- Pultenaea parviflora* (500 plants in 140 mm or larger pots).

Stage 2 of the TFPP is also in progress, comprising a regional-scale genetic research project on *Pimelea spicata* and maintenance of an *ex situ Pimelea spicata* potted collection of about 100 plants comprising 30 genets (genetically distinct individuals) (additional to that listed above). Selection of individual genets that will form the Stage 2 *ex situ* potted collection will be informed by the genetic research project such that genetic fitness of the potted collection is

maximised. The *ex situ Pimelea spicata* potted collection will be maintained for a period of five years.

Following their previous involvement with the study and conservation of threatened plant populations at WSI under the BODP, ABGMA were engaged as a specialist sub-consultant to directly capture their inputs to the Plan. A meeting was held with ABGMA on 23 August 2019 at the ABGMA PlantBank facility, with representatives from WSA and GHD in attendance. Additional consultation with ABGMA was conducted at the WSI site on 4 September 2019 to inspect and assess potential receiver sites for the translocation.

Specifically, ABGMA were consulted regarding:

- Potential translocation methods and approaches.
- Optimal approaches to translocation of the target threatened species populations.
- Viable plant salvage methods.
- Receiver site preparation requirements and consideration.
- Receiver site criteria and selection.

In addition to consultation with ABGMA, relevant managers of the NSW Department of Planning, Industry and Environment Saving Our Species program were contacted to request information relevant to the Plan. No information additional to that already provided by ABGMA was made available.

1.4 Plan scope

In accordance with the Airport Plan biodiversity conditions, agreed services contract and clarifications provided at the project consultation and mid-project meetings, the scope of this Threatened Flora Salvage and Translocation Plan comprises:

- Desktop assessment of the ecology of the subject species.
- Consultation with ABGMA and other relevant agencies and contacts to confirm preferred approaches to translocation for each of the subject species.
- Preparation of the Plan, with reference to Commander *et al* 2018, including but not limited to definition of:
 - The ecology of the subject species.
 - Viability and potential methods for the translocation of subject species.
 - Criteria and assessment of suitable receiver sites within the airport ECZ.
 - Program targets, schedule, roles, responsibilities and contingencies.
 - Salvage and translocation specifications.
 - Framework and specifications for the monitoring of translocated populations.

1.5 Plan goal and objectives

The goal of this Threatened Flora Salvage and Translocation Plan is to:

- Establish viable (self-sustaining) populations of each of the subject flora species, which reproduce through continuous generations without intervention, at a secure site that is managed for conservation.

The target population sizes required to establish 'viable' populations of a species vary widely among species, sites, populations/subpopulations, and with threats and environments (Commander *et al* 2018). Where available, genetic analysis has been used to direct the formulation of target population sizes of the subject species (see Section 4.2). In the absence

of applicable genetic analysis, target populations have been defined in accordance with best-practice 'rules-of-thumb' regarding likely minimum viable population sizes.

Whilst impacts upon the subject species are being directly or indirectly offset under the BODP, given the overall magnitude of the proposal's impact upon biodiversity, and that little opportunity was provided to avoid significant biodiversity impacts, translocation of the threatened flora populations was determined as a reasonable mitigation measure to help conserve and reduce the extinction risk of these species.

The following objectives are to be met to achieve the Plan goal for each of the target threatened flora species, as recorded by scheduled monitoring for up to five years following translocation (see Section 7.5):

- Survival of target minimum population sizes for each species.
- Vegetative growth of translocated species populations.
- Presence of reproductive structures (flowers and fruit) and seed on individuals of translocated species populations.
- Second generation (seedling or vegetative) recruitment.
- Resilience to future disturbance events, including grazing and fire.

1.6 Assumptions

- The primary approach to translocation specified in this Plan is to be limited to:
 - salvage and transplantation of a defined number of individuals from the impacted subject species populations (see section 4.1).
 - excavation and translocation of potential soil seed banks from the impacted subject species populations.
- It is assumed that the physical salvage and transplantation of the population of *Pimelea spicata* at the airport site is to be completed by a translocation deadline to be determined by the bulk earthworks contractor which will be prior to bulk earthworks occurring in the relevant area.
- The threatened flora salvage targets, program and specifications in this Plan assume that planting of existing *ex situ* potted collections of the subject species held by ABGMA will contribute the translocation targets set under this Plan.
- Any approaches to threatened flora translocation additional to the specified primary approaches (e.g. propagation and planting of additional nursery grown *ex situ* populations) would be specified in a future vegetation management plan(s) relating to management of the ECZ at WSI.
- It is assumed that the proposed transplantation of *P. spicata* into Good condition Grey Box – Forest Red Gum grassy woodland within the WSI ECZ falls under the scope of the Airport Plan to rehabilitate existing remnant and native vegetation within the ECZ.
- The proposed transplantation of *P. spicata* into Good condition Grey Box – Forest Red Gum grassy woodland threatened ecological community (TEC) within the WSI ECZ does not require a 'Listed species and ecological community' permit, nor additional assessment or approval under the provisions of the EPBC Act. The proposed transplantation will not adversely affect the TEC and aims to establish a viable population of threatened flora species that will have a positive impact on the biodiversity values of the community.

- The translocation of threatened flora species under this Plan will be included in compliance reporting pursuant to the conditions of the *Environment Protection and Biodiversity Conservation Act 1999* Part 13 Permit for Stage 1 of the WSI.

Figure 1 Site location

2. Threatened plant translocation

2.1 Flora translocation

Flora translocation is the intentional relocation of plants or their regenerative material from their natural habitat or an *ex situ* collection population, to a new location usually in the wild (Commander *et al* 2018). Plant translocation can include introduction, reintroduction, reinforcement and assisted mitigation. A summary of the nature of these translocation actions is provided in Table 2.

Table 2 Flora translocation actions definitions and project applications (Commander *et al* 2018)

Translocation Action	Definition	Application
Reinforcement	Also known as enhancement, re-stocking, enrichment, supplementation or augmentation. Adding individuals of a species into an existing population with the aim of increasing population size, enhancing population viability and genetic diversity.	This action could be used as part of the process of restoration or reconstruction of a site where the species is already present but requires population manipulation to ensure the maintenance of a viable population.
Introduction	This action is an attempt to establish a population in a site where it has not previously occurred.	The recipient site is within the known range of the species and provides similar habitat to known occurrences.
Reintroduction	Also known as re-establishment, this action is an attempt to establish a population in a site or habitat type where the species is locally extinct.	This action could be used as a process of restoration of a habitat where the species was previously known to be present
Assisted migration	Also known as assisted colonization. This action is an attempt to establish a species, for the purpose of conservation, outside its indigenous range in what is considered to provide appropriate habitat for the species based on climate change or habitat change predictions.	Such translocations are potentially high-risk projects with success often difficult to predict, and should only be carried out after an extensive risk assessment has been conducted.

The translocation actions described in Table 2 could be achieved via a number of methods, including transplantation of whole plants from one site to another; the transfer of soil, leaf litter or brush, direct seeding and planting of containerised plants propagated from seed or via cuttings or tissue culture. Translocation may also involve the movement of soil to include associated organisms such as mycorrhizae, essential to the growth and establishment of the species or translocation of associated fauna, including pollinators (Commander *et al* 2018).

2.2 Translocation principles and best-practice

Translocation of threatened plant species is generally implemented for two principal reasons: to assist in the management and conservation of threatened plant species (conservation translocation), and; to ameliorate the impacts of development on a threatened species (mitigation translocation). Conservation and mitigation translocations may use similar techniques with regards to donor material and recipient site selection. The primary difference between the two translocation types is that mitigation translocations are undertaken when the

source population is under immediate risk of destruction if it is not relocated. Mitigation translocation is generally undertaken to mitigate unavoidable residual impacts of a development proposal, should aim to provide a no-net-loss outcome for biodiversity and would be expected to play an important role in the conservation of the subject species (Commander *et al* 2018).

Regardless of the reasons for a translocation program or the type of translocation being implemented, the objective of all plant translocations should be to directly support the conservation of the subject species, and to establish or maintain one or more self-sustaining populations capable of surviving over the long-term (Commander *et al* 2018).

2.2.1 Sources of plants for translocation

Plant translocations can also be classified by the approach to sourcing donor plant material (Commander *et al* 2018). Typical approaches to flora translocation include:

- Translocation of nursery grown plants - the planting of an *ex situ* population propagated from seedlings or cuttings.
- Propagule dispersal - direct sowing of collected seeds or other diaspores.
- Whole plant translocation - the transplantation of mature plants or seedlings, generally from an area due to be affected by development, to an unaffected area. Also referred to as mitigation translocation, salvage, or rescue.
- Soil seed bank translocation - the movement of the soil stored seed bank from one place to another.

Potential source material for plant translocations includes seeds, cuttings, whole plants and the soil seed bank. The availability and optimum time of the year for seed and vegetative material collection should be considered when developing translocation strategies and project milestones. Before collecting plant material the following points should be addressed (Commander *et al* 2018):

- Source site must be identified and a sampling strategy designed.
- Determine the plant material to be collected (seeds, vegetative material).
- Collection of a voucher specimen for verification of the species identity by the National Herbarium of New South Wales.

In general, curation of an *ex situ* nursery plant collection is the most preferable approach to plant translocation. Due to its relative cost-effectiveness it allows for the establishment of a relatively high number of plant genets (c.f. translocation), while also affording the highest degree of control available over the vagaries of plant germination, establishment and survival, and climate.

Salvage and transplantation form the primary approach to translocation specified in this Plan. Excavation and translocation of potential soil seed banks from the impacted subject species populations will also be proposed as a supplementary translocation measure. Any additional approaches to threatened flora translocation (e.g. planting of nursery grown *ex situ* populations) would be specified in a future management plan(s) relating to management of the ECZ at WSI.

A summary of translocation methods not involving propagation of the subject populations and their potential applications is provided in Table 3.

Table 3 Non-propagation approaches to flora translocation
(Commander *et al* 2018).

Translocation method	Description	Application
Salvage and transplant of naturally occurring populations of mature plants or seedlings.	<p>Physical removal of entire subject plants and surrounding soil matrix via manual (e.g. shovels) or mechanical (e.g. tree-spade) means.</p> <p>Salvage and transplantation of more juvenile individuals is likely to be more successful than with mature plants.</p>	<p>Salvage of mature plants should only ever be considered as a last resort in situations where the donor site is to be destroyed imminently and/or there is considerable evidence that it is the most appropriate technique.</p> <p>Care needs to be taken to ensure that pests and diseases are not transferred with the plants or associated soil.</p> <p>Whole turves of soil and plants may be transplanted.</p>
Soil translocation.	<p>The ecological strategy of many flora species includes the formation of a bank of seed in local topsoils (top ~100 mm). This soil seed bank can form an important source of genetic material and diversity for many plant species. Depending on the species and presence of favourable climatic conditions, seed stored within the soil seed bank may germinate sporadically over time with the natural deterioration of seed coats and/or in response to specific germination cues (e.g. soil disturbance, fire-related cues, seasonal temperature fluctuations etc).</p> <p>As a result of this ecological plant strategy, soil seed banks can be a valuable genetic and ecological resource from which a portion of a plant community may be relocated. Soil relocations also provide a potential benefit of coincident translocation of soil microbial communities which can play an important role in the life-cycle and persistence of many plant species.</p>	<p>Similar to salvage and transplantation, soil translocation should only be considered as a last resort in situations where the donor site is to be destroyed imminently.</p> <p>Soil translocation is also generally only recommended when the donor and recipient sites are in relatively close proximity.</p> <p>Particularly in cases where donor and recipient sites are relatively far apart, soil testing should be considered to ensure that it is free of diseases that may be inadvertently translocated in association with translocated soils.</p>
Direct seeding at the recipient site	<p>Direct seeding involves sowing plant seed either by hand or using machinery. Direct seeding requires considerably more seeds</p>	<p>Direct seeding is an alternative revegetation to the installation of nursery-grown tubestock, that can be more cost-effective when</p>

Translocation method	Description	Application
	than growing tubestock from seeds because conditions in the laboratory and nursery can be controlled to maximise germination. The conditions under which a species recruits in nature should be considered when direct seeding, as these conditions will provide information to develop pre-treatments to overcome dormancy and promote germination.	high-density revegetation of large areas is required. Another less common role of direct seeding is to create or re-create a persistent soil seed bank in any new translocation. In such cases, the role of the seeding is not to have immediate germination and growth, but to buffer above-ground plant populations to future disturbances (e.g. fire, grazing).

2.2.2 Translocation targets

Having clear short- and long-term goals and objectives is crucial to the effective and efficient planning, implementation and evaluation of any ecological restoration program. As the goal of conservation translocations is to establish a viable (self-sustaining) population, the initial number of individuals required to achieve this needs to be estimated (Commander *et al* 2018).

Wherever possible, incorporation of the conservation genomics of a species and/or population subject to translocation will provide the most objective and reliable estimate of minimum population sizes required to establish a viable translocated population (Commander *et al* 2018); Frankham, Bradsaw & Brook 2014). As described above (Section 1.3.3), a regional-scale genetic research project on *Pimelea spicata*, including analysis of the subject population at WSI, is currently in progress (RBGS 2019). The preliminary results of this analysis have been applied to translocation population targets for *P. spicata* in this Plan. In the absence of species / population-specific genetic analysis for the subject species under this Plan, target population sizes have been based upon recommendations provided by Commander *et al* (2018) (Section 4).

2.2.3 Plant translocation success

Relatively few documented translocation programs have resulted in self-sustaining populations. In a number of cases, it is too early to assess success due to the long-lived nature of the subject species. However, there are many documented examples where large investments of time and resources have been spent on unsuccessful translocations (Commander *et al* 2018).

Table 4 summarises factors associated with successful and unsuccessful translocations documented from a number of past translocations attempts (Commander *et al* 2018):

Table 4 Factors that resulted in successful and unsuccessful translocation of a plant population

Unsuccessful translocations	Successful translocations
<ul style="list-style-type: none"> High loss of plants within the first year of planting (hot dry summers, frost damage). Poor planting technique. Negative impacts of flood, fire, disease and herbivory (native and introduced) 	<ul style="list-style-type: none"> Adequate translocated population sizes. Preparation of a robust and comprehensive translocation plan. Commitment and collaboration of a range of expertise contributing to project success.

Unsuccessful translocations	Successful translocations
<p>domestic / feral species, both vertebrate and invertebrate).</p> <ul style="list-style-type: none"> • Inadequate established plant numbers (most of the documented translocation had less than 50 propagules). • Failure to adequately control or manage the existing threats affecting the species or habitat. • Poor receiver site selection (inappropriate habitat or threats present at receiver site). • Inadequate consideration or understanding of the biology and ecological requirements of the species, including mycorrhizal fungi, pollinators, seed/fruit dispersers, seed germination biology and associated plant and animal assemblages. • Inappropriate translocation methods, the use of whole plant translocation in the absence of supplementary plant propagation. • Poor <i>ex situ</i> potted plant quality (e.g. pot-bound, immature, overly mature). • Lack of appropriate disturbance regimes required for recruitment of translocated population. • Absence of ongoing commitment of resources to monitoring, evaluation and follow-up maintenance. 	<ul style="list-style-type: none"> • A robust and comprehensive approach to recipient site selection. • Removal and ongoing management of threatening processes. • Watering of plants during dry periods over the first two years following translocation. • Protection from grazing and trampling. • Financial commitment to ongoing maintenance, monitoring and evaluation.

Even when translocations are unsuccessful in terms of plant survival and recruitment, an experimental approach and commitment to monitoring could provide important information to inform future attempts. Most of the documented successful translocations were those that applied learning outcomes from previous unsuccessful attempts (Commander *et al* 2018).

For this reason, when deciding whether to translocate threatened plants it is important to investigate whether the species or a closely related species has been previously translocated and if so to evaluate the reasons for success or failure. This information could positively contribute to the translocation program by avoiding previous mistakes and incorporating success measures tested on previous projects. In some instances, the species of interest might be particularly difficult to translocate and repeat attempts may not be worthwhile (Commander *et al* 2018).

2.2.4 Recipient site selection

Table 5 summarises factors that should be considered when selecting a suitable translocation recipient site (Commander *et al* 2018).

Table 5 Factors to be considered for translocation recipient site selection

Selection Factor	Considerations (recipient site)
Suitable Habitat	<ul style="list-style-type: none"> • Existing habitat matches the donor location as closely as possible.

Selection Factor	Considerations (recipient site)
	<ul style="list-style-type: none"> • Microclimate is appropriate for the species. • Impact of future climate projections upon habitat. • Whether the habitat area is large enough to support a self-sustaining population. • Whether ecological requirements of the species are met. • Ecosystem function and resilience (site condition, pollinator services, mycorrhizal associations).
Land tenure	<ul style="list-style-type: none"> • Long-term security of the site.
Threat management	<ul style="list-style-type: none"> • Ongoing detrimental disturbance regimes and threat management.
Adversely affect any other species	<ul style="list-style-type: none"> • Negative impacts upon receiver ecosystem.

The success of a translocation proposal depends on the availability of suitable recipient sites. The type of translocation may also influence the choice of recipient site. For example, if the main problem for the species is low population abundance, then increasing plant numbers at the site via reinforcement will be the highest priority. Conversely, if narrow geographic range with limited populations is the primary extinction risk, then repopulating depleted known sites and establishing new sites within the known distribution range should be the priority, assuming suitable habitat is available. If no suitable habitat can be found within the species known range, translocation to other potential habitat may be a viable option. Adoption of these scenarios is also dependent on the number of individuals available for translocation and consideration of longer-term threatening processes (Commander *et al* 2018).

2.2.5 Translocation feasibility checklist

Table 6 provides a translocation feasibility checklist extracted from the *Guidelines for the Translocation of Threatened Plants in Australia* (Commander *et al* 2018) to assist in the determination of whether a translocation is achievable. If the answer to any of the checklist questions is no, then the benefits and risks of proceeding without that information should be assessed prior to making a decision to translocate (Commander *et al* 2018).

This checklist has been applied to each of the subject species under this Plan to assist in determining the feasibility of their translocation (see Section 4.3).

Table 6 Translocation feasibility checklist

Translocation feasibility checklist
Have other conservation measures been tried (e.g. reducing existing threats)?
Will extinction risk be reduced by the translocation or will it increase due to habitat loss?
Can the threats to the species be ameliorated to a degree that allows the species to persist at the translocation site?
Is the taxonomic status of the species well understood?
Is the distribution of the species adequately understood? Have adequate field surveys been undertaken to inform the conservation status of the species?
Has a clear purpose and plan for the translocation been identified?
Have suitable recipient sites been identified?

Translocation feasibility checklist

Is the tenure of recipient site secure and is it likely to continue to be secure in the future?

Are other species at the site likely to become threatened or adversely affected because of the translocation?

Can the species be successfully established at the site?

Can the threats be managed /ameliorated at the recipient site?

Are there any emerging threats/risks that need to be considered?

If considering population enhancement, is there evidence of population decline as opposed to simply natural fluctuations and has alternative means of increasing population size been considered or attempted?

Do necessary associated species (symbionts) i.e. pollinators occur at the site?

Is there sufficient germplasm to carry out a translocation?

Does the germplasm have sufficient genetic diversity for long term population persistence?

How will success of the translocation be measured and monitored?

How will assessing the translocation and its success be resourced?

Has the success of any previous translocation programs relevant to the species being considered been investigated?

3. Subject species

3.1 Donor sites

Populations of four threatened flora species - *Pimelea spicata*, *Marsdenia viridiflora* subsp. *viridiflora*, *Pultenaea parviflora* and *Dillwynia tenuifolia* - were recorded at the airport site during surveys undertaken for the biodiversity assessment of the WSI (GHD 2018). These four species form the subject of this Plan. Impacts of the Stage 1 CIZ upon the subject species is shown in Table 7. The locations of the subject species at the airport site, which form the donor sites for the proposed threatened flora translocation, are shown in Figure 2. Details of the subject species, their ecology and characteristics of their presence at the airport site are provided in Section 3.3.

Table 7 Direct impacts upon threatened plants within the Stage 1 CIZ

Scientific name	Common name	EPBC Act status	BC Act status	Quantum of impact in Stage 1 CIZ
<i>Dillwynia tenuifolia</i>	<i>Dillwynia tenuifolia</i>	-	Vulnerable	30 individuals
<i>Pultenaea parviflora</i>	Sydney Bush-pea	Vulnerable	Endangered	4 individuals
<i>Pimelea spicata</i>	Spiked Rice-flower	Endangered	Endangered	4,118 clumps
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	Native Pear	-	Endangered population	1145 stems

3.2 Existing environment

3.2.1 Topography and landscape

The Stage 1 CIZ is part of an elevated ridge system dividing the Nepean River and South Creek catchments on the Cumberland Plain. The site is characterised by rolling landscapes typical of the Bringelly Shale with a prominent ridge in the west of the site, reaching an elevation of about 120 metres AHD, and smaller ridgelines in the vicinity with elevations of about 100 metres AHD. The topography of the Stage 1 CIZ generally slopes away from the ridges towards the west, with elevations between 40 metres and 90 metres AHD.

The Stage 1 CIZ features remnant patches of grassy woodland and narrow corridors of riparian forest within extensive areas of derived grassland, cropland and cleared, developed land. The main land uses prior to the WSI were agriculture and low density rural residential development.

The Stage 1 CIZ is contained within the 'Cumberland Plain' Mitchell Landscape (DECC 2008a). This landscape comprises low rolling hills and valleys in a rain shadow area between the Blue Mountains and the coast, with vegetation characterised by grassy woodlands and open forest dominated by Grey Box (*Eucalyptus moluccana*) and Forest Red Gum (*E. tereticornis*) and poorly drained valley floors with forests of Cabbage Gum (*E. amplifolia*) and Swamp Oak (*Casuarina glauca*) (DECC 2008).

3.2.2 Geology and soils

The dominant geological formations beneath the Stage 1 CIZ are Bringelly Shale, the Luddenham Dyke and Alluvium (Bannerman & Hazelton 1990). Bringelly Shale is a Triassic age geological unit mainly comprising claystone and siltstone and some areas of sandstone

underlying parts of the Stage 1 CIZ. The dyke outcrops toward the peak of the ridge in the west of the Stage 1 CIZ. Alluvium at the Stage 1 CIZ comprises Quaternary age sedimentary deposits along Cosgrove Creek and Badgerys Creek.

Geotechnical investigations at the Stage 1 CIZ generally indicated surficial silt and/or clay topsoils overlying firm residual clays from the weathering of Bringelly Shale, with areas of alluvial gravels, sands, silts and clays associated with Badgerys Creek. The Stage 1 CIZ contains the Blacktown, Luddenham and South Creek soil landscapes. Kurosols (soils with strong texture contrast between the topsoil horizon and strongly acid subsoils horizon) occur over the majority of the airport site. Hydrosols (soils that are saturated for prolonged periods) occur in the vicinity of Badgerys Creek.

3.2.3 Hydrology

Within the broader catchment, the Stage 1 CIZ lies in the Badgerys Creek, Cosgroves Creek and Duncans Creek sub-catchments. Badgerys Creek and Cosgroves Creek are tributaries of South Creek.

Drainage lines in the Stage 1 Construction Impact Zone and airport site are shown on Figure 1. Badgerys Creek starts about two kilometres south-west of the airport site and flows north-easterly along its southern boundary before joining South Creek about four kilometres downstream. South Creek ultimately drains to the Hawkesbury River. The headwaters of Oaky Creek are located in the Stage 1 CIZ and it flows north to Cosgroves Creek, before its confluence with South Creek about seven kilometres downstream. Duncans Creek starts about three kilometres south-west of the airport site and flows north-westerly before joining the Nepean River about nine kilometres downstream from the airport site. This creek is located just outside the airport site at the western end. Duncans Creek receives flows from a number of unnamed tributaries in the Stage 1 Construction Impact Zone.

The reaches of Badgerys, Oaky, Cosgroves and Duncans Creeks and their tributaries that flow through and downstream of the Stage 1 CIZ are highly modified and in poor condition as a result of historical and current land use and disturbance. Despite having a generally well-vegetated riparian zone in some areas, these watercourses are considered to be in moderate geomorphic condition due to past clearing, the construction of online dams and ongoing agricultural activities (GHD 2017).

The proposed Willowdene receiver site (Section 5.2.1) occurs on sloping land surrounding the upper reaches of a first order tributary of Duncans Creek and would not be subject to flooding.

3.2.4 Climate

The airport site is located in Western Sydney, which has a humid subtropical climate, and is generally a few degrees warmer than the Sydney central business district, although nights are cooler. The mean maximum temperature occurs in January, and is about 30 degrees Celsius on average. July is the coolest month, with the mean maximum being about 17 degrees Celsius. Rainfall occurs throughout the year, with summer being the wettest season. Annual rainfall is about 700 mms on average.

3.2.5 Vegetation

Five NSW plant community types (PCT) occur at the airport site (GHD 2017). Stands of these plant community types include near-intact vegetation in 'Good' condition, partially cleared or regrowth vegetation in 'Poor' condition and extensively modified areas in 'Low' condition. Accordingly, 13 vegetation zones (plant community types and broad condition classes) have been identified and mapped at the airport site, as shown on Figure 2. Attributes of these vegetation zones are summarised in Table 8.

Table 8 Vegetation zones at the airport site

Zone ID	Vegetation Zone	EPBC Act status	BC Act status
1	Good condition Grey Box - Forest Red Gum grassy woodland on flats	Some patches comprise Cumberland Plain Woodland and Shale-gravel Transition Forest (CEEC) ¹	Cumberland Plain Woodland (CEEC)
2	Poor condition Grey Box – Forest Red Gum grassy woodland on flats\	-	Cumberland Plain Woodland (CEEC)
3	Good condition Grey Box - Forest Red Gum grassy woodland on hills	Some patches comprise Cumberland Plain Woodland and Shale-gravel Transition Forest (CEEC) ¹	Cumberland Plain Woodland (CEEC)
4	Poor condition Grey Box - Forest Red Gum grassy woodland on hills	-	Cumberland Plain Woodland (CEEC)
5	Good condition Forest Red Gum - Rough-barked Apple grassy woodland	-	River-flat Eucalypt Forest (EEC)
6	Poor condition Forest Red Gum - Rough-barked Apple grassy woodland	-	River-flat Eucalypt Forest (EEC) Shale-Gravel Transition Forest (EEC)
7	Good condition Broad-leaved Ironbark – Grey Box - Melaleuca decora grassy open forest	Some patches comprise Cumberland Plain Woodland and Shale-gravel Transition Forest (CEEC) ¹	-
8	Poor condition Broad-leaved Ironbark - Grey Box - Melaleuca decora grassy open forest	-	Shale-Gravel Transition Forest (EEC)
9	Good condition artificial freshwater wetland on floodplain	-	-
10	Low condition Grey Box - Forest Red Gum grassy woodland on flats	-	-
11	Low condition Grey Box - Forest Red Gum grassy woodland on hills	-	-
12	Low condition Forest Red Gum - Rough-barked Apple grassy woodland	-	-
13	Medium condition Grey Box - Forest Red Gum grassy woodland on flats	-	Cumberland Plain Woodland (CEEC)
x	Cleared land or cropland	-	-

Notes:

EEC – endangered ecological community. CEEC – critically endangered ecological community.

¹ Subject to patch size and condition according to the criteria in the listing advice for the community (TSSC 2008)

The distribution of plant community types at the airport site is closely aligned with soil type, underlying geology and drainage, all of which are correlated with geomorphic position. The most extensive vegetation zones at the airport site are various types of exotic grassland. These vegetation zones contain no native over-storey or mid-storey and less than 50 per cent of the ground cover vegetation is native. Grassland areas contain occasional isolated paddock trees that are remnants of adjoining native woodland and forest. Exotic grassland areas have been mapped and described as low condition forms of the plant community type that is most likely to have occurred previously.

Grey Box - Forest Red Gum grassy woodland on flats is associated with mid- and lower-slopes, on shale derived soils across the airport site and is the most extensive native plant community type. It comprises an open forest or woodland of Forest Red Gum (*Eucalyptus tereticornis*) and Grey Box (*Eucalyptus moluccana*) with a grassy understorey and occasional dense patches of the shrub species Native Blackthorn (*Bursaria spinosa* subsp. *spinosa*).

There are small areas of tertiary gravel influenced soils in the east of the airport site that support Broad-leaved Ironbark - Grey Box - *Melaleuca decora* grassy open forest with a canopy of Forest Red Gum and Grey Box along with Broad-leaved Ironbark (*Eucalyptus fibrosa*), a characteristic mid-storey of Honey Myrtle (*Melaleuca decora*) and a shrub and grass understorey. Vegetation zone 8, 'Poor condition Broad-leaved Ironbark – *Melaleuca decora* grassy open forest', comprises a derived scrub or shrubland form of this plant community type.

There is a volcanic intrusion in the central western portion of the site which is associated with steeper terrain, rock fragments in soil profiles and some rock outcropping. In other parts of the Cumberland Plain, this geology is often associated with Moist Shale Woodland and Western Sydney Dry Rainforest (NPWS 2002; Tozer et al 2010). However, at the airport site it contains Grey Box - Forest Red Gum grassy woodland on hills with relatively few species representative of these other communities.

The above vegetation types grade into Forest Red Gum - Rough-barked Apple grassy woodland along the riparian corridors of Badgerys Creek and other drainage lines through the airport site. This community is a closed woodland or forest of Forest Red Gum, Grey Box and Cabbage Gum (*Eucalyptus amplifolia*) along with Swamp Oak (*Casuarina glauca*), Broad-leaved Apple (*Angophora subvelutina*) and paperbarks (*Melaleuca* spp.). Understorey vegetation is similar to Shale Plains Woodland along with additional moisture-loving species such as rushes and sedges.

The condition of these plant community types varies across the airport site as a result of previous land uses and grazing intensity. Areas that have been historically cleared and/or heavily grazed contain regrowth vegetation in poorer condition. There is moderate to severe weed infestation throughout, with linear remnants along roads and isolated patches in agricultural land the most severely affected.

There are patches of derived native grassland at the airport site that comprise poor condition forms of the native vegetation communities described above. These areas contain at least 50 per cent native groundcover, mainly comprising native grasses such as Kangaroo Grass (*Themeda australis*). Overall there is a moderate species richness, but relative low cover and abundance of understorey herbs associated with the woodlands and forests described above. Exotic grasses and herbs are present throughout.

There are a large number of dams and flooded depressions throughout the airport site formed by the construction of barriers across small drainage lines. These water bodies contain a moderate diversity and abundance of native wetland plants.

There are local occurrences of one threatened ecological community (TEC) listed under the EPBC Act (Cumberland Plain Woodland and Shale-gravel Transition Forest – critically endangered ecological community [CEEC]) and three TECs listed under the BC Act (Cumberland Plain Woodland – CEEC; Shale-Gravel Transition Forest – endangered ecological community [EEC]; River-flat Eucalypt Forest – EEC) at the airport site.

3.3 Subject species

3.3.1 *Pimelea spicata* (Spiked Rice-flower)

P. spicata is listed as an endangered species under the BC and EPBC Acts. A single population of *Pimelea spicata* (Spiked Rice Flower) was recorded at the airport site in March 2017 in the north-western portion of the Stage 1 CIZ (see Figure 2) (GHD 2018). The population occurs adjacent to the western edge of the northern extent of The Northern Road at the airport site. A total of 4,118 clumps of *Pimelea spicata* were recorded, including many flowering plants. The observed clumps of *P. spicata* are located within an area of 2.94 hectares of occupied habitat. The extent of occupied habitat was mapped using GIS and a 20 metre wide buffer

around recorded clumps of *P. spicata* where the buffer area contained areas of suitable grassland or grassy woodland habitat. The buffer area was modified to exclude clearly unsuitable habitat such as gravel tracks, water, fill or rubbish. As part of Stage 1 of the TFPP undertaken by ABGMA, field ecologists installed permanent tags at the base of about 100 *P. spicata* plants in the area of occupied habitat.

P. spicata at the airport site is predominately located within an area of Poor condition Grey Box – Forest Red Gum grassy woodland on flats (vegetation zone 2), as well as within intermixed patches of Good condition Grey Box – Forest Red Gum grassy woodland on flats (vegetation zone 1). The population occurs within undulating flats derived from Bringelly Shale claystone, at a topographic elevation of about 100 m, falling gently to the west towards a nearby first-order stream and associated River-flat Eucalypt Forest. Groundcover throughout the majority of the occupied area is predominately exposed due to an absence of canopy, although areas of dappled shade are present within patches of vegetation zone 1. The natural soil profile is relatively intact and the area also contains a relatively intact native species understorey that includes numerous species which suggest the area has historically been grazed only at relatively low or moderate intensities.

Species characteristics and ecology

P. spicata is a slender, low growing shrub with glabrous prostrate and brittle stems and narrow elliptical leaves 5–20 mms long and approximately 2 mms wide. Flowers are in racemes starting out compact but elongating as they age. Flowers are white often tinged with pink, 7–10 mms long with sparsely haired sepals. Fruit is green and approximately 2.5 mms long. Under optimal conditions, when growing in its natural habitat, this plant can reach 50 centimetres in height. However, it rarely exceeds 30 centimetres in less favourable conditions (DEE 2019) (see Plate 1-3).

P. spicata is a cryptic species and difficult to detect in the field, particularly when not in flower. Survey work can thus not be relied upon unless undertaken whilst the species is flowering. A population at a site may consist only of underground lignotubers and the soil seed bank during droughts or because of excessive grazing or weed infestation. The species is known to grow rapidly and flower in response to fire and/or favourable rainfall. *P. spicata* is known to modify its growth form in response to competitive pressures such as habitat invasion by *Cenchrus clandestinus* (Kikuyu). Under these conditions, the stems can become elongated to over 2 metres in length and even climb to the upper canopy in response to shading. In response to these conditions, *P. spicata* restricts foliage growth to the emergent sections of the stem (DEE 2019).

P. spicata has a relatively scattered distribution over two disjunct areas: the Cumberland Plain area of western Sydney and the Illawarra Region near Wollongong, New South Wales. In western Sydney, the distribution extends from Camden in the south to Maraylya in the north and from Horsley Park east to Bankstown in the west. The species occupies a restricted area of occupancy of less than 17 hectares with 42 sites reported in the year 2000 (DEE 2019).

P. spicata habitat consists of well-structured clay soils in association with Grey Box (*Eucalyptus moluccana*) communities, particularly the Cumberland Plain Woodland variants and Moist Shale Woodland as well as in areas where ironbark is present. Co-occurring species on the Cumberland Plain include *Eucalyptus moluccana* (Grey Box), *Eucalyptus tereticornis* (Forest Red Gum) and *Eucalyptus crebra* (Narrow-leaved Ironbark) (DEE 2019).

Life cycle

P. spicata is not capable of vegetative spread and hence is dependent upon seed production for recruitment (DEC 2005). Mature *P. spicata* plants possess a substantial underground lignotuber that enables mature individuals to re-sprout and recover from disturbances like fire

and irregular grazing (see Plate 4). The species can also spread over short distances via underground rhizomes. Flowers may be self-pollinating, although fruit production is variable. Fruit are not dispersed well, with most seedlings germinating close to the adult (within 30 centimetres). *P. spicata* flowers sporadically throughout the year, with flowering likely to depend upon climatic conditions, particularly rainfall (DEE 2019). The life span of an individual plant could be as long as 20 to 30 years. A soil seedbank develops and is maintained in the presence of a suitable fire disturbance regime implemented at less than 10 years intervals (Committee 2016). Plants have been observed to set seed 1.5-2 years after germination with 80% seedling survival reported during monitoring (DEC 2005).

Plate 1 *Pimelea spicata* individual at Western Sydney International Airport



Plate 2 *Pimelea spicata* individual at Western Sydney International Airport



Plate 3 *Pimelea spicata* individual at Western Sydney International Airport



Plate 4 Excavated *Pimelea spicata* taproot (Western Sydney International Airport)



Figure 2 Donor site locations

Figure 3 Threatened ecological communities

Seed collection, germination and propagation

Ex-situ germination trials have found that smoke application via both smoke water and aerial smoke significantly increases *P. spicata* seed germination. However, Willis *et al* (2003) found that despite any germination promoter treatments, the proportion of seeds germinating in any trial was consistently low (20-30% under optimal conditions). Previous in-vitro propagation studies reported successfully acclimatised explants to greenhouse conditions (Offord 2009). Recent works undertaken by ABGMA at WSI successfully propagated 173 *P. spicata* tubestock from cuttings, with a strike-rate of about 23% (*pers comm* Daniella Pasqualini 2019).

P. spicata flowers opportunistically in response to major rainfall events. As a result, its peak flowering period may vary from year to year. In periods of unfavourable growth, plants can die back entirely to underground plant structures. Subsequently, any seed collection must also be opportunistic, with collection programs ready to proceed at the onset of favourable climatic conditions (DEC 2005). Seed collection should be undertaken by placing seed collection bags (breathable bags) on flowering stems. It is important to regularly check the seed collection bags during periods of continuous rain to avoid mould contamination (PsRT 2013). Similarly, collection of cuttings for propagation can only be reliably sourced from healthy actively growing plants, and subsequently must also wait for favourable climatic conditions to proceed.

Previous translocations

In Victoria, there have been several documented attempts to translocate *Pimelea spinescens*, an ecologically and morphologically similar species to *P. spicata*, from areas proposed for development into conservation reserves (PsRT 2013; Craigie 2014). These translocation attempts have included transplanting entire mature plants with a tree spade, planting propagated seed and cuttings into a reserve, and direct-sowing seed. The translocations have had moderate but variable levels of success.

PsRT (2013) found that planting tubestock propagated from seed in a nursery was the most successful method, with a 30-70% survival rate achieved across four recipient sites. It was found that plant propagation from cuttings readily struck, however, transfer of this material back into natural grasslands had little success. Of 300 cuttings propagated from material at one site, only one was known to survive for more than a year. This was thought to be due to the fibrous roots that cuttings grow which are unlike the taproot that they would naturally grow (PsRT 2013).

The poor field outcomes of the PsRT (2013) plant propagation from cuttings is likely to have been due to inadequate establishment of the propagated plants in the nursery, prior to planting in the field. *Ex situ* populations of *Pimelea spicata* established by ABGMA from cuttings taken from the airport population are establishing a taproot and are expected to show substantially increased field survival rates compared to the PsRT (2013) project (ABGMA *pers. comm.*) Consultation with ABGMA established that a field survival rate of 50% for cuttings-propagated *P. spicata* would be realistic for the current project.

In a review of efforts to translocate *P. spinescens* via salvage and transplantation of mature plants and soil from naturally growing populations, (Craigie 2014) reported an overall 33% survival rate across 13 projects. Initial losses of 15-60% occurred from plants not surviving the move. An overall trend of a gradual decline in survivorship then followed. Due to poor monitoring efforts, causes of the low success rates of the mature plant translocation have not been objectively determined. However, the principal contributors were surmised as: poor initial condition of recipient sites; inadequate post-transplantation management, in particular inadequate management of high understorey biomass levels; and plant positioning and installation within the receiver site causing flooding and drowning (Craigie 2014).

PsRT (2013) produced a translocation protocol in relation to propagation and salvage / transplantation of *P. spinescens*. Parts of the protocol relevant to *P. spicata* and this Plan are provided in Table 9. Minor edits have been made to the wording of the protocol where it is not relevant to this Plan. A number of the protocol proposals can be applied across all the subject species within this Plan.

Table 9 Proposed protocols for the translocation of *Pimelea spinescens* in Victoria (PsRT 2013)

Proposed protocols for the translocation of <i>Pimelea spinescens</i> in Victoria
<ul style="list-style-type: none"> The size and extent of the population is determined using an intensive systematic survey.
<ul style="list-style-type: none"> Mature plants targeted for translocation will be subject to one season of seed collection and collected seed utilised to establish propagated seedlings within the approved recipient site.
<ul style="list-style-type: none"> As many plants (mature and germinants) as physically possible which would otherwise be destroyed by development must be salvaged (i.e. as plants are generally clustered, the salvage of some plants could result in damage or loss of others): <ul style="list-style-type: none"> Germinants should be salvaged first and transplanted to recipient site within 24 hours (preferably the same day); Mature plants should be salvaged after the germinants and during a time of optimum ground moisture.
<ul style="list-style-type: none"> Translocation of plants should be minimised and at least 80% of any significant population should be subject to <i>in situ</i> protection and conservation management.
<ul style="list-style-type: none"> Any recipient site must be: <ul style="list-style-type: none"> A site which is permanently protected with conservation of biodiversity as the primary management objective and the additional management requirements for the translocated population are adequately resourced; and Considered a suitable ecological vegetation type and soil type.
<ul style="list-style-type: none"> Translocation of mature plants using a tractor or bobcat-mounted tree spade is currently considered the most reliable method to salvage and translocate this species.
<ul style="list-style-type: none"> Consideration must be given to the impact of plant and machinery at the donor and recipient site, and the influence of soil moisture upon this impact (i.e. a higher disturbance and impact would be expected during periods when soils are wet).
<ul style="list-style-type: none"> The translocation recipient site should be within an area of relatively low conservation value within a broader area of high conservation value.
<ul style="list-style-type: none"> Selected areas in the translocation recipient site and plants to be translocated must be watered in preparation for the use of the tree spade.
<ul style="list-style-type: none"> All translocated plants (mature and germinants) need to be marked to allow for monitoring of survival and potential recruitment. A diagram of the configuration of translocated plants can also be useful in any monitoring program.
<ul style="list-style-type: none"> All translocated plants (mature and germinants) need to be watered until rainfall produces persistent moist soil conditions.
<ul style="list-style-type: none"> Soil moisture conditions need to be monitored weekly or more frequently if conditions are hot and dry.
<ul style="list-style-type: none"> All translocated plants (mature and germinants) need to be watered during the first and potentially the second summer after the translocation occurs.
<ul style="list-style-type: none"> Plant survivorship should be monitored monthly for the first six months, then every two months for 12 months. Monitoring should then occur at quarterly intervals for the next 2½ years post translocation. Following this if environmental conditions remain stable the monitoring can drop to 6 monthly or otherwise continue at quarterly intervals. Monitoring will document survivorship, flowering, general observations and tagging of any recruitment, assess biomass conditions and adapt management practices in light of the

Proposed protocols for the translocation of *Pimelea spinescens* in Victoria

success or failure to promote subject species recruitment and ensure prescribed and recommended ongoing management actions have been completed.

- Monitoring report summaries of site and plant survival and management and plant health, should be prepared and sent to the relevant responsible authority to ensure compliance with any approval conditions annually for a period of 10 years following the translocation.
- The recipient site should be subject to an approved ecological management plan which includes reinstatement and management of appropriate disturbance regimes and a high level of management works concentrating on the population of translocated plants.
- The supply of adequate funding for active conservation management and monitoring of the translocated population and the associated reserve should be provided for a minimum period of ten years.
- The translocation remains unsuccessful until a self-sustaining population establishes in response to the active ecological management of the reserve.

3.3.2 *Marsdenia viridiflora* subsp. *viridiflora* (Native Pear)

One-hundred and forty five stems of *Marsdenia viridiflora* subsp. *viridiflora* (Native Pear) were recorded in the Stage 1 CIZ. The majority of these were recorded in a single population within Good condition Grey Box - Forest Red Gum grassy woodland on flats adjacent to Longleys Road and Anton Lane in the centre of the airport site (see Figure 2) (GHD 2018). Occurrences of the species at the airport site comprise part of the endangered *Marsdenia viridiflora* R. Br. subsp. *viridiflora* population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas listed under the BC Act.

The population occurs within undulating flats derived from Bringelly Shale claystone, at a topographic elevation of about 80 m, within fully structured remnant native vegetation. The plants at the airport site occur are intermixed with mid- and understorey native and exotic vegetation, and often occur at the base of trees and larger shrubs. The natural soil profile within the area of the population is partially intact, with disturbed areas having been impacted by road building excavations as well as road fill and illegal dumping.

Species characteristics and ecology

M. viridiflora subsp. *viridiflora* is a climber with twining stems that can climb up to four metres in height. The plant's young stems are covered with hairs, older stems and most leaves are glabrous. Leaves are narrow, ranging between 2-12 centimetres long and 1-18 mms wide and have a prominent mid-vein. Bell-shaped flowers occur in groups of 3 to 10 and are 3 - 4 mms in diameter, greenish or yellow. The plant has a milky latex when cut and large underground tubers. Fruits are pear-shaped and up to 80 mms long (OEH 2019b).

M. viridiflora subsp. *viridiflora* is known to grow in vine thickets and open shale woodland (OEH 2019c). The species has a wide distribution in subcoastal and southern Queensland and sporadic occurrence in NSW. A disjunct population of the species near the southern limit of its range occurs in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas of Western Sydney (OEH 2002).

Life cycle

M. viridiflora subsp. *viridiflora* flowers in late spring to summer, generally during periods of average or above-average rainfall, with fruiting and seeding occurring in summer. Plants may die-back to their underground tuber under adverse conditions such as drought or intensive mowing. The longevity of any seed soil bank for the species is unknown (OEH 2019c).

Seed collection, germination and propagation

There is currently limited literature available regarding propagation of *M. viridiflora* subsp. *viridiflora*. Recent works undertaken by ABGMA at WSI successfully propagated 560 *M. viridiflora* subsp. *viridiflora* tubstock from cuttings, with a strike-rate of about 73% (*pers comm* Daniella Pasqualini 2019).

The Warrell Creek to Nambucca Heads Upgrade of the Pacific Highway Threatened Flora Translocation Project reported the propagation of the closely related *Marsdenia longiloba* (Slender Marsdenia) from seed to 30 centimetre tall seedlings to take about 8 months (ECOS 2016a). Propagation of *M. longiloba* from rhizome cuttings collected during transplanting was attempted with poor results (<5% of cuttings produced shoots and shoot growth was very slow) (ECOS 2018).

Another closely related species, *Marsdenia australis* (Native Pear) was found by ANPSA (2013) to germinate from fresh seed, with no pre-treatment. *M. australis* was also reported to propagate successfully from cuttings of firm, young growth tissue (ANPSA 2013).

Previous translocations

No literature relating to past translocations of *M. viridiflora* subsp. *viridiflora* is available in the scientific literature. However, the following translocation methods have been attempted for *Marsdenia longiloba* (Slender Marsdenia), a species with broadly similar morphological and ecological characteristics:

- Approximately 100 mature *M. longiloba* plants were translocated from the road corridor of the Bonville Pacific Highway Upgrade south of Coffs Harbour to two recipient sites in 2006-2007. Excavation of plants revealed that stems grew from a horizontal rhizome network. Stems connected to a piece of rhizome (stem-individuals) and stemless rhizome pieces were transplanted to pots and grown on before planting out in the field resulting in a 90% field survival rate (ECOS 2016a).
- Eight *M. longiloba* were transplanted from the road corridor of the Sapphire to Woolgoolga Pacific Highway Upgrade in 2011. The translocation methods replicated the protocols utilised at the Bonville project. The plants were introduced without fertiliser or any other nutrient enrichment except for a small amount of cane mulch. All eight individuals were surviving in October 2011, however, a year later most of the plant showed evidence of dieback. Nutrient enrichment from cane mulch or pot cultivation might be the cause of the poor health observed (ECOS 2016a).
- Mature plant salvage and transplantation with a 74% survival rate over 3 years monitoring during the Warrell Creek to Nambucca Heads upgrade of the Pacific Highway project (ECOS 2018).

3.3.3 *Pultenaea parviflora* (Sydney Bush-pea)

Four individuals of *Pultenaea parviflora* (Sydney Bush-pea) were recorded in the Stage 1 CIZ, on the southern side of Longleys Road between Ferndale and Taylors Road (see Figure 2) (GHD 2017). *P. parviflora* is listed as a vulnerable species under the EPBC Act and an endangered species under the BC Act.

Seed and cutting collections were made from a previously larger *P. parviflora* population at this location by the Royal Botanic Gardens Trust (RBGT) on a number of occasions in 1990 and 1991, with the aim of testing propagation methods for the species and also ultimately replanting the species at the airport as part of landscaping works (RBGS 1992).

The population occurs within undulating flats derived from Bringelly Shale claystone, at a topographic elevation of about 80 m, within and adjacent to Good condition Grey Box - Forest

Red Gum grassy woodland on flats. The natural soil profile within the area of the population is partially intact, with disturbed areas having been impacted by road building excavations, road fill and illegal dumping and surrounding historical agricultural development.

Species characteristics and ecology

P. parviflora is a small erect branching shrub one metre tall that can reach up to 1.8 metres under competition stress. The leaves are alternate, 2-6 mm long, 1-1.5 mm wide, narrow to broad obovate to cuneate, with an obtuse to slightly notched apex. The upper surface may be paler, or the leaves may be concolorous and stipules two mm long (OEH 2019d).

Inflorescences of *P. parviflora* are clustered towards the ends of the branches, with flower size ranging between 5 - 7 mm long. The flowers are yellow, pea-like in shape with reddish markings and a single leaf present along axil. The calyx is 4-5 mm long, hairless, with long slender lobes and bracteoles about 4 mm long. Fruit are egg-shaped, 5 mm long, holding seeds which have an aril (OEH 2019d).

P. parviflora is confined to the Cumberland Plain, west of Sydney, New South Wales. Within this area the species is mostly found between Penrith and Windsor and is locally abundant within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. *P. parviflora* may also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland (OEH 2019d, DoE 2019b).

Eucalyptus fibrosa (Red Ironbark) is usually the dominant canopy species in vegetation communities associated with the species, however, *Eucalyptus globoidea* (White Stringybark), *Eucalyptus longifolia* (Woollybutt), *Eucalyptus parramattensis* (Parramatta Red Gum), *Eucalyptus sclerophylla* (Hard-leaved Scribbly Gum) and *Eucalyptus sideroxylon* (Mugga Ironbark) may also be present or codominant, with *Melaleuca decora* frequently forming a secondary canopy layer. The species is often found in association with other threatened species such as *Dillwynia tenuifolia*, *Grevillea juniperina* subsp. *juniperina*, *Micromyrtus minutiflora* and *Persoonia nutans* (Nodding Geebung) (OEH 2019d).

Life cycle

It is estimated that reproductive maturity of *P. parviflora* is not reached for 3-4 years following germination, with peak reproduction occurring at 5-6 years. The estimated lifespan of the species is estimated at about 20 years. *P. parviflora* is killed by fire and re-establishes from a soil-stored seed bank. The species flowers between August and November depending on environmental conditions, with a flower peak in September and fruit maturation in December (OEH, 2019d).

Germination can be prolific after a moderate to high intensity fire with ants implicated in the dispersal of the species as the seed has an aril. A population at a particular site may contain substantial numbers of plants as seeds. *P. parviflora* pollinators are unknown (OEH 2019d).

Propagation and seed collection

P. parviflora requires a fire interval of 10–15 years to allow the soil seed bank to establish and create suitable fuel levels to produce moderate to high intensity fires required to promote germination (DoE 2019b).

P. parviflora seed retains viability for many years and its seed propagation is reported to be successful following pre-treatment to break the physical dormancy provided by the impervious seed coat. Pre-treatment can be carried out by abrasion or by the use of boiling water. Cuttings strike well using firm, current season's growth, however, constant misting should be avoided as the hairy foliage tends to hold water and rotting may occur (ANPSA 2016). ABGMA

successfully propagated 500 *P. parviflora* tubestock from seed collected from the population at the airport site in 1990 and 1991, with a strike-rate of about 77% (*pers comm* Daniella Pasqualini 2019).

Previous translocations

No literature relating to past translocations of *P. parviflora* is available in the scientific literature. In general, the seed of species in the family Fabaceae tend to be readily collectable, viable and germinable, and growing plants from wild-collected seed is generally a preferred means of propagation. Conversely, in general salvage and transplantation of mature shrubs is cost-inefficient, problematic and unlikely to be successful. ABGMA hold seed of *P. parviflora* collected from the WSI population in 1990/ 91, and have recently successfully germinated over 500 plants from this seed stock (*pers comm* Daniella Pasqualini 2019).

3.3.4 *Dillwynia tenuifolia*

A single population of 294 individual *Dillwynia tenuifolia* was recorded off Gardiner Road in the north-east portion of the airport site (see Figure 2) (GHS 2018). Only 11 individuals occur within the Stage 1 CIZ. Of the 283 individuals located outside of the Stage 1 CIZ, 275 are located in the ECZ and eight individuals are located in the potential disturbance area for longer term development (i.e. land that is not in the Stage 1 CIZ or the ECZ).

D. tenuifolia is listed as a vulnerable species under the NSW BC Act. It is not listed as a threatened species under the EPBC Act. *D. tenuifolia* is listed at Kemps Creek as an endangered population. The Kemps Creek endangered population is located around three kilometres to the east of the Stage 1 CIZ in an area bound by Western Road, Elizabeth Drive, Devonshire Road and Cross Street, Kemps Creek. *D. tenuifolia* individuals or habitat in the Stage 1 CIZ are not part of this endangered population.

D. tenuifolia at the airport site is located within an area of Good condition Broad-leaved Ironbark – Grey Box – *Melaleuca decora* grassy open forest (vegetation zone 7). The population occurs within undulating flats derived from Bringelly Shale claystone intermixed with alluvial gravels derived from Badgerys Creek. The population occurs at a topographic elevation of about 80 m, falling gently to the east towards Badgerys Creek and associated River-flat Eucalypt Forest. The natural soil profile associated with the population is intact.

Species characteristics and ecology

D. tenuifolia is low spreading pea-flower shrub that can reach up to one metre in height. Its leaves are small and narrow (linear-terete, soft, 4-12 mm long, with the tip often bent downwards). The wide orange-yellow and red pea-flowers are usually single, at or near the tips of the branches. Seed pods are brownish, egg-shaped, 4-5 mm long with reticulate seeds. Both the singular orange flowers and the stem hairs distinguish it from the similar and more common yellow-flowered *Dillwynia glaberrima* and *Dillwynia floribunda* (OEH 2019a).

The core distribution of *D. tenuifolia* occurs within the Cumberland Plain of western Sydney, from Windsor and Penrith east to Dean Park near Colebee. Other populations in western Sydney are recorded from Voyager Point and Kemps Creek in the Liverpool Local Government Area (LGA), Luddenham in the Penrith LGA and South Maroota in the Baulkham Hills Shire. Disjunct localities outside the Cumberland Plain include the Bulga Mountains at Yengo in the north, and Kurrajong Heights and Woodford in the Lower Blue Mountains (OEH 2019a).

D. tenuifolia is locally abundant particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. The species may also be common in transitional areas where these communities adjoin Castlereagh Scribbly Gum Woodland (OEH 2019a).

Red Ironbark is usually the dominant canopy species in vegetation communities associated with the species, however, *E. globoidea*, *E. longifolia*, *E. parramattensis*, *E. sclerophylla* and *E. sideroxylon* may also be present or codominant, with *M. decora* frequently forming a secondary canopy layer. Associated species may include *Allocasuarina littoralis* (Black She-oak), *Angophora bakeri* (Narrow-leaved Apple), *Aristida* spp. *Banksia spinulosa* (Hairpin Banksia), *Cryptandra* spp. *Daviesia ulicifolia* (Gorse Bitter Pea), *Entolasia stricta* (Wiry Panic), *Hakea sericea* (Needlebush), *Lissanthe strigosa* (Peach Heath), *Melaleuca nodosa* (Prickly-leaved Paperbark), *Ozothamnus diosmifolius* (White Dogwood) and *Themeda triandra* (Kangaroo Grass). This species is often found in association with other threatened species such as *Grevillea juniperina*, *Micromyrtus minutiflora*, *Pultenaea parviflora* (Sydney Bush-pea) and *Styphelia laeta* (Five-corners) (OEH 2019a).

Life cycle

Pollination of *D. tenuifolia* is carried out by native bees and seed dispersal is likely to be localised with ants as the probable vectors. This species does not tolerate fire and only re-establishes from soil-stored seed. The high population densities at some recorded sites reflects prolific seed germination in response to fire. *D. tenuifolia* has a longevity between 20-30 years (DoE 2019a).

Flowering occurs sporadically through the year with a peak from August to March depending on environmental conditions. Seed/fruit production peaks in December and it is thought a minimum of 3-4 years is required before seed is produced. Seeds are hard coated and are persistent in the soil seed bank (DoE 2019a). *D. tenuifolia* seed retains viability for many years (ANPSA 2010).

Propagation and seed collection

Propagation of *D. tenuifolia* from seed has been reported to be relatively easy following pre-treatment to break the physical dormancy provided by the impervious seed coat. Pre-treatment can be carried out by abrasion or by the use of boiling water. Propagation by cuttings strike reasonably well using firm, current season's growth (ANPSA, 2010).

Previous translocations

Limited information relating to past translocations of *D. tenuifolia* is available in the scientific literature. The only reference to translocation of *D. tenuifolia* identified in conjunction with this Plan relates to a flora translocation survey conducted in 2013 as part of the *Monitoring and Prioritisation of Flora translocations: a survey of opinions from practitioners and researchers* (Hancock, 2014). The translocation project focussed upon species reinforcement, which is defined as the augmentation, supplementation, re-stocking and enhancement of existing flora species populations. Direct seeding of *D. tenuifolia* was the only method reported (Hancock, 2014).

Similar to *P. parviflora*, in general, the seed of species in the family Fabaceae tend to be readily collectable, viable and germinable, and growing plants from wild-collected seed is generally a preferred means of propagation. Conversely, in general, salvage and transplantation of mature shrubs is cost-inefficient, problematic and unlikely to be successful.

3.4 Appropriate translocation methods

Based upon ecological knowledge of the subject species, past translocation efforts and industry consultation, a summary of appropriate translocation methods for the subject species and likelihood of success of each approach under 'optimal' and 'sub-optimal' conditions is provided in Table 10.

The likelihood of success of any single approach to translocation tends to be moderate only, suggesting that multiple approaches should be used for any single translocation whenever possible. The benefits of undertaking a translocation effort under optional conditions (i.e. soil moisture, plant health and vigour, ongoing management and maintenance resourcing etc) is also highlighted. Also, in general, propagation of seed and/or cuttings provides a relatively reliable approach to flora translocation. Ideally, any plant salvage effort would be supplemented with installation of additional genets, grown from seed or cuttings, sourced from the airport site or, where appropriate, other populations within the Sydney Basin, to contribute to meeting the goals of this Plan. Use of plants grown from seed or cuttings would benefit the translocated populations from a perspective of increasing the genetic diversity of the population, but also by broadening the age demographic of the translocated population and temporal spread of maturity and seed production.

Table 10 Appropriate translocation methods for subject species and likelihood of success.

Subject species	Likelihood of success (optimal conditions)				Likelihood of success (sub-optimal conditions)			
	Salvage / transplant	Soil seed bank	Seed collection / propagation	Cutting collection / propagation	Salvage / transplant	Soil seed bank	Seed collection / propagation	Cutting collection / propagation
<i>Dillwynia tenuifolia</i>	Low	Moderate	Good	Moderate	Low	Moderate	Moderate	Low
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	Moderate	Uncertain (unlikely)	Low	Moderate	Low	Uncertain (unlikely)	Low	Low
<i>Pimelea spicata</i>	Moderate	Moderate	Moderate	Moderate	Low	Moderate	Low	Low
<i>Pultenaea parviflora</i>	Low	Moderate	Good	Moderate	Low	Moderate	Moderate	Low

4. Proposed translocation

4.1 Preferred approach to translocation

This Plan is for a mitigation translocation and reintroduction of the populations of the 4 threatened flora species impacted by construction within the Stage 1 CIZ to the WSI ECZ. The preferred approach to meeting translocation targets under this Plan is to utilise existing *ex situ* potted populations of *M. viridiflora* subsp. *viridiflora*, *P. spicata* and *P. parviflora* (there are no existing *ex situ* potted populations of *Dillwynia tenuifolia*), and undertake whole-plant salvage / transplantation to supplement any projected shortfalls in translocation targets. Translocation targets and the relative contribution of planting *ex situ* populations and plant salvage and transplantation to those targets are detailed in Section 4.2 and Table 11. Details of management of the ECZ, including planting of existing *ex situ* potted populations, would be specified and delivered under a future update of the Vegetation Management Plan that has been prepared as part of the Biodiversity CEMP for the WSI (GHD 2018) (see Section 1.3.1).

The focus of this Plan is thus upon the salvage and transplantation of the subject species. In addition, translocation of the soil seed bank from the area of *P. spicata* occupied habitat is also proposed. This latter approach is considered a worthwhile supplementary translocation measure intended to capture the genetic and regenerative potential of dormant *P. spicata* seed in the soil. The proposed soil seed bank translocation will simultaneously capture the soil seed bank of other native understorey species that form a relatively diverse dominant cover within the area of *P. spicata* occupied habitat. This approach is worthwhile both on the basis of capturing the *P. spicata* seed bank, as well as contributing to the management measure to “replace exotic grasslands with suitable native vegetation in the ECZ” required under the biodiversity conditions of the Airport Plan (see Section 1.3.1).

Depending upon the outcomes of the translocation specified in this Plan, translocated populations of *P. spicata* and *P. parviflora* may be augmented by additional *ex situ* material of these species held by ABGMA (see Section 6.4).

Based on the assessment of target populations and translocation feasibility outlined below (Sections 4.2 and 4.3), translocation effort under this Plan will be limited to the salvage and transplantation of 507 *P. spicata*, supplemented by translocation of the soil seed bank within the area of occupied habitat for this species from the donor population at the airport. Salvage of *P. parviflora* is not recommended given the life form of the species and that a maximum of only 4 individuals is present at the airport site. Salvage of *M. viridiflora* subsp. *viridiflora* is not recommended on the basis that a target translocation population of this species can be delivered via the *ex situ* population held by ABGMA (section 1.3.3). Translocation of the population of *D. tenuifolia* is considered unfeasible and salvage of this species is not recommended as discussed in section 4.3.

4.2 Target translocation populations

RBGS (2019) are currently undertaking a regional-scale genetic research project on *Pimelea spicata*, including analysis of the subject population at WSI. The outcomes of this research suggest that a minimum population of 256 *P. spicata*, randomly selected from the donor population at the airport site would be sufficient to ensure the long-term genetic integrity of a translocated population.

No data relating to the conservation genomics of the remaining subject species / populations is available. Research from Australia shows that small populations of perennial plant species often show reduced genetic and demographic outcomes, and suggests that populations of

around 250 plants are required to minimise these effects (Commander *et al* 2018). It should be noted, however, that while translocated population sizes of around 250 plants are a useful initial target for longer-lived perennial species, others (Frankham *et al.* 2014) suggest that the genetically effective population size should be ≥ 1000 to maintain evolutionary potential.

Following the preferred approach to translocation presented in this Plan, Table 11 provides targets for the number of individuals that must be salvaged in order to meet minimum target translocation populations, following planting of *ex situ* populations of the subject species. The target translocation population sizes presented (i.e. minimum ~250 individuals) assume a 100% survivorship for translocated plants, regardless of the proposed translocation approach. In practice, a survivorship lower than this can be expected (see Section 3.3). Table 11 accounts for expected survivorship for all the presented translocation approaches by applying knowledge from previous flora translocations (see Section 3.3), consultation with industry experts and professional experience. Due to the uncertainty associated with the number of *P. spicata* individuals that can be expected to establish from soil seedbank translocation, this approach has been excluded from the calculations presented in Table 11.

Table 11 Target number of individuals that must be salvaged in order to meet minimum target translocation populations, following planting of *ex situ* populations of the subject species.

Subject species (threatened status)	Quantum of impact in Stage 1 CIZ	Retained local population	Minimum target translocation population size (indv)	Existing <i>ex situ</i> pop _n (indv)	Expected field survival potted pop _n (50% survival rate)	Required salvage pop _n to supplement potted pop _n (indv)	Expected salvage transplantation success rate	Required target salvage pop _n (accounting for projected success rate)
<i>Dillwynia tenuifolia</i> (V - BC Act)	30 individuals	264 individuals	250	0	n/a	250	<20%	>1250
<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i> (E pop _n – BC Act)	1145 stems	0 stems	250	560	280	0	n/a	0
<i>Pimelea spicata</i> (E – BC Act; E – EPBC Act)	4,118 clumps	0 clumps	256	173	87	169	33%	507
<i>Pultenaea parviflora</i> (V – BC Act; E – EPBC Act)	4 individuals	0 individuals	250	500	250	0	n/a	0

Notes: V = vulnerable; E = endangered; pop_n = population; indv = individual

4.3 Translocation feasibility

The suggested translocation feasibility checklist produced by Commander *et al* (2018) has been completed for each of the subject species in Table 12. With the exception of *D. tenuifolia*, translocation is feasible for all the WSI threatened flora populations.

It is recommended that the translocation of *D. tenuifolia* populations at the WSI site is excluded from the delivery phase of this Plan due to:

- The low chance of successfully salvaging and transplanting mature shrubs.
- The inability to meet viable population targets via salvage and transplantation (>1250 plants required – see Table 11).
- The uncertainty of successful establishment of the species resulting from translocation of its soil seed bank, and the impacts of this approach that would be required within an appropriate receiver site.
- The relatively low quantum of impact of construction within the Stage 1 CIZ upon this species.
- The relatively large population of this species that will be retained, conserved and actively managed within the WSI ECZ, which should be sufficient to maintain the integrity of the population over the long-term.

Table 12 Translocation feasibility checklist (Commander *et al* 2018)

Translocation feasibility checklist (Commander <i>et al</i> 2018)	<i>Pimelea spicata</i>	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	<i>Pultenaea parviflora</i>	<i>Dillwynia tenuifolia</i>
Have other conservation measures been tried (e.g. reducing existing threats)?	n/a Proposal is for an approved mitigation translocation.	n/a Proposal is for an approved mitigation translocation.	n/a Proposal is for an approved mitigation translocation.	n/a Proposal is for an approved mitigation translocation.
Will extinction risk be reduced by the translocation or will it increase due to habitat loss?	Translocation will potentially substantially reduce extinction risk.	Extinction risk will be reduced by the translocation.	Translocation will contribute to minor-negligible reduction in extinction risk.	Translocation will contribute to minor-negligible reduction in extinction risk.
Can the threats to the species be ameliorated to a degree that allows the species to persist at the translocation site?	Yes See Section 7 and future updated VMP	Yes See Section 7 and future updated VMP	Yes See Section 7 and future updated VMP	Yes See Section 7 and future updated VMP
Is the taxonomic status of the species well understood?	Yes	Yes	Yes	Yes
Is the distribution of the species adequately understood? Have adequate field surveys been undertaken to inform the conservation status of the species?	Yes See Section 3.3	Yes See Section 3.3	Yes See Section 3.3	Yes See Section 3.3
Has a clear purpose and plan for the translocation been identified?	Yes See Section 1.5	Yes See Section 1.5	Yes See Section 1.5	Yes See Section 1.5
Have suitable recipient sites been identified?	Yes See Section 5	Yes See Section 5	Yes See Section 5	Yes See Section 5
Is the tenure of recipient site secure and is it likely to continue to be secure in the future?	Yes See Section 1.3.1	Yes See Section 1.3.1	Yes See Section 1.3.1	Yes See Section 1.3.1
Are other species at the site likely to become threatened or adversely	Minor excavation and trampling of common	Minor excavation and trampling of common	Minor excavation and trampling of common	Minor excavation and trampling of common

Translocation feasibility checklist (Commander <i>et al</i> 2018)	<i>Pimelea spicata</i>	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	<i>Pultenaea parviflora</i>	<i>Dillwynia tenuifolia</i>
affected because of the translocation?	native understorey species at the recipient site will be required for transplanting / planting.	native understorey species at the recipient site will be required for transplanting / planting.	native understorey species at the recipient site will be required for transplanting / planting.	native understorey species at the recipient site will be required for transplanting / planting.
Can the species be successfully established at the site?	The receiver site is in close proximity and has similar ecological and biophysical characteristics to the donor site.	The receiver site is in close proximity and has similar ecological and biophysical characteristics to the donor site.	The receiver site is in close proximity and has similar ecological and biophysical characteristics to the donor site.	The receiver site is in close proximity and has similar ecological and biophysical characteristics to the donor site.
Can the threats be managed /ameliorated at the recipient site?	Yes See Section 7	Yes See Section 7	Yes See Section 7	Yes See Section 7
Are there any emerging threats/risks that need to be considered?	Yes See Section 6.3 and 7	Yes See Section 6.3 and 7	Yes See Section 6.3 and 7	Yes See Section 6.3 and 7
If considering population enhancement, is there evidence of population decline as opposed to simply natural fluctuations and has alternative means of increasing population size been considered or attempted?	n/a Proposal is for an approved mitigation translocation.	n/a Proposal is for an approved mitigation translocation.	n/a Proposal is for an approved mitigation translocation.	n/a Proposal is for an approved mitigation translocation.
Do necessary associated species (symbionts) i.e. pollinators occur at the site?	There are no known species symbionts. The receiver site is in close proximity and has similar ecological and biophysical characteristics to the donor site.	There are no known species symbionts. The receiver site is in close proximity and has similar ecological and biophysical characteristics to the donor site.	Ants are known to act as dispersal agents for <i>P. parviflora</i> seed. The receiver site is in close proximity and has similar ecological and biophysical characteristics to the donor site.	Ants are known to act as dispersal agents for <i>D. tenuifolia</i> seed. The receiver site is in close proximity and has similar ecological and biophysical characteristics to the donor site.

Translocation feasibility checklist (Commander <i>et al</i> 2018)	<i>Pimelea spicata</i>	<i>Marsdenia viridiflora</i> subsp. <i>viridiflora</i>	<i>Pultenaea parviflora</i>	<i>Dillwynia tenuifolia</i>
Is there sufficient germplasm to carry out a translocation?	Yes (plant salvage, soil seed bank and, nominally, <i>ex situ</i> potted population) See Section 4 for target translocation populations.	Yes (plant salvage and, nominally, <i>ex situ</i> potted population) See Section 4 for target translocation populations.	Yes (nominally, <i>ex situ</i> potted population only) See Section 4 for target translocation populations.	No 30 individuals will be removed by Stage 1 CIZ construction works. 264 individuals will be protected within the ECZ. See Section 4 for target translocation populations.
Does the germplasm have sufficient genetic diversity for long term population persistence?	Yes (RBGS 2019)	Likely (Commander <i>et al</i> 2018)	Likely (Commander <i>et al</i> 2018)	Unlikely Majority of existing population is to be retained and protected (264 of 294 individuals)
How will success of the translocation be measured and monitored?	See Section 7.5	See Section 7.5	See Section 7.5	See Section 7.5
How will assessing the translocation and its success be resourced?	Ongoing funding to be provided by WSA for management of the ECZ.	Ongoing funding to be provided by WSA for management of the ECZ.	Ongoing funding to be provided by WSA for management of the ECZ.	Ongoing funding to be provided by WSA for management of the ECZ.
Has the success of any previous translocation programs relevant to the species being considered been investigated?	Yes See Section 3.3	Yes See Section 3.3	Yes See Section 3.3	Yes See Section 3.3

5. Receiver sites

5.1 Environmental Conservation Zone

Development of WSI will be undertaken in accordance with the Airport Plan. The Airport Plan provides for a Land Use Plan that includes an Environmental Conservation Zone (ECZ) (see Figure 1). The Airport Plan biodiversity conditions require that the suitability of the ECZ as a receiver site for translocated threatened flora is to be considered. The biodiversity conditions also require that a vegetation management plan (VMP) is to be developed as part of the Biodiversity CEMP to guide the activities for managing areas within the ECZ. This includes the replacement of exotic grasslands with suitable native vegetation, rehabilitation of existing remnant and native vegetation and protection of environmental values within the ECZ (see Section 1.3.1).

The ECZ provides a range of potentially appropriate translocation receiver sites for the subject species, given its close proximity to the donor sites, and availability of ecologically and biogeographically analogous sites. While specifications for the first 24 months of post-translocation maintenance will be specified within this Plan, management and maintenance of the translocated populations beyond this period would be included in a future update of the VMP. The planting of existing *ex situ* potted populations in order to achieve the goals of this Plan would also be specified and delivered under a future update of the VMP.

5.2 Site selection

Following inspection of potential threatened flora translocation receiver sites conducted on 4 September 2019, two receiver sites for the proposed translocation works – Willowdene and Badgerys Creek – were identified. The two receiver sites are shown in Figure 4a and b respectively and their characteristics described below.

5.2.1 Willowdene receiver site

It is proposed that the Willowdene receiver site would receive the translocation of all *P. spicata* and *M. viridiflora* subsp. *viridiflora* under this Plan. *P. parviflora* could also be successfully planted at the Willowdene site, however, a closer match for the habitat requirements of this species occurs at the Badgerys Creek receiver site (see Section 5.2.2). The site would also receive the soil seed bank translocation from the occupied habitat of *P. spicata*. A description of the Willowdene transplantation receiver site, with reference to Section 2.2.4 and Table 5, is provided in Table 13.

Table 13 Description of Willowdene transplantation receiver site

Factor	Description
Existing habitat	<p>Good condition Grey Box – Forest Red Gum grassy woodland on flats and fringing Poor condition Grey Box – Forest Red Gum grassy woodland on flats comprising derived native grassland.</p> <p>Good condition areas contain moderate infestations of <i>Olea europaea</i> subsp. <i>cuspidata</i> that would be removed and controlled prior to introduction of translocated plants (see Section 7.3).</p>
Microclimate	Sheltered tree mid-slopes which should minimise frost impacts and provide protection from the heat of direct sunlight.

Factor	Description
Climate projections	Climate projections were not considered. Receiver sites are located in close proximity to donor sites. As such the effect of future climate change upon the translocated populations can be considered as neutral.
Habitat area	The habitat area of the Willowdene transplantation receiver site is approximately 2.45 hectares.
Ecology	Topographic, edaphic, hydrologic and climatic aspects of the Willowdene transplantation receiver site are broadly analogous to that of the donor sites.
Ecosystem function and resilience	<p>Receiver sites are located in close proximity to donor sites. As such it is expected that functional ecological attributes, such as pollination, dispersal vectors and soil microbial interactions will be broadly analogous between the two sites.</p> <p>The Willowdene transplantation receiver site contains a mature remnant canopy cover, relatively high native plant species richness and is expected to have relatively high levels of natural resilience.</p>
Land tenure	The Willowdene receiver site is located within the WSI ECZ. Under the Airport Plan biodiversity conditions, measures must be established to rehabilitate and provide ongoing protection of the biodiversity and environmental values of the ECZ.
Threat management	Principal threats to translocated threatened flora populations within the Willowdene transplantation receiver site include grazing by native and feral herbivores, weed invasion and unmanaged native vegetation biomass. Short-term management of these threats is described on Section 7.3. Ongoing management of these threats would be specified in a future update of the VMP.
Adverse impacts	<p>A total of 507 salvaged <i>P. spicata</i> individuals would be installed in the Willowdene transplantation receiver site. Assuming an impact area of ~0.36 m² per plant, a total of ~182 m² would be directly impacted by the installation of salvaged plants. This direct impact would be balanced by the introduction of native grasses rooted in clods associated with salvaged plants.</p> <p>This Plan is working under the assumption that the proposed transplantation of <i>P. spicata</i> fits under the scope of the Airport Plan to rehabilitate existing remnant and native vegetation within the ECZ, and that the transplantation would not require a 'Listed species and ecological community' permit, nor assessment under the provisions of the EPBC Act.</p>
Access	Willowdene Avenue provides direct access to the Willowdene receiver site. Consideration needs to be given to haulage/vehicle weight restrictions that apply to Willowdene Avenue when resourcing vehicle movements to service translocation works.

The Willowdene *P. spicata* soil translocation receiver site comprises an area of Low condition Grey Box – Forest Red Gum grassy woodland on flats. Vegetation within this zone predominately comprises exotic grass and herbaceous cover intermixed with patchy and variable cover of common native grass and herbaceous species that are tolerant to long periods of medium-high intensity domestic grazing regimes (GHD 2017). The Willowdene *P. spicata* soil translocation receiver site slopes at an approximately 2:1 slope from east to west.

5.2.2 Badgerys Creek receiver site

It is proposed that the Badgerys Creek receiver site would receive the translocation of all *P. parviflora* under this Plan. A description of the Badgerys Creek receiver site, with reference to Section 2.2.4 and Table 5, is provided in Table 14.

Table 14 Description of the Badgerys Creek receiver site

Factor	Description
Existing habitat	<p>Good condition Broad-leaved Ironbark – Grey Box – <i>Melaleuca decora</i> grassy open forest.</p> <p>The areas of the receiver site that form EPBC Act listed Cumberland Plain Shale Woodland and Shale-Gravel Transition Forest are in good condition with low levels of weed cover. Areas towards the eastern and south-eastern boundaries of the receiver site contain increasing densities of exotic perennial grasses, in particular <i>Eragrostis curvula</i> (African Love Grass) that would be controlled in association with works undertaken under a future update of the VMP.</p>
Microclimate	Sheltered, raised undulating flats which should minimise frost impacts and provide protection from the heat of direct sunlight.
Climate projections	Climate projections were not considered. Receiver sites are located in close proximity to donor sites. As such the effect of future climate change upon the translocated populations can be considered as neutral.
Habitat area	The habitat area of the Badgerys Creek receiver site is approximately 5.38 hectares.
Ecology	Topographic, edaphic, hydrologic and climatic aspects of the Badgerys Creek receiver site are broadly analogous to that of the donor sites.
Ecosystem function and resilience	<p>The Badgerys Creek receiver site is located in close proximity to the <i>P. parviflora</i> donor site. As such it is expected that functional ecological attributes, such as pollination, dispersal vectors and soil microbial interactions will be broadly analogous between the two sites.</p> <p>The Badgerys Creek receiver site contains a mature remnant canopy cover, relatively high native plant species richness and is expected to have relatively high levels of natural resilience.</p>

Factor	Description
Land tenure	The Badgerys Creek receiver site is located within the WSI ECZ. Under the Airport Plan biodiversity conditions, measures must be established to rehabilitate and provide ongoing protection of the biodiversity and environmental values of the ECZ.
Threat management	Principal threats to translocated threatened flora populations within the Badgerys Creek receiver site include grazing by native and feral herbivores, weed invasion and unmanaged native vegetation biomass. Short-term management of these threats is described in Section 7.3. Ongoing management of these threats would be specified in a future update of the VMP.
Adverse impacts	A minimum of 250 and up to 500 140 ml potted <i>P. parviflora</i> would be installed in the Badgerys Creek receiver site. A direct impact to existing groundcover of 10-20 m ² would result from the installation of these plants.
Access	The site can be accessed from the decommissioned Gardiner Road via the airport site.

Figure 4a and 4b Receiver sites

6. Translocation program

6.1 Key program dates

Following the assessment provided in Section 3, translocation effort under this Plan will be limited to the salvage and transplantation of 507 *P. spicata*, supplemented by translocation of the soil seed bank within the area of occupied habitat for this species, from the donor population at the airport to the Willowdene receiver site (see Figure 2a and 4a).

The entire known population of *P. spicata* at the airport site occurs west of The Northern Road. A deadline for transplantation and translocation works is to be established by the bulk earthworks contractor responsible for works within the Stage 1 CIZ, against which the translocation timeline provided in Figure 5 will be delivered. The transplantation and translocation may be undertaken at any time prior to the translocation deadline.

A 24 month translocation maintenance period is proposed under this Plan. Following this period, ongoing maintenance to conserve and expand all translocated threatened species populations at the Willowdene receiver site will be continued under a future update of the VMP, as well as plans to install *ex situ* potted collections of the subject species. At the time of writing, a date for delivery of the updated VMP, including management details for the ECZ, had not been established.

6.2 Translocation timeline

A timeline for the salvage and transplantation of *P. spicata* described under this Plan is provided in Figure 5. The translocation timeline assumes that:

- Sufficient resources are available to deliver the specified works.
- The salvage and transplantation and soil translocation will be preceded by a favourable growth period for *P. spicata* (natural or induced).
- That, following an initial 24 month maintenance period under this Plan, maintenance to conserve and expand all translocated threatened species populations at the Willowdene receiver site will be continued under a future updated VMP.

P. spicata salvage and translocation works are to commence immediately following a period of emergence and growth of the species which, under natural conditions, is likely to coincide with a rainfall event(s) (see Figure 5). Based upon field observations, it is likely to take approximately 1 month following a sufficiently good rainfall event for *P. spicata* to show a positive growth response. In the event that sufficient rainfall does not occur prior to the translocation deadline, a simulated rainfall event has been included in the translocation timeline and works specification (see Section 6.4.1). All pre-translocation actions required to undertake the salvage and translocation works should be completed as soon as possible following the approval of this Plan, such that the salvage and transplantation can mobilise as soon as *P. spicata* growth has occurred, whether naturally or as induced by the simulated rainfall event.

The optimal timing for transplantation of *P. spicata* is during early-mid autumn (March-April) while soils are still relatively warm, but the heat of the summer months has past. Ideally, *P. spicata* plants will be beginning a new phase of dormancy following a sustained period of vigorous growth at the time of their salvage. A simulated rainfall event is to be applied to induce *P. spicata* growth if plants are showing above ground growth of less than 5 stems and/or growth of less than 5 cm in height (see Section 7.3 – action ID 1.1.2.3). A simulated

rainfall event is not required if the *P. spicata* plants to be targeted for salvage are exhibiting growth greater than these thresholds.

6.3 Key program risks

Key risks to achieving the goals of the plan, and associated mitigation measures are provided in Figure 6. This risk assessment is directed at the salvage and translocation and soil seed bank translocation of *P. spicata* as these works form the principal output of this Plan. Despite this, a number of the risks assessed apply to all the subject species. In particular, risk item 3.1 is an important consideration for the future establishment of target translocated populations of *M. viridiflora* subsp. *viridiflora* and *P. parviflora*.

The mitigation measures included in Figure 6, and associated actions described in Sections 7.3-7.5, are sufficient to reduce the residual risk of the translocation / translocation to acceptably low levels. In particular, risk item 5.1 (water availability) is a key risk that has the potential to undermine the mitigation strategy for a number of the risk items, and the project as a whole. The translocation / translocation project should not proceed in the absence of a reliable water supply.

It is unlikely that natural rainfall will provide a sufficient or sufficiently predictable water source. Given the scale of the Western Sydney International Airport development and associated on-site water supply, it is anticipated that peak water demands described under this Plan (i.e. including a simulated rainfall event) could be serviced from on-site sources. In the event that insufficient water is available from on-site sources (i.e. the receiver site and/or Western Sydney International Airport), an application should be made to Sydney Water for a water restrictions exemption permit which will allow access to mains water for application at the translocation / translocation project site (see Figure 5 action ID 1.1.1.3 and 1.2.1.4). In the event that no water is reasonably available from on-site sources, and the water restrictions exemption permit is rejected, an alternate source of water should be sought before considering the viability of the project.

6.4 Program contingencies

6.4.1 *P. spicata* condition

The most critical aspect of the translocation timeline relates to whether the *P. spicata* donor population is in a suitable condition at the time of salvage. This is particularly the case if the salvage is happening at the translocation deadline in which case, in the absence of a well-timed natural rainfall event, sufficient forward-planning for a simulated rainfall event (2 months prior to salvage/transplantation) will be required.

The principal contingency to the risk of undertaking salvage and transplantation of *P. spicata* during a period when the donor population is in poor condition due to drought is to postpone the translocation until more favourable growth conditions prevail. The excavation of the area of *P. spicata* occupied habitat at the airport site should be postponed for as long as practicable in order to maximise the chance of the *P. spicata* population experiencing a favourable natural growth period prior to its salvage and transplantation.

If salvage and transplantation of *P. spicata* must proceed prior to the occurrence of a natural favourable growth period, sustained manual watering (simulated rainfall event) of the donor population should be applied in order to stimulate plant growth. The requirement for a simulated rainfall event should be assessed 2 months prior to the salvage transplantation. Application of the simulated rainfall event should commence a minimum of 6 weeks prior to planned salvage and transplantation, and include a 1 week period of sustained watering (see Figure 5 and Section 7.3).

It is likely that the proposed watering regime will promote the required growth response in the target *P. spicata*. At the time of writing, the *P. spicata* population at WSI showed sustained growth 3-4 weeks following an approximately 70 mm rainfall event that occurred over 4 consecutive days, following at least 9 months of below average rainfall.

The area over which a simulated rainfall event would be applied would be minimised in order to minimise water usage. If applied over a (notional) area of 0.25 ha, a depth of 70 mm of water would require the application of a total of 175,000 L (~twelve 15,000 L water carts). This water volume should be considered as the maximum required for a simulated rainfall event, as application of less water over a smaller area may be sufficient to promote the required growth response.

Under a worst case scenario, whereby a simulated rainfall event is ineffective in promoting growth of *P. spicata*, salvage and translocation of all plants previously tagged by ABGMA (at least 100 plants - total numbers and locations to be confirmed with ABGMA) should be undertaken as a minimum translocation effort, to be supplemented by propagation of existing *ex situ* populations (see Section 4 and 6.4.2).

6.4.2 *Ex situ* potted population

In addition to holding existing *ex situ* potted populations of three of the subject species (see Section 1.3.3), ABGMA are currently also commissioned to establish and maintain an additional genetically optimised *ex situ* population of *P. spicata* derived from the airport population. Once established, this additional *ex situ* potted collection may be drawn upon, via engagement of ABGMA, to provide additional *P. spicata* plants for translocation should the translocation population targets set in this Plan not be achieved.

6.4.3 Provenance revegetation

If natural regeneration from the soil seed bank within the *P. spicata* soil translocation receiver site is insufficient or unsuccessful, supplementary planting of provenance native species should be undertaken to establish a native species cover. The requirement for supplementary planting should be assessed by the ecological restoration practitioner in conjunction with monitoring and annual reporting of site works (see Section 7.5).

6.5 Roles and responsibilities

Roles and responsibilities for the works specified under this Plan are provided in Figure 5.

It should be noted that all works directly related to the salvage and translocation and soil seed bank translocation must be overseen and undertaken by a sufficiently qualified and experienced ecological restoration practitioner / company.

6.6 Unexpected finds

In accordance with the Airport Plan biodiversity conditions, any new occurrences of threatened flora found during pre-clearing surveys are to be communicated to the WSA Environment Manager who will notify the Commonwealth Department of Infrastructure, Regional Development and Cities and other external stakeholders. Unexpected finds are to be managed in accordance with the unexpected finds procedure contained in the Biodiversity CEMP.

Figure 5 Translocation timeline - *Pimelea spicata*

Figure 6 Risk assessment – *Pimelea spicata* salvage and transplantation

7. Translocation specifications

7.1 Preliminaries

The translocation specifications and associated action IDs provided in Sections 7.3-7.5 relate directly to the translocation schedule shown in Figure 5. The program sequence provided in Figure 5 should assume that the commencement of a management action is dependent upon completion of those actions preceding it in the program. To assist planning, Figure 5 and Sections 7.3-7.5 are split into pre-translocation, translocation and post-translocation actions. The potential scenario of there being insufficient above-ground *P. spicata* growth to proceed with the salvage and translocation of this species (see Section 6.4.1) occurs during the pre-translocation actions. The management actions specified under this scenario can be omitted from delivery of the Plan if sufficient above-ground *P. spicata* growth is present during the planned delivery of the translocation/translocation.

Ideally, translocation and translocation works should be conducted during March-April when soils are still relatively warm, but the heat of the summer months has passed.

7.2 Preliminary translocation delivery actions

Preliminary translocation action	Objectives	Notes	Responsibility
Appropriately qualified and experienced ecological restoration practitioner	<ul style="list-style-type: none"> Ensure best-practice delivery of translocation and translocation. 	<ul style="list-style-type: none"> The translocation and translocation of <i>P. spicata</i> must be delivered by an appropriately qualified and experienced ecological restoration practitioner. The ecological restoration practitioner should: <ul style="list-style-type: none"> - have extensive previous experience undertaking bushland restoration works within Western Sydney, including verifiable referees. - preferably have past experience conducting threatened plant salvage and translocation, and soil translocation projects. - provide a dedicated internal project manager to manage and oversee all contract works. - provide site supervisor(s) with minimum qualifications and experience, including Certificate III Conservation & Land Management and one year full-time equivalent experience as a trained bush regenerator. 	<ul style="list-style-type: none"> Western Sydney Airport / Bulk earthworks contractor

Preliminary translocation action	Objectives	Notes	Responsibility
		<ul style="list-style-type: none"> - Ensure all bush regeneration crew members undertaking herbicide spray applications hold a current chemicals application training certificate to AQF Level III. 	
Pre-works induction	<ul style="list-style-type: none"> • Provision of bulk earthworks contractor and ecological restoration practitioner with background, context and advice regarding the site, project, target species and Plan. 	<ul style="list-style-type: none"> • Prior to the commencement of the translocation actions, key ABGMA staff involved with the TFPP (see Section 1.3.3) should provide an induction / orientation to the bulk earthworks contractor ecologist and ecological restoration practitioner. 	<ul style="list-style-type: none"> • Western Sydney Airport / Australian Botanic Gardens Mount Annan

7.3 Pre-translocation actions (action ID 1)

Translocation management action (action ID)	Objectives	Notes	Responsibility
1.1 Donor site			
1.1.1 Entire transplantation / translocation site			
1.1.1.1 Soil testing (disease)	<ul style="list-style-type: none"> Identify presence of any soil-borne disease present at the donor site and prevent its dispersal to receiver site. Confirm and deliver appropriate soil sampling regime and analysis. 	<ul style="list-style-type: none"> Analogous testing of soil-borne disease is to be undertaken at the receiver site (transplantation and soil translocation sites) to confirm whether any deleterious disease present at the donor site would be introduced via translocation works, or is already present. If soil-borne disease is identified at the donor but not the recipient site, immediate review of the proposed Plan should be undertaken by the WSA Environment Manager in consultation with relevant experts. 	<ul style="list-style-type: none"> Bulk earthworks contractor or the ecological restoration practitioner.
1.1.1.2 <i>P. spicata</i> digital mapping	<ul style="list-style-type: none"> Provision of GIS data relevant to translocation works to the ecological restoration practitioner. Provide for the location of transplantation / translocation management actions in the field via use of GIS-enabled field devices. 	<ul style="list-style-type: none"> In particular, the point locations of each of the mapped <i>P. spicata</i> clumps should be provided. 	<ul style="list-style-type: none"> Bulk earthworks contractor or the ecological restoration practitioner.
1.1.1.3	<ul style="list-style-type: none"> Confirm sources of equipment, materials and 	<ul style="list-style-type: none"> Consideration should be given to water supply requirements for the duration of the project, including any potential requirement to apply for a water restriction exemption 	<ul style="list-style-type: none"> Bulk earthworks contractor or

Translocation management action (action ID)	Objectives	Notes	Responsibility
Equipment, materials and resources	resources required to deliver <i>P. spicata</i> salvage and soil seed bank translocation.	<p>permit from Sydney Water if there is doubt over whether sufficient water can be supplied from on-site sources (i.e. receiver site and/or Western Sydney International Airport).</p> <ul style="list-style-type: none"> • Following research, investigations and consultation conducted in association with this Plan, it is recommended that an appropriately sized tree-spade is used to conduct salvage of <i>P. spicata</i> as a best-practice approach to transplantation that is likely to maximise success. • Action 1.1.2.1 – Trial plant excavations (I) will provide input regarding the size of tree spade required to conduct the plant salvage and transplantation. • As far as practicable, the size of any plant / machinery utilised to conduct the salvage should be minimised. • When sourcing equipment and materials for the salvage / transplantation, consideration must be given to the process by which salvaged plants will be encased in hessian, containerised, and removed for planting at the receiver site whilst keeping the soil-bound plant root ball intact (see action 2.1.1.2.). • Selection of a truck(s) to deliver translocated topsoil to the Willowdene receiver site must consider road haulage weight limits of Willowdene Ave and other access roads. 	ecological restoration practitioner.
1.1.2 <i>P. spicata</i> transplantation			
1.1.2.1 Trial plant excavations (I)	<ul style="list-style-type: none"> • Confirm breadth and depth of <i>P. spicata</i> root ball to inform approach to salvage and transplantation and equipment required. • Manually excavate and examine underground structures of <i>P. spicata</i> at 	<ul style="list-style-type: none"> • In association with their work on the BODP TFPP (see Section 1.3.3) ABGMA have permanently tagged a large number of <i>P. spicata</i> individuals at the airport site. • If <i>P. spicata</i> plants are reduced to below-ground structures only at the time of trial plant excavations, ABGMA should be consulted regarding excavation of previously tagged plants in conjunction with trial excavations. • No excavation of tagged <i>P. spicata</i> individuals should be undertaken without direct consultation with and the endorsement of ABGMA. • Pre-watering of soils prior to excavation may be required to soften soils. Pre-watering would also provide an indication of the volume/frequency of watering required to 	<ul style="list-style-type: none"> • Ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
	<p>the airport site to provide a clear indication of the plant's underground structures.</p>	<p>penetrate the soil surface to a given depth, and inform any future 'simulated rainfall events' applied during the translocation actions (see Action ID 1.1.2.4).</p> <ul style="list-style-type: none"> • Trial plant excavations should also include assessment of the depth of topsoil at the site, to inform the depth of soil that should be collected for soil seed bank translocation works. • Consideration may be given to the salvage of plants removed during trial excavation. 	
<p>1.1.2.2 Trial plant salvage (II)</p>	<ul style="list-style-type: none"> • Test and refine procedure for salvage of <i>P. spicata</i>. • Maximise chances of successfully salvaging whole <i>P. spicata</i> plants with soil-bound root ball intact. 	<ul style="list-style-type: none"> • Trial salvage should test and refine: <ul style="list-style-type: none"> - excavation of <i>P. spicata</i> from clay soils with soil-bound root ball intact; - encasing of excavated clods in wetted hessian; - containerisation of excavated and wrapped clods for transport. • Excavation of <i>P. spicata</i> should aim to retain soil around the root ball / tap root of each plant as intact at all times in order to minimise disturbance of the plant's root system. • Trial excavations will likely need to be preceded by pre-watering of the excavation area. Consideration should be given to pre-watering each of 2 days prior to trial excavation. • Trial salvage is to be undertaken in conjunction with trial transplantation to the transplantation receiver site. Following completion of trial salvage, salvaged plants should be immediately transported to the transplantation receiver site for trial transplantation (see action ID 1.2.2.2). In association with their work on the BODP TFPP (see Section 1.3.3) ABGMA have permanently tagged a large number of <i>P. spicata</i> individuals at the airport site. • If <i>P. spicata</i> plants are reduced to below-ground structures only at the time of trial plant excavations, ABGMA should be consulted regarding excavation of previously tagged plants in conjunction with trial excavations. • No excavation of tagged <i>P. spicata</i> individuals should be undertaken without direct consultation with and the endorsement of ABGMA. 	<ul style="list-style-type: none"> • Ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
		<ul style="list-style-type: none"> Any irreconcilable issues with the excavation of <i>P. spicata</i> should be referred to the WSA Environment Manager and relevant experts. 	
<p>1.1.2.3 Assessment of simulated rainfall event (Scenario: insufficient <i>P. spicata</i> growth)</p>	<ul style="list-style-type: none"> Determine requirement for manual watering of the area of <i>P. spicata</i> occupied habitat <i>in lieu</i> of natural rainfall. 	<ul style="list-style-type: none"> The action is to be undertaken if airport <i>P. spicata</i> population is exhibiting insufficient growth for optimal plant salvage and transplantation. Assessment of the requirement for creating a simulated rainfall event should occur 2 months prior to the transplantation / translocation deadline, so as to provide for 6 weeks' watering and plant response ahead of the deadline. A simulated rainfall event (see action 1.1.2.4) should be applied if <i>P. spicata</i> plants are showing the following characteristics: <ul style="list-style-type: none"> substantially reduced to underground structures, with no robust above-ground growth, or; exhibiting some recent above-ground growth, but this is limited to <5 stems and/or less than 5 cm in height. Ideally, transplantation actions should be undertaken during the early-mid autumn months, in order to avoid the heat of summer but take advantage of elevated soil temperatures. 	<ul style="list-style-type: none"> Ecological restoration practitioner.
<p>1.1.2.4 Simulated rainfall event (Scenario: insufficient <i>P. spicata</i> growth)</p>	<ul style="list-style-type: none"> Stimulate growth of <i>P. spicata</i> in advance of deadline for salvage and transplantation of the airport population. Simulate rainfall event/s within the area of <i>P. spicata</i> occupied habitat. 	<ul style="list-style-type: none"> Action 1.1.2.4 is only to be undertaken following the determination for its requirement under action 1.1.2.3. Prior to the commencement of the simulated rainfall event, several patches of <i>P. spicata</i> occupied habitat where densities of the species are known to be high, and which are likely to yield growth of more than the target number of individual <i>P. spicata</i> plants should be identified and clearly tagged in the field. The area over which the simulated rainfall event is applied should be confined to ~0.25 ha in order to minimise the volume of water required to be applied. As small an area as possible should be watered. 	<ul style="list-style-type: none"> Ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
	<ul style="list-style-type: none"> • Monitor preferential herbivory within area of manual water application. 	<ul style="list-style-type: none"> • The simulated rainfall event is to be conducted over a six-week, two-staged period: <ul style="list-style-type: none"> - Stage 1: comprising the first week of watering, is to apply thorough repeat watering of the tagged patche(s) of <i>P. spicata</i> occupied habitat every day (i.e. total 5 days watering over a 1 week period). - Stage 2: comprising the final five weeks of watering, is to apply thorough repeat watering of the tagged patches of <i>P. spicata</i> occupied habitat once a week (i.e. total 5 days watering over a 5 week period). • Watering should aim to achieve a field capacity soil moisture level of 25-35% within target areas to a depth of ~100 mm for a minimum period of 1 week. Adequacy of soil wetting should be determined via periodic soil excavation and measurement with a soil moisture meter. • Following soil moisture monitoring and initial growth responses of <i>P. spicata</i>, the remaining watering period and volume of application should be modified as necessary. • There is potential for preferential grazing of vegetation that has been manually watered and this should be monitored. If preferential grazing of watered vegetation is occurring, measures should be put in place to prevent herbivore access to the treatment area. 	
<p>1.1.2.5 Selection and staking of salvage subjects</p>	<ul style="list-style-type: none"> • Provide for an efficient works sequence during <i>P. spicata</i> salvage and transplantation. • Clearly identify target plants in the field prior to salvage and transplantation. 	<ul style="list-style-type: none"> • <i>P. spicata</i> individuals tagged by ABGMA should not be selected and staked for salvage and transplantation, unless in direct consultation with and the endorsement of ABGMA. • The seed of <i>P. spicata</i> is not widely dispersed and falls close to the parent plant. In an attempt to maximise the genetic diversity of the translocated population, individuals selected for salvage and transplantation should be widely spaced and selected from across the area of occupied habitat. <ul style="list-style-type: none"> - N.B. if a simulated rainfall event is applied to promote growth of <i>P. spicata</i>, the salvage area will need to be reduced in order to minimise the volume of water that needs to be applied to promote growth. • As far as is practicable, selected <i>P. spicata</i> Individuals should be: 	<ul style="list-style-type: none"> • Ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
		<ul style="list-style-type: none"> - widely spaced from one another; - drawn from across the area of occupied habitat; - those showing the most robust new growth; - from patches of highest diversity of other native groundcover species; - from patches free of, or with lowest possible cover of, exotic species; - from patches free of invasive noxious and environmental weed species. 	
1.1.3 <i>P. spicata</i> soil translocation			
1.1.3.1 Selection and staking of soil translocation area	<ul style="list-style-type: none"> • Provide for an efficient and targeted works sequence during collection of soils for <i>P. spicata</i> soil translocation. • Maximise quantities of <i>P. spicata</i> seed collected by soil translocation. • Clearly identify the soil collection area in the field in preparation for excavation and collection of topsoils. 	<ul style="list-style-type: none"> • The area of topsoil collection provided below (2.35 hectares) assumes that topsoils at the donor site are ~100 mm deep. If, during assessment under action ID 1.1.2.1 and 1.1.2.2, it is found that topsoil depth at the donor site is substantially less than 100 mm, a larger area of topsoil excavation and collection should be defined, such that ~100 mm of topsoils are spread at the 2.35 hectare soil translocation receiver site. • Selected areas should: <ul style="list-style-type: none"> - provide for ~100 mm of topsoil at the receiver site; - include all areas containing high densities of <i>P. spicata</i>, as indicated by existing digital mapping of the target population and as observed in the field; - include soils from across the known occupied habitat area of <i>P. spicata</i>, including treed and non-treed areas; - contain as high a diversity as possible of native groundcover species; - as far as is practical, avoid areas of relatively high exotic species densities; - as far as is practical, avoid areas containing invasive noxious and environmental weed species. 	<ul style="list-style-type: none"> • Ecological restoration practitioner.
1.2 Receiver site			
1.2.1 Entire transplantation / translocation site			

Translocation management action (action ID)	Objectives	Notes	Responsibility
1.2.1.1 Site fence installation (goat, rabbit, deer proof fence)	<ul style="list-style-type: none"> • Install permanent exclusion barrier to feral herbivores at Willowdene receiver site, to exclude goat, rabbit and deer. • Non-lethal exclusion of all native macropod species from the Willowdene receiver site prior to completion of the perimeter fence. 	<ul style="list-style-type: none"> • Alternate approaches to protection of the transplanted / translocated plant populations (e.g. fencing around translocation sites only, installation of individual plant guards around transplanted <i>P. spicata</i>) may be considered provided they are effective in achieving the goal of feral herbivore exclusion. • Care should be taken to avoid and minimise impacts upon native vegetation during installation of perimeter fencing. 	<ul style="list-style-type: none"> • Western Sydney Airport
1.2.1.2 Feral herbivore control	<ul style="list-style-type: none"> • Eradicate feral herbivores from the Willowdene receiver site. 	<ul style="list-style-type: none"> • Feral herbivore eradication should commence following the completion of the feral herbivore proof perimeter fencing. 	<ul style="list-style-type: none"> • Pest control contractor.
1.2.1.3 Soil testing (disease / chemical / physical)	<ul style="list-style-type: none"> • Confirm presence or otherwise of soil-borne disease at the receiver site. • Identify any chemical or physical limitations of receiver site soils and recommend ameliorants. • Confirm and deliver appropriate soil sampling regime and analysis. 	<ul style="list-style-type: none"> • Analogous testing of soil-borne disease is to be undertaken at the donor site (salvage and soil translocation sites) to confirm whether any deleterious disease present at the donor site would be newly introduced to receiver sites via translocation works, or is already present. • If soil-borne disease is identified at donor but not recipient site, immediate review of the proposed Plan should be undertaken by WSA in consultation with relevant experts. 	<ul style="list-style-type: none"> • Bulk earthworks contractor or the ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
1.2.1.4 Equipment, materials and resources	<ul style="list-style-type: none"> Confirm sources of equipment, materials and resources required to deliver <i>P. spicata</i> transplantation and soil seed bank translocation. 	<ul style="list-style-type: none"> Consideration should be given to water supply requirements for the duration of the project, including any potential requirement to apply for a water restriction exemption permit from Sydney Water if there is doubt over whether sufficient water can be supplied from on-site sources (i.e. receiver site and/or Western Sydney International Airport). 	<ul style="list-style-type: none"> Bulk earthworks contractor or ecological restoration practitioner.
1.2.2 <i>P. spicata</i> transplantation			
1.2.2.1 Primary / secondary weed control	<ul style="list-style-type: none"> Establish favourable establishment and growth conditions for transplanted <i>P. spicata</i>. Complete primary removal and control of major weed infestations within the transplantation receiver site. Commence secondary control of weed growth within the transplantation receiver site. 	<ul style="list-style-type: none"> The aim of the primary weed control is to reduce shading and competition for moisture and nutrient resources within the transplantation receiver site. Principal target species for weed control include (but are not limited to): <ul style="list-style-type: none"> <i>Olea europaea</i> subsp. <i>cuspidata</i> (African Olive) <i>Ligustrum sinense</i> (Small-leaved Privet) <i>L. lucidum</i> (Large-leaved Privet) <i>Nassella neesiana</i> (Chilean Needle Grass) <i>Asparagus asparagoides</i> (Bridal Creeper) <i>Bryophyllum delagoense</i> (Mother-of-Millions) <i>Araujia sericifera</i> (Moth Vine) <i>Ehrharta erecta</i> (Ehrharta) At all times care is to be taken to avoid off-target herbicide damage to native plant species. Following completion of primary weed removal, secondary control of weed species should be undertaken on a monthly basis throughout the transplantation receiver site. Secondary works should aim to maintain the transplantation receiver site in near weed-free condition. 	<ul style="list-style-type: none"> Ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
		<ul style="list-style-type: none"> At all times priority should be given to the consolidation and expansion of native species patches and the minimisation of weed seed set. 	
1.2.2.2 Trial transplantation	<ul style="list-style-type: none"> Test and refine procedure for transplantation of <i>P. spicata</i>. Maximise chances of successfully transplanting whole <i>P. spicata</i> plants with soil-bound root ball intact. 	<ul style="list-style-type: none"> Trial excavations and salvage are to be undertaken in conjunction with trial excavation and salvage from the donor site (see action ID 1.1.2.3). Receiver holes should be excavated at the transplantation receiver site prior to arrival of salvaged <i>P. spicata</i>. Following trial salvage and containerisation of <i>P. spicata</i> from the donor site (see action 1.1.2.2), salvaged plants are to be immediately delivered to the transplantation receiver site for trial transplantation. Transplantation of <i>P. spicata</i> should aim to retain soil around the root ball / tap root of each plant as intact at all times in order to minimise disturbance of the plant's root system. Receiver holes are to be thoroughly watered prior to receiving salvaged <i>P. spicata</i>. A low-nutrient plant establisher product that contains water crystals should also be added to each hole prior to receiving salvaged <i>P. spicata</i>. All transplantations should: <ul style="list-style-type: none"> ensure that the soil level of the salvaged clod sits at or just below the natural soil level. ensure that the receiver hole is thoroughly back-filled. thoroughly water-in the transplanted plant/hole immediately after planting. Any irreconcilable issues with the transplantation of <i>P. spicata</i> should be referred to WSA in consultation with relevant experts. 	<ul style="list-style-type: none"> Ecological restoration practitioner.
1.2.2.3 Transplantation hole excavation and staking	<ul style="list-style-type: none"> Provide for an efficient works sequence during <i>P. spicata</i> salvage and transplantation. 	<ul style="list-style-type: none"> As far as is practicable, receiver holes are to be located within areas of relatively low existing native species understorey cover and diversity. Where practical, receiver holes should be established in clumps of 5-10. As far as practicable, soils excavated from receiver holes should be piled next to holes such that native understorey cover is not smothered. 	Ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
	<ul style="list-style-type: none"> • Prepare receiver holes prior to receipt of salvaged <i>P. spicata</i>. 		
1.2.3 <i>P. spicata</i> soil translocation			
1.2.3.1 Earthworks (soil scalp, landform, dam)	<ul style="list-style-type: none"> • Prepare site for receipt of translocated soils. • Establish site design and controls that will deliver a stable landform following introduction of translocated soils. 	<ul style="list-style-type: none"> • An area of approximately 2.35 hectares (see Figure 4a) is to be scalped of 100 mm of topsoil in preparation for receipt of soil translocation from the <i>P. spicata</i> donor site. • Prior to commencement of excavation works, consideration should be given to optimal site design with regards to maintaining translocated soils <i>in situ</i> at the newly established receiver site. • Consideration should also be given to how establishment and maintenance watering will be applied to the site (see action ID 3.1.1.1). <ul style="list-style-type: none"> - If a water cart is required to apply watering, access paths should be designed so that the carts are not required to drive over translocated soils. - Consideration should also be given to the creation of raised pedestrian access paths upon which translocated topsoil are not spread, from which watering equipment might be laid out. • As far as practicable, any patches of dominant native groundcover around the periphery of the soil translocation receiver site should be retained. • Ideally, if feasible, scalped soils would be removed and utilised offsite. If scalped soils are to be retained at the receiver site they are to be formed into soil berms around the periphery of the soil translocation receiver site. • The farm dam at the bottom of the soil translocation receiver site is to be re-excavated, repaired and re-instated to act as an on-site water source for ongoing maintenance of the soil translocation and <i>P. spicata</i> transplantation. 	<ul style="list-style-type: none"> • Translocation earthworks contractor under the supervision of the ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
1.2.3.2 Site protections (silt fencing)	<ul style="list-style-type: none"> • Prepare site for receipt of translocated soils. • Establish site design and controls that will deliver a stable landform following introduction of translocated soils. 	<ul style="list-style-type: none"> • Prior to commencement of excavation works, consideration should be given to optimal site design with regards to maintaining translocated soils <i>in situ</i> at the newly established receiver site. • Following soil scalping and topsoil introduction, appropriate soil erosion and slumping control and prevention measures should be installed at the receiver site. Stabilisation works should be conducted in accordance with the Soil and Water CEMP. 	<ul style="list-style-type: none"> • Ecological restoration practitioner.
1.2.3.3 Sub-soil amelioration (if required)	<ul style="list-style-type: none"> • Minimise the potential impact of hostile sub-soil conditions on the establishment and growth of plants from the translocated soil seed bank. • Maximise chances of establishment and survival of native plants emerging from the translocated soil seed bank. 	Soil ameliorants should be added to the scalped sub-soils as recommended by the outcomes of chemical and physical sub-soils analysis at the soil translocation receiver site (see action 1.2.1.3).	<ul style="list-style-type: none"> • Ecological restoration practitioner.

7.4 Translocation actions (action ID 2)

Translocation management action (action ID)	Objectives	Notes	Responsibility
2.1 Donor site			
2.1.1 <i>P. spicata</i> transplantation			
2.1.1.1 Soil wetting (assist plant excavation)	<ul style="list-style-type: none"> Maximise chances of successfully salvaging whole <i>P. spicata</i> plants with an intact soil-bound root ball. Provide for efficient progression of plant salvage. 	<ul style="list-style-type: none"> As informed by action ID 1.1.2.2, and depending on the current soil condition, soils around each of the <i>P. spicata</i> plants identified and tagged for salvage and transplantation are to be wetted prior to their excavation, as required. Soil wetting should be undertaken progressively and 2-3 days ahead of the excavation of individual <i>P. spicata</i> plants, corresponding with the period of salvage and containerisation of <i>P. spicata</i> (see action ID 2.1.1.2). 	<ul style="list-style-type: none"> Ecological restoration practitioner.
2.1.1.2 Plant salvage and containerisation	<ul style="list-style-type: none"> Excavate and temporarily pot <i>P. spicata</i> from donor site with intact soil-bound root ball, for transplantation to receiver site. 	<ul style="list-style-type: none"> Plant excavation and salvage is to be undertaken in accordance with the optimum procedure established during action ID 1.1.2.2. All plant, equipment and materials are to be thoroughly cleaned of excess dirt prior to entering the <i>P. spicata</i> donor site, in accordance with Suddaby & Liew (2008). Identified and tagged <i>P. spicata</i> are to be excavated, firmly wrapped with pre-wetted hessian and firmly fitted into plant containers such that the soil-bound root ball of the plant is maintained intact. The location of each salvaged <i>P. spicata</i> individual is to be recorded with a sub-meter accuracy GPS/GNSS. At least one appropriately qualified and experienced ecological restoration practitioner should be present at all times to oversee and direct <i>P. spicata</i> salvage works. All salvaged plants are to be transplanted to the <i>P. spicata</i> transplantation receiver site on the same day as their salvage. 	<ul style="list-style-type: none"> Ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
2.1.1.3 Plant transport to receiver site (same-day transplant)	<ul style="list-style-type: none"> Minimise amount of time salvaged plants spend out of the ground. Maximise chances of survival of salvaged and transplanted <i>P. spicata</i>. 	<ul style="list-style-type: none"> Containerised plants are to be transported to the <i>P. spicata</i> transplantation receiver site and transplanted on the day of their salvage. Care must be taken during transport not to disturb to intact root balls of salvaged plants. 	<ul style="list-style-type: none"> Ecological restoration practitioner.
2.1.2 <i>P. spicata</i> soil translocation			
2.1.2.1 Topsoil excavation	<ul style="list-style-type: none"> Collect topsoils from soil translocation donor site. 	<ul style="list-style-type: none"> Topsoils are to be excavated and collected from the areas identified during action ID 1.1.3.1. Soil scalping to excavate site topsoils (depth determined during action ID 1.1.2.1 and 1.1.2.2) is to be undertaken with machinery determined as most appropriate by the ecological restoration practitioner in consultation with the translocation earthworks contractor. It is expected that collected topsoils will include existing above and below-ground plant matter. 	<ul style="list-style-type: none"> Translocation earthworks contractor under the supervision of the ecological restoration practitioner.
2.1.2.2 Topsoil transport to receiver site (same-day translocation)	<ul style="list-style-type: none"> Minimise amount of time collected soils are stockpiled. Maximise chances of retaining live propagules within translocated soils. 	<ul style="list-style-type: none"> Collected topsoil is to be transported to the soil translocation receiver site on the day of its collection. Delivery of translocated soils is to be undertaken with vehicles/machinery determined as most appropriate by the ecological restoration practitioner in consultation with the translocation earthworks contractor. Selection of a truck(s) to deliver translocated topsoil to the Willowdene receiver site must consider road haulage weight limits of Willowdene Ave and other access roads. 	<ul style="list-style-type: none"> Ecological restoration practitioner.
2.2 Receiver site			
2.2.1 <i>P. spicata</i> transplantation			

Translocation management action (action ID)	Objectives	Notes	Responsibility
2.2.1.1 Transplantation hole preparation	<ul style="list-style-type: none"> Establish a favourable microenvironment for transplant establishment and survival. 	<ul style="list-style-type: none"> Excavated holes intended to receive salvaged <i>P. spicata</i> should be thoroughly watered and plant establisher added ~2 hrs prior to the installation of salvaged plants. 	<ul style="list-style-type: none"> Ecological restoration practitioner.
2.2.1.2 Plant installation	<ul style="list-style-type: none"> Introduction of salvaged <i>P. spicata</i> to transplantation receiver site. Maintenance of intact soil-bound root ball of each salvaged <i>P. spicata</i> individual during transplantation. 	<ul style="list-style-type: none"> Following delivery of salvaged and containerised <i>P. spicata</i> to the transplantation site, <i>P. spicata</i> are to be transplanted to prepared holes in a manner that maintains the soil-bound root ball of each plant as intact. Plants should be installed such that the top surface of each salvaged plant soil clod sits slightly beneath the natural soil level. It should be insured that all soil gaps around the installed plant root ball are backfilled with excavated soils. Installed plants should be gently packing down into the hole following installation. All plants should be thoroughly watered-in following installation. Any remaining soil excavated from the receiver hole is to be thinly spread over the surrounding area such that it does not smother existing native groundcovers in the vicinity. 	<ul style="list-style-type: none"> Ecological restoration practitioner.
2.2.1.3 Survey tagging	<ul style="list-style-type: none"> Facilitate monitoring of plant survival, growth and project success. 	<ul style="list-style-type: none"> Following their installation, the location of each transplanted <i>P. spicata</i> is to be: <ul style="list-style-type: none"> staked with a permanent metal plant survey stake. labelled with aluminium survey tag, securely attached to plant survey stake and imprinted with a survey number. recorded with sub-meter accuracy GPS/GNSS with data recorded including location, plant species and transplantation number. Plant survey stakes are to be installed as close to the base of the plant as possible without risking impact to the taproot. 	<ul style="list-style-type: none"> Ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
2.2.2 <i>P. spicata</i> soil translocation			
2.2.2.1 Topsoil installation	<ul style="list-style-type: none"> • Translocate excavated <i>P. spicata</i> topsoils to prepared receiver site. 	<ul style="list-style-type: none"> • Topsoils collected from the soil translocation donor site are to be deposited directly onto the prepared receiver site. • Deposited soils are to be spread to a depth of ~100 mm across the receiver site. • As far as is practical, any machinery used for topsoil installation should avoid driving over translocated soils. Use of machinery should be limited to bulk spread of deposited soils upon the prepared sub-soil surface only. All fine-level spreading of translocated topsoils should be undertaken manually. • During soil spread, any whole or parts of <i>P. spicata</i> taproots found in the translocated soils should be buried close to the soil surface. 	<ul style="list-style-type: none"> • Ecological restoration practitioner.
2.2.2.2 Watering-in	<ul style="list-style-type: none"> • Bed down translocated soils and stimulate germination and re-sprouting. 	<ul style="list-style-type: none"> • Soil disturbance has the potential to trigger germination from the soil seed bank. Initial watering of the established site may be important for the establishment of any germinated plants, as well as initiate germination itself. • Following its establishment, the soil translocation site is to be thoroughly watered-in. • Thorough maintenance watering should be undertaken every 2 days, for 2 weeks following the site's establishment. 	<ul style="list-style-type: none"> • Ecological restoration practitioner.

7.5 Post-translocation actions (action ID 3)

Translocation management action (action ID)	Objectives	Notes	Responsibility
3.1 Receiver site			
3.1.1 <i>P. spicata</i> transplantation			
3.1.1.1 Water and weed maintenance	<ul style="list-style-type: none"> Establish and maintain transplanted <i>P. spicata</i> population. Prevent establishment of noxious and environmental weed species. 	<ul style="list-style-type: none"> The renovated farm dam is to act as a water source for water maintenance at the transplantation and translocation site. Farm dam water levels should be monitored and topped up from external sources as required. Transplanted <i>P. spicata</i> are to be watered 2 times per week for the first 3 weeks following installation. Subsequent ongoing water maintenance of transplanted <i>P. spicata</i> is to be undertaken as required, dependent upon prevailing climatic conditions and plant health, for a period of 24 months. Secondary and maintenance control of emerging populations of exotic species at the <i>P. spicata</i> transplantation receiver site is to be undertaken every two months, for a period of 24 months. As far as is practical, use of herbicide spray applications for maintenance weed control should be avoided. Maintenance weed control should aim to: <ul style="list-style-type: none"> - maintain the surrounds of transplanted <i>P. spicata</i> as weed free. - consolidate and expand native species patches. - prevent / minimise weed seed set. The frequency of maintenance weed control visits should be increased if the prescribed visitation is insufficient to control weed growth. 	<ul style="list-style-type: none"> Ecological restoration practitioner.
3.1.2 <i>P. spicata</i> soil translocation			

Translocation management action (action ID)	Objectives	Notes	Responsibility
<p>3.1.2.1</p> <p>Water and weed maintenance</p>	<ul style="list-style-type: none"> Establish and maintain native plant species emerging from translocated topsoils. Prevent establishment of noxious and environmental weed species. 	<ul style="list-style-type: none"> The renovated farm dam is to act as a water source for water maintenance at the transplantation and translocation site. Farm dam water levels should be monitored and topped up from external sources as required. Translocated soils are to be watered twice a week for the first 2 months following installation. <ul style="list-style-type: none"> - watering should be undertaken in a manner that minimises trampling of soils within the translocation site. Vehicles should not be driven over the soil translocation site unless dedicated pathways that exclude translocated topsoils have been designed into the site (see action ID 1.2.3.1). Subsequent ongoing water maintenance of transplanted <i>P. spicata</i> and translocated soils is to be undertaken as required, dependent upon prevailing climatic conditions and plant health, for a period of 24 months. If present, control of weed growth upon scalped soil berms should commence in the first month following the completion of soil scalping and translocation. <ul style="list-style-type: none"> - as far as is practicable, weed control efforts on the soil berms should aim to establish a predominately native species cover from species emerging from the soil seed bank. Weed control and maintenance at the soil translocation site should be deferred for as long as possible to avoid trampling of emerging native seedlings. Weed control and maintenance should commence when required to prevent weed seed set, particularly of invasive noxious and environmental weed species. Following commencement of weed control works, maintenance control of emerging populations of exotic species is to be undertaken every month up to 12 months following instalment as required, and then every 2 months from 13-24 months following instalment. As far as is practical, use of herbicide spray applications for maintenance weed control should be avoided. Maintenance weed control should aim to: 	<ul style="list-style-type: none"> Ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
		<ul style="list-style-type: none"> - maintain the surrounds of any emerging <i>P. spicata</i> as weed free. - consolidate and expand native species patches. - prevent / minimise weed seed set. • The frequency of maintenance weed control visits should be increased if the prescribed visitation is insufficient to control weed growth. • In addition to weed control, bush regeneration crews may also need to undertake management of native plant growth if it is smothering emerging <i>P. spicata</i> individuals. • If natural regeneration from the soil seed bank within the <i>P. spicata</i> soil translocation receiver site, as well as upon scalped soil berms, is insufficient or unsuccessful, consideration should be given to supplementary planting of provenance native species to establish a native species cover. The requirement for supplementary planting should be assessed in conjunction with monitoring and annual reporting of site works (see action ID 3.2). 	
3.2 Monitoring & Reporting			
3.2.1 Entire transplantation / translocation site			
3.2.1.1 Translocation Report	<ul style="list-style-type: none"> • Provision of report describing approach to delivery of <i>P. spicata</i> transplantation and soil seed bank translocation. 	<ul style="list-style-type: none"> • Following completion of <i>P. spicata</i> salvage and transplantation, and soil seed bank translocation, a formal translocation report is to be prepared, detailing all works and specific procedures carried out under this Plan, including (but not limited to): <ul style="list-style-type: none"> - methods, results, analysis and recommendations of soil disease, soil chemical and physical analyses and any soil ameliorants applied at receiver sites. - methods and outcomes of trial excavations, salvage and translocation. - the locations of salvaged <i>P. spicata</i> individuals at the donor site (including GIS mapping). - the locations and numbering of translocated <i>P. spicata</i> individuals at the receiver site (including GIS mapping). 	<ul style="list-style-type: none"> • Ecological restoration practitioner / bulk earthworks contractor.

Translocation management action (action ID)	Objectives	Notes	Responsibility
		<ul style="list-style-type: none"> - the <i>P. spicata</i> donor soil seed bank areas. - approach to and outcomes of feral herbivore control and exclusion from the Willowdene receiver site. - approach to and outcomes of weed control. - design of the <i>P. spicata</i> soil translocation receiver site. - condition of <i>P. spicata</i> at the time of salvage, the response to natural rainfall or a simulated rainfall event (as applicable), the timing of all works and prevailing weather conditions at the time of works. - the specific procedures applied for all transplantation and translocation works. - equipment and materials used to deliver the Plan. - specifics regarding consultation undertaken during the course of delivering the Plan. - any problems with delivery of the Plan and how problems were addressed. • The Translocation Report should include photographs of all stages of implementation of the Plan, as well as before-after photos of works wherever applicable. • The Translocation Report should be of sufficient detail and quality that it can be used as a published resource to inform any future threatened species translocations efforts of a similar scope. 	
3.2.1.2 Annual report	<ul style="list-style-type: none"> • Provision of report describing an annual summary of works and monitoring undertaken at the transplantation and translocation sites over the previous 12 months. 	<ul style="list-style-type: none"> • An Annual Report is to be submitted at the end of each of two 12-month periods following the completion of the translocation actions (action ID 2). • The Annual Reports will report on the progress of the threatened species translocation and transplantation, against the goals, objectives and targets described under this Plan. • The Annual Reports are to provide detailed accounts of all works carried out over the previous 12 month period, including (but not limited to): <ul style="list-style-type: none"> - a summary of climatic conditions during the reporting period and influence upon the site. 	<ul style="list-style-type: none"> • Ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
		<ul style="list-style-type: none"> - works / visitation dates. - team sizes. - hours works. - all maintenance works undertaken. - works outcomes. - weed species targeted for control. - details of <i>P. spicata</i> monitoring program (see action ID 3.2.2 and 3.2.3). - observations and site issues. - recommendations. - outcomes of any consultation undertaken. - adaptive management practices in light of the success or failure to promote subject species recruitment. • Annual reporting of the management and monitoring of the <i>P. spicata</i> transplantation and soil translocation receiver sites beyond the 24 month maintenance period described in this Plan is to be undertaken under a future updated VMP for the duration of restoration works in the ECZ. 	
3.2.2 <i>P. spicata</i> transplantation			
3.2.2.1 Survivorship monitoring and minor reporting	<ul style="list-style-type: none"> • Provision of detailed data relating to survivorship of transplanted <i>P. spicata</i>. • Monitoring of Plan objectives (see Section 1.5). 	<ul style="list-style-type: none"> • Plant survivorship and growth should be monitored monthly for the first six months, then every two months for 12 months. Monitoring should then occur at quarterly intervals for the next 2½ years post-transplantation. • Following this if environmental conditions remain stable the monitoring can drop to 6 monthly or otherwise continue at quarterly intervals. 	<ul style="list-style-type: none"> • Ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
		<ul style="list-style-type: none"> - monitoring of <i>P. spicata</i> translocation beyond the 24 month maintenance period described in this Plan is to be undertaken under a future updated VMP for the duration of restoration works in the ECZ. • Each monitoring action should include formal collection of required data on field proformas or similar to provide a clear record of the timing and outcomes of the monitoring action. • The outcomes of the year’s monitoring actions are to be present in the Annual Report, reporting against the goals, objectives and targets under this Plan. • Monitoring will document: <ul style="list-style-type: none"> - survivorship of translocated <i>P. spicata</i>. - vegetative growth of transplanted <i>P. spicata</i> populations. - presence of reproductive structures (flowers and fruit) and seeding of transplanted <i>P. spicata</i>. - presence of any second generation recruitment. - response to disturbance events. - general observations. • Newly recruited <i>P. spicata</i> individuals should be staked with a metal plant survey stake; labelled with an aluminium survey tag, securely attached to plant survey stake and imprinted with a unique plant ID number; recorded with cm-accurate GPS/GNSS with data recorded including location, plant species and unique plant ID. 	
3.2.3 <i>P. spicata</i> soil translocation			
3.2.3.1 Regeneration monitoring	<ul style="list-style-type: none"> • Provision of detailed data relating to regeneration from the translocated soil seed bank. 	<ul style="list-style-type: none"> • Plant regeneration and establishment should be monitored 6-monthly for the 24 month maintenance period under this Plan. 	<ul style="list-style-type: none"> • Ecological restoration practitioner.

Translocation management action (action ID)	Objectives	Notes	Responsibility
		<ul style="list-style-type: none"> • Following the 24 month maintenance period under this Plan, monitoring should continue to be undertaken every six months under a future updated VMP for an additional 36 months. • Each monitoring action should include formal collection of required data on field proformas or similar to provide a clear record of the timing and outcomes of the monitoring action. • The summarised outcomes of the year's monitoring actions are to be present in the Annual Report, reporting against the goals, objectives and targets under this Plan. • Monitoring will document: <ul style="list-style-type: none"> - all native and exotic plant species to have germinated from the translocated topsoils. - cover and abundance of vegetation as determined by survey of two standard 400 m² flora survey plots. - recruitment of <i>P. spicata</i> at the soil translocation site. - every <i>P. spicata</i> individual emerging at the soil translocation site should be monitored in accordance with the procedure described in action ID 3.2.2.1. - response of vegetation to disturbance events. - general observations. • Newly recruited <i>P. spicata</i> individuals should be staked with metal plant survey stake; labelled with an aluminium survey tag, securely attached to plant survey stake and imprinted with a unique plant ID number; recorded with cm-accurate GPS/GNSS with data recorded including location, plant species and unique plant ID. 	

8. References

- ANPSA (2010). *Dillwynia tenuifolia*. Retrieved 10/09/19, 2019, from <http://anpsa.org.au/d-tenu.html>.
- ANPSA (2013). *Marsdenia australis*. Retrieved 10/09/19, 2019, from <http://anpsa.org.au/l-aus.html>.
- ANPSA (2016). *Pultenaea parviflora*. Retrieved 10/09/19, 2019, from <http://anpsa.org.au/p-par.html>.
- Benson, D. and K. L. McDougall (1996). *Ecology of Sydney plant species Part 4: Dicotyledon family Fabaceae*. Cunninghamia. Sydney: Royal Botanic Gardens.
- Bannerman, S. M. and Hazelton, P. A. (1990). *Soil landscapes of the Penrith 1:100 000 Sheet. Penrith soil landscape series sheet 9030*. Sydney: Soil Conservation Service of NSW, 1990.
- Commander, L. E., Coates, D., Broadhurst, L., Offord, C. A., Makinson, R. O. and Matthes, M. (2018). *Guidelines for the translocation of threatened plants in Australia*. Third Edition. Australian Network for Plant Conservation Australia, Canberra.
- Committee, T. S. S. (2016). *Conservation Advice Pimelea spicata spiked rice-flower*. From <http://www.environment.gov.au/biodiversity/threatened/species/pubs/20834-conservation-advice-15072016.pdf>.
- Craigie, V. (2014). *Translocation of Pimelea spinescens - a story of mixed success Vanessa Craigie on behalf of the Pimelea spinescens Recovery Team*.
- Cuneo, Peter., Emery, Nathan., Errington, Graeme., Sherieff, Ahamad. (2018). *Assisted run(a)way: Translocation planning to secure the Bankstown Hibbertia*. Australasian Plant Conservation: journal of the Australian Network for Plant Conservation, Volume 27 Issue 1 (Jun-Aug 2018).
- DEC (2005). *Pimelea spicata Recovery Plan*. Department of Environment and Conservation, Hurstville, NSW.
- DECC (2008). *NSW (Mitchell) Landscapes*. Department of Environment and Climate Change, Commonwealth of Australia.
- DEE (2019). *Pimelea spicata in Species Profile and Threats Database*. Department of the Environment, Canberra.
- DIRD (2016a). *Western Sydney Airport – Airport Plan*. Department of Infrastructure and Regional Development, Commonwealth of Australia, December 2016.
- DIRD (2016b). *Western Sydney Airport – Environmental Impact Statement*. Department of Infrastructure and Regional Development, Commonwealth of Australia, 2016.
- DoE (2019a). *Dillwynia tenuifolia in Species Profile and Threats Database*. Department of the Environment, Canberra, Canberra.
- DoE (2019b). *Pultenaea parviflora in Species Profile and Threats Database*. Department of the Environment, Canberra, Canberra.
- ECOS (2016a). *Warrell Creek to Nambucca Heads Upgrade of the Pacific Highway Threatened Flora Translocation Project Annual Monitoring Report – Year 1*. Mullumbimby NSW 2482.
- ECOS (2016b). *Warrell Creek to Urunga Upgrade of the Pacific Highway Threatened Flora Management Plan*. Mullumbimby, NSW 2482.

- ECOS (2018). *Warrell Creek to Nambucca Heads Upgrade of the Pacific Highway Threatened Flora Translocation Project Annual Monitoring Report – Year 3*. Mullumbimby, NSW 2482.
- Frankham, Richard., Bradshaw, Corey, J. A. and Brook, Barry, W. (2014). *Genetics in conservation management: Revised recommendations for the 50/500 rules, Red List criteria and population viability analysis*. *Biological Conservation*, vol. 170, pp 56-63.
- GHD (2018). *Western Sydney Airport - Stage 1 Biodiversity Assessment Report Addendum*. Prepared on behalf of the Department of Infrastructure, Regional Development and Cities, Commonwealth of Australia, August 2018.
- GHD (2017). *Western Sydney Airport - Stage 1 Development Biodiversity Assessment Report*. Prepared on behalf of the Department of Infrastructure and Regional Development, Commonwealth of Australia, September 2017.
- Hancock, N., Gallagher, R.V. & Makinson, R.O (2014). *Monitoring and prioritisation of flora translocations: a survey of opinions from practitioners and researchers*. Report to the Biodiversity Hub of the NSW Office of Environment & Heritage.
- NPWS (2002). *Interpretation Guidelines for the Native Vegetation Maps of the Cumberland Plain, Western Sydney*. Final Edition. New South Wales National Parks and Wildlife Service, Hurstville.
- OEH (2002). *Marsdenia viridiflora subsp. viridiflora in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith Local Government Areas - endangered population listing*. NSW Scientific Committee - final determination, from <https://www.environment.nsw.gov.au/Topics/Animals-and-plants/Threatened-species/NSW-Threatened-Species-Scientific-Committee/Determinations/Final-determinations/2000-2003/Marsdenia-viridiflora-subsp-viridiflora-endangered-population-listing>.
- OEH (2014). *Framework for Biodiversity Assessment – NSW Biodiversity Offsets Policy for Major Projects*. Office of Environment and Heritage.
- OEH (2019a). "Dillwynia tenuifolia - profile." from <https://www.environment.nsw.gov.au/threatenedspeciesapp/profile.aspx?id=10226>.
- OEH (2019b). *Marsdenia viridiflora subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd, Liverpool and Penrith local government areas - profile*. From <https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10508>.
- OEH (2019c). *NSW BioNet Atlas*. <http://www.bionet.nsw.gov.au/>.
- OEH (2019d). *Pultenaea parviflora - profile*. From <https://www.environment.nsw.gov.au/threatenedSpeciesApp/profile.aspx?id=10715>.
- Offord, C. L. T., Joanne. (2009). *In vitro propagation of Pimelea spicata (Thymelaeaceae), an endangered species of the Sydney region*. *Plant Cell Tissue and Organ Culture* 98(1): 19-23.
- PsRT (2013). *Pimelea spinescens Translocation Protocol (March 2013)*. Melbourne: *Pimelea spinescens* Recovery Team.
- RBGS (2019). *Conservation genetics of Pimelea spicata (Spiked Rice-flower) in support of management and translocation activities*. Royal Botanic Gardens Sydney early draft summarising translocation-related information in support of Western Sydney Airport Biodiversity Offsets Delivery Program, September 2019.
- RBGS (1992). *Further progress report on the ex situ conservation at the Mt Annan Botanic Garden of the Badgerys Creek population of Pultenaea parviflora*. Royal Botanic Gardens

Sydney letter dated 20 February 1992 to Infrastructure Planning Group, Department of Transport and Communications.

Suddaby, Therese and Liew, Edward (2008). *Best Practice Management Guidelines for Phytophthora cinnamomi within the Sydney Metropolitan Catchment Management Authority Area*. Botanic Gardens Trust, Royal Botanic Gardens Sydney, June 2008.

TSSC (2008). *Commonwealth Listing Advice on Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest*. Threatened Species Scientific Committee, Department of the Environment, Water, Heritage and the Arts. Canberra, ACT.

Tozer, M.G., Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P., & Cox S. (2010). Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. *Cunninghamia* 11: 359–406.

Appendix E

Bush Fire Management Plan



Western Sydney Airport

**Bushfire Risk Management Plan of
WSA Controlled Land 2020 - 2022**

2021



**Western
Sydney
Airport**

Document status

Version and Title	Purpose	Prepared by	Approved by	Date
1.0 Badgerys Creek Bushfire Risk Management Plan 2015-16 and 2016-17 Financial Year	Update Badgerys Creek Bushfire Risk Management Plan from 2002 following transfer of site management responsibilities from Aviation and Airports Division to the Western Sydney Unit in 2015	Environment and Land Use Planning Section; Communications, Environment and Legal Branch; Western Sydney Unit	General Manager, Communications, Environment and Legal Branch Western Sydney Unit	November 2015
2.0 Western Sydney Airport Site at Badgerys Creek Bushfire Risk Management Plan 2017	Update Badgerys Creek Bushfire Risk Management Plan 2015-2016 and 2016-17 Financial Year to reflect advice received from Rural Fire Service on 15 December 2016 and take account of the commencement of implementation phase of the Western Sydney Airport project	Director, Site Integration and Transition Section	General Manager, Communications, Environment and Legal Branch Western Sydney Unit	Updated 20 December 2016 Approved 20 January 2017
3.0 Western Sydney Airport – Bushfire Risk Management Plan 2018 - 2020	Update the 2017 Plan to reflect the impact on bushfire management and RFS access to site as a result of: <ol style="list-style-type: none"> 1. the move to WSA management of the site 2. the proposed construction activities 3. the proposed Fire Trail standards to be implemented by 2020 	Principal Construction Surveillance Manager	Construction Manager	
4.0 Western Sydney Airport – Bushfire Risk Management Plan 2018 - 2020	Update the plan to reflect the activities associated with the Early Earthworks	WSA Co	General Manager, Communications, Environment and Legal Branch Western Sydney Unit	September 2018
5.0 Western Sydney Airport – Bushfire Risk Management Plan 2018 - 2020	Update the plan to reflect the activities associated with the construction of the Visitors Centre and Site Accommodation and Material Importation and remove outdated information	WSA Co	General Manager, Communications, Environment and Legal Branch Western Sydney Unit	December 2018
5.1	RFS consultation	WSA		September 2019
5.2	Updated to address comments and annual review	WSA	S Reynolds	November 2019
6.0 Western Sydney Airport – Bushfire Risk Management Plan 2020 – 2022	Refinement covers WSA Controlled land – the 600Ha.	WSA	Tony Cummings	September 2020

Version and Title	Purpose	Prepared by	Approved by	Date
7.0	Comments from stakeholders consultation - CEMP review for Terminal Works	WSA	Tony Cummings	

Information sources

Source

Macarthur Bush Fire Management Committee (2012) Bush Fire Risk Management Plan (still current)

Available at: http://www.rfs.nsw.gov.au/__data/assets/pdf_file/0017/2393/Macarthur-BFRMP.pdf

WSA Documents including:

- Environmental Management Plan
- Construction Environmental Management Plan(s)
- Construction Plans and Scheduling

NSW Rural Fire Service

Strategic Fire Trail Network paper & Fire Trail Standards - August 2017

WSA / GHD Master Engineering Design Services *Draft Bushfire Resilience Report* April 2020

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1. Introduction

1.1 Background

Originally, the Badgerys Creek Bush Fire Risk Management Plan (the Plan) was prepared by the Western Sydney Unit (WSU) of the Department of Infrastructure and Regional Development for the Western Sydney Airport (WSA) site. The Plan was an interim strategy to address bushfire risks associated with the management of the site only, which require mitigation and response actions. The Plan was intended to sit within the broader context of the *Macarthur Bushfire Risk Management Plan*, prepared by the Macarthur Bush Fire Management Committee.

Subsequent iterations of the Plan have taken into account a greater understanding of the site, its inherent conditions and the changing nature of the works being performed as well as consultations with all relevant stakeholders and local authorities.

The Bushfire Risk Management Plan in all its iterations did not address bushfire risks associated with the development of the site or construction and future operations of an airport. In July 2015, as part of the Western Sydney Airport Environmental Impact Statement (EIS), a Bushfire Risk Assessment was conducted for airport operations. The responsible authority would prepare any required plans for the airport in future following the grant of a lease to an Airport Lessee Company.

In late 2017 WSA Co was established with the objective of the design, construction and operation of Western Sydney Airport. Subsequently in May 2018 WSA assumed responsibility of the site in the lead up to the commencement of construction activities. In assuming control of the site WSA has taken responsibility for bushfire management and relationships with the Rural Fire Service (RFS) and will ensure the bushfire management and mitigation plan is up to date and reflects the changing site conditions generated by the construction activities and into the future, the final operations as a functioning airport.

This latest iteration prepared by WSA in consultation with specialist consultants addresses pertains to the 600Ha currently controlled by WSA:

- a. The known fire conditions
- b. Future-proofing the Plan to consider the changing construction activities and the changed levels of responsibility associated with the appointment of contractors to complete the various packages
- c. The requirements of the RFS proposed fire trail standards

1.2 Aims and objectives

The aim of this Plan is to identify and define the levels of bushfire risk within the site boundary and from / to adjoining properties. This Plan also aims to minimise the adverse impacts of bushfires on the local community and environment through implementation of the bushfire risk management activities identified in Section 3. The objectives of the Plan are to:

- Meet the **obligations** of a large landowner under the *Rural Fires Act 1997*, and under the Macarthur Bush Fire Risk Management Plan;
- **Reduce the risk** of bushfire damage to life, property and the environment on the site and adjoining lands (see discussion in Section 2) through the use of appropriate bushfire risk management strategies (Section 3);
- **Manage fuel** to reduce the rate of spread and intensity of bushfires, while minimising environmental impacts (Section 3);
- Develop and communicate a variety of plans and maps – **bushfire prone lands, hydrant maps and updated fire access and fire trail plans**;
- Ensure relevant people **understand** their bushfire management responsibility, including the local community through the Western Sydney Airport updates; and
- Provide for effective **monitoring** of bushfire risk management strategies to ensure protection and conservation of the site.

1.3 Scope of the Plan

1.3.1 Description of the Badgerys Creek site

The scope of this plan is the Commonwealth owned land at Badgerys Creek in New South Wales, which was proclaimed as the Western Sydney Airport site in August 2015 and covers approximately 1800 hectares, with this version of the plan pertaining specifically to the approx. 600 Ha for which WSA has control as at September 2020. The operation of this Plan will be undertaken in alignment and cooperation with the Project Contractors Bushfire Management Plan to ensure there is a consistent approach to management and emergency response.

The site is located approximately 50 kilometres west of the Sydney central business district and is within the Liverpool local government area and the Macarthur Bush Fire Management Committee (BFMC) area. The Nepean River and the Greater Blue Mountains area lie to the west of the site. The landscape consists mostly of large areas of grassland related to the past agricultural uses of the site, with patches of forest and shrub vegetation.

Until 2014 there were around 200 short-term residential rural and commercial leases within the site. Land uses of the site in the past have included grazing, horse agistment, a winery, a shop, a piggery, duck farming, quarrying, irrigation, landfilling and market gardens. The majority of the individual properties were approximately two hectares or greater in size.

Following the Australian Government's announcement in April 2014 that the site for a Western Sydney airport would be Badgerys Creek, all leases were gradually terminated with no tenants remaining on site at the time WSA assumed control.

In 2018, the newly established company, Western Sydney Airport (WSA) Co assumed responsibility for the site. In doing so, WSA also became responsible for the management of risks associated with bushfires on the site.

In early 2020 with the commencement of Bulk Earthworks Construction on the airport site, responsibility for the bulk of the site moved to the appointed contractor and WSA remained

responsible for approximately 600 hectares. This iteration of the Plan relates to this WSA controlled land – Figure 3 and shown in yellow.

Refer to Figure 1 for site location, Figure 2 for site layout plan and Figure 3 details the WSA controlled land specifically covered by this plan.

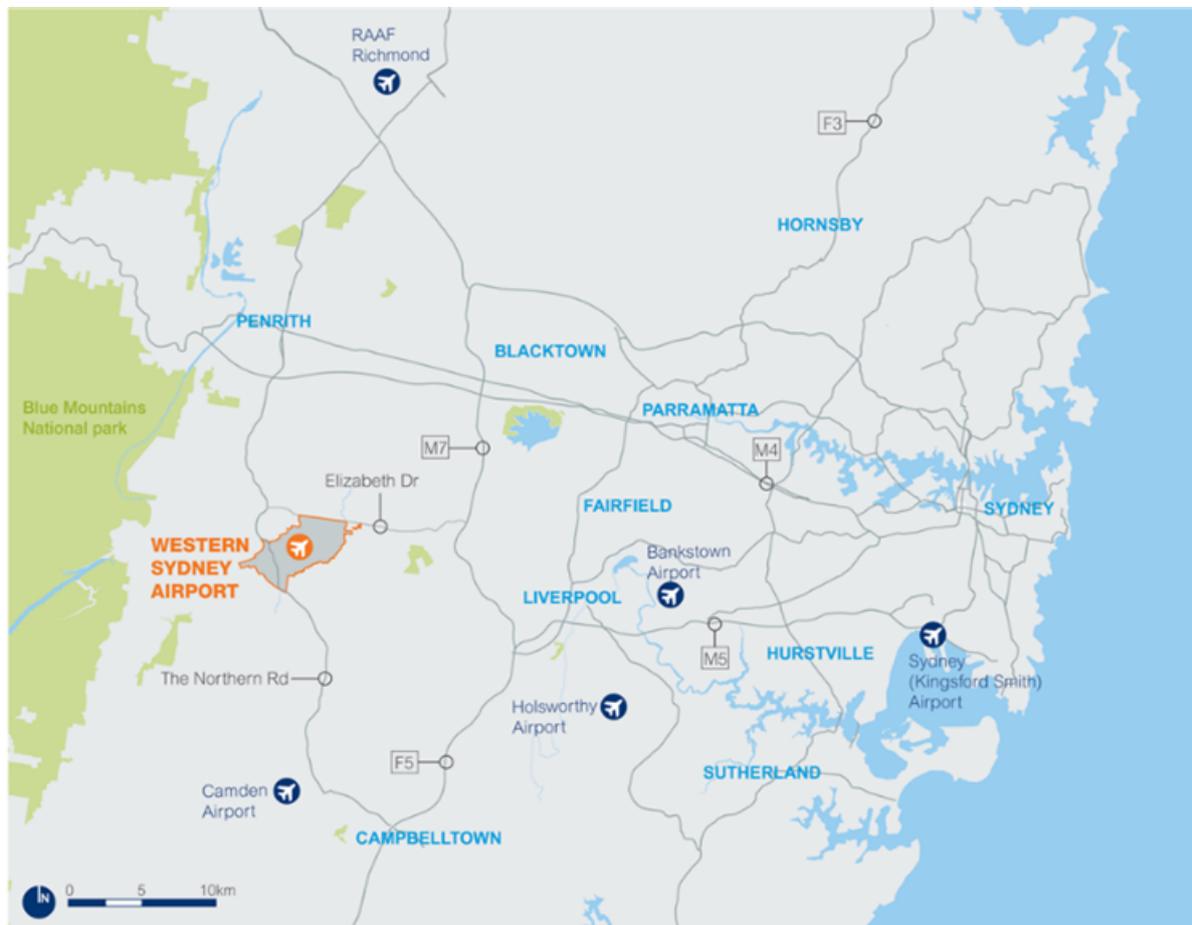


Figure 1 Western Sydney Airport site location plan

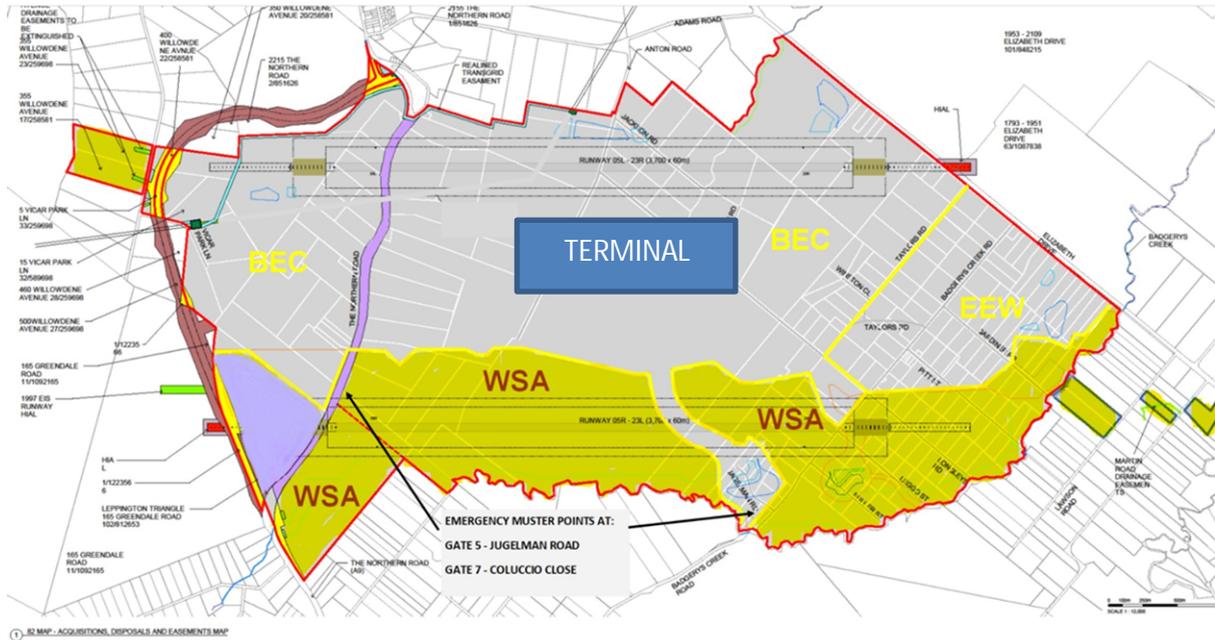


Figure 3 Site map of WSA controlled land – marked up in yellow

1.3.2 Climate and bushfire season

The Badgers Creek site typically experiences warm to hot conditions and the bushfire season usually runs from October to the end of March. However, it is worth noting that in recent years the nominated bushfire season has been extended with earlier starts or later finishes. During this period, the area experiences strong south-westerly to north-westerly winds and high daytime temperatures. The main sources of ignition have been through thunderstorm activity (dry electrical storms), accidental ignition, escaped and intentionally lit fires (arson).

In the summer of 2019 / 2020 the bushfire season commenced earlier than previous years across NSW with devastating bushfires impact across the regions. The airport site whilst not directly impacted by the fires, operations were on alert to take action as required. The fires came within approx. 6kms of the site, to the west, in the Warragamba region. In consultation with RFS, it has been identified that the coming years will see the official bushfire season extended. This Plan will be subject to review with input from the RFS and the impending results of the Bushfire Royal Commission, which was instigated following the devastating bushfires of 2019 / 2020.

2. Bushfire Risk

2.1 What is bushfire risk?

Bushfire risk is the chance of a bushfire igniting, spreading and causing damage to assets valuable to the community, including land, residential development and items of heritage and natural significance (Macarthur BFMC, 2012). Bushfire is an established natural hazard within this landscape and can occur across parts of south-western Sydney frequently during the summer months. The Macarthur BFMC area, in which the WSA site is located, experiences an average of 417 bushfires annually, of which around five develop into major fires (Macarthur BFMC, 2012). The last major fires to burn near the WSA site occurred in 2001 and 2002, where fires under adverse westerly winds resulted in significant property and stock losses.

Prolonged dry conditions, hot temperatures, and low humidity during spring, summer and early autumn are experienced regularly at the WSA site. In the years leading up to the 2019 / 2020 fire season climatic conditions and droughts were at their worst during recorded history. Along with wind, these climate features contribute significantly to the behaviour of a fire (such as increasing the chance ignitions will hold, quicker build-up time and rate of spread, quicker curing and increased combustibility of grass fuels, and higher intensity and spotting potential). The correlation between very dangerous fire weather conditions, major wildfire events, and long hot dry periods is strong.

The *Bush Fire Risk Management Planning Guidelines* and Australian/New Zealand Standard AS/NZS 4360: 2004 *Risk Management* were used as a basis for the risk assessment process. A bushfire hazard exists where there is fuel in the form of vegetation, including grass, scrub, bushes and trees. The risk arising from the hazard depends on factors including:

- **Fuel:** The initial development of a bushfire depends largely on the availability of fuel. The type and arrangement of vegetation are factors in determining how a fire will behave. Fuel reduced areas, mown areas, bare or wet ground will reduce the intensity of a bushfire.
- **Ignition sources:** Includes both natural sources and those that are caused by deliberate activity.
- **Topography:** The slope of land will affect the speed and intensity of fire. Some aspects will also receive increased exposure to the drying effects of sun.
- **Climate:** Including humidity, temperature, wind and rainfall. High temperatures can make fuel more susceptible to ignition. Wind can increase the intensity and rate of spread of fire.

2.2 Bushfire Risk Assessment: identifying the site assets and risks

Current and near future assets within the site that have been and continue to be at risk from bushfire include:

- Livestock (present risk)
- Areas within and around the boundary of the airport site that face on to internal and external roads (present risk)

- Fencing – currently being finalised (present risk)
- Identified areas of threatened or significant flora, including land which has been utilised for translocation activities – Willowdene Avenue property (present risk);
- Aboriginal Cultural Heritage sites (present risk)
- Experience Centre and Office Accommodation (present risk)
- Badgerys Creek Road and supporting infrastructure (present risk)
- Transgrid transition sites x 2 – Northern and Southern
- Identified Environmental Conservation Zone (ECZ) – primarily located adjacent to wetlands including Badgerys Creek and Oaky Creek (present risk)

2.2.1 Environmental significance

An environmental assessment of the WSA site was conducted and an EIS publicly released on 15 September 2016 and provided to the Minister for the Environment and Energy for consideration alongside the draft Airport Plan. On 11 November 2016 the Minister for the Environment and Energy provided environmental protection advice to the Minister for Urban Infrastructure, who announced on 12 December 2016 that he had determined the Airport Plan, incorporating all the environment conditions advised by the Environment Minister. The finalised EIS and Airport Plan can be found at <http://westernsydneyairport.gov.au/environment/index.aspx> and should be referred to for a full assessment of environmental significance.

The EIS recognises that the WSA site is composed of gently undulating, low hills on shale and broad flats on alluvium on the Cumberland Plain. The site features remnant patches of grassy woodland and narrow corridors of riparian forest within extensive areas of derived grassland, cropland and cleared, developed land. Across the site, the condition of native vegetation is generally poor, and there is moderate to severe weed infestation.

The EIS identified that notwithstanding the generally poor condition of the airport site, it has high conservation significance due to the presence of threatened species and ecological communities and the generally limited extent and quality of similar environments in the Western Sydney region. The activities that could be undertaken to manage the Site were extremely limited whilst the EIS was being developed. With the finalisation of this assessment process including environmental protections in mid-December 2016, further management actions have been progressed and will continue. NOTE: Mitigation activities have been undertaken for many years in conjunction with the Rural Fire Services (RFS) – state and local levels.

2.2.2 Aboriginal and European Heritage

No heritage values consistent with World Heritage or National Heritage listing were identified within the WSA site. However, the EIS identified items of indigenous heritage significance and of European heritage significance within the WSA site.

The EIS identified 74 artefact occurrences of indigenous heritage significance within the WSA site. Included are two items which fall within the scope of this plan namely: one possible Aboriginal scarred tree, situated on the creek line (and north east boundary of the site) and grinding stones. Each item has been fenced to allow both segregation and protection.

A total of 20 European and other heritage items of local significance were identified within the boundary of the site, including cemeteries, the local primary school, and several homesteads dating to the turn of the century.

Mitigation measures for the management of these items, including preparatory activities were undertaken and completed by the Department, and are detailed in the Aboriginal and European and Other Cultural Heritage CEMPs.

2.2.3 Experience Centre and Site Accommodation

The Eaton Road compound of the Airport is located adjacent to the Luddenham shops near The Northern Road and is within 2 kms of the local Rural Fire Services brigade.

Assets:

1. The site consists of two major assets / buildings – The WSA Experience Centre and Site Office.
2. Supporting infrastructure in terms of roads, parking areas and fences.
3. Landscaping – the design, layout and planting has been designed to offer a low impact in terms of additional fuel on which a bushfire could spread. Grassed areas have been installed and are maintained immediately adjacent to the assets.

The risks and mitigation measures for the Eaton Road compound are outlined in the following sections.

2.3 Bushfire Risk Assessment: analysing/assessing/evaluating the site risks

In recognising the assets at 2.2, the potential impact of a bushfire on these assets has been considered. For all assets, this involved consideration of:

- Assessing likelihood and consequences of a bushfire occurring and impacting these assets
- Fire history of the region
- Ignition cause and patterns
- Known fire paths
- Access routes
- Containment potential and
- Potential fire run

Consequence and likelihood ratings were used to identify the level of risk. The risk assessment for current and near future assets can be found at **Appendix 1: Asset Register**.

Once the risk ratings were identified, these were evaluated to identify appropriate risk level assessment, where treatment was required and treatment priorities. The bushfire risk ratings were used to prioritise the risk treatments.

In addition to considering the key assets on the site the overall likelihood factors were considered. The identified likelihood factors are contained in **Appendix 2: Risk Assessment**.

2.4 Activities likely to generate sparks

All Contractors working on the airport site have the potential to generate sparks and create a source of fire when undertaking certain activities. These activities are summarised in Table 1.

Table 1 Activities likely to generate sparks

Activity	Mitigation Measures
Smoking	<p>Ignition management – no smoking (including e-cigarettes) on site except at designated areas. Dedicated butt disposals at each location.</p> <p>Hazard reduction – fuel on site will be managed on an ongoing basis, reducing ignition sources.</p> <p>Preparedness – Not required as smoking is banned on site, except in designated areas.</p>
Plant maintenance	<p>Ignition management – Hot works permit to be completed on a case by case basis, assessing the risk of fire and setting appropriate mitigation measures</p> <p>Hazard reduction – fuel on site will be managed on an ongoing basis, reducing ignition sources. Contractors will not undertake cutting, welding or grinding on total fire ban days. Exemptions will be considered where an application for exemption has been approved by the RFS or where exemptions are gazetted. Where exemptions are granted then the works must take place in an area at least 50m away from an ignition source and appropriate firefighting controls are in place.</p> <p>Preparedness – Fire extinguishers available on all plant and equipment and in areas where maintenance is conducted.</p>
Driving on site	<p>Ignition management – Vehicles will not be driven or idled in areas of long grass on fire ban days or after prolonged periods of dry weather.</p> <p>Hazard reduction – fuel on site will be managed on an ongoing basis, reducing ignition sources. During periods of fire bans, all entry points into the site are to be shut to prevent unauthorised vehicle access and torching.</p> <p>Preparedness – Fire extinguishers available on all plant and equipment. Regular communication with Fire Services on changes to fire trails and water sources. Site Monitoring Protocol as detailed in Appendix G.</p>
Other Hot works	<p>Ignition management – Hot works permit to be completed on a case by case basis, assessing the risk of fire and setting appropriate mitigation measures</p> <p>Hazard reduction – fuel on site will be managed on an ongoing basis, reducing ignition sources. Contractors will not undertake cutting, welding and grinding on total fire ban days, unless the works takes place in an area at least 50m away from an ignition source and appropriate firefighting controls are in place.</p> <p>Preparedness – Fire extinguishers available on all plant and equipment.</p>

3. Bushfire Treatments (mitigation and management strategies)

3.1 Bushfire Procedures

In the event of a Bushfire occurring on or threatening the site, any personnel on site should respond by raising the alarm in accordance with communicated procedures, to emergency services and any other onsite personnel immediately and where it is safe to do so.

3.2 Bushfire management zones

Bush Fire Management Zones were identified and mapped within the site, identifying the fire management intent for each specific area, refer Table 2. The four categories of Bush Fire Management Zones are:

- Asset Protection Zone
- Strategic Fire Advantage Zone
- Land Management Zone
- Fire Exclusion Zone

Maps in Appendix 3: *Bushfire Management Zones* sets out the Asset Protection Zones within the site (these areas identify the European and Aboriginal heritage items on the site – it is worth noting that the European Heritage items have been documented and removed from site) and the Strategic Fire Advantage Zones within the site (these areas identify where low intensity hazard reduction activities can occur).

All areas that are not mapped or described as an Asset Protection Zone or a Strategic Fire Advantage Zone are considered to be a Land Management Zone. Table 2 describes these zones and their purposes.

A series of bushfire trails have been created on the site. These provide quick, unobstructed access within the site. The map at Appendix 4: *Badgerys Creek Bush Fire Trails* sets out:

1. the bushfire trails on site which should be used to allow rapid emergency access and egress in event of a bushfire
2. access gates across the site including location of internal gates
3. meeting points to coordinate escorted access for RFS as required
4. GIS coordinates for all trails, access and meeting points

This map will be reviewed and updated as site conditions change or at least annually. This map and future revisions will be supplied to the RFS.

Other bushfire risk management and mitigation activities implemented include the extension of fire breaks; hay baling and stock grazing to reduce fuel load, removal of contaminated waste and other rubbish which maybe illegally dumped on the site, and further bushfire risk assessment and

emergency response activities. The maps at Appendix 4: *Livestock & Hay Baling* identifies areas of the site where hay baling and livestock grazing is conducted.

Table 2 Bush Fire Management Zones: Purpose, objectives and characteristics

Zone	Purpose	Suppression Objective(s)	Zone characteristics
Asset Protection (APZ)	Protect human life, property and highly valued public assets and values.	Enable safe use of Direct Attack suppression strategies ¹ within zone and minimise impact on undefended assets.	Refer to NSW RFS's 'Standards for Asset Protection Zones' for further information.
Strategic Fire Advantage (SFAZ)	<ul style="list-style-type: none"> • Provide strategic fire protection advantage areas to reduce speed and intensity of bush fires and reduce potential for spot fires to develop. • Aid containment of wildfires to existing management boundaries. 	<p>Improve likelihood and safe use of:</p> <ul style="list-style-type: none"> • Parallel Attack suppression strategies² within the zone, and/or • Indirect Attack³ (back burning) in high to very high fire weather conditions within the zone. <p>Reduce likelihood of:</p> <ul style="list-style-type: none"> • Crown fire⁴ development within the zone and/or • Spot fire ignition potential from the zone. 	<p>Factors such as:</p> <ul style="list-style-type: none"> • Topography • Aspect • Spotting propensity • Location of adjacent firebreaks • Mosaic pattern of treatment • Assess overall fuel hazard once vegetation communities reach minimum fire thresholds within this plan. <p>Management practices should aim for mosaic fuel reduction patterns so majority of the zone has an acceptable overall hazard.</p>
Land Management (LMZ)	Meet relevant land management objectives in areas where Strategic Fire Advantage Zones are not appropriate.	<ul style="list-style-type: none"> • As per land management and fire protection objectives of the responsible land management agency. • Reduce likelihood of spread of fires. 	Undertake mosaic slashing as appropriate to achieve land management objectives such as heritage, biodiversity and/or fire protection objectives.
Fire Exclusion (FEZ)	To exclude bush fires.	N/A	Zone characteristics vary depending on the size of the fire sensitive area requiring protection.

¹ Direct Attack - any treatment applied directly to burning fuel such as wetting, smothering, or chemically quenching the fire or by physically separating the burning from not burned fuel. This includes the work of fire engines, fire personnel and aircraft applying water or fire retardant directly to the burning fuel.

² Parallel Attack - where crews construct a fireline at some distance from the edge of the fire and then *burn out* the fuel in the buffer as the fireline is completed.

³ Indirect Attack – is a preparatory suppression tactic carried out a distance away from the oncoming fire. These include fuel reduction activities, establishment of firelines, backburning activities and wetting unburnt fuels.

⁴ Crown Fire - a fire that advances from the top-to-top of trees or shrubs more or less independently of a surface fire.

3.3 Bush Fire Management Treatments

Bush fire management treatments are undertaken on an ongoing basis to reduce the overall bushfire risk within the area near the site. Five broad strategies are available for this Plan to treat the bushfire risk. The types of asset specific treatments which can be applied are set out in Table 3:

Table 3 Bush Fire Management Strategies: Purpose, objectives and characteristics

Strategy	Targeted treatments
1. Ignition Management	<ul style="list-style-type: none"> • Roadside Vegetation Management: prevents ignition and inhibits the spread of any fire. This can occur through mowing or slashing as appropriate • Roadside firebreaks: maintain firebreaks along the roadside to provide access for fire services; implement containment lines and to reduce the spread of fire. • Vegetation Inspections and Management: prevent bushfires across the site including those associated with power infrastructure. • Restrict Vehicle Access: prevent unauthorised access to site (interface) with gates, locks and barrier fencing and associated liaison with NSW Police Force.
2. Hazard Reduction	<ul style="list-style-type: none"> • Strategic Fire Advantage Zone Management: maintain identified SFAZ by mowing, mechanical slashing, hay baling, cattle grazing as appropriate. • Land Management Zone Management: maintain identified LMZ in accordance with relevant Fire Management Plans. • Rubbish accumulation: continually monitor and remove accumulated or dumped rubbish.
3. Community Education	<ul style="list-style-type: none"> • Community Engagement: communicate bushfire hazards to all stakeholders interacting with the site including neighbours and the community at large.
4. Property Planning	<ul style="list-style-type: none"> • Pre-Incident Planning: undertake pre-incident planning regimes as identified. Regular liaison with relevant authorities. • Once assets such as EC/SO established, revised plans to be developed and communicated to relevant stakeholders.
5. Preparedness	<ul style="list-style-type: none"> • RFS and Fire & Rescue NSW Operational Pre-Incident Planning / Protocols: Consultative processes in place to ensure maximum understanding pertaining to items including the following: <ul style="list-style-type: none"> • adequate response and recorded information for assets identified at risk • access / egress points including internal gates • regular liaison with relevant authorities. • the bushfire trails on site which should be used to allow rapid emergency access and egress in event of a bushfire • meeting points to coordinate escorted access for RFS as required • GIS coordinates for all trails, access and meeting points • any other information to facilitate the effective management of bushfires and associated activities

Strategy	Targeted treatments
	<ul style="list-style-type: none"> Establish regular meetings and working parties with all first responders.

3.4 Implementation of Treatments

The bushfire mitigation and management strategies discussed above have been and will be implemented according to Appendix 6 – *Treatment Register*. Environmental and heritage assets of the site will be considered as this Plan is implemented.

3.5 Site Access Protocols

Site Access Protocols for all WSA controlled land govern all access to the site and must be followed by any person entering the site for any purpose at any time. They are at Appendix 6 – *Site Access Protocols*.

3.6 Road Closures & Site Security

As areas within the site have become vacant over time and the various construction packages have commenced, all internal roads are now closed to public access. Where roads are used for site access (eg Pitt Street), secured gates have been installed to maintain site security.

For reference at Appendix 8 is the current site map detailing access points and gates – both WSA managed as well as BEC and Terminal managed gates.

3.7 Monitoring and review of Bushfire Risk

The management of the site, in particular its risk of bushfire (and therefore this Bushfire Risk Management Plan), is monitored on an ongoing basis by WSA. WSA's proactive management of the site aims to ensure:

- all relevant stakeholders are aware of their bushfire management responsibility
- the plan is effective in reducing the risk of bushfires
- the plan remains current over the period which it is in place, in terms of current and near future site activities, assets and infrastructure.

Appendix 1: Risk Assessment

Risk assessment likelihood definitions

Likelihood level	Definition
Almost certain	<ul style="list-style-type: none"> The impact is expected to occur in most circumstances.
Likely	<ul style="list-style-type: none"> The impact will probably occur in most circumstances.
Possible	<ul style="list-style-type: none"> The impact will probably occur at some time.
Unlikely	<ul style="list-style-type: none"> The impact could occur at some time.
Rare	<ul style="list-style-type: none"> The impact may only occur in exceptional circumstances.

Risk matrix

Likelihood	Consequences				
	Insignificant	Minor	Moderate	Major	Extreme
Almost certain	<ul style="list-style-type: none"> Significant 	<ul style="list-style-type: none"> Significant 	<ul style="list-style-type: none"> High 	<ul style="list-style-type: none"> High 	<ul style="list-style-type: none"> High
Likely	<ul style="list-style-type: none"> Moderate 	<ul style="list-style-type: none"> Significant 	<ul style="list-style-type: none"> Significant 	<ul style="list-style-type: none"> High 	<ul style="list-style-type: none"> High
Possible	<ul style="list-style-type: none"> Low 	<ul style="list-style-type: none"> Moderate 	<ul style="list-style-type: none"> Significant 	<ul style="list-style-type: none"> Significant 	<ul style="list-style-type: none"> High
Unlikely	<ul style="list-style-type: none"> Low 	<ul style="list-style-type: none"> Low 	<ul style="list-style-type: none"> Moderate 	<ul style="list-style-type: none"> Moderate 	<ul style="list-style-type: none"> Significant
Rare	<ul style="list-style-type: none"> Low 	<ul style="list-style-type: none"> Low 	<ul style="list-style-type: none"> Low 	<ul style="list-style-type: none"> Moderate 	<ul style="list-style-type: none"> Moderate

Asset Register of current and near future assets

Asset / Location	Location	Type	Threat	Vulnerability	Likelihood (Likely, Almost certain, Possible or Unlikely)	Consequence (Minor, Moderate, Major or Catastrophic)	Risk (Low, Medium, High, Very High or Extreme)	Treatment Number
Aboriginal site, various locations	Various locations & 2 primary sites along Badgerys Creek	Heritage/Cultural - Aboriginal significance	Medium	High	Low	Moderate	Medium	1
Threatened Flora and various locations	Various locations	Environment / Endangered	Medium	High	Low	Moderate	Medium	2
Experience Centre and Site accommodation	Eaton Road, Luddenham	Commercial / Infrastructure	Medium	High	Low	Moderate	Medium	1/4/5
Badgerys Creek Road (new)	Badgerys Creek Road between Badgerys Creek (south) and Elizabeth Drive (north)	Infrastructure	Medium	High	Low	Moderate	Medium	1/2/4/5
Willowdene Avenue – translocated endangered flora	345 Willowdene Ave, Luddenham	Environment / Endangered	Medium	High	Low	Minor	Medium	1/2/4/5
ECZ – various locations	Badgerys Creek, Oakey Creek	Environment / Endangered	Medium	High	Low	Minor	Medium	1/2
Transgrid – Northern & Southern Transition Points	2 locations	Power infrastructure	Medium	High	Low	Medium	Medium	1/2/4/5
Livestock - cattle	Various locations	Commercial	Medium	High	Low	Minor	Medium	1

Identified likelihood factors and their risk

All construction activities will significantly reduce vegetation cover, these include:

1. Early Earth Works (EEW) – September 2018
2. Experience Centre & Office accommodation – mid 2019
3. Bulk Earthworks Construction (BEC) - late 2019 (enabling activities) & construction activities early 2020 (bulk earthworks)
4. Terminal – June 2021

All areas of the site, including uncleared areas, will be subject to restricted access – vehicle and personnel to reduce the risk of ignition sources.

Likelihood factors	Risk Rating	Risk Description	Mitigation measures
Vegetation cover in the surrounding landscape	Moderate	The site adjoins areas of rural-residential subdivision and agricultural enterprises which contain grass and woodland vegetation. The Blue Mountains National Park to the west contains large areas of thick vegetation in which a fire can develop and spread from.	This risk could be reduced through community consultation (including consultation with and conducted by the Liverpool, Penrith and Wollondilly councils) on the importance of being bushfire aware and the required mitigations to reduce the potential of a bushfire. Additionally, this could be extended to the recent increased awareness programs conducted by the NSW Rural Fire Service (RFS).
Vegetation cover within the site	Moderate	The 600 Ha is comprised of existing pastoral / rural land with extensive grasslands and wooded areas as well as the natural bushland of and adjoining the identified ECZs – Badgerys Creek and Oakey Creek. The grass and woodland vegetation are capable of supporting a bush or grassfire which may burn across Badgerys Creek.	The measures currently in place include: <ol style="list-style-type: none"> 1. Strategic reduction of grass fuel and fine-fuels (slashing and mowing) within the site including along the site boundaries and adjacent to areas where people work or the public may congregate. 2. Contracts to allow for hay baling and cattle grazing as appropriate for further fuel load reduction measures. 3. Establishment and maintenance of agreed fire trails and access / egress points across the site.

Likelihood factors	Risk Rating	Risk Description	Mitigation measures
		Unmanaged grass and woodland fuel can enable grassfires to spread and then potentially move off-site and impact peri-urban areas of Bringelly, Badgerys Creek and Kemps Creek. These areas contain fire sensitive agricultural assets including vegetable gardens, poultry farms and stables.	
Proximity of woody / bushland vegetation on surrounding lands	Moderate	The site is adjacent to woody vegetation in some areas and on some occasions is only separated by narrow breaks. The proximity of adjoining grass and woodland fuel can enable direct fire spread into the site along a number of boundaries. Adjoining vegetation also provides a means by which a fire may be able to move off-site.	The measure currently adopted is strategic reduction of grass fuel and fine-fuels (slashing and mowing) along those boundaries which adjoin vegetation hazard.
Spotting and ember attack potential of vegetation	Moderate	The vegetation surrounding parts of the site may facilitate spotting and ember attack. Long distance spotting, as has occurred previously, may also result from fires burning under adverse conditions in the Blue Mountains National Park to the west.	The measure currently adopted is strategic reduction of grass fuel and fine-fuels (slashing and mowing) within the site and adjacent to assets. Risks to assets which adjoin vegetation hazards may be reduced through the creation and maintenance of asset protection zones and appropriate operational preparedness actions.

Likelihood factors	Risk Rating	Risk Description	Mitigation measures
		Vegetation retained within the site may be susceptible to spotting and ember attack, igniting spot fires within the site.	
Land management practices on adjoining land	Moderate	The site is predominantly surrounded by rural residential areas and agricultural enterprises which include patches of woody vegetation which may not be frequently hazard-reduced. The removal of grazing and agricultural enterprises may result in an increase in fuel load across the adjoining land, significantly elevating bush and grass fire risk above historic levels.	The measure currently adopted is strategic reduction of grass fuel and fine-fuels (slashing and mowing) within the site and along the site boundaries.
Topography and access within and surrounding the site	Low	Topography surrounding the site is relatively flat and access is not restricted. On the site this risk may move into the MEDIUM class where access trails and roads across former agricultural properties fall into disrepair (through erosion, revegetation or tree fall) and access is restricted from current levels. Where access is restricted for responding fire crews, initial bushfire attack may be delayed, potentially enabling a fire to	<p>The site will be managed to ensure that open access is preserved across the site, through maintaining a clearance area around the fire trails (marked on Appendix 4). This will enable the responding fire crews to access all parts of the site in the event of a fire ignition.</p> <p>The bushfire trails will be maintained in accordance with RFS requirements and regulations. Bushfire trail maps (including names) and gate numbers will be provided to local fire authorities. There is ongoing liaison between the site and emergency services authorities in particular the NSW Police and NSW Rural Fire Service.</p> <p>Regular inspections and Maintenance conducted with obstructions removed.</p>

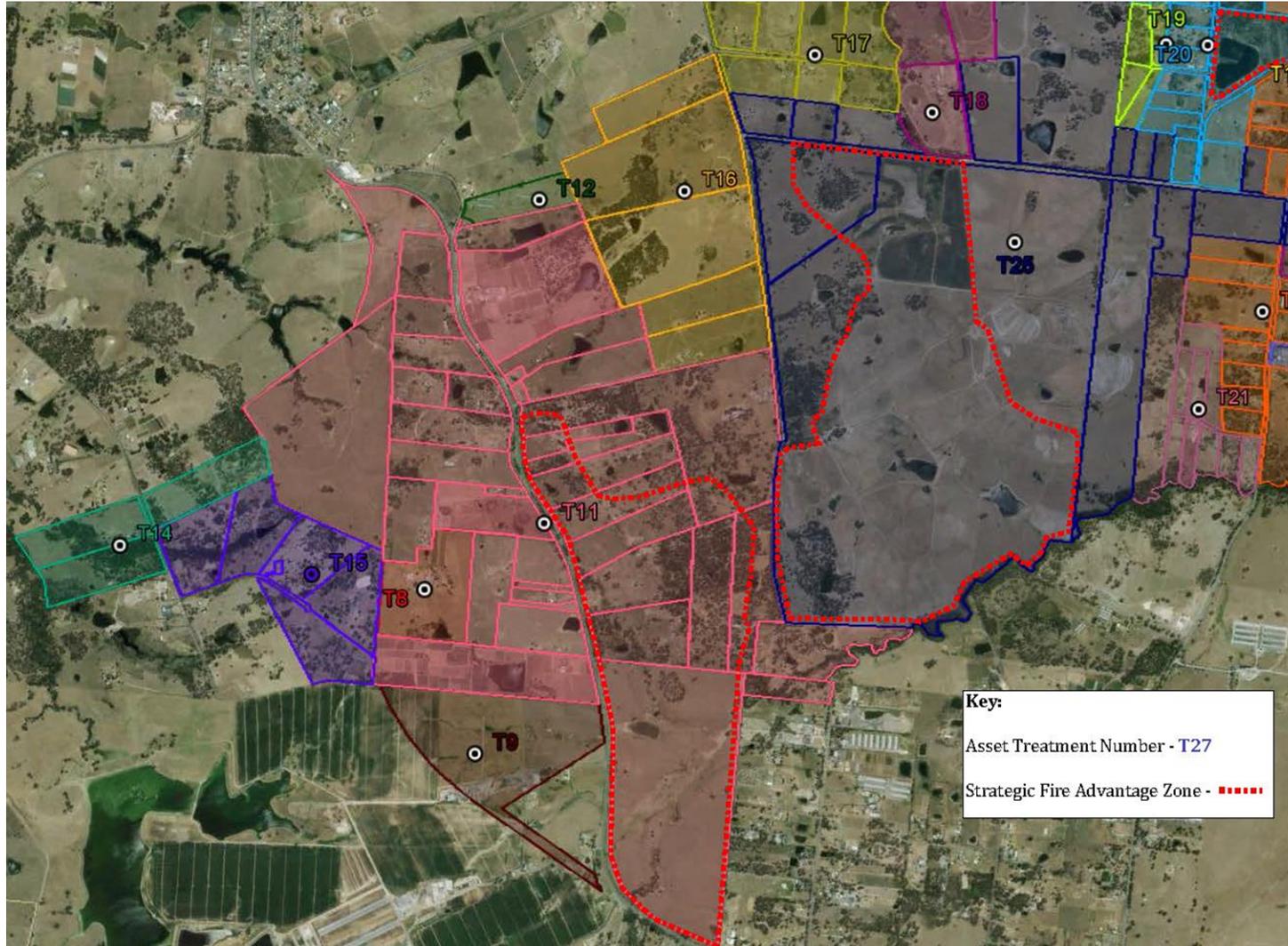
Likelihood factors	Risk Rating	Risk Description	Mitigation measures
		develop into an uncontrollable size before control actions can be applied.	
Potential ignition sources within and surrounding the site	Moderate	<p>The site has a history of ignitions on or adjoining the site (from an annual to a decadal occurrence).</p> <p>The departure of residents and agricultural enterprises has not seen an increase in unauthorised and illegal ignitions at the site, as was predicted.</p>	<p>This risk will be reduced through active management strategies (fencing, the closure of internal roads and fuel reduction through slashing, spraying and mowing) reducing the opportunities for arson and unauthorised use of the site.</p> <p>A Site Security Services contract is in place to ensure randomised security patrols of the site. Security patrols are increased in times of higher likely risk, for example in school holidays.</p> <p>The significant increase in site activities associated with the construction is an additional deterrent to unauthorised access and activities across the site.</p>
Detection of new ignitions	Low	<p>New ignitions will be quickly detected in western Sydney due to the sites' proximity to residential areas and main roads.</p> <p>This risk has been highest during the pre-construction phase and is expected to reduce during construction phases, with the lowest risk likely during the operational phase.</p>	<p>This risk will be reduced through the site security patrols described above and the regular site visits of the Site team</p> <p>The existing arrangements with local Rural Fire Service crews provides appropriate emergency fire response.</p> <p>Construction activities will see a significant increase in people on site and the detection of any fires will be rapid with appropriate responses.</p>
Local fire response capacity	Low	The site is located in an urban/rural residential area and firefighting resources are located nearby – Warragamba, Kemps Creek,	<ul style="list-style-type: none"> This risk factor is reduced through the maintenance of clear access trails across the site, to enable responding fire crews to access all parts of the site in the event of a fire ignition.

Likelihood factors	Risk Rating	Risk Description	Mitigation measures
		<p>Bringelly and Luddenham as the closest.</p> <p>Site access trails and roads across former agricultural properties which fall into disrepair (through erosion, revegetation or tree fall) and restricted access may restrict access for responding fire crews.</p>	<ul style="list-style-type: none"> • Fire trails retained are clearly signposted and are suitable dimensions and load capacity for access by all RFS vehicles. • Trail maps (including names) and gate numbers are provided to local fire authorities and prepared in consultation with NSW RFS senior staff. • In late 2019 the fire trails were assessed and the vehicles categorised and subsequently included in this revision. The updated map has been provided to RFS HO, local brigades and their Captains. • September 2020 – fire trails have been reviewed in keeping with this Plan and the land controlled by WSA.
Local fire at the Eaton Road Complex	Low	<p>The facility is located in an urban/rural area and fire suppression resources have been installed in the buildings on site.</p> <p>Landscaping surrounds the establishment and is maintained regularly.</p> <p>Designated smoking areas have been established</p>	<ul style="list-style-type: none"> • Landscaping – there has been extensive use of mulch / bark to cover a significant area of the site in an effort to minimise grasses which could aid in the spread of any fire. To minimise the effect the mulch may have on the spread of a fire a landscaping company has been retained to ensure grass and weed management are monitored and actioned accordingly. • Buildings - whilst the buildings and the materials do not present a significant risk, the fire systems have been significantly upgraded to improve water pressure by the installation of large water tanks. • To minimise ignition to mulch and other points of ignition <ol style="list-style-type: none"> a. Smoking will be in one designated area on site which is removed from any areas of potential ignition. Cigarette butt containers will be used and maintained under cleaning / maintenance contracts. b. All hot works on site will be only conducted in accordance with established procedures and all subcontractors will be subject to prestarts outlining these requirements. Contractors will not undertake cutting, welding or grinding on total fire ban days. Exemptions will be considered where an application for

Likelihood factors	Risk Rating	Risk Description	Mitigation measures
			<p>exemption has been approved by the RFS or where exemptions are gazetted. Where exemptions are granted then the works must take place in an area at least 50m away from an ignition source and appropriate firefighting controls are in place.</p>

Reference: *Western Sydney Airport Environmental Impact Statement (EIS): Bushfire Risk Assessment*, September 2015, GHD.

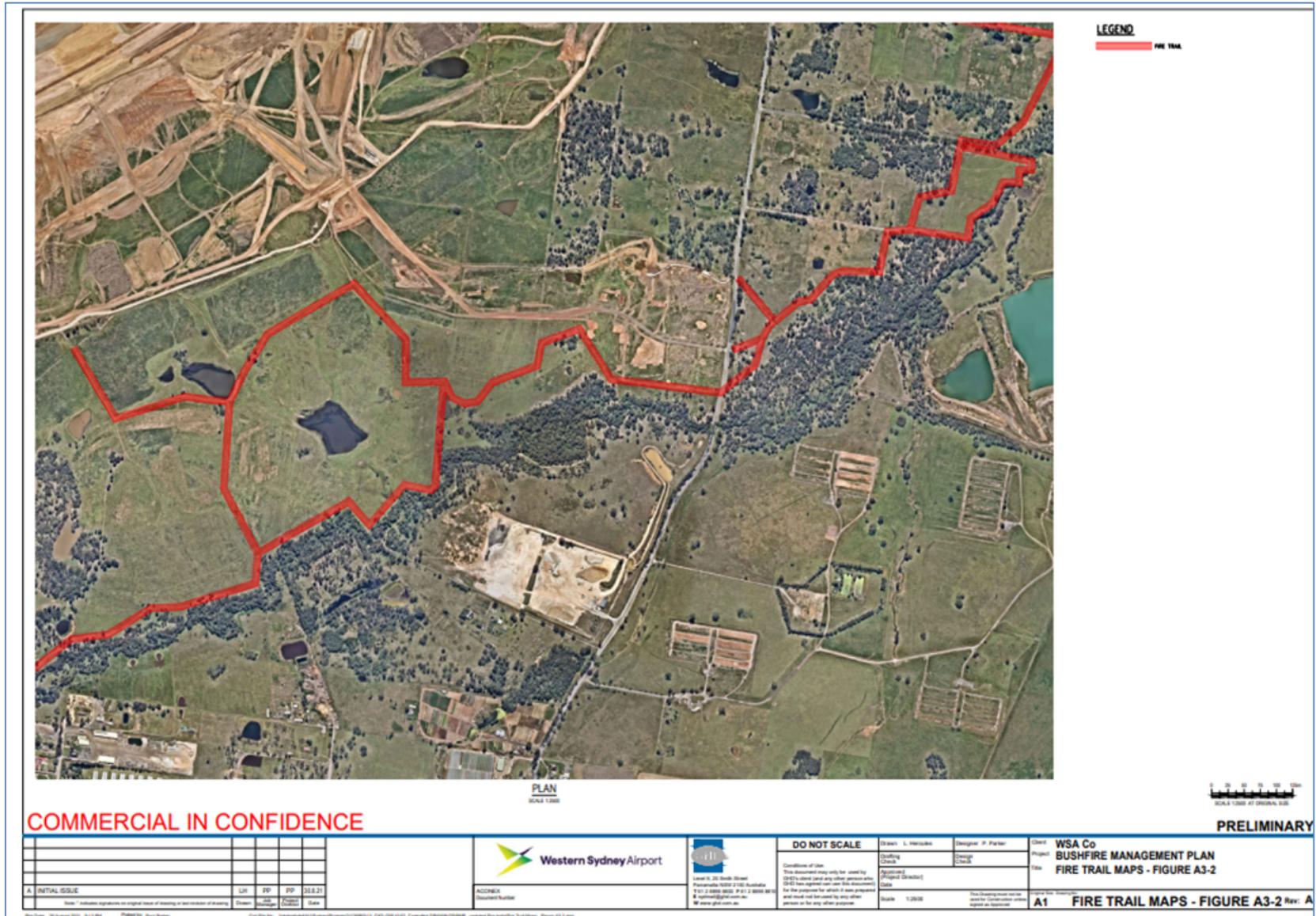
Appendix 2: Bush Fire Management Zones

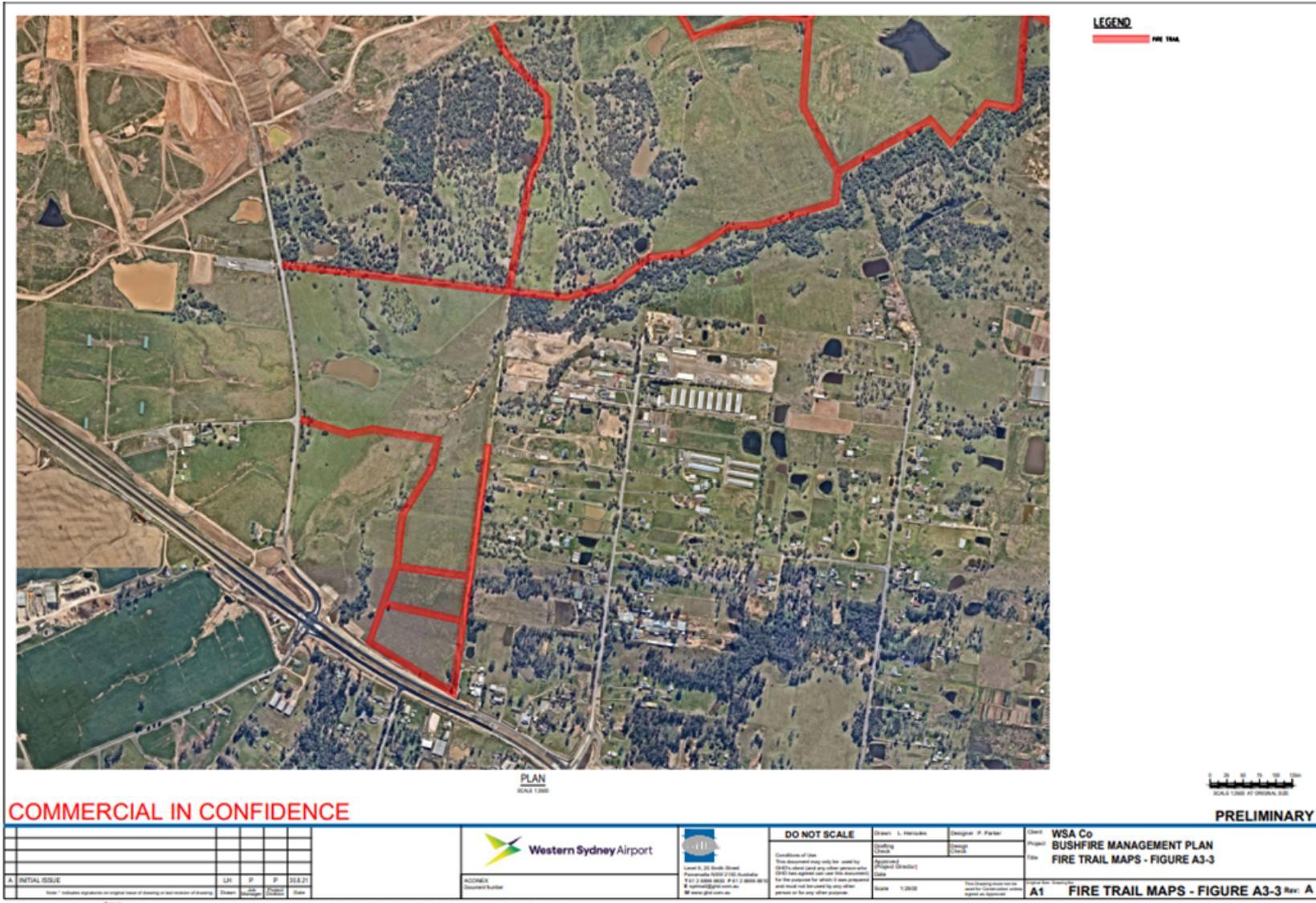


Appendix 3: Fire Trails Map

The following maps detail the fire access points and subsequent trails which have been established to allow RFS the ability to fight bushfires on site. The currently established trails / roads are shown in red and identified new trails which will be established in late 2020 are shown in blue. The maps are indicative and will be socialised with local RFS Captains and fully developed maps involving RFS Office personnel will be developed and included by December 2020.



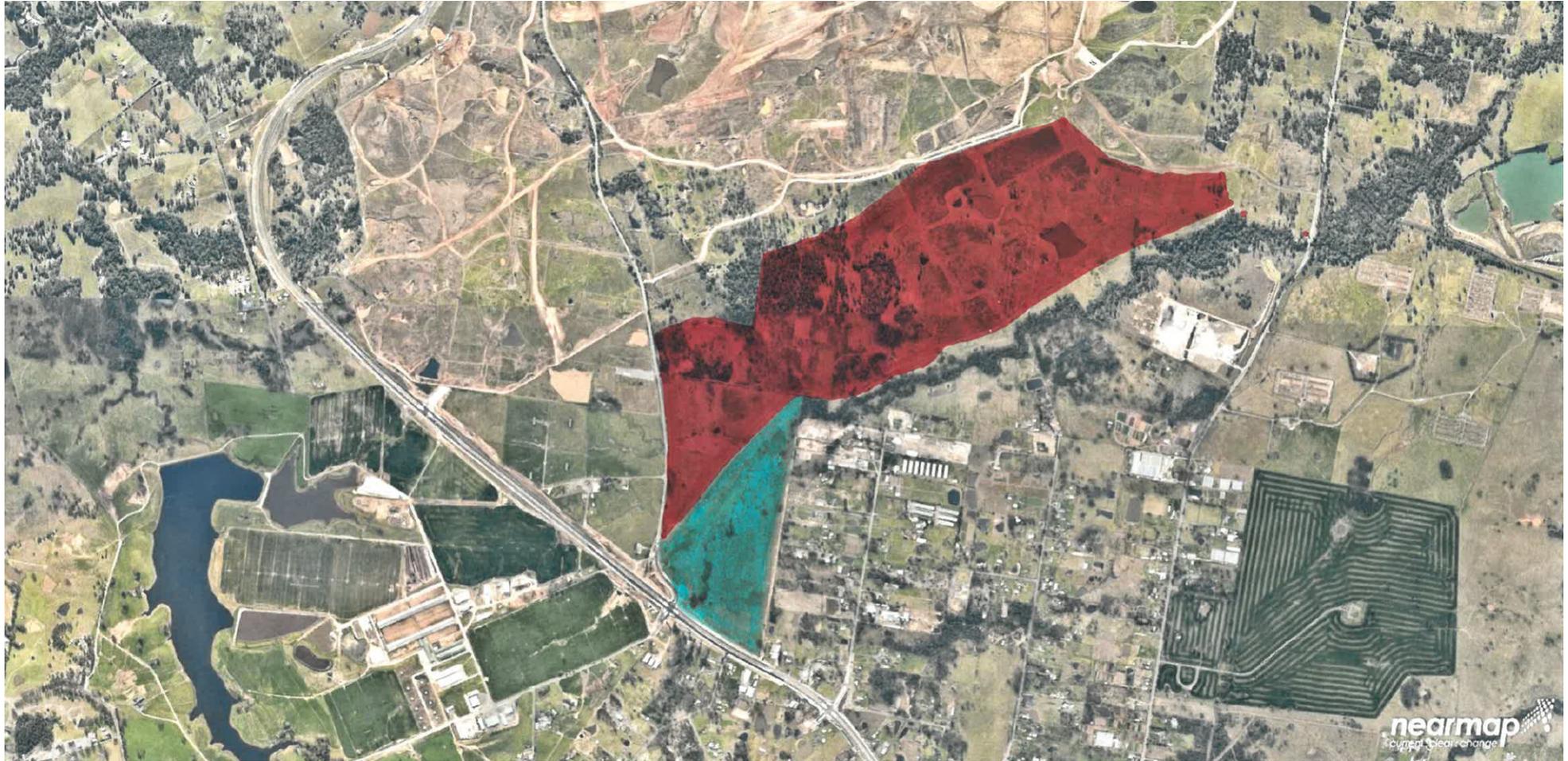




Appendix 4: Livestock & Hay Baling maps

The following maps detail the areas of the 600Ha which have been identified for fuel reduction activities of livestock grazing (shown in red) and hay baling (shown in blue).





Appendix 5: Treatment Register for current and near future assets

To protect all assets on site both currently and into the near future there are a number of consistent activities which will be required. These actions include (but not limited) to the following:

- Construction Contractors:
 - No smoking on-site except at designated areas.
 - All works involving a fire source to have a hot works permit in place with specific controls to prevent risk of a fire.
 - Supply of water to be available at all times for firefighting purposes. Supply points will be communicated with local firefighting authorities.
 - Emergency response procedure to be implemented and detailed in an Emergency Management Plan.
 - Contractors will not undertake cutting, welding or grinding on total fire ban days. Exemptions will be considered where an application for exemption has been approved by the RFS or where exemptions are gazetted. Where exemptions are granted then the works must take place in an area at least 50m away from an ignition source and appropriate firefighting controls are in place.
 - All entry points into the site are to be shut to prevent unauthorised vehicle access and torching.
 - Site Access Protocol as detailed in Appendix 6.
 - Site Condition Monitoring Protocol – Appendix 8
- RFS will be consulted to assist and provide professional advice to WSA and other relevant stakeholders as required.
- WSA will be responsible for hazard reduction and ignition management of vacant properties, community education and assist in the preparedness for residents in the local community.
- Liverpool City Council will provide services in hazard reduction and ignition management of roadside and public areas.

Table 1: Treatment register

Treatment Number	Asset / Location	Strategy (Community Education, Hazard Reduction, Ignition Management, Preparedness or Property Planning)	Action (Slashing, mowing, back burning)
1	Aboriginal site, various locations	Community education, hazard reduction, ignition management, preparedness	Slashing and mowing as required
2	Threatened Flora, various locations	Community education, hazard reduction, ignition management, preparedness	Slashing and mowing as required

Treatment Number	Asset / Location	Strategy (Community Education, Hazard Reduction, Ignition Management, Preparedness or Property Planning)	Action (Slashing, mowing, back burning)
3	Experience Centre/ Site Accommodation	Community education, hazard reduction, ignition management, preparedness Construction Site offices	Slashing and mowing as required
4	Badgerys Creek Road (new)	Community education, hazard reduction, ignition management, preparedness	Slashing and mowing as required
5	Willowdene Avenue – translocated endangered flora	Community education, hazard reduction, ignition management, preparedness	Slashing and mowing as required
6	ECZ – various locations	Community education, hazard reduction, ignition management, preparedness	Slashing and mowing as required
7	Transgrid – Northern & Southern Transition points	Community education, hazard reduction, ignition management, preparedness	Slashing and mowing as required
8	Livestock (cattle)	Hazard reduction, ignition management, preparedness	Cattle will reduce fuel loads

Appendix 6: Site Access Protocols

SITE ACCESS PROTOCOLS

The following site access protocols have been developed to provide guidance to WSA staff and all other people including consultants accessing the 600Ha of WSA controlled land. These protocols must be followed to ensure WSA's property management and environmental obligations continue to be met.

As the airport lessee company, WSA has compliance obligations in accordance with airports legislation and regulations and health and safety requirements. In fulfilling these obligations, WSA is responsible for managing the site in an appropriate manner and therefore has wide discretion in determining who can access the site, when that access can be granted and for what purpose.

Summary of process

Any access must follow the process described below.

1. Personnel requiring site access submit a request for access to WSA (see [section 1](#) below).
2. WSA provides initial advice on site sensitivities and assists the requesting team to refine site access requirements.
3. WSA provides final advice on on-site protocols (see [section 2](#) below).

1 Requesting site access

An email must be sent to acummings@wsaco.com.au with the information set out below. This will assist the team to identify any sensitivities and facilitate site access arrangements where appropriate. A minimum of 5 working days' notice.

- Describe the nature of work proposed, addressing the following matters:
 - proposed activities while on site
 - the name and organisation of those who will be accessing the properties
 - number of personnel on site
 - machinery/vehicles to be used
 - any information on likely work health and safety issues – copies of relevant SWMS to be reviewed
- Identify the proposed timing of access, including the date(s) on which access is required and the duration of access (i.e. hours/days/weeks). Be as specific as possible to allow facilitation of site access with minimal delays.
- Identify the sites to be accessed, including whether the proposal is to only access public roads.
 - Provide specific title details and/or street addresses and schedule (if known). Plans to access different parts of the site on different dates should be avoided wherever possible.
 - Speak with a WSA team member prior to submitting the access request as they can assist in identifying properties.

2 On-site protocols

On day 1 of the intended work schedule all persons will attend for a site induction. The intent of the induction will be to provide information on the project, safety and cultural awareness as well as the hazards which maybe encountered whilst on site. All inductees will be required to provide:

- General construction induction card

- Proof of identity with photo
- Complete WSA induction form

While on site, all visitors must:

- avoid damaging any environmental or heritage features on the land
- avoid any actions that may pose a fire risk and be vigilant for any source of ignition (and please also check behind you when you leave)
- inform a site representative immediately if any issues are encountered on site.

In order to ensure on-site activities do not breach any obligations the under the *Environment Protection and Biodiversity Conservation Act 1999* the following matters must be addressed when considering any construction, building works or site investigations involving machinery undertaken on site:

- protocols and permits, including Conditions of Approval attached to Part 13 Permit E2017-1038, as referenced in the Biodiversity CEMP), that address impacts on listed threatened species or ecological communities, a member of a listed migratory species, or a member of a listed marine species in or on a Commonwealth area;
- protocols to protect and manage known sites of environmental sensitivity, including Aboriginal cultural heritage sites; and
- unexpected finds protocols to be followed in the event that new heritage items or safety risk items (asbestos) are encountered, including stopping work immediately.

WSA will ensure the above protocols and permits have been addressed prior to any activities taking place on the site.

Appendix 7: Site Condition Monitoring Protocol

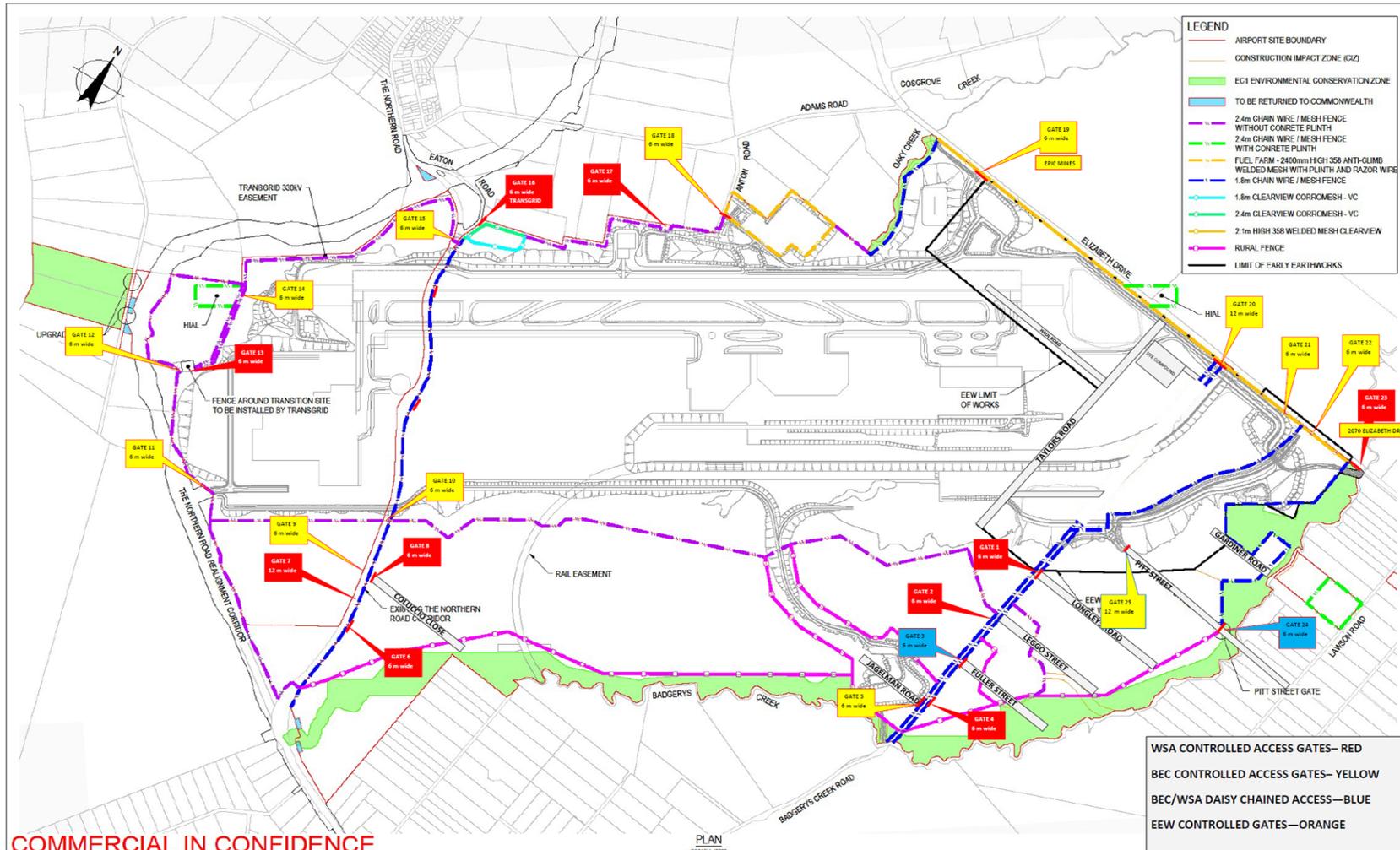
NOTE: The following protocols have been established for the entire Airport site and any actions contained will also be performed by those responsible under this version of the plan and pertaining to the 600Ha. This approach will ensure a consistent set of actions are undertaken by all personnel on site at the time of any events.

	Normal	Trigger Level 1 (T1)	Trigger Level 2 (T2)	Trigger Level 3 (T3)
Trigger Description	<p>Wind – Light to gentle breeze (20 km/h). Not impacting working @ heights or lifting activities</p> <p>Rain – No rain forecasted. No recent flooding impacting works.</p> <p>Lightning – No lightning or signs of lightning within area</p> <p>Bushfire – No bushfire</p> <p>Fire Danger Ratings – Low to High</p>	<p>Wind – Strong wind with wind gusts up to 45 km/h/ 12.5m/s creating a risk that is not controlled with existing measures</p> <p>Rain – Light rain fall (50-90% chance 50-100mm) in immediate catchment area with continuing rain forecast</p> <p>Lightning – Lightning activity greater than 30 kilometers away.</p> <p>Other - Weather warning from BOM</p> <p>Bushfire – 30kms-200kms away</p> <p>Fire Danger Ratings – Very High</p>	<p>Level 1 triggers plus</p> <p>Wind – Strong wind to strong gale force winds of 45 km/h to 87 km/h, 13-24 m/s</p> <p>Rain – Forecast significant rain fall (50-90% chance of 100-200mm) in immediate catchment area. Rain / storms forecast in catchment areas.</p> <p>Lightning – Lightning activity 10-30 kilometers away</p> <p>Other - Severe weather warning from BOM</p> <p>Bushfire – Bushfire 5-30kms away</p> <p>Fire Danger Ratings – Severe</p>	<p>Level 2 triggers plus</p> <p>Wind – Storm force winds in excessive of 88 km/hr., 25 m/s causing immediate risk</p> <p>Rain – Current/immediate risk of heavy downpour resulting (Greater than 200MM) in localised flooding. Current/immediate risk of waterways flooding. Long term > 4-day loss of site access</p> <p>Lightning – Lightning <5 Kilometers away.</p> <p>Other- Flood warning BOM website</p> <p>Bushfire – Bushfire <5km away</p> <p>Fire Danger Ratings – Catastrophic</p>

Position	Normal	Trigger Level 1 (T1)	Trigger Level 2 (T2)	Trigger Level 3 (T3)
Site works	Operate as normal	Check crane operation limits and cease works if required Ensure ERSED measures are in place to manage dirty water Operate as normal ensure measures are in place to control fire if it occurs	Check crane operation limits and cease works if required Ensure ERSED measures are in place to manage dirty water Allow Hot Works if strictly necessary	Cease crane operation Ensure ERSED measures are in place to manage dirty water Cease all Hot Works
Project Manager	No variation from standard project managerial activities	Communicate status to all Section Managers.	Communicate status to with relevant staff (function support managers). Consider mobilisation of ECO Communicate status to EPC	Communicate status to senior Managers Conduct Planning session with relevant staff (function support managers)
Superintendent/Emergency Controller	No variation from standard supervision activities	Communicate status to subcontractors Ensure new environmental conditions are assessed by contractors and Identify temporary works at risk in event of escalation Communicate status to Project Manager	Communicate status to Project leader Communicate with subcontractors and develop action plan. Ensure sub-contractors and emergency management plans are ready to be activated. Monitor progress. Communicate status to Project Manager	Communicate status to Project Manager Ensure Project emergency management plans are activated Monitor progress of action plan Communicate status to Project Manager
Environmental Staff	No variation from standard management activities	Monitor and communicate information relating to inclement weather to Project Manager	Monitor and communicate information relating to inclement weather to Project Manager Provide advice on environmental preparation Conduct inspections as required	Monitor and communicate information relating to inclement weather to Project Manager Provide advice on environmental preparation Conduct inspections as required

Appendix 8: Site Access and Gates

The following drawing details the access points to the airport site and showing the various gates and who has control of the gate.



<p>B RE-ISSUED FOR INFORMATION</p> <p>A ISSUED FOR INFORMATION</p> <p>No. Revision Note: *Indicate signatures on original issue of drawing or last revision of drawing</p>		<p>S,JP PP OW 15.11.18</p> <p>S,JP PP OW 12.11.18</p>	<p>0 100 200 300 400 500m</p> <p>SCALE 1:10,000 AT ORIGINAL SIZE</p>	<p>Western Sydney Airport</p> <p>ACONEX Contract Number: WSA00-GHD-03000-GE-DRG-000004</p>	<p>GHD</p> <p>Level 6, 20 Smith Street Parramatta NSW 2150 Australia T 61 2 8990 8800 F 61 2 8990 8800 E support@ghd.com.au W www.ghd.com.au</p>	<p>DO NOT SCALE</p> <p>Conditions of Use: This document may only be used by OHS&S clients (and any other person who OHS&S has agreed can use this document) for the purpose for which it was prepared and must not be used by any other person or for any other purpose.</p>	<p>Drawn: S.PATTESON Checked: G. ATKINS Approved: G. WOOD Date: 15.11.2018</p> <p>Scale: AS DRAWN</p>	<p>Design: S.PATTESON Design Check: P. PARKER Project Director: G. WOOD Date: 15.11.2018</p> <p>This Drawing must not be used for Construction unless signed as Approved</p>	<p>Client: WSA Co Project: WESTERN SYDNEY AIRPORT Title: FENCE PLAN</p> <p>Drawn By: S.PATTESON Drawing No: A1 WSA-GHD-3300-GEN-DRG-0004 Rev: B</p>
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