Melbourne Airport
M3R MDP

Chapters B1–B13

Part B

MELBOURNE AIRPORT

Chapter B1
Airport - Introduction

Overview

Part B of the M3R MDP describes the potential impact of the project on ground-based aspects of the environment. The extent and scope of ground issues considered by this part of the MDP have been informed by the requirements of the Airports Act 1996 (Cth) (Airports Act) and as described in Chapter A8: Assessment and Approvals Process.

Melbourne Airport provides detail on the disturbance impacts the proposed project will have on the 'whole of the environment' (as defined in the Environment Protection and Biodiversity Conservation Act (1999) 'Significant impact guidelines 1.2 Actions on, or impacting upon Commonwealth land, and actions by Commonwealth agencies') including air quality, water quality, ground-based noise, heritage, land contamination, waste and hazardous material, traffic, heritage and flora and fauna (including nationally listed threatened species and ecological communities).

The potential impacts from M3R on these aspects of the environment are informed by existing environmental conditions, assessments of construction and operation, and the measures necessary to avoid, mitigate and manage hazards and risks.

Part B addresses on-ground impact evaluation and assessment requirements in the following chapters:

Chapter B2: Land Use and Planning provides a detailed assessment of the Commonwealth, Victorian and local planning and environmental legislative requirements, land use conditions and land tenure relevant to M3R. This chapter also considers potential offsite impacts and long-term land use issues and opportunities.

Chapter B3: Soils, Groundwater and Waste considers the potential of M3R to impact, and be impacted by, the condition of soil and groundwater and the potential generation of waste during construction and operation of M3R. The soil and groundwater assessment considers the interaction of M3R with changes to groundwater quality and flow and the disturbance of existing soil conditions, and identifies appropriate mitigation and monitoring measures. The waste assessment considers the likely sources of waste generated through the construction and operation of M3R and measures to limit the environmental impacts of the waste.

Chapter B4: Surface Water and Erosion describes the existing waterbodies on and adjoining Melbourne Airport, and assesses the potential for M3R to impact soil erosion, surface water quality and flooding risk of relevant waterbodies. It includes the identification of appropriate mitigation and monitoring measures.

Chapter B5: Ecology describes the existing terrestrial flora and fauna and aquatic fauna attributes within and adjacent to the M3R development footprint, including Commonwealth and State listed endangered and threatened species and ecological communities.

It assesses the potential ecological impacts associated with M3R and associated management and mitigation measures.

Chapter B6: Indigenous Cultural Heritage provides an overview of Indigenous cultural heritage values associated with the development footprint, and the potential impacts associated with construction of M3R. It discusses the Cultural Heritage Management Plan that has been prepared for M3R and associated mitigation proposals.

Chapter B7: European Heritage identifies the European heritage places within and adjacent to the development footprint, in alignment with Heritage Victoria and National Heritage criteria, and assesses the potential impacts associated with M3R. Appropriate mitigation and monitoring measures are identified.

Chapter B8: Surface Transport assesses the implications of the construction and operation of M3R on Melbourne Airport's surface transport network and off-airport arterial road network. Appropriate mitigation measures have been identified to address the impacts.

Chapter B9: Ground-Based Noise and Vibration provides an assessment of the potential noise and vibration impacts associated with M3R construction activities, taxiing noise, use of auxiliary power units, engine ground running and surface access noise from traffic and other modes of transport. Mitigation and monitoring measures are defined to address the noise impacts.

Chapter B10: Air Quality and Chapter B11: Greenhouse Gas Emissions evaluate likely air quality impacts and greenhouse gas emissions associated with the construction and ground-based operational activities of M3R. Relevant mitigation and monitoring measures are identified to address the impacts.

Chapter B12: Landscape and Visual provides an assessment of the impact of construction and operation of M3R on the existing day and night visual environment and landscape values surrounding the airport, with mitigation measures identified where appropriate.

Chapter B13: Climate Change and Natural Hazard Risk presents an assessment of the current risks to M3R associated with climate change and natural hazards, and how these risks may alter with projected climate change. These risks have been incorporated in M3R design and operational procedures.

Chapter B2
Land Use and Planning

Summary of key findings:

- The majority of works associated with Melbourne Airport's Third Runway (M3R) will occur within the existing Melbourne Airport boundary.
- M3R is consistent with the long-term (four runway) development concept plan in the airport's current approved Master Plan 2018. However, M3R represents a substantial and fundamental change to the orientation of the planned third runway reflected in Master Plan 2018. APAM is therefore updating the Master Plan for Melbourne Airport, in conjunction with M3R, to reflect the changed orientation of the third runway.
- M3R will be entirely consistent with 'Master Plan 2022 (proposed)' which reflects the changed orientation of the planned third runway. Master Plan 2022 will include a new Australian Noise Exposure Forecast (ANEF) for the airport. The approval of Master Plan 2022 will occur first, and consideration of approval of the M3R MDP will follow. This is because the M3R MDP cannot be approved while the current Master Plan 2018 is applicable.
- Limited works may be undertaken outside airport land to provide connections with existing transport and utility networks. These works will be subject to separate planning assessment processes in accordance with requirements of the relevant local planning scheme.
- M3R is consistent with, and will support, state and local planning policy.
- The Melbourne Airport Environs Overlay (MAEO) applies planning controls for land use and development proposals within the boundary of the overlay to protect against incompatible development and land use. The MAEO is based on the 2018 ANEF contours.
- This MDP includes a 'M3R 2046 Composite ANEC' for the two existing runways and the planned third runway. This ANEC will form part of the new ANEF in Master Plan 2022.
- The M3R 2046 Composite ANEC has been compared to the current MAEO. This provides an indication of those areas that may be impacted by M3R in terms of changed land use restrictions based on the M3R 2046 Composite ANEC.
- The M3R 2046 Composite ANEC may result in some variations to the existing MAEO north and south of the airport. However, the formalisation of any such changes to the MAEO (via a Planning Scheme Amendment) is a separate process undertaken by the Victorian Minister for Planning.

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B2.1
INTRODUCTION

This chapter describes the existing baseline land-use planning context, applicable legislation, and policies relevant to the Melbourne Airport's Third Runway (M3R) Major Development Plan (MDP). It then assesses M3R's consistency with the applicable legislation and policies, and describes M3R's potential land use and planning impacts. Where required, specific measures to avoid, manage, mitigate and/or monitor these impacts are identified.

For the purposes of this chapter, the 'study area' refers to the area up to and including approximately 15 kilometres from the airport (**Figure B2.1**) and also taking into account the primary aircraft noise contours within this radius.

B2.1.1
Overview

Melbourne Airport is located on Commonwealth land. The *Airports Act 1996* (Cth) (Airports Act) is the key piece of legislation setting out the land use regulatory framework for M3R and this land use assessment. Commonwealth land within the Melbourne Airport boundary is exempt from the Victoria Planning Provisions; however, a MDP must address consistency with planning schemes under Victorian law.

The majority of works associated with M3R's footprint will occur on airport (Commonwealth) land, including an allowance for Runway End Safety Areas (RESA), security requirements, and High Intensity Approach Lighting Systems (HIALS). There are also a range of potential off-site impacts associated with M3R that could influence, and be influenced by, the land use and planning of surrounding areas.

Land use planning around Melbourne Airport is primarily the responsibility of local government, and will be in accordance with state and local planning policies, directions and provisions. Effective long-term land use planning is important in minimising incompatible development activities near the airport: off-airport land use and development can have a significant effect on the operations and viability of the airport.

Limited works associated with M3R may be undertaken outside airport land to provide appropriate connections and interface with those existing transportation and utility networks primarily associated with the construction phase of M3R. Separate approvals will be required for any off-airport works. There may also be indirect off-site impacts on land use as a consequence of noise and air quality, which potentially create development constraints requiring management.

The 'development footprint' as described in **Chapter A4: Project Description**, encompasses the existing and proposed runways, aircraft movement areas, and land proposed for the contractors' work compounds, stockpile areas and construction haulage routes. The existing air traffic services area, passenger terminal buildings and land to the east and south-east of the terminals (including Melbourne Airport Business Park) are outside the defined project footprint.

As part of M3R, a new construction access road for vehicles entering the site from the north will be required.

B2.2
METHODOLOGY AND ASSUMPTIONS

This chapter identifies and appraises the existing land use and planning context at and surrounding Melbourne Airport. Collating this has included gathering and reviewing relevant background information, historic data, previous planning investigations and studies, land ownership and tenure data, and planning scheme documents and maps.

The general methodology used for the preparation of the land use and planning assessment included:

- An inspection and analysis of the key characteristics of the airport site and surrounding land. Fieldwork included a visual inspection of the airport, existing facilities and infrastructure and the surrounding area, as relevant to M3R.
- A review of relevant background information and technical reports relevant to M3R.
- A review of existing Commonwealth, Victorian and local government legislation that applies to the airport site and surrounding land - including a review of strategic land use planning documentation to identify key objectives for development of the airport environs and the broader region.
- A review of M3R against the provisions of the relevant planning schemes surrounding the airport to assess the consistency of the proposals with the intent of the local planning provisions.
- Consultation and reference to previous engagement undertaken by Melbourne Airport with the Victorian Government and with planning staff of surrounding councils (particularly Hume and Brimbank City councils) to confirm applicable land use plans, policies and assessment considerations.
- An assessment of the existing conditions and land use within approximately a 15-kilometre radius of the airport, with a particular focus on land identified within the airport's Australian Noise Exposure Forecast (ANEF) contours in proximity to the airport, and with potential to impact the airport's airspace. The ANEF contours are contained within the 15-kilometre radius.
- An assessment of the likely land use and planning-related impacts of M3R (three runways) on surrounding land uses and development, together with recommended mitigation measures to reduce the impacts.

This impact assessment is based on the current and future operation of the airport, with M3R in operation in 2046. The assessment focuses on direct and indirect impacts of the three runways on land use, with the assessment of social and environmental impacts addressed in other chapters of this MDP.

The assessment does not address the ultimate four runway configuration, which is addressed within the approved 2018 Melbourne Airport Master Plan and proposed 2022 Master Plan.

B2.3
STATUTORY REQUIREMENTS AND POLICY

This section identifies relevant Commonwealth, Victorian and local statutory requirements, policies and provisions that must be considered during the preparation of a MDP for Melbourne Airport. An assessment of M3R's consistency with these statutory requirements and policy is provided in **Section B2.6.1**.

B2.3.1
Commonwealth legislation and policy

Melbourne Airport is located on Commonwealth land, leased by Australia Pacific Airports (Melbourne) Pty Ltd (APAM). The Airports Act and the EPBC Act are the key pieces of legislation that set the regulatory framework for M3R and this assessment, as discussed in **Chapter A8: Assessment and Approvals Process**.

B2.3.1.1
Airports Act 1996

Section 91(1)(ca) of the Airports Act requires a MDP to set out whether or not the development is consistent with the airport lease. For the M3R MDP, the relevant airport lease is the lease between APAM and the Commonwealth of Australia dated 1 July 1997 (hereafter referred to as the 'Airport Lease').

Section 112 sets out the Commonwealth's intention that Part 5 of the Airports Act applies to the exclusion of the law of a state and, specifically laws of the state relating to land use and planning. Notwithstanding section 112, section 91(1)(ga) requires this MDP to set out the likely effect of M3R on traffic flows at the airport and surrounding the airport, employment levels at the airport and the local and regional economy and community, including an analysis of how the proposed development fits within the local planning schemes for commercial and retail development in the adjacent area. In addition, section 91(4) requires that, in specifying a particular objective or proposal in section 91(1)(ga), this MDP will address the extent (if any) of consistency with planning schemes in force in Victoria and, if this MDP is not consistent with those planning schemes, the justification for the inconsistencies.

Section 91(3) of the Airports Act, and Regulation 5.04 of the Airports Regulations 1997 (Cth), require this MDP to address APAM's obligations (as the 'airport lessee company') as sub-lessor under any sub-lease of the airport site concerned and the rights of any sub-lessee under such sub-lease (including interests or obligations that existed prior to the commencement of the Airport Lease and to which the Airport Lease is subject).

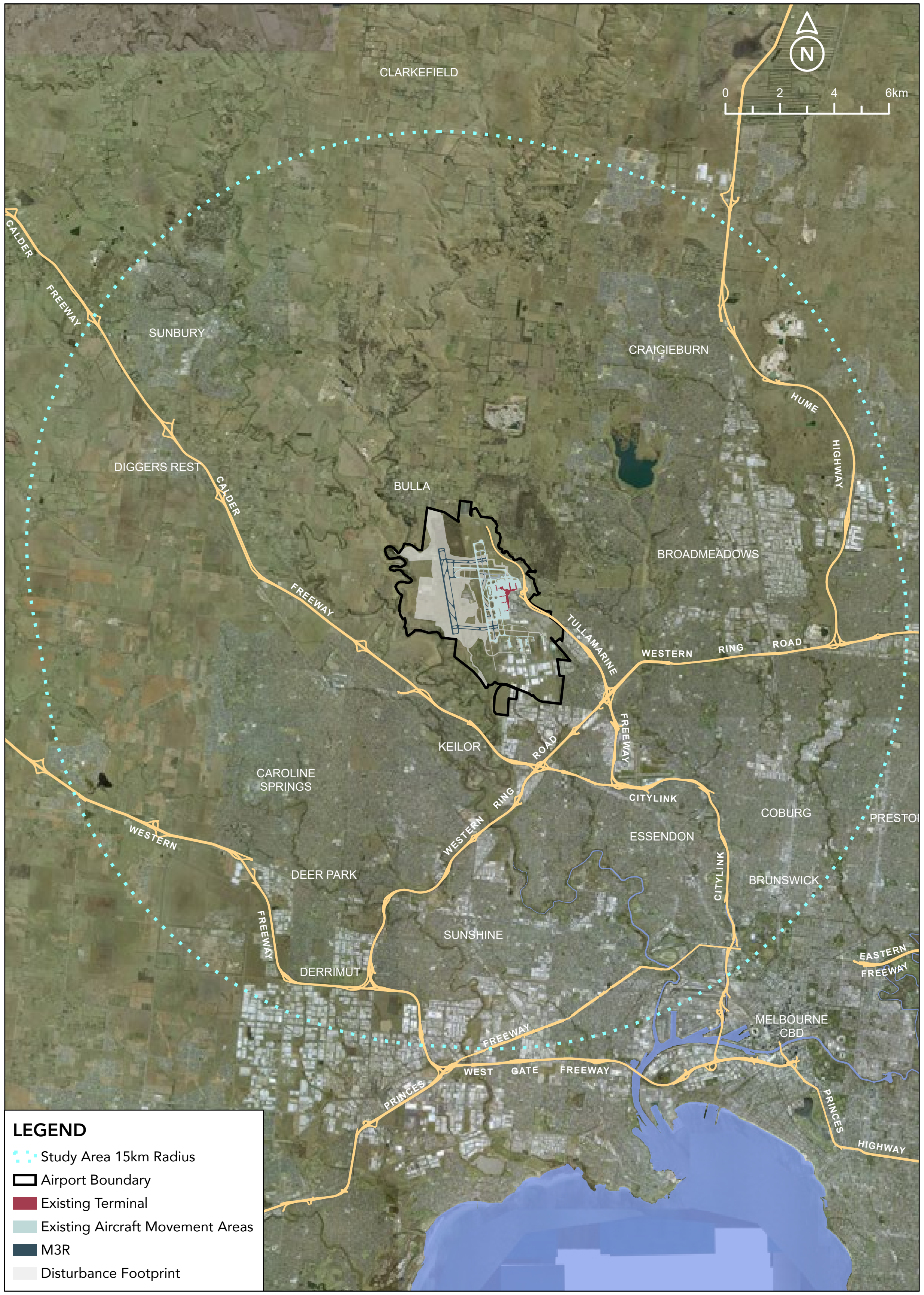
Melbourne Airport's searches indicate that, at the date of writing this MDP, there are overhead electricity assets, underground telecommunications assets and NBN Co assets in the M3R development footprint. The impact of the project on these assets will be addressed through the detailed design and construction process.

Other than as set out above, Melbourne Airport is not aware of any material conflicts or inconsistencies between the interests of any such sub-lessees or interest holders and M3R.

B2.3.1.2
Airports (Protection of Airspace) Regulations 1996

Obstructions on and in the vicinity of an airport have the potential to cause air safety hazards and limit the scope of aviation operations. Part 12 of the Airports Act and the Airports (Protection of Airspace) Regulations 1996 (the Regulations) establish a framework for the protection of airspace at and around airports.

Figure B2.1
Study Area



Under these provisions, the airspace associated with an airport may be declared 'Prescribed Airspace' to protect it for the safe arrival and departure of aircraft.

The Regulations define two sets of virtual 'surfaces' above the ground at and around an airport. These surfaces form the lower boundary of an airport's protected airspace and include:

- Obstacle Limitation Surface (OLS) – generally the lowest surface, designed to provide protection for visual flying, or Visual Flight Rules (VFR), i.e. when the pilot is flying by sight.
- Procedures for Air Navigational Services – Aircraft Operations (PANS-OPS) surface – generally above the OLS, designed to provide protection for instrument flying, or Instrument Flight Rules (IFR), i.e. when the pilot is flying based on instruments - for instance, in poor conditions. The PANS-OPS may also protect airspace around the network of navigational aids that are critical for instrument flying.

The Airports Act defines any activity resulting in an intrusion into an airport's protected airspace to be a 'controlled activity' and requires that controlled activities cannot be carried out without approval. The Regulations provide the Department of Infrastructure, Transport, Regional Development and Communication (DITRDC) or the airport operator with the ability to assess and approve applications to carry out controlled activities and to impose conditions on an approval.

As outlined in the 2018 Master Plan, Melbourne Airport's airspace, based on the ultimate four runway layout, has been declared 'Prescribed Airspace' by the Commonwealth Government. The airport's prescribed airspace, being based on the ultimate four-runway layout, therefore broadly incorporates the airspace associated with the operation of M3R. As part of the 2018 Master Plan, Melbourne Airport prepared updated prescribed airspace to ensure that the airspace required for the ultimate four-runway system continues to be adequately protected, while taking account of changes which may have occurred since the four-runway airspace was originally prescribed.

These matters are explained and deal with further in **Chapter C5: Airspace Hazards and Risk Assessment**.

B2.3.1.3
Environment Protection Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a national scheme of environment and heritage protection, and biodiversity conservation.

The objectives of the EPBC Act are to:

- Provide for the protection of the environment, especially matters of national environmental significance
- Conserve Australian biodiversity
- Provide a streamlined national environmental assessment and approvals process
- Enhance the protection and management of important natural and cultural places
- Control the international movement of plants and animals (wildlife), wildlife specimens, and products made or derived from wildlife
- Promote ecologically sustainable development through the conservation and ecologically sustainable use of natural resources
- Recognise the role of Indigenous people in the conservation and ecologically sustainable use of Australia's biodiversity
- Promote the use of Indigenous peoples' knowledge of biodiversity with the involvement of, and in cooperation with, the owners of the knowledge.

The *Environment Protection and Biodiversity Conservation Regulations 2000* set out the criteria for the environmental impact assessment processes.

The *Actions on, or impacting upon Commonwealth land, and actions by Commonwealth agencies, Significant impact guidelines 1.2 Environment Protection and Biodiversity Conservation Act 1999* (Significant Impact Guidelines 1.2) provide guidance on determining whether an action is likely to have a significant impact on a matter protected under national environmental law; and whether assessment and approval is required under the EPBC Act (DSEWPC, 2013). The Matters of National Environmental Significance (MNES) protected under national environmental law include:

- World heritage properties
- National heritage places
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- Nationally threatened species and ecological communities
- Migratory species
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions
- A water resource, in relation to coal seam gas development and large coal mining development.

The Significant Impact Guidelines 1.2 of the EPBC Act provide guidance for any person who proposes to take an action which is situated on, or may have an impact on, Commonwealth land - or for representatives of Commonwealth agencies who propose to take an action that may impact on the environment anywhere in the world.

The guidelines assist in deciding whether or not to submit for a referral under the EPBC Act on whether assessment or approval is required.

The EPBC Act also addresses actions that have a significant environmental impact on Commonwealth land, or carried out by a Commonwealth agency, and provides for a 'whole-of-environment' impact assessment. The EPBC Act is administered by the Commonwealth Department of Agriculture, Water and the Environment (DAWE).

The EPBC Act requires that before a Commonwealth agency or employee gives an authorisation of certain 'actions', that agency or employee will obtain and consider advice from the Minister for the Environment. In relation to M3R, the Minister for Infrastructure, Transport and Regional Development ('The Minister' - who will ultimately assess this MDP for approval) will obtain and consider advice from the Minister for the Environment.

To formalise this process and the approach to the assessment of the action under the EPBC Act, a referral is submitted to the Minister for the Environment under section 160 of the EPBC Act. The Minister then confirms the assessment approach to be adopted under the EPBC Act.

As outlined in Chapter A8: Assessment and Approvals Process, the Exposure Draft version of this MDP was referred to DAWE for consideration under section 160 of the EPBC Act. In March 2021, DAWE formally advised that the Environment Minister's advice is required to be obtained and considered before the MDP is approved by the Minister for Infrastructure, Transport and Regional Development and adopted or implemented. DAWE also decided that the proposal requires further assessment under the EPBC Act by an accredited process, being the MDP process as defined under the Airports Act.

The MDP therefore constitutes the assessment mechanism for whole-of-environment impacts under the EPBC Act.

B2.3.1.4
Native Title Act 1993

The *Native Title Act 1993* (NT Act) recognises and protects the Native Title rights and interests of Aboriginal and Torres Strait Islanders across Australia. Native Title does not provide Indigenous people with ownership of the land. Freehold titles and most leases over land extinguish (or put at an end) native title completely (except some titles held by Aboriginal people). Pastoral leases only partially extinguish native title and, Aboriginal titles, like land rights title or Aboriginal-owned pastoral stations, will generally have no effect on Native Title.

If a commercial lease (that is not an agricultural lease or pastoral lease), residential lease, community purpose lease or any other lease that provides for a party's exclusive use existed prior to 1 January 1994, then Native Title is completely extinguished over the lease area. The authorised construction of public works (for example roads) on Crown land prior to 1 January 1994 will have completely extinguished Native Title over the land on which the public work is situated.

The NT Act provides a mechanism for acknowledging the existence of Native Title and sets out procedures that must be complied with by the managers of Crown land. Any activity on Crown land where Native Title is not considered to be extinguished may impact Native Title.

Land adjacent to (but not forming part of) the development footprint contains unreserved and reserved Crown land, primarily off-airport land along the bed and banks of rivers and creeks, road reserves and parkland. Any works in these areas may require Native Title notification in accordance with the provisions of the NT Act.

However, the development footprint is located within the Melbourne Airport boundary and is Commonwealth land leased to APAM under the Airports Act. The majority of the land was previously freehold land where Native Title had already been extinguished.

B2.3.1.5
Australian Standard AS2021:2015 Acoustics – Aircraft noise intrusion – Building siting and construction

Australian Standard AS2021:2015 provides guidance on the siting and construction of buildings in the vicinity of airports to minimise aircraft noise intrusion. AS2021:2015 was developed to assist in land use planning and forms the basis of the Melbourne Airport Environs Overlay (MAEO) control. Aircraft noise intrusion within a building depends substantially on:

- The location, orientation and elevation of the site relative to the aircraft flight paths
- The types and frequency of aircraft operating from the aerodrome
- Meteorological conditions
- The types of activity (including sleep) to be, or being, accommodated in the building
- The type of layout, construction and ventilation used
- The internal acoustic environment.

The assessment of potential aircraft noise exposure at a given site is based on the ANEF system, which is widely referred to in guiding statutory land use planning in the vicinity of airports. AS2021:2015 notes that:

> *'…experience has shown that communities that are newly-exposed to aircraft noise (e.g. as a result of the construction of new runways…) tend to be more sensitive to such noise than communities that are accustomed to it. Land use planning must by necessity use a long-term horizon, and the building siting acceptability recommendations in [this Standard] are based on the reactions of noise-accustomed communities. Regulatory authorities are cautioned that a transient heightened reaction could result from substantial new noise exposure.'*

B2.3.1.6
National Airports Safeguarding Framework

The Commonwealth Government recognises that responsibility for land use planning rests primarily with the state, territory and local governments, but that a national approach can assist in improving planning outcomes on and near airports and under flight paths. To this end, the National Airports Safeguarding Advisory Group (NASAG) has developed the National Airports Safeguarding Framework (NASF) which has been agreed to by the Commonwealth, states and territories including Victoria.

The NASF is comprised of a set of principles and guidelines that seek to:

- Improve community amenity by minimising aircraft noise-sensitive developments near airports including the use of additional noise metrics and improved noise-disclosure mechanisms
- Improve safety outcomes by ensuring aviation safety requirements are recognised in land use planning through guidelines being adopted by jurisdictions on various safety-related issues.

NASF applies at all airports and their environs, and seeks to protect communities living and working near airports. NASF provides guidance and information on planning and development around airports, including development activity that might penetrate operational airspace and/or affect navigational procedures for aircraft. It seeks to enhance the current and future safety, viability and growth of aviation operations at Australian airports and provide guidance on planning requirements for development that affects aviation operations.

The NASF also seeks to provide guidance to Commonwealth, state, territory and local government decision-makers, which in turn can be used to guide assessment and approvals for land use and development on and around airports. It is the responsibility of each jurisdiction to implement the framework into their respective planning schemes.

In Victoria, the requirements of NASF have been given effect through its inclusion as a policy guideline in clause 18.04 of the Planning Policy Framework (PPF). The NASF principles and guidelines must be considered in all planning decisions as relevant. A detailed summary of clause 18.04 of the PPF is provided in B2.3.2.11.

A summary of the current NASF guidelines is outlined in Table B2.1. An assessment of M3R's consistency with the NASF guidelines is provided in Section B2.6.1.1.

B2.3.2
State legislation and policy

Planning requirements for the Melbourne Airport site (Commonwealth land) are administered under the Airports Act and, as such, state and local planning provisions are not directly applicable. However, the Airports Act requires master plans to address the extent of consistency with relevant planning schemes in force within the state in which the airport is located (which includes local planning schemes). Similarly, the preparation of a MDP is required to address the extent of consistency with these planning schemes.

In preparing this MDP, Melbourne Airport has had regard to the PPF, the Local Planning Policy Framework, and the zones, overlays and other planning provisions derived from the Victoria Planning Provisions (VPP). The Master Plan and development approval processes for Melbourne Airport land are aligned with Victorian processes insofar as ensuring that any such development is compatible with broader strategic planning directions for the airport and adjoining areas as a whole. The state and local planning provisions considered as part of this MDP process are summarised below.

An assessment of M3R's consistency with the relevant state legislation and policy provided in Section B2.6.1.3 of this chapter.

B2.3.2.1
Planning and Environment Act 1987

The *Planning and Environment Act 1987* (Vic) (P&E Act) establishes a framework for the use, development and conservation of land in Victoria and is administered by the Department of Environment, Land, Water and Planning (DELWP). Commonwealth land within the Melbourne Airport boundary is exempt from the requirements of the P&E Act, including the requirement to obtain a planning permit, however any off-airport works are subject to relevant provisions of the P&E Act.

The P&E Act provides for the preparation and administration of planning schemes that control the use and development of land. The Ministerial Direction on the Form and Content of Planning Schemes requires relevant planning schemes to incorporate Australian Standard AS 2021-2015. Planning schemes prepared under the provisions of the P&E Act apply to, and have effect in, each municipality in Victoria. Objectives of the P&E Act relevant to the planning, design and development of M3R are to:

- Provide for the fair, orderly, economic and sustainable use and development of land
- Provide for the protection of natural and man-made resources and the maintenance of ecological processes and genetic diversity
- Secure a pleasant, efficient and safe working, living and recreational environment for all Victorians and visitors to Victoria

Table B2.1
NASF guidelines

NASF guidelines	Purpose
Guideline A: Measures for Managing Impacts of Aircraft Noise	Guideline A acknowledges that inappropriate development around airports can result in unnecessary constraints on airport operations and negative impacts on community amenity. Guideline A provides guidance on the use of a complementary suite of noise metrics, including the ANEF system and frequency-based noise metrics to inform strategic planning and provide communities with comprehensive and understandable information about aircraft noise. Guideline A also recommends using the 'Number above' ('N') contour system to supplement the ANEF contours. N Contours help to inform strategic planning decisions. NASF is referenced within the Victoria Planning Provisions Planning Policy Framework clause 18.04-1S of the PPF, further detailed under Section B2.3.2.11 of this chapter.
Guideline B: Managing the Risk of Building Generated Windshear and Turbulence at Airports	Guideline B identifies the negative impacts that building-induced windshear can have on aviation operations in cases where structures are situated close to airport runways. Guideline B presents a layered risk approach to the siting and design of buildings near airport runways to assist land use planners and airport operators to reduce the risk of building-generated windshear and turbulence. The current Guideline B, developed in 2011, was updated in 2018 to reflect current world-best practice and available science, and to encourage the use of existing assessment technologies and methodologies. Measures for managing the risk of building-generated windshear and turbulence are generally associated with building works.
Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports	Guideline C seeks to manage wildlife strikes, avoid major damage to aircraft and protect aircraft safety. Guideline C provides advice to help protect against wildlife hazards originating around airports and guidance to facilitate appropriate land use planning decisions in the vicinity of airports. The guideline identifies land uses that have the potential to increase wildlife strike potential and provides guidance on buffer zones within which certain activities around airports should be controlled.
Guideline D: Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation	Guideline D addresses risks associated with wind turbines and low flying aviation operations. This guideline is not applicable to the proposed development.
Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports	Guideline E acknowledges the importance of aeronautical ground lights during inclement weather and outside daylight hours. Guideline E therefore provides advice on the risks of lighting distractions to ensure that they are minimised or avoided.
Guideline F: Managing the Risk of Intrusions into the Protected Airspace of Airports	Guideline F provides advice for planners and decision-makers about working within and around protected airspace, including OLS and PANS-OPS intrusions, and how these can be better integrated into local planning processes to protect aircraft from obstacles or activities that could be a threat to safety.
Guideline G: Protecting Aviation Facilities – Communication, Navigation and Surveillance (CNS)	Guideline G provides land use planning guidance to better protect CNS facilities that support the systems and processes in place by Airservices Australia, the Department of Defence or other agencies under contract with the Commonwealth Government to safely manage the flow of aircraft into, out of and across Australian airspace
Guideline H: Protecting Strategically Important Helicopter Landing Sites	Guideline H provides guidance to ensure the ongoing operation of Strategically Important Helicopter Landing Sites (SHLS), and that the use of an SHLS is not compromised by any proposed development encroaching into flight paths. In addition, new development (and associated activities) should not present a hazard to helicopters arriving or departing from the SHLS and any new SHLS are to be appropriately located. For the purposes of Guideline H, a SHLS is an area not located on an aerodrome. Therefore, this guideline does not apply to Melbourne Airport.
Guideline I: Managing the Risk in Public Safety Areas at the End of Runways	Guideline I was developed to mitigate the risk of on-ground fatalities from an aircraft incident, by informing a consistent approach to land use at the end of airport runways. Public safety areas are a designated area of land at the end of an airport runway within which development may be restricted in order to control the number of people on the ground at risk of injury in the event of an aircraft accident on take-off or landing.

- Conserve and enhance those buildings, areas or other places which are of scientific, aesthetic, architectural or historical interest, or otherwise of special cultural value
- Protect public utilities and other assets and enable the orderly provision and coordination of public utilities and other facilities for the benefit of the community
- Facilitate development in accordance with the objectives set out in the points above
- Facilitate the provision of affordable housing in Victoria
- Balance the present and future interests of all Victorians.

The local planning authority administers municipal planning scheme provisions and development approval requirements as per the processes in the P&E Act. As Melbourne Airport is located on Commonwealth land, planning scheme provisions do not directly apply, however they must be considered when preparing a MDP. Furthermore, it is anticipated that off-airport impacts will be managed via the provisions of the P&E Act.

Pursuant to the P&E Act, planning approval can be pursued through two primary pathways: a planning permit application or Planning Scheme Amendment (PSA).

A Planning Permit may be required for use and/or for buildings and works associated with development, while a PSA allows planning schemes to be modified. A PSA may be prepared by any planning authority (including the relevant Council or the Minister for Planning) but can only be approved by the Minister for Planning, in order to ensure consistency with state and regional planning objectives.

Under the P&E Act, the Minister for Planning can amend the planning scheme with exemption from public notice requirements or to expedite an amendment in accordance with section 20 of the P&E Act. The section 20 process also enables the coordination of multiple planning approval requirements across different planning jurisdictions.

The general tests for the Minister for Planning exercising this power are that the interests of Victoria make an exemption appropriate and that further consultation is not warranted.

Considerations informing such an action may include:

- The matter being of genuine state or regional significance
- The matter giving effect to an outcome where the issues have been reasonably considered and the views of affected parties are known
- The matter introducing an interim provision which is substantially the same as a provision that is subject to a separate process of review
- The matter raising issues of fairness or public interest
- The matter requiring co-ordination to facilitate decision-making by more than one agency
- If consultation is required, the Minister can also establish separate and more time-efficient processes, such as focused consultation periods and hearings.

Part 3C of the P&E Act relates to the Melbourne Airport Environs Strategy Plan (MAESP) and applies to land surrounding the airport. The MAESP includes a recommendation for applying a planning overlay that includes restrictions for development within the Melbourne Airport surrounds. During the preparation of the 2018 Master Plan, the Minister for Planning formally advised he would amend the MAEO using the powers set out under s20(4) and s20(5) of the P&E Act to apply the 2018 ANEF, in consultation with affected councils and property owners.

This, and related actions to review the MAESP and associated planning provisions, were outlined by the Minister for Planning in his September 2017 letter to APAM and the 10 current noise contour-affected councils. The MAEO was updated to apply the 2018 ANEF in October 2021 via Amendment VC173.

In December 2019, the Minister for Planning appointed a Standing Advisory Committee pursuant to Part 7, section 151 of the P&E Act to review the effectiveness of controls intended to safeguard Melbourne Airport. The Melbourne Airport Environs Safeguarding Standing Advisory Committee (MAESSAC) was established by the Minister to consider:

- Planning proposals of strategic importance within the Melbourne Airport Environs Area and approved Melbourne Airport Master Plan noise contours, including planning scheme amendments and planning permit applications, or proposals which may be inconsistent with Victorian policy safeguarding Melbourne Airport
- The effectiveness of the Melbourne Airport Environs Area, the Melbourne Airport Environs Strategy Plan 2003, the Melbourne Airport Environs Overlay and other related planning provisions, in safeguarding Melbourne Airport's ongoing curfew-free operation and its environs.

In relation to the review of planning provisions safeguarding Melbourne Airport, at the time of writing, MAESSAC had held hearings but had not released a final report for the Minister's consideration.

B2.3.2.2
Environment Effects Act 1978

In Victoria, the assessment of potential environmental impacts or effects of a proposed development may be required under the *Environment Effects Act 1978* (Vic) (EE Act). The process enables statutory decision-makers (ministers, local government and statutory authorities) to decide whether a project with potentially significant environmental effects should proceed. As M3R is being constructed on Commonwealth land and is the subject of approvals under Commonwealth legislation, approval under the EE Act is not required.

B2.3.2.3
Environment Protection Act 2017

The *Environment Protection Act 2017* (Vic) seeks to protect human health and the environment by reducing the harmful effects of pollution and waste through setting environmental quality objectives and establishing programs to meet them. State Environment Protection Policies (SEPPs) are subordinate legislation made under the provisions of the Act to provide more detailed requirements and guidance for the application of the Act to Victoria. SEPPs are used to implement the policies outlined in the primary legislation to protect the environment. The SEPPs relate to emissions to air, water and land in Victoria (including through noise and waste). The Act establishes the powers, duties and functions of EPA, including recommending SEPPs and Industrial Waste Management Policies (IWMPs) to the Governor in Council, issuing works approvals, licences, permits, pollution abatement notices and implementing National Environment Protection Measures (NEPMs). For off-site impacts of M3R, the MDP has taken into consideration the requirements of the relevant SEPPs as detailed in the relevant environmental impact assessment chapters of this MDP (particularly Chapter B3: Soils, Groundwater and Waste, Chapter B4: Surface Water and Erosion, Chapter B9: Ground-Based Noise and Vibration and Chapter B10: Air Quality).

B2.3.2.4
Water Act 1989

The *Water Act 1989* (Vic) is the legislation that governs water entitlements and establishes the mechanisms for managing Victoria's water resources. Approval is required to connect to the stormwater system (including open waterways) or to commence work on any utility installations (such as gas, electricity and water) or excavate near Melbourne Water assets. Melbourne Airport is located on Commonwealth land but ultimately discharges stormwater to waterways, which are outside the airport boundary.

Desired environmental conditions of receiving waterways are stipulated under Victorian Government legislation, including the SEPP (Waters).

Further details are provided in Chapter B3: Soils, Groundwater and Waste and Chapter B4: Surface Water and Erosion.

B2.3.2.5
Aboriginal Heritage Act 2006

The purpose of the *Aboriginal Heritage Act 2006* (Vic) (AH Act) is to provide for the protection of Aboriginal cultural heritage in Victoria. The AH Act is administered by Aboriginal Victoria and is the Victorian Government's key cultural heritage legislation for Indigenous heritage, and identifying and protecting Indigenous heritage places and objects in Victoria. The Act establishes a Victorian Aboriginal Heritage Register (VAHR) that records all the Indigenous heritage places and objects.

Aboriginal Victoria does not have jurisdiction on Commonwealth land and, therefore, the provisions of the AH Act do not apply. Obtaining an approved Cultural Heritage Management Plan (CHMP) or Cultural Heritage Permit would be the normal process for obtaining statutory approval for any works that may cause harm to places listed on the VAHR. While Aboriginal Victoria does not have jurisdiction on Commonwealth land, Melbourne Airport has sought to meet the standards of state heritage assessment in order to address cultural heritage impacts and a voluntary CHMP under the AH Act was considered appropriate to facilitate this. Further details are described in Chapter B6: Indigenous Cultural Heritage, which assesses cultural heritage impacts.

B2.3.2.6
Heritage Act 2017

The Victorian *Heritage Act 2017* (Heritage Act) is administered by Heritage Victoria and is the principal legislation for the identification and management of heritage places and objects of state significance, historical archaeological sites and maritime heritage. The Heritage Act establishes the Victorian Heritage Register (VHR) for places of state significance, the Victorian Heritage Inventory (VHI) for places that have historical archaeological values and the Heritage Council of Victoria.

Heritage Victoria does not have jurisdiction on Commonwealth land and, therefore, the provisions of the Heritage Act do not apply to Commonwealth property that is part of M3R development footprint. Obtaining a 'Consent to Damage' would be the normal process for obtaining statutory approval for any works that may cause harm to places listed on the VHI. As with cultural heritage, Melbourne Airport seeks to meet standards of Victorian European heritage assessment and management legislation given the absence of specific guidance on Commonwealth land. This is addressed in Chapter B7: European Heritage.

B2.3.2.7
Flora and Fauna Guarantee Act 1988

The *Flora and Fauna Guarantee Act 1988* (Vic) (FFG Act) is the primary legislation dealing with biodiversity conservation and sustainable use of native ecology in Victoria. Under the FFG Act, a permit is required for the potential impacts and removal of listed flora and fauna. Any species or ecological community listed as threatened under the FFG Act is considered to be of state significance. The FFG Act also sets out protected flora controls, which provide protection over public land for listed threatened flora, plants belonging to a listed threatened community or protected plants declared under section 46 of the FFG Act. The FFG Act listed species, ecological communities and any species listed as rare, vulnerable, endangered or critically endangered on a DELWP advisory list are considered to be of state significance and may also be of relevance under the EPBC Act.

For direct impacts to significant ecological values that cannot be avoided, the provision of appropriate offsets in accordance with the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012) will be the primary mitigation measure. The proposed offset strategy is described in Chapter E3: Offset Management Strategy. There is no legislative requirement to provide offsets for state significant ecological values, but as these values largely correspond with nationally listed species and ecological communities, it is anticipated that any proposed offset strategy will assist in mitigating impacts on these values.

A formal ecological assessment has occurred as part of the MDP process which identifies ecological assets impacted by M3R. Further details are described in Chapter B5: Ecology which assesses ecological impacts.

B2.3.2.8
Metropolitan Planning Strategy: Plan Melbourne 2017-2050

Plan Melbourne 2017-2050 (Plan Melbourne) is Melbourne's overarching Metropolitan Planning Strategy, released by the Victorian Government in March 2017. A key challenge identified within this strategy is 'keeping up with the growing transport needs of the city', which is 'coming under increased pressure from growth'.

Plan Melbourne's vision for the city is guided by nine principles. Principle 2 seeks to 'develop and deliver infrastructure to support its competitive advantages in sectors such as business services, health, education, manufacturing and tourism'. This principle is further supported by relevant 'outcomes' and corresponding 'policy directions' that are set out in the strategy. The following outcomes are considered relevant to the operation and future expansion of the Melbourne Airport:

- Outcome 1: Melbourne is a productive city that attracts investment, supports innovation and creates jobs
- Outcome 3: Melbourne has an integrated transport system that connects people to jobs, and services and goods to market
- Outcome 4: Melbourne is a distinctive and liveable city with quality design and amenity.

These outcomes are supported through the following directions and policies:

- Direction 1.1 seeks to 'create a city structure that strengthens Melbourne's competitiveness for jobs and investment'. This direction is supported by policy 1.1.5 which:
  - Endeavours to 'support major transport gateways as important locations for employment and economic activity'
  - Identifies that Melbourne Airport is 'well placed to capitalise on growing labour markets and supporting employment and economic development opportunities', which together with Essendon Fields Airport's expanding regional services, 'has the potential to become one of Australia's leading transport and logistic hubs'
  - Highlights the need to protect Melbourne Airport from 'incompatible land uses' through policies that encourage complementary uses and employment generating activity.
- Direction 3.1 seeks to 'transform Melbourne's transport system to support a productive city'. This direction is supported through policy 3.1.4 which:
  - Aims to 'provide guidance and certainty for land-use and transport development through the Principal Public Transport Network and Principal Freight Network'
  - Identifies that the Principal Freight Network will help direct land-use decisions to minimise uses that might conflict with areas expected to have intense freight activity.
- Direction 3.4 aims to 'improve freight efficiency and increase capacity of gateways while protecting urban amenity' and identifies the need to protect Melbourne Airport's curfew-free status and support its expansion. This direction is supported by policy 3.4.3 which:
  - Seeks to 'avoid negative impacts of freight movement on urban amenity' through a more consistent approach to land use planning in freight precincts and corridors.
- Direction 4.5 identifies the need to 'plan for Melbourne's green wedges and peri-urban areas', which provides for food production, stone supply, biodiversity, recreation, tourism and critical infrastructure including airports. The direction seeks to use green wedges and peri-urban areas to protect state infrastructure and is further supported by policy 4.5.2, which:
  - Endeavours to 'protect and enhance valued attributes of distinctive areas and landscapes'
  - Identifies that a desired outcome for GWZ and peri-urban areas is to protect state significant infrastructure, including airports and flight paths.

B2.3.2.9
Growth Corridor Plans 2012

Growth Corridor Plans (GCPs) are high-level integrated land use and transport plans that provide a strategy for the development of Melbourne's four growth corridors over the coming decade (refer to **Figure B2.2**). The plans were prepared by the Growth Areas Authority (now Victorian Planning Authority) to provide a strategy for the development of Melbourne's growth corridors over the next 30 to 40 years. The GCPs provide for housing, jobs, transport, town centres, open space and key infrastructure across Melbourne's newest metropolitan suburbs. The plans also identify broad transport networks, industrial and employment zones, residential areas and recreation precincts.

The GCPs consist of multiple Precinct Structure Plan (PSP) areas, which are at various stages of completion. PSPs are developed in accordance with the PSP guidelines. More specific information regarding the implementation of PSPs has not been prepared as part of this report because the overarching GCP is considered sufficient for the purposes of this land use assessment.

GCPs are relevant to this MDP as they provide information regarding proposed future development around the airport, particularly future residential development. This is important information in terms of airport safeguarding, noise, health and social impact assessments.

GCPs considered relevant to the development and operation of Melbourne Airport are summarised below:

The North Growth Corridor Plan

- The area covered by the North Growth Corridor Plan (north-east of the airport) will eventually accommodate a population of 260,000 or more people and has the capacity to provide for at least 83,000 jobs. It also shows the proposed Outer Metropolitan Ring Road to the north-west of the airport. The majority of new industrial land for the northern metropolitan region will be located within the North Growth Corridor.
- The Plan identifies Broadmeadows as the Central Activities Area (CAA) for Melbourne's north; supported by a network of principal town centres in Epping and Donnybrook and major town centres in Mernda, South Morang, Wollert, Roxburgh Park, Gladstone Park, Craigieburn and Mickleham. Many of these town centres have been located on public transport networks to maximise accessibility (refer to **Figure B2.3**).
- The Plan identifies Melbourne Airport as a 'Specialised Town Centre'.

The West Growth Corridor Plan

- The area covered by the West Growth Corridor Plan (south-west of the airport) will eventually accommodate a population of 377,000 or more people and have the capacity to accommodate at least 164,000 jobs.
- Development includes the creation of attractive and accessible locations for a wide range of jobs, investment, and services – including in six new higher-order town centres.
- Creating a network of principal and major town centres at Toolern, Rockbank North, Rockbank South, Plumpton, Sayers Road and Tarneit.
- Connections between districts will be provided by a grid of arterial roads and extended public transport networks. Each town centre is located centrally within its district and will be accessible by multiple transport modes (refer to **Figure B2.4**).
- The Plan identifies Melbourne Airport as a 'Specialised Town Centre'.

The Sunbury Growth Corridor Plan

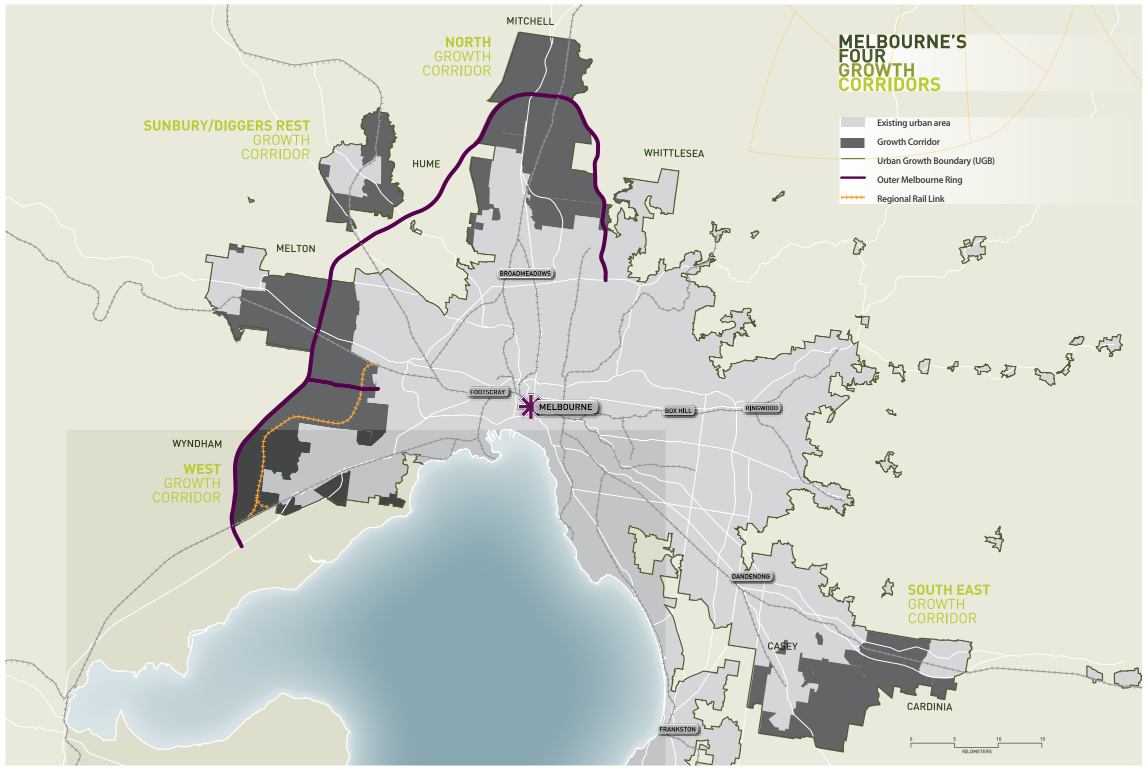
- The area covered by the Sunbury Growth Corridor Plan will eventually accommodate a population of a least 71,000 people and approximately 10,000 jobs.
- There is relatively limited local employment within Sunbury and Diggers Rest at present, primarily due to proximity to other larger employment locations (including Melbourne Airport, which is a major employer in the north).
- The need to improve local transport links (including creek crossings and improved capacity on the main approach roads to the town) are identified as key issues to be addressed in future development of Sunbury and Diggers Rest (refer to **Figure B2.5**).
- The Plan identifies Melbourne Airport as a 'Specialised Town Centre'.

B2.3.2.10
Melbourne Airport Environs Strategy Plan 2003

Part 3C of the P&E Act identifies the MAESP as an approved strategy plan and a prescribed document applicable to every municipal council whose municipal district is wholly or partly within the Melbourne Airport Environs Area. It also requires works by a government department, public authority or council to be in conformity with the MAESP unless otherwise approved by the Premier of Victoria.

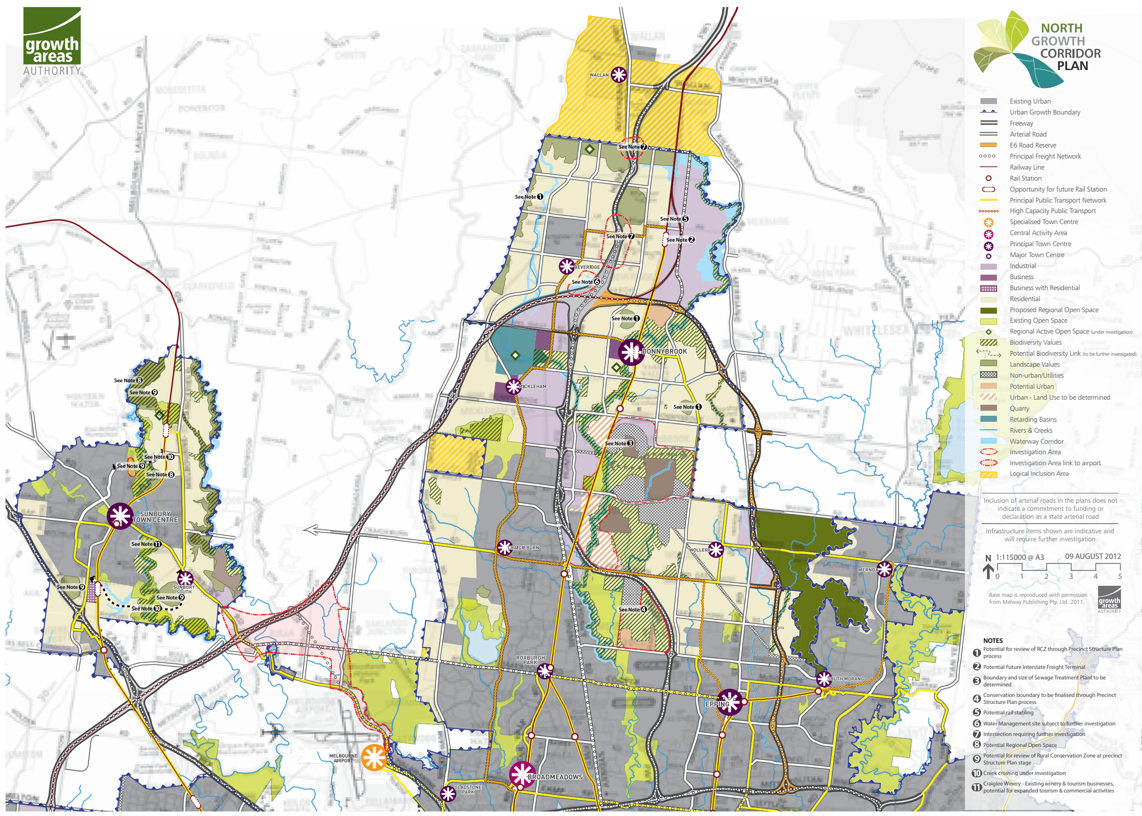
The Victorian Government prepared MAESP to address a number of issues and concerns with the Airport Environs Overlay in place at the time. The overall aim was to ensure that Victoria could retain a 24-hour, curfew-free airport and manage associated aircraft noise impacts on residential areas. The MAESP's recommendations took the form of a new overlay control (PSA VC30), the MAEO. The introduction of the MAEO reflected the State Government's response to the MAESP Steering Committee's report recommendations and is applied to areas of high and moderate aircraft noise exposure (in excess of the 20 ANEF noise contour) as detailed under **Section B2.3.4.7** of this chapter. The boundaries of the MAEO are based on the 2018 ANEF contours.

Figure B2.2
Melbourne's four growth corridors



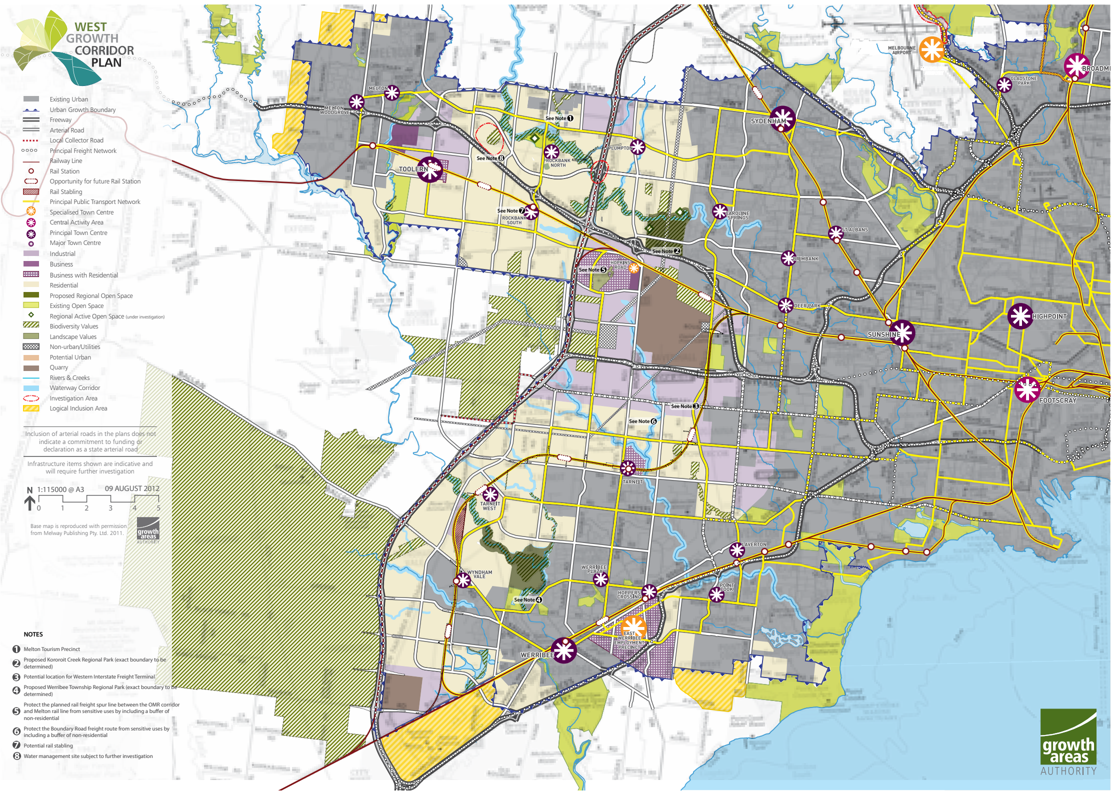
Source: GAA, 2012

Figure B2.3
North Growth Corridor Plan



Source: GAA, 2012

Figure B2.4
West Growth Corridor Plan



Source: GAA, 2012

Figure B2.5
Sunbury Growth Corridor Plan

Source: GAA, 2012

The Ministerial Direction on the Form and Content of Planning Schemes requires relevant planning schemes to incorporate Australian Standard AS 2021-2015: Acoustics – Aircraft noise intrusion – Building siting and construction. The MAEO in the relevant planning schemes references AS2021-2015. Land that is or will be subject to high levels of aircraft noise based on the 25 ANEF contour is classified under MAEO Schedule 1 and generally applies to land close to the runway ends. Land that is or will be subject to moderate levels of aircraft noise based on the 20 to 25 ANEF contour is classified under MAEO Schedule 2.

The purpose of the MAEO control is to:

- Implement the Municipal Planning Strategy and the Planning Policy Framework
- Ensure that land use and development are compatible with Melbourne Airport's operation under the relevant airport strategy or Master Plan, and with safe air navigation for aircraft approaching and departing the airfield
- Assist in shielding people from the impact of aircraft noise by requiring appropriate noise attenuation measures in dwellings and other noise-sensitive buildings
- Provide for appropriate levels of noise attenuation depending on the level of forecast noise exposure.

The effectiveness of the Melbourne Airport Environs Area, the Melbourne Airport Environs Strategy Plan 2003, the Melbourne Airport Environs Overlay and other related planning provisions in safeguarding Melbourne Airport's ongoing, curfew-free operation and its environs and its environs, was at the time of writing, being reviewed by MAESSAC and the Minister for Planning (discussed earlier in **Section B2.3.2.1**).

B2.3.2.11
Planning Policy Framework

All planning schemes contain the Planning Policy Framework (PPF) which establishes the context for spatial planning and decision-making in Victoria. Planning and responsible authorities are to have regard to, and be consistent with, the PPF when formulating and implementing local planning schemes for their municipal area. At an overarching level, the PPF seeks to ensure that the needs of existing and future communities are properly planned having regard to factors ranging from the provision of appropriately zoned and located land, to understanding and minimising environmental impacts.

The relevant sections of the PPF in relation to M3R are summarised below:

- *Clause 11 Settlement* seeks to ensure that planning recognises the need for and contributes towards, among other things, accessibility and land use and transport integration.
  - *Clause 11.01-1R Settlement – Metropolitan Melbourne* aims to create a city structure that attracts investment and drives growth, with particular focus on supporting major Transport Gateways such as airports.
  - *Clause 11.01-1R Green Wedges – Metropolitan Melbourne* endeavours to plan and protect major infrastructure and resource assets that serve the wider Victorian community, such as airports and ports with their associated access corridors.
- *Clause 12 Environmental and landscape values* seeks to ensure that planning protects ecological systems and biodiversity, and conserves areas with identified environmental and landscape values. In particular, the clause identifies that planning must implement environmental principles for ecologically sustainable development that have been established by international and national agreements.
  - *Clause 12.01-1S Protection of biodiversity* seeks to assist in the protection and conservation of Victoria's biodiversity and encourages the use of strategic planning as the primary tool for the protection and conservation of Victoria's biodiversity.
  - *Clause 12.01-2S Native vegetation management* seeks to ensure that there is no net loss to biodiversity as a result of the removal, destruction or lopping of native vegetation.
- *Clause 13 Environmental risks and amenity* identifies that 'planning should aim to avoid or minimise natural and human-made environmental hazards, environmental degradation and amenity conflicts'.
  - *Clause 13.05-1S Noise abatement* seeks to assist in the control of noise effects on sensitive land uses by ensuring that development is not prejudiced and community amenity is not reduced by noise emissions by using a range of building design, urban design and land use separation techniques as appropriate to the land use functions and character of the area.
- *Clause 15 Built Environment and heritage* identifies that land use and development planning must support the development and maintenance of communities with adequate and safe physical and social environments for their residents through the appropriate location of uses and development, and quality of urban design.
  - *Clause 15.03-1S Heritage* conservation endeavours to ensure the conservation of places of heritage significance.
  - *Clause 15.03-2S Aboriginal cultural heritage* seeks to ensure the protection and conservation of places of Aboriginal cultural heritage significance.
- *Clause 17 Economic development* acknowledges that planning must provide for a strong and innovative economy and seeks to support and foster economic growth and development by providing land, facilitating decisions and resolving land use conflicts, so that districts may build on strengths and economic potential.
  - *Clause 17.04-1S Facilitating tourism* and *Clause 17.04-1R Tourism in Metropolitan Melbourne* seek to ensure that tourism facilities have access to suitable transport and to maintain Metropolitan Melbourne as a desirable tourist destination by improving transport infrastructure.

- *Clause 18 Transport* seeks to ensure an integrated and sustainable transport system that provides access to social and economic opportunities, facilitates economic prosperity, contributes to environmental sustainability, coordinates reliable movements of people and goods, and is safe.
  - *Clause 18.01 Integrated transport* seeks to create a safe and sustainable transport system by integrating land use and transport and coordinating development of all transport modes to provide a comprehensive transport system.
  - *Clause 18.04-1S Planning for Airports and Airfields* seeks to strengthen the role of Victoria's airports and airfields within the state's economic and transport infrastructure, facilitate their siting and expansion and protect their ongoing operation. This clause notes that the NASF must be considered as a relevant policy document. Key strategies include to:
    - Protect airports from incompatible land-uses
    - Ensure that in the planning of airports, land-use decisions are integrated, appropriate land-use buffers are in place and provision is made for associated businesses that service airports
    - Ensure the planning of airports identifies and encourages activities that complement the role of the airport and enables the operator to effectively develop the airport to be efficient and functional and contributes to the aviation needs of the state
    - Ensure the effective and competitive operation of Melbourne Airport at both national and international levels.
  - *Clause 18.04-1R Melbourne Airport* seeks to protect the curfew-free status of Melbourne Airport and ensure any new use or development does not prejudice its operation. The clause notes that planning must consider as relevant the Melbourne Airport Master Plan (December 2013) (now superseded by the 2018 Master Plan) and the Melbourne Airport Strategy 1990 (MAS) for planning decisions affecting land in the vicinity of the Melbourne Airport.
- *Clause 19 Infrastructure* seeks to ensure that growth and redevelopment of settlements is planned in a manner that allows for the logical and efficient provision and maintenance of infrastructure, including the setting aside of land for the construction of future transport routes.

B2.3.3
Local planning schemes

The local planning authority administers municipal planning scheme provisions and development approval requirements as per the processes provided for in the state's legislation. The local content of planning schemes must be consistent with the PPF and the Ministerial Direction on the Form and Content of Planning Schemes set out under section 7(5) of the P&E Act. As Commonwealth land, planning scheme provisions do not directly apply to Melbourne Airport land, although they must be considered when preparing a MDP.

Melbourne Airport is wholly located within the City of Hume and therefore the Hume Planning Scheme must be considered. The airport's MAEO noise control traverses the City of Hume and four other municipalities, and therefore the planning schemes for those other four municipalities must also be considered. The following sub-sections identify the relevant clauses of these local planning schemes.

B2.3.3.1
Hume Planning Scheme

The City of Hume's LPPF contained within the Hume Planning Scheme includes the Municipal Strategic Statement (MSS) and local planning policies.
The following clauses of the MSS are particularly relevant to Melbourne Airport and M3R:

- *Clause 21.01 Municipal profile* provides local and regional context for the municipality, noting that it is located approximately 20 kilometres north-west of the Melbourne city centre, is one of Melbourne's seven growth area municipalities and recognises Melbourne Airport as a 'transport gateway' and one of Victoria's key strategic assets and economic drivers.
- *Clause 21.01-2 Protecting the operation of Melbourne Airport* states that the 'importance of the Melbourne Airport to the State's economy, and the accessibility of Melbourne to global markets, depends upon the continued curfew free operation of the airport'. It also states 'As the airport continues to grow it will attract significant demand for development in proximity to the airport. It will also generate an increase in traffic and increased aircraft noise. Council recognises the need to achieve a balanced approach that protects the curfew free status of the airport and supports economic growth and businesses, whilst at the same time minimising the impacts on existing residents.'
- *Clause 21.01-3 Vision and Strategic Framework Plan* sets the following vision for the municipality 'Hume City Council will be recognised as a leader in achieving social, environmental and economic outcomes with a common goal of connecting our proud community and celebrating the diversity in Hume'. In addition, the land use and development vision identifies Melbourne Airport as an employment precinct that employs local people across a range of trades and professions.
- *Clause 21.02-1 Managing growth and increasing choice* identifies that Growth Corridor Plans and Plan Melbourne have been developed at the metropolitan level which set the strategic direction for the future urban development of land within Melbourne's Urban Growth Boundary.
- *Clause 21.02-2 Hume corridor* identifies key issues for the municipality including the protecting and promotion of Melbourne Airport operations.
  The clause seeks to 'encourage job growth and diversity' and 'reinforce the role of Melbourne Airport as one of Victoria's key economic assets'.
- *Clause 21.02-4 Non-urban land* sets out Hume's strategy to support land uses and development on non-urban land (green wedge) that are compatible and sympathetic to the rural landscape; and take into account the presence of the Melbourne Airport Environs Overlay and the need to maintain the airport's curfew-free status.
- *Clause 21.08 Natural Environment and Environmental Risk* sets out Hume's objectives and strategies relating to natural heritage, environmental land management and water quality and conservation. Objectives relating to these matters are:
  - To protect, conserve and enhance natural heritage for biodiversity, amenity and landscape character purposes.
  - To improve the land health of the natural environment.
  - To protect water quality and ensure that water resources are managed in a sustainable way.

B2.3.3.2
Brimbank, Melton, Whittlesea and Moonee Valley planning schemes

<u>Brimbank Local Planning Policy Framework</u>

- *Clause 21.06 Built environment* contains several objectives for areas that contribute to the built environment. The following clauses are of relevance to Melbourne Airport and M3R:
  - *Clause 21.06-3 Escarpments and ridgelines* relates to development of escarpments and ridgelines and identifies a number of key policies to guide decision-makers, including that development should not impact on Melbourne Airport's prescribed airspace.
  - *Clause 21.06-4 Landscaping* seeks to ensure landscaping within new developments respects the natural environment and landscape character of the surrounding area. It is strategy that *'Landscaping within the MAEO Schedule 1 and Schedule 2 areas should not be bird attracting and comply with the Melbourne Airport Urban Landscape Plantings Guide'.*
- *Clause 21.07 Housing* identifies the City's opportunities for residential development with an appropriate scale and built form. It is an objective to protect the operations of Melbourne Airport.
  A strategy in achieving this is to limit residential development within the MAEO areas and apply the Neighbourhood Residential Zone. Further strategic work to support this objective is to investigate mechanisms to control development within the prescribed airspace of Melbourne Airport.
- *Clause 21.09 Industrial land use* also states that development should not impact Melbourne Airport's prescribed airspace.

<u>Melton Local Planning Policy Framework</u>

- *Clause 21.02-2 Established Areas* states that the 'proximity of Melbourne Airport provides significant economic opportunities to the municipality'.
  It also states that the 'need to ensure the airport's curfew-free status is protected considerably restricts development opportunities within the areas under the Melbourne Airport Environs Overlay. Sensitive land uses on land affected by the Melbourne Airport Environs Overlay Schedule 1 and 2 need to be controlled in order to protect airport operations and maintain appropriate levels of amenity for the Melton community'.

<u>Whittlesea Local Planning Policy Framework</u>

- *Clause 21.04 Settlement* identifies opportunities for activity centres throughout the city with a key focus on strengthening existing centres. Further strategic work is required to support options for strengthening local planning provisions to protect Melbourne Airport and manage the impacts on the community.

<u>Moonee Valley Local Planning Policy Framework</u>

- *Clause 02.01 Context* states that 'Moonee Valley holds strong economic potential as a premier location for business and investment. This is due to its strategic location in the Melbourne CBD-Tullamarine Airport corridor'.

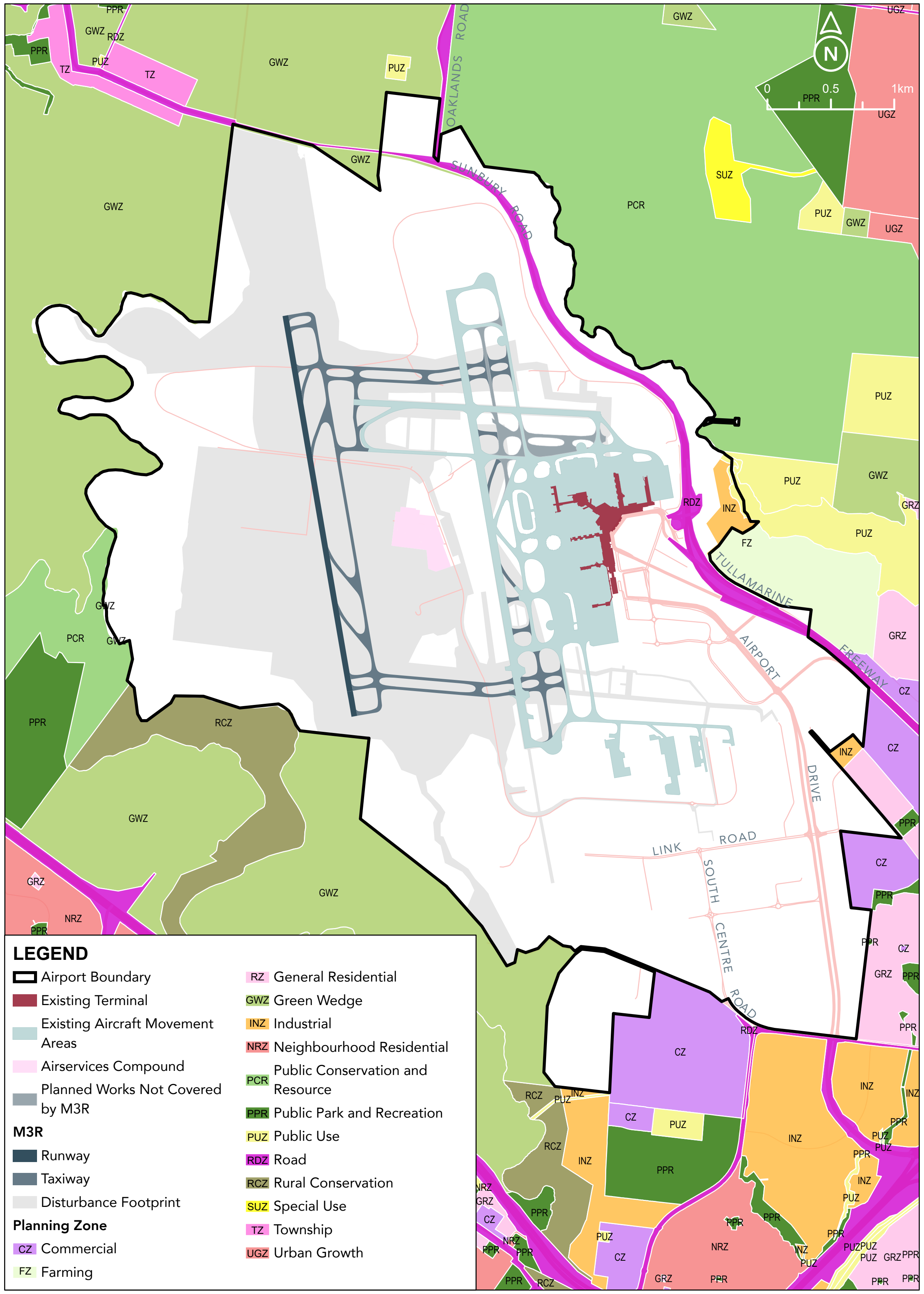
B2.3.3.3
Planning controls

<u>Zones</u>

With the exception of Commonwealth land (a 'Commonwealth Place'), which is not subject to the controls of planning schemes, land within Victoria has a zone, with standard zones used in all planning schemes as required. The following zoning provisions apply to land in the immediate vicinity of the development footprint as shown in Figure B2.6.

- Clause 35.04 Green Wedge Zone (Hume and Brimbank planning schemes)
  - The purpose of this zone, among other things, is to 'recognise, protect and conserve green wedge land for its agricultural, environmental, historic, landscape, recreational and tourism opportunities, and mineral and stone resources' and 'encourage sustainable farming activities'.
  - A permit is required to subdivide land. Depending on land use the zone may require permits for use or to construct a building or construct or carry out works.

Figure B2.6
Zoning plan



- Clause 36.04 Road Zone (Hume and Brimbank planning schemes)
  - The purpose of this zone, among other things, is to 'identify significant existing roads' and 'identify land which has been acquired for a significant proposed road'.
  - Pursuant to clause 36.04-1 (Table of uses), a permit is not required for a use listed in clause 62.01, which includes *'the use of land for a road except within the urban floodway zone and a public conservation and resource zone'*. In addition, clause 62.02-2 (Buildings and works not requiring a permit unless specially required by the planning scheme) includes roadworks. A permit is required to subdivide land.
- Clause 36.03 Public Conservation and Resource Zone (Hume and Brimbank planning schemes)
  - The purpose of this zone, among other things, is to 'protect and conserve the natural environment and natural processes for their historic, scientific, landscape, habitat or cultural values', and 'provide facilities which assist in public education and interpretation of the natural environment with minimal degradation of the natural environment or natural processes'.
- A permit is required to subdivide land. Depending on land use, the zone may require permits for use or to construct a building or construct or carry out works. Clause 35.06 Rural Conservation Zone (Brimbank Planning Scheme)
  - The purpose of this zone, among other things, is to 'protect and enhance the natural environment and natural processes for their historic, archaeological and scientific interest, landscape, faunal habitat and cultural values' and 'encourage development and use of land which is consistent with sustainable land management and land capability practices, and which takes into account the conservation values and environmental sensitivity of the locality'.
  - A permit is required to subdivide land. Depending on land use the zone may require permits for use or to construct a building or construct or carry out works.

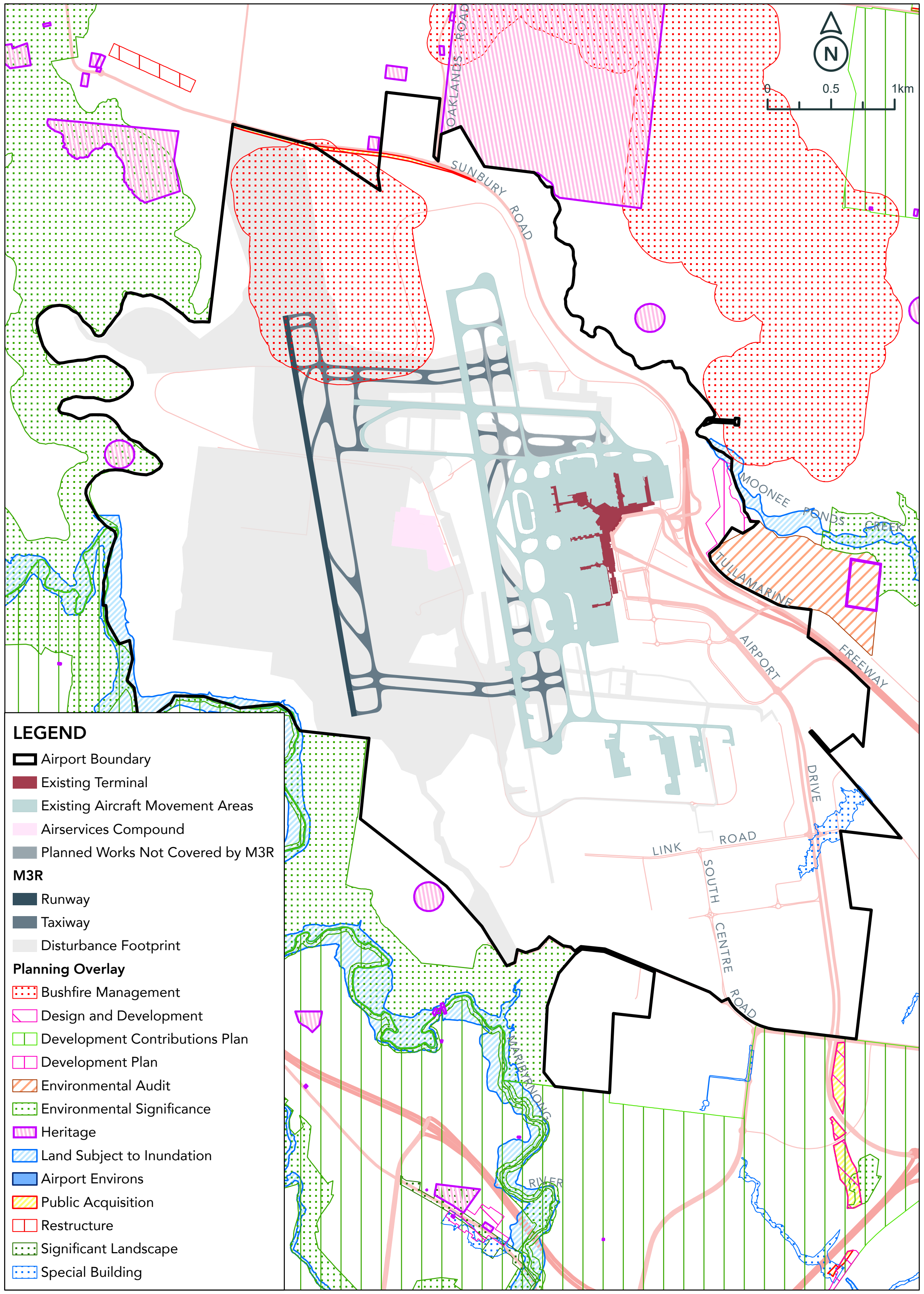
Overlays

A range of overlays apply to land surrounding the Melbourne Airport boundary. These are indicated in Figure B2.7.

The following overlays are located both on (see also Figure B2.11) and in the immediate vicinity of the airport but do not directly impact the development footprint:

- Clause 42.01 Environmental Significance Overlay (Hume and Brimbank planning schemes)
  - This clause seeks 'to identify areas where the development of land may be affected by environmental constraints' and 'to ensure that development is compatible with identified environmental values'.
  - This overlay may require a planning permit if native vegetation removal is required or to construct a building or construct or carry out works.
- Clause 44.04 Land subject to inundation overlay (Hume and Brimbank planning schemes)
  - This clause seeks to ensure that 'development maintains the free passage and temporary storage of floodwaters, minimises flood damage, is compatible with the flood hazard and local drainage conditions and will not cause any significant rise in flood level or flow velocity'.
  - This overlay would require a planning permit for construction of a building or to construct a building or construct or carry out works and the approval of the relevant floodplain management authority as a section 55 Referral Authority. If a local floodplain development plan has been prepared for the area and has been incorporated into this scheme, an application must be consistent with the plan.
- Clause 43.01 Heritage overlay (Hume and Brimbank planning schemes)
  - Heritage overlays seek to 'ensure that development does not adversely affect the significance of heritage places' and to 'conserve and enhance those elements which contribute to the significance of heritage places'. Full details of the impact of M3R on cultural or European heritage are described in **Chapter B6: Indigenous Cultural Heritage** and **Chapter B7: European Heritage**.
  - A permit is required within the heritage overlay to demolish or remove a building or to construct a building or construct or carry out works.
- Clause 44.06 Bushfire Management Overlay (BMO) (Hume Planning Scheme)
  - The BMO seeks to 'ensure that development of land prioritises the protection of human life and strengthens community resilience to bushfire; to identify areas where the bushfire hazard warrants bushfire protection measures to be implemented; and to ensure development is only permitted where the risk to life and property from bushfire can be reduced to an acceptable level'.
  - The overlay would require a planning permit to subdivide land, and to construct a building or construct or carry out works associated with particular uses.

Figure B2.7
Overlay plan (excluding MAEO)



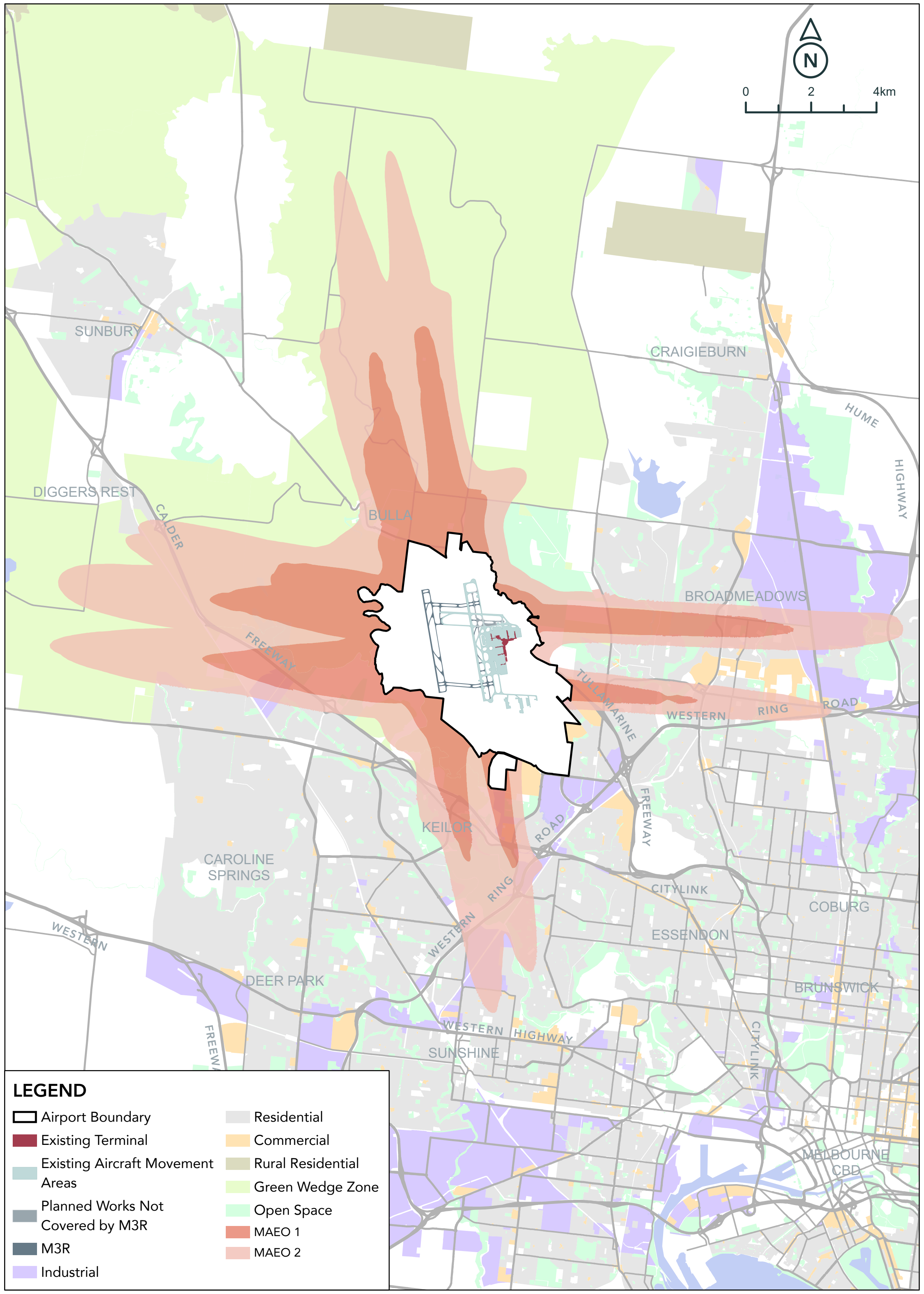
- Clause 45.08 Melbourne Airport Environs Overlay (MAEO) (Hume, Brimbank, Melton, Moonee Valley and Whittlesea planning schemes)
  - The MAEO (refer to **Figure B2.8**) is a planning tool to manage the use and development of land within close proximity to Melbourne Airport. The overlay seeks to minimise the number of people exposed to aircraft noise through setting density limits, enforcing acoustic requirements for building and it can restrict certain land uses. The MAEO is currently based on the 2018 ANEF contours and AS2021-2015: Acoustics – Aircraft noise intrusion – Building siting and construction. Municipalities surrounding the airport apply the provisions of the MAEO to noise sensitive land uses within close proximity of the airport.
  - The purpose of the MAEO is, among other things:
    - To ensure that land use and development are compatible with the operation of Melbourne Airport in accordance with the relevant airport strategy or master plan and with safe air navigation for aircraft approaching and departing the airfield'.
    - To assist in shielding people from the impact of aircraft noise by requiring appropriate noise attenuation measures in dwellings and other noise sensitive buildings'
    - vide for appropriate levels of noise attenuation depending on the level of forecasted noise exposure'.
  - The overlay introduces a range of controls for buildings and works which must be constructed so as to comply with any noise attenuation measures required by AS 2021- 2015, Acoustics - Aircraft noise intrusion - Building siting and construction. The classification of land into Schedule 1 and Schedule 2 is determined by the predicted level of noise exposure according to the ANEF.
  - Land that is or will be subject to high levels of aircraft noise based on the 25 ANEF contour (or greater) is classified under Schedule 1 to provide the greatest level of control of the use and development of the land. MAEO1 prohibits the development of noise-sensitive land uses, such as accommodation (excluding dwellings), child care centres, education centres and hospitals. It requires a planning permit for other land uses that may be sensitive to aircraft noise. The overlay prohibits the subdivision of land that would increase the number of dwellings for which the land could be used. Uses such as industry are not affected by this overlay.
  - Land that is or will be subject to moderate levels of aircraft noise based on the 20 to 25 ANEF contour is classified under Schedule 2. MAEO2 does not prohibit sensitive uses but does require a planning permit for such uses. It also specifies a lot size minimum for subdivisions.

B2.3.3.4
Particular and general provisions

The following particular and general planning provisions, applicable to all councils neighbouring the airport, are also of relevance to development of M3R.

- Clause 52.15 Heliport and helicopter landing site
  - Clause 52.15 of the Victoria Planning Provisions seeks to ensure the amenity impacts of a heliport and a helicopter landing site on surrounding areas is considered. A permit is required to use or develop any land for a heliport or a helicopter landing site even if it is ancillary to another use on the land unless specifically exempt via the table of exemptions for use.
- Clause 52.17 Native vegetation
  - Clause 52.17 of the Victoria Planning Provisions is relevant to M3R insofar as native vegetation may be impacted outside the airport site. The purpose of the clause is to ensure that there is no net loss to biodiversity as a result of the removal, destruction or lopping of native vegetation. A permit is required to remove, destroy or lop native vegetation unless exempt in accordance with the schedule to the clause or is listed in a native vegetation precinct plan. An impact on Commonwealth land is exempt from the Victoria Planning Provisions, including the requirement to obtain a permit for the removal of native vegetation and provide appropriate offsets in accordance with the Biodiversity Assessment Guidelines.
- Clause 52.29 Land adjacent to a road zone, Category 1, or a public acquisition overlay for a Category 1 road
  - Clause 52.29 of the Victoria Planning Provisions seeks to ensure appropriate access to identified roads and requires a planning permit to create or alter access to a road in a road zone, Category 1 (RDZ1). The creation of a new access way or the alteration of an existing access way will require a planning permit and the approval of the Road Corporation as a section 55 Referral Authority.
- Clause 63.01 Extent of existing use rights
  - An existing use right is established in relation to use of land under this scheme if any of the following apply:
    - 'The use was lawfully carried out immediately before the approval date
    - A permit for the use had been granted immediately before the approval date and the use commences before the permit expires
    - A permit for the use has been granted under clause 63.08 (alternative use) and the use commences before the permit expires
    - Proof of continuous use for 15 years is established under clause 63.11 (proof of continuous use)
    - The use is a lawful continuation by a utility service provider or other private body of a use previously carried on by a Minister, government department or public authority, even where the continuation of the use is no longer for a public purpose'.

Figure B2.8
Melbourne Airport Environs Overlay (MAEO)



B2.3.4
Airport strategies and plans

B2.3.4.1
Melbourne Airport Strategy 1990

A key step in the history of runway options development at Melbourne Airport was the preparation of the Melbourne Airport Strategy (MAS). The MAS and associated Environmental Impact Statement (EIS) were prepared jointly by the Federal Airports Corporation and the Victorian Government, and endorsed by the Commonwealth and Victorian governments in 1990. The MAS was designed to provide a foundation for the ongoing long-term development of Melbourne Airport and, in accordance with the former *Environment Protection (Impact of Proposals) Act 1974* (Cth), provided an assessment of environmental issues identified in the MAS. The EIS involved extensive community and industry consultation.

The MAS (which was prepared based on the best available information at the time) provided a broad framework for orderly airport development, road and rail access, and external land use control to protect the airport's 24-hour, curfew-free operation. It established the historic context for M3R, and encompassed a number of separate studies including a Runway Strategy, Landside Strategy, Land Use Strategy, Surface Access Strategy and Economic Benefits Study.

Importantly, the EIS included provision for the future development of a four-runway layout, which has been reflected in all Melbourne Airport master plans since 1990. This layout included wide-spaced parallel north-south and east-west runways to optimise hourly and annual capacities and operational flexibility. M3R's parallel north-south runway clearly facilitates the implementation of part of the four-runway system envisaged within the MAS in 1990, which was subject to the EIS approved by the Commonwealth Government. Further information on the development of runway options under the MAS is described in **Chapter A3: Options and Alternatives**.

It is noted that the Airports Act was enacted following the approval of the MAS and requires Commonwealth-regulated airports, including Melbourne Airport, to prepare a Master Plan every five years to establish the strategic direction of the airport. As such, the MAS/EIS has been superseded by the current Melbourne Airport Master Plan and is not a binding document under the Airports Act. It is acknowledged that the MAS is a policy guideline within PPF clause 18.04-1R, alongside the Master Plan and NASF.

For clarity, the relevant strategic document foreshadowing the development of Melbourne Airport at any point in time is the current Melbourne Airport Master Plan.

B2.3.4.2
Melbourne Airport Land Use Study 1992

The Melbourne Airport Land Use Study established the context for the protection of the airport from future encroachment from sensitive uses. The study made a number of recommendations in relation to the introduction of planning controls to limit the development of noise-sensitive land uses in certain areas around the airport.

This included areas within which noise-attenuation features will be required in construction, and areas of land suitable for airport-related commercial and industrial development.

The recommendations of the study subsequently led to the introduction of land use planning controls for land surrounding the airport. This formed the basis of the first Airport Environs Overlay introduced in 1996. The study also led to the introduction of a Public Acquisition Overlay applying to areas identified in the MAS EIS for future runway development, including some of the land now subject to this MDP (which has since been acquired).

B2.3.4.3
Melbourne Airport Master Plan 2018

The Airports Act requires that Melbourne Airport develop a new Master Plan every five years. The 2018 Master Plan was prepared in accordance with the five-year planning cycle in section 76 of the Airports Act, and approved by the Commonwealth Minister for Infrastructure, Transport and Regional Development on 14 February 2019.

Melbourne Airport's 2018 Master Plan outlines the vision and strategic intent for Melbourne Airport's future development over the next 20 years. The Master Plan has regard to state and local planning requirements. This applies most readily at the 'strategic level' for both state interests and council planning intent.

The principal features of the 2013 Master Plan relating to M3R were carried through to the 2018 Master Plan. The 2018 Master Plan builds upon the concept of a third runway and further extends long-term capacity of Melbourne Airport by proposing four runways.

The proposed north-south runway (16R/34L) is clearly identified as an element of the Long-Term Development Concept Plan for the airport in the 2018 Master Plan. The Long-Term Development Concept (refer to **Figure B2.9**) includes the four runways as well as a full build-out of the airport site. This long-term plan was based on the planning assumption that the existing terminal precinct would cater for up to 80 million passengers a year.

The proposed development is therefore consistent with the 2018 Master Plan and its long-term development scenarios. While the 2018 Master Plan indicated that the next (third) runway to be constructed would be the parallel east-west runway, a subsequent planning review determined that the next runway should be the parallel north-south runway (refer **Chapter A1: Introduction**). This change in runway staging will be addressed in the proposed 2022 Master Plan (refer **Section B2.3.4.8**).

The 2018 Master Plan also contains an ANEF endorsed for technical accuracy by Airservices Australia on 2 July 2018. This long-range ANEF comprises four ANECs prepared for the major operational stages of the airport's development, including two ANECs for the operation of three runways incorporating parallel east-west runways (ANECs 2 and 5). Compared to the 2013 ANEF, the area captured by the 2018 ANEF contours, 20 and above, increased by 26 per cent, growing by 32 square kilometres to 156 square kilometres. The proposed 2022 Master Plan includes a new ANEF including ANECs for the operation of parallel north-south runways.

B2.3.4.4 Melbourne Airport Master Plan 2018: Airport Land Use Plan

The 2018 Master Plan contains an Airport Land Use Plan. In accordance with the zoning provisions outlined in the Airport Land Use Plan, any activities listed in sections 89 and 89A of the Airports Act classified as a major airport development or a sensitive development require a MDP to be prepared which is subject to approval by the Commonwealth Minister for Infrastructure, Transport, Regional Development.

The Airport Land Use Plan for Melbourne Airport designates five land use precincts, each with a different focus or function:

- Airside Operations Precinct
- Airport Expansion Precinct
- Terminals Precinct
- Landside Main Precinct
- Landside Business Precinct.

The Master Plan also contains a Zoning Plan and an Overlay Plan (Figure B2.10 and Figure B2.11). M3R's development footprint is contained within the Special Use Zone Schedule 1 (Airside Operations Precinct) and Schedule 2 (Airport Expansion Precinct).

The application of the Special Use Zone to the airside operations and airport expansion precincts aims to reflect and accommodate the critical role and specific nature of these areas. Under the VPP, the proposed use falls under the definition of 'Airport' which is a permitted use in the Special Use Zone 1 and 2. M3R is therefore consistent with the Master Plan and with the applicable zones.

Most of the land identified for the new north-south runway is located within the Airport Expansion Precinct. The role of the Airport Expansion Precinct is to:

- Provide for the airport's future expansion, including additional future runways and taxiways and possible future terminal or aviation support facilities
- Support the ongoing operation and growth of aviation-related organisations, including Airservices Australia services and facilities (control tower, air traffic control, hot fire training ground)
- Conserve environmentally significant land where such land is not required for future airport operations.

The remainder of M3R works are contained within the Airside Operations Precinct. The role of the Airside Operations Precinct is to:

- Provide for safe, secure and efficient airfield activities, including aircraft landing, take-off, taxiing, handling and parking
- Accommodate the provision of aircraft navigation aids, aviation rescue and firefighting services, and other facilities essential for safe and efficient aircraft operations
- Provide for 24 hours a day, seven-days-a-week aircraft operations.

The 2018 Master Plan also sets out applicable overlays for the Airport. M3R is to be constructed on land that is subject to the following overlays, which are shown in the Overlay Plan (Figure B2.11):

- Environmental Significance Overlay (ESO) applies to land along Deep Creek, the Maribyrnong River, Moonee Ponds Creek, and the golf course. It ensures that development in these areas considers the natural environment, and flora and fauna habitats.
- Melbourne Airport Environs Overlay (MAEO) is based on the 2018 Australian Noise Exposure Forecast (ANEF) contours and the Australian Standard AS2021:2015: Acoustics – Aircraft noise intrusion – Building siting and construction. Land that is, or will be subject to, high levels of aircraft noise based on the 25 ANEF contour is classified under MAEO Schedule 1, and generally applies to the immediate airport and surrounds. Land that is, or will be subject to, moderate levels of aircraft noise based on the 20-25 ANEF contour is classified under MAEO Schedule 2.
- Heritage Overlay (HO) is based on areas of land or sites that have heritage significance identified in the Victorian Heritage Register, including the former St Mary's Church, Grey Box Woodland and Keilor archaeological site.
- Bushfire Management Overlay (BMO) is applied to land identified in the Hume Planning Scheme where the bushfire hazard warrants bushfire protection measures to be implemented.

Aviation fuel storage facilities at Melbourne Airport must meet increased fuel demands and ensure the airport retains sufficient on-site storage. The requirements for expansion of this infrastructure and associated land are shown in the 2018 (and 2022) Master Plan's development concept plans, classified as 'aviation support'.

The Airports Act requires a Master Plan to describe the extent to which the proposals contained in the Plan are consistent with planning schemes in force under state law. The application of the Special Use Zone to the operational areas of the airport, and overlays to areas that require additional building controls (such as environmental or heritage overlays), is consistent with the Planning Policy Framework and Victoria Planning Provisions. This is further outlined under B2.3.2.11 and Section B2.3.3 of this chapter.

A new Airport Land Use Plan forms part of Master Plan 2022 (refer Section B2.3.4.8). It is noted that Master Plan 2022 no longer includes an Overlays Plan.

B2.3.4.5 Melbourne Airport Environment Strategy 2018

Environmental management at Melbourne Airport is carried out in accordance with Melbourne Airport's approved Environment Strategy.

The Environment Strategy provides a platform to review previous actions, and provides guidance for new actions required for continuous improvement and positive environmental outcomes.

The strategy contains objectives, targets and environmental action plans that aim to assist in achieving the Melbourne Airport environmental policy goal and therefore meet the requirements of the Airports Act. The Melbourne Airport Environment Policy strives to lead the airport 'to be an environmental leader for transport and logistics sites in Australia'. Proactive communication and interaction with business partners and other stakeholders is required to implement defined sustainability standards and frameworks that respond to the global challenge of climate change, and allow continuous commitment to the Airport Carbon Accreditation Scheme.

Melbourne Airport also has in place an Environment Management System certified to the international standard ISO14001. The Environment Strategy highlights areas within the Melbourne Airport site considered to have environmental significance status, and which have been designated as conservation and recreation areas. M3R will occur within an area clearly designated for runways within the Ultimate Airport Environmental Plan (reflecting the ultimate development vision for environmental management at the airport) contained within the Environment Strategy.

The airport perimeter in the vicinity of the works is identified for conservation and recreation, and the area adjacent to the Grey Box Woodland is identified as an historic site which may also contain Indigenous features. Detailed consideration of the airport environs and European and cultural heritage is described in subsequent chapters of Part B of this MDP.

Environmental management of M3R construction and operational impacts will be undertaken in accordance with the Melbourne Airport Environment Strategy and Environmental Management System. Specifically, M3R construction impacts will be managed through development and implementation of a Construction Environmental Management Plan (CEMP).

A new Airport Environment Strategy forms part of aster Plan 2022 (refer Section B2.3.4.8).

B2.3.4.6 Ground Transport Plan 2018

The 2018 Master Plan incorporates the Ground Transport Plan for Melbourne Airport. The Ground Transport Plan sets out the actions required to address the forecast increases in passenger, employee and commercial vehicle travel to Melbourne Airport. In particular, the plan continues the development of a long-term solution to address congestion in the peak periods, and details opportunities to increase the use of mass transit and to manage travel demand through infrastructure and non-infrastructure solutions.

The Ground Transport Plan focuses on Melbourne Airport's strategy for moving people and freight at the airport, and access to and from the airport based on the aviation and non-aviation developments identified in the 2018 Master Plan.

The forecast growth that will be facilitated by M3R is accommodated within the Ground Transport Plan 2018. Chapter B8: Surface Transport provides a detailed assessment of surface transport at the airport.

A new Ground Transport Plan will form part of Master Plan 2022 (refer Section B2.3.4.8).

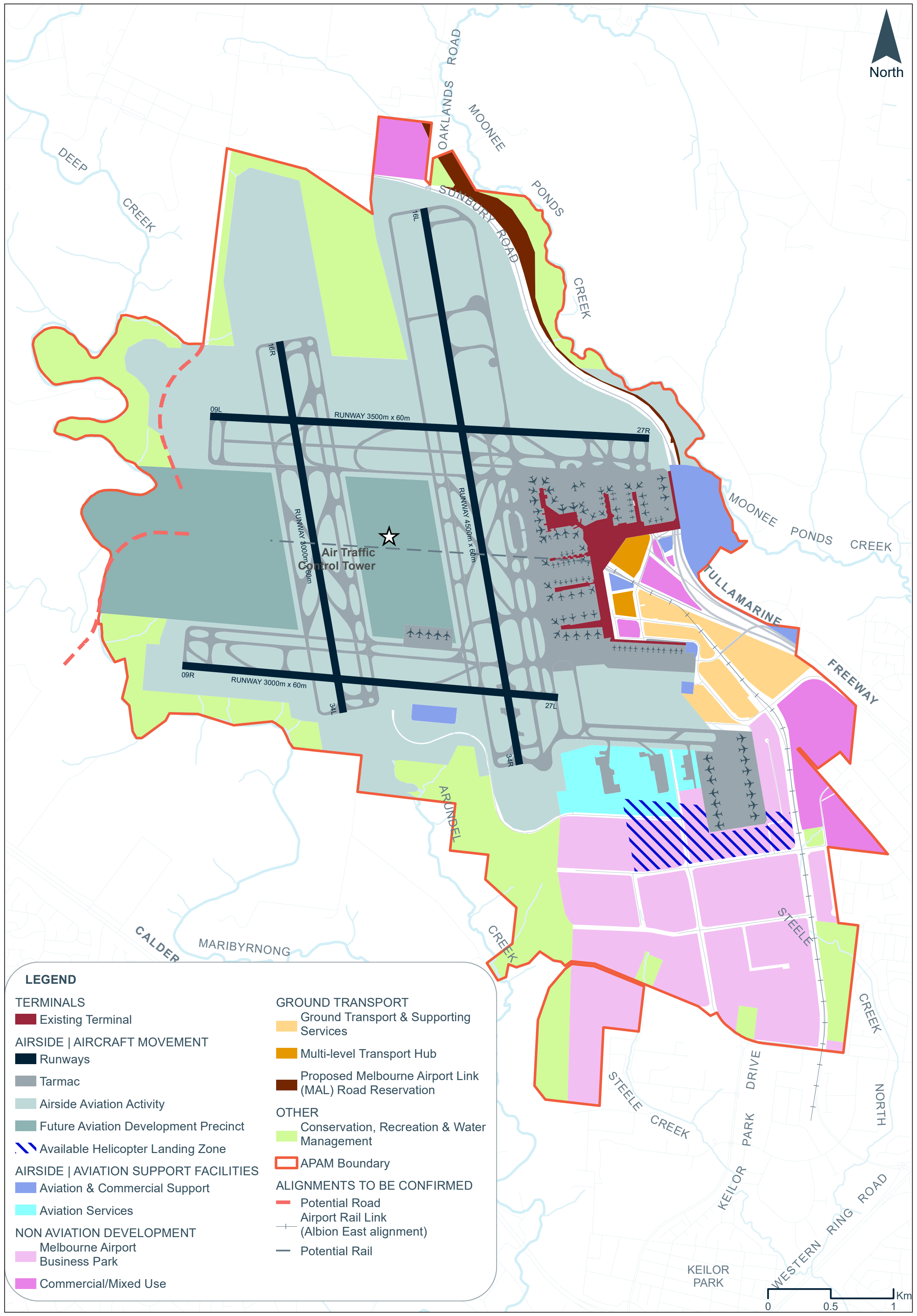
B2.3.4.7 Australian Noise Exposure Forecast

The Airports Act requires that a Master Plan includes an ANEF to determine likely noise exposure around the airport. ANEFs are the official forecasts of future noise-exposure patterns around an airport and constitute the contours on which land use planning authorities base their controls. (The system was developed as a land use planning tool aimed at controlling encroachment on airports by noise-sensitive buildings.)

Three types of aircraft noise charts are produced using the ANEF system: the Australian Noise Exposure Index (ANEI), Concept (ANEC) and Forecast (ANEF). The ANEI contour map presents historic aircraft noise levels over a certain time period (usually one year). The ANEC chart is a map showing forecast contours of aircraft noise exposure around the airport, based on indicative data on aircraft types, aircraft operations and flight paths. The ANEF chart provides cumulative noise effects for a given year of operations, with contours representing an average annual day (i.e. a measure of the total noise exposure over a 12-month period divided by 365 days).

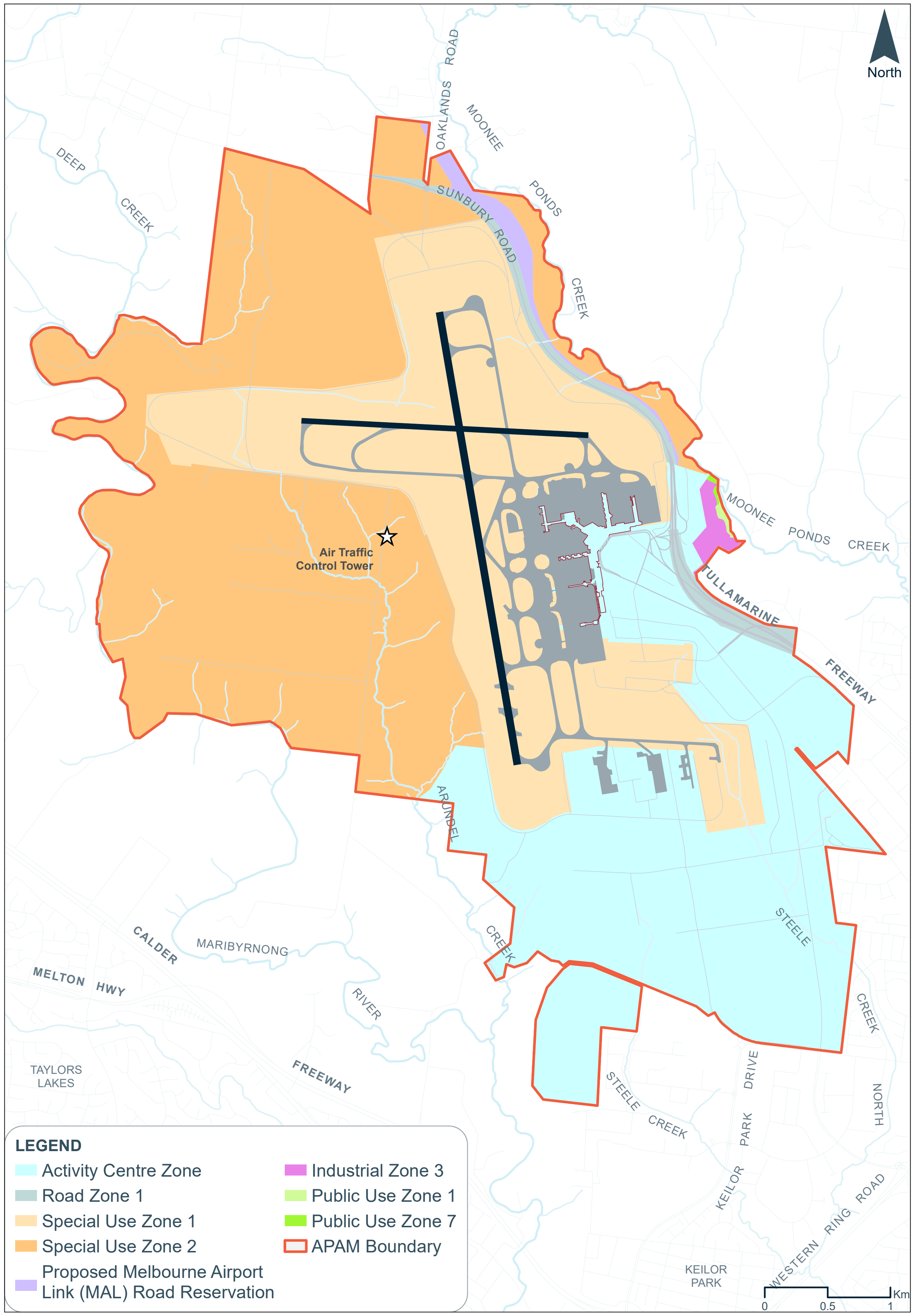
The 2018 Master Plan contains Melbourne Airport's Long Range ANEF (as shown in Figure B2.14) which was endorsed for technical accuracy by Airservices on 2 July 2018. The 2018 ANEF contours represent the airport's forecast impact, based on information available at the time. The 2018 Master Plan also contains an ANEI for 2015. The proposed 2022 Master plan contains a new, updated ANEF.

Figure B2.9
Melbourne Airport Master Plan 2018 Long Term Development Concept Plan for Melbourne Airport



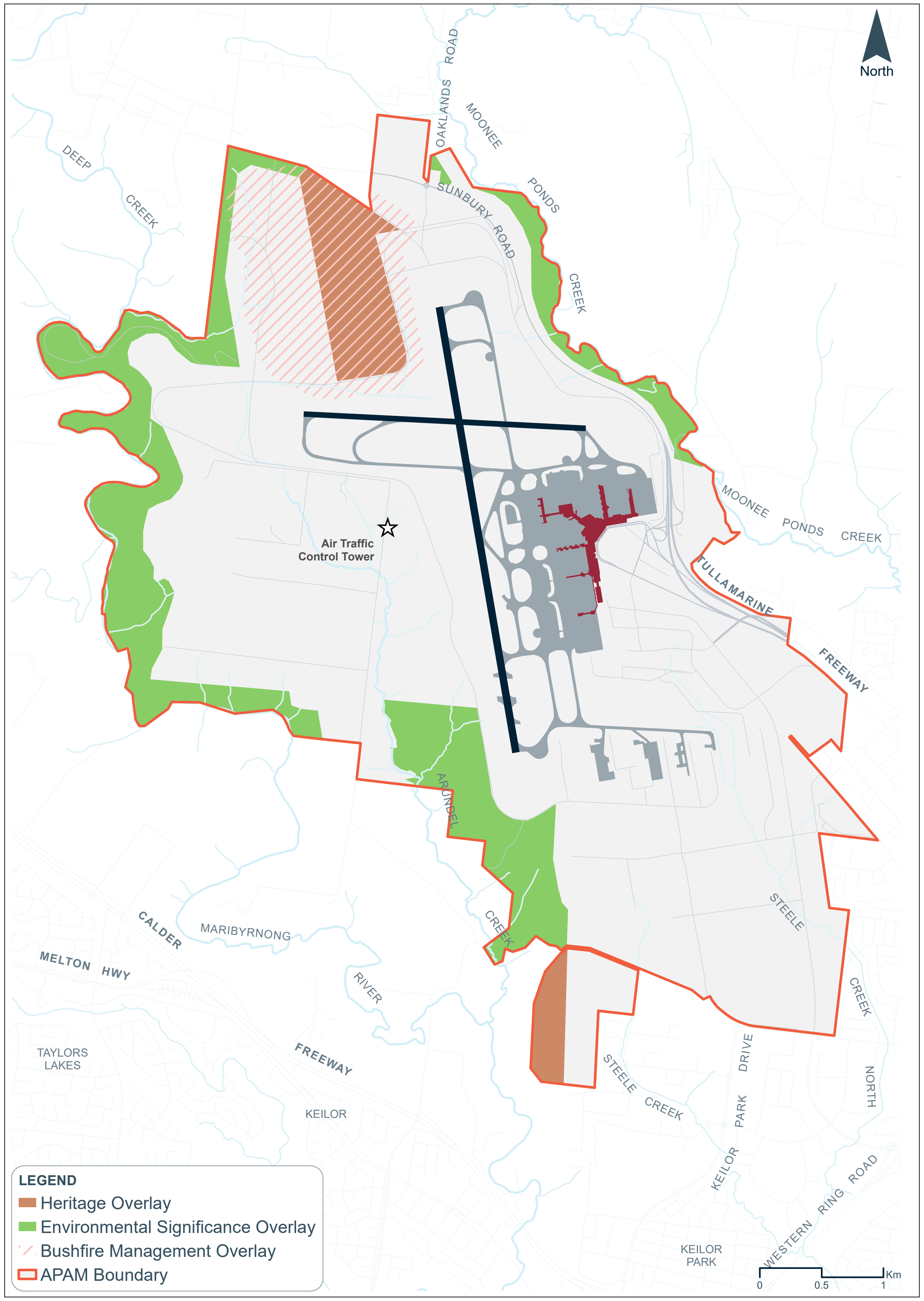
Source: APAM, 2018

Figure B2.10
Melbourne Airport Master Plan 2018 – Zoning Plan



Source: APAM, 2018

Figure B2.11
Melbourne Airport Master Plan 2018 – Overlay Plan



Source: APAM, 2018

As outlined in **Section B2.6.2.3**, land that is or will be subject to high levels of aircraft noise based on the 25 ANEF contour is classified under MAEO Schedule 1, which generally applies to the airport and immediate surrounds. Land that is or will be subject to moderate levels of aircraft noise based on the 20-25 ANEF contour is classified under MAEO Schedule 2. It has, however, been recognised that aircraft noise is not confined to areas inside the 20 ANEF noise contour, and that many complaints relating to aircraft noise originate from beyond this contour line.

There are limitations of the ANEF system that relate to the ability to describe aircraft noise. Number-above noise contours (or 'N contours') are considered a useful additional information tool for airport operators, particularly in assisting communities to better understand potential noise impacts. In Victoria, the State Government has agreed to consider N contours when considering planning scheme amendments and other strategic planning proposals.

NASF Guideline A recommends using N contours to supplement the ANEF contours. The N contour system is a complementary aircraft noise metric which produces contours showing the potential number of aircraft noise events above 60dB(A), 65dB(A) or 70dB(A) and represents these through corresponding N60, N65 and N70 diagrams. The Master Plan 2018 (Figure 9-12) includes N contours, and the proposed 2022 Master Plan will include new, updated N contours. Further information relating to noise is described in **Chapter C3: Aircraft Noise Modelling Methodology** and **Chapter C4: Aircraft Noise and Vibration**.

B2.3.4.8
2022 Master Plan (proposed)

Master Plan 2018 is the current, approved Master Plan for Melbourne Airport. However, the change of the third runway orientation announced in November 2019 necessitates a correlating update to the Master Plan.

The progression from RDP to M3R is a substantial and fundamental change to the airport's planning context, as reflected in the airport's current approved Master Plan 2018. APAM is therefore updating the Master Plan for Melbourne Airport, in conjunction with M3R, to reflect the changed orientation of the planned third runway.

Recognising that the primary driver for the new Master Plan is to reflect the revised third runway plan, the Preliminary Draft Master Plan 2022 and Preliminary Draft M3R MDP will be exhibited concurrently. This will reduce potential confusion in the community due to duplicated engagement processes.

For this reason (and in order to comply with section 91(1)(d) of the Airports Act), this Preliminary Draft MDP refers to both the approved 2018 Master Plan and the Preliminary Draft 2022 Master Plan.

Master Plan 2018 is referenced, where contextually appropriate in this document, as the current effective planning reference for Melbourne Airport. However, reference to 'Master Plan 2022 (proposed)' is also included where necessary as it reflects the changed orientation of the planned third runway. The year 2022 has been assigned to the proposed Master Plan as this is expected to be the year in which it is approved by the Minister for Infrastructure.

Following exhibition of both documents, the Draft Master Plan 2022 will be submitted to the Minister for consideration, followed by the Preliminary Draft M3R MDP. The Draft Master Plan 2022 approval decision will occur first, and consideration of approval of the M3R MDP will follow. This is because the M3R MDP cannot be approved while the current Master Plan 2018 is applicable.

Given the above, before the Draft MDP is submitted to the Minister under section 92, Melbourne Airport will remove any references in the MDP to the 2018 Master Plan and the commentary about the 2018 Master Plan. When the Minister makes a decision on the Draft MDP, the effective final Master Plan for the airport will be the 2022 Master Plan.

Master Plan 2022 will be a completely new Master Plan including new versions of:

- Long-Term Development Concept Plan - see **Figure B2.12**
- Zoning Plan – see **Figure B2.13**
- Airport Environment Strategy
- Ground Transport Plan
- Noise contours.

M3R will be entirely consistent with 'Master Plan 2022 (proposed)' which reflects the changed orientation of the planned third runway and associated construction footprint. It is noted that Master Plan 2022 no longer includes an Overlays Plan.

Figure B2.12
Melbourne Airport Master Plan 2022 (Proposed) – Long Term Development Concept Plan for Melbourne Airport

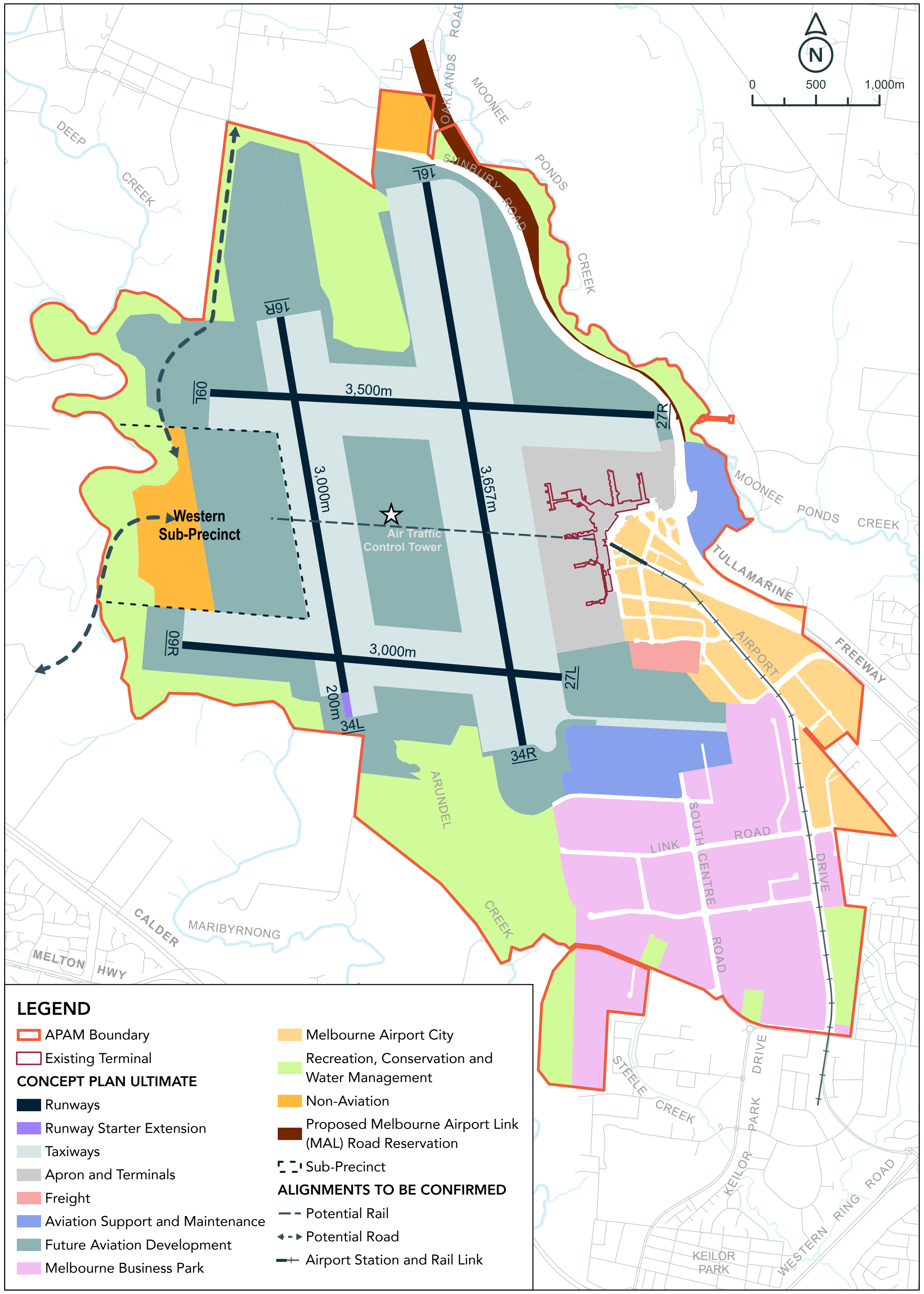


Figure B2.13
Melbourne Airport Master Plan 2022 (Proposed) – Zoning Plan

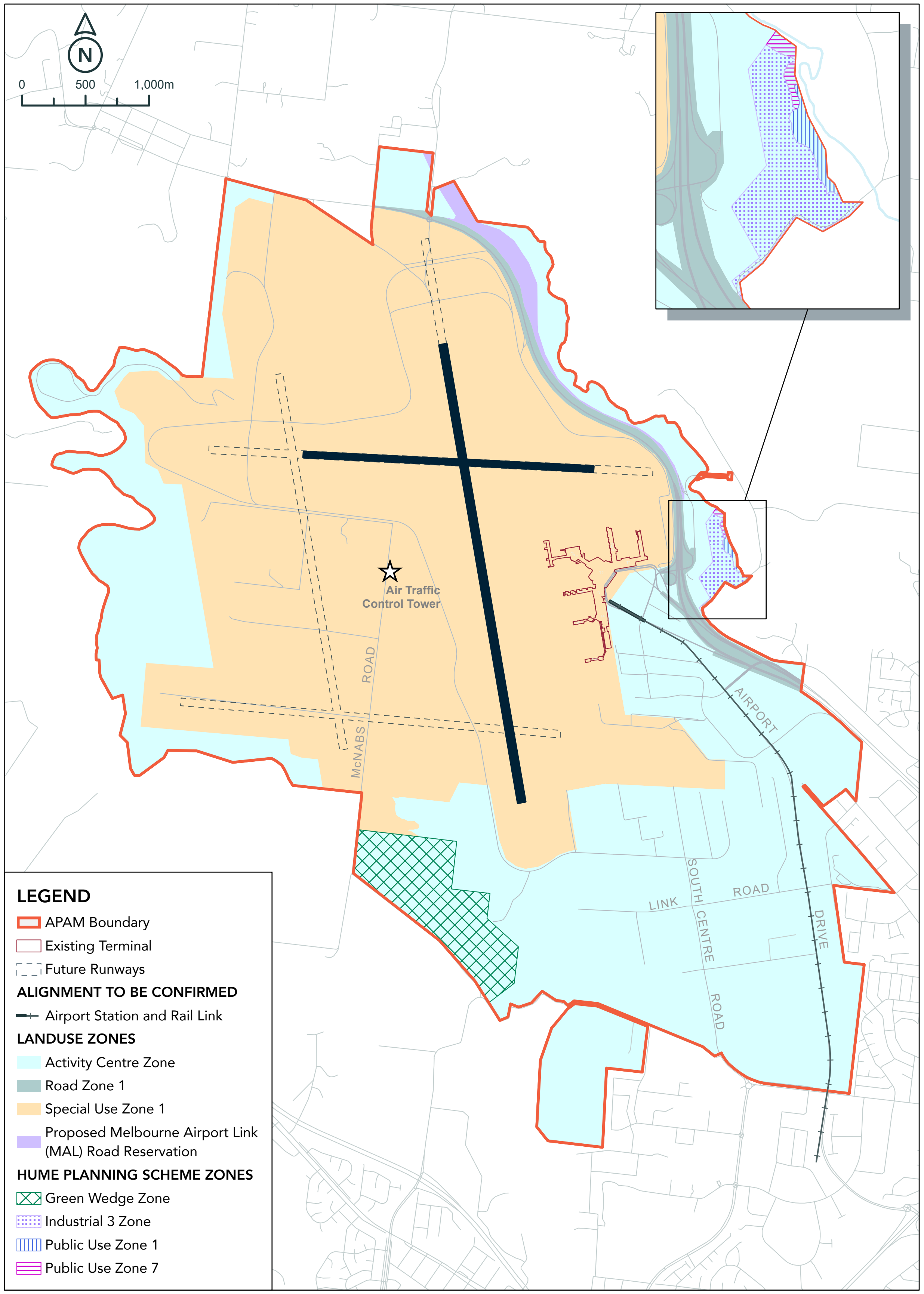
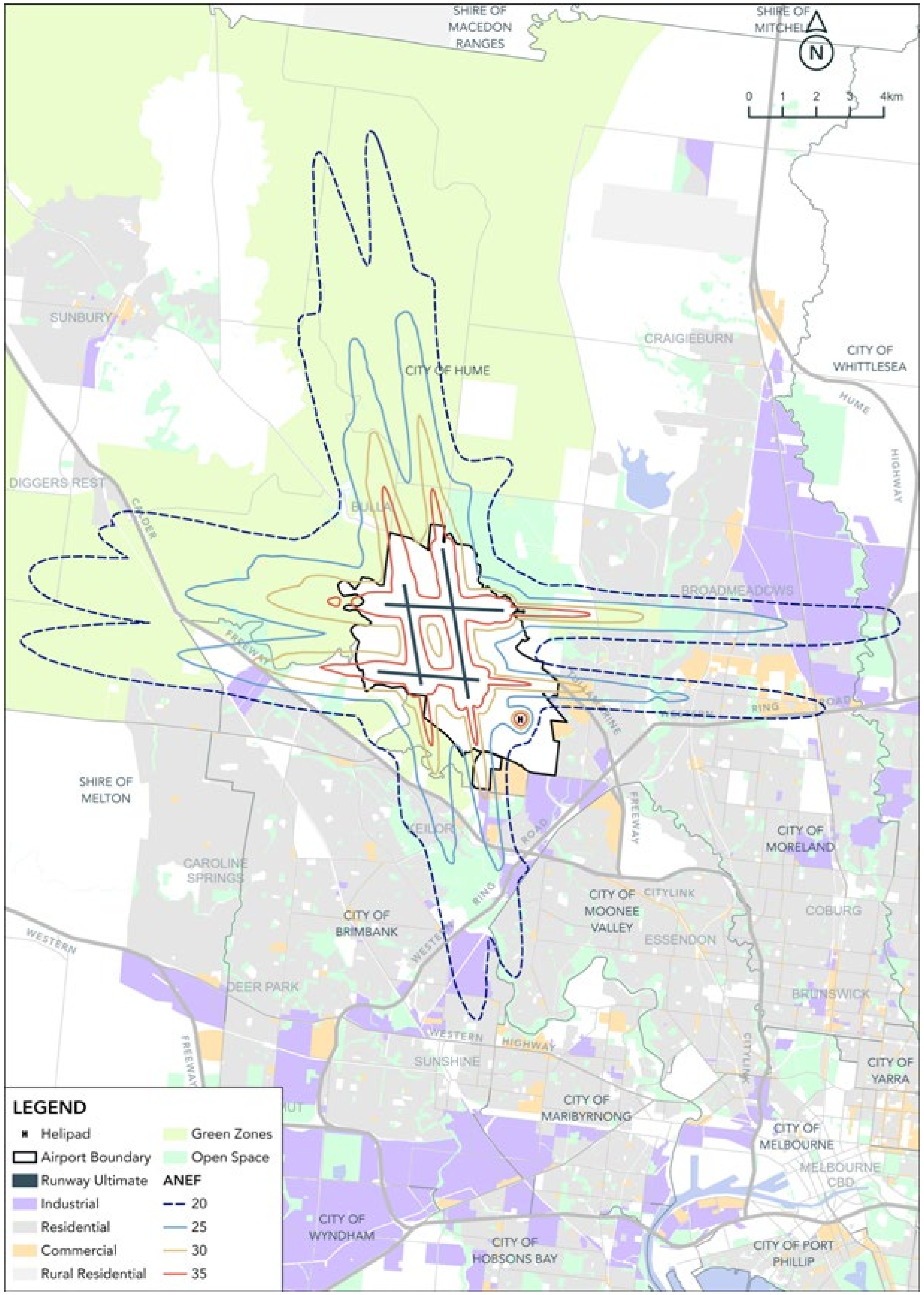


Figure B2.14
Long Range 2048 ANEF



Source: APAM, 2018

B2.4 DESCRIPTION OF SIGNIFICANCE CRITERIA

The impact assessment has involved the identification and evaluation of potential interactions between M3R components and activities and sensitive assets, values and uses in order to identify potential land use and planning impacts.

Potential receptors were established from the existing conditions assessment by identifying assets, values or uses that are protected by legislation and policy, important to the local community (or wider geographic area) or likely to be impacted by M3R. The receptors and the causes and outcomes of potential impacts were considered, which were then assessed in terms of likelihood and consequence to determine the magnitude of impact that could occur.

- Severity criteria - considers impact based on intensity, scale and duration
- Likelihood assessment - denotes the likelihood of the impact occurring and associates a risk rating.

To assist in the assessment of potential impacts identified under **Section B2.6.2** of this chapter and to ensure consistency between topics, project-specific severity criteria have been developed in relation to land use and planning impacts. These are described in **Table B2.2**. Duration impact criteria and likelihood criteria are described in **Chapter A8: Assessment and Approvals Process**.

B2.5 EXISTING CONDITIONS

B2.5.1 Study area

Land at Melbourne Airport is primarily utilised for aviation purposes, which comprise passenger and freight flight movements. Within the airport site are airside and landside facilities, including runways, aprons and terminal buildings. The airport also contains a range of complementary land uses, including hotels, car parks, public transport facilities, car rentals and commercial, retail and industrial activities. The Melbourne Airport Business Park extends from the Tullamarine Freeway and Mercer Drive in the north to Annandale Road and Sharps Road in the south, and contains a mixture of aviation and non-aviation-related development.

The development footprint is generally bounded by the existing north-south runway to the east, Deep Creek and the Maribyrnong River to the west and south-west, and Sunbury Road to the north.

Table B2.2
Severity criteria

Impact severity	Description
Major	Land use changes inconsistent with nationally significant planning policies and strategic plans. Permanently affects capacity to provide land for nationally significant residential or economic growth. Permanently affects ability for existing land use to continue in accordance with nationally significant planning policies/strategic plans. Major adverse change to current amenity, lifestyle and everyday community activities.
High	Land use changes significantly inconsistent with regionally/state significant planning policies, strategic plans and relevant development area structure plans with a major impact on the capacity to provide land for state significant residential or economic growth. Permanently affects ability for existing land use to continue in accordance with regional/state planning policies/strategic plans. Considerable adverse change to current amenity, lifestyle and everyday community activities.
Moderate	Land use changes somewhat inconsistent with local planning policies, strategic plans and relevant development area structure plans with a moderate impact on the capacity to provide land for locally significant residential or economic growth. Permanently affects ability for existing land use to continue in accordance with local planning policies/strategic plans. Noticeable adverse change to current amenity, lifestyle and everyday community activities - but with scope for mitigation.
Minor	Land use changes broadly consistent with planning policies, strategic plans and relevant development area structure plans with a limited impact on capacity to provide land for residential or economic growth. Temporary effect on ability for existing land use to continue in accordance with planning policies/strategic plans. There may be localised or limited noticeable change to current amenity, lifestyle or everyday community activities.
Negligible	Land use changes entirely consistent with planning policies, strategic plans and relevant development area structure plans. No effect on ability for existing land use to continue in accordance with planning policies/strategic plans. Minimal to no change to the existing situation.
Beneficial	Land use changes are likely to have beneficial impacts by implementing relevant planning policies, strategic plans and relevant development area structure plans.

The development footprint and wider study area is a highly modified urban fringe environment, which has been subject to significant disturbance. Historically, large areas of the M3R study area have been used for grazing, both prior to the construction of the airport in the 1960s and more recently in the areas to the west of McNabs Road and south of the existing east-west runway. This area is characterised by low grasses and weed species with limited larger vegetation species along historic fence lines, property boundaries and roads, and along the river and creek corridors. Broader areas of grass-dominated vegetation occur between the established airport infrastructure which includes runways, taxiways, HIALS, management roads and various buildings and other structures. The Grey Box Woodland on the northern part of the study area is well established and recognised by the Master Plan 2018 as having ecological and heritage significance. A range of site photographs are provided in Figure B2.15, Figure B2.16 and Figure B2.17, showing the general characteristics of the site.

Topographically, Melbourne Airport and the M3R project area are located on a relatively flat plateau, with some steep undulation associated with Deep Creek, Maribyrnong River and Arundel Creek to the west of the existing north-south runway. (Arundel Creek is a tributary of the Maribyrnong River.)

Figure B2.15
View north/north-west along McNabs Road from the south end of the site

Figure B2.16
View north-east from McNabs Road at the south end of the site

Figure B2.17
View south/south-west from Sunbury Road at the north end of the site

To the south and west of M3R, Jacksons Creek, Deep Creek and the Maribyrnong River dissect this plateau landscape with steep banks descending approximately 70 metres below the plateau in parts. To the south of the airport, the southern banks of the Maribyrnong River have been modified through historic agricultural land uses and a widened river valley has been created.

B2.5.2
Land use

The majority of the proposed works and ancillary activities associated with M3R will occur within the existing Melbourne Airport boundary. This section describes existing and planned future land use conditions of the surrounding areas outside the airport boundary:

- Residential and community facilities
- Industrial, commercial and retail (including extractive industry) development
- General agriculture and farming
- Public open space and recreation.

Melbourne Airport is predominantly surrounded by non-urban or green wedge land, particularly to the north and west, which helps separate the airport and its flight paths from the encroachment of incompatible activities. However, there is established urban development located to the east and south of the airport, comprising a mixture of industrial and residential development. The township of Bulla is nearby, to the north-west.

The impact of M3R on land use will primarily be in corridors extending in a northerly and southerly direction based on the proposed new north-south runway.

B2.5.2.1
Northerly direction

To the north of the M3R project area, land use largely comprises the small township of Bulla (to the north-west), and rural-residential or rural-living land uses in the Green Wedge Zone. To the north of Somerton Road, the land use changes to larger, open farming parcels of land, also in the Green Wedge Zone. Woodlands Historic Park is located to the north-east.

B2.5.2.2
Southerly direction

To the south of the M3R project area, land use largely comprises farming, rural-residential or rural-living land uses in the Green Wedge Zone.

The Maribyrnong River traverses across the southern area in a south-easterly direction. Sydenham Park and the Keilor Public Golf Course are located to the south-west of the Maribyrnong River.

Over the Maribyrnong River to the south, but north of the Calder Freeway, is Overnewton Anglican Community College. Urban areas are located to the south of the Calder Freeway, including the suburbs of Keilor, Keilor Lodge, Keilor Park and Taylors Lakes.

B2.5.3
Land tenure and ownership

When it was opened in 1970, Melbourne Airport occupied what was formerly agricultural land. In 1997, when Commonwealth airports were privatised, APAM became the airport-lessee company for Melbourne Airport for 50 years with a 49-year extension option under its lease with the Commonwealth. In 2013, the Melbourne Airport site was approximately 2,457 hectares.

Land acquisition has occurred to accommodate the airport's expansion and increased the area of the site to approximately 2,741 hectares.

The MAS and subsequent master plans identified that the airport will ultimately have a four-runway system. Previous plans identified that additional land west of McNabs Road would be required to accommodate the two future runways and further development. By 2013, the majority of the 26 properties identified for acquisition in the MAS had been acquired by negotiation. Final acquisition of freehold land has now taken place, with tenure of all on-airport land associated with M3R transferred to the Commonwealth and leased to APAM under the Airports Act. In addition, a number of roads including Mansfield Road, McNabs Road (part) and Barbiston Road have been closed and integrated into the APAM head lease.

B2.6 ASSESSMENT OF POTENTIAL IMPACTS

Impact assessment is a MDP requirement under section 91 of the Airports Act. Notably:

- 91(1)(ga)(iii) identifies that a MDP must set out the details of a major airport development, and the likely effects of the proposed developments that are set out in the MDP on the local and regional economy and community - including an analysis of how the proposed development fits within the local planning schemes for commercial and retail development in the adjacent area
- 91(4)(a) requires a MDP to address the extent (if any) of the consistency with planning schemes in force under a law of the state in which the airport is located
- 91(4)(b) in instances where the MDP is inconsistent with those planning schemes, the MDP must provide justification for the inconsistencies.

B2.6.1 Statutory and policy consistency

Section B2.3 provided an overview of relevant land use and planning legislation and policy requirements for the MDP. **Table B2.3** to **Table B2.6** describe the consistency of this MDP with respect to the requirements of each instrument.

The assessment of environmental and community impacts is dealt with in the impact assessment chapters of this MDP. These assessments have informed the assessment of statutory and policy consistency below.

Each impact assessment chapter contains a 'Statutory and Policy Requirements' section which discusses relevant Commonwealth, state and local government legislation and policy directly related to the particular assessment. The individual assessments also discuss consistency with those requirements where relevant.

Part E of this MDP (Management Framework) details the management structures and processes to be implemented, and summarises the M3R impacts and commitments made in the MDP to mitigate these impacts in order to meet relevant legislative and policy requirements.

B2.6.1.1 Commonwealth legislation and policy

Melbourne Airport applies NASF guidelines for the assessment of on-airport development and as the basis for responses to off-airport development proposals. Further details of NASF are provided in **Section B2.3.1.6** of this chapter.

Table B2.3
Statutory and policy consistency - Commonwealth

Legislation/policy	Commentary
Airports Act 1996 (Cth)	In accordance with the Airports Act, a MDP has been prepared for M3R which is consistent with the lease for the Melbourne Airport site between APAM and the Commonwealth and both the approved 2018 Master Plan and the proposed 2022 Master Plan. M3R is consistent with the Airport Lease because M3R: • Is for a lawful purpose and is not in breach of legislation (under clause 3.1(a)(iv) of the Airport Lease) • Maintains the environment of the airport in accordance with clause 6.2 of the Airport Lease • Complies with all legislation relating to the 'airport site' (under the Airports Regulations 1997 (Cth) (Airports Regulations)) and its structures or uses or occupation (under clause 7.1 of the Airport Lease) • Must comply with all licences and approvals required for M3R (including a permit under Part 13 of the Airport (Environmental Projection) Regulations 1997 (Cth)) (under clause 7.2 of the Airport Lease) • Does not grant any sub-lease or licence prohibited under legislation (under clause 10 of the Airport Lease) • Has regard to actual and anticipated growth in and pattern of traffic demand for the airport site (under clause 12.1(a) of the Airport Lease) • Will be to the quality standards reasonably expected of an airport in Australia and will have regard to good business practice (under clauses 12.1(b) and (c) of the Airport Lease).
Airports (Protection of Airspace) Regulations 1996	Persons wishing to undertake activities that will result in an intrusion of protected airspace are required to apply to the relevant airport-operator company. If the proposed activity is short-term (i.e. three months or less), the airport-operator company may approve the application. However, if the proposed activity is long-term, the airport-operator company co-ordinates assessments of the proposal and forwards these and the application to DITRDC for final assessment and approval. All construction works associated with M3R will be assessed for potential airspace impacts in consultation with Airservices Australia and CASA. This will primarily occur through the detailed design, construction planning and secondary approvals stages of M3R. Airservices Australia will be consulted with regard to any impact on the performance of precision/non-precision navigational aids, High Frequency/Very High Frequency (HF/VHF) communications, Advanced-Surface Movement Guidance and Control Systems (A-SMGCS), radar, Precision Runway Monitor (PRM), Automatic Dependent Surveillance Broadcast (ADS-B), Wide Area Multilateration (WAM) or satellite/links to ensure that works will not affect any sector or circling altitude, nor any instrument approach or departure procedure at Melbourne Airport.
Environment Protection and Biodiversity Conservation Act 1999 (Cth)	Potential impacts to significant ecological values are described in **Chapter B5: Ecology**. Particular attention was given to the potential for significant impacts to MNES and to the environment as a whole on Commonwealth land, as defined in relevant EPBC Act Significant Impact Guidelines. The design of M3R incorporates a number of measures aimed at avoidance and reduction of potential impacts on ecological values and an offset strategy is described in **Chapter E3: Offset Strategy** in accordance with the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012).
Native Title Act 1993 (Cth)	It is considered that native title rights have been extinguished across the development footprint as the land is made up of freehold titles that were previously used as farmland prior to the development of the Melbourne Airport which is now wholly under Commonwealth ownership. Land adjacent to the development footprint contains unreserved and reserved Crown land, primarily off-airport land along the bed and banks of rivers and creeks, road reserves and parkland. Any works in these areas may require Native Title notification in accordance with the provisions of the Act.
Australian Standard 2021:2015	Airport operations will inevitably create unavoidable aircraft noise. **Chapter C4: Aircraft Noise and Vibration** sets out the noise and vibration assessment of M3R. Amendments to the MAEO will ultimately be required to minimise future noise-sensitive uses from being located in noise-affected areas and to manage the impacts of future encroachment of noise-sensitive uses on the airport.
National Airports Safeguarding Framework (NASF)	NASF has been given effect and is listed in clause 18.04 of the PPF as a policy guideline. M3R is consistent with the NASF guidelines, which are more specifically addressed in **Table B2.4** which describes the compliance/consistency of this MDP against the requirements of the NASF guidelines. Melbourne Airport has extensive policies and procedures in place to ensure that on-airport development addresses all of the NASF requirements, as outlined in **Section B2.3.4** and further supported through other specialist chapters of this MDP. In addition, section 5.11 of the Master Plan outlines the development approval process which must be followed at Melbourne Airport, which includes a three-step approval process: • Planning and Design Approval or MDP approval • Building Activity Consent • Building Permit from the ABC in consultation with the AEO. Melbourne Airport has a set of planning and design guidelines for on-airport developments that must be considered and addressed to obtain Planning and Design Approval. The guidelines require proponents to consider matters such as building heights, acoustic treatments, safety and security, use of non-reflective materials, illumination levels, landscaping, signage and environment. Potential impacts of on-airport commercial and industrial developments on neighbouring properties must also be considered, including issues such as privacy, noise levels and building setbacks.

Table B2.4
National Airports Safeguarding Framework

NASF guidelines	Comment/response
Guideline A: Measures for Managing Impacts of Aircraft Noise	Measures for managing the impacts of aircraft noise are discussed under **Section B2.3.1.5** and **Section B2.3.4.7** of this chapter, and explained in more detail within **Chapter B9: Ground-Based Noise and Vibration, Chapter C2: Airspace Architecture and Capacity, Chapter C3: Aircraft Noise Modelling Methodology** and **Chapter C4: Aircraft Noise and Vibration.**
Guideline B: Managing the Risk of Building Generated Windshear and Turbulence at Airports	Measures for managing the risk of building generated windshear and turbulence is generally associated with building works. Consideration of these risks is described in **Chapter C5: Airspace Hazards and Risks**.
Guideline C: Managing the Risk of Wildlife Strikes in the Vicinity of Airports	An assessment of the potential for aircraft collisions with significant fauna species, and recommend plantings which are not bird attracting are described in **Chapter B5: Ecology**. Any areas of landscaping associated with M3R will include non-bird attracting plant species which are to be used in accordance with Melbourne Airport's Planting Guidelines. Further details are provided within **Chapter C5: Airspace Hazards and Risks**.
Guideline D: Managing the Risk of Wind Turbine Farms as Physical Obstacles to Air Navigation	Wind turbine farms are not considered a significant issue for Melbourne Airport due to the location of the airport on the urban fringe where these facilities are unlikely to be developed. They are usually developed in rural and regional areas. In any event, there is a planning control relating to wind turbine farms in all Victorian Planning Schemes (clause 52.32) which requires consideration of nearby airports as part of the planning permit process. Further details are provided within **Chapter C5: Airspace Hazards and Risks**.
Guideline E: Managing the Risk of Distractions to Pilots from Lighting in the Vicinity of Airports	The type, form and location of external lighting treatments during the construction and operational phases of M3R will be designed and baffled to comply with the relevant standards. External lighting will need to be designed to not emit upward waste light in accordance with the relevant standards. Further details are described in **Chapter C5: Airspace Hazards and Risks**.
Guideline F: Managing the Risk of Intrusions into the Protected Airspace of Airports	As noted in the 2018 Master Plan, Melbourne Airport's airspace, based on the ultimate four-runway layout, has been declared Prescribed Airspace by the Commonwealth Government. The airport's Prescribed Airspace, being based on the ultimate four-runway layout, therefore broadly incorporates the airspace associated with the operation of M3R. The 2018 Master Plan includes updated Prescribed Airspace to ensure that the airspace required for the ultimate four-runway system (including M3R) continues to be adequately protected whilst taking account of changes which may have occurred since the four-runway airspace was originally prescribed. This takes account of any existing structures, terrain and other potential obstacles. M3R involves the introduction of new flight paths for approaches and departures on the new north-south runway and changes to the existing flight paths to accommodate new flight paths. As a result of the construction of M3R, including the runway infrastructure: • A reconfiguration of the Melbourne airspace is required. Existing Standard Instrument Departure (SIDs) and Standard Terminal Arrival Routes (STARs) have been maintained where possible. However, the standards for near parallel runway operations will need a number of changes to existing SIDs and STARs. Other changes have been considered in order to minimise or reduce the impacts of aircraft noise on residential areas. • Changes to the airspace architecture design and flight paths around the airport are required. Investigations into the probable airspace requirements have been undertaken including engagement with the operator of Essendon Fields Airport, Airservices Australia and CASA including how the impacts of M3R will be most appropriately managed to enable safe and effective operations in the future. Proposed airspace changes will not be formally approved until a time closer to the opening of the changed infrastructure, and hence details of the airspace procedures are indicative and conceptual at this stage. • Melbourne Airport is aware of the Keilor and Districts Model Aircraft Society that operates in Keilor North. This land use may not be compatible with the proposed runway and, under the applicable regulations, the club will need approval from relevant Government agencies to continue operating once M3R is operational. The Prescribed Airspace Regulations provide DITRDC (or the airport operator) with the ability to assess and approve applications to carry out controlled activities, and to impose conditions on an approval. These controlled activity provisions are the primary measure for managing the risk of intrusions into the airspace. Controlled activity approvals need to be obtained from Airservices Australia during construction if intrusions into controlled airspace occur. Construction and associated approvals will be in accordance with Airservices Australia and CASA requirements. Prior to the construction phase commencing, a 'Notice to Airmen' (NOTAM) will be issued by Melbourne Airport advising the temporary erection of obstacle(s) near airfields (e.g. cranes). Controlled activity approvals are issued by the DITRDC following assessment advice from Airservices Australia and CASA. Airservices Australia will work with Melbourne Airport in assessing construction activities for potential intrusion into prescribed airspace and where required, Airservices Australia will the issue relevant instrument flight procedure and/or other relevant NOTAMs. These matters are described in detail within **Chapter C2: Airspace Architecture and Capacity** and **Chapter C5: Airspace Hazards and Risks**.
Guideline G: Protecting Aviation Facilities – Communication, Navigation and Surveillance (CNS)	All construction works associated with M3R will be assessed in consultation with Airservices Australia and CASA. Airservices Australia is consulted with regard to any impact on the performance of precision/non- precision navigational aids, High Frequency/Very High Frequency (HF/VHF) communications, Advanced- Surface Movement Guidance and Control Systems (A-SMGCS), radar, Precision Runway Monitor (PRM), Automatic Dependent Surveillance Broadcast (ADS-B), Wide Area Multilateration (WAM) or satellite/ links to ensure that works will not affect any sector or circling altitude, nor any instrument approach or departure procedure at Melbourne Airport.
Guideline H: Protecting Strategically Important Helicopter Landing Sites	As outlined in **Section B2.3.3.4** of this chapter, the Victoria Planning Provisions already incorporate clause 52.15 (Heliport and Helicopter Landing Site) which seeks to ensure the amenity impacts of a heliport and a helicopter landing site on surrounding areas is considered. A permit is required to use or develop any land for a heliport or a helicopter landing site unless specifically exempted by the provisions of the clause.
Guideline I: Managing the Risk in Public Safety Areas (PSAs) at the End of Runways	The impacts of estimated changes in individual risk levels on future development have been assessed with reference to NASF Guideline I. This is addressed in **Chapter C5: Airspace Hazards and Risks**. The land uses allowed under the zoning provisions of the Hume Planning Scheme are broadly compatible with the public safety principles set out in the guideline. The resultant restrictions on future land uses due to M3R are therefore expected to be very limited.

B2.6.1.2
Airport strategies and plans

Table B2.5
Statutory and policy consistency – Melbourne Airport

Legislation/policy	Comment
Melbourne Airport Strategy 1990	This strategy provides an historic context for M3R and encompasses a number of separate studies and impact assessment that supports M3R. M3R is consistent with the MAS 1990. Importantly, it was supported by an EIS that included provision for the future development of a four-runway layout that has been reflected in all Melbourne Airport Master Plans to date. M3R's new runway clearly facilitates the implementation of part of the four-runway system envisaged within the MAS in 1990, which was subject to the EIS approved jointly by the Victorian and Commonwealth governments.
Melbourne Airport Land Use Study 1992	This study contains a number of recommendations about introduction of planning controls to limit the development of noise-sensitive land uses. A review of land use planning controls has been undertaken as part of M3R MDP with key recommendations outlined in **Section B2.7** of this chapter.
2018 Master Plan	The proposed north-south runway is clearly identified as an element of the Long-Term Development Concept Plan for the airport. M3R is located within the following Master Plan precincts and zones: • Airside Operations Precinct - Special Use Zone 1 • Airport Expansion Precinct - Special Use Zone 2 As a runway project, M3R is entirely consistent with the purposes of these precincts and zones. The Heritage Overlay and Bushfire Management Overlay applies to a portion of the M3R development footprint (Grey Box Woodland). These overlays do not prohibit works, they require consideration of the matters which are the subject of the overlay. The impact of the development on the Grey Box Woodland has been addressed elsewhere in this MDP. It is noted that that Master Plan 2022 no longer includes an Overlays Plan. Provision for expansion of the airport's aviation fuel storage infrastructure and associated land is included in the 2018 Master Plan's development concept plans. The proposed development is therefore consistent with the 2018 Master Plan and its long-term development scenarios. Given the change of the third runway orientation announced in November 2019, a correlating update to the Master Plan is required. Master Plan 2022 is therefore being developed and will be publicly exhibited and submitted for approval in conjunction with the M3R MDP.
Melbourne Airport Environment Strategy 2018	The M3R development footprint is within the 2038 Development Footprint shown in the Melbourne Airport Environment Strategy 2018 (Figure 16-3). The Environment Strategy recognises that proposed Airport expansions will result in the disruption of known (or as yet undiscovered) areas of *cultural* and/or environmental value. More specifically, for major development projects such as M3R, thorough investigations and management programs for environmental and cultural impact are required prior to approvals being granted. Detailed consideration of the airport environs and European and cultural heritage are described within subsequent chapters of the MDP.
Ground Transport Plan 2018	The Ground Transport Plan does not apply specifically to M3R. However, the forecast growth and additional traffic that will be facilitated by M3R is accommodated within the Ground Transport Plan 2018. **Chapter B8: Surface Transport** provides a detailed assessment of surface transport at the airport.
Australian Noise Exposure Forecast	**Chapter C4: Aircraft Noise and Vibration** explains that ANEF contours are expected to change as a result of M3R and will ultimately require an amendment to the existing MAEO to ensure that land use planning appropriately acknowledges these changes and limits sensitive land uses that may restrict the operation of the airport.

B2.6.1.3
State legislation and policy and local planning schemes

Table B2.6
Statutory and policy consistency - Victorian and local government

Legislation/policy	Comment
Planning and Environment Act 1987 (Vic)	The MDP recognises that the P&E Act establishes the framework for planning in Victoria. Although the P&E Act does not apply to Commonwealth land, this MDP demonstrates that M3R is consistent with the objectives of the P&E Act through the fair, orderly, economic and sustainable use and development of land, a key objective of the Act.
Environment Effects Act 1978	As M3R is being constructed on Commonwealth land and is the subject of approvals under Commonwealth legislation, an EES in accordance with the EE Act is not required.
Environment Protection Act 2017	Any off-site works associated with M3R will be required to comply with the provisions of the Act. This applies in particular to activities that may have an impact on air, water, soil and ground-based noise. SEPPS define the environmental quality objectives (for air, land and groundwater, noise and water) and describe the attainment and management programs that will ensure the necessary environmental quality is maintained and improved. For off-site impacts of M3R, the MDP has taken into consideration the requirements of the relevant SEPPs, and M3R is generally consistent with those requirements, as detailed in the relevant environmental impact assessment chapters. Further details of the requirements and M3R's consistency are described within **Chapters B3: Soils, Groundwater and Waste, B4: Surface Water and Erosion, B9: Ground-Based Noise and Vibration and B10: Air Quality.**
Water Act 1989	Approval is required to connect to the stormwater system (including open waterways). It is expected that stormwater outfalls from the new runway will extend into the Maribyrnong River corridor. Approval to work on any new or modified stormwater connections to Melbourne Water assets will necessitate approvals from Melbourne Water. M3R will comply with these requirements (refer to **Chapter B3: Soils, Groundwater and Waste** and **Chapter B4: Surface Water and Erosion**).
Aboriginal Heritage Act 2006 (Vic)	Although the AH Act does not apply to Commonwealth land, Melbourne Airport has sought to meet standards of state heritage assessment process through the preparation of a voluntary CHMP under the Act (refer to **Chapter B6: Indigenous Cultural Heritage**).
Heritage Act 2017 (Vic)	Heritage Victoria does not have jurisdiction on Commonwealth land and therefore the provisions of the Heritage Act 2017 do not apply to the development footprint. Although the study area is exempt from the requirements of the Heritage Act, consultation has been undertaken with Heritage Victoria for the heritage places assessed as part of M3R development and planning. Further details are provided in **Chapter B7: European Heritage**.
Flora and Fauna Guarantee Act 1988 (Vic)	Under this Act, there is no legislative requirement to provide offsets for state-significant ecological values. **Chapter B5: Ecology** describes the potential impacts to ecological communities and identifies mitigation measures and offset requirements in accordance with the EPBC Act and/or FFG Act.
Metropolitan Planning Strategy: Plan Melbourne (2017-2050)	The continued development of the airport is consistent with its role as a state-significant transport gateway for Victoria. Plan Melbourne acknowledges that "Melbourne must protect its curfew-free airport and support its expansion".
Growth Corridor Plans 2012	The airport is located to the north-east of the Western Growth Corridor and south-west of the Northern Growth Corridor. The development of these corridors is guided by corridor plans, which recognise and protect the ongoing operation of Melbourne Airport. GCPs are relevant to this MDP as they provide information regarding proposed future development around the airport, particularly future residential development. This is important information in terms of airport safeguarding, noise, health and social impact assessments. These plans have been taken into consideration in the assessment of off-airport impacts. Areas identified in the corridor plans for future residential growth and sensitive uses are generally located outside of the study area and beyond the ANEF contours.
Melbourne Airport Environs Strategy Plan	The MAESP's recommendations took the form of a new overlay control (PSA VC30), the Melbourne Airport Environs Overlay (MAEO). A detailed assessment of the impact of the M3R 2046 Composite ANEC on the existing MAEO is provided in **Section B2.6.2.3**. The differences between the existing MAEO1 and MAEO2 and the M3R 2046 Composite ANEC are shown in **Figure B2.19** and **Figure B2.20**. At the time of writing, the MAESP was being reviewed by MAESSAC and the Minister for Planning.
Planning Policy Framework	M3R is highly consistent with key objectives and policies contained within the PPF. Specific policies or guidelines, where relevant, are dealt with in the individual impact assessment chapters of this MDP. Notably, however, M3R will: • Increase the capacity of Melbourne's only international airport, strengthening its role within the state's economic and transport infrastructure and facilitate a more connected Melbourne • Enhance Victoria's competitive advantages • Seek to manage environmental impacts, with investigation of ecological impacts undertaken to ensure that the impacts to ecological systems and biodiversity within the development footprint are adequately mitigated or managed • Protect the future operations of the airport from encroachment from incompatible land uses and ensure appropriate land-use buffers are in place though updates to planning controls. Part E of this MDP (Management Framework) details the management structures and processes to be implemented and summarises the M3R impacts and commitments made in the MDP to mitigate these impacts in order to meet relevant legislative and policy requirements.
Local Planning Policy Framework	The LPPFs for Hume, Brimbank, Melton, Moonee Valley and Whittlesea provide local context and support the PPF. M3R is consistent with relevant objectives and policies contained within the LPPFs of the abovementioned municipalities. Due to its location within the City of Hume, Melbourne Airport has a greater significance within the objectives and policies identified in the Hume LPPF. M3R is consistent with relevant objectives and policies contained within the LPPF, as: • It will enhance the role of the Melbourne Airport as provider of employment and economic activity within the municipality • It will seek to manage environmental impacts, with a thorough investigation of environmental and heritage impacts undertaken to ensure that the impacts within the development footprint are adequately mitigated or managed as required • Proposed mitigation measures including amendments to the MAEO are consistent with local policies that seek to ensure that Melbourne Airport remains curfew-free and prevent development that might prejudice the airport's continuing role as one of Victoria's key economic asset.
Planning Controls	Proposed works that are located on Commonwealth-owned land are exempt from Victorian planning provisions. Land formerly in private ownership west of McNabs Road required for airport expansion has recently been acquired by the Commonwealth. As such, current zoning and overlay maps will need to be amended to reflect the acquired land is now Commonwealth-owned. Potential works associated with M3R on land outside of Commonwealth land are limited to a new connection to land contained within the Road Zone, Category 1, and potentially works on waterways for stormwater outfalls to the Maribyrnong River.
Particular Provisions	Potential works associated with M3R on land outside of Commonwealth land are limited to a new road connection to Sunbury Road for construction access and potential works on waterways for stormwater outfalls to the Maribyrnong River. A planning permit will be required to 'create or alter access to a Road in a Road Zone, Category 1' in accordance with the provisions of clause 52.29. Provided the proposed work satisfies Council and VicRoads requirements, the responsible authority is expected to support the proposed works. Approval to work on any new or modified stormwater connections to Melbourne Water assets will necessitate approvals from Melbourne Water.

B2.6.2
Land use impacts

The 2018 Master Plan contains the airport's Long Range ANEF. The ANEF contours represent the airport's long-range forecast noise impact, taking into account the development stages of the planned four-runway system.

The land-use impacts relating to noise contours considered in this chapter are based on the M3R 2046 Composite ANEC which reflects the proposed parallel north-south runway system. The 2018 Master Plan ANEF does not include the M3R 2046 ANECs. As a result, the ANEF is being updated and a new ANEF is included in the proposed 2022 Master Plan. Following approval of the 2022 Master Plan, the MAEO may be updated by the Victorian Minister for Planning to apply the 2022 Master Plan ANEF, which will include the M3R 2046 ANECs.

The following sections describe identified land use impacts and associated mitigation and management measures, with an assessment summary in accordance with the significance assessment framework provided in **Table B2.7** at the conclusion of this chapter.

B2.6.2.1
On-airport

As outlined in Section B2.5.2, Melbourne Airport contains a mix of existing land uses, which can be broadly categorised as follows:

- Airside land uses – runways, aprons and terminal buildings
- Landside land uses – hotels, carparks, public transport facilities, car rental facilities and commercial, retail and industrial premises
- Natural areas – including temperate Grassland of the Victorian Volcanic Plain, Grey Box Woodland located to the north of the existing east-west runway and Growling Grass Frog habitat around Arundel Creek
- Rural areas – largely cleared former grazing land located to the south of the existing east-west runway and west of McNabs Road, with certain European heritage values, some of which are listed as Heritage Inventory Sites on the Victorian Heritage Register.

The Bushfire Management Overlay (BMO) has been applied to parts of the airport site, however the BMO does not technically apply given it is Commonwealth land.

The proposed new north-south runway and associated expansion of airside area will represent a change from the existing rural land use character of the area west of the existing airfield. While there will be medium level impacts to the existing natural and rural areas, M3R is consistent with the strategic planning intent for these areas as articulated in the MAS and subsequent master plans and is therefore considered a benefit from a land use planning perspective.

B2.6.2.2
Off-airport impacts – infrastructure works

Limited works may be undertaken outside airport land to provide appropriate connections, and interface with existing transportation and utility networks. These works will be subject to consultation and any necessary approvals with relevant authorities.

Sunbury Road construction access

An additional construction access road for vehicles entering the site from the north will be necessary to undertake works within the road corridor to formalise or upgrade an intersection. The access road would not be publicly accessible, and be contained within the airport site. Intersection works at Sunbury Road are likely to be contained within the existing road corridor, and no land use change or impact is expected to occur.

If the construction access is temporary, it may be managed through relevant CEMP or a Traffic Management Plan, which would be prepared in consultation with the relevant roads authority. However, if construction of the access is permanent, a planning permit will be required in accordance with clause 52.29 – Land Adjacent to a Road Zone, Category 1, to create or alter access to a road in a Road Zone, Category 1. Pursuant to clause 66.03 (referral of permit applications under other state standard provisions) the Roads Corporation is a determining referral authority for this application.

Stormwater outfalls

Site-wide works will include installation of a new stormwater drainage network (including diversions of the existing drainage system, installation of new pipework, manholes, swales, culverts and outfall structures). While the majority of these works will be contained within airport land, stormwater outfalls may extend outside the airport boundary. The majority of M3R infrastructure is expected to drain into the Arundel Creek catchment. Arundel Creek discharges to the Maribyrnong River.

Subject to detailed design investigations, it is possible that new drainage infrastructure outside the airport site may include stormwater outfalls, landscaping and scour protection. This potential infrastructure is not anticipated to have a significant land use impact or represent a change in the nature or function of any external waterway corridor.

The land that might be affected, that is not Commonwealth land, is generally situated within the Green Wedge Zone (GWZ). A stormwater drain (defined as a Minor Utility Installation under clause 74 Land Use Terms of the Planning Scheme) is listed as a Schedule 1 use in the GWZ and therefore does not require a planning permit for use. Furthermore, pursuant to clause 62.02, a permit is not required for building works associated with a minor utility installation, however the works would be required to comply with applicable state level legislation. Approval to work on any new or modified stormwater connections to Melbourne Water assets may necessitate approvals from Melbourne Water.

B2.6.2.3
Off-airport impacts – development controls

The MAEO is a planning tool that manages the use and development of land within Melbourne Airport's ANEF noise contours, as described in Section B2.3.3.3. It seeks to apply planning controls within the boundary of the overlay in order to control incompatible land use and development, particularly noise-sensitive land uses. The MAEO applies controls for the use of land and buildings and works that limit densities, require acoustic attenuation for buildings and can restrict certain land uses. Any buildings for which a permit is required under this overlay must be constructed in accordance with any noise attenuation measures required by AS 2021:2015 previously detailed in Section B2.3.1.5 of this chapter. The application of the MAEO applies to new use of land and buildings and works which require a permit under the overlay. Retrospective attenuation of existing buildings is not required by the MAEO provisions. The MAEO is based on the airport's 2018 ANEF.

As detailed in Chapter C4: Aircraft Noise and Vibration, three new ANECs have been prepared for this MDP reflecting three different modes of operation.

A composite of these three ANECs, the 'M3R 2046 Composite ANEC', has been prepared for the purpose of this Land Use and Planning Assessment (see Figure B2.18). The 2018 Master Plan ANEF does not include the M3R 2046 ANECs. The 2022 Master Plan (proposed) inludes the 2046 ANEF.

However, for the purpose of this assessment, the key comparison is between the M3R Composite ANEC and the current MAEO which imposes land use restrictions.

Following approval of the 2022 Master Plan, the MAEO may be updated by the Victorian Minister for Planning to apply the 2022 Master Plan ANEF, which includes the M3R ANECs.

The differences between the existing MAEO1 and MAEO2 and the M3R 2046 Composite ANEC are shown in Figure B2.19 and Figure B2.20. These plans illustrate those areas contained within M3R ANECs that differ from the existing MAEO boundary. This provides an indication of those areas that may be impacted by M3R in terms of land use restrictions based on the 2046 Composite ANEC. The M3R 2046 Composite ANEC forms only one part of the four-runway ANEF. The M3R ANEC relates to the operation of the parallel north-south runways, and therefore primarily influences the MAEO to the north and south of the airport. It will not affect the extent of the MAEO east and west of the airport.

Note that only those areas inside M3R Composite ANEC but outside the current MAEO are considered to be directly affected. This includes some areas currently subject to MAEO1 that may become subject to MAEO2, or areas currently subject to MAEO2 that may become subject to MAEO1.

MAEO Schedule 1

MAEO Schedule 1 applies to land subject to ANEF 25 or greater that is likely to be subject to high levels of aircraft noise. The overlay places controls on new land use and buildings and works, limiting densities, requiring acoustic attenuation and restricting certain land uses. This overlay restricts development of some noise-sensitive land uses and requires a planning permit for other land uses that may be sensitive to aircraft noise. In addition, the overlay limits any subdivision of land that would increase the number of dwellings for which the land could be used.

The M3R 2046 Composite ANEC area may result in some variations to the existing MAEO1 as shown in Figure B2.19.

In some locations north and south of the airport, land currently not affected by the MAEO or that is affected by MAEO2 may become subject to MAEO1 planning controls, resulting in greater restrictions on land use and subdivision. Conversely, there are some locations where the M3R 2046 Composite ANEC 25+ contour has reduced from the existing MAEO1 boundary, potentially reducing restrictions in some areas which may no longer be subject to MAEO1. Such land currently subject to MAEO1 provisions would then be subject to the less restrictive MAEO2 planning controls.

The key areas that may be impacted by increased MAEO1 restrictions on land use and subdivision (as shown in Figure B2.19) are located in the suburbs listed below.

- To the north of the airport: parts of Oaklands Junction and a small part of Greenvale (west) would be affected.
- To the south of the airport: small parts of Keilor, Keilor Park and Keilor East (north) would be affected.

MAEO1 prohibits the development of noise-sensitive land uses, such as accommodation (excluding a dwelling), childcare centres, education centres and hospitals. It requires a planning permit for other land uses that may be sensitive to aircraft noise. The overlay allows only one dwelling on a lot and prohibits the subdivision of land that would increase the number of dwellings for which the land could be used. Any development must be constructed to comply with any noise-attenuation measures required by AS2021-2015. Uses such as industry and warehouse are not affected by this overlay.

MAEO Schedule 2

This overlay applies to land that is or will be subject to moderate levels of aircraft noise based on the 20-25 ANEF contours and requires a planning permit for sensitive uses. Uses such as industry are not affected by this overlay.

The M3R 2046 Composite ANEC area may result in some variations to the existing MAEO2 as shown in Figure B2.20.

In some locations north and south of the airport, land that is not currently affected by MAEO2 may become subject to MAEO2 planning controls, resulting in greater restrictions on land use and subdivision. Conversely, there are some locations where the M3R 2046 Composite ANEC 20-25 contour has reduced from the existing MAEO2 boundary, potentially reducing restrictions in some areas which may no longer be subject to the overlay. Further, some land currently subject to MAEO1 provisions may become subject to the less restrictive MAEO2 planning controls.

The key areas that may be impacted by increased MAEO2 restrictions on land use and subdivision (as shown in Figure B2.20) are located in the suburbs listed below.

- To the north of the airport: parts of Oaklands Junction and Yuroke (west) would be affected. For the most part, the land affected to the north is zoned for non-urban purposes (e.g. Green Wedge Zone).
- To the south of the airport: parts of Sunshine North, Avondale Heights, Keilor East, Keilor Park and small section of Kealba would be affected.

MAEO2 does not prohibit sensitive uses but does require a planning permit for such uses. It also specifies a lot size minimum for subdivisions (300 square metres). Any development must be constructed to comply with any noise attenuation measures required by AS2021-2015. Uses such as industry and warehouse are not affected by this overlay.

Figure B2.18
M3R 2046 composite ANEC

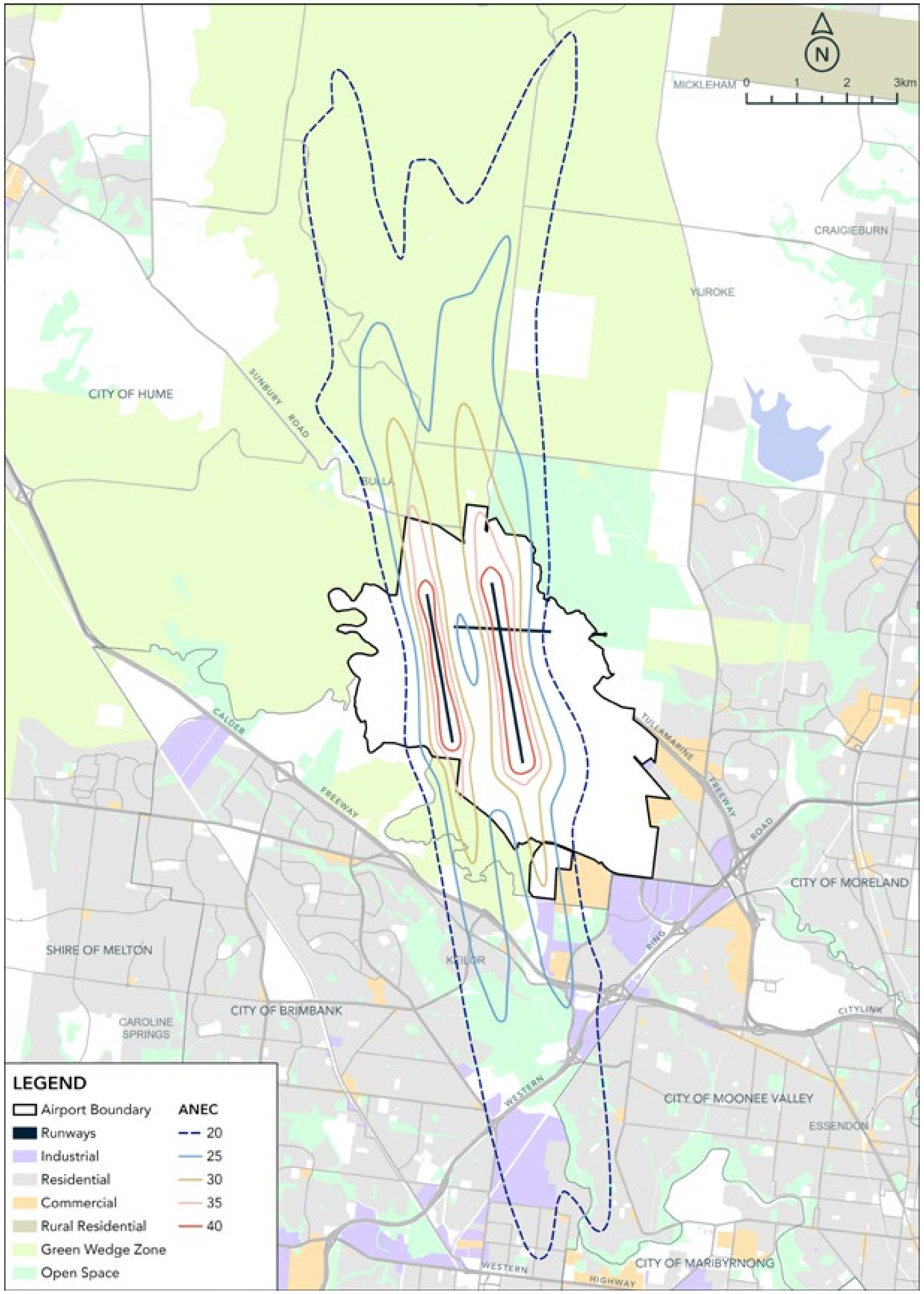


Figure B2.19
Potential impact of M3R 2046 composite ANEC on MAEO1

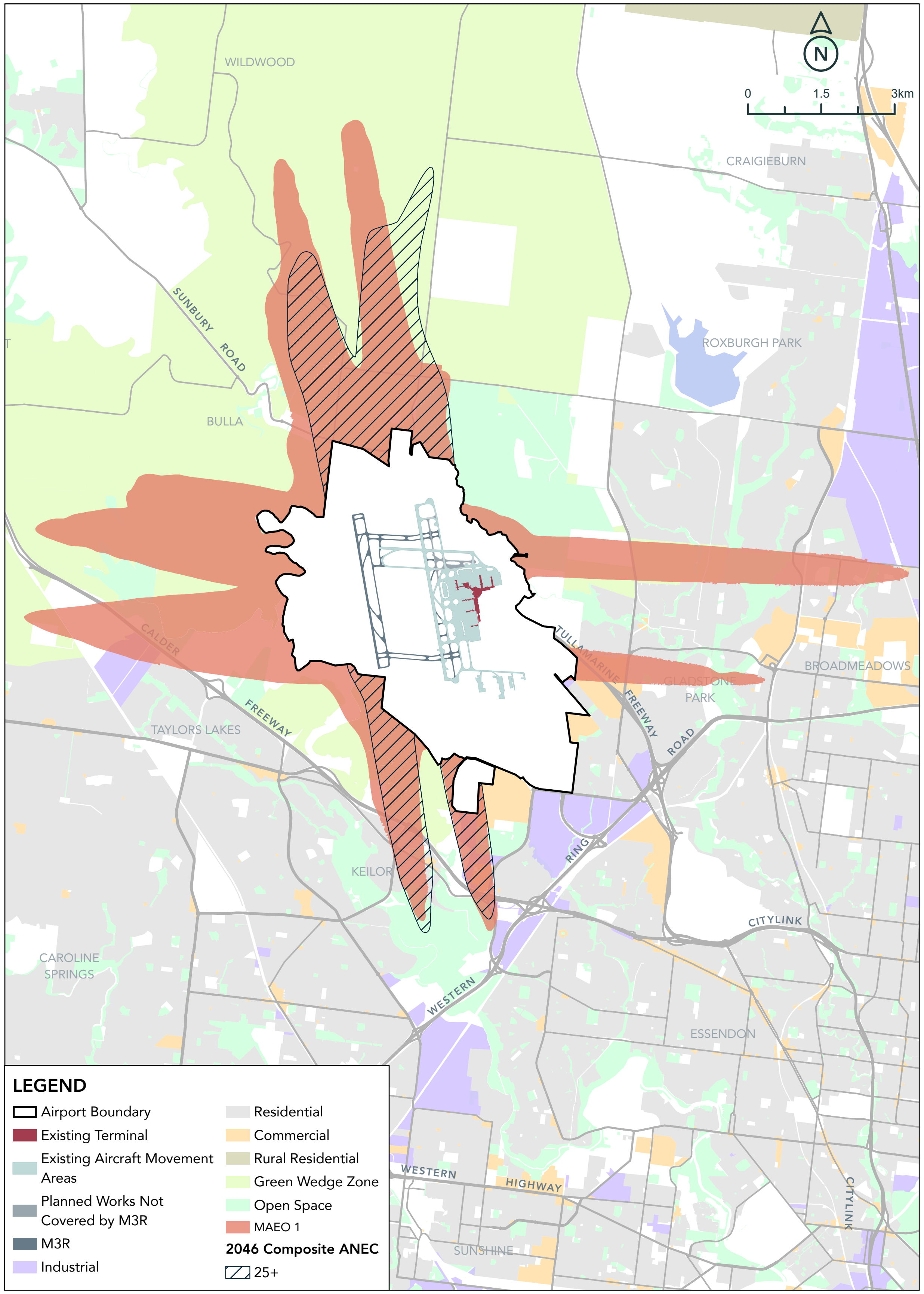
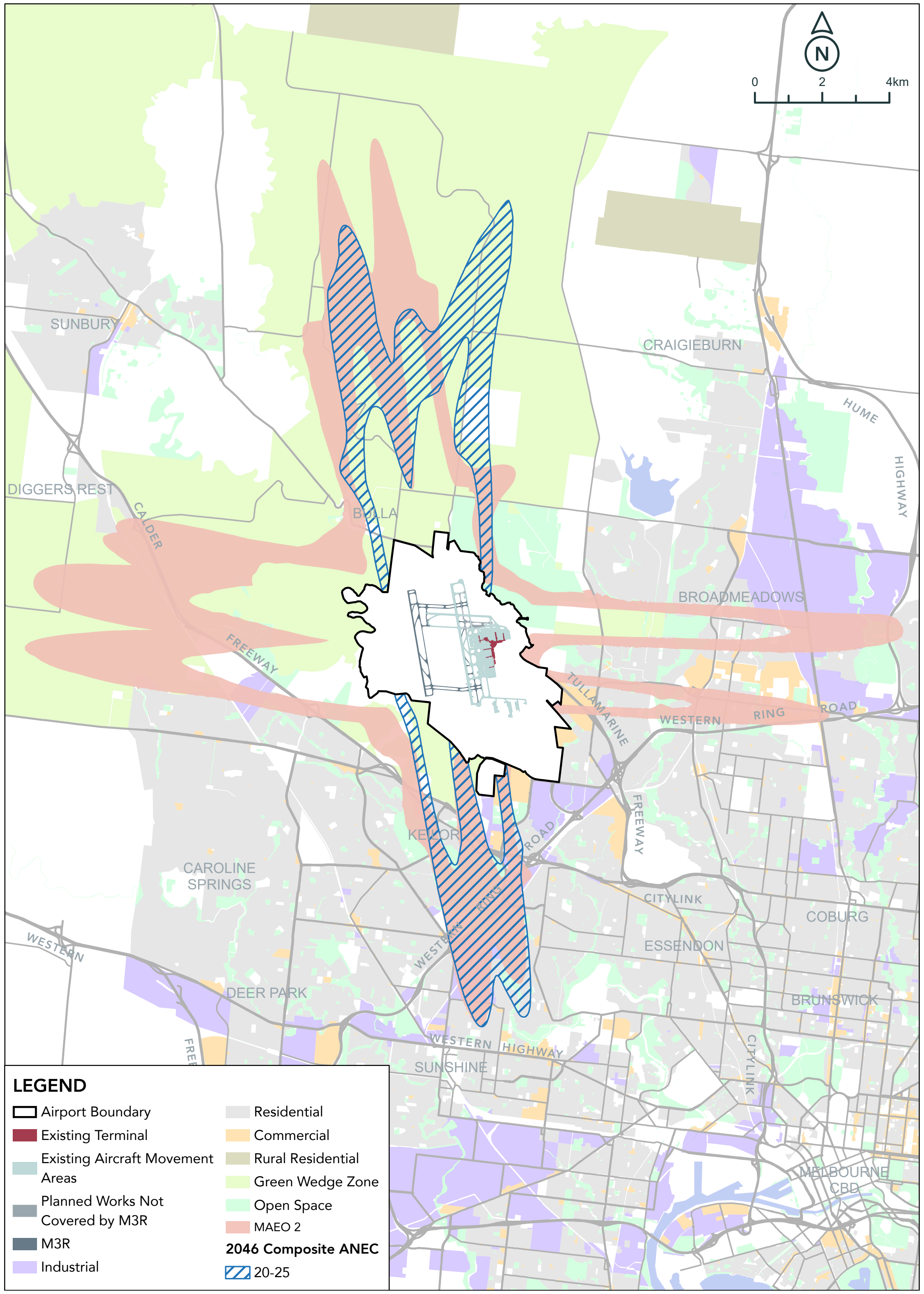


Figure B2.20
Potential impact of M3R 2046 composite ANEC on MAEO2



B2.6.2.4
Off-airport impacts – prescribed airspace

As noted in the 2018 Master Plan, Melbourne Airport's airspace, based on the ultimate four-runway layout, has been declared 'Prescribed Airspace' by the Commonwealth Government.

The airport's prescribed airspace, being based on the ultimate four-runway layout, therefore broadly incorporates the airspace associated with the operation of M3R.

The 2018 Master Plan incorporated updated airspace surfaces to ensure that the airspace required for the ultimate four-runway system continues to be adequately protected, while taking account of changes which may have occurred since the four-runway airspace was originally prescribed. This process is not expected to affect materially any building height limits, compared with those already in place over the Melbourne metropolitan area. As part of the process of having the future airspace required for M3R and the ultimate four-runway configuration prescribed by DITRDC, further consultation will be undertaken with all local government areas which may be affected by changes to building height limits as a result of the new prescribed airspace in accordance with Part 12 of the Airports Act.

The regulations relating to prescribed airspace can affect the use and development of land. The 'controlled activity' provisions under the Airports (Protection of Airspace) Regulations 1996 are the primary measure for managing the risk of intrusions into the airport's airspace. The Regulations provide DITRDC or the airport operator with the ability to assess and approve applications to carry out controlled activities which include:

- Permanent structures, such as buildings, intruding into the protected airspace
- Temporary structures such as cranes intruding into the protected airspace
- Any activities causing intrusions into the protected airspace through glare from artificial light or reflected sunlight, air turbulence from stacks or vents, smoke, dust, steam or other gases or particulate matter.

The regulations differentiate between short-term (less than three months) and long-term controlled activities. Most notably, long-term intrusions of the PANS-OPS surface are prohibited. However, where agreed by all stakeholders that a long-term penetration of the PANS-OPS surfaces is deemed essential, the PANS-OPS surfaces must be raised above the intrusion. This may also have operational penalties for airport operations and could have community impacts, such as redesign of flight paths that may increase noise impacts.

As previously stated, the Keilor and Districts Model Aircraft Society that operates in Keilor North, may not be compatible with the proposed runway and, under the applicable regulations, the club will need approval from relevant Government agencies to continue operating once M3R is operational.

B2.7 AVOIDANCE, MANAGEMENT AND MITIGATION MEASURES

Having regard to the planning and land use impact assessment, the following sections summarise the proposed avoidance, management or mitigation measures required as part of the implementation of MDP. The Planning Policy Framework (PPF) recognises the social and economic importance of Melbourne Airport to the local region and the state. In accordance with this, the planning system adopts a precautionary approach to protecting the operation of the airport in order to prevent the encroachment of urban development.

B2.7.1
Off airport – permit requirements

The following permits may be required as a result of off-airport works associated with M3R (subject to detailed design):

Sunbury Road vehicular connection:

- Proposed works associated a new vehicular connection to Sunbury Road require a planning permit to create or alter access to a road in a Road Zone in accordance with the provisions of clause 52.29. These are the only works that will be subject to a planning permit application.
- Provided the proposed work satisfies Hume City Council and VicRoads' requirements, it is considered that the proposed works would be supported by the responsible authority (Hume City Council subject to VicRoads support).

Native Title:

- Native Title notification may be required for works over unreserved and reserved Crown land, primarily off-airport land along the bed and banks of rivers and creeks, road reserves and parkland.

Stormwater outfalls:

- Stormwater outfalls from the new runway may extend into the Maribyrnong River or other watercourses outside the airport boundary. Approval to work on any new or modified stormwater connections to Melbourne Water assets may necessitate approvals from Melbourne Water.

Utility and asset approvals:

- Approval may be required from relevant utility and asset managers to commence work on any utility installations (such as gas, electricity and water) or undertake excavation near such assets.

Controlled activity approvals:

- Local councils in the vicinity of the airport's protected airspace are required to review all building and development applications they receive for any infringements of protected airspace. These local councils refer proposals to the airport operator if an infringement is likely to occur. The proponent will then need to apply through the airport operator for approval (or DITRDC in the case of long-term controlled activities). OLS and PANS- OPS surfaces charts are prepared by the airport operator and are available to the public to confirm whether a proposed land use or activity will require controlled activity approval. Early consultation by a proponent with the airport operator and/or regulator is encouraged to ascertain protected airspace requirements before submitting a planning application.

B2.7.2 Airport safeguarding

Melbourne Airport is critical state and national infrastructure. Planning in the vicinity of the airport needs to be carefully managed to ensure encroachment is minimised and the airport's curfew-free status is maintained. The current suite of planning tools (including the PPF clause 18.04, Urban Growth Boundary, Green Wedge Zone and MAEO) provide a solid basis for the protection of the long-term operation of the airport including its curfew-free status. These planning provisions do not unreasonably curtail urban growth, recognising the need for a balance between on-airport and off-airport growth.

NASF provides guidance and advice relating to airport safeguarding. Based on NASF, Melbourne Airport will continue to advocate for appropriate land use planning in the vicinity of the airport, using appropriate metrics to identify and protect noise-sensitive areas, and actively discourage inappropriate development in such areas.

There is a need for improved or enhanced safeguarding measures in planning schemes. As such, Melbourne Airport advocates for the NASF recommendations to be considered (particularly use of the N-contour system as a supplement to the ANEF contours) as part of the review of the Melbourne Airport Environs Strategy Plan. In addition, the mitigation of indirect off-site impacts by means other than zoning and overlay controls is supported wherever practicable. These matters are the focus of the current MAESSAC review.

As discussed in **Section B2.6.2.3** of this chapter, this MDP includes a new M3R 2046 Composite ANEC (**Figure B2.18**) which forms part of the new ANEF in the 2022 Master Plan. It should be noted that the impact being considered here is the potential impact of M3R based on the ANEC. The formalisation of this mitigation measure (via a PSA) will not occur until after the approval of the new ANEF and 2022 Master Plan, noting that approval of the new ANEF is a separate process to this MDP. Following approval of the 2022 Master Plan, the MAEO may need to be updated by the Minister for Planning to apply the 2022 Master Plan ANEF.

It is anticipated that the amendment process will be facilitated by the Victorian Minister for Planning, and affect planning controls that form part of the Brimbank, Hume, Melton, Moonee Valley and Whittlesea planning schemes. Forecast impacts from M3R will then be implemented through the local planning schemes.

It is recognised that aircraft noise is not confined to areas inside the 20 ANEF noise contour and that many complaints relating to aircraft noise originate from beyond this line. Given these limitations, NASF Guideline A recommends using the N-above contour system to supplement the ANEF contours, particularly when considering strategic planning matters. N contours are mapped within the 2018 Master Plan, and this MDP. However, the ANEF and its application through the MAEO remains the primary noise contour for the purposes of statutory planning decisions.

B2.7.3 Zoning maps update

Commonwealth-owned land is exempt from the operation of planning schemes and is not included in any zone or overlay in a planning scheme. It is simply recognised by the designation 'CA' on planning scheme maps. In order to facilitate the delivery of M3R and ongoing future development of the Melbourne Airport, all freehold and APAM owned land within the airport boundary has been acquired and is now Commonwealth land. As a result, current zoning and overlay provisions affecting airport land no longer apply and will need to be removed from Hume Planning Scheme zoning and overlay maps and replaced with the uncoloured 'CA' designation.

B2.7.4 Environmental management

Baseline amenity conditions are an intrinsic requirement for the ongoing functionality of certain sensitive land uses (e.g. residential dwellings, schools, day care centres). Of particular importance are proposed noise, air and vibration emissions during construction and operation of M3R. M3R MDP provides a detailed assessment against applicable regulations and standards for each of these key environmental factors.

The process and procedure for managing construction and operational-related impacts at the airport are set out under the Melbourne Airport Environment Strategy contained within the approved Master Plan which require the preparation and implementation of a:

- Construction Environmental Management Plan (CEMP): The purpose of a CEMP is to eliminate or significantly reduce the environmental impacts of construction to the satisfaction of Melbourne Airport and the Airport Environment Officer.
- Operational Environmental Management Plan (OEMP): OEMPs are required to be prepared by all operators of significant facilities at Melbourne Airport. The OEMP must be approved and in place prior to the commencement of operations at the site and will be produced/updated each year, and be subject to an annual audit.

Environmental management measures proposed for M3R are described in detail in **Chapter E2: Environmental Management Framework**.

Melbourne Airport will continue to make readily available information about airport operations and future development, including information about M3R. This includes information about aviation-related noise in the vicinity of the airport, which assists people in making more informed decisions about property purchases and rental agreements.

B2.8 CONCLUSION

This chapter has documented the baseline land use planning context with respect to M3R at Melbourne Airport, and has assessed M3R's consistency with Commonwealth, Victorian and local legislative requirements and policies, as well as its potential effects on land use conditions around the airport.

This MDP is consistent with the long-term land use planning objectives for Melbourne Airport outlined in the MAS (and associated EIS) and the 2018 Master Plan (and the proposed 2022 Master Plan).

The majority of works associated with M3R footprint will occur on airport (Commonwealth) land. Limited works may be undertaken outside airport land to provide appropriate connections and interface with existing transportation and utility networks. Those works are outlined in this chapter (and described in detail in other chapters of this MDP). There is potential for indirect off-site impacts on land use as a consequence of noise and air quality, and the resultant potential of increased development constraints, which are primarily addressed through overlay controls. The following measures are proposed to address these potential off-site land use impacts:

- Submit a Planning Permit Application to create or alter access to a road in a Road Zone if required, in accordance with the provisions of clause 52.29, for the works associated with a new vehicular connection to Sunbury Road.
- Minimise impacts on baseline amenity conditions for sensitive land uses via implementation of CEMP and OEMP in accordance with relevant guidelines and standards, as recommended by technical assessments contained in this MDP.
- Continue with established initiatives including provision of publicly available information about airport operations and development, including noise.
- Undertake Native Title notification in accordance with the provisions of the relevant legislation if works are proposed to be carried out over unreserved and reserved Crown land (primarily off-airport land along the bed and banks of rivers and creeks, road reserves and parkland).
- Prior to commencement of works, obtain approval from relevant utility and asset managers to connect to the stormwater system (including open waterways) or to commence work on any utility installations (such as gas, electricity and water) or undertake excavation near Melbourne Water assets, if required.
- Undertake other complementary, non-statutory planning methods for notifying the community about aircraft noise risk or impact other than zoning and overlay controls wherever practicable. Options are outlined in the MAESP, NASF and Standards Australia's Noise Handbook.
- Upon approval of the 2022 Melbourne Airport Master Plan, the Victorian Minister for Planning may amend the MAEO to apply the new ANEF, in consultation with affected councils and property owners. The MAEO will apply planning controls within the boundary of the overlay to protect against incompatible development and land use.
- PSA to amend zoning and overlay maps in the Hume Planning Scheme and replace them with the uncoloured 'CA' designation (thereby removing current zoning and overlay provisions affecting the airport land which no longer apply as a result of land acquisition).

A summary of the impacts identified, and the associated risk level and mitigation measures, is provided in **Table B2.7**. It identifies that for land use and planning there are both adverse and beneficial impacts associated with M3R. A High Adverse impact is associated with the potential for the Melbourne Airport Environs Overlay (MAEO) to be amended to incorporate the proposed new Master Plan ANEF, based on the M3R 2046 ANECs and the greater restrictions to land use and subdivision in newly covered areas. This is considered an indirect and facilitated impact as, although the M3R 2046 Composite ANEC will inform the new ANEF, the direct requirement for amending the MAEO will be derived from approval of the 2022 Master Plan. This impact is reduced to Medium by the requirement for a planning scheme amendment by the Victorian Government, as this will provide a separate consultation and approval process. This process modifies the likelihood of the impact from Almost Certain to Likely.

Table B2.7
Impact assessment summary

Environment aspect & baseline condition	Assessment of original impact: Original Impact	Mitigation inherent in design/practice	Significance: Duration	Severity	Likelihood	Impact	Mitigation and/or management measures	Assessment of residual impact: Residual Impact	Significance: Duration	Severity	Likelihood	Impact
Construction / Operation							**Construction / Operation (cont.)**					
On-airport – airside land use (runways, aprons and terminal buildings)	Direct – airside land use composition to intensify/change	Design has been undertaken in accordance with airport Master Plan land use framework	Long-term	Beneficial	Almost certain	Beneficial	No additional mitigation or management measures required – beneficial impact risk	Airside land use composition to intensify/change	Long-term	Beneficial	Almost certain	Beneficial
On-airport – landside land use (hotels, car parks, public transport facilities, car rental facilities and commercial, retail and industrial premises)	Indirect – functionality of landside land use may be restricted by proposed works	Design has been undertaken in accordance with airport Master Plan land use framework	Long-term	Minor	Possible	Low	Implement industry standard safeguarding and management controls	Functionality of landside land use may be restricted by proposed works	Long-term	Minor	Unlikely	Low
On-airport – natural areas (some natural areas of native vegetation and habitat not currently used or developed for airport purposes)	Direct – diminishing of functionality a natural land use by virtue of proposed works	Design has evolved to minimise removal. CEMP will set out construction controls to minimise indirect impacts	Long-term	Moderate	Possible	Medium	Implement industry standard controls as part of CEMP/ TMP to minimise further direct or indirect impacts	Residual area retained will remain functional as a natural land use	Long-term	Moderate	Unlikely	Low
On-airport – rural areas (largely cleared former grazing land located to the south of the existing east-west runway and west of McNabs Road)	Direct – conversion to airside land use	Design has been undertaken in accordance with airport Master Plan land use framework	Long-term	Beneficial	Almost certain	Beneficial	No additional mitigation or management measures required – beneficial impact risk	Land use conversion consistent with Master Plan	Long-term	Beneficial	Almost certain	Beneficial
Off-airport –road corridor land (Sunbury Road dual carriageway)	Direct – physical works within road corridor land for construction access	Design has sought to minimise number of construction access points onto external transport network	Short-term	Minor	Likely	Medium	Implement industry standard TMP and obtain necessary permits	Works within road reserve not affecting function as road corridor land	Short-term	Negligible	Likely	Negligible
Off-airport – natural areas (Maribyrnong River and other waterway corridors and fringing vegetation)	Direct – potential loss of natural area for stormwater infrastructure works which may affect overall functionality of corridor as a natural land use	Design has evolved to restrict physical works to necessary stormwater outfalls	Long-term	Minor	Possible	Low	CEMP will set out construction controls to minimise impacts. Obtain necessary permits.	Potential loss of natural area for infrastructure works which may affect overall functionality of corridor as a natural land use.	Long-term	Minor	Possible	Low
Off airport – impact of development controls on land use (Existing Melbourne Airport Environs Overlay (MAEO) – Schedule 1 and Schedule 2)	Indirect - MAEO may be amended by the Victorian Minister for Planning in accordance with the 2022 Master Plan ANEF, incorporating M3R 2046 Composite ANEC, resulting in greater restrictions to noise-sensitive land use and subdivision in newly covered areas	Airspace design has sought to minimise the coverage and extent of the M3R 2046 Composite ANEC– refer Chapters C2: Airspace Architecture and Capacity and C4: Aircraft Noise and Vibration	Long-term	Moderate	Almost certain	High	Public consultation on and approval of the 2022 Master Plan and associated ANEF, and the subsequent Planning Scheme Amendment process to amend the MAEO	Design of future development around the airport would be subject to new planning provisions that control land use via amended MAEO controls reflecting new ANEF	Long-term	Moderate	Likely	Medium

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Chapter B3
Soils, Groundwater and Waste

Summary of key findings:

- There are some areas of the M3R footprint where soil and groundwater have been contaminated as a result of past activities. Assessment of soil and groundwater has been undertaken to identify potentially contaminated areas so they can be managed appropriately during M3R construction.
- The key contamination issue requiring management in the M3R footprint is PFAS (both source and diffuse impacts). A project-specific PFAS management strategy will be prepared. Confirmation of management and remediation options, including detailed feasibility, will be completed as part of detailed design works. A project-specific human health and ecological risk assessment will also be prepared to support the management and remediation options assessment, and PFAS management strategy.
- Minor occurrences of asbestos-containing material, isolated occurrences of metals and hydrocarbons, and other potential impacts from historic landfilling activities have been identified in isolated areas of the project footprint. A Construction Environmental Management Plan (CEMP) will be developed to provide specific details regarding how these impacts will be mitigated and managed in accordance with applicable regulations.
- Waste generated during the construction and operation of M3R will be managed proactively to limit potential environmental impacts. The CEMP will be developed to include specific details on the waste management controls that will be applied to mitigate potential risks to the environment from these wastes.

CHAPTER B3 CONTENTS

CHAPTER B3 FIGURES

CHAPTER B3 TABLES

B3.1
INTRODUCTION

This chapter describes the existing conditions of soil and groundwater of the study area (**Figure B3.1**), and the potential impacts, as part of Melbourne Airport's Third Runway (M3R) Major Development Plan (MDP) approvals process.

B3.1.1
Objectives

The objectives of the soils, groundwater and waste study were to:

- Contribute to the description of the 'whole of the environment' affected by M3R by assessing the project's land contamination and waste aspects
- Identify at a preliminary level those impacts that could be avoided or mitigated through engineering design, and confirm compliance with relevant legislation
- Identify sources, likely volumes, and quality of wastes generated during the pre-construction phases of M3R, and during its operation.

B3.2
METHODOLOGY AND ASSUMPTIONS

The following methodology was undertaken for the assessment of soil, groundwater and waste:

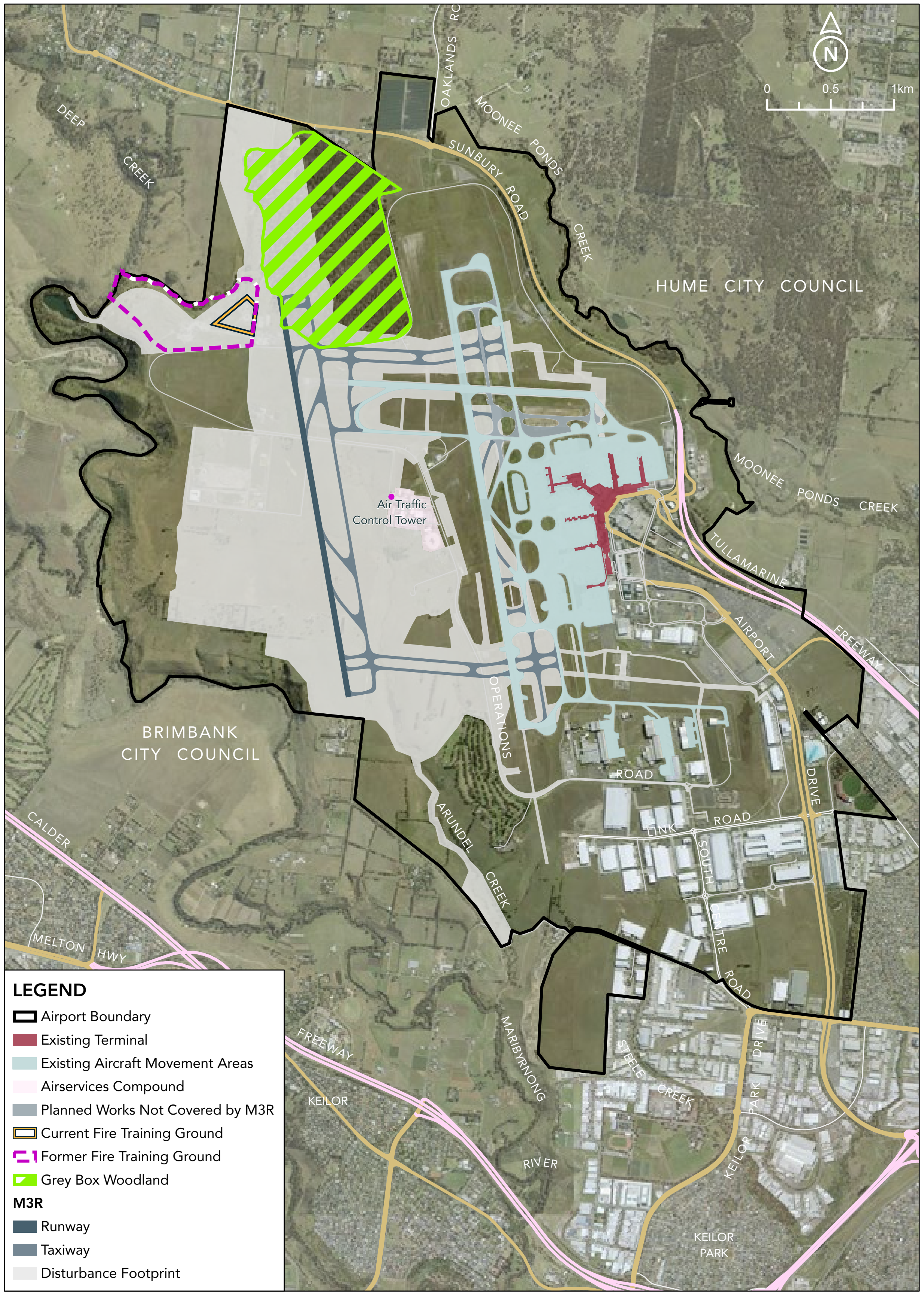
- A review of relevant national, state and local legislation and policy
- A desktop assessment to characterise existing geological conditions, historic and existing land uses, and known potential sources of contamination
- Collation of previous investigation information, and confirmation of data gaps for further investigation
- Site walkovers to visually inspect current site activities and areas of environmental concern
- Site investigation works to further characterise soil, groundwater and wastes
- A qualitative risk assessment to prioritise the impact assessment and development of potential design responses and engineering controls
- An assessment of the potential soil, groundwater and waste impacts during construction, operation and maintenance of the project.

The primary technical document supporting this MDP chapter is the *Environmental Site Assessment* prepared by Senversa (Senversa, 2020). Estimates of waste types and volumes have been sourced from Beca and WT Partnerships.

The following assumptions were made as part of this assessment:

- The broad scope of works includes disturbance of a large volume of soil and rock in the northern part of the runway alignment, and filling in the southern extent of the alignment. An area of cut is also proposed for the underpass under the southern cross-field taxiways
- Disturbance of soil across the remaining project area is likely to be limited to near-surface disturbance. This will include, but not necessarily be limited to, the following:
    - Demolition of existing structures and site clearance works
    - Stripping vegetation and topsoil from cut and fill areas
    - Bulk earthworks associated with cut and fill processes
    - Temporary construction roads and staging zones
    - Construction of the main runway and taxiway pavements
    - Installation of ancillary services supporting the new runway (e.g. electrical services, stormwater drainage, security fencing etc)
- The current project design identifies a fill deficit which is likely to require either importation of fill to complete the works or establishment of an on-site source.

Figure B3.1
M3R study area boundary



B3.3 STATUTORY AND POLICY REQUIREMENTS

Melbourne Airport is located on Commonwealth land. The *Airports Act 1996* (the Airports Act), the Airports (Environmental Protection) Regulations 1997 (Airport Regulations) and *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) are the key pieces of legislation setting out the regulatory framework for M3R works on airport land and this assessment. Where there is potential to impact on the environment outside the airport site boundary (and on Victorian land), Victorian acts, policies and regulations apply.

Consideration of on-site and off-site impacts in this assessment meets the requirements of the *Significant Impact Guidelines* (DSEWPC, 2013) that the MDP considers the project in the context of the 'whole of the environment' affected by M3R, and recognises that the environmental impact of M3R may extend outside the specific M3R footprint/boundary and the Melbourne Airport site. It also considers the 'specific' and 'general' matters of assessment provided to the airport by the then Department of Environment in relation to the (previously proposed) Runway Development Program (RDP) MDP (EPBC Ref: 2016/7654 March 2016).

In regard to management of contaminated soil, groundwater and wastes within Commonwealth Airport land, the following overarching documents apply:

- *Airports Act 1996* (The Airports Act)
- *Airports (Environment Protection) Regulations 1997* (Airport Regulations)
- *Environment Protection Act 2017* (EP Act Vic).

The Airport Regulations include criteria for 'accepted limits' of contamination for soil and water pollution.

The Airport Regulations also refer to Section 14 of the *National Environment Protection Council Act 1994 (Division 2 – Making of national environment protection measures)* whereby monitoring is to be undertaken 'in a way that is not inconsistent with (i) any international convention, treaty or agreement, relating to environment protection to which Australia is a party; or (ii) a provision of national environment protection measures made under section 14 of the National Environment Protection Council Act 1994'.

The EP Act Vic applies in relation to waste management as there is no Commonwealth equivalent for the management of wastes. In addition, wastes generated by M3R may be managed/disposed off-site and therefore state legislation applies.

The following sections outline key regulations and guidelines, noting that supporting guidance documentation is reviewed and updated on a regular basis. Any changes in legislation, regulations and guidance will be considered and incorporated as required.

B3.3.1 Soil and groundwater

Based on the above, it is considered that the following key regulations and guidelines also apply to the assessment of soil and groundwater contamination:

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018)
- *Australian Drinking Water Guidelines, National Water Quality Management Strategy.* National Health and Medical Research Council & Natural Resource Management Ministerial Council (2011) (Updated October 2017) (NHMRC/NRMMC 2011)
- *Guidelines for Managing Risk in Recreational Waters* National Health and Medical Research Council (2008) (NHMRC 2008)
- *Guide to the Sampling and Investigation of Potentially Contaminated Soil. Part 2: Volatile Substances*, Australian Standards: 4882.2
- *Guide to the Investigation and Sampling of Sites with Potentially Contaminated Soil, Part 1: Non-Volatile and Semi-Volatile Compounds*, Australian Standard: AS4482.1-2005
- *National Environmental Protection (Assessment of Site Contamination) Measure*, as *amended 15 May 2013*, National Environmental Protection Council (1999) (NEPM)
- *PFAS National Environmental Management Plan Version 2.0 – January 2020* (PFAS NEMP 2020), National Chemicals Working Group of the Heads of EPAs Australia and New Zealand (HEPA, 2020)
- *Environmental Reference Standard (Vic)*

The assessment also considers the *Melbourne Airport PFAS Management Framework* (APAM, 2020). This provides guidance for re-use and management options of PFAS-impacted soil and water across the Melbourne Airport estate. The framework identifies three management levels for soil re-use (unrestricted re-use, capping at surface, and engineered containment) which are based on PFAS contaminant levels (total concentrations and leachability). This framework has been endorsed by the Commonwealth Department of Infrastructure, Transport, Regional Development and Communications (DITRDC) and is being applied to current construction and maintenance projects across the Melbourne Airport estate.

B3.3.1.1 Adopted assessment criteria for soil and groundwater

Taking into consideration the above and the proposed land use, the following assessment criteria were adopted for soil investigations:

- Airport Regulations Soil Pollution – accepted limits – Table 1 – areas of an airport generally
- Airport Regulations Soil Pollution – accepted limits – Table 2 – areas of environmental significance.
- NEPM Human Health Setting 'D' – Commercial / Industrial
- NEPM Maintenance of Ecosystems – Commercial/ Industrial (including relevant derivations for nickel and zinc)
- PFAS NEMP Human Health – Industrial /Commercial
- PFAS NEMP Ecological indirect exposure – All land uses
- Melbourne Airport PFAS Management Levels.

The following assessment criteria were adopted for groundwater investigations in consideration of both onsite and off-site receptors:

- Airport Regulations – Freshwater
- PFAS NEMP 'Aquatic Ecosystem – Freshwater 95 per cent and 99 per cent species protection' criteria
- PFAS NEMP Health-based guidance values – Drinking water and recreational water
- ANZG 2018 – 'Aquatic Ecosystem – Freshwater 95 per cent species protection' criteria
- ANZG2018 – 'Primary Contact Recreation' and where relevant, guidelines were sourced from NHMRC 2011
- ANZG 2018 – 'Irrigation & Stock watering.

B3.3.2 Asbestos

The following additional legislation and guidance are applicable to management of asbestos:

- *Work Health and Safety Act 2011* (Cth)
- Work Health and Safety Regulations 2011 (Cth)
- *Occupational Health and Safety Act 2004* (Vic)
- *Occupational Health and Safety Regulations 2017* (Vic)
- *WorkSafe Guidance Note - Asbestos-contaminated soil, October 2010* (Vic).

B3.3.3 Wastes

The EP Act Vic and supporting regulations and guidelines commenced on 1 July 2021. This new legislation and guidance will be relevant at the time of construction works. This legislation adopts a different approach to environmental issues, focusing on preventing waste and pollution impacts. A cornerstone of the Act is the General Environmental Duty (GED) requiring reasonably practicable steps to be undertaken to eliminate or otherwise reduce the risks of harm to human health and the environment. Based on documentation published or circulated as proposed to date, the overall waste management principles are not expected to change significantly. As supporting guidance documentation is often reviewed and updated on a regular basis, for the purposes of the MDP the available legislation and guidance documentation has been considered.

- *Environment Protection Act 2017* (EP Act Vic)
- *Environment Protection Regulations (Vic)*
- *Guide to classifying industrial waste. Publication 1968. EPA Victoria.*
- *Waste disposal categories – characteristics and thresholds. Publication 1828. EPA Victoria.*

B3.4
DESCRIPTION OF SIGNIFICANCE CRITERIA

Table B3.1 presents the severity assessment criteria developed to assess impacts from soils, groundwater and wastes in accordance with the M3R Significance Assessment Framework.

Table B3.1
Significance assessment framework for soil, groundwater & waste

Magnitude	Specialist Criteria – Soil and Groundwater	Specialist Criteria - Waste
Major	In situ concentrations of contaminants in impacted media (soil, groundwater, surface water, sediments, and air) exceed adopted human health investigation levels and present an immediate risk to the health of persons accessing the site. Mitigation measures are likely to be extensive or complex, requiring a high level of resources and may involve regulatory intervention.	Waste generated by M3R is entirely disposed to landfill or stored or handled in a way that results in permanent, irreversible or long-term adverse impact to the local or receiving environment. Management or mitigation measures are unlikely to restore the ecological values to the local or receiving environment.
High	The disturbance of in situ contamination with concentrations that exceed adopted human health or ecological investigation levels and potentially present a risk to the health of persons accessing the site, or which result in the mobilisation of the contaminants within the immediate environment sufficient to cause adverse impacts to the local environment and long-term impacts in the receiving environment. Careful management or avoidance can mitigate.	Waste generated is entirely disposed to landfill or stored or handled in a way that results in adverse impact to the local environment or long-term impacts to the receiving environment. Careful management or avoidance can mitigate adverse effects but may require many years to restore the ecological values to the local or receiving environment.
Moderate	The disturbance of soil or groundwater containing contaminants with concentrations that exceed adopted investigation levels for ecological receptors and human health, which results in the mobilisation of the contaminants within the immediate environment, which is sufficient to cause adverse impacts to the local environment and long-term impacts in the receiving environment. Appropriate management measures can mitigate.	More than 80 per cent of waste generated is disposed to landfill. Storage or handling of waste results in adverse impacts to local environment or long-term impacts to the receiving environment that can be managed via implementation of appropriate mitigation measures.
Minor	The disturbance of soil or groundwater containing one or more contaminants with concentrations exceeding screening levels for ecological receptors and highly sensitive human receptors, but are below screening criteria for commercial /industrial land uses, which is sufficient to cause adverse impacts to the local environment and long-term impacts in the receiving environment. Appropriate management measures can mitigate.	More than 80 per cent of wastes are either recycled or treated to allow beneficial re-use, with the exception of prescribed industrial wastes (and hazardous wastes). Storage or handling of waste results in minor adverse impacts to local or receiving environment that can be managed via implementation of appropriate mitigation measures.
Negligible	The disturbance of soil or groundwater containing isolated occurrences of contamination which may result in mobilisation of small amounts of contaminants within the immediate receiving environment. Degradation of the greater receiving environment (being areas outside of the M3R land-based footprint) is unlikely with no measurable degradation to the local receiving environment. Monitoring of potential impact may be an appropriate response rather than implementation of mitigation measures.	All wastes are diverted from landfill and either recycled or treated to allow beneficial re-use.
Beneficial	The disturbance of soil or groundwater and subsequent management during construction leads to a reduction in risks to human health or ecological receptors. This can be achieved by reducing or removing potential pathways such as capping, containing or relocating contamination away from sensitive receptors or implementing other controls such as surface water diversion and erosion controls.	All wastes are diverted from landfill and either recycled or treated to allow beneficial re-use. Implemented management measures result in removal of legacy wastes thereby improving the local or receiving environment.

B3.5
EXISTING CONDITIONS

This section outlines the existing conditions of the study area relating to soil, groundwater and waste.

B3.5.1
Geology – Published

The geological formations outcropping in the site's vicinity is shown in the Sunbury 1:63,360 Geological Map section reproduced in Figure B3.2.

The stratigraphic sequence beneath the northern part of the site consists of the Quaternary-aged Newer Volcanics Formation directly overlying the Devonian-aged Bulla Granodiorite. The elevation of the upper surface of the Bulla Granodiorite appears to be highly variable and, consequently, the thickness of the overlying Newer Volcanics is likely to be variable across the site.

The stratigraphic sequence beneath the southern part of the site generally comprises the following formations, from youngest to oldest:

- Quaternary-aged Newer Volcanics, consisting of clay-rich basaltic soils overlying highly decomposed basalt rock
- Tertiary-aged Sandringham Sandstone (formerly known as the Brighton Group) consisting of clayey sands and sandy clays
- Tertiary-aged Older Volcanics, consisting of highly to extremely weathered basalt
- Silurian-aged Murrindindi Supergroup comprised of the Deep Creek Formation, Springfield Sandstone and Dargile Formation) occurring as fractured siltstone, mudstone, sandstone, shale and greywacke.

The Quaternary-aged Newer Volcanics Formation is the predominant surface outcrop across the plateau forming the majority of the site area. The sequence of underlying Tertiary-aged formations outcrop along the deeply incised river and creek valleys around the site. The Maribyrnong River and Monee Ponds Creek valleys are located west and east of the site respectively, and Arundel Creek valley, a tributary of the Maribyrnong River, separates the new north-south runway (16R/34L) from the existing airport terminal facilities.

The Bulla Granodiorite and Murrindindi Supergroup form the bedrock of the region and outcrop in topographic highs in the northern part of the site (the Grey Box Woodland), north-east and north-west of the site.

Figure B3.2 presents the published geological information for M3R.

B3.5.2
Geology – Observed

Surface soils across the site generally consist of variably weathered basalt of the Newer Volcanics. In the south, this is underlain by the Sandringham Sandstone (clay and sand), Older Volcanics (clay and basalt rock) and siltstone bedrock of the Murrindindi Supergroup.

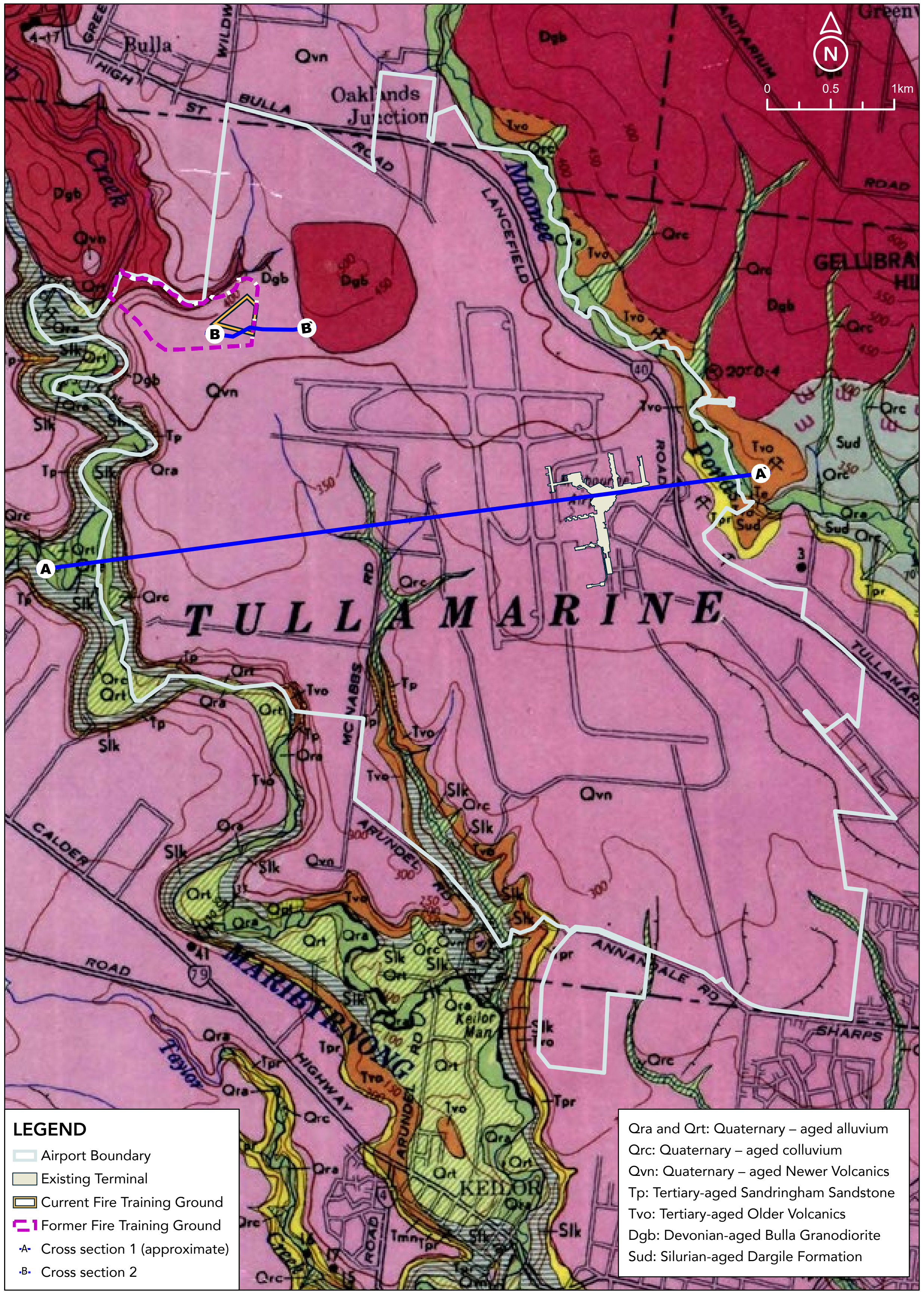
In the area of the Grey Box Woodland to the north of the site, Bulla Granodiorite (ranging from residual sand and clay soils to fresh rock) was encountered. It was found to extend to the west outside the Grey Box Woodland directly below the Newer Volcanics basalt in some investigation locations. Weathering of the Bulla Granodiorite was highly variable, with slightly weathered to fresh granodiorite encountered towards the east of the Grey Box Woodland from depths of ten centimeteres below ground level (bgl). Towards the western side of the Grey Box Woodland, extremely weathered granodiorite (recovered as sandy clay and clayey sand) was encountered from surface to the target depth of 15 metres bgl.

Shallow fill soils were encountered across the current Fire Training Ground (FTG) to a maximum thickness of 1.8 metres. Deeper filling was encountered in the area west of the current FTG, up to six metres bgl thick. This typically comprised reworked siltstone material, and localised and sporadic inert waste materials observed in the shallow fill zones.

Figure B3.3 (cross-section B-B') presents the interpreted vertical surface geology encountered during drilling in the northern part of the proposed runway's alignment.

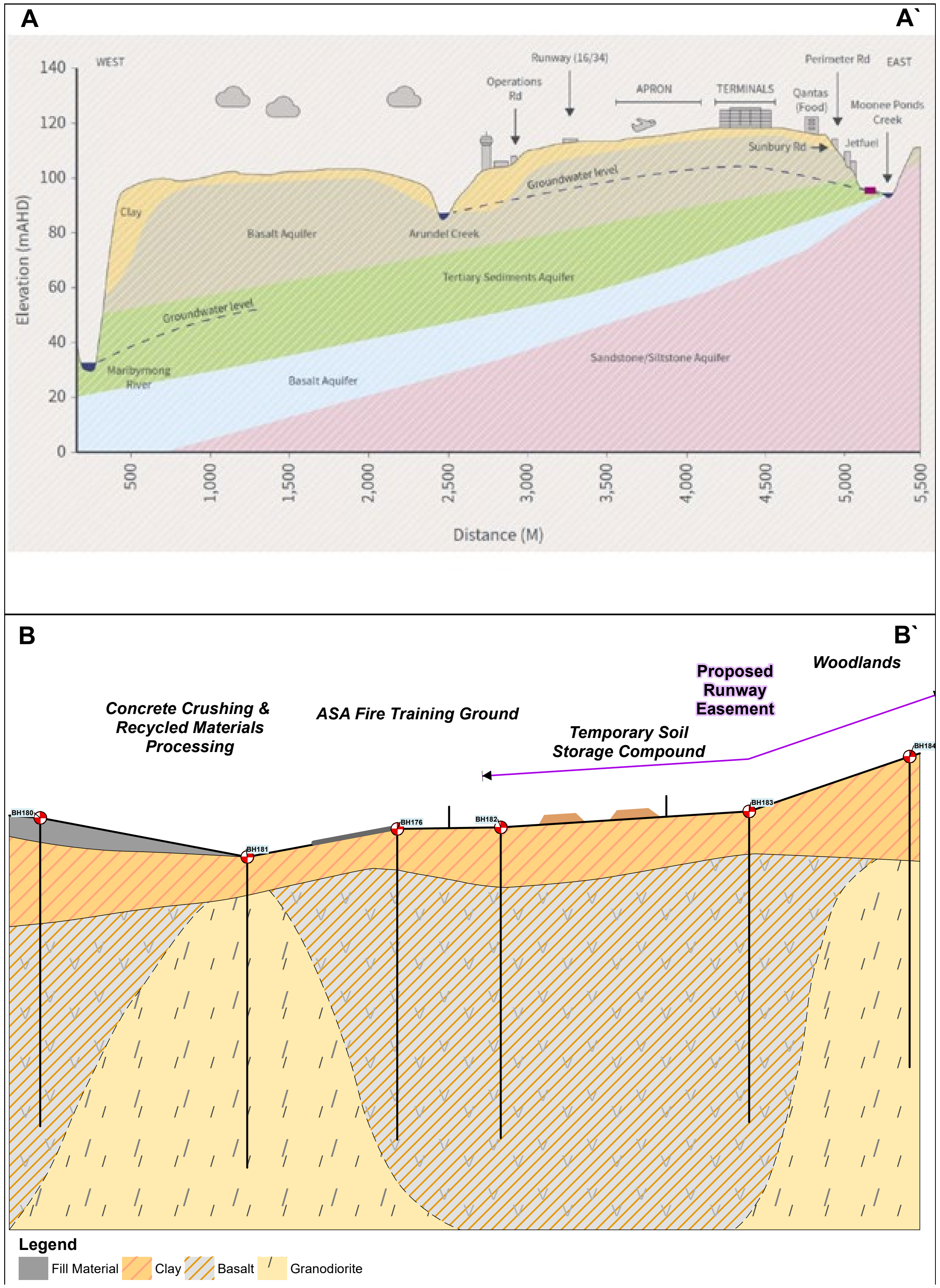
Drilling works in the southern portion of the site (in the location of the proposed underpass beneath the proposed cross-field taxiway) showed that the Newer Volcanic basalt rock will likely be penetrated at depths of approximately 0.25 to two metres bgl; and Sandringham Sandstone at thirteen to fourteen metres bgl. Figure B3.3 (cross-section A-A') provides a simplified interpretation of the vertical sequence of geological formations encountered during investigations in the southern part of the proposed runway alignment.

Figure B3.2
Map of published geology



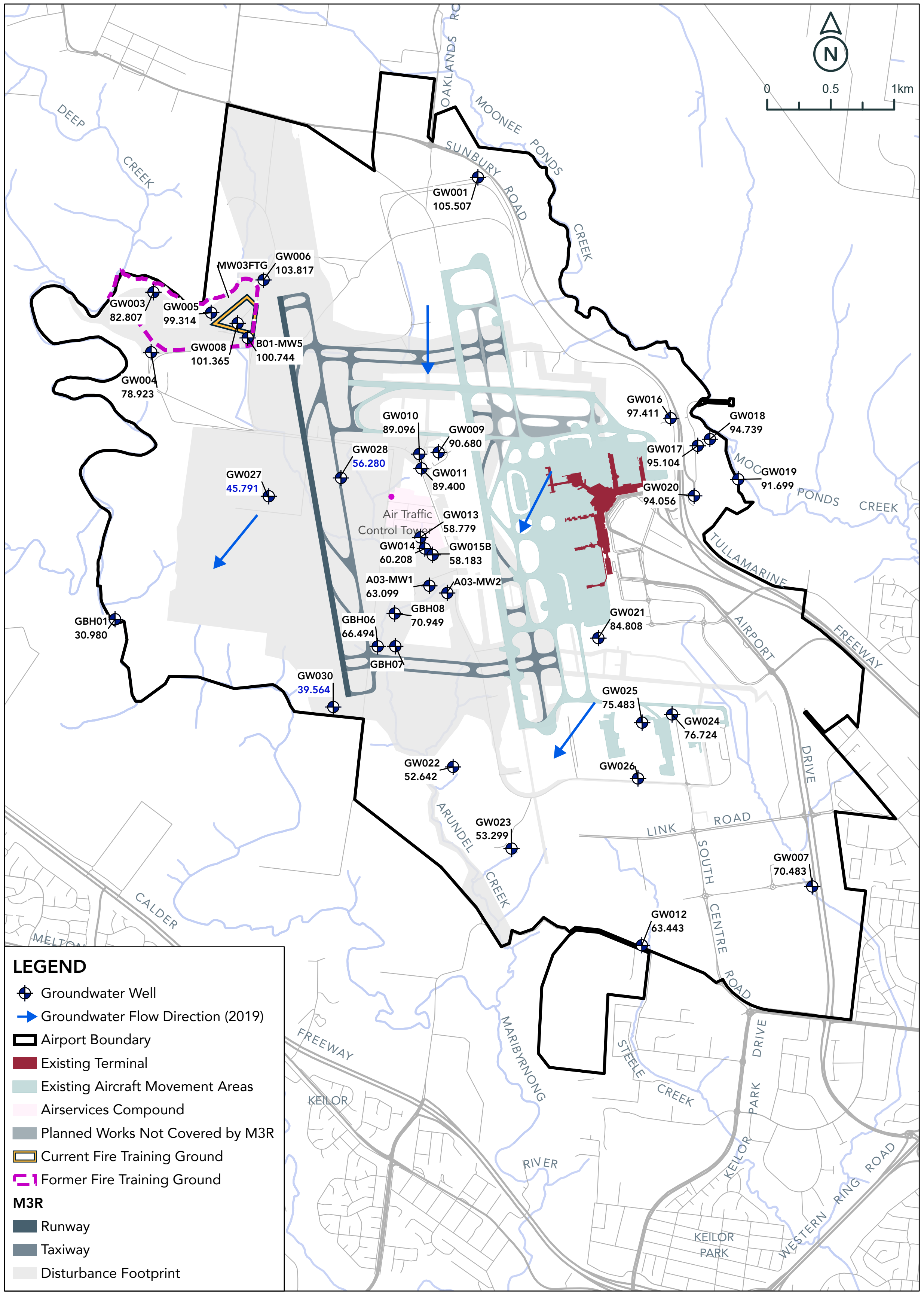
Source: Geological Survey of Victoria, 1973. Sunbury 1:63,360 Geological Map Sheet.

Figure B3.3
Geological cross sections A-A' and B-B'



Source: A-A' from Melbourne Airport Master Plan, 2018.
B-B' from Senversa, 2020.

Figure B3.4
Groundwater monitoring well network and groundwater elevations



Source: Senversa, 2020.

B3.5.3
Hydrogeology

Regional groundwater flow is generally south towards Port Phillip Bay. However, groundwater beneath the project area is heavily influenced by the presence of incised river/creek valleys (the dominant flow direction being south-west across the site towards Deep Creek and Maribyrnong River).

The uppermost water table occurs in the Newer Volcanics to the north and east of the site, and is reported to also occur in the Sandringham Sandstone and Older Volcanics in wells located in the centre, south and west of the project area. In some elevated areas and close to surrounding watercourses, groundwater is not present in the Sandringham Sandstone and Older Volcanics.

Groundwater does occur at depth in the fractures and jointing in the deeper Murrindindi Supergroup and Bulla Granodiorite. However, aquifers in the bedrock formations are likely to be hydraulically isolated from overlying water tables by clay-rich weathering of these units' upper layers.

Figure B3.4 shows the Melbourne Airport monitoring well network and groundwater elevations from gauging undertaken in 2019. Groundwater depths across the project area generally range from approximately eighteen to fourty-eight metres below ground level. Shallower groundwater depths are noted within incised valleys such as Arundel Creek, where groundwater seeps have also been observed. Perched groundwater is also expected to occur but project works will generally take place above the water table.

B3.5.4
Current and Historical Land Use

Figure B3.5 and **Figure B3.6** present Areas of Environmental Concern (AEC). These have been identified by assessing current and historic land uses and activities, and their potential to have caused soil or groundwater contamination. A summary of AECs is presented in **Table B3.2** and their key features are summarised below:

The majority of the project area is located within the landside area of the Melbourne Airport estate. The following current site uses have been observed:

- Current Fire Training Ground (FTG) (AEC 13) leased to Airservices Australia for firefighting activities (no training is currently occurring at this site)
- Agricultural (grazing) land in non-operational areas of the airport estate
- Concrete crushing and recycled materials processing area (AEC 16)
- Construction laydown areas and compounds for current project activities (AEC 15 and 25)
- Operational areas of the airport (existing east-west runway (09/27), existing north-south runway (16L/34R) and associated infrastructure including navigation, communications infrastructure, taxiways etc
- Melbourne Airport Golf Course (AEC 37)
- Temporary PFAS soil stockpiling and storage area (AEC 40)
- Other temporary PFAS soil stockpiling (AEC 22 and 31).

The following provides a summary of historic land use:

- Prior to development of land for the airport in the late 1960s, the Melbourne Airport site was predominantly used for grazing and crops. A number of former homesteads, dams and ancillary features were observed from 1951 to 1969.
- The east-west runway (09/27) was constructed commencing circa 1966. Material for the runway was sourced from a quarry at the western end of the Melbourne Airport Estate abutting Deep Creek, which comprised siltstone from the Murrindindi Supergroup. The Deep Creek tributary was also dammed as part of runway construction in the late 1960s. In circa 1982, historic aerial imagery suggests the dam walls were no longer intact.
- Evidence of fire training activities in the northern part of the project area was observed from 1975 onwards, with a much broader area of use than the current lease area (AEC 11 extent on **Figure B3.5** provides broad area of use; AEC 29 and 30 on **Figure B3.6** detail observed areas of activity from aerial photographs).
- Significant ground disturbance and soil filling have been observed, associated with the construction of the current east-west runaway and former fire training ground - plus the existing concrete crushing and recycling area, where large amounts of stockpiled soil, rock and materials have been received and processed.
- The northern area previously included a construction laydown for the original runway development adjacent to the current compound (AEC 21). Activities at the current compound (AEC 15) have had multiple site users and various activities predominately associated with existing runway upgrade and maintenance works. They include storage of new and used construction materials, equipment, soil and wastes. The activities of this compound extend north outside its boundary, where an area of land was used for managing waste streams from asphalt works (settling ponds for solid/liquid separation). More recently, this area has been used to stockpile PFAS contaminated soils excavated from the Joint User Hydrant Infrastructure (JUHI) tank expansion project (outside current project area).
- Two former communications towers (AEC 17 and 18) were located in the northern part of the project area and have been demolished. The towers included storage of fuel (both above and below ground).
- Land uses and site activity in the southern extent included a former landfill and incinerator site (AEC 1 and 2), former residential and agricultural activities (AEC 3 to 7), filling activities (AEC 5) on the northern and southern boundaries of the golf course, and the longer term use of the current construction compound/laydown area (AEC 25) west of the aviation maintenance areas (AEC 38).

Table B3.2
Areas of Environmental Concern

AEC	Details	AEC	Details
1	Former landfill	21	Former construction/laydown area associated with original airport development
2	Former incinerator site	22	Stockpiled materials (2018-2019)
3	Demolished and dilapidated buildings	23	Radar and diesel above ground storage tank
4	Waste dumps	24	Above ground storage tank and former underground storage tank
5	Disturbed ground and infilled land	25	Construction compuound/laydown area
6	Vehicle maintenance	26	Residential property – historically agricultural, currently storing equipment associated with carnival/show ground equipment/rides
7	Activities associated with former hobby farms, horse agistment and kennels	27	Temporary construction compounds/infrastructure (various locations)
8	Runway and fill beneath runway	28	Infilled dams
9	Settlement ponds (runway/asphalt works waste management)	29	Former Fire Training Ground infrastructure and props
10	Disused quarry	30	Burn scars visible in 1982 aerial image around former Fire Training Ground infrastructure
11	Former Fire Training Ground	31	Airservices Australia stockpiled PFAS contaminated soil
12	Evaporation pond	32	Current Fire Training Ground infrastructure – operational (kerosene, generator and holding tanks for wastewater)
13	Current Fire Training Ground	33	Melbourne Airport Fire Station
14	Aboveground storage tank and fuel line to current Fire Training Ground (kerosene)	34	Learning academy
15	Construction (multiple users/uses) laydown, stockpiling, asphalt batching, equipment storage	35	Smoke Hut and former training areas to south of Smoke Hut.
16	Concrete crushing & recycled materials processing	36	Satellite Fire Station
17	Former communications tower complex west of the Grey Box Woodland.	37	Melbourne Airport golf course
18	Former communications tower complex within the Grey Box Woodland	38	Aviation maintenance areas (various users/tenants)
19	Former Bulla Road	39	Joint User Hydrant Installation
20	Former Oaklands Road	40	Temporary PFAS soil stockpile/storage area

Many of these areas of concern have been investigated at least partially in previous assessments. The assessment undertaken by Senversa (Senversa, 2020) qualitatively assessed the risks associated with these areas of concern and identified potential contaminants of concern. The key areas of concern located within the project area are the current and former FTG (AECs 13 and 11, respectively) and associated infrastructure including, but not limited to, the evaporation pond (AEC 12) relating to the historic use of Aqueous Film Forming Foams (AFFF) containing per- and poly-fluoroalkyl substances (PFAS). AECs 11 to 13 are located within and/or adjacent to the proposed main area of works (which will include bulk excavation of material in the northern part of the 16R/34L alignment).

Impacts associated with PFAS contamination have been further delineated and are identified as being a key issue that requires management as part of project works.

The presence of asbestos in near surface soils is a common issue for construction projects that have had historical buildings and infrastructure. The presence of asbestos-containing wastes has been noted in isolated areas of waste material within the project area, and observed in fill at some soil sampling locations.

Landfills and areas of filling have been identified within the project area. One of the AECs appears to be a former landfill (AEC 1) containing material generally consistent with construction and demolition waste rather than putrescible waste or hazardous chemicals. Other areas of filling appear to predominantly involve use of displaced soils from other parts of the site.

The main contaminants associated with the other AECs in the project area predominantly include metals and petroleum hydrocarbon contaminants. These are generally limited to shallow soil and considered to present a moderate to low level of risk. Concentrations of some metals in soil are reflective of naturally occurring background levels in the soils at the site. Soils containing elevated levels of metals and petroleum hydrocarbons associated with historic use are considered relatively easy to manage in the context of the earthworks associated with the project.

Additional information on the categorisation of AECs and management responses is provided in **Section B3.5.5** of this chapter.

B3.5.5 Contaminants of Potential Concern

B3.5.5.1 PFAS

At airports, Aqueous Film Forming Foams (AFFF) containing per- and poly-fluoroalkyl substances (PFAS) were historically used because they are very effective at putting out liquid fuel fires. At Melbourne Airport, AFFF has been stored in aircraft hangers for deluge systems; and used extensively in training for and responding to firefighting emergencies involving liquid fuels. Potential source areas in the project area include the following Airservices Australia facilities as presented on **Figure B3.8**:

- Current and former fire training grounds (FTGs) (AEC 11 and 13)
- The Melbourne Airport Fire Station (AEC 33)
- The Smoke Hut (AEC 35).

Diffuse PFAS impacts are widespread across the project area and a number of secondary sources of PFAS contamination have also been identified (refer to **Figure B3.8**). However, these are predominantly associated with surface water drainage, groundwater contamination and water re-use impacts (e.g. Melbourne Airport golf course – AEC 37).

The key PFAS compounds of concern within the Airport Estate are perfluorooctane sulfonate (PFOS) and perfluorohexane sulfonate (PFHxS). Although other PFAS compounds have been detected above laboratory limits of reporting (LOR), PFOS and PFHxS are considered suitable indicators of overall PFAS impacts and the primary drivers of risk because they:

- Have as high or higher toxicity than other PFAS for which toxicological studies have been conducted
- Have screening and toxicity reference values published by Australian agencies for use in screening level and detailed quantitative health risk assessments
- Comprise the majority (predominantly greater than two-thirds) of total analysed PFAS compounds at Australian sites where PFAS-containing fire-fighting foams have been used.

It is noted that screening levels are also available for perfluorooctanoic acid (PFOA). However, PFOA has not been demonstrated to be a risk driver at Australian sites. This is due to its lower toxicity than PFOS and PFHxS, and its occurrence at lower concentrations in environmental media.

Table B3.3 summarises PFAS impacts across the project area.

Estate-wide human health risk assessments have been commissioned by APAM as part of broader estate management. They identified that on-site and off-site risks are considered low and acceptable. For the purposes of this MDP, assessment of project risks from PFAS will need to consider the current risk profile, and how PFAS will be managed to ensure the risk profile does not increase and/or can be improved as part of project works.

B3.5.5.2 Other Contaminants - Soil

Other non-PFAS contaminants of concern in soil within the project area include metals, petroleum hydrocarbons, asbestos and herbicides/pesticides. Historic landfilling on-site also presents a potential range of contaminant issues. **Table B3.4** summarises the current understanding of these contaminants in soils within the project area.

B3.5.5.3 Other Contaminants – Groundwater

Groundwater monitoring at the wells shown in **Figure B3.9** is undertaken on an annual basis for a broad range of analytes. In addition to PFAS impacts reported in groundwater, the following contaminants have been reported at levels above the adopted guidelines:

- Widespread total nitrogen, copper and zinc
- Isolated occurrences of arsenic, cadmium, chromium, cobalt, lead, manganese, nickel, selenium and nitrate
- Isolated occurrences of petroleum hydrocarbons associated with historic and current use areas (current FTG, maintenance area and JUHI).

Nitrogen and nitrate concentrations are considered representative of regional background concentrations. Metal concentrations are also generally considered representative of regional background concentrations, although some isolated impacts of mercury, chromium (total and VI) and manganese are above regional levels but considered stable.

Table B3.3
Summary of PFAS impacts across the project area

Matrix	Summary of PFAS presence across project area
Soil	Extensive PFAS investigation works have been undertaken across the Melbourne Airport estate, including approximately 370 sample locations within the project area (refer to **Figure B3.7**). This has shown that: • PFAS concentrations (as indicated by sum of PFOS and PFHxS) have been reported above laboratory LOR in most soil samples, however concentrations in most locations are below 0.01 mg/kg (**Figure B3.8**). Areas with relatively high concentrations (>0.01 mg/kg) have been identified where PFAS-containing foams are known or inferred to have been used in the past, including the vicinity of the former and current FTG, smoke hut, fire stations, maintenance hangars, Melbourne Airport golf course (due to irrigation from Arundel Creek), and the historic remote training area near Deep Creek Tributary discharge point. PFOA concentrations are generally non-detect and no exceedances of the health-based criteria have been reported. PFOA only reports above LOR where significant concentrations of PFAS (sum PFOS and PFHxS) have been reported. • PFAS concentrations exceeding health-based screening levels for commercial/industrial workers of >20 mg/kg have only been reported in the vicinity of the current and former fire training grounds. The key source areas for the project area are the current and former FTG. • PFAS concentrations exceeding 50 mg/kg have been reported within the vicinity of the current and former FTG. Concentrations above 50 mg/kg are considered unsuitable for re-use. The volume of soil impacted at these concentrations and above has been estimated conservatively to be in the order of 18,000 M^3. • PFAS (total concentrations) has been well delineated at the near-surface (0 m to 0.2 m below ground level (bgl) across the project area, including key source areas. Vertical delineation is limited across most of the project area, although targeted sampling along the runway alignment and in proposed areas of deep cutting has been investigated. Vertical delineation beneath the key source area (current FTG and surrounds) has also been undertaken. • PFAS leachability rather than total concentrations is considered to the be key driver for management of soils within the project area. Due to limited PFAS leachability data across the broader project area, the potential for increased leachability due to pre-placement treatment (liming) and issues with reliance of laboratory results, maximum leachability concentrations have been estimated from total concentration data. This is considered to be a conservative approach and results indicate that all three Melbourne Airport PFAS management levels are present within the project area. In addition, areas that exceed the highest management level have been reported in the vicinity of known primary and secondary source areas (current and former FTG, Main Fire Station, Smoke Hut, Melbourne Airport golf course and maintenance area) as well as sediment within drainage lines down gradient of the current FTG and other Airservices Australia leaseholds. In summary, the soil data collected to date (both project specific and broader estate) is considered comprehensive and the understanding of PFAS impacts for the purpose of the MDP is considered sufficient. Further investigations are likely to be required as part of management requirements and remediation options assessments.
Groundwater	The current APAM groundwater monitoring well network consists of 36 wells located across the airport estate (**Figure B3.9**). Annual monitoring for PFAS has been occurring since 2017. Three of the wells (GW027, GW028 and GW030) were installed as part of project specific works to obtain specific information on groundwater quality beneath proposed fill areas. Additional wells are also located within the airport estate that are controlled by tenants and target source specific issues. The results of groundwater monitoring undertaken by Melbourne Airport indicate the following: • PFAS concentrations (as indicated by sum of PFOS and PFHxS) have been detected in a number of groundwater wells across the network. • Inferred groundwater flow direction is to the west, southwest and south, towards the Maribyrnong River and Arundel Creek. • The majority of monitoring wells at the airport are screened within the upper aquifer across much of the site (Newer Volcanics and Sandringham Sandstone). However, some wells (GW013, GW014, GW015B, A03-MW1 and A03-MW2) appear to be screened in a lower Silurian Siltstone aquifer which may have limited connection to the shallower regional water tables. • PFAS concentrations are reported above adopted screening levels in multiple monitoring wells, with highest concentrations around Airservices Australia infrastructure including the current FTG and Main Fire Station. PFOA has also been detected but only in wells where sum of PFOS and PFHxS are reported above adopted screening levels. PFOA concentrations only report above adopted screening levels in wells with significant concentrations of sum of PFOS and PFHxS. • PFAS concentrations exceed adopted screening levels at the down-gradient (southwest) site boundary but appear to be stable with the exception of GW003 which shows an increasing trend. The groundwater monitoring network and PFAS data collected to date is considered suitable for providing an understanding of groundwater quality beneath identified PFAS source areas and across the broader project area.

B3.5.6
Other soil characteristics and impacts

B3.5.6.1
Acid Sulfate Soil

Acid sulfate soil is the common name given to soils (and rock) containing metal sulphide materials that have the potential to generate sulphuric acid when exposed to oxygen which could occur during construction (e.g. dewatering or excavation activities).

An online review of the *Atlas of Australian Acid Sulfate Soils* (CSIRO, 2013) was undertaken and the M3R project area is not identified as an area of known or potential acid sulfate soils. The surface geology and geological units likely to be encountered during M3R construction activities within the study area are primarily the Tertiary-aged Newer Volcanics unit and Bulla Granodiorite. These are not recognised potential acid sulfate soil generating soil types/rock types in Victoria. The geological units at the site that have the potential to be acid sulfate generating include the Tertiary-aged Sandringham Sandstone sediments and Silurian siltstone and

Table B3.4
Summary of non-PFAS contamination impacts across project area

Contaminant group or area	Summary of non-PFAS contaminants across project area
Metals	Metals have been identified as a contaminant of potential concern both as naturally elevated occurrence in geological units as well as at most areas where there has been any historical site use. The data indicates that the project area comprises low-level metals impacts below the Airport Regulations Soil Pollution – accepted limits 'areas of an airport generally' (Schedule 3). Some exceedances of adopted ecological investigation levels are noted as follows: Elevated concentrations of nickel, copper and total chromium in soil have been reported across the project area and are considered to be a reflection of naturally occurring levels in the basaltic clay soils. Isolated elevated concentrations of arsenic and zinc have also been reported but are considered to be representative of a small soil volume and poses a low risk to the M3R project.
Petroleum Hydrocarbons	Hydrocarbons have been identified as a contaminant of potential concern where there has been historical site use. The bulk of these areas have been assessed and show that the project area has isolated occurrences of low-level hydrocarbon impacts below the Airport Regulations Soil Pollution – accepted limits 'areas of an airport generally' (Schedule 3) except for within the current FTG and an isolated occurrence in a cleared area of the Grey Box Woodland. Impacts within the current FTG also exceed adopted human health investigation levels. These locations correspond to areas where high concentrations of PFAS also occur.
Asbestos	Asbestos was identified as a primary contaminant of potential concern as part of previous assessment (RDP) and confirmed to be a contaminant that required further management. Impacts identified from previous assessments have included a former landfill and incinerator site, former residential properties and associated building rubble and waste piles (**Figure B3.10**). Additional areas of historical use have been identified in the current project area and are currently identified as suspected to contain asbestos until the presence/absence of asbestos is confirmed.
Herbicides and Pesticides	The use of herbicides and pesticides for weed control and insect management has been identified as a contaminant of potential concern, particularly near the current runway, aprons and taxiways. Previous assessment work in these areas have identified low-level concentrations below Airport Regulations Soil Pollution – accepted limits 'areas of an airport generally' (Schedule 3). Isolated impacts have been limited to areas directly adjacent to hardstand or roadways (apron, taxiway, service road) as well as within the Melbourne Airport golf course.

Historic Landfilling Activities	A range of landfilling activities have been identified within the project area and fall into three broad categories:
	• A former unlicensed landfill (AEC 1) and associated incinerator site (AEC 2) which is understood to be at least 7.5 m deep and known to contain inert waste, clay, concrete, bricks, crushed rock, rubber tyres and green waste.
	• Backfilled dams from former agricultural practices.
	• Fill (soil) associated with existing runway development including historic access routes (AEC 5) from the former quarry (AEC 10).
	• In addition to the contaminants of potential concern listed above, the following contaminants can be associated with landfilling:
	  ○ Other chemicals that are likely to have had an historic use and may have been disposed of inappropriately (for example solvents and degreasers).
	  ○ Contaminants generated from the practice of landfilling and decomposition of putrescible wastes including nutrients (nitrogen and sulphate compounds) and methane.
	  ○ Inert waste streams that may require management if any disturbance of these areas is proposed.
	Previous investigations have been undertaken in key filled areas and confirmed that in general landfilling on site has predominantly involved either disposal of inert waste streams and/or have been filled with site sourced soil. The size and number of filled areas, in particular former dams, means that not all areas of historic filling have been assessed in detail. The level of investigation to date is considered adequate for the purposes of assessing environmental impacts for the MDP.

sandstone (rock) of the Murrindindi Supergroup. Other project data within the estate has investigated these two units and confirmed very low to negligible potential for acid generation in both units.

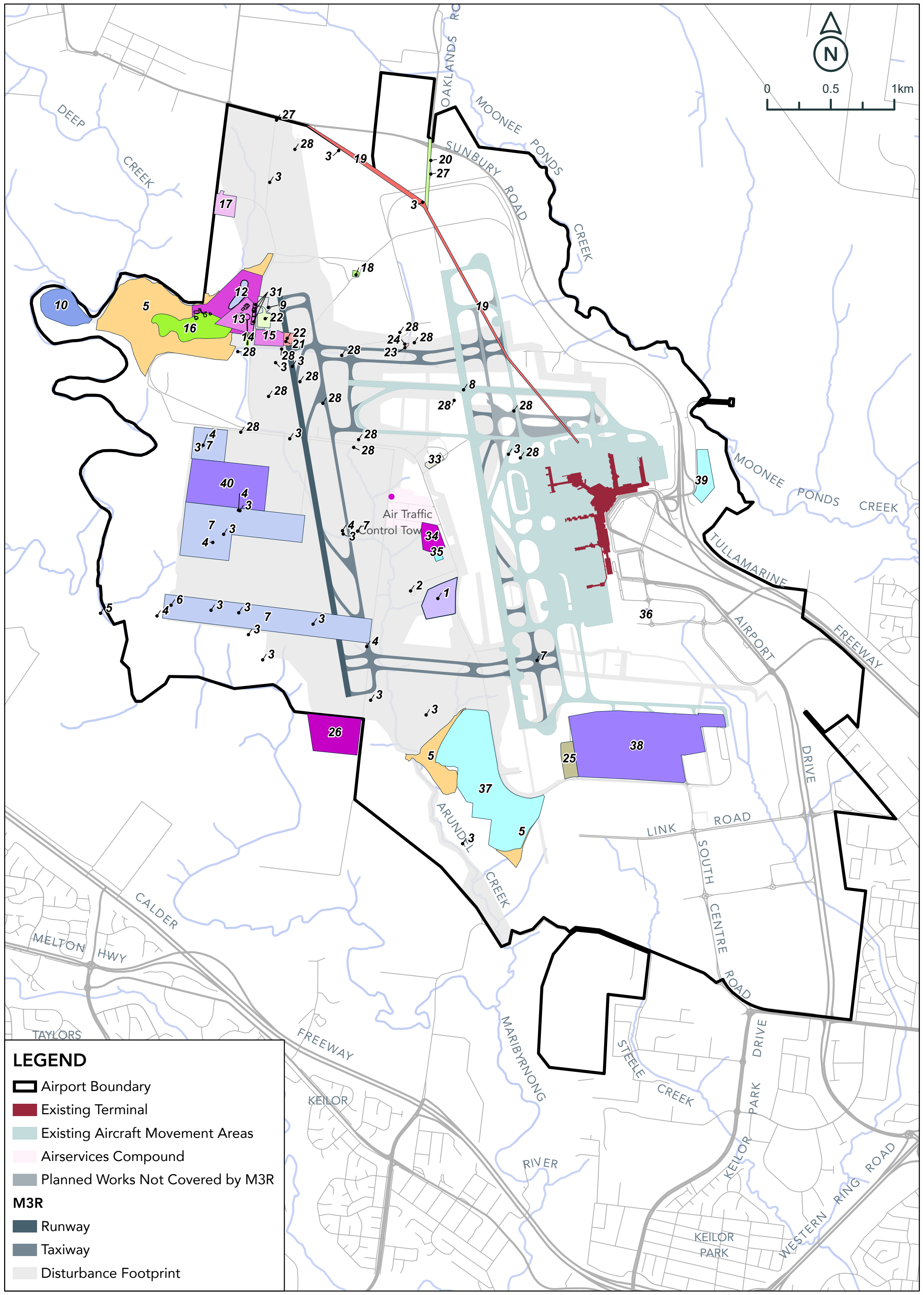
Both of these geological units occur well below the design levels and are unlikely to result in disturbance of soils or rock that would trigger the need to investigate acid forming potential and development of an acid sulfate soil/rock management plan.

B3.5.6.2
Odour, Gas and Vapours

Excavation and other construction activities could release underground gas and vapours impacting human health and the environment. Excavation of soils during construction may also expose volatile contamination, and create a pathway for gas and vapours to migrate from below the ground surface into buildings and other enclosed spaces. Potential sources of vapour have previously been identified and investigated. They included field investigations of former areas of landfilling which may have included putrescible wastes within the project area. All identified areas of concern have been confirmed to not present a risk from gas or vapours.

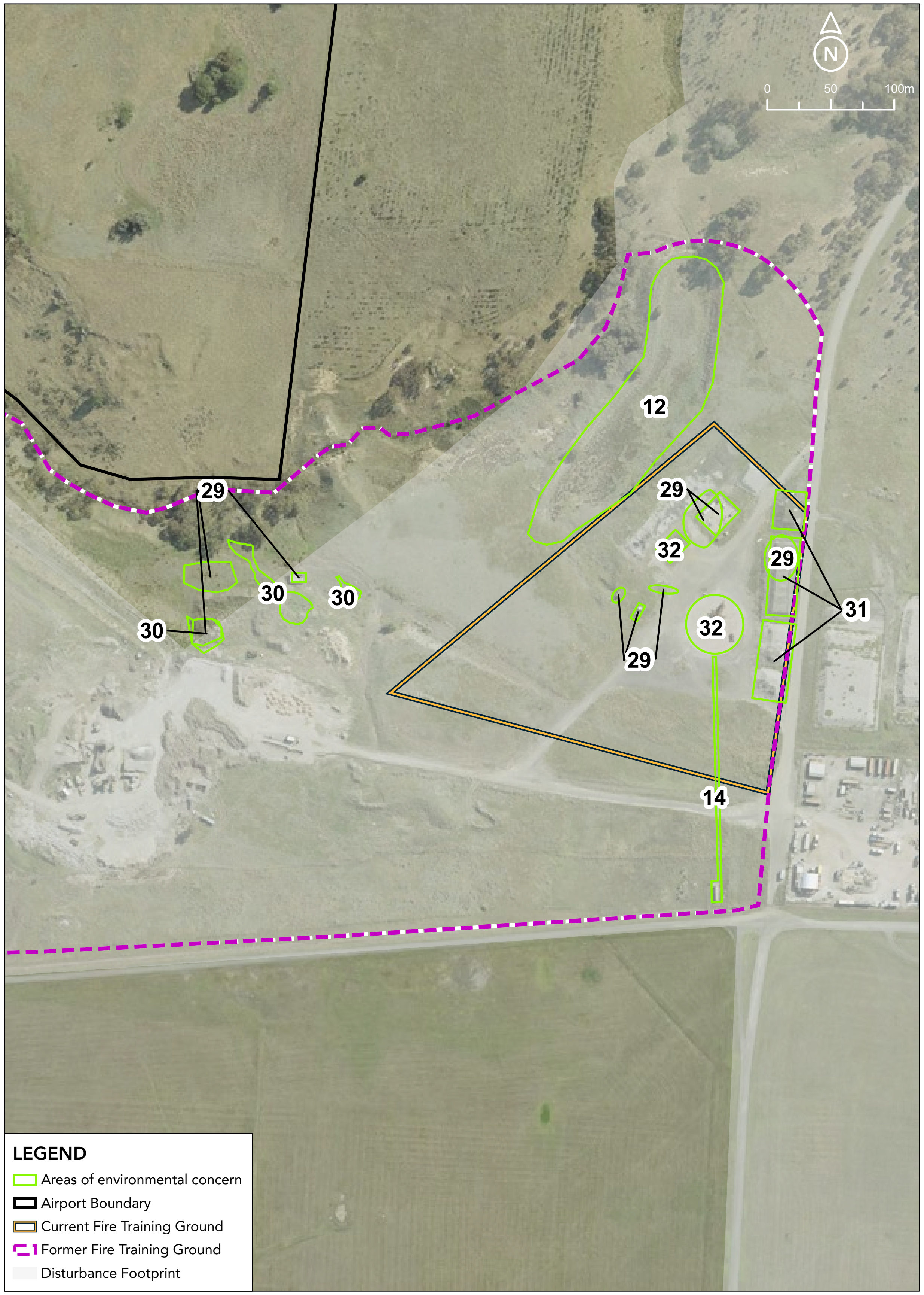
The risk from odour or vapours from point source contamination that may be encountered is already considered in managing impacts from non-PFAS contaminants (e.g. point source hydrocarbon impacts).

Figure B3.5
Areas of environmental concern (refer to Table B3.2 for legend key for AECs)



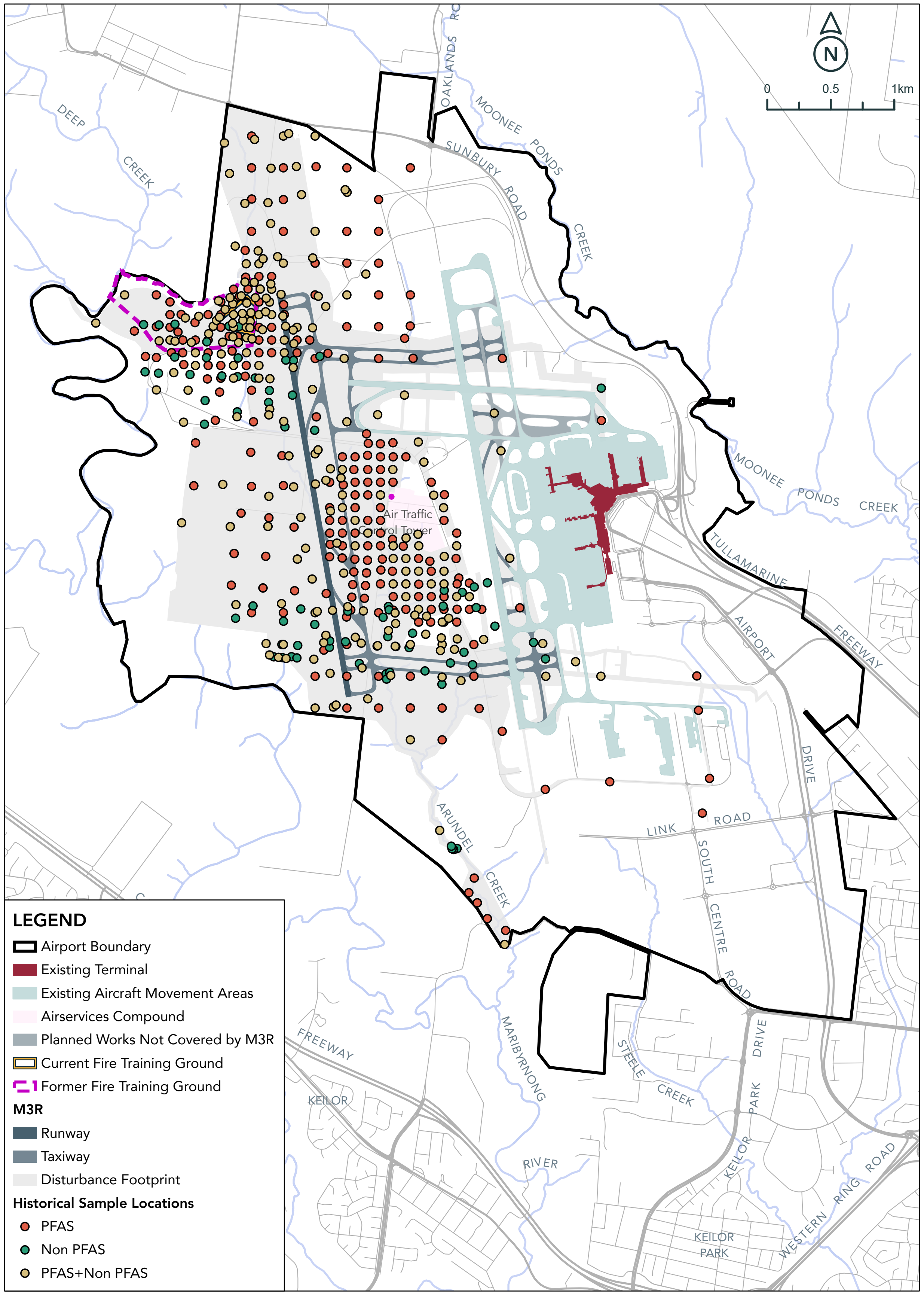
Source: Senversa, 2020.

Figure B3.6
Areas of Environmental Concern – current and former fire training grounds



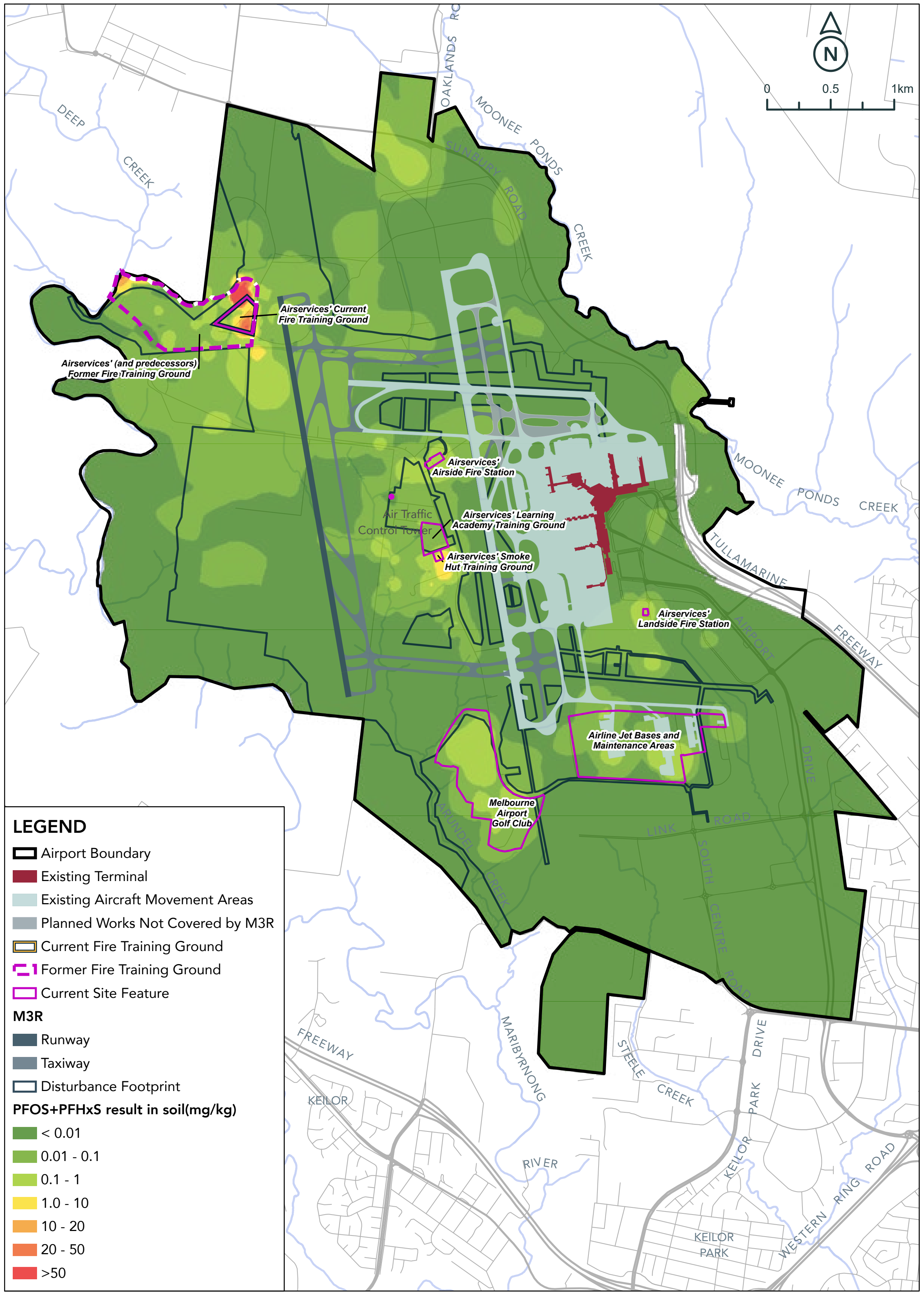
Source: Senversa, 2020.

Figure B3.7
Summary of soil sampling investigaiton locations



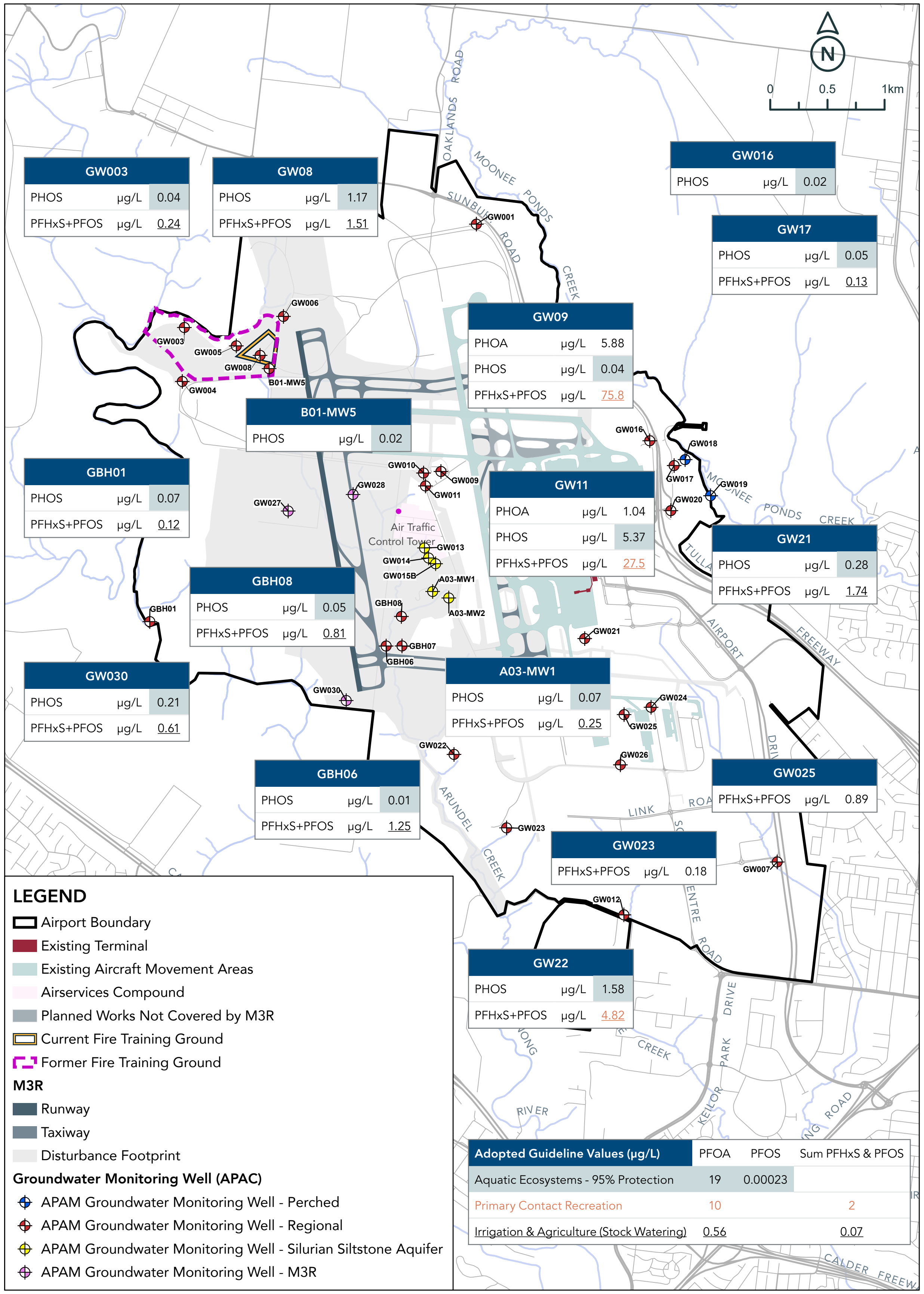
Source: Data sourced from APAM Geographic Information System (GIS) Database.

Figure B3.8
Concentration map of PFOS+PFHxS total concentratons in soil (near surface)



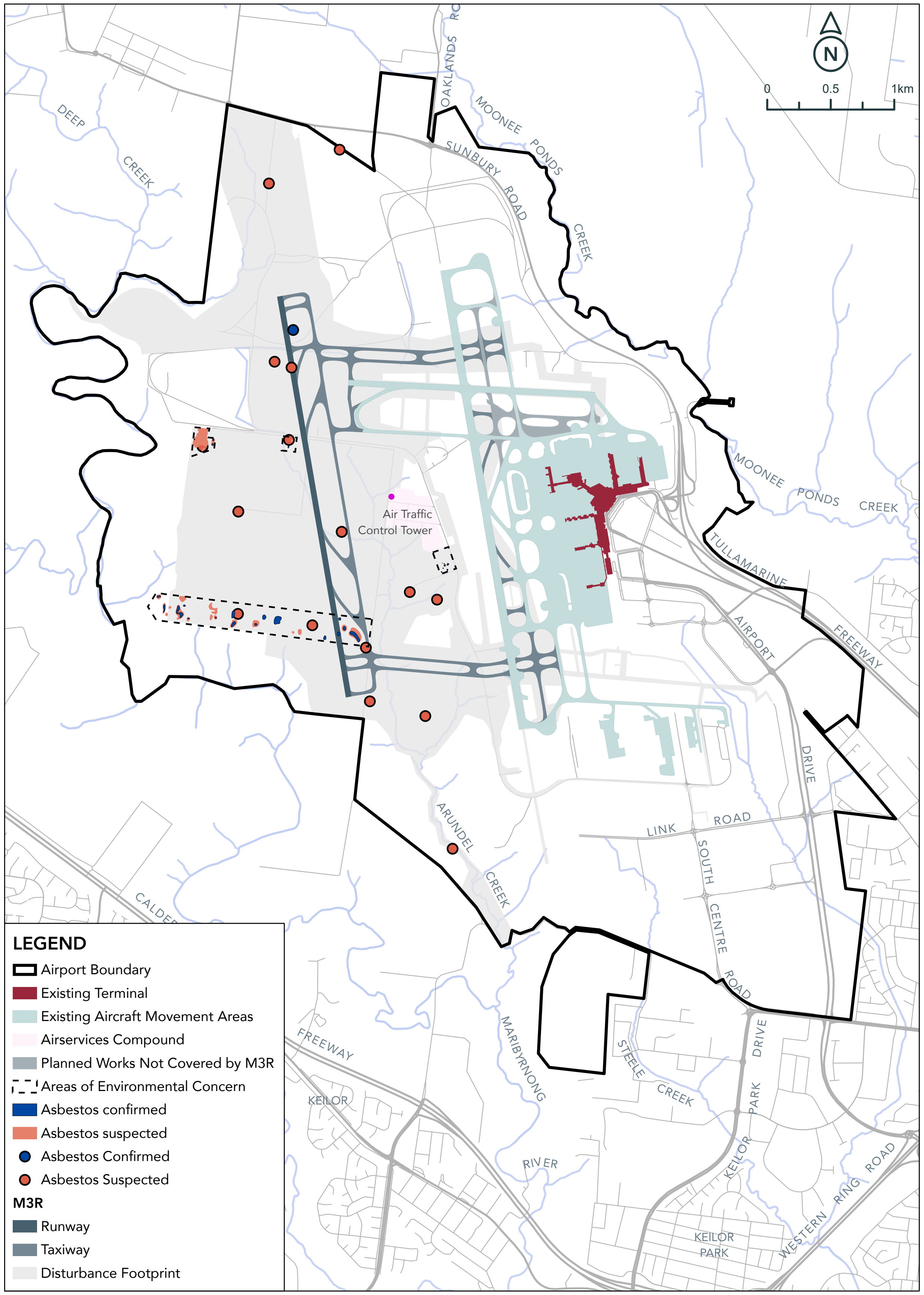
Source: Data collation from Senversa, 2020.

Figure B3.9
Groundwater exceedances



Source: Data sourced from Senversa 2020

Figure B3.10
Asbestos occurrences (suspected and confirmed)



Source: Data sourced from Senversa, 2020 and Coffey, 2017.

B3.5.7
Conceptual Site Model

Table B3.5 presents a summary of the potential sources of contamination, the identified receptors that may be exposed to contamination, and the pathways by which sources of contamination may reach receptors.

B3.5.8
Wastes

The key potential wastes to be generated by M3R across the lifespan of the project, and estimated quantities, are presented in Table B3.6.

Table B3.5
Conceptual site model

Source	Contamination	Pathway	Potential Receptor(s)	Potential Linkage
Firefighting foam	PFAS contamination in shallow soil, sediments and groundwater. PFAS contamination of existing infrastructure (e.g. pavements).	Dermal contact, dust inhalation, ingestion, uptake by plants and organisms, leaching to surface water and groundwater and discharging off-site into waterways, transport of impacted soils via water run-off	Construction/ maintenance workers, land-based and aquatic based ecosystems, surface water users	Without appropriate management of PFAS impacted soil and groundwater there is potential for unacceptable exposure and/ or exacerbation and increased risk profile to on and off-site receptors.
Fill and natural soils	Metals contamination both natural and anthropogenic impacts.	Uptake by plants and organisms, leaching to surface water and groundwater and discharging off-site into waterways, transport of impacted soils via water run-off	Land-based and aquatic based ecosystems, surface water users	Naturally elevated concentrations are not considered to present a risk due to low leachability potential. Isolated impacts of elevated metals from past land use are small volume and unlikely to present a significant risk.
Fuel and chemical storage and use	Hydrocarbon contamination in shallow soil	Vapour inhalation, dermal contact, dust inhalation, ingestion.	Construction/ maintenance workers	The only potentially complete exposure pathways is for site workers, and construction/maintenance workers, via dermal contact, dust inhalation and ingestion.
Building waste	Asbestos in shallow soil	Inhalation of dust.	Construction/ maintenance workers	Bonded asbestos containing material has been identified in several areas across the site. Disturbance of asbestos may cause fibres to be released and become airborne.
Historic landfilling activities	In addition to PFAS, metals, hydrocarbons and asbestos, other contaminants such as solvents, degreasers (buried waste), nutrients and gases (generated from buried wastes) may be present either in filled areas or impacts in surrounding soil and groundwater.	If areas of historic landfilling are exposed during works the following possible pathways may exist: dermal contact, dust inhalation, vapour inhalation, ingestion, uptake by plants and organisms, leaching to surface water and groundwater and discharging off-site into waterways, transport of impacted soils via water run-off	Construction/ maintenance workers, land-based and aquatic based ecosystems, surface water users	Pathways are generally only complete if areas are disturbed or exposed during works. Main areas of concern where wastes are known or expected to be buried are located in the broader project area and not specifically in areas identified for disturbance/excavation as part of construction works.

Table B3.6
Potential waste types, sources and volumes

Waste Type	Presence/waste generation activity	Estimated volumes (tonnes, t)	Comments
Pre-construction to opening day			
Demolition waste	Pavements, former structures and buildings, fencing, lighting, redundant underground services, stormwater structures, stockpiled or buried wastes.	400,000 to 600,000	Greater than 80% of demolition is expected to be recycled.
Green waste generated from surface scraping and removal of trees	Pre-construction removal of surface vegetation (grass and weeds) and topsoil, removal of trees and other native vegetation.	Surface vegetation: 1,300,000 to 2,050,000 Trees: 770,000 m^2 to 1,800,000 m^2	Storage of green waste from surface vegetation (grass) has potential to spread noxious species that require management. Native trees and vegetation will be mulched for on-site re-use.
Excavated PFAS contaminated soil and sediments	Bulk excavation works. Drainage diversions and upgrades.	7,500,000 to 8,200,000	Estimate based on total volume of topsoil and clay to be excavated and total construction footprint. Assumes deeper rock and geological units are generally not contaminated noting exceptions under source areas. Due to the project's anticipated fill deficit there is a high potential for re-use of excavated soils.
Asbestos in soil	Isolated areas associated with former use/ buildings/waste piles.	9,600 to 14,400	Removal of asbestos and remediation of soils where asbestos is suspected/confirmed to maximise on-site re-use potential. Estimated that 80% of total volume will be suitable for re-use.
Asphalt plant (on-site)	Wastes associated with asphalt batching (e.g. off-spec, cleaning and maintenance of plant).	1,200 to 1,800	Greater than 80% of waste asphalt is expected to be recycled.
Concrete plant (on-site)	Wastes associated with concrete batching (e.g. off-spec, cleaning and maintenance of plant).	1,800 to 2,700	Greater than 80% of waste concrete is expected to be recycled.
Wastes associated with maintenance of plant and equipment during construction	Vehicle maintenance (e.g. replacement of tyres, fluids, spares, batteries, etc).	150	Majority of tyres and maintenance waste goes to landfill.
Concrete formwork*	Waste generated from undertaking concrete formwork on site where pre-cast options are not available.	15 to 25	All wooden concrete formwork is generally disposed to landfill.
Concrete reinforcing*	Offcuts from reinforcing material.	20 to 30	Majority of waste reinforcing is recycled.
Wash water	As part of general cleaning of equipment during construction.	360	Majority of wash water disposed to ground and may lead to short term impacts to ecological receptors.
Other construction wastes	Packaging, pallets, offcuts.	360	Some waste streams can be recycled. Majority of other construction wastes are disposed to landfill.
Site office waste (paper, recycling, etc)	General waste generated from office style activities including putrescibles.	90	Some office waste can be recycled by segregation of wastes and diversion from landfill.
Site office – Sewage	Wastes generated from provision of facilities (hygiene, toilets and lunch room water supply and wastewater).	500 to 800 (sewer) 45 to 65 (potable)	Appropriate disposal either via approved sewer connections or disposal off site by licenced contractor to appropriate disposal facility.
Operational (based on 20 years of operation and maintenance)			
Runway lighting	Waste globes and fittings associated with high intensity approach lighting system and general runway lighting.	0.04 to 0.1	Likely to all be disposed to landfill or licenced facility.
Rubber	Rubber removed from runway landing areas.	1,100 to 1,700	80% recycled.
Concrete	Waste concrete from repairs.	400 to 600	Greater than 80% of waste concrete is expected to be recycled and/or re-used on site.
Asphalt	Waste asphalt from repairs.	400 to 600	Greater than 80% of waste asphalt is expected to be recycled and/or re-used on site

** If precast concrete is used for all concrete requirements and no pour in place concrete is used, then waste formwork would reduce to approximately zero waste, and reinforcing steel would reduce to less than five tonnes for the construction program duration.*

B3.6 ASSESSMENT OF POTENTIAL IMPACTS

Table B3.7 below presents the impact assessment for soils, groundwater and wastes.

Table B3.7
Impact Assessment

Environment aspect & baseline condition	Assessment of original impact						Mitigation and/or management measures	Assessment of residual impact				
	Original Impact	Mitigation inherent in design/practice	Duration	Significance				Residual Impact	Duration	Significance		
				Severity	Likelihood	Impact				Severity	Likelihood	Impact
Construction							**Construction (cont.)**					
Disturbance/removal of PFAS contaminated soils and sediment	The majority of project site contains PFAS impacted soils and sediments above ecological investigation levels. The project works are likely to require excavation of key source areas which also contain impacts above human health investigation levels (e.g. the current and former FTGs). Mismanagement of excavated soils and exposed surfaces may increase risks to both onsite and off-site receptors	The project presents an opportunity to "remediate" key source areas and further mitigate long term impacts associated with residual PFAS in soils	Long Term	High	Likely	High	Management of PFAS impacted materials in accordance with project specific PFAS management strategy which will outline re-use options for PFAS impacted soils and identify where additional controls may be required. Re-use options and controls will depend on soil contamination levels and will include options for unrestricted re-use and re-use in particular settings such as placement at depth or under constructed pavements. Engineered containment, onsite treatment or off-site disposal may be required for higher levels of contamination	Appropriate management of PFAS impacted soils during construction is feasible and likely to lead a significant reduction in risk to human health and the surrounding environment associated with existing impacts	Long Term	Moderate	Unlikely	Low
Disturbance/removal of existing contaminated soils containing asbestos-containing material	Direct impact to on-site construction workers – non-cumulative.	Nil	Short term	High	Likely	High	Removal of asbestos-containing material under controlled conditions and disposed of to landfill.	Direct impact to construction workers.	Temporary	Minor	Rare	Negligible
Disturbance/removal of existing non-PFAS contaminated soils uncovered as part of demolition works	There is likely to be point source impacts associated with redundant infrastructure that is required to be removed. Historical areas of landfilling	Nil	Short term	Minor	Likely	Medium	Inspection and where necessary validation of any excavations beneath and surrounding former infrastructure (pits, tanks, pipelines). Where possible avoidance of known landfill areas	Direct impact to construction workers.	Temporary	Minor	Rare	Negligible
Intersecting perched groundwater	Although groundwater is unlikely to be intersected during project works, there is the potential to intersect perched groundwater systems that may be impacted by PFAS and other contaminants	Projects works have been designed to be above reported groundwater levels.	Short term	Minor	Unlikely	Low	If groundwater is encountered and is required to be extracted as part of works, existing water treatment facilities are available to treat water to remove contaminants of concern	Water can preferentially be treated rather than disposed of off-site to licenced facility	Temporary	Negligible	Rare	Negligible
Importation of fill	The project's cut and fill balance in deficit. Importation of fill will be required to achieve design levels. Importation of fill if not managed properly can present a risk to the receiving environment.	There is a high potential for re-use of excavated soils as well as on-site borrow areas. For achieving remaining fill balance, material that meets EPA guidance for fill material will be required.	Long Term	Moderate	Possible	Medium	Management of importation of fill in accordance with Construction Environmental Management Plan (CEMP) to ensure it meets EPA guidance for fill material and does not present a risk to the receiving environment. Early identification of fill source sites, confirming fill materiall categorisation and appropriate tracking and monitoring of incoming material to confirm compliance will be key elements to mitigating risks	Appropriate re-use of excess high-quality fill generated from other major infrastructure projects with negligible impact to receiving environment.	Long Term	Minor	Unlikely	Low
Green waste removal	Protected grasslands and other native vegetation exist across project site – improper handling of green waste during removal leads to spread of pest weeds and/or pathogens disrupting native species	Herbicide application reduces volumes of waste, stockpiling generally restricts impact to localised areas. Opportunity to re-use topsoil as part of design works where engineering property requirements of soil are not critical to performance and associated PFAS impacts can be appropriately managed	Medium Term	High	Possible	Medium	Management of weeds in accordance with Construction Environmental Management Plan (CEMP)	Possible release of weeds at clearance site	Short Term	Moderate	Unlikely	Low

Environment aspect & baseline condition (cont.)	Assessment of original impact (cont.)						Mitigation and/or management measures (cont.)	Assessment of residual impact (cont.)				
	Original Impact	Mitigation inherent in design/practice		Significance				Residual Impact		Significance		
			Duration	Severity	Likelihood	Impact			Duration	Severity	Likelihood	Impact
Construction (cont.)							**Construction (cont.)**					
Waste management – construction and demolition waste	Wastes generated from demolition works and construction works (e.g. concrete formwork)	A number of waste streams (solids and liquids) will be generated as part of construction works but many can be considered suitable for re-use/recycling which diverts waste from landfill Demolition wastes may be impacted by PFAS and require higher level of management. Onsite management of PFAS impacted demolition waste via existing facilities	Short Term	High	Possible	Medium	Management of wastes in accordance with CEMP to maximise re-use/recycling opportunity Onsite management and recycling and re-use of PFAS-impacted demolition wastes	Reduction of waste generation, or reduction required to be disposed of to off-site licenced landfill/facility	Temporary	Minor	Possible	Low
Operation							**Operation (cont.)**					
Waste management - rubber and tyre waste - pavement maintenance - lighting	Waste generated from use and maintenance of runway, wear and tear of aeroplane tyres, replacement and maintenance of navigation and other lighting requirements. Off-site impact as waste disposed to landfill	Recycling opportunities from waste generated from operational and maintenance falls under Melbourne Airport's Environmental Management Plan which aims to reduce overall impacts from waste generation	Long Term	High	Possible	Medium	Manage wastes in accordance with Melbourne Airport Waste Management Strategy to maximise re-use/recycling opportunities.	Reduction in waste generation and waste going to landfill	Long Term	Minor	Rare	Negligible

B3.7 AVOIDANCE, MANAGEMENT AND MITIGATION MEASURES

B3.7.1 Soils

The contamination assessment has identified two key soil contamination issues that, without avoidance, management or mitigation measures, will potentially present an increased risk of impacts to relevant receptors as a consequence of M3R works. They are as follows:

- PFAS in soils and sediments
- Asbestos in shallow soils.

The risks for both these issues require further management or mitigation.

B3.7.1.1 PFAS

PFAS management is a minimum requirement for any construction works being conducted at Melbourne Airport where disturbance of soil and groundwater is anticipated. The *Melbourne Airport PFAS Management Framework* (APAM, 2020) was developed to deliver consistent environmental management practices for the potential environmental risks posed by PFAS impacted material on construction and maintenance projects at Melbourne Airport. The framework outlines the minimum environmental management requirements to be included in any project-specific CEMP. PFAS impacts and potential risks during construction are well understood; and APAM has a number of existing and effective management controls in place – both as part of wider estate management and as part of project specific works. These include the controls currently being implemented under other current construction projects with MDP approvals.

As PFAS impacts are widespread across the project area, a project-specific PFAS Management Strategy is proposed to be developed to provide a framework for how PFAS is to be managed to in order maximise re-use potential, and protect human health and the environment.

In general, PFAS impacts are observed in soils at near-surface and do not extend to depths beyond fifty centimetres bgl. The only areas where PFAS may extend to greater depths are below and adjacent to identified source zones.

The current design indicates that deep excavation near identified source zones (e.g. the current and former FTGs) is proposed. This is likely to disturb soil with high concentrations of PFAS contamination that will require specific management. As the project design identifies a fill deficit, there is an opportunity as part of cut-and-fill works to mitigate future impacts from PFAS impacted soil as part of an engineered design.

The PFAS Management Strategy will be supported by a project-specific human health and ecological risk assessment to confirm that the risks during works, and longer-term risks, are considered low and acceptable. Confirmation of management and remediation options, including further site investigations and detailed feasibility, is required to be completed as part of detailed design works. These further investigations are primarily to confirm the specific management measures and appropriate placement locations that can be integrated into the design and construction phases. An integrated approach during detailed engineered design will be required to confirm that any proposed controls appropriately mitigate risks. Construction environmental management plans will be required to be aligned with the framework to be outlined in the PFAS Management Strategy.

B3.7.1.2 Asbestos

Suspected and confirmed asbestos-containing material was identified in shallow soils (or on the ground surface) at a number of discrete locations across the broader project area. These occurrences are linked to the presence of historic site use, where demolition of former buildings or structures constructed with asbestos containing materials and/or waste dumping has led to relatively small volumes of potentially hazardous material being left on-site.

The preferred management measure for controlling exposure to asbestos-containing material is removal, as the asbestos containing material is currently present on the surface of the site and not all suspected areas for the study area have been confirmed or investigated in detail. Whilst further investigations will assist in better characterising risk and provide a more accurate understanding of the scope of works required, it is likely that some removal of asbestos-containing material will be required. If all asbestos cannot be removed prior to commencement of construction activities, hazardous materials management measures will need to be incorporated into Construction Environmental Management Plans (CEMPs).

As part of the early phases of works, impacted areas will be confirmed and appropriate administrative controls (e.g. restricting access) put in place until asbestos removal is done. Removal of asbestos and remediation of affected areas is expected to be undertaken, with asbestos clearance certificates to be provided by an Occupational Hygienist to allow stockpiled soils and remediated areas to be ready for construction works and soil re-use. Requirements for appropriate personal protective equipment will be implemented, depending on the nature of activities to be undertaken.

B3.7.2 Groundwater

Although groundwater is unlikely to be intersected during project works, there is the potential to intersect perched groundwater systems that may be impacted by PFAS and other contaminants. The expected volumes and potential to intersect groundwater are considered low, but if encountered will require management.

If groundwater is encountered and required to be extracted as part of works, existing water treatment facilities (both on-site and off-site) are available to treat water to remove contaminants of concern. This is the preferred option, rather than seeking permits for trade waste or disposing off site to a licenced facility for treatment/disposal.

B3.7.3
Waste

M3R has the potential to produce a large quantity of waste including, but not limited to, excavated soil and water, demolition, operational and decommissioning wastes that would present a significant environmental impact if disposed of to landfills.

As offsite waste transport and disposal would fall under Victorian legislation, the principles of the waste hierarchy apply. *The Melbourne Airport Environment Strategy 2018* also aligns with this hierarchy for its on-site waste management principles.

In accordance with waste hierarchy, the options for management of wastes (from most preferred to least preferred) are:

- Avoidance
- Re-use
- Recycling
- Recovery of energy
- Treatment
- Containment
- Disposal.

The primary management measure for the various waste streams for M3R is to avoid creating wastes in the first instance. Where waste generation cannot be avoided, the priority is to look to either re-use or recycle the wastes, with various procedures and targets set for segregating wastes for re-use or recycling. With the exception of hazardous or prescribed industrial wastes (including asbestos and other contaminated soils/materials) the primary objective is to divert wastes from landfill (disposal) and therefore mitigate potential longer-term impacts to the environment.

Mitigation and management measures will be developed in the CEMP for waste streams that may potentially result in either medium, high or extreme impacts on the environment.

Table B3.8 presents a summary of mitigation and management measures proposed for M3R, and the expected timeframes for delivery.

Table B3.8
Mitigation and management measures

Environmental Aspect	Mitigation or management measure	Timing
Excavated PFAS-contaminated soil and sediments from bulk excavation works, drainage diversions and upgrades	Due to the project's fill deficit there is a high potential for re-use of excavated soils. Re-use potential dependent on contaminant levels. On-site containment may be considered for higher levels of contamination from source areas. Some discrete areas of material may require thermal destruction off-site.	A PFAS Management Strategy will be developed and implemented prior to construction activities. Confirmation of management and remediation options including detailed feasibility to be completed as part of detailed design works. A project-specific human health and ecological risk assessment will also be required to support the management and remediation options assessment and PFAS Management Strategy.
Asbestos in soil	Removal of any asbestos-containing waste and remediation of soils where asbestos is suspected/confirmed to maximise on-site re-use potential. Higher disposal costs for any impacted soils may occur due to presence of PFAS.	Further investigations proposed prior to the start of construction. All asbestos excavation to be implemented prior to any disturbance of identified areas. Treatment to occur either prior to or during construction.

Environmental Aspect (cont.)	Mitigation or management measure (cont.)	Timing (cont.)
Green waste generated as a result of earthworks (stripping of surface covering, topsoil and mulching of trees).	The storage and management of green waste has the potential to lead to pest plant species and pathogens being spread across the site if not handled appropriately. To mitigate this risk, a CEMP and weed management plan will be developed which will include measures to reduce the magnitude of potential impact to either minor or negligible, on the basis that the risks of spread of pest plants and pathogens should be eliminated thereby reducing the potential environmental impacts. Temporary storage of green waste will be managed with appropriate measures implemented to limit the spread of seeds or pathogens from storage area. The CEMP and weed management plan will also incorporate any green waste that is re-used onsite as mulch, salvaged habitat or erosion control to verify that any waste re-used is stored appropriately and is suitable for its intended re-use. Due to the presence of PFAS in topsoil that will be included in the green waste volume, it is proposed that all green waste be re-used on site. This may include incorporation into earthen mounds/batters where these materials would be appropriately placed to minimise environmental impacts from both the green waste itself and the associated topsoil.	Plan to be developed prior to the start of construction.
Demolition waste including but not limited to pavements, former structures and buildings, fencing, lighting, redundant underground services and stormwater structures.	Melbourne Airport currently retains, crushes and recycles concrete and pavement for onsite re-use. Potentially PFAS impacted pavements will be prioritised for recycling and on-site re-use. Other wastes, such as brick and steel from former buildings, will be considered for off-site recycling potential. All non-recyclable material will require disposal off-site.	Plan to be developed prior to the start of construction.
Future construction and maintenance wastes	All construction sites produce construction wastes, a proportion of which are sent to landfill. The proposed mitigation measures include the segregation of construction wastes and disposal to appropriate recyclers. Concrete formwork (typically laminated plywood or treated pine timber) is generally disposed to landfill when the product is no longer serviceable. The management measures proposed to limit the waste streams include diverting all reinforcing steel offcuts to recycling, reusable metal formwork is to be used, and waste formwork materials are to be segregated and sent to a recycler. These mitigation measures should result in an overall reduction of the magnitude of the impact to minor on the basis that the overall reduction of waste being disposed to landfill would reduce to less than 10% of the total waste stream. The construction contractor will be required to develop a waste management plan as part of their CEMP.	Plan to be developed prior to the start of construction.
Lighting waste	The waste globes used for runway and high intensity approach lighting are generally self-contained units with limited options for recycling. Diversion of these wastes to an e-recycler may be possible, depending on the units used. These mitigation measures should result in an overall reduction of the magnitude of the impact to minor on the basis that the overall reduction of waste being disposed to landfill would reduce to less than 10% of the total waste stream.	To be regularly reviewed as part of Melbourne Airport's Environment Management Strategy and Environmental Management Plan.
Rubber	Approximately 80% of the rubber removed from the runway is recycled, with the balance disposed to landfill. However, several rubber recycling operators have been recently licensed in Victoria to accept rubber waste for a secondary beneficial re-use. The proposed mitigation measures for rubber include diversion from landfill to a rubber recycler. These mitigation measures should result in an overall reduction of the magnitude of the impact to negligible on the basis that all waste would be diverted to a recycler.	To be regularly reviewed as part of Melbourne Airport's Environment Management Strategy and Environmental Management Plan.

B3.8 CONCLUSION

The assessment identified that the presence of contamination in soils, sediments and groundwater, and the generation of wastes, have the potential to impact the environment as part of construction and operation of M3R if appropriate management or mitigation controls are not implemented.

Where impacts were identified, appropriate mitigation measures are proposed and the residual risks of negative impacts are classified as Low or Negligible.

Without appropriate management and mitigation, the potential for impacts from disturbance of PFAS-impacted soils and sediment is considered High. Based on existing and demonstrated onsite PFAS management practices, and the development of a project specific PFAS management strategy, there is a potential significant beneficial impact anticipated as part of the M3R construction works, as it provides an opportunity to improve on-site management and containment of PFAS-impacted soil and sediment. The project could result in a significant reduction in ongoing impacts to the environment from pre-existing contamination.

The presence of asbestos in near-surface soils is a common issue for construction projects that have had historical buildings and infrastructure. The areas of impact appear to be both limited and isolated and, with appropriate remediation and management of any disturbed soils, the impact from the presence of asbestos wastes is considered Negligible.

Although there are likely to be some additional impacts from non-PFAS contamination identified as part of demolition and construction works, the relatively small volumes and level of impacts expected to be encountered are considered able to be readily managed by general construction activities and plans. They are therefore considered to have Negligible impact on the environment.

The key waste streams identified include those generated during demolition and construction activities, as well as ongoing operational and maintenance of the new assets delivered as part of M3R. There is a high re-use potential for excavated soils due to the project fill deficit. The majority of waste generated from pavement materials (demolition, construction and operational maintenance) is also identified for on-site processing and re-use as a recycled crushed product. For other demolition, construction and operational wastes, there are various levels of opportunity to avoid landfill disposal that can be minimised by appropriate identification and management of generated waste streams.

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Chapter B4 Surface Water and Erosion

Summary of key findings:

- Arundel Creek runs through the airport and some sections of it will be impacted by Melbourne Airport's Third Runway (M3R). A culvert will be constructed to maintain the creek's flows under associated infrastructure.
- Water sensitive urban design measures have been incorporated into M3R's design to improve the quality of water discharging into Arundel Creek and from the airport estate.
- Modelling has demonstrated that the proposed treatment train will effectively remove the increased pollutants generated by the project.
- Infilling of the parts of the Arundel Creek valley and the addition of culverts will result in minor flood level increases on the culvert's upstream side within the airport. However, modelling shows this will not impact land downstream from the airport.
- Mitigation of PFAS impacts in surface water, and appropriate controls, will be outlined in the proposed PFAS Management Strategy. The strategy will incorporate a whole-of-project approach to PFAS management, from source management to mitigation of surface water impacts discharging off-site.
- Mitigation measures will be incorporated into the Construction Environmental Management Plan in order to protect waterways and minimise erosion.

CHAPTER B4 CONTENTS

CHAPTER B4 CONTENTS (cont.)

CHAPTER B4 FIGURES

CHAPTER B4 TABLES

B4.1
INTRODUCTION

This chapter describes the study area's existing surface water and erosion conditions, applicable legislation and policy requirements, the potential impacts of Melbourne Airport's Third Runway (M3R) and associated assessment methodology. It then identifies specific measures to avoid, manage, mitigate and/or monitor these impacts.

This chapter draws on analysis and findings from the M3R Stormwater Management Strategy completed by BECA in 2020, the Preliminary Erosion and Sediment Control Plan completed by Golders in 2020, and Melbourne Airport's own extensive knowledge and monitoring programs.

For the purposes of this chapter, the study area refers to the M3R development footprint and immediate surrounds that may be impacted by M3R.

B4.2
METHODOLOGY AND ASSUMPTIONS

Assessment of existing and potential surface water, water quality and erosion impacts from M3R was undertaken through site inspections and subsequent desktop assessments. This included the following scope of work:

- Identification of overarching legislative requirements
- Review of available baseline information to characterise the existing conditions of the site with regard to:
  - water quality and flow
  - surface water and flooding
  - stream health
  - erosion potential.
- Describing existing conditions (including geological conditions, climate and topography) within the M3R study area that have the capacity to impact erosion potential of the site
- Development of significance criteria for potential water quality, surface water and erosion impacts taking into consideration severity and likelihood, and providing a way to determine an impact risk
- Qualitative and quantitative assessment of M3R's impacts related to water quality, surface water and erosion, and identification of strategies and actions to mitigate identified impacts
- Documentation of the assessed residual impacts of M3R, and compliance of the mitigated design with legislative and other requirements.

B4.2.1
Site inspection

Inspections of the M3R study area and the wider airport estate have been done to confirm site topography and drainage features. The key locations of focus during the inspections were Arundel Creek and, to a lesser extent, Deep Creek and the Maribyrnong River. The inspections provide the opportunity to verify existing land use and ground conditions, creek conditions, and the general siting and scale of the proposed development.

B4.2.2
Information used for the assessment

The following primary documents and data sources were used for the assessment:

- M3R – Stormwater Management Strategy, BECA 2020
- M3R – Preliminary Erosion and Sediment Control Plan, Golders 2020
- M3R - Concept Design, BECA 2020
- Geotechnical information generated to inform design of M3R
- Rainfall and River Region Catchment input data obtained from:
  - Bureau of Meteorology 2016 Rainfall IFD data
  - Australia Rainfall and Runoff 2019 (ARR, 2019) data
- Melbourne Airport Pluviography 086282 Rainfall data
- Melbourne Airport historic water quality monitoring data
- Melbourne Airport Taxiway Zulu Program and Northern Access Road MDP and design documentation
- Melbourne Airport Flood Modelling Report
- Melbourne Airport Environment Strategy (2018)
- Melbourne Airport water quality monitoring data.

B4.3
STATUTORY AND POLICY REQUIREMENTS

Melbourne Airport is located on Commonwealth land. Commonwealth and Victorian regulatory requirements are applicable to the management of water quality on and off the estate. Management of water quality within Melbourne Airport estate is governed by Commonwealth regulations, and management of waters leaving Melbourne Airport estate is governed by Victorian legislation. The key legislative requirements related to water quality management include the following:

Commonwealth – on airport:

- *Airports Act 1996*
- *Airports (Environment Protection) Regulations 1997.*

State Government of Victoria – off airport:

- *Environment Protection Act 2017* (EP Act Vic)
- *Environmental Reference Standard 2021 (Vic)*
- *Water Act 1989 (Vic)*
- *Yarra River Protection (Wilip-gin Birrarung murron) Act 2017.*

B4.3.1
Commonwealth

The Airports Act 1996 establishes a regulatory system for airports providing due regard to the interests of airport users and the general community. These regulations define standards and impose compliance requirements.

The environmental requirements include regulations relating to pollution generated at airport sites, impacts on biota and habitat, and impacts on heritage value.

The Airports (Environment Protection) Regulations 1997 aim to improve environmental management practices for activities conducted at airport sites, and to establish a system of regulation and accountability for pollutant-generating airport activities. These regulations aim to minimise adverse effects on waters and promote their beneficial use though management of pollution and promotion of habitat preservation.

Schedule 2 of the regulations, *Water Pollution – accepted limits*, sets out the accepted limit for pollutants in fresh water for a range of substances.

The Airport Regulations also refer to Section 14 of the *National Environment Protection Council Act 1994 (Division 2 – Making of national environment protection measures)* whereby monitoring is to be undertaken 'in a way that is not inconsistent with (i) any international convention, treaty or agreement, relating to environment protection to which Australia is a party; or (ii) a provision of national environment protection measures made under section 14 of the National Environment Protection Council Act 1994'.

Based on the above, it is considered that the following key documentation also applies:

- *National Environmental Protection (Assessment of Site Contamination) Measure*, as *amended 15 May 2013*, National Environmental Protection Council (1999) (NEPM, 1999).
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018)
- *PFAS National Environmental Management Plan Version 2.0 – January 2020* (PFAS NEMP 2020), National Chemicals Working Group of the Heads of EPAs Australia and New Zealand (HEPA, 2020).

B4.3.2
State Government of Victoria

The EP Act Vic creates a legislative framework for the protection of environment in Victoria. The Environment Protection Authority Victoria (EPA) is responsible for administering and enforcing the EP Act Vic to ensure no adverse impacts result to receiving waters by reducing the harmful effects of pollution and waste. The EP Act Vic commenced on 1 July 2021. This legislation adopts a different approach to environmental issues, focusing on preventing waste and pollution impacts. A cornerstone of the EP Act Vic is the General Environmental Duty (GED) which requires reasonably practicable steps to be undertaken to eliminate or otherwise reduce the risks of harm to human health and the environment.

The Environmental Reference Standard (Vic) defines clear and relevant standards, legal rules and statutory obligations to protect and improve the quality of Victoria's waters with regard to the principles of environment protection set out in the EP Act Vic.

Melbourne Airport is predominantly located within the Central Foothills and Coastal Plains Segment for rivers and streams. The identified environmental values for this segment are:

- Water dependent ecosystems and species (slightly to moderately modified)
- Water-based recreation including primary and secondary contact and aesthetic enjoyment
- Traditional Owner cultural values
- Agriculture and irrigation
- Fishing and aquaculture
- Industrial and commercial use.

The indicators and objectives for the identified environmental values have been sourced from Environmental Reference Standard (Vic) (where directly referenced) and, where no objective is provided, sourced from other applicable guidelines including:

- *National Environmental Protection (Assessment of Site Contamination) Measure*, as *amended 15 May 2013*, National Environmental Protection Council (1999) (NEPM, 1999)
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG, 2018)
- *Australian Drinking Water Guidelines, National Water Quality Management Strategy.* National Health and Medical Research Council & Natural Resource Management Ministerial Council (2011) (incorporating rolling revisions) (NHMRC/NRMMC, 2011)
- *Guidelines for Managing Risk in Recreational Waters* National Health and Medical Research Council (2008) (NHMRC, 2008)
- *PFAS National Environmental Management Plan Version 2.0 – January 2020* (PFAS NEMP 2020), National Chemicals Working Group of the Heads of EPAs Australia and New Zealand (HEPA, 2020).

The Water Act 1989 (Vic) provides the legal framework for managing Victoria's water resources. Some of the Act's main purposes are to ensure water resources are conserved and properly managed for the benefit of all Victorians, and provide for the protection of catchment conditions. Melbourne Water is the relevant statutory authority of the Victorian Government, has delegated responsibilities under the Act, and is responsible for ensuring drainage and waterway management in accordance with it. As this project proposes to make changes to existing waterways, consideration of the Water Act 1989 (Vic) and engagement with Melbourne Water is required as part of the project's development, detailed design and implementation.

The Yarra River Protection (Wilip-gin Birrarung murron) Act 2017 declares the Yarra River and certain public land in its vicinity, for the purpose of protecting it, as a single living and integrated natural entity. Provision is made for the development and implementation of a Yarra Strategic Plan, and protection principles are defined - including ensuring that biodiversity and ecological integrity is maintained.

B4.3.3
Adopted assessment criteria for water quality

Taking into consideration the Commonwealth and Victorian requirements above, the following assessment criteria were adopted for water quality:

- Environmental Reference Standard (Vic) for environmental water quality indicators and objectives for rivers and streams (Central foothills and coastal plains – Uplands)
- Airport Regulations – Freshwater (Airport Regulations)
- PFAS NEMP 'Aquatic Ecosystem – Freshwater 95% and 99% species protection' criteria
- PFAS NEMP Health-based guidance values – Drinking water and recreational water
- ANZG 2018 – 'Aquatic Ecosystem – Freshwater 95% species protection' criteria
- ANZG 2018 – 'Primary Contact Recreation' and where relevant, guidelines were sourced from NHMRC 2011
- ANZG 2018 – 'Irrigation & Stock watering'.

Waterways with recreation identified as an environmental value also require aesthetic indicators and objectives to be met, which include being free from:

- Visible materials that may settle to form objectionable deposits
- Floating debris, oil, scum and other matter
- Substances producing objectionable colour, odour, taste or turbidity
- Substances and conditions that produce undesirable aquatic life.

No environmental quality objectives for Traditional Owner cultural values have been specified in Environmental Reference Standard (Vic). Therefore, the objectives for water dependent ecosystems and species, and water-based recreation, have been adopted as default objectives. This is on the assumption that, if these objectives are achieved, then the environmental value of Traditional Owner cultural values will also be protected. In circumstances where these objectives are not attained, Environmental Reference Standard (Vic) identifies that, if the level of any environmental quality indicator or objective is not provided for, contamination must not cause an adverse impact on the environmental values.

B4.4
MELBOURNE AIRPORT POLICY

B4.4.1
Melbourne Airport Environment Strategy (2018)

The Melbourne Airport Environment Strategy forms an integrated component of Melbourne Airport's Master Plan (current approved Master Plan 2018, and proposed Master Plan 2022).

The key objectives of the Environment Strategy are to:

- Continually improve environmental management practices
- Ensure Indigenous and non-indigenous cultural heritage sites are protected
- Ensure strong stewardship of the physical environment
- Meet all compliance obligations to maintain the goodwill of regulators, passengers and the community
- Future-proof the environmental value of the airport site.

The aspects applicable to the stormwater management strategy are:

- Stormwater management relating to the drainage network elements
- Climate resilience by completing a climate change assessment (in relation to altered rainfall patterns and run-off regimes) that considers frequent extreme daily rainfall events with an increased potential for flooding
- Management of stormwater quantity due to increases in impervious areas; and management of adverse effects such as bank erosion, weed invasion and degradation of aquatic and terrestrial habitat
- Improving stormwater runoff quality by implementing Water Sensitive Urban Design (WSUD) strategies to meet current best practice targets.

B4.5
DESCRIPTION OF SIGNIFICANCE CRITERIA

Criteria have been developed to determine the significance of the impact from M3R associated with erosion, surface water and flooding impacts, and water quality.

B4.5.1
Erosion potential

The assessment of significance has applied the framework described in **Chapter A8: Assessment and Approvals Process**. For severity, project-specific criteria have been developed for the assessment of potential erosion impacts (including direct, indirect and off-site impacts). These criteria are described in **Table B4.1** and are focused on the potential impacts during the construction phase of M3R.

Table B4.1
Severity criteria – erosion potential (construction phase focus)

Impact severity	Description
Major	Permanent degradation of soil conditions that impact construction and operational phases of M3R and/or ongoing erosion that leads to a permanent reduction in water quality in the catchment downstream of the airport.
High	Significant erosion events that have ongoing impacts to the construction phases and/or water quality downstream of the airport and require additional control measures or M3R re-design prior to implementation of operational phases.
Moderate	Erosion during construction phases that leads to temporary land degradation with impacts to water quality such that the scheduled Environmental Reference Standard (Vic) objectives for downstream waters are not achieved.
Minor	Minor erosion event that temporarily impacts water quality but does not prevent Environmental Reference Standard (Vic) objectives from being achieved or impact operational phases due to the use of appropriate mitigation measures.
Negligible	Minimal soil erosion events with no significant sediment release off-site during the construction, and no perceptible impacts on downstream water quality due to the use of effective mitigation measures.
Beneficial	Positive effects on soil conditions through control measures and M3R design strategies that lead to improved water quality downstream during operational phases of M3R.

B4.5.2 Surface water and flooding

The assessment of significance has applied the framework described in **Chapter A8: Assessment and Approvals Process**. For severity, project-specific criteria have been developed for the assessment of potential surface water and flooding impacts (including direct, indirect and off-site impacts). These criteria are described in **Table B4.2**.

B4.5.3 Water quality

The assessment of significance has applied the framework described in **Chapter A8: Assessment and Approvals Process**. For severity, project-specific criteria have been developed for the assessment of potential water quality and frequent flow impacts including direct, indirect and off-site impacts. These criteria are described **Table B4.3**.

The criteria focus on operational stages of M3R. They relate to water quality and the potential effect of water quality on the airport's off-site receiving water quality conditions. Impacts on water quality during construction are heavily associated with the potential for increased sediment loads due to stockpiles and excavation works. Mitigation of these impacts is covered under the erosion potential in **Section B4.8.1.1**.

The methodology for ascribing significance has focused on the severity and duration of impact, noting that the impacts are almost certainly likely to occur once M3R commences operation.

Table B4.2
Severity criteria – surface water and flooding

Impact severity	Description
Major	Risk of flooding that could result in major injury or loss of human life, or major damage to public and private infrastructure both on and off the airport. Repairs to damaged infrastructure that can take several months to repair and impacts businesses and people during that time. Residential and business buildings are unusable until repairs taking several months are undertaken. Road pavements may be washed away preventing access along or across the affected road, impacting commuters and access to businesses and residents. Environmental impacts tend to be permanent, irreversible or otherwise long-term and can occur over large-scale areas both on and of the airport estate.
High	Risk of flooding that can result in minor damage to public and private infrastructure, both on and off the airport estate. Repairs to damaged infrastructure are likely to take less than a month to repair but impact businesses and people during that time. Residential and business buildings are still usable but have minor damage resulting in short term discomfort or changes to operations. Risk of flooding that may stop or severely delay aeronautical operations. Runways, taxiways or airside roads may be flooded to the extent of preventing movements. Ground services and airport operations staff are prevented from accessing areas of the airport estate, preventing them from carrying out their duties. Environmental impacts tend to be permanent or irreversible or otherwise long to medium term, and can occur over large or medium scale areas, including outside the estate.
Moderate	Risk of flooding that can result in minimal damage to public and private infrastructure, both on and off the airport estate. Damage is limited to damaged verges and gardens, and deposit of debris on roads and properties. Risk of flooding that may delay aeronautical operations. Runways, taxiways or airside roads may be limited for use. Staff experience difficulties in carrying out their work. Environmental impacts can range from long term to short term in duration, can occur over medium scale areas or otherwise represent a significant impact at the local scale.
Minor	Flooding is limited to road reserves, may cause minor disruption to pedestrians and reduce vehicle speeds - both on and off the airport estate. Risk of flooding that may cause minor delays to aeronautical operations due to difficulties experienced by staff. Environmental impacts tend to be short term or temporary.
Negligible	Flooding is limited to areas designed to be flooded, or areas where there will be no adverse impacts during larger storms on the airport estate. Environmental impacts would be beneath levels of detection, consistent with seasonal variations, within the normal bounds of variation, or within the margin of forecasting error.
Beneficial	Changes to existing situation as a result of M3R that will lower the risk of flooding both on and off the airport estate.

B4.6 EXISTING CONDITIONS

This section presents baseline information regarding surface water and erosion potential to characterise the existing conditions within the M3R study area and/or Melbourne Airport (as required).

B4.6.1 Climate

Average monthly and annual rainfall data was obtained from the Australian Bureau of Meteorology (BoM) Melbourne Airport climate station. Anticipated monthly evaporation within the M3R study area is expected to significantly exceed monthly rainfall, potentially reducing overall run-off volumes. A summary of historically representative monthly rainfall and evaporation data is presented in **Table B4.4**.

B4.6.2 Flora and fauna

Ecology assessments indicate that the majority of M3R study area has been highly modified by historic agricultural land uses and development of existing airport infrastructure. Vegetation within the M3R study area consists of introduced invasive grasses and weeds and native grasses, which increase the evapotranspiration potential of rainfall. Areas of Natural Temperate Grassland of the Victorian Volcanic Plain and Grey Box Grassy Woodlands are within the study area.

Table B4.3
Severity criteria – water quality

Impact severity	Description
Major	Increasing load and/or concentration of water quality pollutants being discharged from M3R during its operational phase, resulting in permanent changes in receiving waters quality that have the potential to adversely impact sensitive receptors.
High	Increasing load and/or concentration of water quality pollutants being discharged from M3R during its operational phase resulting in permanent and wide-spread adverse impacts upon downstream water quality, and its identified social and environmental values.
Moderate	Increasing load and/or concentration of water quality pollutants being discharged from M3R during its operational phase that do not comply with applicable discharge/water quality objectives, and are likely to lead to longer-term localised adverse impacts upon downstream water quality and its identified social and environmental values.
Minor	Increasing load and/or concentration of water quality pollutants being discharged from M3R during its operational phase that do not comply with applicable discharge/water quality objectives, and are likely to lead to localised or intermittent adverse impacts upon downstream water quality and its identified social and environmental values.
Negligible	Increasing load and/or concentration of water quality pollutants being discharged from M3R during its operational phase that do not comply with applicable discharge/water quality objectives and has no perceptible adverse impacts upon downstream water quality, and its identified social and environmental values.
Beneficial	Improvement in water quality downstream of the airport resulting from the direct effects of operational stage water quality and quantity control measures built as part of M3R.

Table B4.4
Climate summary (1970 – 2016)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean monthly rainfall (mm)												
40.6	41.7	36.8	43.8	39.3	39.6	35.9	44.2	47.2	53.3	61.2	50.5	534.6
Mean number of rainy days												
8.3	6.9	9.0	10.2	12.6	13.4	14.0	15.5	14.1	13.3	11.5	9.5	138.3
Mean monthly evaporation (mm)*												
251.1	198.8	179.8	114.0	77.5	54.0	62.0	83.7	123.0	161.2	180.0	229.4	1715.5

*Source: BOM *Data collected between 1998 and 2017*
Note: Where figures have been rounded, discrepancies may occur between monthly totals and annual sums of components.

As described in Chapter B5: Ecology, given the size and scale of M3R, complete avoidance of impacts to ecological values is not possible. However, the design for M3R incorporates a number of measures aimed at avoiding and minimising potential impacts. The study area and surrounds support a range of ecological features, including areas of native vegetation, scattered trees, escarpments, wetlands and artificial structures that provide habitat value.

Extensive earthworks are planned within parts of the Arundel Creek valley, with approximately 500 metres to be filled. Therefore over 500 metres of the creek will be realigned and directed through a culvert below an approximately thirty metres high fill embankment with batter slopes of up to 1:2.5. Direct impacts to the creek will include removal of riparian and aquatic habitats, localised increases in water velocity, and possible reduction in downstream water temperature. The Commonwealth listed Growling Grass Frog has been recorded within this section of Arundel Creek and impacts to its habitat are unavoidable. Further discussion about impacts to the frog's habitat is outlined in Chapter B5: Ecology.

B4.6.3 Topography and surface conditions

The topography of the site generally slopes from north to south, its ground level ranging from 145 metres Australian Height Datum (AHD) in the north to 95 metres AHD in the south. At the southern extremity of the study area in the Arundel Creek valley, the ground level falls to approximately 40 metres AHD (Figure B4.1). Land adjacent to the Deep Creek/Maribyrnong River systems comprises areas of steep to very steep slopes which are generally outside the development footprint. The current alignment of Arundel Creek is within a gully and intersecting the proposed southern cross-field taxiways. The gully embankment slopes at this location are estimated to be 10 to 25 per cent.

Current surface run-off within the study area follows the surface contours primarily as sheet flow toward swales and waterways. More concentrated gully flows occur in some locations, down the existing embankments of the Deep Creek, Maribyrnong River and Arundel Creek systems.

Visual assessments and geotechnical investigations of the project footprint have indicated several areas of potential instability and erosion risk along the embankment and within the Arundel Creek gully. The areas of concern are small, localised occurrences that can easily mitigated (Section B4.8.1).

B4.6.4 Catchment drainage and surface water features

The Melbourne Airport estate drains to a number of local creeks and rivers. They include Moonee Ponds Creek, Arundel Creek, Maribyrnong River and Steele Creek North. Previous ground surface modifications and artificial stormwater drainage infrastructure have modified the pre-existing natural drainage patterns of the site. Current site drainage catchments are shown in Figure B4.2.

B4.6.4.1 Arundel Creek catchment

Arundel Creek is a sub-catchment of the Maribyrnong River (approximately 13 square kilometres in area) which lies within, and is external to, the airport estate. Arundel Creek is the discharge point for the stormwater generated over approximately half of the current airport area. Stormwater discharges through four outfall structures. Three (referred to as ACO1, ACO2 and ACO3) are located in the valley bottom; while a smaller structure discharges to the head of the small valley marking the north-western boundary of the golf course (see Figure B4.2).

Base flow in the Arundel Creek is largely sustained by the contribution from airport stormwater flows, with discharge via the existing outfall structures. Groundwater discharge to the creek is evident in spring-fed pools at locations along the creek line. Upstream of ACO1, the creek is ephemeral, with local rainfall events causing short-term peak flows.

In terms of land use within the airport estate, the catchment mostly comprises vegetated areas. However, it also includes significant areas of runway and taxiways, aprons, terminal precinct buildings, fire training grounds, aircraft maintenance hangars and workshops, and part of a golf course. Arundel Creek discharges to the lower Maribyrnong River, approximately 700 metres south of the airport boundary.

The great majority of M3R-developed infrastructure will drain into the Arundel Creek catchment.

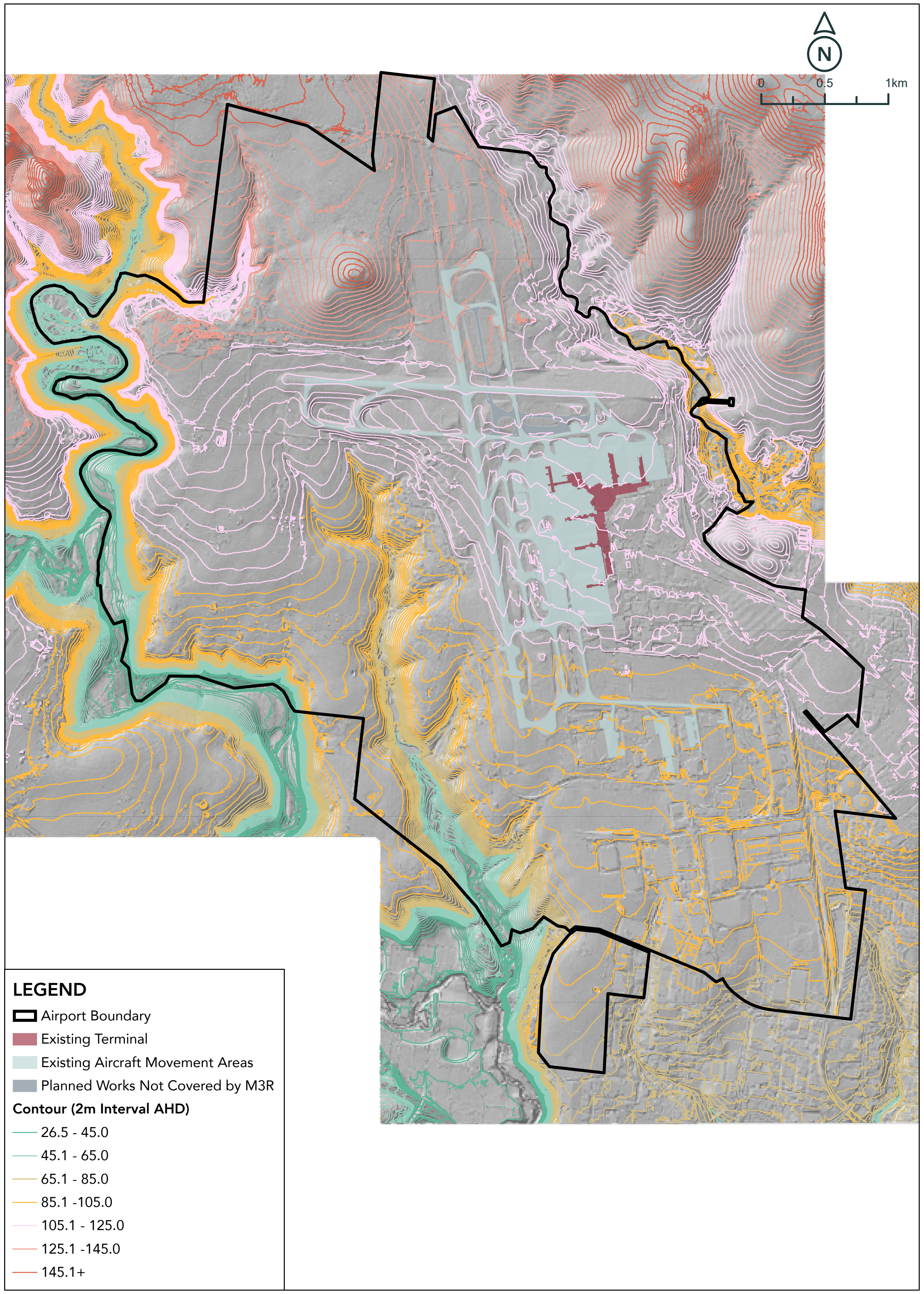
B4.6.4.2 Maribyrnong River catchment

Lying west of the airport estate is the confluence of Deep Creek and Jacksons Creek. Downstream of this confluence, the waterway is known as the Maribyrnong River.

The majority of the Melbourne Airport site drains to the Maribyrnong River catchment via Arundel Creek. The Maribyrnong River has an overall catchment area of about 1408 square kilometres. The river meanders within a deeply-incised valley, running approximately 70 metres below the edge of the airport plateau. The valley floor is generally between 100 metres and 150 metres wide. The tree-lined river channel is approximately 20 metres wide.

Approximately 17.6 square kilometres (65 per cent) of Melbourne Airport land drains ultimately to the Maribyrnong River. A small portion of the western boundary drains directly to the Maribyrnong River, while further north drains to Deep Creek. The majority of the proposed project development sits within the Arundel Creek catchment, and the project footprint affects the entire Arundel Creek catchment within airport land.

Figure B4.1
Existing surface digital elevation model and contours



B4.6.4.3
Moonee Ponds Creek catchment

Located along the north-eastern boundary of the airport estate, Moonee Ponds Creek is significantly urbanised, especially downstream of the airport. Although the catchment upstream of the airport is predominantly pasture, this land is being slowly urbanised with expanding residential development in the region. The Moonee Ponds Creek catchment is approximately 145 square kilometres in size. Only a small portion of this catchment resides within the airport estate (approximately 3.6 square kilometres or 2.5 per cent of the catchment).

Within the airport boundary, land use comprised vegetated areas, taxiways, aprons, roads, car parks, terminal precinct buildings, and a fuel storage facility. Moonee Ponds Creek is a tributary to the lower Yarra River.

B4.6.4.4
Steele Creek and Steel Creek North catchment

The Steele Creek and Steel Creek North catchments receive discharges from the southern and eastern regions of Melbourne Airport. The proposed works and operation of M3R will have a negligible impact within the catchment, and therefore not result in any changes to either the flows or flood behaviour.

B4.6.5
Subsurface conditions

Geotechnical investigations and laboratory testing have found that ground conditions across the development footprint are generally consistent with the wider region.

The geology of the southern portion of the site broadly consists of a cap of basalt rock. The surface of the basalt has weathered to a residual clay that is encountered at the surface over the majority of the site. The basalt mass consists of seams of variable strength, weathering and fracturing. There is a general trend of increasing strength, reduced fracturing and reduced weathering with depth, but this is not always the case, with zones of more highly weathered and weaker strength material often encountered beneath less weathered and higher strength material. The variability in the basalt layers is likely due to multiple overlying basalt flows creating layers of variable strength and weathered materials.

In some areas, particularly around Arundel Creek, sandy sediments of the Brighton Group formation, exposed areas of weathered Older Volcanics, and colluvial and alluvial deposits are evident. Similarly, investigations near the Maribyrnong River found colluvial materials to depths of 14.5 metres which were likely to have been formed as the Maribyrnong River eroded the area to form its current valley.

The geology of the northern portion of the site comprises Newer Volcanics flows overlying Devonian aged Bulla Granodiorite. In some areas the Bulla Granodiorite outcrops at the surface. The granodiorite has weathered to residual sandy clay, which is typically encountered at the surface where the granodiorite outcrops. The granodiorite is often extremely weathered close to the surface, with a reduction in weathering with depth. In some areas, high strength, slightly weathered granite rock is encountered. Towards the base of the hill an increasing depth of colluvium is expected. There is also a shallow gully located under the north-west extents of the footprint, which may comprise an increased thickness of residual or alluvial soils.

Topsoil encountered within the M3R study area consists of clayey silt, generally described as firm and moist with organic matter including grass roots to ten centimetres below ground level (bgl). The topsoil layer was encountered between 10 and 25 centimetres bgl, with deeper topsoil layers typically near Arundel Creek observed to 70 centimetres bgl."

Refer to Chapter B3: Soils, Groundwater and Waste for further details.

B4.6.6
Erosion potential

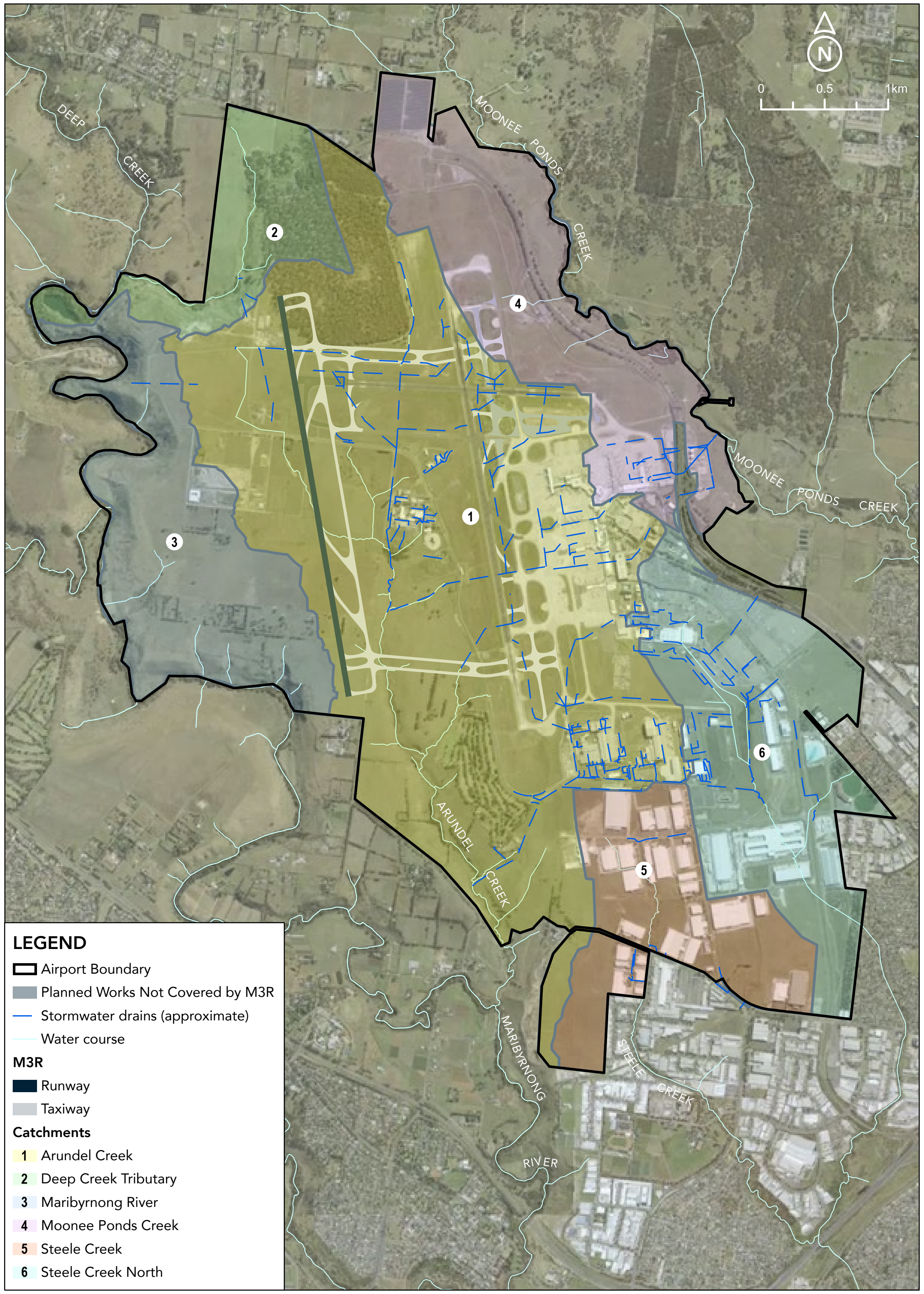
The overall erosion potential of soil within the M3R study area has been assessed as low. The soil characteristics (topsoil overlying basaltic clays, typically surfaced by grasses) do not present an erosion risk in their current state. The main areas of erosion concern are within the Arundel Creek gully but considered likely to be localised occurrences.

B4.6.7
Surface water run-off performance modelling approach

To assess the performance of surface water run-off, a TUFLOW computer model was developed to model the hydrology and hydraulics for both existing conditions and the proposed M3R development. It was developed using previous models developed for the Airport, Australian Rainfall and Runoff 2019 guidelines and methodology (ARR, 2019); and existing and proposed infrastructure layouts.

The ARR 2019 methodology involved running a full ensemble of temporal patterns for each storm duration for particular Annual Exceedance Probability (AEP) events through the TUFLOW model. The hydraulic model results were then used to identify critical storm durations, and generation of maximum flood depth and peak flood water level.

Figure B4.2
Existing drainage and catchment boundaries



Source: Modelled by Senversa using existing surface elevations sourced from Photomapping Project #5806, Melbourne Airport LiDAR Acquisition (8 March 2017)

B4.6.7.1
Hydrology

Design rainfall depths were derived from the Bureau of Metrology (BoM) techniques for Intensity-Frequency-Duration (IFD) curves for ARR 2019. They were obtained for the frequent, intermediate and rare AEPs events for each standard design storm (as outlined by BoM and ARR 2019).

The design rainfall depths were temporally distributed for the one per cent AEP for each storm design duration based on the 10 temporal patterns obtained from the ARR 2019 Data Hub.

The one per cent AEP design flood event was selected for the assessment because it is the maximum baseline for protection required for airport airside assets. Further modelling will be undertaken as part of detailed design to consider requirements that satisfy the immunity needs of different airside components.

The one per cent AEP design flood event was modelled for a range of storm durations (10 minutes to 12 hours) to determine the flood impact (flow and level) of the existing conditions and the proposed M3R development.

B4.6.7.2
Hydraulics

The TUFLOW model was developed to estimate flood level and flood depth within the extent of the airport catchments, and to provide details of the existing condition of outfalls into the Arundel Creek system.

Once a base model representing the existing condition was established, the TUFLOW model was updated with the proposed M3R infrastructure so that the system's performance could be assessed against the existing condition.

The flow rates for the proposed M3R development were compared to the existing conditions in Arundel Creek. Peak flows were extracted for the critical storm duration from the TUFLOW model at reach stations on Arundel Creek (locations shown in **Figure B4.3**).

Critical storm durations for both the existing conditions and the development scenarios are outlined in **Table B4.5**.

Table B4.5
Critical storm duration

TUFLOW Scenario	AEP Event	Critical Storm Durations
Existing Condition	1%	20-min, 45 min, 1-hour, 1.5 hours, 2 hours
M3R Development	1%	20-min, 45 min, 1-hour, 1.5 hours, 2 hours

Source: BECA

The peak one per cent AEP event flow rates (corresponding to their critical storm duration and median temporal pattern at each of the reporting locations along Arundel Creek for the existing condition) are presented in
Table B4.6.

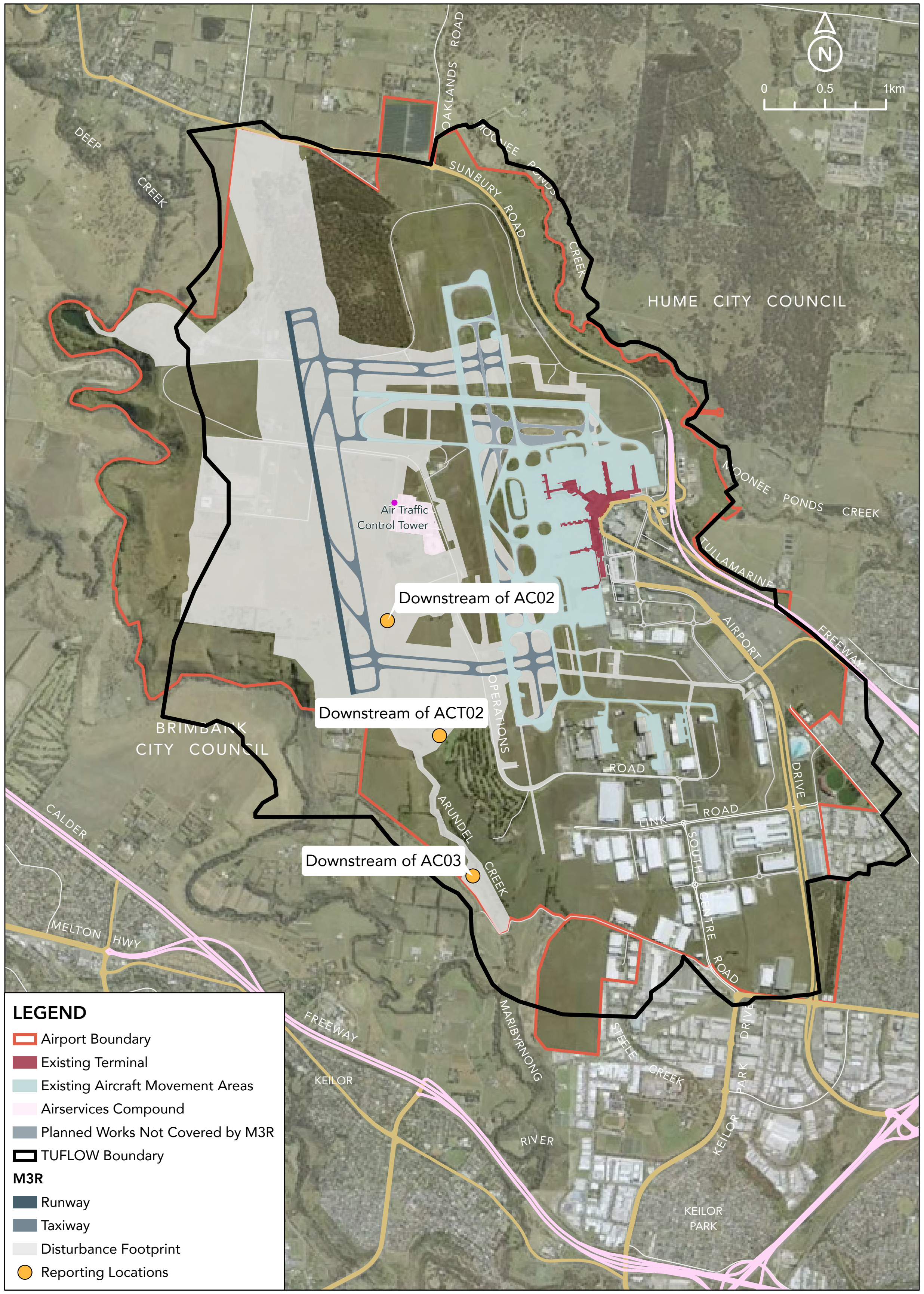
Figure B4.4 and **Figure B4.5** show the representative peak flood levels and maximum depths for the existing condition in the one per cent AEP event. The figures generally indicate controlled and uncontrolled flow paths within the airport, and ponding against runways and roads.

Table B4.6
Peak 1% flows for existing condition along Arundel Creek

Reporting locations	Critical duration	Median temporal pattern	1% AEP peak flows (m³/s)
Downstream of ACO2	2 Hours	Temporal Pattern 2	36.94
Downstream of ACTO2	2 Hours	Temporal Pattern 2	6.66
Downstream of ACO3	2 Hours	Temporal Pattern 8	66.06

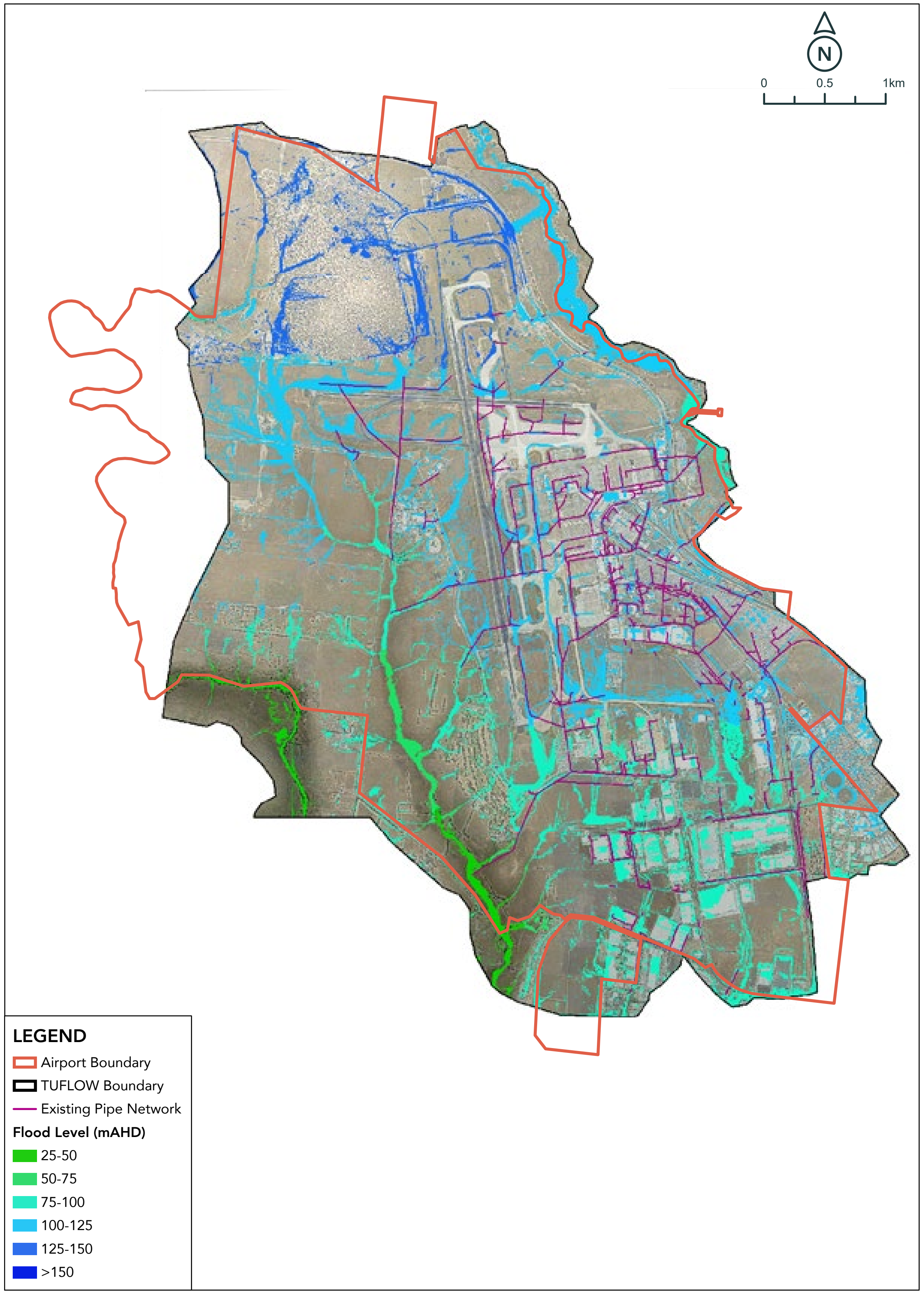
Source: BECA

Figure B4.3
Reporting reach stations locations for flows on Arundel Creek



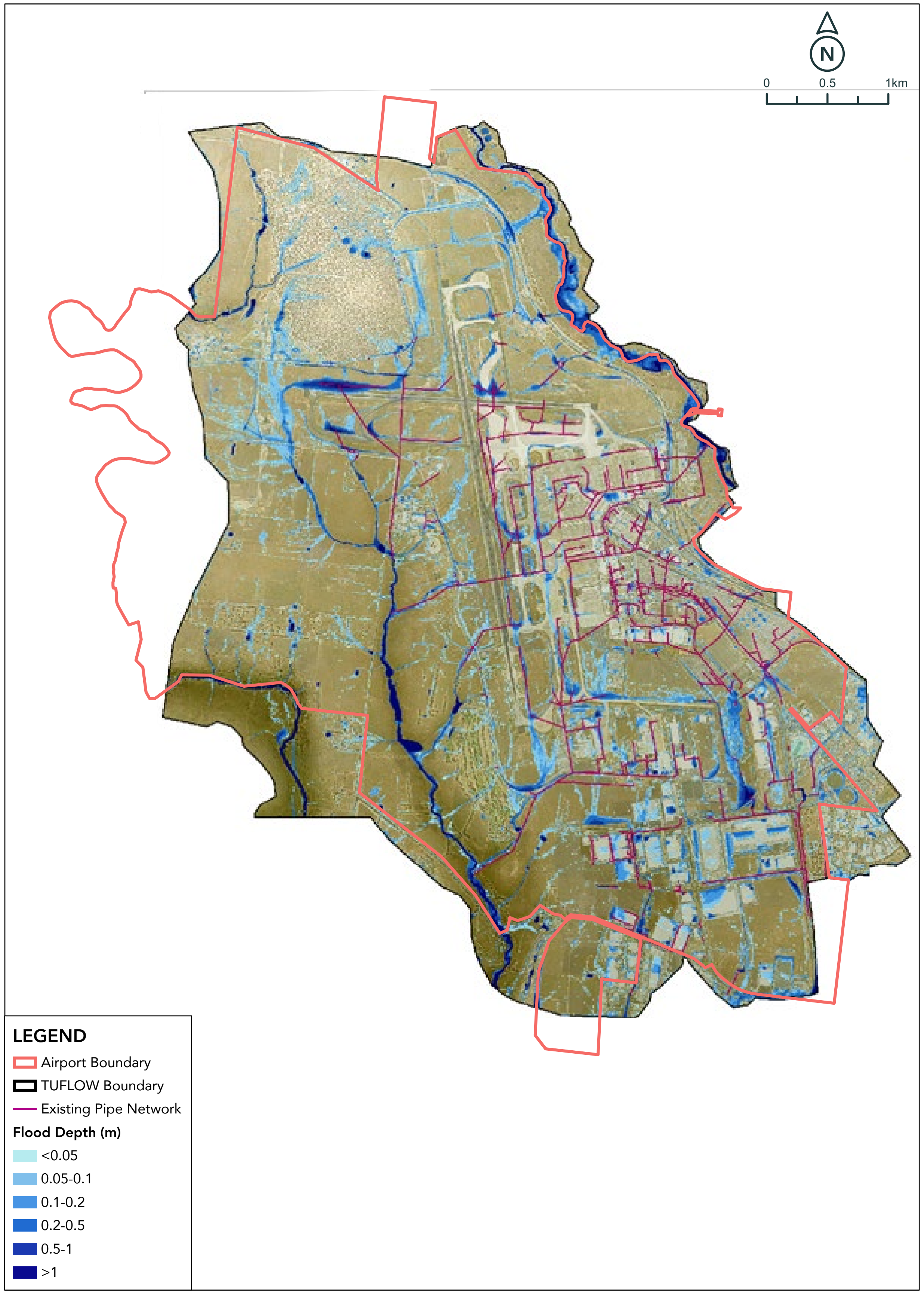
Source: BECA, 2020

Figure B4.4
Existing condition flood level 1% AEP



Source: BECA, 2020

Figure B4.5
Existing condition flood depth 1% AEP



Source: BECA, 2020

B4.6.7.3
Modelling approach

MUSIC (Model for Urban Stormwater Improvement Conceptualisation) is a continuous simulation software tool used to simulate rainfall, stormwater runoff and pollution. A MUSIC model has been developed to model the baseline conditions and estimate pollutant loadings under the M3R development scenario.

The MUSIC model adopts the Melbourne Water 10-year rainfall templates, in line with the 2018 Melbourne Water MUSIC Guidelines Input Parameters and Modelling Approach for MUSIC Users in Melbourne Water's Service Areas.

Daily potential evapotranspiration values were obtained from the Melbourne Water MUSIC Rainfall Template files - default soil parameters within the MUSIC model have been amended to reflect pervious area properties for Melbourne.

The full 10-year rainfall period has been adopted at the finest timestep resolution, i.e. six minutes, with sub-catchments established based on flow direction from the piped drainage network and overland flow paths.

Hydraulic routing has been included along all primary drainage links (to account for travel time in the overland flow and pipe networks), giving the model a better representation of on-ground drainage conditions.

B4.6.8
Surface water quality

Extensive water monitoring has been undertaken by APAM across the estate and upstream and downstream catchments, at over 40 monitoring locations with electronic records dating back to 2009.

APAM is required to monitor surface water quality as part of the environmental obligations under its long-term lease of the airport. Some tenants are also responsible for monitoring surface water derived from tenant-related operations. Figure B4.6 presents the current monitoring locations. The current monitoring program consists of approximately 30 locations, including key up-gradient and down-gradient discharge points. The intention of the monitoring network is to meet APAM's responsibilities, verify tenant monitoring programs, and limit duplication of data collected by tenants.

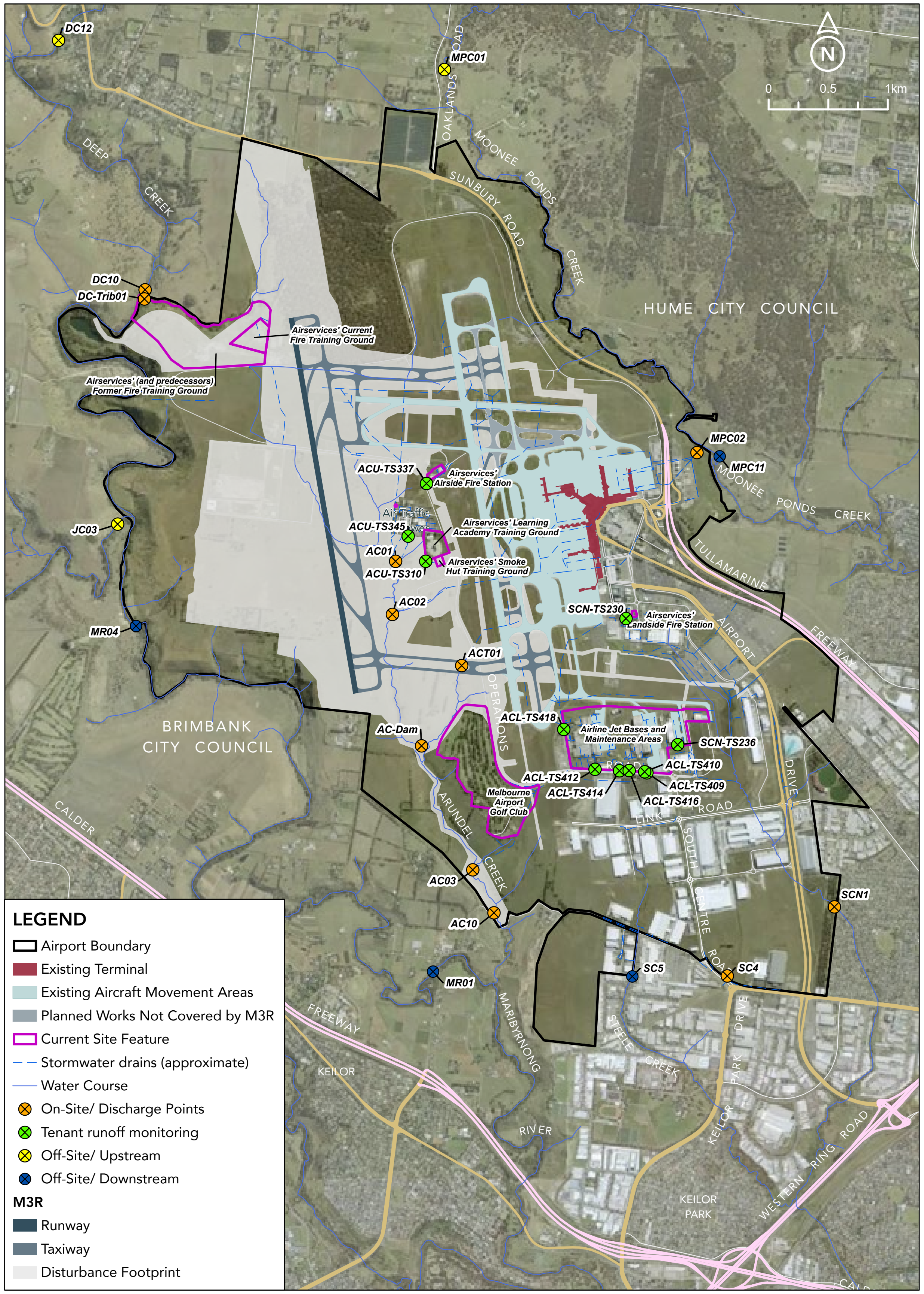
B4.6.8.1
Stream health monitoring

In addition to surface water quality monitoring, APAM also undertakes stream health assessment monitoring on a biannual basis at the monitoring locations in Figure B4.7. The stream health monitoring includes macroinvertebrate sampling to assess potential impacts on receiving waterways from airport activities' runoff.

Table B4.7
Water quality parameters monitored

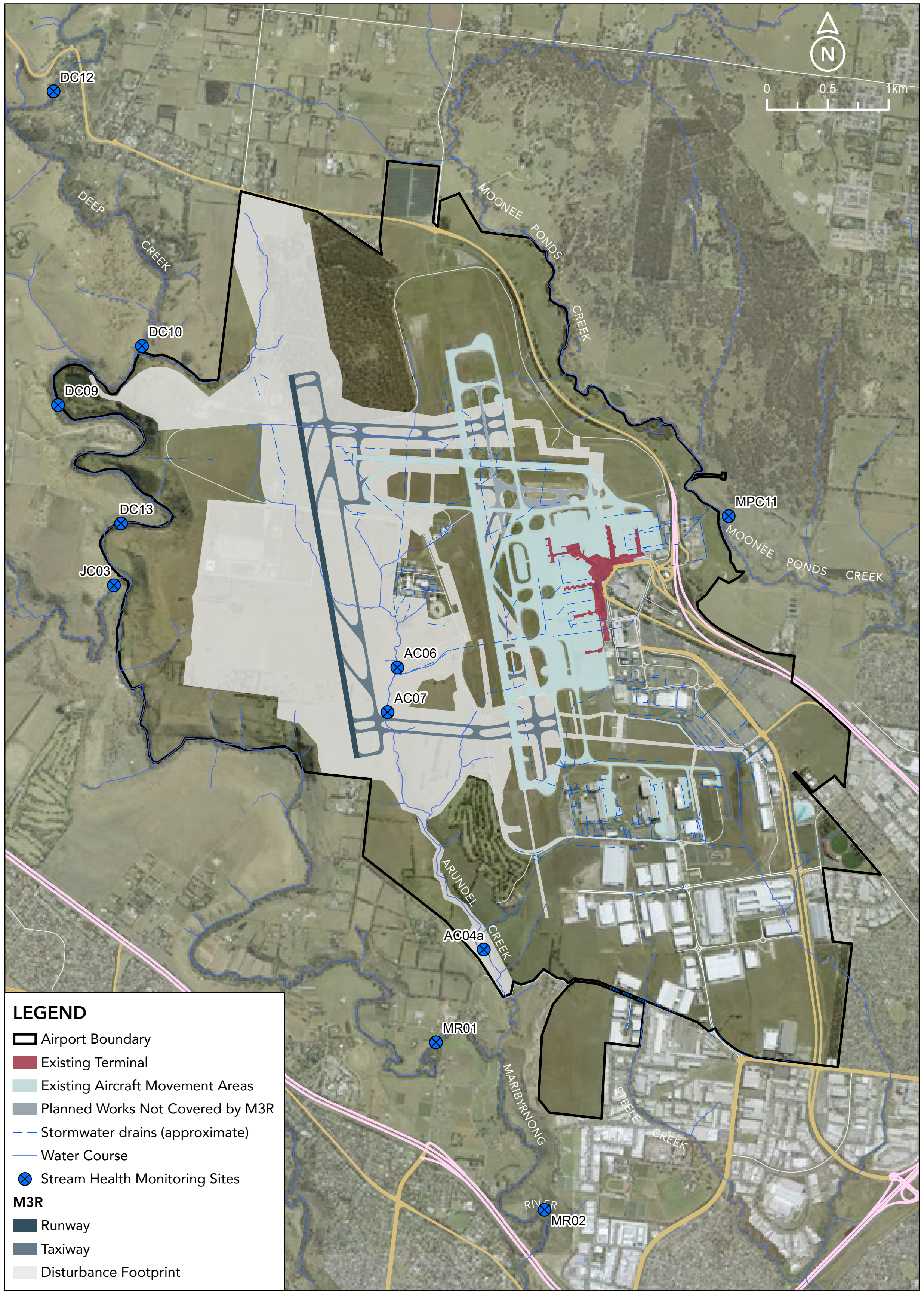
Group	Individual parameters
Physico-chemical	Electrical conductivity, pH, dissolved oxygen, temperature, turbidity, total dissolved solids, suspended solids, hardness, biochemical oxygen demand, chemical oxygen demand
Metals	Aluminium, arsenic, copper, cadmium, chromium, lead, zinc, nickel
Nutrients	Total nitrogen, nitrate, nitrite, total kjeldahl nitrogen, total phosphorus
Hydrocarbons	TPH C6-C40 fractions, benzene, toluene, ethylbenzene, xylenes, naphthalene, chlorinated hydrocarbons, oil and grease, methylene blue active substances
Pesticides and herbicides	Phenoxy acid herbicides, triazine herbicides, synthetic pyrethroids, fungicides, organophosphorus pesticides, organochlorine pesticides
Microbiological	E. coli, faecal coliforms
Per- and poly-fluoroalkyl substances (PFAS)	Extended suite of 28 key PFAS compounds

Figure B4.6
Water quality sampling locations



Source: Senversa, 2020

Figure B4.7
Stream health monitoring sites



Source: Map produced by Senversa from Elgin 2020b

B4.6.8.2
Overview of catchment and receiving water conditions

B4.6.8.3
Key contributions to water quality

The following is a broad overview of key contributions to water quality in catchments and receiving waterways at Melbourne Airport:

- Natural sources from soil sediment load such as runoff from existing soils across the Melbourne Airport estate and broader catchment, (e.g. naturally occurring metals in soil)
- Agricultural practices (both past and present) in non-operational areas of the airport estate and within the broader catchments (e.g. nutrient loads, faecal coliforms)
- Application of pesticide and herbicides as part of pest management in operational areas of the airport
- Runoff from operational areas of the airport where use of chemicals and fuels are required as part of general operations
- Historic accidental spills/releases, which may also occur as secondary sources within sediment in the artificial and natural drainage lines
- Potential impacts during construction activities including increased sediment loads and runoff from imported fill.

B4.6.8.4
Monitoring parameters

Melbourne Airport's surface water quality monitoring program is outlined in Section B4.6.8. The monitoring program is reviewed and updated periodically to ensure currency and ongoing relevance. It includes monitoring for parameters listed in Airport Regulations and Environmental Reference Standard (Vic), and consideration of the known water quality contributions as listed in Section B4.6.8.3 above.

The most recent monitoring events were undertaken in spring 2019 and autumn 2020. Some minor variance occurred due to the site conditions and inclusion of additional locations when targeting potential runoff from operational areas.

It should be noted that the adopted guidelines consider water quality within the airport boundary (Airport Regulations) or in the receiving waters (Environmental Reference Standard (Vic)). Runoff into Arundel Creek and other natural creek lines within the airport bounds is governed by Commonwealth legislation (Airport Regulations). Stormwater runoff and discharge from natural creeks leaving Melbourne Airport is governed by Victorian legislation (Environmental Reference Standard (Vic)). Many of the monitoring locations within the current monitoring program specifically target drainage discharge points to understand where impacts may be derived from to help identify improvement measures. They are not necessarily reflective of water quality within natural drainage lines. Monitoring of all airport boundary discharge points is included in the monitoring program in order to understand potential contributions to off-site water quality.

B4.6.8.5
Existing water quality conditions

General water quality indicators – Airport Regulations

Average concentrations across the historic data set have been compared to Airport Regulations to give a summary of existing water quality conditions. They are summarised in Table B4.8 below.

For the purposes of this MDP, assessment of project risks from general water quality indicators will need to consider the current risk profile and general water quality. Indicators will be managed to ensure the risk profile does not increase and/or improving it as part of the project works.

Table B4.8
General water quality indicators – Airport Regulations

Group	Individual parameters	Comments
Physico-chemical	Average concentrations for physico-chemical parameters generally meet Airport Regulations. The key exceedances are: Dissolved oxygen concentrations reported in Moonee Ponds Creek (MPC11) and outfall (MPC02) with long term averages of 5.4 and 5.5 mg/L (just below the 6 mg/L Airport Regulations guideline) Salinity (mg/L) in particular, the long-term averages in DC-Trib01 and AC10 Turbidity based on the variation of total suspended solids compared to long term averages.	Moonee Ponds Creek has been reported to be in poor condition both upstream and downstream of airport discharge site MPC02. Surface water sampling is often undertaken during rainfall events, not during low flow periods where turbidity and total suspended solids would not be as significant.
Nutrients	Average concentrations for ammonia (as N), total nitrogen, phosphorous (as P) have been reported above Airport Regulations.	Ammonia, total nitrogen and phosphorous also exceed at some upgradient locations and are considered to be catchment wide issues.
Microbiological	Average concentrations for faecal coliforms have been exceeded across the airport.	Faecal coliforms have also been reported at upgradient locations and are considered to be a catchment wide issue.

Comparisons against Environmental Reference Standard (Vic) quality objectives

The following sites are considered representative of airport discharge and receiving waters (as defined in Environmental Reference Standard (Vic)):

- Site AC10 has been selected to represent the quality of Arundel Creek as a receiving water containing three upgradient stormwater discharge sites (including AC01, AC02 and AC03). It also represents water quality discharging from the airport boundary
- Site DC-Trib01 and DC10 for water quality discharging into Deep Creek at the airport boundary
- MPC02 as the outfall discharge point into Moonee Ponds Creek and in stream down gradient boundary at site MPC11
- SCN1, SC4 and SC5 as the boundary discharge points for Steele Creek and Steele Creek North. As the project will have limited impact on these catchments, further discussion about them is considered unwarranted. They have been excluded from the data set.

The historic data set for the above locations (AC10, DC-Trib01, DC10, MPC02 and MPC11) was reviewed against Environmental Reference Standard (Vic) quality indicators. The results are summarised in **Table B4.9** below.

Review of the surface water data against Environmental Reference Standard (Vic) indicates that not all objectives are met. This is generally consistent with the outcomes from assessment against the airport Regulations. These quality indicators can often be impacted by broader catchment quality and environmental factors. As previously noted, because surface water sampling is undertaken during rainfall events (to maximise available sampling locations in the network) it is not necessarily a true indicator of general water quality in the receiving waters.

Table B4.9
General water quality indicators – Environmental Reference Standard (Vic)

Quality Indicator	Metric	Receiving water objective	Environmental Quality Indicator Results
Electrical Conductivity	75th percentile	≤ 2000 µS/cm	The objective was not met at AC10, DC-Trib01 and DC10
pH	25th percentile	≥ 6.8	The 25th percentile objective was met at all locations
	75th percentile	≤ 8.0	The 75th percentile objective was not met at DC10 which reported pH at 8.5
Dissolved Oxygen[1]	25th percentile Maximum	≥ 70% Saturation 130 % Saturation	Field and laboratory DO was reported below the 25th percentile at MPC02 at 47%-68% saturation (4.3 mg/L-6.2 mg/L) and similar concentrations at MPC11 Field and laboratory DO was reported above the maximum at DC10 at 132% to 143% (12-13 mg/L)
Turbidity	75th percentile	≤ 15 NTU	The objective was not met at AC10 (20 NTU) and MPC02 (18 NTU)
Total phosphorus	75th percentile	≤ 55 µg/L	The objective was not met at all locations
Total nitrogen	75th percentile	≤ 1,050 µg/L	The objective was not met at AC10 and MPC02
E. coli[2] (water based recreation)	Short term indicator	≤ 260 orgs / 100mL (consecutive sample) ≤550 orgs/100 mL (single sample)	Average E. coli concentrations exceeded the consecutive sample guideline at AC10, MPC02, MPC11 Maximum E. coli concentrations have exceeded the single sample guideline at AC10, DC10, MPC02 and MPC11 95th percentiles indicate that water quality is not suitable for primary contact recreation but is suitable for secondary contact recreation at site discharge points noting that sampling is often undertaken during rainfall events

Note 1: Dissolved oxygen was converted from mg/L to % saturation assuming 1 atmospheric pressure and temperature of 20 degrees Celsius.

Note 2: These results are provided for general comparison only as the collection of E. coli data as part of surface water monitoring program does not fully comply with the Environmental Reference Standard (Vic) requirements to allow for direct comparison with the guidelines.

Stream Health

The most recent results for stream health monitoring (2020) are presented in **Table B4.10**.

The stream health conditions are considered to be more influenced by broader catchment conditions and rainfall - they do not necessarily correlate to impacts directly associated with airport activities and resultant discharges.

PFAS

PFAS (per- and poly-fluoroalkyl substances) are manufactured chemicals used for more than 50 years. PFAS make products non-stick, water repellent; and fire, weather and stain resistant. PFAS have been used in a range of consumer products such as carpets, clothes and paper, and in firefighting foams, pesticides and stain repellents.

At airports, Aqueous Film Forming Foams (AFFF) containing per- and poly-fluoroalkyl substances (PFAS) were historically used because they are very effective at putting out liquid fuel fires. At Melbourne Airport, AFFF has been stored in aircraft hangers for deluge systems; and used extensively in training for, and responding to, firefighting emergencies involving liquid fuels. Potential source areas in the project area include the following Airservices Australia and their predecessors' facilities as presented in **Figure B4.6**:

- Current and former Fire Training Grounds (FTGs)
- The Melbourne Airport Fire Station
- The Smoke Hut.

Diffuse PFAS impacts are widespread across the project area, and a number of secondary sources of PFAS contamination have also been identified. However, these are predominantly associated with surface water drainage, groundwater contamination and water re-use impacts (e.g. Melbourne Airport golf course).

The key PFAS compounds of concern at the airport are perfluorooctane sulfonate (PFOS) and perfluorohexane sulfonate (PFHxS). Although other PFAS compounds have been detected above laboratory limits of reporting (LOR), PFOS and PFHxS are considered suitable indicators of overall PFAS impacts and the primary risk drivers because they:

- Have as high or higher toxicity than other PFAS for which toxicological studies have been conducted
- Have screening and toxicity reference values published by Australian agencies for use in both screening level and detailed quantitative health risk assessments
- Comprise the majority (i.e. predominantly greater than two-thirds) of total analysed PFAS compounds at Australian sites where PFAS-containing fire-fighting foams have been used.

Screening levels are also available for perfluorooctanoic acid (PFOA). However, PFOA has not been demonstrated to be a risk driver at Australian sites (due to its lower toxicity than PFOS and PFHxS) and its occurrence at lower concentrations in environmental media.

PFAS compounds (specifically PFOS, PFHxS and PFOA) are reported in surface water with exceedances of adopted guidelines at the site boundary. Surface water impacts are most pronounced downgradient of areas of historic use. Some other secondary source contamination in sediment within drainage lines has been reported.

Table B4.10
Stream health results

Catchment	Stream Health
Arundel Creek Sub-Catchment	In general, stream health in Arundel Creek does not meet Environmental Reference Standard (Vic) quality objectives which has been attributed to poor stormwater quality, peak stormwater flows and poor habitat conditions. It should be noted that these are all on-site locations and not representative of off-site receiving water conditions.
Deep Creek Sub-Catchment	Monitoring in Deep Creek has shown to generally meet Environmental Reference Standard (Vic) quality objectives for stream health and has continued to show high ecological value.
Maribyrnong River	Monitoring in the Maribyrnong River indicates good stream health but with some impairment (with the spring conditions generally being the time when Environmental Reference Standard (Vic) quality objectives were not met).
Moonee Ponds Creek	Some improvement to stream health has been reported in Moonee Ponds Creek with Environmental Reference Standard (Vic) quality objectives met in autumn monitoring period but not met in the spring. The stream health of Moonee Ponds Creek is impacted by upstream catchment runoff contributions as well as from discharge from the airport (stormwater quality and peak flows) that are impacting on the habitat conditions at the reference monitoring point.

Table B4.11 summarises PFAS impacts across the project area, and average concentration from monitoring data collected between 2016 and 2020.

PFOS concentrations are exceeded at all locations (both on and off-site) due to the low guideline limit of 0.00023 μg/L for 99 per cent protection of species (which is adopted in consideration of bioaccumulation potential). It should be noted that this guideline limit is below the laboratory limits of reporting of 0.01 μg/L. Average concentrations of cumulative PFHxS and PFOS also exceed acceptable thresholds for stock watering (at most locations), and primary contact recreation (in Arundel Creek and Deep Creek Tributary). Average and maximum PFOA concentrations also exceed stock watering at some locations within the airport boundary. For locations within the airport boundary, primary contact recreation is not permitted. Controls have also been put in place to restrict stock access to creeks within the airport boundary.

Estate-wide human health risk assessments have been commissioned by APAM and identified that on-site risks are considered low and acceptable. Further confirmation of off-site risks is ongoing and being addressed as part of broader estate management. For the purposes of this MDP, assessment of project risks from PFAS will need to consider the current risk profile and how PFAS impacts will be managed to ensure the risk profile does not increase and/or can be improved as part of project works.

Metals and toxicants (non-PFAS)

Average and maximum concentrations across the historic data set have been compared to Airport Regulations (and, where applicable, to Environmental Reference Standard (Vic)) to provide a summary of existing water quality conditions. They are summarised in Table B4.12.

Estate-wide risk assessments are currently in progress to confirm whether off-site risks from non-PFAS contaminants pose a risk to environmental values (including aquatic ecosystems, primary contact recreation, irrigation and stock watering) and are being addressed as part of broader estate management. For the purposes of this MDP, assessment of project risks from non-PFAS contaminants will need to consider the current risk profile, and how non-PFAS impacts will be managed to ensure the risk profile does not increase and/or can be improved as part of project works.

B4.7 ASSESSMENT OF POTENTIAL IMPACT

The construction and operation of M3R has the potential to modify existing catchment-specific water quality, surface water and erosion characteristics.

The construction stages of the program include large-scale earthworks and use of plant and machinery that present risks for enhanced erosion and sedimentation, and discharge of PFAS, hydrocarbons and other hazardous materials. These effects may be experienced on-site and off-site. Operational phase impacts resulting from the increase in impervious land use include modified hydrologic and hydraulic responses to rainfall events and altered water quality.

Table B4.11
Summary of PFAS impacts across the project area

Catchment	Summary of PFAS presence
Arundel Creek Catchment	Key source areas within this catchment are the Airservices Australia lease areas, including the Main Fire Station, Learning Academy and Smoke Hut (refer to Figure B4.6). Historically, run off from the current Fire Training Ground (FTG) area was also received by this catchment. Secondary source sediment and drainage infrastructure contamination has been reported, as well as impacts from using PFAS contaminated water from Arundel Dam to irrigate the Melbourne Airport golf course. Run off from the operational areas of the airport including the maintenance areas are also identified as historical source areas. Average concentrations of Sum of PFHxS and PFOS at AC10 discharge point are 4.2 μg/L. In addition to concentration data, estimates of contaminant load indicate that Arundel Creek is the key discharge point that contributes to offsite discharge of PFAS.
Deep Creek and Deep Creek Tributary (Maribyrnong River Catchment)	The key source areas within this catchment are the current and former FTG (refer to Figure B4.6) as well as secondary sources in sediment within the tributary. As Deep Creek Tributary generally only flows during high rainfall events, although the reported concentrations at the site discharge point are high, the overall contaminant load and impact to water quality in Deep Creek and Maribyrnong River is lower than that estimated from Arundel Creek. Average concentrations of Sum of PFHxS and PFOS at DC-Trib-01 discharge point are 200 μg/L but reduce to 1.8 μg/L at the receiving water location (DC10) in Deep Creek
Moonee Ponds Creek	The key sources areas within this catchment are the Joint User Hydrant Infrastructure (JUHI) (aviation fuel) facility (refer to Figure B4.6) as well as operational areas of the airport where historically PFAS may have been stored or used as part of firefighting activities. Average concentrations of Sum of PFHxS and PFOS at MPC02 (discharge point) are 0.13 μg/L and 0.14 μg/L at MPC11 (receiving water location).

This section assesses likely impacts on local site features and off-site features with respect to erosion potential, water quality and surface water. The assessment process is based on a review of project-specific site characteristics that is both qualitative and quantitative in nature. Impacts are assessed relative to the existing condition and legislative requirements.

B4.7.1 Erosion potential

The potential for erosion within the M3R development footprint results from the stripping of topsoil, vegetation removal and bulk earthworks. Impacts may occur at the site of erosion, in the transportation of sediments into surface water systems, and/or at the site of sediment deposition.

B4.7.1.1 Construction phase

The primary activities identified as having the potential to contribute to erosion risk during preliminary staging and construction include:

- Excavation and placement of imported materials during preparation, and development of large earthwork platforms and haul roads
- Removal of vegetation and topsoil stripping
- Exposure of large areas of unstabilised ground during excavations
- Bulk excavation and handling of material to be re-used as fill
- Stockpiling of significant soil volumes directly up-gradient of drainage lines
- Placement of fill material within the Arundel Creek gully during culvert and taxiway construction
- Modification of Arundel Creek's existing embankments.

The specific mechanisms expected to increase the erosion potential during the above activities include:

- Exposure of clay soils which may dry and release fine sediments via surface run-off or wind erosion
- Improper placement, containment or stockpiling of soil leading to increased erosion of materials
- Direct mobilisation of soils from embankments through physical modification of existing surfaces.

Impacts from erosion processes will include the loss of soils from newly-formed surfaces or stockpiles, access issues if significant rills or gullies are formed, and potential construction delays if sub-grade materials or working platforms and batter slopes are eroded. Downstream impacts include a reduction in surface water quality, sediment build-up at depositional locations, and reduction in air quality through release of dust particles.

Table B4.12
Summary of non-PFAS impacts across the project area

Group	Airport Regulations	Environmental Reference Standard (Vic)
Metals	Aluminium, copper and zinc are the key dissolved metals concentrations that exceed Airport Regulations (average and maximum concentrations). To a lesser degree, chromium, cadmium, lead and iron have also been reported but generally not at site boundary discharge points. Aluminium is also reported in Moonee Ponds Creek and Deep Creek upgradient of the airport which indicate the widespread presence of aluminium in the catchments and not a site derived pollutant. The presence of copper, iron zinc and chromium are also reported in soil and groundwater (refer to Chapter B3: Soils, Groundwater and Waste) and are inferred to be associated with natural background concentrations in soils.	Metals also exceed multiple environmental value guidance with many also exceeding upstream of the airport.
Hydrocarbons	Long term averages are below Airport Regulations with the majority of records below laboratory detection limits. Petroleum hydrocarbons have been reported on occasion above Airport Regulations at drain discharge points within Arundel Creek, Moonee Ponds Creek.	Hydrocarbon concentrations have historically exceeded primary contact recreation and stock watering at site discharge point MPC02 but average concentrations are all below Environmental Reference Standard (Vic) guidance.
Pesticides and herbicides	Dieldrin has been reported above Airport Regulations at some locations including at the discharge point (MPC02) and at the down gradient location (MPC11) in Moonee Ponds Creek and AC10 (Arundel Creek discharge point). Dichlorodiphenyltrichloroethane (DDT) has historically reported above Airport Regulations at some onsite locations. Other herbicides have also been detected but not above adopted criteria. The presence of these contaminants in the airport is largely attributed to legacy pest and weed control within operational areas of the airport. In particular, insecticides have been used in runway easements to control insect populations in an attempt to reduce bird strikes. Dieldrin and DDT have been banned for this use since the late 1980s and concentrations are reflective of diffuse contamination from historical use.	Maximum and average dieldrin concentrations have exceeded aquatic ecosystem 95% protection at site discharge points (AC10 and MPC02).

B4.7.1.2
Operational phase

During the post-construction and operational phases of M3R, erosion risks may be associated with greater run-off and surface water flows from an increase in impermeable surfaces. These ongoing risks may increase sediment loading in surface waters in the absence of suitable design considerations and effective mitigation measures.

B4.7.2
Surface water

B4.7.2.1
Proposed modification and expected outcomes

M3R works have the potential to impact the surface water and flooding behaviour of Arundel Creek and the Maribyrnong River. Moonee Ponds Creek, Steele Creek North and Steele Creek catchments are located predominantly outside the project footprint, and any impact by the proposed development is expected to be minimal.

The proposed works will increase the impervious surfaces within Arundel Creek catchment and, without mitigation, may cause increased flows to enter the waterway. The additional impervious surfaces are proposed to be drained using a combination of buffer strips, open grassed swales, and a new pit/pipe drainage system to a series of discharge points along Arundel Creek.

The proposed development will also require the filling of parts of the Arundel Creek valley to ensure a continuous level surface for the southern cross-field taxiways. This will result in the existing creek conveyance being replaced with a culvert at this location. The realigned Operations Road will also cross a tributary of Arundel Creek adjacent to the Melbourne Airport golf course. The crossing of this tributary will require a culvert to ensure conveyance of the tributary is maintained.

Expected outcomes from these changes include potential modification of:

- Surface run-off (flooding) i.e. changes in the timing, frequency and volume of flow. The net effect of M3R will vary from catchment to catchment depending on the extent of change it is subject to, relative to its existing size and hydrologic function.
- Loss of floodplain storage. The infilling of the Arundel Creek valley will result in a loss of floodplain storage within the Arundel Creek system, potentially exacerbating flood levels along the valley.
- Flow volumes will be increased for events and as a long-term average.
- Flow events will occur more frequently - smaller rainfall events will give rise to more frequent flow events in drains and waterways due to reduced infiltration.

The key changes resulting from the proposed implementation of M3R include:

- Modification to catchment areas and drainage
- Increases in impervious area
- Modifications to land use.

In terms of modifications to catchments and drainage, the Arundel Creek catchment will increase in size by 160,000 square metres, with almost all M3R infrastructure draining into Arundel Creek (Figure B4.8).

Associated with M3R is a new stormwater collection and conveyance system. This includes capturing run-off from the runway surface and all associated taxiways, and conveying these flows to Arundel Creek. Stormwater discharges will occur on the upstream and downstream ends of the proposed Arundel Creek culvert. Additionally, an outfall will be required in a tributary of Arundel Creek adjacent to the golf course (Figure B4.9).

B4.7.2.2
Quantification of changes and outcomes

As described in Section B4.6.7, hydraulic modelling has been completed for Arundel Creek including:

- The Arundel Creek valley, to determine the impact of the partial infilling of the valley
- The stormwater drainage system, to determine the increases (or decreases) to peak flow at discharge locations along the waterway.

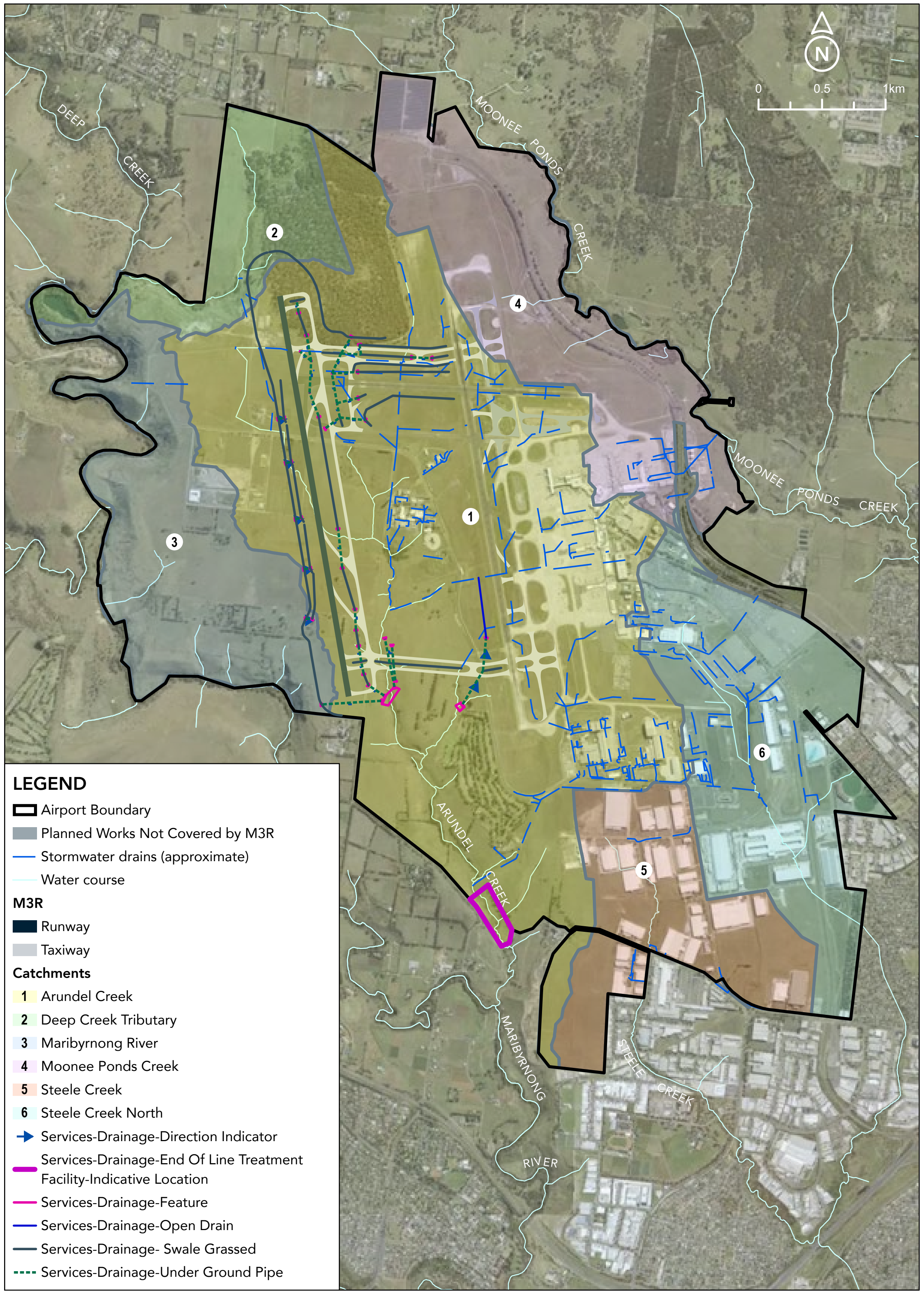
Results

The Arundel Creek hydraulic model (as described in Section B4.6.7) was modified to include the proposed M3R development. This involves modelling the inclusion of an approximately 500 metre culvert and the associated partial infilling of the Arundel Creek valley to allow for the southern cross-field taxiways.

The hydraulic model was tested for the one per cent AEP flood event. Figure B4.10 and B4.11 show the representative peak flood levels and maximum depths for the M3R development scenario condition in the one per cent AEP event.

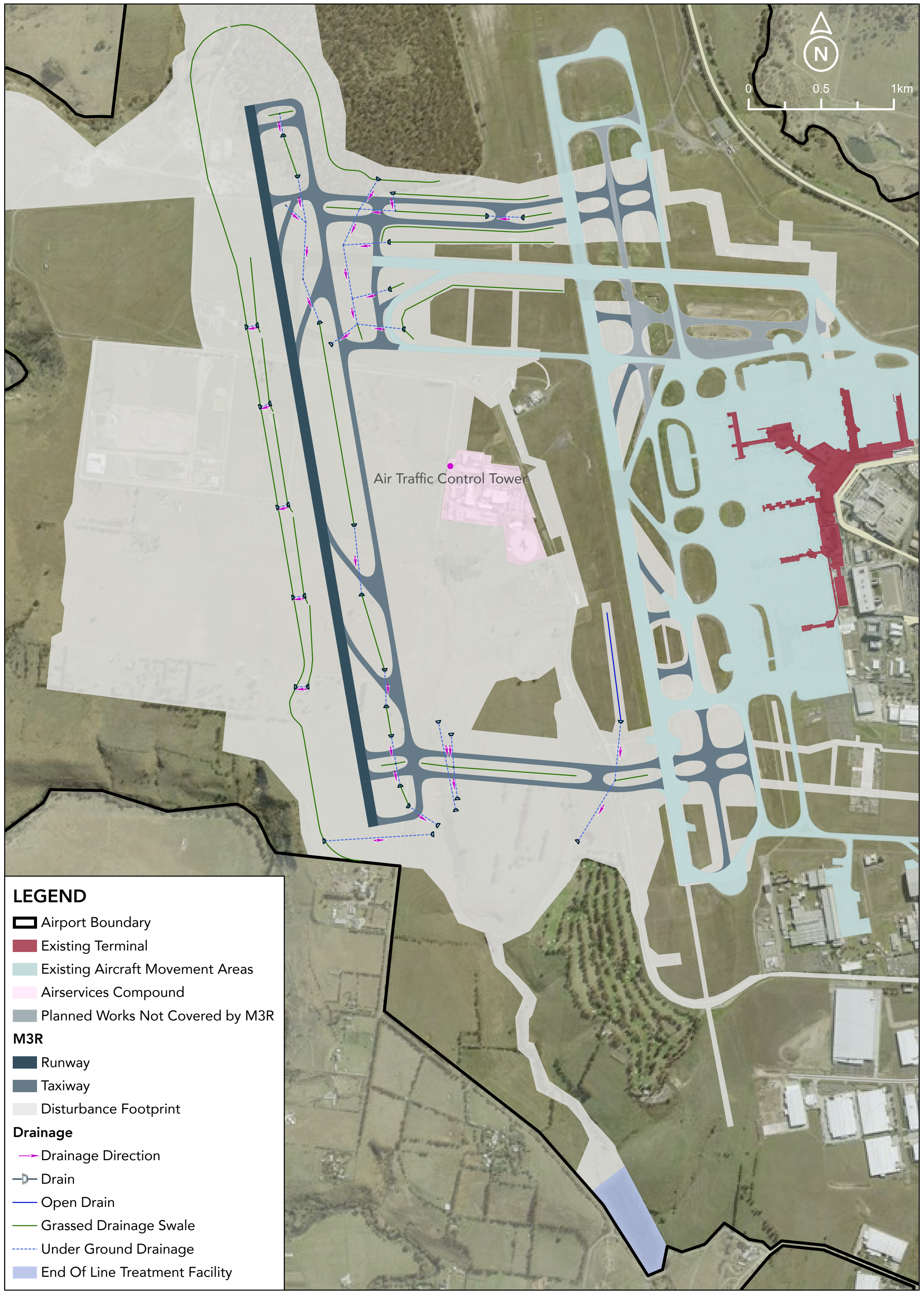
In general, the flooding and flow paths have been confined to the new swales and underground cross drainage through to the Arundel Creek culvert. Minor flooding is modelled to occur on existing runway 09/27 and adjacent Taxiway Echo. Modification to the preliminary swale and drainage system will be done during detailed design to eliminate any flooding in or near to paved areas.

Figure B4.8
Proposed development and catchment boundaries



Source: Modelled by Senversa using existing surface elevations sourced from Photomapping Project #5806, Melbourne Airport LiDAR Acquisition (8 March 2017) and finished design levels (BECA, 2020.

Figure B4.9
Indicative M3R stormwater network



Source: APAM

The drainage philosophy for M3R is to attenuate discharge rates to pre-development levels in Arundel Creek. The peak one per cent flows in the M3R development scenario are shown in Table B4.13; they are lower or comparable to the existing flow along Arundel Creek. Accordingly, the M3R development scenario is expected to control post-development flows to existing conditions. This has largely been achieved by using online grass swales located parallel to the new north-south runway (16R/34L).

Frequent flows

In addition to the rare flood events discussed in the previous sections, M3R will have implications for the more frequent rainfall runoff events at the airport. Increases in frequent flow events have the potential to impact receptor species in the receiving environment. Impacts on ecology are described in Chapter B5: Ecology.

B4.7.3 Water quality

B4.7.3.1 Proposed modifications and expected outcomes

Key operational stage changes resulting from the implementation of M3R include:

- Modification to catchment areas and drainage
- Increases in impervious area
- Modifications to land use.

The implementation of large areas of pavement associated with runways and taxiways will increase the ratio of impervious to pervious areas, and change the mixture of land use within the catchment. Expected water quality outcomes from these changes include:

- Hydrology – changes in the timing, frequency and volume of flow. Increases in flow volumes and rates generally increase the pollutant generation potential of a catchment.
- Water quality – changes in the quality of water and load of pollutant generated. Typically, low intensity uses (such as vegetated lands) generate lower quantities of pollutants in run-off, while higher intensity usage types (such as urban areas) generate significantly higher quantities of pollutant in run-off. Therefore, intensification of land use brought about through runway and taxiway development will generally increase a catchment's pollutant generation potential.

Table B4.13
Peak 1% Flows existing and M3R development scenario along Arundel Creek

Reporting locations	Critical duration	Median temporal pattern	1% AEP peak flows (m^3/s)
Existing Condition			
Downstream of ACO2	2 Hours	Temporal Pattern 2	36.94
Downstream of ACTO2	2 Hours	Temporal Pattern 2	6.66
Downstream of ACO3	2 Hours	Temporal Pattern 8	66.06
M3R Development Scenario			
Downstream of ACO2	2 Hours	Temporal Pattern 7	13.02
Downstream of ACTO2	1.5 Hours	Temporal Pattern 6	4.81
Downstream of ACO3	2 Hours	Temporal Pattern 7	57.77

Figure B4.10
Development scenario flood level 1% AEP

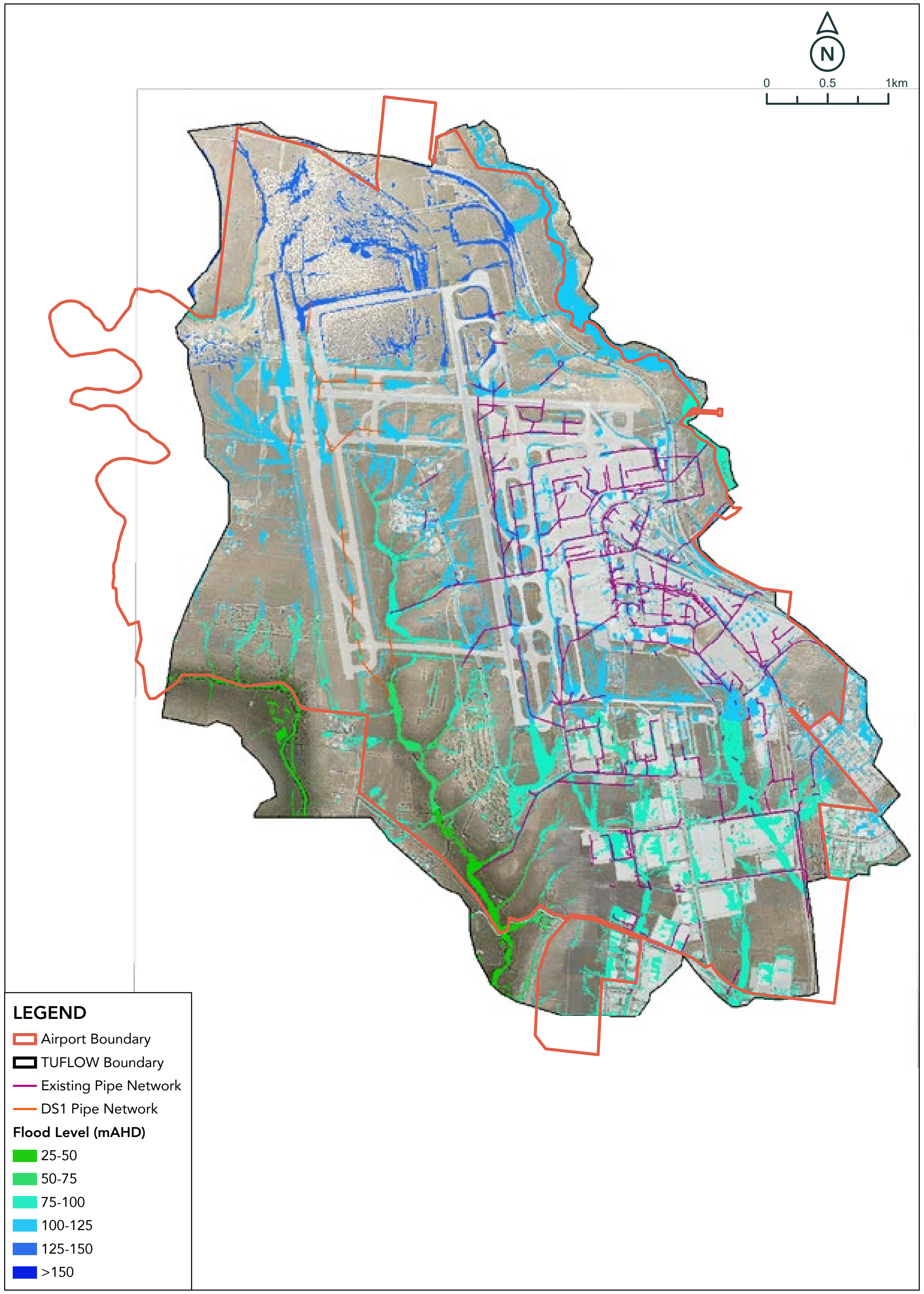
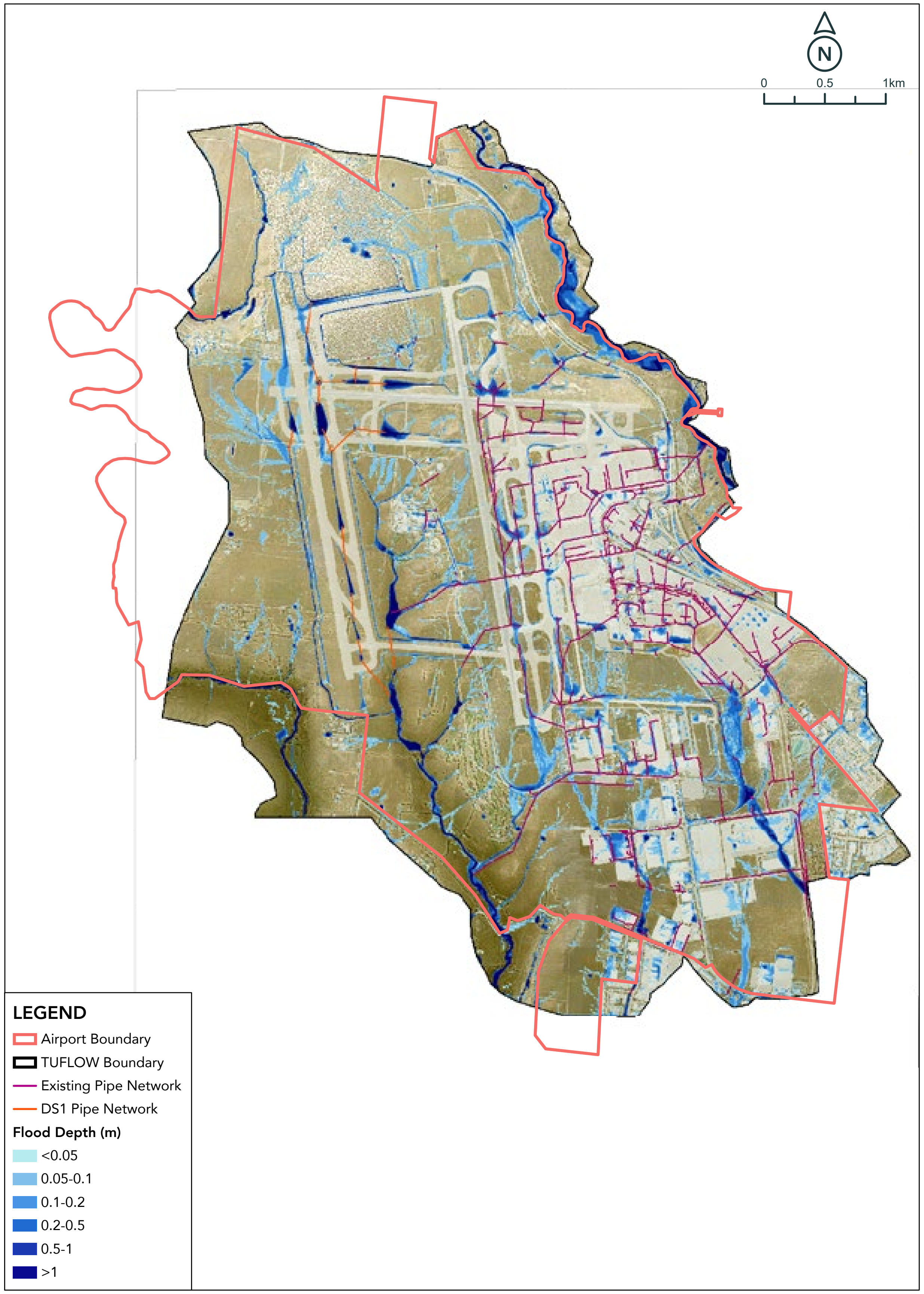


Figure B4.11
Development scenario flood depth 1% AEP



Source: BECA, 2020

B4.7.3.2
Quantification of changes and outcomes

The M3R stormwater design process included the following tasks. They were undertaken to refine design and assess potential impacts on pollutant loads and concentrations:

- Modelling of the proposed future case model *without* stormwater mitigation applied
- Modelling of the proposed future case model *with* stormwater mitigation applied.

In both models, the catchment extents are adjusted as necessary to reflect the modified landform, drainage and land use resulting from M3R.

Predicted impacts without mitigation

Table B4.14 provides the mean annual load for the M3R development without mitigation.

Table B4.14
Unmitigated developed mean annual pollutant loads

Parameter	Mean Annual Load (kg/y)
Gross pollutants (kg/y)	Not calculated
Total Suspended Solids	176e3
Total Phosphorous	594
Total Nitrogen	4.45e3

Source: BECA 2017

Gross pollutants have not been calculated. Melbourne Airport currently manages gross pollutants and Foreign Object Debris (FOD) as part of typical airfield and broader estate safety management. Management of gross pollutants will be expanded to cover the M3R development.

Without mitigation and management measures and controls, pollutant loads may increase from the existing site condition due to the implementation of M3R. These increases would result from the combination of increased flow (due to increased impervious catchment) and increased pollutant concentrations in run-off from surfaces that have undergone intensification. The combination of higher pollutant concentrations, particularly in event run-off and increased flow, provides for the increase in predicted mean annual load.

The predicted impacts of the flow and concentration increases in airport run-off include increased flow volume, peak flow and pollutant concentrations in Arundel Creek and the lower Maribyrnong River. Without mitigation, the impacts of the increased flows and pollutant loads would likely result in the deterioration of water quality in these waterways, thereby reducing current ecosystem and waterway social and cultural use values. Other impacts resulting from the increased flow could include geomorphic modifications within the receiving waterways as they adjust to modified hydrology and changes including sedimentation, reduced bank stability, and vegetation growth patterns.

In line with the Melbourne Airport Environment Policy and Melbourne Airport Environment Strategy, mitigation of these potential impacts will be further refined in the design phase of the project, and further refine the proposed Water Sensitive Urban Design (WSUD) treatment train outlined in this document.

Mitigation approach

A water quality and quantity control program based on WSUD principles is part of the M3R design process. The program is responsive to M3R design, and aims to mitigate the impacts of the development on the receiving environment.

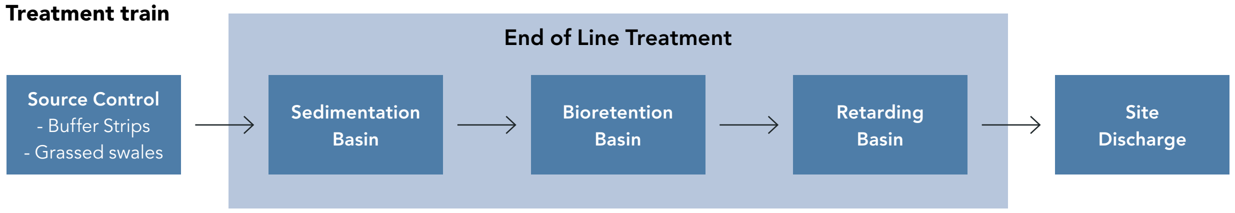
This treatment train approach of M3R will utilise a series of devices that operate to remove particular pollutants in the stormwater stream. The correct order and size of devices ensures they operate within their hydraulic loading capacities and can remove relevant pollutants.

Stormwater treatment systems proposed to be utilised are illustrated in Figure B4.12 and include:

- Buffer strips adjacent to the runways and taxiways
- Grass swales collecting and conveying stormwater
- Sedimentation basin
- Bio-retention systems
- Retardation basin.

The proposed arrangement of most of these treatment systems is shown in Figure B4.9 (note that buffer strips are not explicitly represented). In converting the conceptual stormwater design to a design for construction, all modelling assumptions will be confirmed during the detailed design phase.

Figure B4.12
Treatment train



Source: BECA 2020

The treatment train starts at the source: the runways and taxiways. Run-off from these surfaces sheet flows over buffer strips (essentially gently graded grassed area) adjacent to the impervious surfaces. The buffer strips are effective in removing coarse or medium-sized sediments. The configuration of the buffer strips in MUSIC represents the proposed M3R design.

Stormwater, having passed through the buffer strips, then enters into grassed swales, which act as both treatment and conveyance devices. The collection and slow movement of water along the swales promotes coarse- to medium-sized sediment fractions to settle and become entrained in the grass. Because the swales proposed as part of M3R are long (relative to typical urban development swales), the travel times for stormwater will generally be quite long. This provides ample time for treatment to be affected. While attenuation will be present within the swales, they will all be designed with appropriate grade to be free of standing water following rainfall events.

A sedimentation basin has been located downstream of ACO3, providing sedimentation removal potential for the full Melbourne Airport Arundel Creek catchment as part of the stormwater management treatment train. The sedimentation basin is expected to remove particles sized 125 µm or larger. The bioretention system will be located downstream of the sedimentation basin.

In addition to the sedimentation and bioretention basins, an appropriately sized retarding basin will be included to ensure peak flows are retarded back to existing condition peak flows. This will supplement the online attenuation provided by the grass swales and ensure there is no increase to peak flows downstream of the airport estate into Arundel Creek.

Analyte concentration information was unable to be used directly within the MUSIC modelling due to the spatial distribution of the water quality data. In lieu of direct use of the sampling data results, empirical relationships between Total Suspended Solids (TSS) and heavy metals will be relied upon for the qualification of heavy metal reduction. There is significant research and literature available exploring the correlation between TSS and heavy metal concentrations (Nasrabadi et al, 2018) - many studies demonstrate a positive correlation between the two. Studies also demonstrated that excellent removal of dissolved heavy metals can be expected through bioretention infiltration (Davis et al, 2003, Jianlong et al, 2017). Adsorption and filtration are the most dominant metal retention processes present within bioretention systems, with metals becoming largely immobile following bonding to bioretention media, and predominantly concentrated within the top layer of biofiltration media.

Specific pH management has not been included within the assessment. The pH of stormwater flows may be altered during the construction phase as a result of concrete installation and curing, some of this will be related to the proposed stormwater treatment train. Should non-conforming pH levels be observed during construction or operations, appropriate mitigation measures will be implemented.

Hydrocarbons are a common contaminant found within an airfield environment. Refuelling and maintenance activities on aircraft introduce the potential for fuel and oil spills that can become mobilised into the stormwater network. These activities are undertaken on the apron areas where there are a number of mitigation measures including flame traps, sumps and cut off valves should the spill enter the drainage network. These mitigation measures allow for an immediate and effective response to prevent hydrocarbons entering the natural waterways. Melbourne Airport has a mature and effective apron spill response procedure including dedicated airside personnel and equipment to minimise any potential spills to the draining network.

Large spill incidents and responses are managed in accordance with Melbourne Airport's Emergency Management Plan, which will be updated to incorporate changes associated with M3R. Similar to other end-of-line treatment of storm water at Melbourne Airport, during incidents, the outfall will be able to be blocked/ shut off to prevent release of contaminants and allow for clean-up on site, prior to allowing further discharge of storm water.

M3R conceptual design has ample additional space to increase the level of treatment beyond that currently achieved. This allowance provides assurance that, in the event that the revised modelling to be completed during detailed design indicates additional treatment is required, this can be accommodated within the extents of M3R. Specifically, modifications could be made to the swale to incorporate additional infiltration zones or bioretention systems to increase treatment performance. During design refinement, additional modelling will be able to account for new relevant information such as revised MUSIC modelling parameters, revised objectives values (e.g. load reductions or discharge concentration limits) and monitoring data as relevant to the assessments.

Once construction has commenced, there are additional controls which will be applied to ensure stormwater mitigation measures have been established correctly and are operating at design levels. During the maintenance period (extended for at least two years for vegetated stormwater controls) the following elements will be verified by the contractor:

- No water ponding in swales (for more than a couple of hours after rainfall flows have passed)
- Underflow drainage is working adequately
- Vegetation has established appropriately
- Water quality testing is in place at defined locations to verify the quality of inflows and discharges during rain events.

During the operational phase, continued monitoring and maintenance will be required by Melbourne Airport to ensure stormwater systems remain operational. Key elements for monitoring will include adequacy of vegetation coverage, adequacy of drainage and longer-term mechanisms for renewal of media in bioretention systems.

Predicted impacts

Discharge into Arundel Creek consists of flow from runways, taxiways, aprons, other paved areas, buildings and grassed areas. The proposed drainage system directs all runoff from within the M3R development into Arundel Creek and through the stormwater treatment train described previously.

Table B4.15 provides the mean annual loads from the developed site incorporating WSUD mitigation measures.

Table B4.15
M3R expected mean annual pollutant loads, mitigated and unmitigated

Parameter	Mean Annual Load (kg/y)	
	Unmitigated	Mitigated
Gross pollutants (kg/y)	Not calculated	Not calculated
Total Suspended Solids	176E3	95.0e3
Total Phosphorous	594	421
Total Nitrogen	4.45E3	3.01e3

Source: BECA, 2020

Gross pollutants have not been calculated. Melbourne Airport currently manages gross pollutants and FOD as part of typical airfield safety management. Management of gross pollutants will be expanded to cover the M3R development.

In reference to Table B4.15, Victoria Planning Provisions set an aspirational target for compliance for the developed mitigated site in pollutant load reductions. These provisions require development to achieve 80 per cent retention of TSS, 45 per cent retention of total phosphorous, 45 per cent retention of total nitrogen and 70 per cent retention of gross pollutants. The proposed stormwater design achieves these minimum targets for all pollutants (Table B4.16).

Table B4.16
M3R pollutant reduction performance

Parameter	% Reduction Level Targets	% Reduction Level
Total Suspended Solids	80	85.3
Total Phosphorous	45	61.2
Total Nitrogen	45	45.1

Source: BECA, 2020

B4.8 AVOIDANCE, MANAGEMENT AND MITIGATION MEASURES

The construction and operation of M3R will, without mitigation and management measures, impact surface water, water quality and quantity, and erosion potential.

The assessment primarily compares two main scenarios: the current scenario (effectively a No Build scenario or the baseline condition for the proposed M3R) and the opening day scenario post-construction of M3R when operation begins. The highest likelihood of impacts occurs from the commencement of construction to the point of operation. Beyond this point, there may be some minor increasing effects related to water quality (increases to pollutant loads) resulting from increased aircraft movements associated with increased usage of the airport.

B4.8.1 Erosion potential

Management and mitigation measures to effectively limit the risk of erosion during M3R will include industry standard requirements in addition to specific controls implemented based on site conditions. The specific details regarding implementation and monitoring of mitigation measures will be included in a Construction Environmental Management Plan (CEMP) developed for M3R following final design approval. This will be developed by an International Erosion Control Association Australasia specialist.

B4.8.1.1 Mitigation measures in design and construction

M3R details several design considerations (some or all of which will be implemented as mitigation measures following more detailed design stages) for management of potential erosion risk.

A Sediment and Erosion Control Plan will also be developed as part of the CEMP detailing mitigation measures specific to each significant aspect of the construction phase. While the detailed design and CEMP will detail specific mitigation measures, the following measures will be considered to minimise sedimentation impact to waterways:

- Minimisation of site disturbance and barrier fencing
- Gravelling of non-vegetated areas
- Grass buffer zones installed adjacent to waterways and swale drains
- Erosion control blankets to be installed in erosion-prone locations before vegetation is established
- Check dams and sediment traps can be installed in swales
- Rock filter dam installed in areas of high erosion potential and fast flowing water to reduce the water velocity and trap suspended sediment within the dam
- Sediment weir installed in areas of high erosion potential and fast flowing water to reduce the water velocity and trap suspended sediment within the dam
- Dust control to minimise wind erosion in locations prone to dust generation
- Filter socks to be placed around or adjacent to minor storm water inlets
- Vibration grids located in series at the exits of the site
- Large sediment basin.

Erosion can also be minimised by seasonal scheduling of construction works (where possible), revegetation, and rock or gravel placement over exposed soil roads or channels.

Effective implementation of the mitigation measures incorporated into design and construction will result in a low erosion risk following development. To ensure this risk remains low for future operation, physical features will be maintained and erosion potential will be considered for any future development.

B4.8.2 Surface water

B4.8.2.1 Mitigation in design

M3R design includes several mitigation measures inherent in the design (swales, bioretention zones and retention basins). These measures are shown to be effective in the reduction of M3R development impacts to existing flows. The approaches adopted are considered industry best practice and based on the available information. No further measures are required.

B4.8.2.2 Mitigation in construction

During the construction of M3R, there is a risk that a significant rainfall event could result in an increase to the existing condition discharges if the designed drainage infrastructure has not been completed.

This risk could occur if the construction of the new runway did not occur in parallel with the construction of the required drainage infrastructure (swales and retention basins). This risk is considered low due to the requirements to implement elements of this drainage infrastructure to manage the water quality during the construction process (CEMP). The CEMP will also include controls and management of dewatering where required to remove standing or stored water from the construction site following a rainfall event.

B4.8.3 Water quality

B4.8.3.1 Mitigation in design

M3R design has explicitly considered management of water, given its critical nature for safe airport operations. The design therefore includes best practice stormwater initiatives for the operational phase of M3R.

The conceptual stormwater treatment systems proposed to be utilised include:

- Buffer strips adjacent to the runways and taxiways
- Grass swales collecting and conveying stormwater
- Infiltration/bio-retention systems integrated into the grass swales.

In converting the conceptual stormwater design to a design for construction modelling, assumptions and approaches will be confirmed. This is also a best practice approach and provides the highest level of design certainty to Melbourne Airport and regulators.

All modelling limitations will be addressed during detailed design to refine and optimise the sizing and configuration of selected stormwater treatment measures. If required, device sizes will be increased to achieve the design requirements applied to M3R - there remains ample opportunity to do this within the current design configuration. The detailed design will be completed to applicable regulatory requirements.

B4.8.3.2 Establishment phase

Once construction has commenced, additional controls will be applied to ensure the stormwater mitigation measures have been established correctly and are operating at design levels. During the on-maintenance period (which could extend for at least two years for vegetated stormwater controls) the following elements will be verified by the contractor as part of the normal construction verification process:

- No water ponding in swales (for more than a couple hours after rainfall flows have passed)
- Underflow drainage is working adequately
- Vegetation has established appropriately.

B4.8.3.3
Operation

During the operational phase, continued monitoring and maintenance will be required to ensure that stormwater systems remain operational. Key elements for monitoring will include adequacy of vegetation coverage, adequacy of drainage and longer-term mechanisms for renewal of media in bioretention systems.

B4.8.3.4
PFAS

As discussed in **Chapter B3: Soils, Groundwater and Waste**, PFAS management is a minimum requirement for any construction work conducted at Melbourne Airport where disturbance of soil, groundwater or surface water is anticipated. The Melbourne Airport PFAS Management Framework (APAM, 2020) was developed to deliver consistent environmental management practices for potential environmental risks posed by PFAS impacted material on construction and maintenance projects at Melbourne Airport. The framework outlines the minimum environmental management requirements to be included in any project-specific CEMP. The current understanding of PFAS impacts and potential risks during construction is well understood, and APAM has a number of existing and effective management controls in place, both as part of wider estate management and as part of project-specific works. These include controls currently being implemented under other current construction projects with MDP approvals.

As PFAS impacts are widespread across the project area, a project-specific PFAS Management Strategy is proposed to be developed to provide a framework for how PFAS is to be managed to maximise re-use potential and protect human health and the environment.

The PFAS Management Strategy will be supported by a project-specific risk assessment to confirm that risks during works and longer-term risks are considered low and acceptable. Confirmation of management and remediation options (including further site investigations and detailed feasibility) will be required to be completed as part of detailed design works. These further investigations are primarily to confirm specific management measures and appropriate placement locations that can be integrated into the design and construction phases. An integrated approach during detailed engineered design will be required to confirm any proposed controls appropriately mitigate risks. CEMPs will be required to be aligned with the framework to be outlined in the PFAS Management Strategy.

The PFAS Management Strategy will inform the requirements for surface water controls that will need to be considered as part of the detailed design process, and potential treatment measures in addition to the treatment train that is proposed for other water quality parameters in the Arundel Creek catchment.

B4.9
CONCLUSION

Summary assessments of the impact of M3R on erosion, surface water and water quality (in accordance with the significance assessment frameworks in **Section B4.5**) are provided in **Table B4.17**, **Table B4.18** and **Table B4.19**.

B4.9.1
Erosion potential

The baseline site and soil conditions within M3R study area indicate a relatively low potential for erosion. Significant rainfall and wind conditions are offset by cohesive soils and established vegetation with generally flat or undulating topography throughout most of M3R study area. Localised areas of minor instability and potential erosion risk were identified within Arundel Creek.

The potential for increased erosion risk will be primarily associated with construction activities (including soil and vegetation stripping, bulk earthworks and development of temporary staging platforms). Effective mitigation measures to be implemented throughout the construction phase are considered capable of reducing erosion risk to acceptable levels. Specific strategies to control localised risks will be developed within the CEMP, which will reduce erosion potential in the central area of M3R to a negligible residual impact risk.

During the post-construction and operation phases of M3R, ongoing erosion risks are expected to be low, based on implementation of suitable management and maintenance (including inspections of drains, and maintaining vegetation and media along drains).

B4.9.2
Surface water

The proposed M3R project includes provision for the attenuation of flows from the airport due to the increased impermeable area. The modelling undertaken to date demonstrates that the Build peak flow discharges to the Moonee Ponds Creek, Arundel Creek and Maribyrnong River are all lower than the No Build levels. Furthermore, the modelling of Arundel Creek demonstrates that the infilling of the creek valley and addition of culverts to replace the conveyance of the creek at the alignment of the runway only results in minor flood level increases on the upstream side of the culvert, within the boundary of the airport land.

The modelling has demonstrated that there is no flood level increase in the one per cent AEP flood event downstream of the proposed culvert underneath the proposed runway (16R/34L) located on Arundel Creek. The impact risk for surface water is considered low.

The proposed design will be checked against additional modelling requirements as part of later design phases.

B4.9.3
Water quality

Melbourne Airport is located on Commonwealth land but ultimately discharges stormwater to waterways outside the airport which fall under Victorian Government jurisdiction. It is important to consider these waterways as part of a holistic approach to environmental management. The environmental operations of the airport are regulated under the *Airports Act* and the *Airport Regulations*. Desired environmental conditions of receiving waterways are stipulated under Victorian legislation including the Environmental Reference Standard (Vic).

Water quality discharging from the airport does not currently meet all *Airport Regulations* and Environmental Reference Standard (Vic) quality objectives. This is not an uncommon issue: many quality objectives are also not met in the broader catchment areas. However, M3R presents an opportunity to improve surface water discharge quality, particularly from Arundel Creek which is the main discharge point for the airport.

In addition to improvements to the drainage network and the proposed end-of-line treatment train for Arundel Creek, additional measures will be developed as part of the proposed PFAS Management Strategy. The PFAS Management Strategy will incorporate a whole-of-project approach to PFAS management: from source management to mitigation of surface water impacts discharging off-site.

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Table B4.17
Impact assessment summary – erosion

Environment aspect & baseline condition	Original Impact	Mitigation inherent in design/practice	Duration	Severity	Likelihood	Impact	Mitigation and/or management measures	Residual Impact	Duration	Severity	Likelihood	Impact
Construction							**Construction (cont.)**					
Erosion potential in the M3R study area Low potential for erosion due to soil conditions generally comprising fine-grained basaltic clay with overlying topsoil and established vegetation.	Increase in erosion potential during placement of large earthworks platform and haul roads.	Proposed lime stabilisation of exposed clay surface during construction. Appropriate material handling and transport procedures. Other potential stabilisation tools to consider include soil binders/hydromulch and mulch.	Short Term	Moderate	Likely	Medium	Further analysis of staging plans to limit exposed area, and streamline material handling. Development of specific sediment and erosion control plan within the EMP.	Some sediment run-off during material handling and placement.	Short Term	Negligible	Likely	Negligible
	Degradation of existing surface leading to sediment release from topsoil/ vegetation stripping and bulk excavation for fil reuse.	Appropriate drainage controls to manage overland surface water flow across excavated areas. Renovation (ripping and/or topsoil reinstatement) of exposed surface prior to revegetation.	Short Term	Minor	Possible	Low	No management measures in addition to those inherent to design/practice area required.					
	Erosion and release of soils from stockpiles and temporary work areas.	Controlled placement, compaction and shaping of stockpiled material to protect from surface water loading/run-off. Topsoil coverage and vegetation of long-term stockpiles. Dust suppression methods.	Temporary	Minor	Possible	Low	No additional mitigation or management measures in addition to those inherent to design/practice area required.					
Erosion potential along creek embankments Some areas of existing instability observed and potential for additional erosion occurrence due to steep slopes and presence of alluvial and colluvial sediments.	Erosion events and release of sediment during modification of embankments and development of work platforms/structure.	Excavation and/or stabilisation of areas of instability within M3R. Temporary controls including bunds, silt fences and toe of slopes.	Temporary	Moderate	Possible	Medium	Appropriate staging to undertake works with increased risk during lower rainfall/surface water flow periods. Effective engineering controls (e.g. suitable batter slopes, shoring, retention walls, stormwater drainage) confirmed in final design.	Minor sediment release during modification of embankments and development of work platforms/ structures during construction.	Temporary	Minor	Possible	Low
Operation							**Operation (cont.)**					
Erosion potential in the M3R study area Low potential for erosion due to soil conditions generally comprising fine-grained basaltic clay with overlying topsoil and established vegetation.	Increase in erosion potential via surface loading from reduction of pervious surface.	Suitable revegetation of non-paved areas. Design of appropriate run-off management including culverts, buffer strips and grass swales.	Long Term	Minor	Possible	Low	No additional mitigation or management measures in addition to those inherent to design/practice area required.					
Erosion potential along creek embankments Some areas of existing instability observed and potential for additional erosion occurrence due to steep slopes and presence of alluvial and colluvial sediments.	Increase in erosion potential of existing embankments from surface loading and increased frequent flows.	Stabilisation methods including revegetation, reinforced soil structure, geofabrics and riprap and modification of embankment slopes.	Long Term	Minor	Possible	Low	No additional mitigation or management measures in addition to those inherent to design/practice are required.					

Table B4.18
Impact assessment summary – surface water

Environment aspect & baseline condition	Assessment of original impact: Original Impact	Mitigation inherent in design/practice	Significance: Duration	Severity	Likelihood	Impact	Mitigation and/or management measures	Assessment of residual impact: Residual Impact	Significance: Duration	Severity	Likelihood	Impact
Flood conditions in the Arundel Creek Current peak discharges have been determined for the Arundel Creek Modelling has demonstrated the current flooding conditions.	Increased flow rates from site due to increased impervious surfaces resulting in increased flood levels.	Use of swales to attenuate the discharge back to existing conditions.	Temporary	Negligible	Almost certain	Low	No additional mitigation or management measures in addition to those inherent to design/practice are required.					
	Increased flood velocities due to concentrated discharge from outlets and culverts.	Use of energy dissipaters at outlet structure to reduce outlet velocity.	Temporary	Negligible	Almost certain	Low	No additional mitigation or management measures in addition to those inherent to design/practice are required.					
	Increased flood levels upstream of the airport.	Use of retention basins and storage to maintain discharges to existing conditions.	Temporary	Negligible	Almost certain	Low	No additional mitigation or management measures in addition to those inherent to design/practice are required.					
	Increased flow rates from increased impervious surfaces decreasing the performance of existing drainage.	Upgraded drainage elements and additional drainage elements.	Temporary	Negligible	Almost certain	Low	No additional mitigation or management measures in addition to those inherent to design/practice are required.					

Table B4.19
Impact assessment summary – water quality

Environment aspect & baseline condition	Assessment of original impact: Original Impact	Mitigation inherent in design/practice	Significance: Duration	Severity	Likelihood	Impact	Mitigation and/or management measures	Assessment of residual impact: Residual Impact	Significance: Duration	Severity	Likelihood	Impact
Construction							**Construction (cont.)**					
Water quality in all waterways within or downstream of the airport.	Existing waterways both within project area and the receiving waters show some exceedances of water quality objectives, including physico-chemical, nutrients, and toxicants.	Construction Environmental Management Plans will identify risks associated with planned construction activities and higher level risks will be mitigated through explicit controls on machinery, products or construction practices. The CEMP will also detail monitoring requirements and define an inspection/ audit program.	Short Term	Moderate	Possible	Medium	No additional mitigation or management measures in addition to those inherent to design/practice are required. Airport wide monitoring programs commissioned directly by APAM will provide an additional level of monitoring throughout the project duration.		Short Term	Moderate	Possible	Medium
Operation							**Operation (cont.)**					
Post construction water quality conditions – non-PFAS.	Existing waterways both within project area and the receiving waters show some exceedances of water quality objectives including physico-chemical, nutrients, and toxicants.	Surface runoff from M3R will increase flow in Arundel Creek. Current stormwater guidance associated with new construction projects will provide improvements to current stormwater network, particularly in Arundel Creek. This includes use of swales, bio-retention swales, buffer strips or similar to mitigate increases in pollutant loads	Long Term	Minor	Likely	Medium	Refinement of the model during detailed design phase to address existing modelling assumptions to ensure an optimised outcome that is fit for purpose.	Sufficient space exists to include additional stormwater treatment to ameliorate impacts under normal operations. A residual risk will remain from extenuating circumstances (major disaster/emergency, force majeure etc) that are not part of general operational activities.	Long Term	Beneficial	Likely	Beneficial

Chapter B5
Ecology

Summary of key findings:

- The project will have impacts on 78.74 hectares of Grey Box Woodland (intact woodland and derived grassland), 97.89 hectares of Natural Temperate Grassland of the Victorian Volcanic Plain, 9.75 hectares of Golden Sun Moth habitat, 64.34 hectares of Growling Grass Frog habitat and 68.02 hectares of Swift Parrot habitat
- Mitigation measures will be implemented through the Construction Environmental Management Plan to reduce impacts where possible
- An offset management strategy has been prepared. This identifies offsets to compensate for the residual significant impact on threatened species and ecological communities, in accordance with the EPBC Act Offsets Policy.

CHAPTER B5 CONTENTS

CHAPTER B5 CONTENTS (cont.)

CHAPTER B5 FIGURES

CHAPTER B5 TABLES

CHAPTER B5 TABLES (cont.)

CHAPTER B5 PLATES

B5.1 INTRODUCTION

B5.1.1
Context

This chapter reports on the ecological values present within Melbourne Airport's Third Runway (M3R) project area. It outlines the ecological survey methods; details the findings of the surveys; and provides a significance assessment of the project's likely impacts on threatened species, ecological communities, listed migratory species and relevant ecological features on Commonwealth land.

Implications for the project were assessed in relation to key Commonwealth biodiversity legislation and policy. The ecological assessments described in this chapter were undertaken for Australia Pacific Airports (Melbourne) Pty Ltd (APAM) by Biosis Pty Ltd.

The ecological assessments described in this chapter were completed to fulfill the requirements of the *Airports Act 1996* (Airports Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). These are the key pieces of Commonwealth environmental legislation under which Melbourne Airport operates. Although the Airports Act does not define what a significant environmental or ecological impact is, the EPBC Act gives guidelines for assessing impacts to Matters of National Environmental Significance (MNES) and the environment on Commonwealth land.

All ecological assessments for the project were undertaken in accordance with Commonwealth survey guidelines; and with reference to the listing advice for threatened species, ecological communities and migratory species.

B5.1.2
Project area description

The M3R project area is approximately 834 hectares in size. It includes Commonwealth and freehold land owned and/or controlled by Melbourne Airport in Tullamarine, Victoria, that is approximately 19 kilometres north-west of Melbourne's Central Business District (**Figure B5.1**).

The project area is located within the:

- Victorian Volcanic Plain and Central Victorian Uplands bioregions
- Catchment area of:
  - Maribyrnong River
  - Arundel Creek
  - Moonee Ponds Creek
  - Steele Creek and Steele Creek North
  - Management area of Melbourne Water (waterways)
- City of Hume (freehold land portions).

The project area supports a range of land uses including:

- Airside: active operational airfield containing runways, taxiways and other infrastructure associated with operation of the airfield. This area is predominantly a highly modified and managed environment
- Landside: various uses including carparks, business park, terminals, undeveloped areas, roads, concrete-recycling plants, grazing land, dams, waterways, drainage lines, stockpile sites and a golf course. This land ranges from highly modified to relatively intact (e.g. some waterways and woodland habitats are intact).

B5.1.2.1
Impact area description

The impact area (**Figure B5.1**) is approximately 772 hectares in size. It includes land within the project area not subject to existing approvals for the Taxiway Zulu and Northern Access Road development.

B5.1.2.2
Description of areas not assessed

Landside area not assessed

The 'landside area not assessed' (**Figure B5.1**) includes approximately 65.5 hectares of land landside not subject to field assessments under the current assessment.

This area was included in the project area after completion of the detailed M3R field assessments in the 2019-20 spring/summer season. Because its ecological values are therefore unknown, potential impacts cannot be determined and are not included in this report's calculations.

Airside area not assessed

The 'airside area not assessed' (**Figure B5.1**) includes approximately 18.28 hectares of land inaccessible during the field assessments.

In these areas the extent and condition of native vegetation and MNES was estimated or assumed. These estimates and assumptions are included in this report's impact and offset calculations.

B5.2 METHODOLOGY AND ASSUMPTIONS

This section provides a summary of the methods used during the ecological assessments. Detailed survey methods for targeted surveys and native vegetation assessments can be found in **Appendix B5.A**.

Desktop assessments were initially undertaken to inform the level of field investigation required to assess the project with regard to key Commonwealth biodiversity legislation and policy.

B5.2.1
Desktop assessment

B5.2.1.1 Climate, soil, geomorphology and land use history (physical conditions)

Climate, soils, geomorphology and the history of land use within the project area have influenced the type, extent and condition of native vegetation and habitat that is present.

A review of these influences formed part of the assessment of Ecological Vegetation Classes (EVCs), threatened species habitat, listed Threatened Ecological Communities (TECs) and listed migratory species habitat – either within the project area or with the potential to occur in it.

The following resources formed the basis of the physical conditions review (**Figure B5.2** to **Figure B5.8**):

- Historic subdivision plans of the Parish of Tullamarine drafted by government surveyors (Kemp, 1840; Doll c.,1849; Hoddle, 1850)
- Historic maps of Sunbury prepared by the Commonwealth Government's Department of Defence (DoD, 1915; DoD, 1938)
- Historic photo map of Sunbury, produced by the Victorian Government's Department of Crown Lands and Survey (DCLS, 1946)
- An inventory of sites of botanical significance in the western region of Melbourne (McDougall, 1987)
- EVC modelling as displayed on the Victorian Government Department of Environment Land Water and Planning's (DELWP's) NatureKit (DELWP, 2020)
- Geological data including the 1:63.360 Geological Survey of Victoria (Mines Department, 1973), 1:250,000 Geological Survey of Victoria (Mines Department, 1970; DNRE, 1997) and geological mapping inferred from geological testing performed as part of the M3R project (Senversa, 2020, unpublished)
- Climate data from the Commonwealth Government's Bureau of Meteorology (BoM) which maintains an active weather station at Melbourne Airport.

Figure B5.1
Location of the Melbourne Airport's Third Runway project and impact area

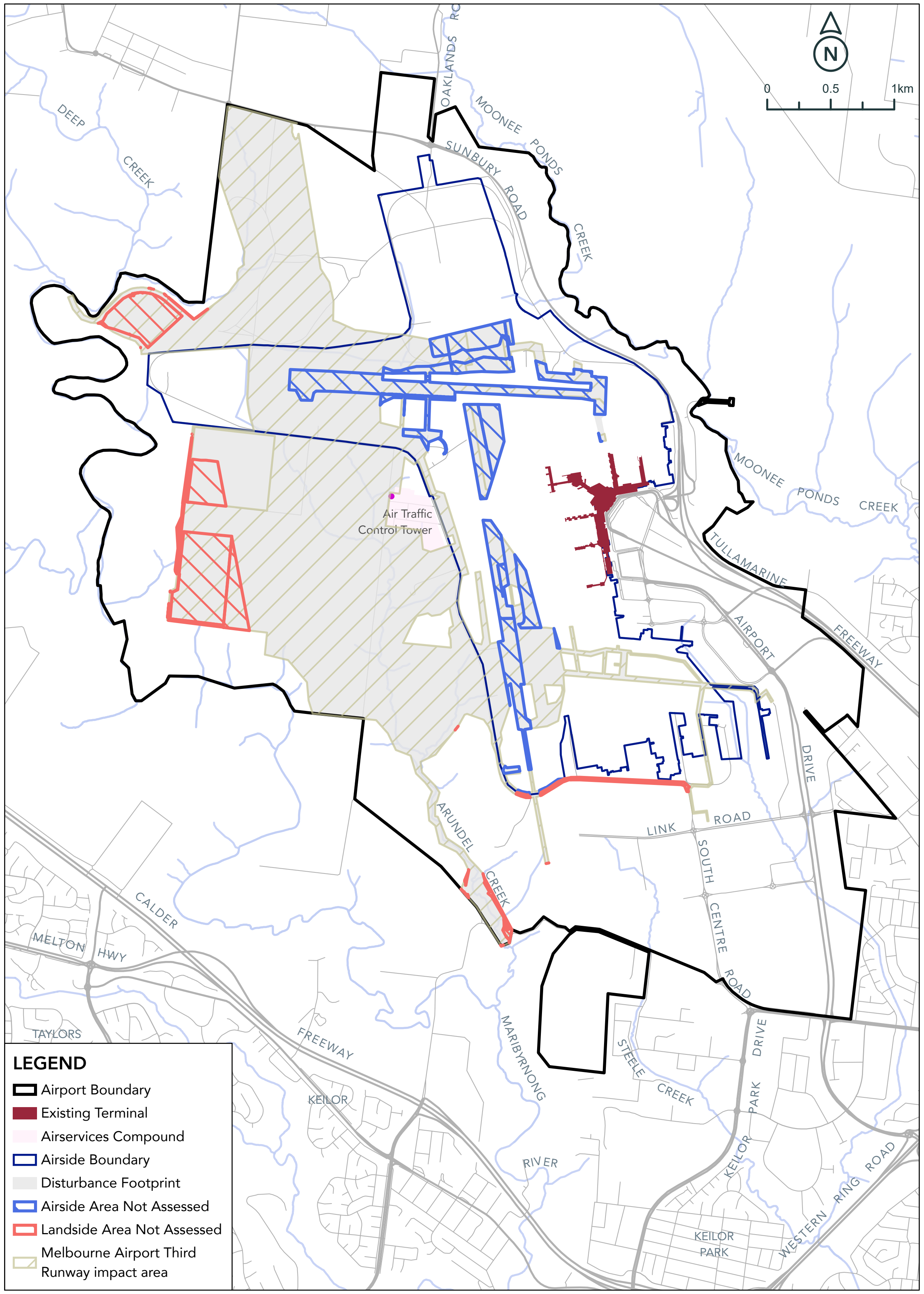


Figure B5.2
1840 historic plan of the Parish of Tullamarine (Kemp, 1840) overlaid with contemporary mapping (Biosis, 2019-2020)

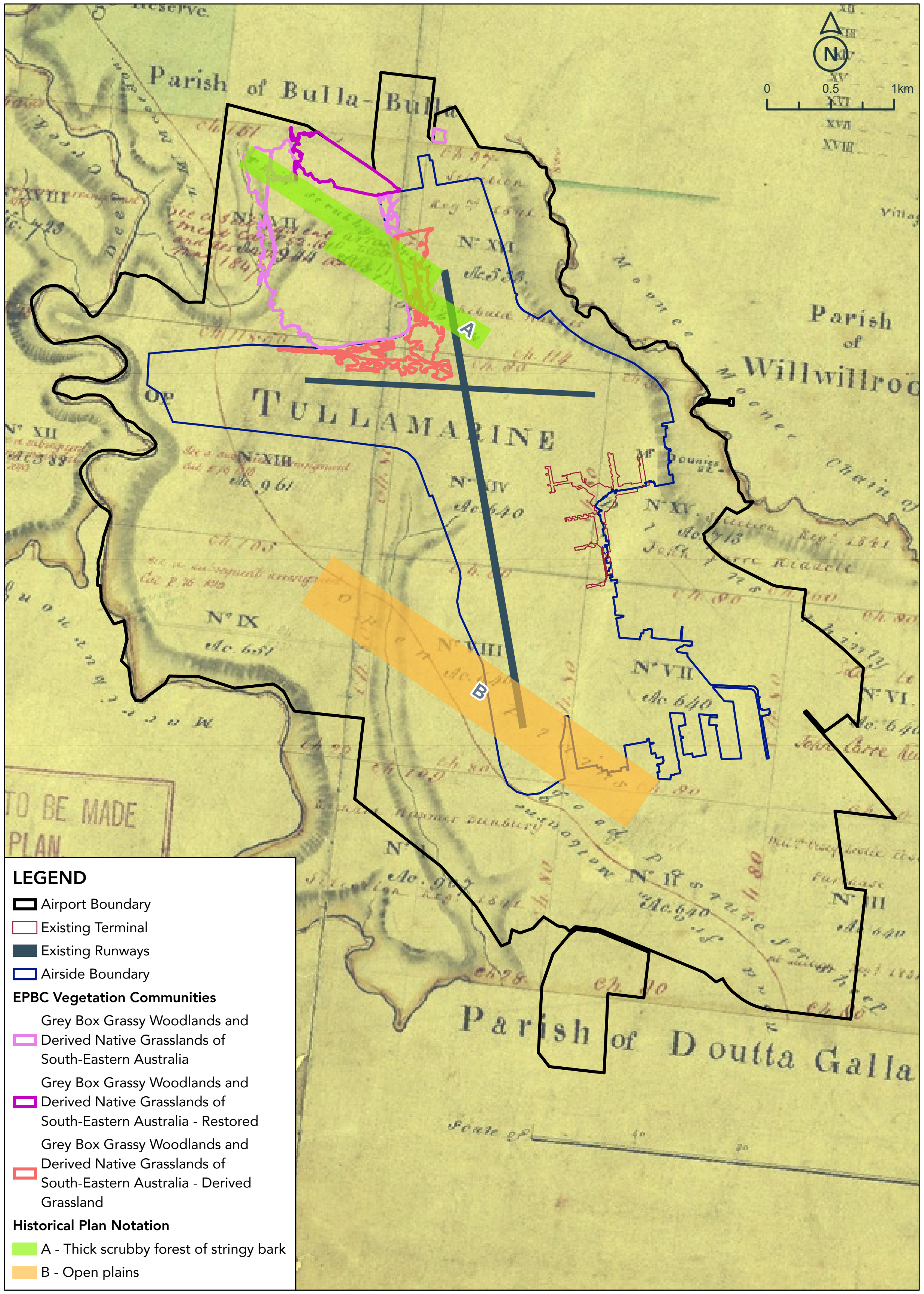


Figure B5.3
c.1849 historic subdivision plan of the Parish of Tullamarine (DoL, c.1849) overlaid with contemporary mapping (Biosis, 2019-2020)

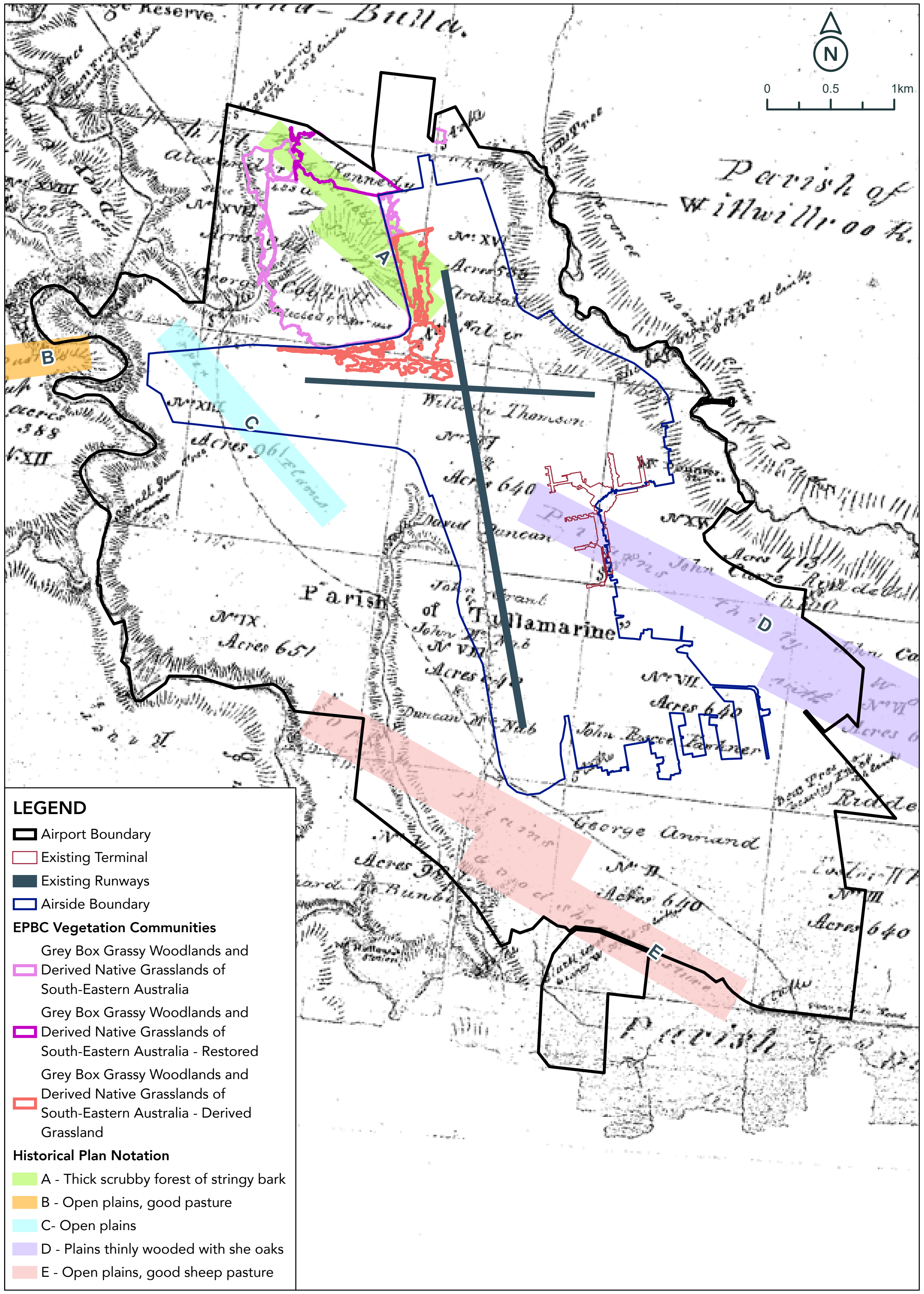


Figure B5.4
1850 historic subdivision plan for the Parish of Tullamarine (Hoddle, 1850) overlaid with contemporary mapping (Biosis, 2019-2020)

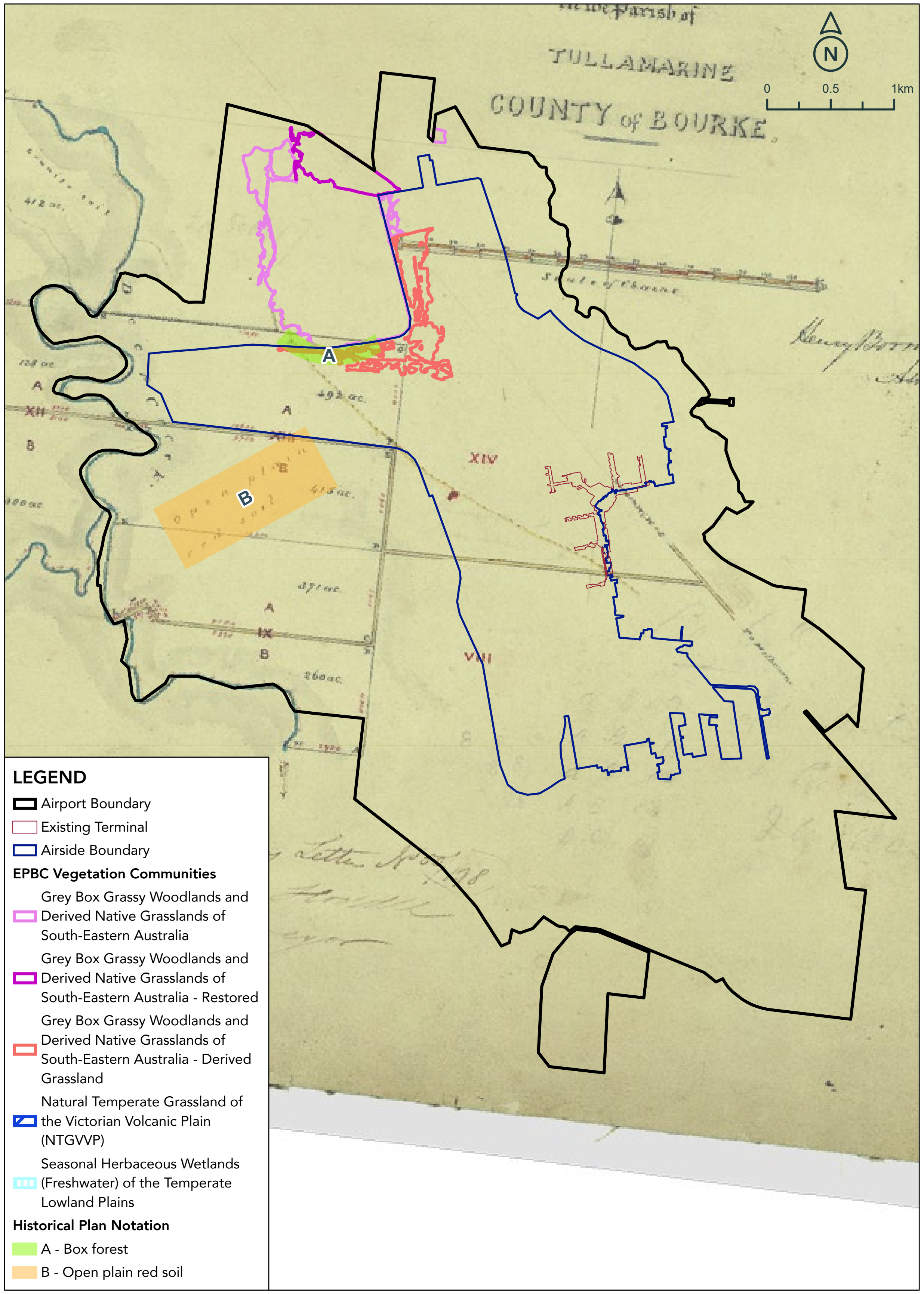


Figure B5.5
1915 historic map of Sunbury (DoD, 1915) overlaid with contemporary mapping (Biosis, 2019-2020)

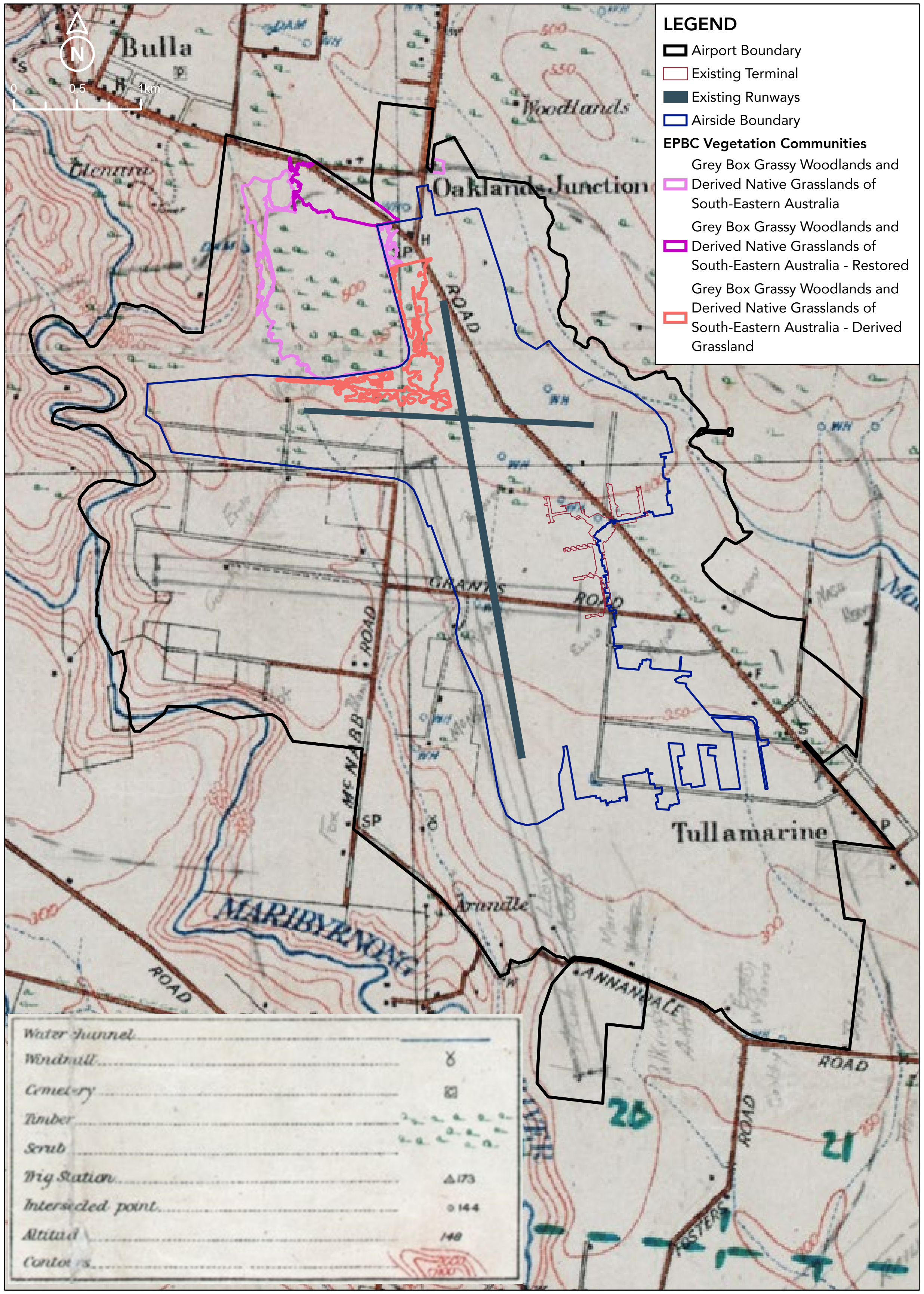


Figure B5.6
1938 historic map of Sunbury (DoD, 1938) overlaid with contemporary mapping (Biosis, 2019-2020)

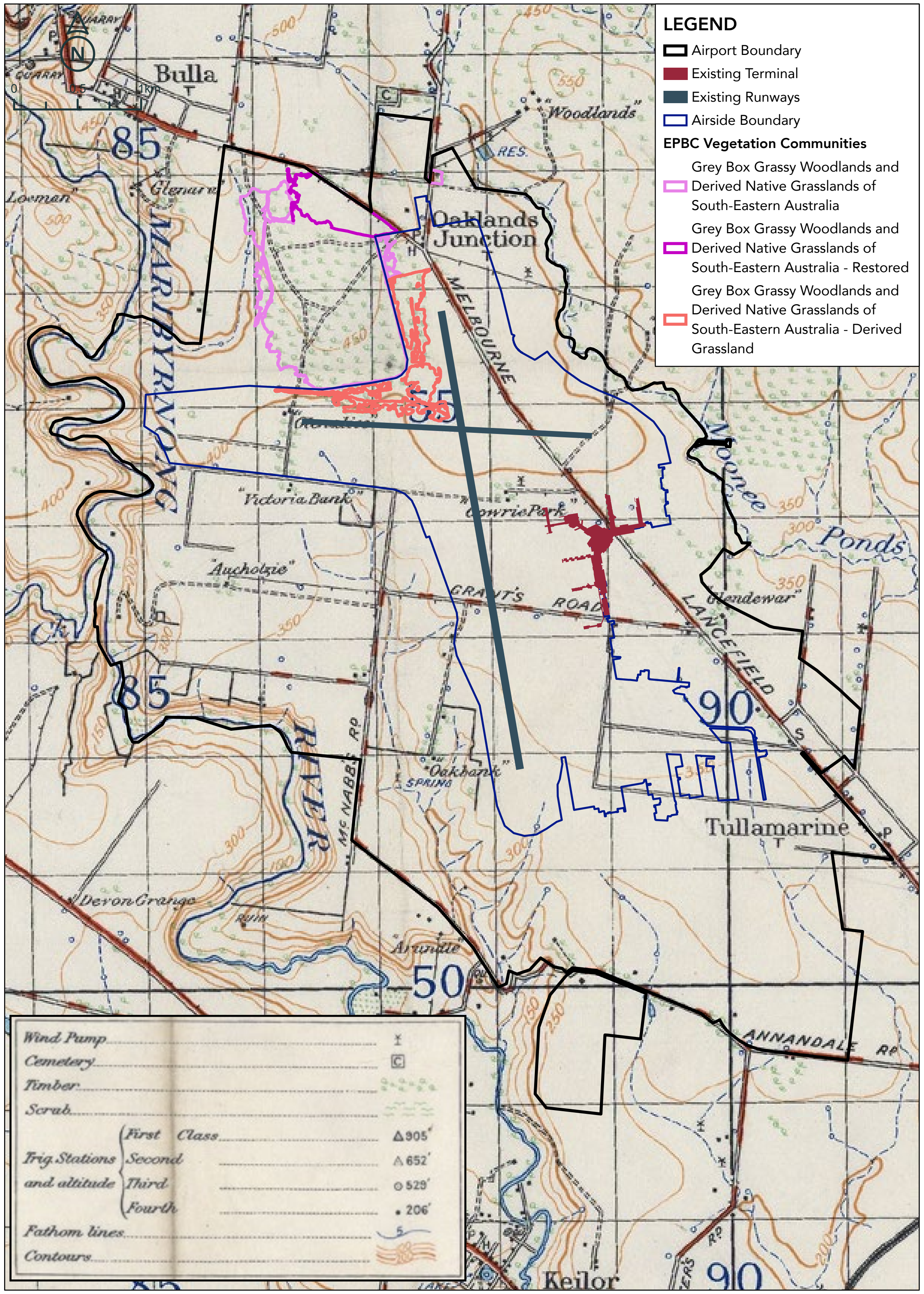


Figure B5.7
1946 historic photo map of Sunbury (DCLS, 1946) overlaid with contemporary mapping (Biosis, 2019-2020)

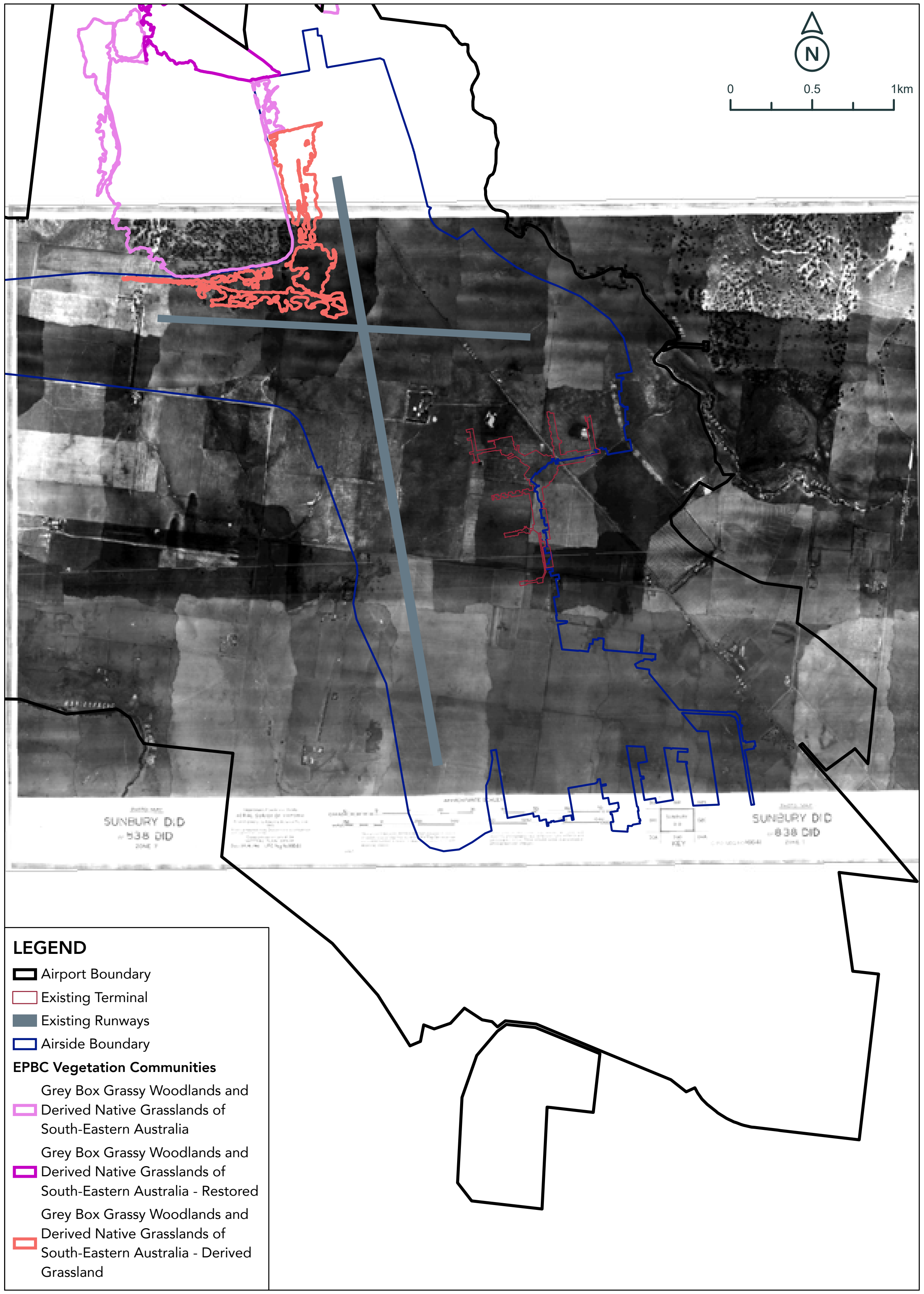
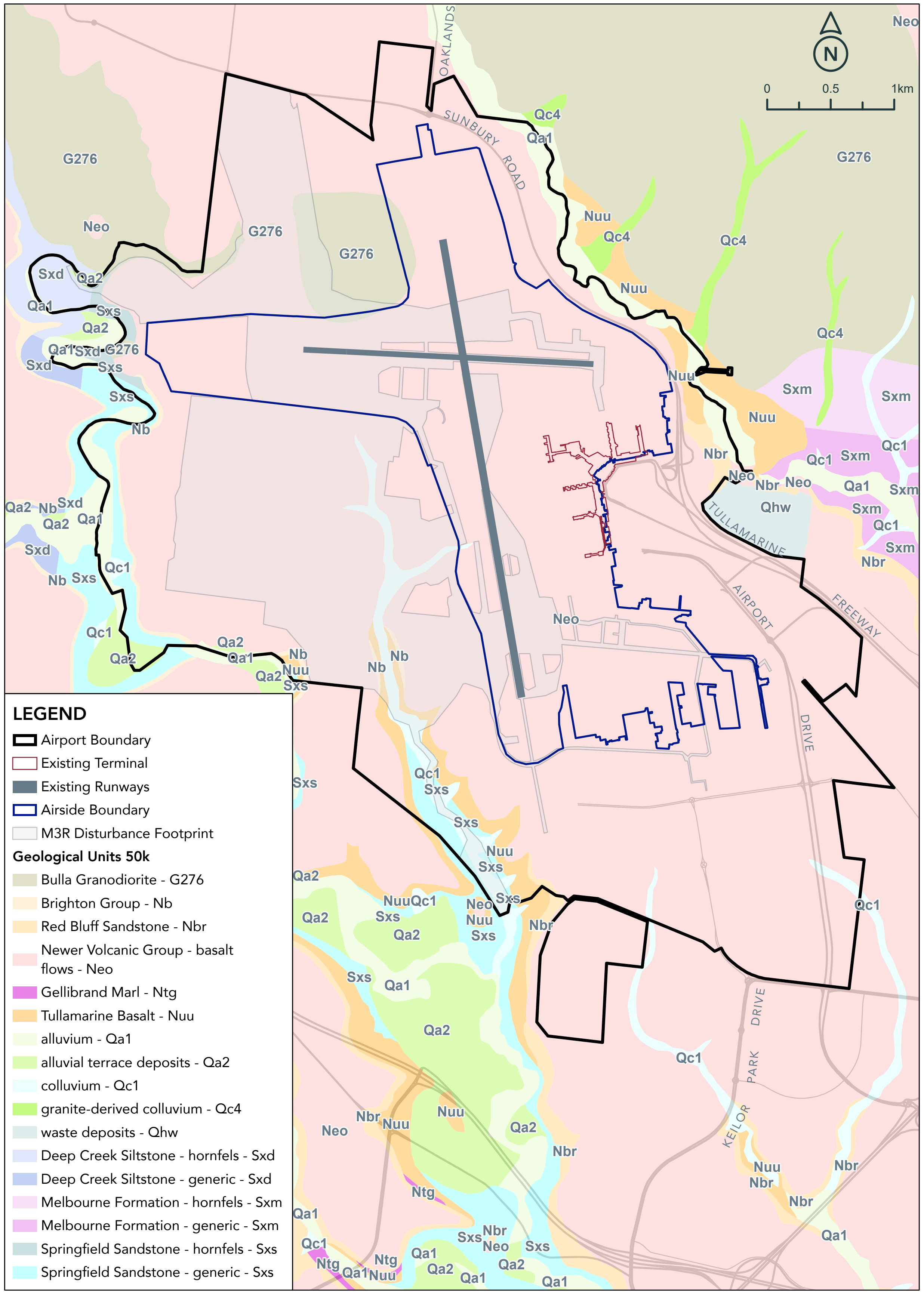


Figure B5.8
Geological features of the M3R project area overlaid with contemporary woodland mapping (Biosis, 2019-2020)



B5.2.1.2
Determining natural values for assessment

Preliminary desktop assessments identified the key threatened species, TECs, listed migratory species and other natural values (such as native vegetation) with the potential to be present within the project area. Natural values were identified based on:

- Their known occurrence within the Victorian Volcanic Plain and Central Victorian Uplands bioregions (e.g. the TEC Natural Temperate Grassland of the Victorian Volcanic Plain)
- Database records within 10 kilometres of the centre of the project area
- Previous ecological investigations in and around the project area (see **Figure B5.9** to **Figure B5.14**) including:
    - An inventory of sites of botanical significance in the western region of Melbourne (McDougall, 1987)
    - Vegetation mapping of the Port Phillip and Westernport region (Oates and Taranto, 2001)
    - A flora and fauna assessment for much of Melbourne Airport for the Runway Development Program (Biosis, 2015)
    - Vegetation mapping at Melbourne Airport in financial year 2019 (Biosis, 2019a)
    - Fauna survey program for Hume City Council (Biosis, 2016a)
    - Initial habitat hectare and net gain assessment of the Grey Box Woodland (GAGIN, 2007)
    - Biodiversity assessment for Taxiway Zulu and Northern Compound (Biosis, 2016b)
    - Melbourne Airport Ecology gaps study report (Biosis, 2018a)
    - Melbourne Airport Elevated Road MDP Specialist Study: Flora and Fauna (Biosis, 2013a)
    - Melbourne Airport Grey Box Woodland Environmental Management Plan and associated monitoring reports (Biosis, 2013b; 2014; 2016b; 2017; 2018b)
    - Striped Legless Lizard *Delma impar* survey Melbourne Airport Business Park (Biosis, 2014b)
    - Golden Sun Moth *Synemon plana* surveys by GAGIN (GAGIN, 2008; 2009; 2010)
    - Swift Parrot *Lathamus discolor* surveys (Steele & Peter, 2019)
    - Grey-headed Flying Fox *Pteropus poliocephalus* surveys (Ecology & Infrastructure International, 2018)
    - Sites of Faunal Significance in the Western Region of Melbourne (inland of Princes Freeway) (Beardsell, 1991)
    - Financial year 2019 Growling Grass Frog *Litoria raniformis* surveys (Biosis, 2019b, unpublished)
    - Financial year 2010 Golden Sun Moth habitat survey (Biosis, 2019c).

In addition, searches of the following databases and online tools were undertaken:

- DELWP's Victorian Biodiversity Atlas (VBA) including the VBA_FLORA25, FLORA100 & FLORA Restricted and VBA_FAUNA25, FAUNA100 & FAUNA Restricted datasets (accessed for preliminary desktop assessment on 12 July 2019, on 11 March 2020 and 26 July 2021 for this report)
- Department of Agriculture, Water and the Environment (DAWE's Protected Matters Search Tool (PMST) for MNES protected under the EPBC Act (accessed for preliminary desktop assessment on 12 July 2019, and on 11 March 2020 and 26 July 2021 for this assessment) [MA: suggest tidy up report references e.g. 'on 11 March 2020 report']
- Birdlife Australia New Atlas database (accessed 17 March 2020).

Following the database searches, threatened species, TECs and listed migratory species were categorised as having a negligible, low, medium or high likelihood of occurring within the project area; or, if a species was observed during field surveys, as having been recorded within the project area.

These categorisations were determined with reference to surrounding records of the species, expert knowledge of the species ecology, and knowledge of the habitat types present in the project area. The rationale is provided for each species in **Appendix B5.B** and **Appendix B5.C**. Those species or TECs for which there is little or no suitable habitat within the project area were assigned a likelihood of low or negligible and not considered further. Natural values subject to further assessment are listed below.

Species listed as threatened under the EPBC Act were subject to detailed targeted field surveys if all the following criteria were met:

- The species had not been previously recorded anywhere at Melbourne Airport despite suitable habitat being present

and

- There were parts of the project area where no targeted surveys were known to have taken place despite suitable habitat being present (e.g. recently acquired land)

and

- Where survey data was considered outdated (i.e. more than three years since last survey)
- The species was considered to have a medium to high likelihood of occurring within the project area
- There was potential for the project to have a significant impact on the species.

The purpose of targeted field surveys was to establish the presence or absence of the species or TEC, and to better understand a species' use of habitat across the project area.

No targeted field surveys were undertaken for FFG Act-listed flora, fauna or TECs.

Figure B5.9
Striped Legless Lizard (SLL) previous surveys – Melbourne Airport

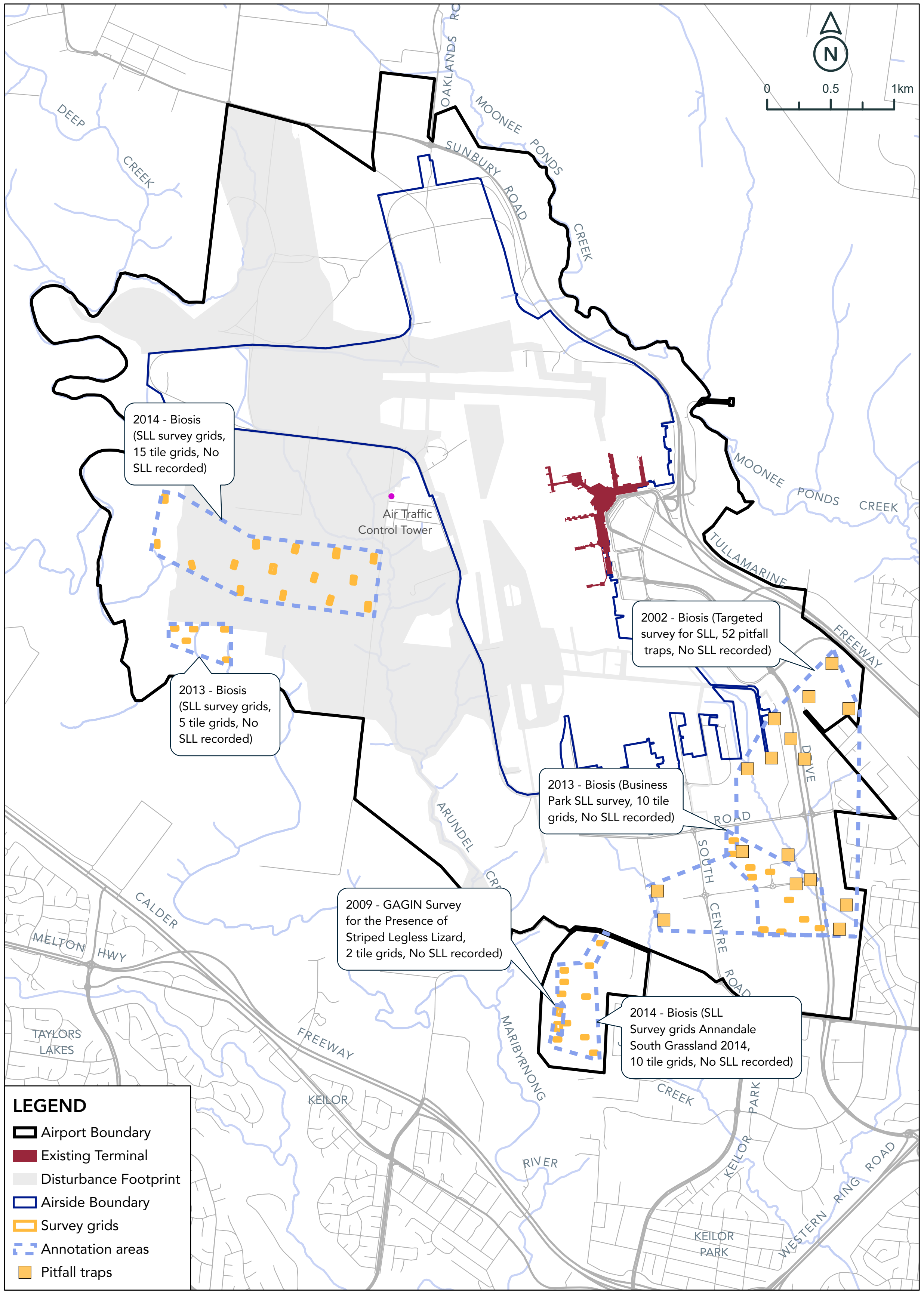


Figure B5.10
Golden Sun Moth (GSM) previous surveys – Melbourne Airport

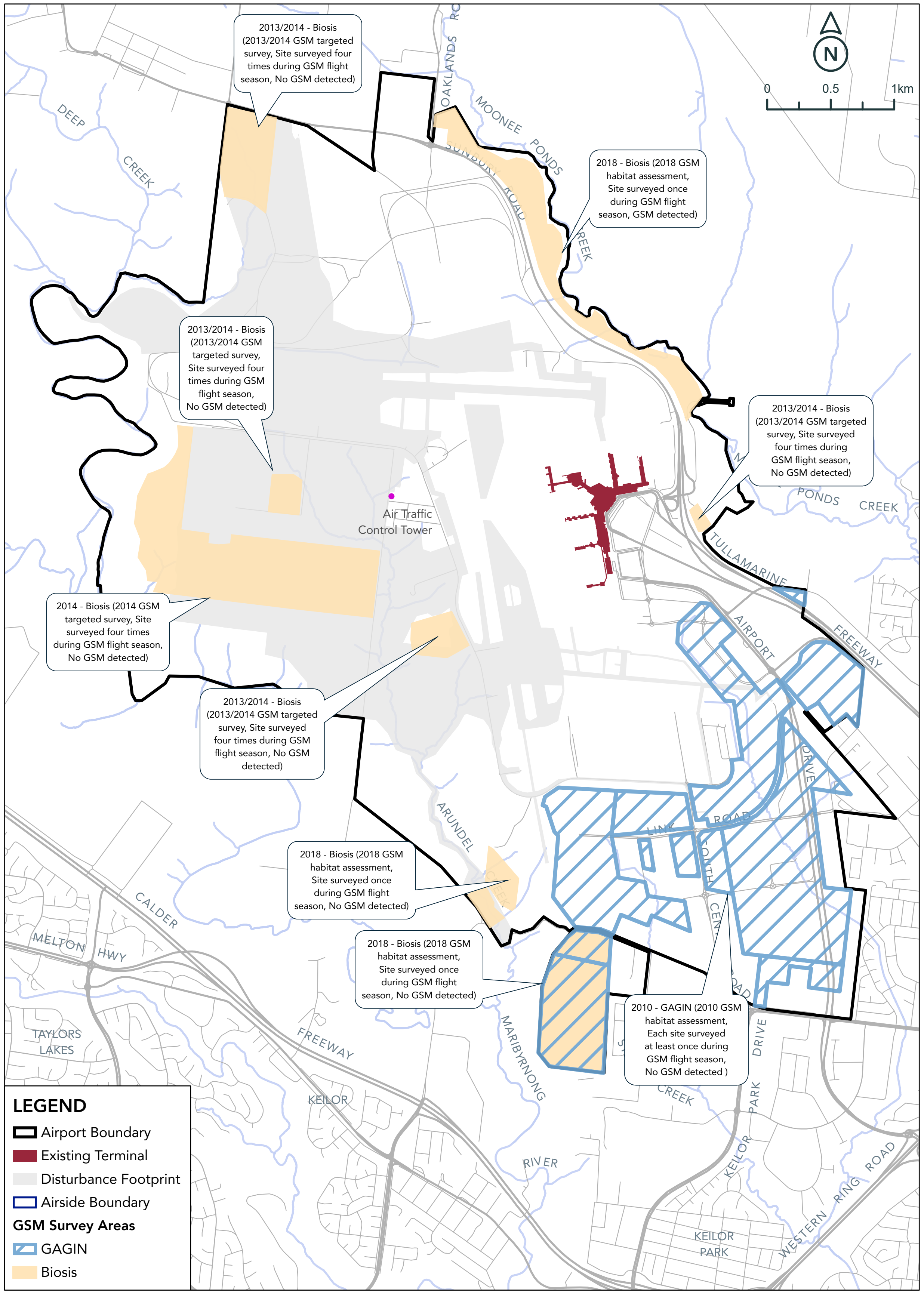


Figure B5.11
Growling Grass Frog (GGF) previous surveys – Melbourne Airport

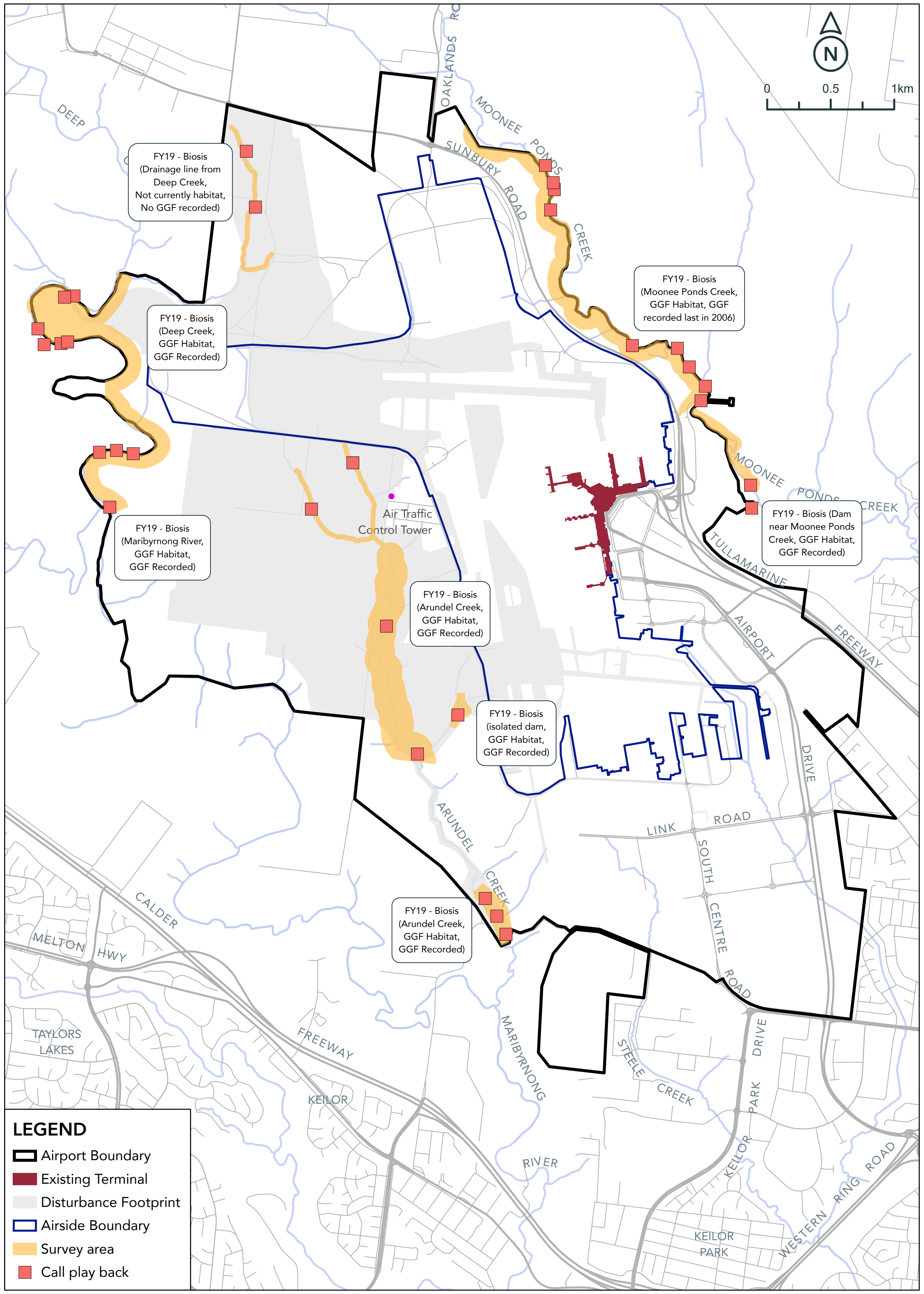


Figure B5.12
Swift Parrot previous surveys – Melbourne Airport

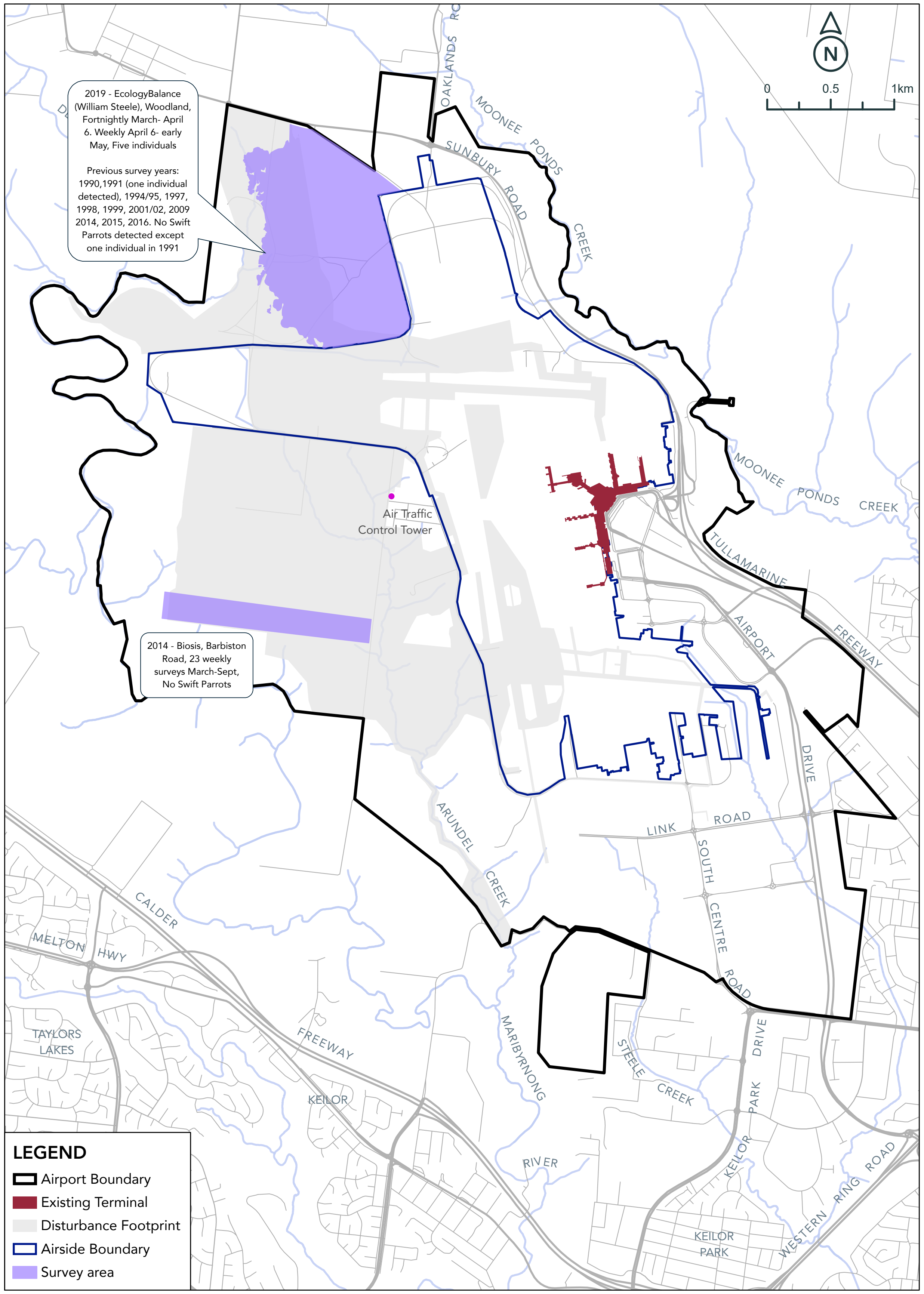
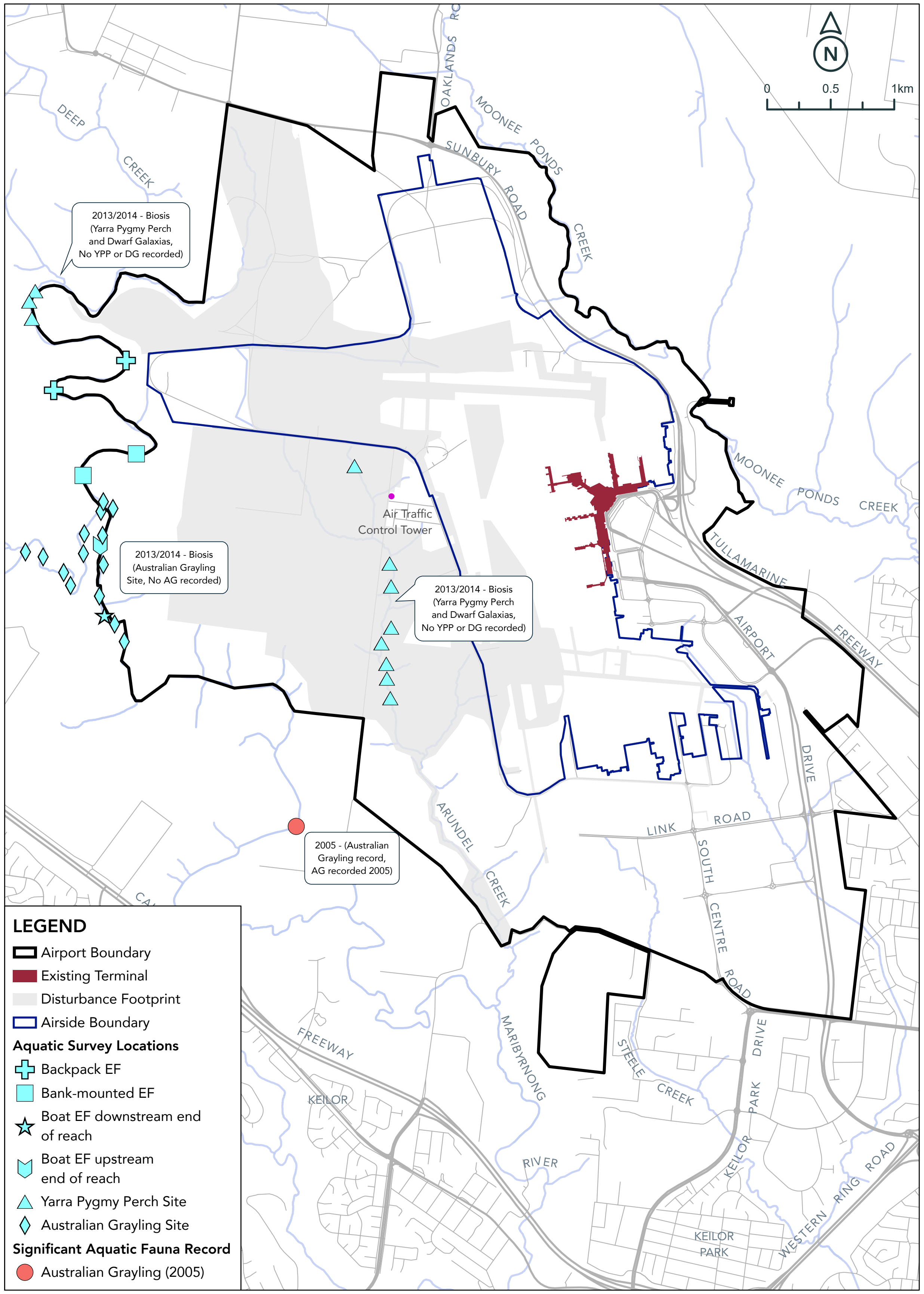
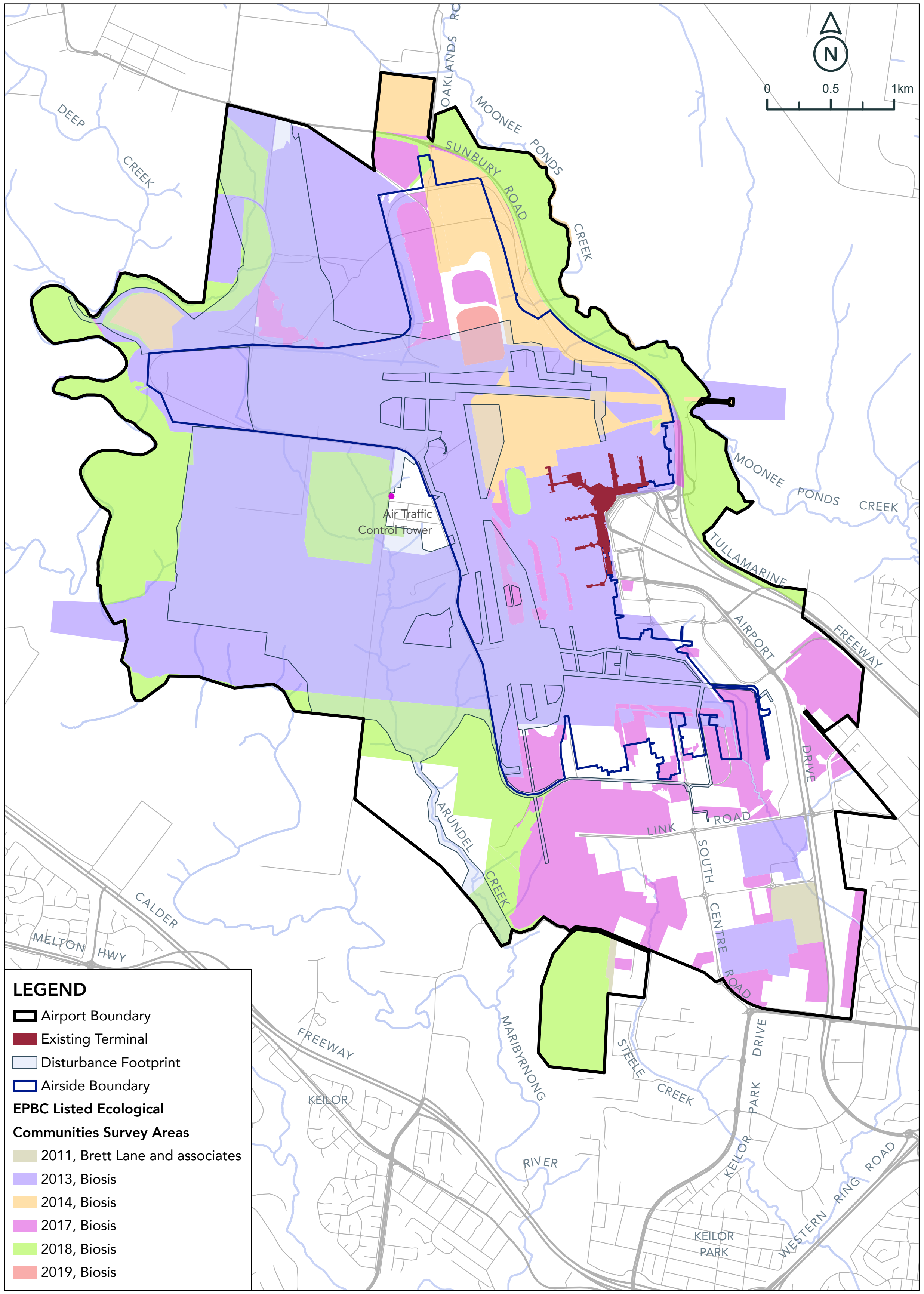


Figure B5.13
Yarra Pygmy Perch and Australian Grayling previous surveys – Melbourne Airport[1]



[1] *EF stands for electrofishing which is a scientific survey method used to sample fish populations to determine abundance, density and species composition.*

Figure B5.14
Native vegetation previous surveys – Melbourne Airport



The following list of EPBC Act-listed threatened species, TECs, and migratory species and FFG Act-listed species and communities were identified for further consideration.

Threatened flora

No EPBC Act-listed threatened flora were categorised as having a medium or high likelihood of occurring within the project area, and none were recorded during the field survey and vegetation mapping (see **Section B5.5** and **Appendix B5.B** of this report).

The following flora species are listed under the Victorian FFG Act (**Table B5.1**) and were considered to have a medium likelihood of occurrence within the project area due to the presence of suitable habitat and their cryptic or ephemeral nature. This means the species may not be able to be detected by surveys even when present.

Extensive native vegetation surveys have been undertaken across the entirety of Melbourne Airport over the past 10 years (**Figure B5.14**). It is highly likely that threatened flora, if present, would have been detected during these surveys.

Threatened fauna

The following EPBC Act and Victorian FFG Act-listed threatened fauna species (**Table B5.2**) were either identified as previously recorded, or as having a medium to high likelihood of occurring within or immediately adjacent to the project area in the preliminary desktop assessment. Therefore, the need for targeted survey and subsequent significant impact self-assessment was considered for EPBC Act-listed species (**Table B5.2**). Targeted survey for FFG Act listed species was not considered.

Migratory species

The following EPBC Act-listed migratory species (**Table B5.3**) were identified as previously recorded, or as having a medium to high likelihood of occurring within or immediately adjacent to the project area in the preliminary desktop assessment. Therefore, the need for targeted survey and subsequent significant impact assessment was considered (**Table B5.3**).

Table B5.1
Threatened flora

Common name	Scientific name	Likely occurrence in the project area	Rationale for likelihood ranking	Targeted survey need
State significance				
Plump Windmill Grass	*Chloris ventricosa*	Medium	Limited records within the area. Closest record is located within habitat similar to habitat present within Melbourne Airport.	No. Targeted surveys for FFG listed flora species was not considered necessary. The vegetation surveys undertaken for the project are sufficient to detect these species if present. There is no further regulatory requirement to undertake targeted surveys for these species.
Austral Crane's-bill	*Geranium solanderi var. solanderi s.s.*	Medium	Recent records nearby <20 yrs. Suitable habitat onsite and can be present in disturbed grasslands and grassy woodlands.	
Pale-flower Crane's-bill	*Geranium sp. 3*	Medium	Recent records nearby <20 yrs. Suitable habitat onsite and can be present in disturbed grasslands and grassy woodlands.	
Purple Blown-grass	*Lachnagrostis semibarbata var. semibarbata*	Medium	Limited records within the area however the closest record within 10km of the project area is located within habitat similar to habitat present within Melbourne Airport.	
Rye Beetle-grass	*Tripogonella loliiformis*	Medium	Species was recorded within suitable habitat in the woodland in 1994 however has not been recorded since.	

Table B5.2
Threatened fauna

Common name	Scientific name	Likely occurrence in the project area	Rationale for likelihood ranking	Targeted survey need
National significance				
Swift Parrot	*Lathamus discolor*	Recorded	The species was recorded in the Grey Box Woodland within the project area in 2019 (Steele & Peter, 2019). The Grey Box Woodland represents a large example of intact habitat for the species in the southern extent of its mainland range. Other scattered eucalyptus and planted trees may also provide foraging habitat for the species on occasion however scattered trees are unlikely to provide significant habitat for the species.	No. Following a review of previous targeted survey effort (**Figure B5.12**), additional targeted surveys were not recommended. A significant impact self-assessment was undertaken for the species (**Section B5.6**).
White-throated Needletail	*Hirundapus caudacutus*	High	It is likely that the species utilises all of the above ground habitat at Melbourne Airport. Additional interrogation of Birdlife Australia's online database (Birdata) revealed there is an incidental record of the species from 2010 (Birdlife Australia) over Sky Road in Melbourne Airport and other records surrounding the Airport. The species is known to have a preference for foraging above wooded areas and is known to roost in the canopy and hollows of trees in forests and woodlands.	No. The species is assumed present. Targeted surveys for the species are unlikely to produce additional information to assist with current understanding of the species' use of the project area. A significant impact self-assessment was undertaken for the species (**Section B5.6**).
Grey-headed Flying-fox	*Pteropus poliocephalus*	Recorded	The species is known to forage in flowering eucalypts within the project area (Ecology and Infrastructure International, 2018). The closest 'camp' for the species is located approximately 20km south-east of the project area. Habitat present within the project area is unlikely to provide important habitat critical for the survival of this species.	No. The species is known to use habitat in the project area. Targeted surveys for the species are unlikely to produce additional information to assist with current understanding of the species' use of the project area. A significant impact self-assessment was undertaken for the species (**Section B5.6**).
Growling Grass Frog (GGF)	*Litoria raniformis*	Recorded	Growling Grass Frog has been recorded in Arundel Creek and Moonee Ponds Creek within the project area and Deep Creek and the Maribyrnong River adjacent to the project area. Breeding, aquatic and terrestrial habitat for the species occurs within the project area.	Yes. Survey data from the 2019 targeted survey is to be utilised (Biosis, 2019b) (**Figure B5.11**). Additional targeted surveys of 270 and 300 Arundel Road were recommended and completed as Arundel Creek within these properties had not been previously assessed. A significant impact self-assessment was undertaken for the species (**Section B5.6**).
Australian Grayling	*Prototroctes maraena*	Recorded downstream of project area	Targeted surveys between 2013 and 2014 (Biosis, 2015) did not record the species within the project area. However, the species is known to occur downstream from the project area in the Maribyrnong River and is therefore likely to utilise similar suitable habitat in the portion of the Maribyrnong River adjacent to the project area. Permanently altered run-off pathways, volumes and water quality to be managed by design, and relevant approval conditions to ensure integrity of adjacent waterways as habitat for the species.	No. Previous survey data (Biosis, 2015) (**Figure B5.13**) is sufficient for current assessment. No further targeted surveys recommended. A significant impact self-assessment was undertaken for the species (**Section B5.6**).
Golden Sun Moth (GSM)	*Synemon plana*	High	The species has been recorded from Woodlands Historic Park to the north and east and the Moonee Ponds Creek corridor to the east. Potential habitat for GSM includes grassy habitats supporting suitable larval food plants including spear grasses, wallaby grasses and the introduced Chilean Needle-grass *Nassella neesiana* and potentially Serrated Tussock *Nassella trichotoma*. Despite previous surveys (**Figure B5.10**) not detecting the species within the project area, there were areas of potential suitable habitat located within the M3R project area which was not previously surveyed.	Yes. GSM targeted surveys were recommended and undertaken in all suitable habitat within the project area. Targeted surveys detected the species in a small area north of the Grey Box Woodland. The likelihood of occurrence has since been changed to 'recorded' (**Appendix B5.C**). A significant impact assessment was undertaken for the species (**Section B5.6**).
Striped Legless Lizard (SLL)	*Delma impar*	Medium	Potential SLL habitat is present within the project area. Past targeted surveys have not detected the species within project area (**Figure B5.9**). There are no known database records of the species within a 5km radius of the Airport, although they have been detected just beyond that radius.	Yes. Targeted surveys for the species were recommended and undertaken. No SLL were detected during the current targeted survey and the likelihood of occurrence for this species has since been changed to 'low' (**Appendix B5.C**).

Common name (cont.)	Scientific name (cont.)	Likely occurrence in the project area (cont.)	Rationale for likelihood ranking (cont.)	Targeted survey need (cont.)
State significance				
Little Egret	*Egretta garzetta*	High	Suitable habitat present in watercourses and dams.	No. Targeted surveys for FFG listed fauna species was not considered necessary. The extensive targeted fauna and vegetation surveys undertaken for the project were considered likely to identify many of these species if present. Some may utilise habitat present within the project area on occasion but are unlikely to be resident whilst some of the species may be or are recorded as resident within the project area there is no further regulatory requirement to undertake targeted surveys for these species.
Plumed Egret	*Ardea intermedia plumifera*	High	Suitable habitat present in watercourses and dams.	
Eastern Great Egret	*Ardea alba modesta*	High	Suitable habitat present in watercourses and dams.	
Freckled Duck	*Stictonetta naevosa*	Medium	May occasionally use the large water storage dams on Arundel Creek.	
Hardhead	*Aythya australis*	Medium	May visit the large water storage dams along Arundel Creek on occasion, may fly over the project area.	
Blue-billed Duck	*Oxyura australis*	Medium	May visit the large water storage dams along Arundel Creek on occasion, may fly over the project area.	
Musk Duck	*Biziura lobata*	Medium	May visit the large water storage dams along Arundel Creek on occasion, may fly over the project area.	
Grey Goshawk	*Accipiter novaehollandiae*	Medium	May occasionally use the Grey Box Woodland and to a lesser extent planted trees within the project area.	
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	Medium	May visit waterways and dams in the project area on occasion, in particularly the Maribyrnong River and potentially the large water storage dams on Arundel Creek.	
Black Falcon	*Falco subniger*	High	Areas of grassland and woodland area suitable habitat for this species.	
Little Eagle	*Hieraaetus morphnoides*	High	Areas of grassland and woodland area suitable habitat for this species.	
Powerful Owl	*Ninox strenua*	Medium	Although not previously recorded, this species may use the Grey Box Woodland. Targeted surveys for the species have not been undertaken.	
Turquoise Parrot	*Neophema pulchella*	Medium	The species may use the Grey Box Woodland on rare occasions.	
Common Sandpiper	*Actitis hypoleucos*	Medium	The water storage dams on Arundel Creek may provide temporary foraging habitat for this species when water levels are lower.	
Marsh Sandpiper	*Tringa stagnatilis*	Medium	The water storage dams on Arundel Creek may provide temporary foraging habitat for this species when water levels are lower.	
Common Greenshank	*Tringa nebularia*	Medium	The water storage dams on Arundel Creek may provide temporary foraging habitat for this species when water levels are lower.	
Hooded Robin	*Melanodryas cucullata*	Recorded	Grey Box Woodland and woodland area along Barbiston Road provide suitable habitat for the species, one individual was recorded within the Grey Box Woodland in 2002. Species is an uncommon visitor to the local area, normally located north of the Great Dividing Range.	
Speckled Warbler	*Pyrrholaemus sagittatus*	Recorded	Habitat on-site is limited to woodland areas. The species was recorded in the Grey Box Woodland in the project area in 1990. The species has been recorded reliably across multiple years in nearby Woodlands Historic Park with the latest in 2019.	
Brush-tailed Phascogale	*Phascogale tapoatafa*	Medium	Due to the isolation of Melbourne Airport from other suitable habitat and known populations we consider it unlikely that there is a resident population of the species utilising suitable habitat in the Grey Box Woodland. A database record from 2017 at Oaklands Junction confirms that the species is in the nearby region however it is unknown whether that record is from a nearby unknown population or was a young dispersing male. Surveys for this species have not been undertaken in the project area.	
Yellow-bellied Sheathtail Bat	*Saccolaimus flaviventris*	High	Species recorded from Bulla Hill and School Hill approximately 1.5km north west of the project area (Biosis 2016). Treed areas, in particular the woodland provide habitat for this species in the project area.	
Common Bent-wing Bat (eastern ssp.)	*Miniopterus schreibersii oceanensis*	High	Treed areas, in particular the woodland provide habitat for this species in the project area.	
Platypus	*Ornithorhynchus anatinus*	High	Species known from Deep Creek in Bulla, north of Melbourne Airport, last recorded in 2018 in the Australian Platypus Conservancy records. The species is also known from Jacksons Creek and the Maribyrnong River adjacent to the project area.	
Tussock Skink	*Pseudemoia pagenstecheri*	Recorded	Species recorded during targeted surveys for SLL. Seventeen Tussock Skink were captured and recorded during the SLL tile surveys. Suitable habitat is present within grassland habitat throughout the project area and was recorded from tile grids landside and airside.	
Brown Toadlet	*Pseudophryne bibronii*	Medium	Suitable habitat present for the species around waterways and in woodland areas within the project area. Species has not been recorded within Melbourne Airport however typical ecological surveys undertaken at Melbourne Airport have been outside of the male calling season for the species	
Murray River Turtle	*Emydura macquarii*	Recorded	Species recorded from the quarry dam north of Deep Creek within the project area.	

Table B5.3
Migratory species

Common name	Scientific name	Likely occurrence in the project area	Rationale for likelihood ranking	Targeted survey need
Fork-tailed Swift	*Apus pacificus*	High	Project area is within core range for the species (DoE, 2015). No records from within project area however there are several from surrounding areas such as Sunbury, Greenvale and Yuroke from the past 10 years.	No. The species is assumed present. Targeted surveys for the species are unlikely to produce additional information to assist with current understanding of the species use of the project area and the project's impacts. A significant impact self-assessment was undertaken for the species (**Section B5.6**).
Latham's Snipe	*Gallinago hardwickii*	High	Species recorded along Maribyrnong River flats Ascot Vale 2007, and regularly from the nearby Jacana Wetlands (Birdata, Birdlife Australia).	No. Large numbers of this species have never been recorded within the project area, however targeted surveys have not been undertaken for the species. A significant impact self-assessment was undertaken for the species (**Section B5.6**).
Rufous Fantail	*Rhipidura rufifrons*	Recorded	Project area is within core range for the species (DoE, 2015). Species was recorded in the Grey Box Woodland in 2009.	No. Targeted surveys for the species are unlikely to produce additional information to assist with current understanding of the species use of the project area and the project's impacts. A significant impact self-assessment was undertaken for the species (**Section B5.6**).
Satin Flycatcher	*Myiagra cyanoleuca*	High	Project area is within core range for the species (DoE, 2015). Species recorded in Woodlands Historic Park in 2007, 2013 and 2015 (Birddata, Birdlife Australia).	No. Targeted surveys for the species are unlikely to produce additional information to assist with current understanding of the species use of the project area or the project's impacts. A significant impact self-assessment was undertaken for the species (**Section B5.6**).
White-throated Needletail	*Hirundapus caudacutus*	Recorded	Project area is within core range for the species (DoE, 2015). There is an incidental record of the species from 2010 (Birdlife Australia) over Sky Road in Melbourne Airport and other records surrounding the project area.	No. The species is assumed present. Targeted surveys for the species are unlikely to produce additional information to assist with current understanding of the species use of the project area or the project's impacts. A significant impact self-assessment was undertaken for the species (**Section B5.6**).

Threatened ecological communities

The following EPBC Act and FFG Act-listed TECs (**Table B5.4**) were identified as previously recorded; or as having a medium to high likelihood of occurring within or immediately adjacent to the project area in the preliminary desktop assessment. Therefore, the need for targeted survey and subsequent significant impact self-assessment for EPBC Act TECs was considered (**Table B5.4**).

B5.2.1.3 Threatened species survey methods

Several EPBC Act-listed species were either considered to have a medium to high likelihood of occurring within the project area (**Appendix B5.B** and **Appendix B5.C** of this chapter) or had previously been recorded in the local area.

Targeted surveys were undertaken to determine whether they were present within the project area and, if so, the extent to which they used it. For some species, investigations extended beyond the project area to include the local area. This was to provide a broader understanding of landscape context, and to capture areas adjacent to the project area that may have represented more suitable habitat for the species (thereby increasing the likelihood of detection). EPBC Act listed species for which targeted surveys were undertaken as part of this current assessment included:

- Striped Legless Lizard
- Golden Sun Moth
- Growling Grass Frog.

Table B5.4
Threatened ecological communities

Ecological community	Likely occurrence in the project area	Rationale for likelihood ranking	Targeted survey need
National significance			
Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-Eastern Australia (GBW)	Recorded	Community is known to occur within the project area.	Yes. Extent and quality assessment of the community was recommended and undertaken.
Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP)	Recorded	Community is known to occur within the project area.	Yes. Extent and quality assessment of the community was recommended and undertaken.
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains (SHW)	Medium	Community is known to occur adjacent to the project area.	Yes. Presence/ absence survey for SHW was undertaken during the native vegetation assessment of the entire project area. SHW was not recorded within the project area and a significant impact self-assessment was not considered necessary for the community.
State significance			
Victorian Temperate Woodland Bird Community	Recorded	This community includes the woodlands stands in the project area. Listed woodland birds within this community that have been recorded or may occur are Swift Parrot, Speckled Warbler, Jacky Winter Microeca fascinans, and Hooded Robin.	No. Extent corresponds with the Grey Box Woodland
Western (Basalt) Plains Grassland i.e. all the Plains Grassland that we have mapped	Recorded	This FFG listed community will be similar to the EPBC grassland community present in the project area.	No. Extent corresponds with all Plains Grassland mapped within the project area during the native vegetation surveys.
Western Basalt Plains (River Red Gum) Grassy Woodland	Low	EVC 55 in the project area has affinities with this community when River Red-gum is dominant canopy species but all patches of this EVC are highly modified and unlikely to represent this community.	No. Vegetation surveys undertaken within the project area would identify this community if present.

Detailed survey methods for each species are provided in **Appendix B5.A**. Survey effort and location of targeted survey for listed species is provided in **Figure B5.15**.

Golden Sun Moth

The initial site assessment determined that suitable habitat for was present within the project area.

Previous surveys of Melbourne Airport land west of Sunbury Road had failed to detect the species. However, due to the presence of suitable habitat, feedback from the Commonwealth, and lack of current knowledge for the species within the project area, targeted surveys for this species were recommended.

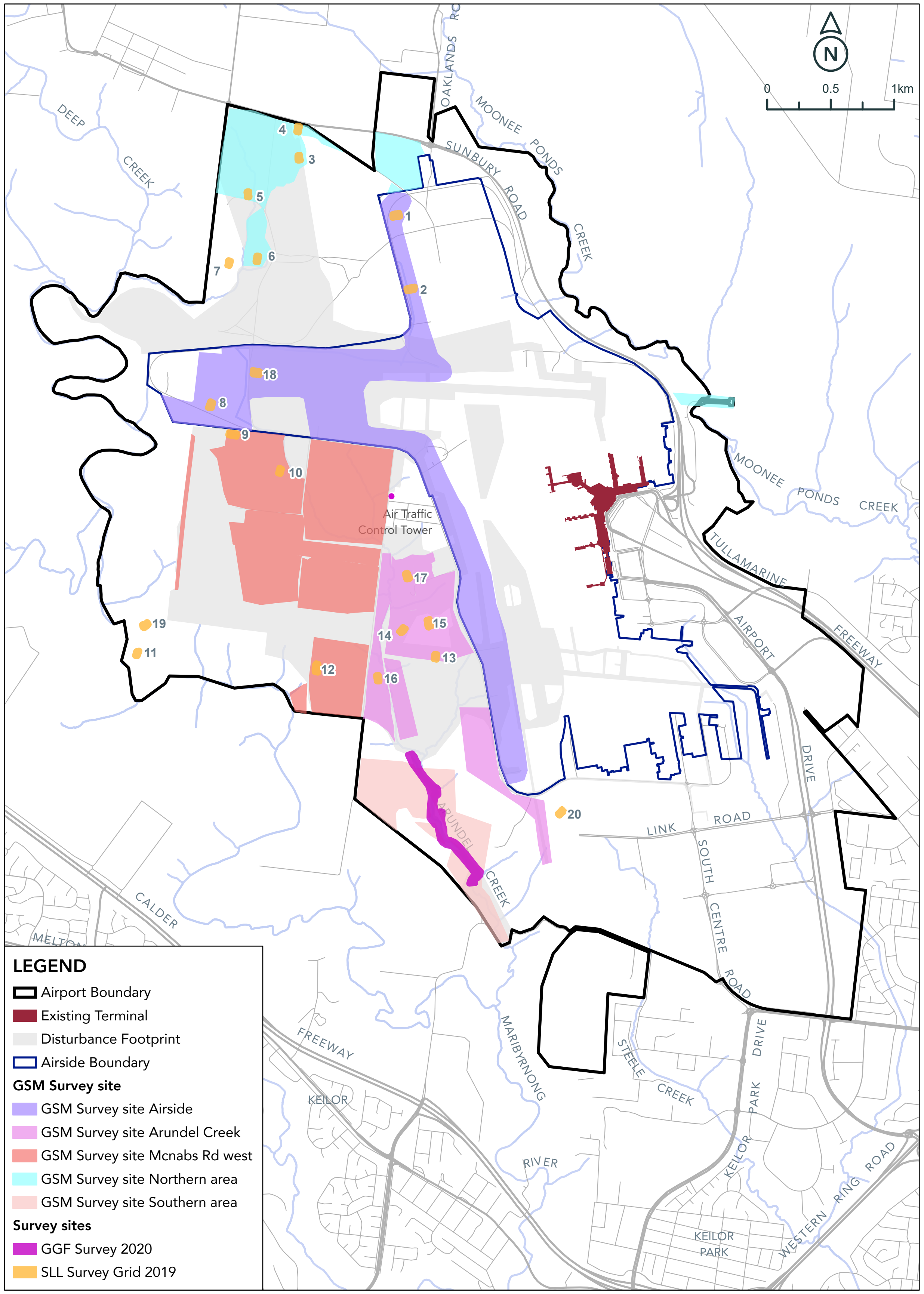
Four surveys were conducted, on days with appropriate weather conditions and in accordance with the Commonwealth survey guidelines (DEWHA, 2009a).

Growling Grass Frog

Previous habitat assessments and targeted surveys for the Growling Grass Frog were undertaken in February 2019 (Biosis, 2019b, unpublished) across all of Melbourne Airport's land. Since then, additional land has been acquired by Melbourne Airport.

A habitat assessment and targeted survey for the Growling Grass Frog was undertaken within the new land (located at 270 and 300 Arundel Road) in February 2020. The information and data obtained in February 2019 and 2020 was utilised for this assessment. The targeted surveys were undertaken in accordance with Commonwealth survey guidelines (DEWHA, 2010).

Figure B5.15
Targeted fauna survey – current survey



Striped Legless Lizard

To determine its presence or absence, targeted surveys were conducted from September to December 2019 following Commonwealth referral guidelines for the vulnerable Striped Legless Lizard, *Delma impar* (DoE, 2011).

Arrays of terracotta roof tiles were placed in areas of potential habitat in and adjacent to the project area. Twenty tile grids were deployed, each consisting of 50 tiles with five-metre spacing between them arranged in a grid of 10 x 5 tiles. They were checked 15 times at weekly intervals between September and December 2019.

Australian Grayling

Australian Grayling surveys were undertaken between 2013 and 2014 by Biosis for the Runway Development Program. Detailed survey methods are recorded in the Biosis 2015 report (Biosis, 2015).

Although these surveys were undertaken more than seven years ago, subsequent surveys were not recommended because targeted surveys for this species are usually unsuccessful. The species is very difficult to catch, even in dense populations. Additional surveys would not therefore further enhance understanding of this species' use of the Maribyrnong River.

Swift Parrot

Swift Parrot assessments were not undertaken by Biosis. The most recent Swift Parrot survey was undertaken in autumn 2019 (Steele and Peter, 2019). This report and other available reports were used to assess the presence of the species within the project area and the subsequent significant impact self-assessment.

Grey-headed Flying-fox

Grey-headed Flying-fox assessments were not undertaken by Biosis. The most recent survey for this species was undertaken by Ecology and Infrastructure International (2018). This report and other available reports/databases were utilised for assessing the presence of the species within the project area, and the subsequent significant impact self-assessment.

Threatened flora

All EPBC Act-listed threatened flora species are considered to have a low likelihood of occurrence within the project area and therefore no targeted surveys were undertaken.

No other threatened flora (i.e. FFG Act) were categorised as having a medium or high likelihood of occurring within the project area, and none recorded during field survey and vegetation mapping (see **Section B5.5** and **Appendix B5.B** of this report).

B5.2.1.4
Threatened Ecological Communities (TECs) and native vegetation survey methods

Threatened Ecological Communities (TECs) are unique assemblages of plants, animals and ecological interactions. Although the species that make up an ecological community may be common and widespread, it is their presence in a particular part of the landscape that makes them important.

Ecological communities become threatened when landscape-scale modifications (such as land clearing for agriculture on fertile soils) cause the loss of a community and its function across widespread geographical areas. Ecological communities may also be threatened when restricted to small geographical areas or highly localised environmental conditions.

Threatened ecological communities are protected under Victorian and Commonwealth legislation. After background research, three TECs listed under Victoria's FFG Act and five TECs listed under the Commonwealth's EPBC Act were considered to have some potential to be present in the project area (see **Table B5.4** and **Appendix B5.B** of this chapter).

It should be noted that there is often an overlap between Victorian and Commonwealth legislation in the listing of a community, with broadly similar communities listed but given different names in each jurisdiction. In addition, each jurisdiction has its own thresholds for delineating a TEC based on location, characteristics and condition.

EPBC Act listed communities tend to have a much narrower and well-articulated set of key diagnostics published by the Commonwealth Government; FFG Act listed communities have broader descriptions and less well-defined condition thresholds in the Victorian Scientific Advisory Committee's nomination documents.

Usually, ecological communities would require separate consideration for identification and impact assessment across the two jurisdictions. However, given the project is assumed to occur entirely on Commonwealth land, FFG Act provisions do not apply (see **Section B5.3**). Although impacts to EPBC Act TECs have been assessed in detail according to the Significant Impact Guidelines 1.1 (DoE, 2013) impacts to FFG Act listed communities have been considered only as part of an assessment of impacts on the environment on Commonwealth land, in accordance with the Significant Impact Guidelines 1.2 (DSEWPaC, 2013).

Identifying EPBC Act-listed TECs is conducted in accordance with listing advice and supporting policy statements produced by the Commonwealth Government. The process of identifying whether a patch of native vegetation is a TEC relies on an assessment of:

- Bioregional context
- Landscape setting
- Vegetation structure
- Tree size and density (for treed communities)
- Plant cover
- Plant species richness (species diversity)
- Ecological function.

These considerations were incorporated into the following three-step approach to assessing EPBC Act-listed TECs within the project area:

1. Identifying and mapping all native vegetation using the Victorian EVC classification system
2. Identifying and mapping all areas of native vegetation that satisfy the criteria for TEC listed under the EPBC Act
3. Assessing the quality of all TECs present.

Identifying and mapping native vegetation

Survey effort and location of the current native-vegetation assessment is provided in Figure B5.16.

Native vegetation within the project area was identified and mapped for two reasons. First, the type and extent of native vegetation helped assess the project's impacts on the environment on Commonwealth land. Second, the type and extent of native vegetation helped to identify the potential presence of TECs.

The listing advice for TECs refers to EVC equivalents indicating the potential presence of each TEC (TSSC, 2008; TSSC, 2010; TSSC, 2012). The Victorian system of classifying native vegetation into EVCs was therefore used to define and map native vegetation within the project area (DELWP, 2017; Appendix B).

The key terms used for identifying and mapping native vegetation are explained in Table B5.5. Patches of native vegetation were assigned to an appropriate EVC with reference to EVC benchmarks for the bioregion (DSE, 2004a; DSE, 2004b). Where native vegetation patches crossed the project area boundary, mapping and assessment of native vegetation often extended beyond the project area to some of the local area. This was to provide a better understanding of the quality of the native vegetation and its landscape context.

Identifying and mapping TECs

Where a patch of native vegetation was suspected to be a TEC, listing advice and policy statements provided key diagnostic characteristics and condition thresholds that allowed for an objective determination of TEC presence.

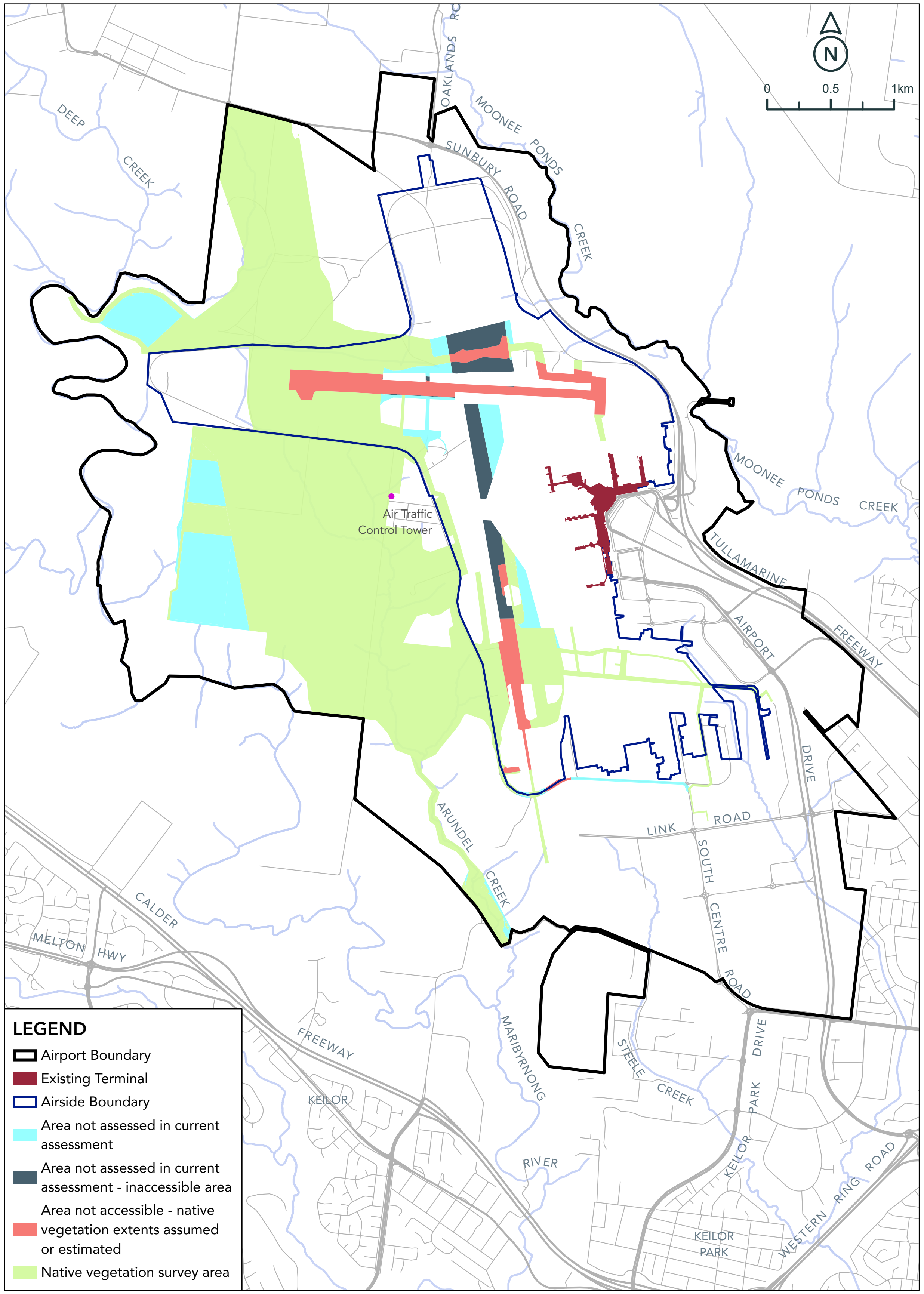
The methods used to identify listed TECs, define their spatial extent, and assess their condition are outlined below for the relevant communities.

These methods vary depending on community type (e.g. grassland, woodland or wetland) and the information required to accurately define, map and assess the condition of the TEC. The methods are linked to standard practices outlined in Commonwealth listing advice; and also utilise Victorian methods for defining vegetation extent and metrics for quality assessment (Table B5.5).

Table B5.5
Key definitions used for identifying, mapping and assessing native vegetation and TECs

Term	Definition	Reference
Native vegetation	Plants that are indigenous to Victoria, including trees, shrubs, herbs, and grasses.	VPP cl., 73.01
Patch of native vegetation	An area of vegetation where at least 25% of total perennial understorey plant cover is native or any area with three or more native canopy trees where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy (Note that the Current Wetlands Map has been excluded from this definition.)	DELWP, 2017 p. 6
Habitat zone	A habitat zone is a single continuous patch of vegetation of the same EVC and condition. New habitat zones are only defined when one of the following conditions is met: • The EVC changes • A clear physical boundary occurs • The site condition score (out of 75) varies by at least 15 points through sampling and the extent of the continuous patch of vegetation to be removed is greater than 1 hectare.	DELWP, 2018 p. 15
Scattered tree	A native canopy tree that does not form part of a patch.	DELWP, 2017 p. 6
Canopy tree	A mature tree (i.e. it is able to flower) greater than 3 metres in height and normally found in the upper layer of the relevant vegetation type (EVC).	DELWP, 2017 p. 35
Ecological Vegetation Class (EVC)	A native vegetation type classified on the basis of a combination of its floristics, lifeforms and ecological characteristics.	DELWP, 2017 p. 35
Patch of a Threatened Ecological Community (TEC)	A discrete and uniform area that comprises the ecological community. It does not include substantial elements of other ecological communities, such as woodlands dominated by other tree species and other types of grasslands. However, a patch of the listed ecological community may include small-scale variations in vegetation, and small-scale disturbances, such as tracks or breaks, that do not alter its overall functionality – including the easy movement of wildlife or dispersal of plant spores and seeds.	TSSC, 2008 p. 50 TSSC, 2010 p. 10

Figure B5.16
Current survey effort – Native vegetation



Grey Box (*Eucalyptus microcarpa*) Grassy Woodland and Derived Native Grasslands of South-eastern Australia

Listing advice (TSSC, 2010) and the supporting policy statement (DSEWPaC, 2012a) describe this community in two condition states: an intact woodland form (treed) and a derived native grassland form where tree cover has been historically removed.

The methods used to identify this community in both of its states, and restored areas, are summarised in Table B5.6 and are taken from TSSC (2010). A randomised sampling approach was used to collect ground-layer condition information for the woodland community. This method is outlined in detail in Appendix B5.B.

Natural Temperate Grassland of the Victorian Volcanic Plain

A field checklist (Appendix B5.A) was used to identify the presence or absence of NTGVVP in areas mapped as suitable EVCs (i.e. Heavier-soils Plains Grassland).

The checklist was based on the key diagnostic characteristics and condition thresholds outlined in the listing advice for the TEC (TSSC, 2008). Where this was unclear, further clarity was sought from the NTGVVP Information Sheet (DSEWPaC, 2011a) and, if required, guidance provided by DAWE (and its predecessors).

Table B5.6
Approach for identifying Grey Box Grassy Woodland community

Criteria	Condition Thresholds	Method used to test patch against threshold
Tree cover	If tree crown cover is at least 10%, the 'treed' condition state is present. If tree crown cover is less than 10%, the 'derived grassland' condition state is present.	Assessment of tree crown cover from aerial photography and ground observations.
Dominant tree species	For treed patches, Grey Box must be the dominant or co-dominant tree species in the canopy layer. For derived grassland, there must be evidence that the vegetation was once woodland dominated or co-dominated by Grey Box.	For treed patches, identification of dominant tree species on site. For derived grassland, assessment of historical records (e.g. aerial imagery) and observations of trees stumps, logs, recruitment or regeneration Grey Box.
Patch size	Patch must be greater than 0.5 ha to firstly qualify as the community, and then different native cover and diversity thresholds apply based on a 2 ha threshold for patches in the 'treed' condition states.	Patches were mapped to determine size and areas. Minor physical barriers were aggregated based on ecological function (e.g. fauna movement prospects, seed/genetic dispersal, water and nutrient cycling, recruitment and regeneration).
Weediness	The vegetation cover of non-grass weeds in the ground layer is less than 30% at any time of the year. Any site that has >30% cover of non-grass weeds in the ground layer is not the community.	For treed patches, plant cover data was collected according to a comprehensive life form schema using 47 randomly located 50 x 1m point intercept transects (i.e. 2350 data points across the site, Appendix B5.B). For derived grassland patches, plant covers were estimated with reference to cover charts and, if required, 1 x 1 m quadrats.
Tree stem size and density	For treed patches ≥2 ha in size there must be at least 8 trees/ha that are >60 cm DBH or hollow-bearing. For treed patches ≥2 ha in size that do not meet the large tree and hollow tree density requirements above there must be at least 20 live trees/ha that are >12 cm DBH.	Tree size, hollow status and density sampling was undertaken using 31 randomly allocated 1 ha plots.
Species richness/ diversity	For treed patches <2 ha, there must be at least 8 perennial native species in the mid and ground layers. For derived grassland patches, there must be at least 12 perennial native species in the ground layer.	For treed patches, plant cover data was collected according to a comprehensive life form schema using 47 randomly located 50 x 1 m point intercept transects (i.e. 2350 data points across the site, Appendix B5.B). For derived grassland patches, plant covers were estimated with reference to cover charts and, if required, 1 x 1 m quadrats. Plant species richness data in derived patches was collected using the VQA method.
Perennial native species cover	For treed patches ≥2 ha with at least 8 trees/ha that are >60 cm DBH or hollow-bearing, perennial native grasses must make up ≥10% perennial native grass cover in the ground layer. For all other patches (derived grassland, treed patches <2 ha in size or treed patches ≥2 ha in size with at least 20 live trees/ha that are >12 cm DBH), perennial native species must make up ≥50% of total perennial ground layer vegetation cover.	For treed patches, plant cover data was collected according to a comprehensive life form schema using 47 randomly located 50 x 1 m point intercept transects (i.e. 2350 data points across the site, Appendix B5.B). For derived grassland patches, plant covers were estimated with reference to cover charts and, if required, 1 x 1m quadrats. Tree size, hollow status and density sampling undertaken using 31 randomly allocated 1 ha plots.

The approach to completing the field checklist is outlined in Table B5.7. The percentage cover of native flora within each grassland patch was estimated by reference to predefined cover charts. Where cover estimates were close to the condition threshold, gridded one-by-one metre quadrats (square frames) were used to objectively sample plant cover within the grassland patch and confirm the veracity of cover estimates.

For the purposes of assessing minimum contiguous size thresholds, the 'grassland patch' was taken to be the area of contiguous grassland that otherwise met all other key diagnostic characteristics and condition thresholds for the TEC – rather than the (generally larger) Heavier-soils Plains Grassland patch.

In addition, the 'native vegetation remnant' was taken to be the contiguous area of native vegetation, whether or not belonging to more than one EVC. DAWE has confirmed that this interpretation is correct and upholds the intention of the listing advice (J. Vranjic, DAWE, pers. comm., March 2020).

Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains

The listing advice for this TEC gives the condition thresholds applying under various environmental conditions (TSSC, 2012). Part A of the condition thresholds was used because field surveys were not undertaken during a prolonged period of drought (i.e. more than one year). Rather, field surveys were undertaken in summer, during typical seasonal wetting and drying, including after periods of heavy rain. The approach to completing the field assessment is outlined in Table B5.8.

Table B5.7
Approach for identifying Natural Temperate Grassland community

Criteria	Condition Thresholds	Method used to test patch against threshold
Location	With limited exceptions, the grassland patch must be associated with Quaternary basalt soils within the Victorian Volcanic Plain bioregion.	The position of the grassland patch relative to modelled geological and bioregional boundaries was reviewed. Surface soil texture observations were made during vegetation mapping on site.
Perennial native flora cover	Native flora must make up ≥50% of total vegetation cover, excluding introduced annuals, within the grassland patch.	The percentage cover of native flora within each grassland patch was estimated with reference to cover charts and, if required, 1x1 m quadrats.
Dominant grass genera	Grasses in the genera *Themeda*, *Rytidosperma*, *Austrostipa* and/or *Poa* make up ≥50% of total native species cover.	The percentage cover of the four key native grass genera within each grassland patch was estimated with reference to cover charts and, if required, 1x1 m quadrats.
Weediness	For grassland patches where *Themeda*, *Rytidosperma*, *Austrostipa* and/or *Poa* are the dominant native genera, one of the following thresholds must be met: Themeda, Rytidosperma, Austrostipa and/or Poa must also make up ≥50% of total perennial tussock cover or Perennial non-grass weeds must be <30% of total vegetation cover.	The percentage cover of the four key native grass genera and perennial non-grass weeds within each grassland patch was estimated with reference to cover charts and, if required, 1x1 m quadrats.
Native forb cover	For grassland patches where *Themeda*, *Rytidosperma*, *Austrostipa* and/or *Poa* are not the dominant native species, native forbs must make up ≥50% of total vegetation cover during spring-summer (September to February).	The percentage cover of native forbs within each grassland patch was estimated with reference to cover charts and, if required, 1x1 m quadrats.
Patch size	For a native vegetation remnant ≤1 ha, the grassland patch must be ≥0.05 ha and the crown cover of shrubs/ trees >1 m tall must be ≤5%. For a native vegetation remnant >1 ha, the grassland patch must be ≥0.5 ha and there must be <2 mature trees per ha.	Contiguous native vegetation remnants and grassland patches were mapped to determine size and areas. Minor physical barriers were aggregated based on ecological function (e.g. fauna movement prospects, seed/genetic dispersal, water and nutrient cycling, recruitment and regeneration). Mature trees were counted and the crown cover of shrubs/trees >1 m estimated with the assistance of recent aerial imagery (i.e. from the past 6 months), where required.

Assessing the quality of TECs

To determine and properly assess the impact on TECs, the quality of native vegetation corresponding to a TEC was assessed using the Vegetation Quality Assessment (VQA habitat hectare) method (DSE, 2004c).

DAWE has previously endorsed the 'habitat hectare' method as appropriate for assessing the condition of TECs in Victoria such as GBW, NTGVVP and SHW. It is further explained in Appendix B5.A.

For the purposes of assessing impacts and calculating offset requirements, each TEC (or condition state in the case of GBW) was assigned a weighted average quality score. The weighting ensured that the contribution a patch of TEC made to the average score of its TEC was proportionate to the total area of the TEC within the impact area.

Table B5.8
Approach for identifying Seasonal Herbaceous Wetlands community

Criteria	Condition Thresholds	Method used to test patch against threshold
Landscape	The patch must be in temperate Australia, on flat plains grading into slopes, lower than 500 m above sea level and generally of poorly draining clay soils, receiving 400-800 mm mean annual rainfall.	The desktop assessment revealed that the project area's location, climate, soil and geomorphology was suitable.
Hydrology	The patch must be on isolated drainage lines or depressions which are seasonally inundated (typically during winter-spring) and subsequently dry (typically by late summer).	
Rainfall must be the main water source and the salinity of the water is fresh to slightly brackish.	The position of the patch of vegetation in the landscape and types of plants present allowed for hydrological inferences to be made in the field.	
Trees and shrubs	Trees and shrubs must be sparse or absent such that the cover of woody species accounts for ≤10% projective foliage cover across the patch.	The cover of trees, shrubs and other woody vegetation was visually estimated in the field, with the assistance of recent aerial imagery (i.e. from the past 6 months), where required.
Dominant species	Native wetland graminoids and/or native wetland forbs characteristic of the community must make up ≥50% of total vegetative cover in the ground layer.	Flora were identified and the cover of native wetland graminoids/forbs was estimated with reference to cover charts.
Native wetland graminoids	One or more of the following native wetland graminoids is typically present: *Amphibromus* spp., *Carex tereticaulis*, *Deyeuxia* spp., *Glyceria* spp., *Lachnagrostis* spp., *Poa labillardierei* and/or *Rytidosperma duttonianum*.	Flora were identified and checked against the list of species typical of the community.
Native wetland forbs	At least one species of native wetland forb must be present.	Flora were identified and checked against the list of species typical of the community.
Contra-indicators	The wetland must not be dominated by or have a significant cover (>25% vegetative cover) of contra-indicative species (e.g. Cumbungi Typha spp., Common Reed Phragmites australis, Spike rushes Eleocharis spp. etc.) or otherwise display hydrological and/or landscape features of contra-indicative EVCs (e.g. Tall Marsh EVC 821).	The position of the patch of vegetation in the landscape and types of plants present allowed for hydrological inferences to be made in the field. Flora were identified and the cover of contra-indicative species estimated with reference to cover charts.
Patch size	If the wetland occurs as a single isolated wetland, it must be ≥0.5 ha. If the wetland occurs as a cluster of many small wetlands in reasonably close proximity, the wetlands within the cluster must collectively be ≥0.5 ha across a total area ≥5 ha (i.e. wetland must account for ≥10% of the total area). If an individual wetland or wetland cluster is <0.5 ha, it must be ≥0.1 ha in size and contiguous with a native vegetation remnant that together with the wetland or wetland cluster is ≥1 ha.	Contiguous native vegetation remnants and wetland patches were mapped to determine size and areas. Minor physical barriers were aggregated based on ecological function (e.g. fauna movement prospects, seed/genetic dispersal, water and nutrient cycling, recruitment and regeneration).

B5.2.1.5
Other natural values

Common species

Information on common flora and fauna species was collected during targeted and incidental survey efforts. It has been added to the flora/fauna recorded lists in Appendix B5.B and Appendix B5.C.

Landscape

Landscape values were defined based on existing bioregional reports and landscape ecology principles, such as the physical and functional connectivity for fauna.

B5.2.1.6
Limitations

The survey effort was underpinned by comprehensive coverage of grassland vegetation and a sampling approach for woodland vegetation. A discussion of significant assessment limitations and relevant government guidelines is provided below; specific limitations for particular survey methods are detailed in Appendix B5.A where relevant.

Vegetation surveys

- The dynamic nature of grassy ecosystems means that, over time, vegetation communities change naturally in response to seasonal conditions; and also due to land-management practices (e.g. grazing, slashing). Given that vegetation communities are dynamic, and assessments are snapshots taken at a particular moment in time, a number of limiting factors influence the results of the assessment (these are not mutually-exclusive and their influence varies throughout the assessment period.) Land-management practices influence vegetation structure and floristics on short to medium timescales. Therefore, patch delineation and quality assessments (e.g. habitat hectares assessments) must rely on observed conditions at the time of assessment
- Use of handheld uncorrected GPS means vegetation boundaries are generally accurate to three-to-five vertical metres, corrected through aerial photography interpretation when necessary
- For most temperate grassy ecosystems. the majority of species grow and flower through winter to midsummer. Assessments were conducted over most of the flowering season. This allowed detectability in plant traits, cover, and species richness across the seasons that would contribute to the overall quality assessment outcomes
- For safety reasons, standard vegetation surveys were not possible within 50 metres of runways or close to critical flight infrastructure. Native vegetation extent and condition (including presence of TECs) in these areas was therefore either estimated or assumed:
  - 'Estimated vegetation' are areas assessed at night during planned runway closures or by assessing from a distance using binoculars. Where possible, a habitat score was given; where not possible, TECs were assigned the relevant weighted average score of all assessed habitat zones of the same EVC that also qualified as the TEC
  - 'Assumed vegetation' are areas within the project area that could not be accessed during day or night, or from a distance (e.g. due to topography). Native vegetation and TECs were assumed to be present and assigned the relevant weighted average score.

In all cases, estimates and assumptions were conservative. Assumed areas are more conservative than estimated areas and made with reference to recent aerial imagery (i.e. from the last six months) from the time of mapping. A total of 18.28 hectares of airside land was classified as assumed or estimated vegetation

- An additional 65.5 hectares of land, landside was included within the project area (56.9 hectares in the impact area) after completion of field assessments. It has been defined as 'landside area not assessed'. Native vegetation information for this area has not been verified
- The boundaries between Hills Herb-rich Woodland (EVC 71), Plains Woodland (EVC 803) and Plains Grassland (EVC 132) were mapped according to floristics as observed on the ground, historic records (e.g. historic plans and 1946 aerial imagery) and soil/geology. However, the transition between these vegetation types typically occurs over an ecocline. This means the boundary between vegetation types can be diffuse and difficult to define at the site scale. At Melbourne Airport, defining a boundary between woodland and grassland is made more challenging by historic and present land uses. These have resulted in the removal of mature trees from areas of Plains Woodland (EVC 803) in the airside area, thereby converting woodland into derived grassland. While every effort was made to accurately map boundaries between woodland and grassland vegetation types, it should be understood that these boundaries are a construct and therefore do not necessarily represent a clear point of transition visible at all times of the year.

Fauna surveys

- The current survey program was largely undertaken in the spring and summer months, when the majority of fauna species are present, active and readily detectable. However, species active in the autumn and winter months may be present within the project area and undetected during the current survey period
- Targeted surveys for EPBC Act-listed species were undertaken during timeframes recommended by Commonwealth survey guidelines
- The Striped Legless Lizard is a cryptic species and may not be detected by surveys even when present (DSEWPaC, 2011b). Biosis considers the current targeted surveys' effort – along with the extensive previous surveys undertaken across a large proportion of the project area (**Figure B5.9**) – sufficient to conclude that the species is highly unlikely to be present within the project area
- For the additional 65.5 hectares of land that were included landside, further targeted surveys for fauna were considered unnecessary given the extent of surrounding targeted fauna surveys and knowledge of the area.

B5.3 STATUTORY AND POLICY REQUIREMENTS

This section provides a summary of key biodiversity legislation and government policy relevant to the project.

B5.3.1 Applicability of Victoria and Commonwealth legislation and policy

The 834-hectare project area currently includes approximately 821 hectares of Commonwealth land (under jurisdiction of the Commonwealth of Australia) and approximately 13 hectares of freehold land (under jurisdiction of the State of Victoria).

However, it is expected that the freehold land will soon be vested in the Commonwealth and that the entire 834-hectare project area will be Commonwealth land before approval and commencement of M3R. The findings and impact assessments in this report are therefore based on the assumption that the project area is entirely Commonwealth land.

The provisions of the Airports Act and associated regulations are intended to 'cover the field' and provide a comprehensive regime for development at the airport. Although some Victorian environmental laws can apply to Commonwealth land at Melbourne Airport (as per section 136 of the Airports Act) the FFG Act is excluded due to the operation of the provisions of the Airports (Environment Protection) Regulations 1997 that deal with biota and habitat. Similarly, section 112(2) of the Airports Act states that Part 5 of the Act applies to the exclusion of State laws relating to the regulation of building activities or land-use planning, which would include the *Victorian Planning and Environment Act 1987* (P&E Act).

B5.3.2 Commonwealth legislation and policy

B5.3.2.1 Airports Act 1996

The Airports Act and associated *Airports (Environment Protection) Regulations 1997* govern planning approvals and procedures on Commonwealth land at Melbourne Airport. A Major Development Plan (MDP) is required for each major development on Commonwealth land at Melbourne Airport (Airports Act s.88). The Act defines actions that constitute a major development and therefore require an MDP (Airports Act s.89).

B5.3.2.2 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act applies to actions (e.g. developments and associated activities) with the potential to significantly impact Matters of National Environmental Significance (MNES) or the environment on Commonwealth land.

MNES are typically listed under the EPBC Act following listing advice provided for each MNES (this listing advice is the authoritative description of a MNES). Further policy documents may help with clarifying listing advice, and identifying the presence or absence of specific MNES. Ecological MNES relevant to the project are identified in **Section B5.2** and **Section B5.5** of this chapter.

The EPBC Act Significant Impact Guidelines 1.1 (DoE, 2013) provide a framework against which potential significant impacts on MNES are assessed. Species-specific significant impact guidelines may further help define significant impacts to certain listed threatened species (e.g. DEWHA, 2009a; DEWHA, 2009b; DoE, 2015; DoEE, 2017). An assessment against the Significant Impact Guidelines 1.1 (DoE, 2013) (and any associated species-specific significant impact guidelines) is provided in **Section B5.6**.

Section 26 of the EPBC Act requires that APAM seeks approval for any action that has, will have or is likely to have a significant impact on the environment on Commonwealth land.

The EPBC Act Significant Impact Guidelines 1.2 (DSEWPaC, 2013) provide guidance for identifying environmental values and assessing potential significant impacts to the environment on Commonwealth land. In accordance with the Significant Impact Guidelines 1.2 State environmental legislation and policy may assist in identifying special environmental values. The Significant Impact Guidelines 1.2 indicate that 'State government protected species lists and heritage lists may assist in identifying components of the environment with special value' and that 'local government may also have information about rare or otherwise important elements of the environment' (DSEWPaC, 2013 p.8).

B5.3.3 Victorian legislation and policy

B5.3.3.1 Flora and Fauna Guarantee Act 1988

The FFG Act is the state's key piece of legislation for the conservation of threatened species and communities, and management of potentially threatening processes in Victoria.

The FFG Act does not apply to Commonwealth land at Melbourne Airport, being excluded by the operation of the Commonwealth Airports (Environment Protection) Regulations 1997. Furthermore, the offences and permit requirements of the FFG Act for the handling of flora do not apply to private land (unless part of critical habitat for the flora). For the purposes of the FFG Act, private land includes land that APAM has leased or purchased at Melbourne Airport because APAM has a right to exclusive possession of this leasehold and freehold land.

However, in accordance with the Significant Impact Guidelines 1.2, the FFG Act as a Victorian Government biodiversity protection mechanism is used as a guide for identifying ecological components of the environment that can be considered to have 'special value' (DSEWPaC, 2013 p.8). Threatened taxa, threatened communities and threatening processes listed under Section 10 of the FFG Act, associated Action Statements, and the *Flora and Fauna Guarantee Amendment Act 2019* (which came into effect on June 1, 2020) and Victorian Scientific Advisory Committee determinations, provide local context for an assessment of impacts to the environment on Commonwealth land under the Significant Impact Guidelines 1.2.

B5.3.3.2 Planning and Environment Act 1987 (inc. planning schemes)

The P&E Act controls the planning and development of land in Victoria; and provides for the development of a comprehensive set of planning provisions for the state (the Victoria Planning Provisions) and specific planning schemes for all municipalities. The local Hume Planning Scheme recognises the Commonwealth's exclusive power to legislate in respect of Commonwealth land at Melbourne Airport, identifying it as 'Commonwealth Land not controlled by Planning Scheme' (Hume Planning Scheme Map Numbers 15, 16, 21, 22, 25 and 26).

Removal, destruction and lopping of native vegetation in Victoria is regulated through the planning schemes and through *Victoria's Guidelines for the Removal, Destruction or Lopping of Native Vegetation* (DELWP, 2017) which is an incorporated document of all planning schemes in Victoria.

These provide a policy setting for defining native vegetation, assessing its values, making decisions regarding clearing and providing compensatory offsets. Although the P&E Act, and therefore the Guidelines, do not directly apply to Commonwealth land at Melbourne Airport, the Guidelines do provide standard methods for defining and assessing native vegetation. These methods have been applied in the absence of a standard Commonwealth approach to native vegetation assessment.

B5.4 DESCRIPTION OF SIGNIFICANCE CRITERIA

B5.4.1.1 Impact assessment approach

In accordance with the Significant Impact Guidelines 1.1, significant impact self-assessments were undertaken for all EPBC Act-listed species, ecological communities and migratory species recorded or assessed as having a medium to high likelihood of occurring within the project area (DoE, 2013). Where available, species-specific significant impact guidelines were relied on to make impact assessments (e.g. DEWHA, 2009a; DEWHA, 2009b; DoE, 2015; DoEE, 2017).

For actions on, or adjacent to, Commonwealth land, impacts on the environment as a whole must be considered. A significant impact self-assessment for relevant ecological features of the environment on Commonwealth land was conducted in accordance with the Significant Impact Guidelines 1.2.

B5.4.1.2 Likelihood of a significant impact

A significant impact on the environment is 'likely' if there is a real or not remote chance or possibility of the impact occurring (DoE, 2013).

The significant impact criteria outlined in the Significant Impact Guidelines 1.1 (DoE, 2013), Significant Impact Guidelines 1.2 (DSEWPaC, 2013) and species-specific (e.g. DEWHA, 2009a; DEWHA, 2009b; DoE, 2015; DoEE, 2017) significant impact guidelines were assessed for the project.

The 'likelihood of impact criteria' defined in **Table A8.3 in Chapter A8: Assessment and Approvals Process** were used for this assessment. All categories except for rare are 'likely' to result in a significant impact on the environment as per (DoE, 2013).

B5.4.1.3 Severity of impact

The severity of an impact is a useful concept when referring to the thresholds for significant impacts on ecological MNES; or to the scale, intensity, timing, duration and frequency of an impact on an ecological component of the environment on Commonwealth land.

Table B5.10 describes the criteria used in this chapter to define the severity of an ecological impact (whether on MNES or the environment as a whole). For the purposes of this chapter, where an impact on ecological values would meet the significant impact criteria outlined in any of the relevant Significant Impact Guidelines, it would be considered an impact of major severity.

Table B5.9
Severity assessment criteria for ecological impacts

Magnitude	Specialist criteria
Major	A significant impact on an EPBC Act listed threatened species, ecological community or migratory species as defined by the Significant Impact Guidelines 1.1 (DoE, 2013) or relevant species-specific guidelines, where the impact is likely to result in population decline and / or reduction in extent or area of occupancy. A significant impact on the environment on Commonwealth land, as defined by the Significant Impact Guidelines 1.2 (DSEWPaC, 2013).
High	Any adverse impact to an EPBC Act listed threatened species, ecological community or migratory species that is not significant according to the Significant Impact Guidelines 1.1 (DoE, 2013) and / or is unlikely to result in population decline and / or adversely affect status and extent. Significant adverse impact to a state significant species or ecological community that is likely to result in population decline and / or reduction in extent or area of occupancy.
Moderate	Adverse impacts on native vegetation, as defined by Victoria's Native Vegetation Guidelines (DELWP, 2017), that does not constitute an ecological community of national or state significance. Adverse impacts on flora and / or fauna values of regional importance or on a regional scale. For significant species and ecological communities at a national and / or state scale, adverse impacts are considered moderate once appropriate offsets or controls have been established to mitigate impacts on the national and state scale.
Minor	Adverse impacts on flora and / or fauna values at a local scale only. For significant species and ecological communities, adverse impacts are considered minor once appropriate offsets or controls have been established that mitigate impacts on national, state and regional scale.
Negligible	No or minimal adverse impacts on flora and / or fauna values at the local scale.
Beneficial	An enhancement of existing ecological values.

Ultimately, significant impact assessments must consider the likelihood of an impact occurring, in addition to the severity of the impact if the impact were to occur. The question is whether there is a 'real or not remote chance or possibility' of the impact occurring (DSEWPaC, 2013; DoE, 2013). Chapter A8: Assessment and Approvals Process provides a framework for combining severity and likelihood.

The significance matrix is applied in Section B5.8 Conclusion, which includes an assessment of the significance of the project's impacts on ecological MNES and components of the environment.

B5.4.1.4
Duration of impact

The duration of the impact is considered in the significance matrix applied in Section B5.8. The duration-of-impact criteria in Table A8.2 in Chapter A8: Assessment and Approvals Process is utilised in this assessment.

B5.5
EXISTING CONDITIONS

The existing conditions in the Melbourne Airport local area can be divided into those for airside and for landside. They represent significantly different land use and conditions.

Airside is a highly-managed environment containing runways, taxiways, and other infrastructure directly associated with operating the airfield. It is a large flat expanse characterised by hard surfaces, outbuildings and technical equipment, and is surrounded by a large expanse of grassed areas.

Relevant management activities occurring within the airfield include:

- Regular slashing of grasses, with some areas (e.g. near critical infrastructure) mowed up to once per week
- Use of bird deterrents such as motion-activated noise generators and shooting (as a last resort) to reduce the risk of aircraft wildlife strike
- Insecticides applied alongside some lengths of runway to reduce foraging by birds in these high-risk wildlife strike zones.
- Currently airside is undergoing significant construction works, with major earthworks being undertaken for the construction of the Taxiway Zulu and Northern Access project.

Landside is a highly variable landscape: some areas are highly modified and developed (i.e. business park) while others are used for cattle grazing. Some of these areas have been subject to pasture improvement while others are relatively intact. A large intact woodland area is located in the north-west. An operational construction-materials plant is located south-west of the woodland. Much of landside has been degraded through past land use and it contains expanses of weedy areas punctuated with native vegetation.

B5.5.1
Environmental features

B5.5.1.1
Climate, soil, geomorphology and land use history

Climate, soil and geomorphology influence the observable vegetation and habitat types within the project area.

DELWP's pre-1750 EVC modelling is available via NatureKit and suggests that, before the industrial revolution, the northern two-thirds of the project area (including areas where there are now runways) mostly supported Plains Grassy Woodland, while the southern third of the project area (including a projection north along Arundel Creek) mostly supported Plains Grassland.

Although DELWP's pre-1750 EVC modelling uses climate, soil and geomorphological data as inputs, it is a coarse representation of vegetation types at a landscape scale, ranging from 1:25,000 to 1:100,000 (DELWP, 2020). Historic survey plans, historic aerial imagery, geological maps and contemporary on-ground floristics strongly suggest that DELWP's pre-1750 EVC modelling is not an accurate representation of the vegetation types that were – and, to some extent, still are – present at Melbourne Airport.

Historic parish and subdivision plans from 1840, c.1849 and 1850 suggest that distribution of woodland and grassland across the project area was similar to the present day (Figure B5.2, Figure B5.3 and Figure B5.4).

The plans of 1840 and c.1849 describe a 'thick scrubby forest of stringy bark' at the current location of the woodland; and the vegetation to the south, where grassland is currently the predominant vegetation type, as 'open plains', 'plains thinly wooded' or 'good pasture' (Kemp, 1840; DoL c.1849; Figure B5.2 and Figure B5.3).

Robert Hoddle's 1850 subdivision plan places a curved label for 'box forest' along the curved south-western boundary of the present-day woodland. It labels the area immediately south as 'open plain red soil' – in an area currently grassland but described by NatureKit as Plains Grassy Woodland (Hoddle, 1850; DELWP, 2020; Figure B5.4).

Maps produced by the Commonwealth Department of Defence (DoD, 1915; DoD, 1938) and Victorian Department of Crown Lands and Survey (DCLS) in the early 1900s add further weight to contemporary vegetation mapping as opposed to NatureKit modelling. DoD maps from 1915 and 1938 depict a dense stand of 'timber' in the vicinity of the present-day woodland, and very sparse trees in what is now grassland further south (DoD, 1915; DoD, 1938; Figure B5.5 and Figure B5.6). Similarly, a 1946 photo map covering part of the project area shows that the woodland boundary then extended almost as far south and east as the current runways – very similar to the present-day distribution of woodland and derived grassland (DCLS, 1946; Figure B5.7).

In line with historic maps and plans, geomorphology and floristics suggest that the majority of the project area would have been grassland; with woodland concentrated around a granodiorite rise and outwash known as Radar Hill in the north adjacent to the project area (Figure B5.8).

Radar Hill is represented on some historic plans of the area (e.g. DoL, c.1849; Figure B5.3). Geological maps show that Radar Hill is a granodiorite or granite intrusion surrounded by plains of basalt lava flows (Mines Department, 1970; Mines Department, 1973; DNRE, 1997; Senversa, 2020, unpublished). While the basalt plains are characteristic of the Victorian Volcanic Plain bioregion and mapped as such on NatureKit (DELWP, 2020), the granodiorite rise of Radar Hill is likely an outlier of the nearby Central Victorian Uplands bioregion.

As the main geological formations weathered over time, relatively infertile granodiorite-derived soils (supporting woodland) have developed at Radar Hill while relatively fertile basalt-derived soils (supporting grassland) formed on the surrounding plain. In addition, granodiorite has weathered and washed out over areas of basalt immediately surrounding Radar Hill, leading to diffuse soil boundaries which in some cases are reflected by diffuse vegetation boundaries between woodland and grassland. Climate, soil and geomorphology have influenced the following floristic patterns observable today and documented in various maps since 1840:

- The granodiorite rise of Radar Hill supports a central patch of Hills Herb-rich Woodland which is often found on granite hill landforms and well-drained-soils (DSE, 2004a)
- A ring of Plains Woodland encircles the Hills Herb-rich Woodland on the basalt surrounding the granodiorite. Plains Woodland generally occurs on silty, loamy or clay topsoils with heavy subsoils. The soils in this area are predominantly basalt-derived and therefore heavy, although weathered, granodiorite is present at or near the surface (washed away from the central rise) and adds a silty component. Gilgai micro-relief is also present in the Plains Woodland, typical of heavy clay soils
- The ring of Plains Woodland appears incomplete due to the removal of trees from the southern and eastern sides (i.e. airside) resulting in the presence of Plains Woodland in derived grassland form
- Within the project area, the derived grassland form of Plains Woodland is typically distinguishable from Plains Grassland on the basis of floristic composition, as follows:
    - Characteristic woodland species, such as Eucalypts *Eucalyptus* spp. (including stumps or suspected stumps), Golden Wattle *Acacia pycnantha*, Gold-dust Wattle *Acacia acinacea* and Common Eutaxia *Eutaxia microphylla*, are present in derived grassland, albeit in stunted or prostrate form due to being regularly slashed. The outermost occurrences of these species (i.e. those records that were most distant from Radar Hill) typically corresponded closely to the woodland boundary observable in 1946 (DCLS, 1946; Figure B5.7)
    - Silky Blue-grass *Dichanthium sericeum* subsp. *sericeum* and/or Red-leg Grass *Bothriochloa macra* seem to favour areas of historical disturbance (e.g. tree removal) and soils that appeared to be basaltic with granodiorite (granitic sand) at the surface. Therefore, the boundary between the derived grassland form of Plains Woodland and Plains Grassland often corresponds closely with the point at which there is a strong transition between grassland dominated almost entirely by Silky Blue-grass and/or Red-leg Grass (Plains Woodland) and grassland dominated by wallaby grasses *Rytidosperma* spp. and spear grasses *Austrostipa* spp. (Plains Grassland)
- DELWP's pre-1750 EVC modelling suggests that most woodland within the project area would have been Plains Grassy Woodland (EVC 55_61) which is typically dominated by River Red-gum *Eucalyptus camaldulensis* (DSE 2004b). Woodland around Radar Hill is in fact dominated by Grey Box *Eucalyptus microcarpa*, making Hills Herb-rich Woodland (EVC 71) and Plains Woodland (EVC 803) more appropriate EVCs to assign to this vegetation
- The mean annual rainfall within the project area is 531.3 millimetres (BoM, 2020). Grassland within the project area is therefore more likely to be Heavier-soils Plains Grassland (EVC 132_61) that occurs in areas with a mean annual rainfall of at least 500 millimetres.

B5.5.1.2
Wetlands and waterways

Melbourne Airport land is located on broad expanses of basalt plains with a low rise (Radar Hill) in the north-west. These plains and Radar Hill are bounded by watercourses surrounded by escarpment, hillslopes, cliffs and floodplains to the north-west (Deep Creek), south/south-west (Maribyrnong River) and east (Moonee Ponds Creek); and cutting through the middle of the land from north to south (Arundel Creek and Steele Creek/Steele Creek North).

Other smaller drainage lines and channels associated with these waterways are dispersed across the project area. The three catchment areas for Melbourne Airport are the Maribyrnong River, Arundel Creek and Moonee Ponds Creek; which ultimately discharge into the Yarra River and on to Port Phillip Bay.

Deep Creek is characterised by a deep and narrow valley cut through the surrounding basalt plains, with steep escarpments rising up from the edges of the waterway. In some places these rise immediately adjacent to the waterway and in others they rise beyond areas of floodplain. Within the project area, Deep Creek has many bends that form permanent, still pools of water, and the creek is well vegetated. Deep Creek reaches a confluence with Jackson's Creek where they join and form the Maribyrnong River, a wide, deep and permanent waterway that drains into the Yarra River. The section of Maribyrnong River closest to the project area is wide and fast flowing.

Arundel Creek runs north to south through the centre of Melbourne Airport and connects with the Maribyrnong River south of the airport estate. Arundel Creek is a narrow waterway for most of its length, interspersed with small impoundments and two inline dams.

Moonee Ponds Creek flows in the north-east of the project area and can be considered a semi-permanent waterway. During years of below-average rainfall, the majority of pools within the creek are dry. Historically, Moonee Ponds Creek was known as Moonee Moonee Chain of Ponds which is descriptive of this waterway's nature.

Other unnamed tributaries/drainage channels occur throughout the project area. These have been modified and comprise a series of impoundments and drainage lines that were dry at the time of assessment (containing little to no water). Some dams are located in paddocks with livestock access, resulting in highly turbid water, pugged embankments, and little to no fringing or aquatic vegetation. Other dams are fenced off from livestock and in better condition.

The majority of Arundel Creek is located within the impact area. Only small areas of the terrestrial land adjacent to Deep Creek and the Maribyrnong River are included within the impact area.

B5.5.1.3
Flora species and vegetation types

A total of 298 plant taxa were recorded in the project area: 136 were native and 162 introduced. A flora species list is presented in Appendix B5.B.

Site investigations identified seven terrestrial and two wetland EVCs including:

- Plains Grassy Woodland 55
- Creekline Grassy Woodland EVC 68
- Hills Herb-rich Woodland EVC 71
- Heavier-soils Plains Grassland EVC 132
- Riparian Woodland EVC 641
- Plains Woodland EVC 803
- Escarpment Shrubland EVC 895
- Aquatic Herbland EVC 653
- Tall Marsh EVC 821.

The remaining vegetation and land cover in the project area is predominantly introduced vegetation and highly-modified areas. Open water also occurs in association with local creeks and farm dams.

Vegetation types are described in detail in Table B5.12. It was determined that the patch of Hills Herb-rich Woodland at Radar Hill corresponded with an outlier of the Central Victorian Uplands bioregion and therefore assessed accordingly (Note: the EVC benchmarks for Hills Herb-rich Woodland are identical to the Victorian Volcanic Plain and Central Victorian Uplands bioregions).

B5.5.1.4
Fauna species and habitat

A total of 72 native and four introduced fauna species were recorded within and adjacent to the project area.

A list of all fauna species recorded during the current field assessment and the financial year 2019 Growling Grass Frog survey is provided in Appendix B5.C. A breakdown of the detection method for each species is also included. Habitat types for the fauna groups present are described in Table B5.12 and waterways in Section B5.5.1.2.

B5.5.1.5
Landscape context

The project area is located in Melbourne's northern suburbs. Native vegetation has either been cleared or become degraded on most land within five kilometres of the project area. This is due to agricultural activities (mostly livestock grazing) or industrial and residential development.

Nearby waterways (Deep Creek, Jacksons Creek, Arundel Creek, Maribyrnong River and Moonee Ponds Creek) provide the most intact dispersal corridors for fauna. The largest and most intact areas of native vegetation outside the project area, but within the local area, are Woodlands Historic Park to the north-east and Organ Pipes National Park to the west.

Table B5.10
Summary of vegetation and fauna habitat values within the project area (Figure B5.17)

EVC	Vegetation description	Fauna values	Location	FFG community	MNES	Photo
Plains Grassy Woodland EVC 55	**Structure:** Small patches dominated by introduced weed species and disturbance-tolerant native species. **Character species:** The dominant overstorey species is River Red-gum *Eucalyptus camaldulensis*. Understorey species include Golden Wattle *Acacia pycnantha*, Lightwood *Acacia implexa* and Hedge Wattle *Acacia paradoxa*. The ground layer includes native grasses such as wallaby grasses *Austrodanthonia* spp. and spear grasses *Austrostipa* spp. Small herbs are generally present, however prostrate shrubs are the most common non-grass ground cover, particularly Berry Saltbush *Atriplex semibaccata* and Nodding Saltbush *Einadia nutans*. **Weeds:** High threat species such as Serrated Tussock *Nassella trichotoma*, Chilean Needle-grass *Nassella neesiana* and Panic Veldt-grass *Ehrharta erecta* occur.	Plains Grassy Woodland provides habitat for a range of common fauna species such as possums, birds, macropods, bats, reptiles, and amphibians. It provides potential nesting and roosting areas for large birds of prey such as Wedge-tailed Eagle *Aquila audax* and owl species. Where the ground cover is dominated by appropriate food species and canopy cover is dispersed it has the potential to provide habitat for the critically endangered GSM. Plains Grassy Woodland present in the project area is too disturbed to provide habitat for SLL.	This EVC has limited distribution in the project area and is highly modified.	Western Basalt Plains (River Red Gum) Grassy Woodland which is threatened under the FFG Act is generally considered affiliated with the Plains Grassy Woodland EVC. There are no minimum patch size or condition thresholds for this community.	This EVC does not represent a TEC. May be visited by the vulnerable Grey-headed Flying-fox when trees in flower. Note: EVC 55 has affinities with the EPBC Act listed 'Grassy Eucalypt Woodland of the Victorian Volcanic Plain Critically Endangered Community' when River Red-gum is the dominant canopy species. However, all patches of this EVC recorded are less than 0.5 ha and highly fragmented so therefore do not meet the size condition thresholds to qualify as a TEC (TSSC, 2009).	 **Plate B5.1** **EVC 55 Plains Grassy Woodland**
Creekline Grassy Woodland EVC 68	**Structure:** An open woodland growing along seasonal creeks and drainage lines with a grassy/sedgy understorey. In some areas the overstorey is a mix of native species and planted trees. **Character species:** Overstorey is River Red-gum with an understorey of Cumbungi *Typha* sp., Common Reed *Phragmites australis*, Club-rush *Schoenoplectus tabernaemontani*, Hollow Rush *Juncus amabilis*, Pale Knotweed *Persicaria lapathifolia*, Little Club-sedge *Isolepis marginata*, Common Tussock-grass *Poa labillardierei* and Weeping grass *Microlaena stipoides* var. *stipoides*. **Weeds:** Common weed species include Spiny Rush *Juncus acutus*, Creeping Buttercup *Ranunculus repens*, Drain Flat-sedge *Cyperus eragrostis*, Panic Veldt-grass *Ehrharta erecta* and Water Couch *Paspalum distichum*.	Provides habitat for a range of common fauna species such as possums, birds, macropods, bats, reptiles, and amphibians. Significant species likely to utilise this habitat include the GGF. Migratory waterbird species may use this habitat on occasion including Latham's Snipe.	Along the riparian zones of Arundel Creek and Deep Creek.	This EVC does not represent a FFG Act listed community.	This EVC does not represent a TEC as associated riparian vegetation does not fit the key landscape setting and floristic diagnostics of any listed woodland or wetland community. Growling Grass Frog terrestrial habitat is associated with this vegetation type in the project area. May be visited by the vulnerable Grey-headed Flying-fox when trees in flower. Habitat for Latham's Snipe.	 **Plate B5.2** **EVC 68 Creekline Grassy Woodland**
Hills Herb-rich Woodland EVC 71	**Structure:** An open woodland with a sparse shrub layer and grassy ground layer on gently rising elevated locations. **Character species:** Overstorey is dominated by Grey Box *E. microcarpa* with occasional Yellow Box *E. melliodora*. The understorey shrub layer is consistently sparse with occasional Fragrant Saltbush *Rhagodia parabolica*, Tree Violet *Melicytus dentatus*, Golden Wattle and Lightwood. The ground layer includes native graminoids and herbs such as wallaby grasses, spear grasses, Finger Rush *Juncus subsecundus*, Black Anther Flax-lily *Dianella revoluta*, Kidney Weed *Dichondra repens* and Grassland Wood-sorrel *Oxalis perennans*. The resurrection Rock Fern *Cheilanthes austrotenuifolia* also occurs on dry well-drained soils that typify this EVC. This EVC is floristically and structurally similar to EVC 803 but has a lower cover of chenopods and less bare ground and bryophyte cover. **Weeds:** Weed cover is variable and dominated by annual species such as Annual Veldt-grass *Ehrharta longiflora*, Rat's-tail Fescue *Vulpia myuros* and Hair-grass *Aira* sp. Perennial high threat species have a moderate cover and include Serrated Tussock, Galenia *Galenia pubescens* var. *pubescens*, African Box-thorn *Lycium ferocissimum*, Prickly Pear *Opuntia* sp. and Horehound *Marrubium vulgare*.	This habitat type is frequented by macropods, a diverse range of woodland bird species and provides habitat for bats, reptiles, frogs, possums and other mammals and invertebrates.	A contiguous patch of habitat embedded in EVC 803 in the north-west part of the project area. Occurs on areas of outcropping granite and well-drained granitic outwash soils.	This habitat type is synonymous with the FFG Act listed Victorian Temperate Woodland Bird Community. This community is defined by a group of bird species which are totally or largely restricted to temperate woodland habitats and commonly associated with Box Iron-Bark, Yellow Box, Cypress Pine (and other) woodland tree species. A large percentage of the species recorded in the Grey Box Woodland in the north of the study area are included within this community.	The treed areas of the project area woodland represent the EPBC Act listed Grey Box Grassy Woodland TEC. This area provides habitat for the critically endangered Swift Parrot and the vulnerable Grey-headed Flying Fox.	 **Plate B5.3** **EVC 71 Hills Herb-rich Woodland**

EVC (cont.)	Vegetation description (cont.)	Fauna values (cont.)	Location (cont.)	FFG community (cont.)	MNES (cont.)	Photo (cont.)
Plains Grassland EVC 132	**Structure:** Typically a low growing treeless vegetation community dominated by grasses and herbs. Scattered trees and shrubs are often present. Dominant tussock-forming grass species vary across seasons, soil types and according to disturbance history. **Character species:** Dominant C3 grasses include wallaby grasses and spear grasses. Dominant C4 grasses include Silky Blue-grass *Dichanthium sericeum* subsp. *sericeum*, Red-leg Grass *Bothriochloa macra*, Windmill Grass *Chloris truncata*, Kangaroo Grass *Themeda triandra*, Rigid Panic *Walwhalleya proluta* and Hairy Panic *Panicum effusum*. Commonly encountered herbs include Lemon Beauty-heads *Calocephalus citreus*, Blue Devil *Eryngium ovinum*, and Bindweed *Convolvulus* spp. **Weeds:** Annual and perennial grass weeds dominate the weed flora in grassland vegetation and include Rat-tail Grass *Sporobolus africanus*, Paspalum *Paspalum dilatatum*, Cocksfoot *Dactylis glomerata*, Toowoomba Canary-grass *Phalaris aquatica*, Kikuyu *Cenchrus clandestinus*, Couch *Cynodon dactylon*, Chilean Needle-grass, Serrated Tussock, Brome-grasses *Bromus* spp., Wimmera Rye-grass *Lolium rigidum* and Oat *Avena* spp. Woody and herbaceous weeds include Artichoke Thistle *Cynara cardunculus* subsp. *flavescens*, Ribwort *Plantago lanceolata*, Buck's-horn Plantain *Plantago coronopus*, Ox-tongue *Helminthotheca echioides*, African Box-thorn, Galenia, Clover *Trifolium* spp., Medic *Medicago* spp., and Peppercress *Lepidium* spp.	Plains Grassland provides habitat for a broad range of reptile species, birds and mammals. It is important habitat for reptiles and invertebrates. This area generally represents ideal habitat for the GSM, however the species has not been recorded within this habitat type in the project area. Tussock Skink was recorded broadly across the project area during the tile grid checks. The species was recorded in Plains Grassland habitat both airside and landside. The Plains Grassland present within the project area appears to be providing good habitat for the species.	Plains Grassland is the dominant native vegetation community throughout the project area. It is predominantly found in areas where some form of active land management or disturbance is occurring, i.e. grazing or slashing in landside area and slashing only in airside areas.	Western (Basalt) Plains Grassland which is threatened under the FFG Act is generally considered affiliated with the presence of Plains Grassland EVC. There are no minimum patch size or condition thresholds for this community.	Some areas of EVC 132 represent the 'Natural Temperate Grassland of the Victorian Volcanic Plain critically endangered community'. Other areas do not meet the size or condition thresholds.	 **Plate B5.4** **EVC 132 Plains Grassland**  **Plate B5.5** **EVC 132 Plains Grassland**
Plains Woodland EVC 803 (Treed condition state)	**Structure:** Open woodland with variable shrub cover including restored areas. **Character species:** Overstorey is dominated by Grey Box *E. microcarpa* with very occasional Yellow Box on well-drained soils and River Red-gum in seasonally inundated areas. The understorey varies in species richness and weed cover but generally includes a medium shrub layer of Golden Wattle, Gold-dust Wattle *Acacia acinacea*, Hedge Wattle *Acacia paradoxa*. Chenopods such as Ruby Saltbush *Enchylaena tomentosa*, Berry Saltbush *Atriplex semibaccata* and Nodding Saltbush *Einadia nutans* dominate the ground layer with occasional herbs, grasses and sedges including Rough Spear-grass *Austrostipa scabra* subsp. *falcata*, wallaby grasses, Kidney Weed, Grassland Wood-sorrel, Knob Sedge *Carex inversa*, Wattle Mat-rush *Lomandra filiformis* subsp. *coriacea* and New Holland Daisies *Vittadinia* spp. Bare ground and bryophyte cover is high in places reflective of local climatic and soil conditions. Restored areas support a higher diversity of planted small trees and medium shrubs including Sweet Bursaria *Bursaria spinosa*, Drooping She-oak *Allocasuarina verticillata* and Sticky Hop-bush *Dodonaea viscosa*. **Weeds:** Weed cover is highly variable with core areas of the woodland having low weed cover and edges supporting higher weed cover. Key high threat species include Galenia, Bridal Creeper, Serrated Tussock, Chilean Needle-grass, African Box-thorn and Horehound.	This habitat type is frequented by macropods, a diverse range of woodland bird species and provides habitat for bats, reptiles, frogs, possums and other mammals and invertebrates.	Occurs on the transition between granitic outwash soils and heavy basalt-derived clays with gilgai micro-relief. A contiguous patch of habitat in the north-west part of the project area.	This habitat type is synonymous with the FFG Act listed Victorian Temperate Woodland Bird Community. This community is defined by a group of bird species which are totally or largely restricted to temperate woodland habitats and commonly associated with Box Iron-Bark, Yellow Box, Cypress Pine (and other) woodland tree species. A large percentage of the species recorded in the Grey Box Woodland in the north of the study area are included within this community.	The treed areas of the Airport woodland represent the EPBC Act listed Grey Box Grassy Woodland TEC. This area provides habitat for the critically endangered Swift Parrot and the vulnerable Grey-headed Flying Fox. Disturbed small patches of regenerating Wattles such as Lightwood to the west and south of the Airport Woodland do not represent this community as they do not meet the size or condition thresholds that define the community.	 **Plate B5.6** **EVC 803 Plains Woodland, intact high quality old growth woodland**  **Plate B5.7** **EVC 803 Plains Woodland, restored area**

EVC (cont.)	Vegetation description (cont.)	Fauna values (cont.)	Location (cont.)	FFG community (cont.)	MNES (cont.)	Photo (cont.)
Plains Woodland EVC 803 (Derived Grassland condition state)	**Structure:** The derived grassland condition state of Plains Woodland has less than 10% tree cover with occasional scattered remnant trees and slashed Grey Box saplings. There are also tree stumps present in these areas indicating the historical woodland structure. The vegetation structure is a low grassland dominated by native graminoids, scattered herbs and slashed shrubs. **Character species:** Grey Box occurs as scattered trees and the understorey is dominated by Silky Blue-grass, Red-leg Grass, Windmill Grass, wallaby grasses, spear grasses, Black-anther Flax-Lily and Wattle Mat-rush *Lomandra filiformis*. A number of shrub species are present including Gold-dust Wattle, Golden Wattle and Common *Eutaxia Eutaxia microphylla* var. *microphylla*. Herb species include Lemon Beauty-heads *Calocephalus citreus* and Tufted Bluebell *Wahlenbergia communis* s.l. **Weeds:** Dominant weeds include Paspalum, Serrated Tussock, Chilean Needle-grass and Ribwort.	Provides habitat for a broad range of reptile species, birds and mammals. It is important habitat for reptiles and invertebrates. This area generally represents habitat for GSM, however the species has not been recorded within this habitat type in the project area.	Occurs in the Airside land management zone to the east of the Airport Woodland in a transitional zone between Plains Grassland and Plains Woodland/Hills Herb-Rich Woodland.	This EVC does not represent a FFG Act listed community.	The derived grassland areas represent the EPBC Act listed Grey Box Grassy Woodland TEC.	 **Plate B5.8** **EVC 803 Plains Woodland, derived native grassland**

EVC (cont.)	Vegetation description (cont.)	Fauna values (cont.)	Location (cont.)	FFG community (cont.)	MNES (cont.)	Photo (cont.)
Riparian Woodland EVC 641	**Structure:** An open Eucalypt woodland community with an understorey of native shrubs and woody weeds, and a grassy/sedgy ground layer. **Character species:** The dominant canopy species is River Red-gum. Understorey species include Blackwood *Acacia melanoxylon*, River Bottlebrush *Callistemon sieberi*, Club-rush , Cumbungi, Common Reed, Hollow Rush, Streaked Arrowgrass *Triglochin striata*, Little Club-sedge, Common Tussock-grass *Poa labillardierei* and Kangaroo Grass. Herbs include *Verbena* sp., Water Pepper *Persicaria hydropiper*, Small-leaved Clematis *Clematis microphylla* and Angled Lobelia *Lobelia anceps*. **Weeds:** Common weeds include Willow *Salix* spp., Rat-tail, Cocksfoot, Toowoomba Canary-grass, Serrated Tussock, Panic Veldt-grass, Drain Flat-sedge *Cyperus eragrostis*, Spiny Rush, Common Blackberry *Rubus anglocandicans* and Blue Periwinkle *Vinca major*.	Provides habitat for a range of common fauna species such as possums, birds, macropods, bats, reptiles, and amphibians. Significant species likely to utilise this habitat include GGF. Migratory waterbird species may use this habitat on occasion including Latham's Snipe.	Riparian Woodland occurs on the western boundary of the project area in the riparian zone of major creeks and waterways such as Deep Creek, the Maribyrnong River and their tributaries.	This EVC does not represent a FFG Act listed community.	This EVC does not represent a TEC as associated riparian vegetation does not fit the key landscape setting and floristic diagnostics of any listed woodland or wetland community. Growling Grass Frog terrestrial habitat is associated with this vegetation type in the project area. May be visited by the vulnerable Grey-headed Flying-fox when trees in flower. Habitat for Latham's Snipe.	 **Plate B5.9** **EVC 641 Riparian Woodland**
Escarpment Shrubland EVC 895	**Structure:** Due to high level of modification to this EVC, the structure and composition is simplified and the community is now dominated by a small suite of hardy native species. Woody weeds dominate the structure and plant diversity with the remaining small areas. **Character species:** The dominant species found within the project area include *Eucalyptus* spp., wattles *Acacia* spp., Tree Violet, Berry Saltbush, Nodding Saltbush and wallaby grasses and spear grasses. **Weeds:** Dominant weeds include Chilean Needle-grass, Serrated Tussock, Artichoke Thistle, Boneseed *Chrysanthemoides monilifera* and African Box-thorn.	Provides habitat for common reptile and bird species.	On steep slopes of incised gullies and tributaries leading down to Deep Creek and Maribyrnong River in the west of the project area.	This EVC does not represent a FFG Act listed community.	This EVC does not represent a TEC as associated escarpment vegetation does not fit the key landscape setting and floristic diagnostics of any listed shrubland or woodland community.	 **Plate B5.10** **EVC 895 Escarpment Shrubland**

EVC (cont.)	Vegetation description (cont.)	Fauna values (cont.)	Location (cont.)	FFG community (cont.)	MNES (cont.)	Photo (cont.)
Aquatic Herbland EVC 653	**Structure:** Aquatic Herbland occupies open, semi-permanent pools where water depth and seasonality limits the dominance of Bulrush and Common Reed. This community is typically treeless with occasional over hanging trees from adjacent communities. Within the project area planted trees and shrubs are common features. **Character species:** Common species include low densities of Bulrush and Common Reed, Loose-flower Rush *Juncus pauciflorus*, Club Sedge *Isolepis* spp., Small Loosestrife *Lythrum hyssopifolia*, Water Milfoil *Myriophyllum* spp., Swamp Lily *Ottelia ovalifolia* subsp. *ovalifolia* Streaked Arrowgrass and Duckweed *Lemna* spp. **Weeds:** Dominant weeds include Willow species, Jointed Rush *Juncus articulatus* subsp. *articulates*, Water Couch, Water Buttons *Cotula coronopifolia*, Panic Veldt-grass, Cocksfoot and Toowoomba Canary-grass.	Significant species likely to utilise this habitat include GGF. Migratory waterbird species may use this habitat on occasion including Latham's Snipe.	Aquatic Herbland occurs as very small patches along Arundel Creek and is a transitional zone between Tall Marsh and Creekline Grassy Woodland / Riparian Woodland.	This EVC does not represent a FFG Act listed community.	This EVC does not represent a TEC as associated wetland vegetation does not fit the key landscape setting and floristic diagnostics of Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains Critically Endangered Community. This is due to Aquatic Herbland occurring in creek systems (and not as a depressional wetland) and the lack of wetland grass and herb species. Growling Grass Frog terrestrial habitat is associated with this vegetation type in the project area. Habitat for Latham's Snipe.	 **Plate B5.11** **EVC 653 Aquatic Herbland**
Tall Marsh EVC 821	**Structure:** Occurs as reed beds to 2 m tall in slow flowing or still waterbodies where water depth reaches 1 m. Trees are typically absent, however, in some areas planted trees occur within the canopy layer. **Character species:** Dominated by large graminoids Bulrush and Common Reed. Open areas have similar structure and floristics to Aquatic Herbland described above. **Weeds:** Common weeds include Water Couch, Cocksfoot, Toowoomba Canary-grass, Drain Flat-sedge, and Spiny Rush, Panic Veldt-grass and Aster-weed *Symphyotrichum subulatum*.	Significant species likely to utilise this habitat include GGF. Migratory waterbird species may use this habitat on occasion including Latham's Snipe.	Scattered throughout the central and southern parts of the project area as small patches. Associated with Arundel Creek and modified drainage systems.	This EVC does not represent a FFG Act listed community.	This EVC does not represent a TEC as associated wetland vegetation does not fit the key landscape setting and floristic diagnostics of Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains Critically Endangered Community. This is due to Tall Marsh being dominated by 'contra-indicator species' (tall native graminoids) and occurring in creek systems not as depressional wetlands. Growling Grass Frog terrestrial habitat is associated with this vegetation type where it is located along Moonee Ponds Creek and Arundel Creek in the project area. Habitat for Latham's Snipe.	 **Plate B5.12** **EVC 831 Tall Marsh**
Scattered trees	Scattered remnant trees occur as isolated individuals and include mostly River Red-gum, Grey Box, Lightwood and dead trees. The understorey associated with these trees is predominantly introduced vegetation with the occasional disturbance-tolerant native species such as Nodding Saltbush and Berry Saltbush.	Trees within the project area provide habitat for a broad range of bird species and mammals such as possums and bats.	Throughout the project area.	This EVC does not represent a FFG Act listed community.	Although Grey Box occurs as a scattered trees these areas do not represent the Grey Box Grassy Woodland TEC community as they do not meet the size or condition thresholds that define the community. Swift Parrot and Grey-headed Flying Fox may visit scattered trees on occasion.	 **Plate B5.13** **Scattered tree**

EVC (cont.)	Vegetation description (cont.)	Fauna values (cont.)	Location (cont.)	FFG community (cont.)	MNES (cont.)	Photo (cont.)
Planted vegetation	Tree plantings that are a mix of non-indigenous native species such as Sugar Gum *Eucalyptus cladocalyx*, Lemon-scented Gum *Corymbia citriodora* subsp. *citriodora*, Spotted Gum *Corymbia maculata*, native shrubs, introduced conifers and ornamental species.	Planted vegetation is unlikely to provide habitat to any significant fauna species however it does provide habitat for common reptiles, amphibians, birds and mammals.	Mostly occurs landside associated with old buildings, grazing paddocks and farm infrastructure.	This EVC does not represent a FFG Act listed community.	Planted vegetation does not represent a TEC.	 **Plate B5.14** **Planted vegetation**
Predominantly introduced vegetation	A large proportion of the study area supports degraded paddocks that have been cleared in the past and are currently used for grazing purposes. Native vegetation in these areas consists of scattered spear grasses and wallaby grasses. Many paddocks are heavily infested with weed species such as Serrated Tussock, Chilean Needle-grass.	Flowering eucalypts that are not indigenous to the study area offer foraging habitat for fauna including the EPBC Act listed Swift Parrot and Grey-headed Flying-fox. Chilean Needle-grass is a known food source for EPBC Act listed critically endangered GSM which is using 12.68 hectares of this habitat in the northern section of the project area south of Sunbury Road.	Throughout the project area.	Predominantly introduced vegetation does not represent a FFG Act listed community.	Predominantly introduced vegetation does not represent a TEC.	 **Plate B5.15** **Predominantly introduced vegetation**

B5.5.2
Native vegetation extent

The project area supports 273.58 hectares of native vegetation cover from the nine EVCs described above (reduced from initial assessment 424.54 hectares). Of these, 255.29 hectares are within the impact area (reduced from initial assessment 403.86 hectares).

A summary of native vegetation extents in the project and impact areas is provided in Table B5.11 and Figure B5.17. Additional native vegetation may be present within the project and impact areas in the additional 65.5 hectares of 'landside area not assessed' (Figure B5.17). No current assessment has been undertaken within this area at the time of writing this report.

The impact proposed under the previous footprint from the initial impact assessment area is included below to demonstrate the reduction achieved by refining the project design.

B5.5.3
Threatened species

Threatened flora

No threatened flora species were recorded within the project area.

Threatened fauna

The following summarises the results of the current targeted surveys for threatened fauna species; and additional background information for species not subject to current surveys in this assessment but for which impact assessments were undertaken.

The Growling Grass Frog and Golden Sun Moth were recorded within the project area during the current assessment. The Swift Parrot and Grey-headed Flying-fox have previously been recorded in the project area (Steele & Peter, 2019; Ecology and Infrastructure International, 2018) and Australian Grayling is known to occur downstream outside the project area in the Maribyrnong River (Biosis, 2015). Striped Legless Lizard was not detected during the assessment and is considered unlikely to occur within the project area.

The habitat for threatened fauna species within the project area is shown in Figure B5.18 and within the impact area in Figure B5.19.

B5.5.3.1
Growling Grass Frog

Targeted survey

Growling Grass Frog was recorded in Deep Creek, Arundel Creek, the quarry lake near Deep Creek, and the dam adjacent to the Golf Course within or adjacent to the project area (Figure B5.18). Sub-juvenile Growling Grass Frog were recorded in Arundel Creek and Deep Creek in 2019; small adults (juveniles) were recorded in the Arundel Creek dams in 2020.

Seven other non-threatened frog species were observed during the surveys across all waterways. They included: Eastern Common Froglet *Crinia signifera*, Eastern Banjo Frog *Limnodynastes dumerilii*, Striped Marsh Frog *Limnodynastes peronii*, Spotted Marsh Frog *Limnodynastes tasmaniensis*, Southern Brown Tree Frog *Litoria ewingii*, Southern Stony-creek Frog *Litoria lesueuri* and Whistling Tree Frog *Litoria verreauxii verreauxii*.

Table B5.11
Summary of native vegetation extent within the project and impact area

Vegetation type	Project area (ha)	Current impact area (ha)	Initial impact assessment area (ha)
Aquatic Herbland (EVC 653)	0.01	0.01	0.01
Creekline Grassy Woodland (EVC 68)	1.33	1.33	1.33
Escarpment Shrubland (EVC 895)	0.76	0.76	0.75
Hills Herb-rich Woodland (EVC 71)	10.89	10.89	43.45
Plains Grassland (EVC 132)	187.62	169.30	225.97
Plains Grassy Woodland (EVC 55)	0.25	0.25	0.25
Plains Woodland (EVC 803)	70.98	71.01	130.35
Riparian Woodland (EVC 641)	1.26	1.26	1.26
Tall Marsh (EVC 821)	0.49	0.49	0.49
Total	273.58	255.29	403.86

Figure B5.17
Native vegetation in the impact area – Melbourne Airport's Third Runway

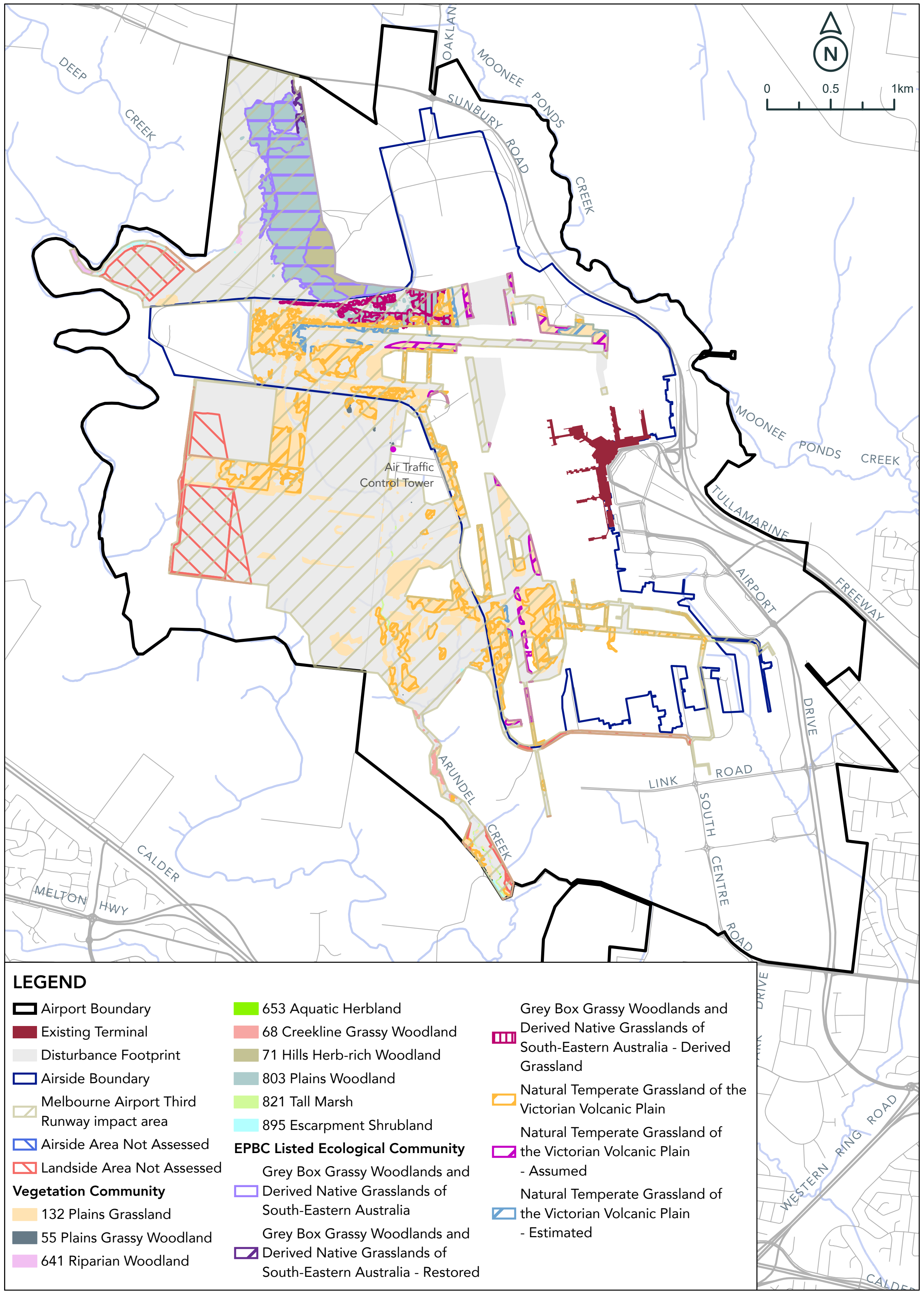


Figure B5.18
EPBC Act listed species habitat in the project area – Melbourne Airport's Third Runway

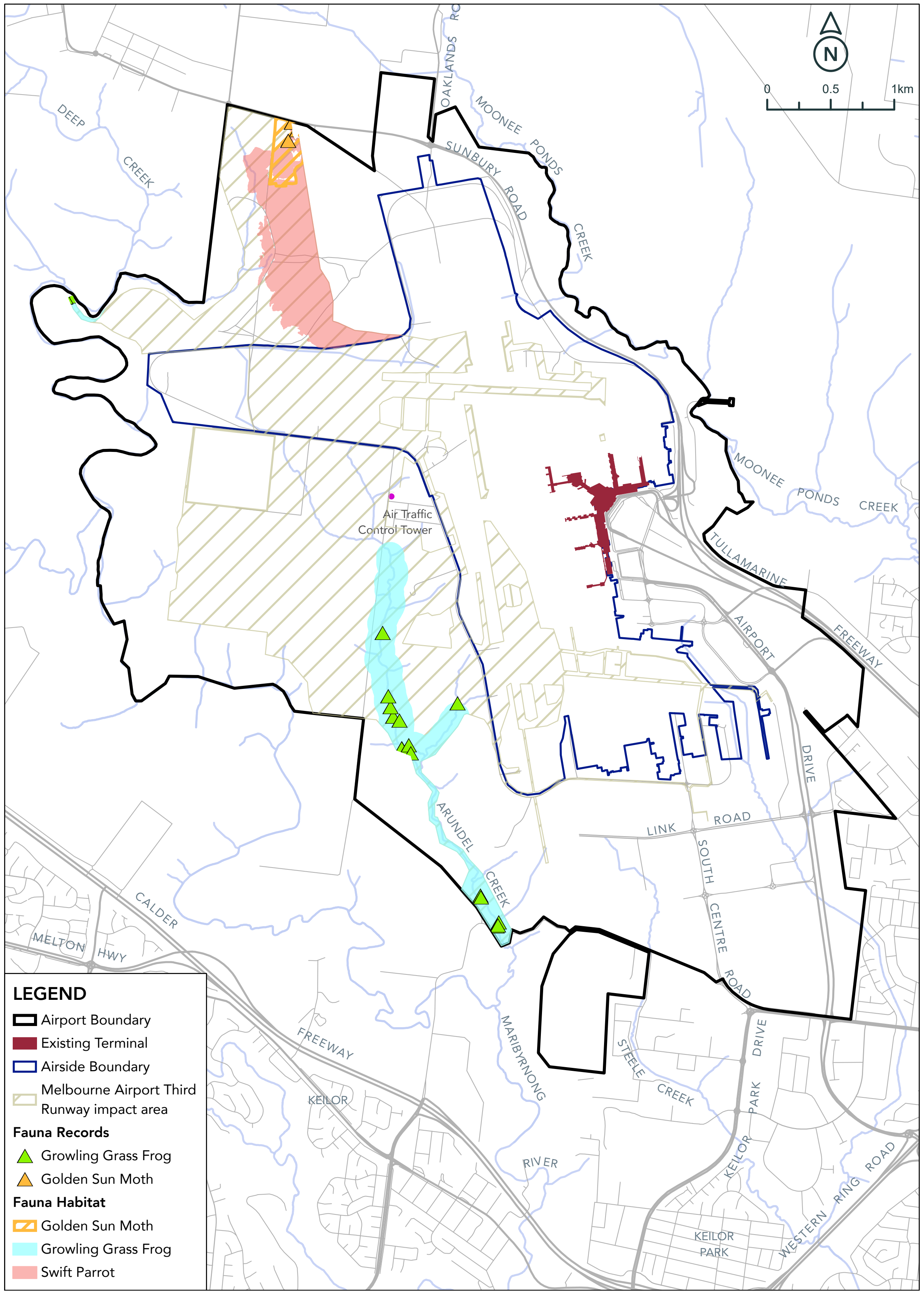
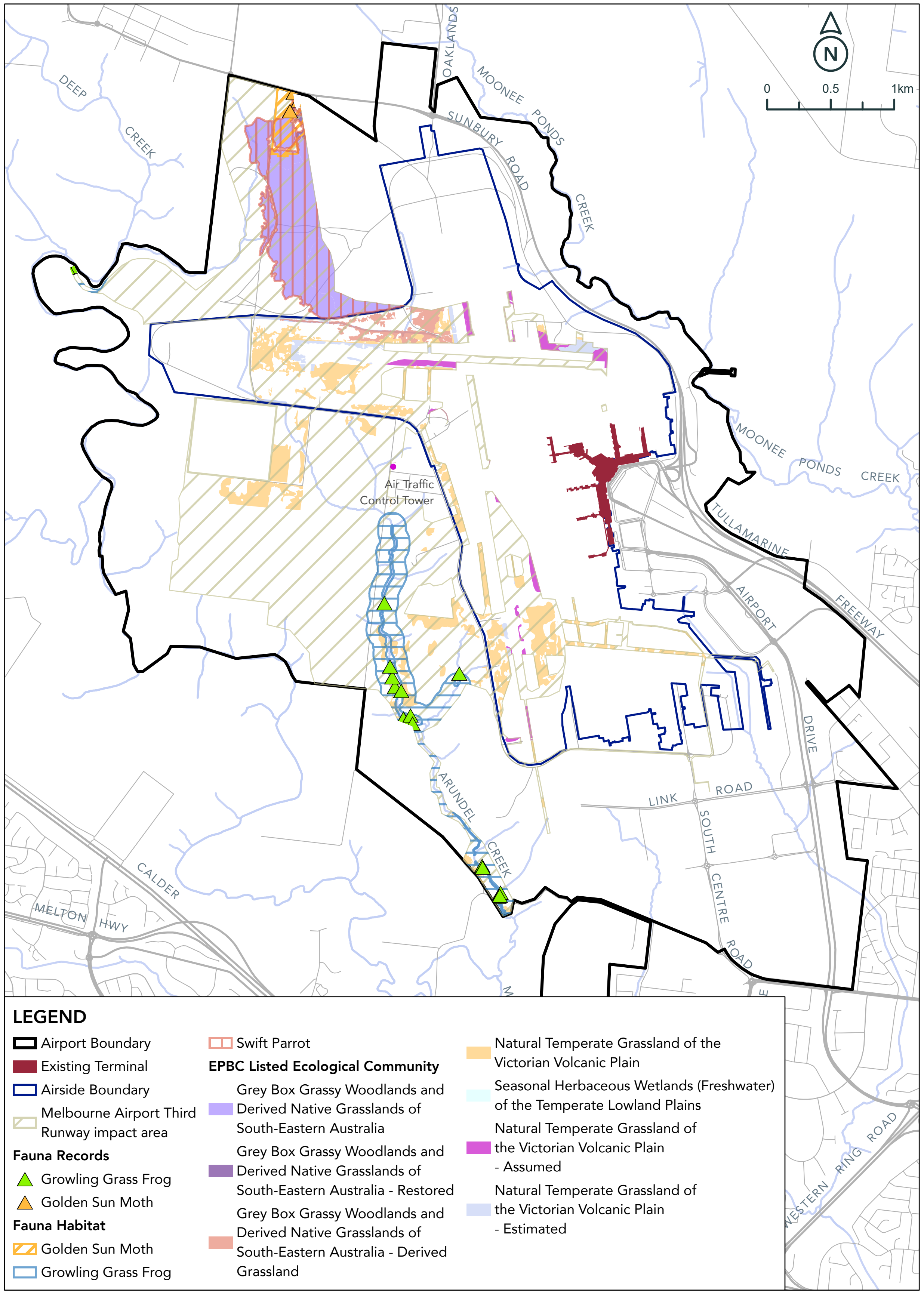


Figure B5.19
EPBC Act listed species and ecological communities within the impact area – Melbourne Airport's Third Runway



Habitat survey

Waterways and adjacent farm dams, quarries and drainage lines were assessed for habitat values for Growling Grass Frog. The classifications used to determine habitat type are listed in the Methods section (**Appendix B5.C**).

There are 64.34 hectares of Growling Grass Frog habitat within the impact area. They include 57.07 hectares of terrestrial habitat, 4.05 hectares of breeding habitat and 3.21 hectares of aquatic habitat. A map depicting the habitat values for Growling Grass Frog from this assessment is shown in **Figure B5.20**. A description of each waterway within or adjacent to the project area and their value for Growling Grass Frog is described in further detail below.

Arundel Creek

The lower reaches and middle section (around the two water-holding dams) of Arundel Creek offer important breeding habitat for Growling Grass Frog.

The lower reach of Arundel Creek on Airport land, specifically 200 Arundel Road, contains deeper pools, slow-moving water, and abundant emergent and fringing vegetation with presence of logs/branches above the water. In the middle of Arundel Creek are two large, constructed dams.

These waterbodies can be classified as deep permanent open freshwater wetlands using the Victorian wetland classification framework 2014 (DELWP, 2016). They are characterised by being more than two metres deep and retaining water for longer than 12 months, however they can have periods of drying. They are fringed by emergent aquatic vegetation and basalt boulders.

The upper section of Arundel Creek between the two dams and McNabs Road provides aquatic habitat for the species but at the time of assessment there were no pools suitable for breeding. North of McNabs Road, where Arundel Creek is diverted under the road, there was no suitable aquatic, terrestrial or breeding habitat for Growling Grass Frog at the time of assessment. The upper reaches of Arundel Creek in this area are likely to be used by the species during dispersal only. There is no connected habitat in the vicinity of the upper reaches of Arundel Creek and these upper reaches are unlikely to provide any important habitat for Growling Grass Frog.

The large dam located adjacent to the golf course is connected to Arundel Creek by dried-out drainage lines. These drainage lines do not provide habitat for Growling Grass Frog. However, it is likely the species has moved up the drainage line into the dam where one individual Growling Grass Frog was recorded.

The majority of the section of Arundel Creek located within the properties of 270 and 300 Arundel Road is terrestrial or a movement corridor only. This section does not provide permanent aquatic habitat for the species, and has been subject to direct access by cattle with the surrounding terrestrial habitat heavily pugged and damaged. There were some areas within this property that did contain small pools, and the area closer to the outflow point above 200 Arundel Road held water at the time of assessment.

Moonee Ponds Creek

At the time of assessment, Moonee Ponds Creek was relatively dry with the occasional pool of water along the creek. It dries out regularly, leaving pools of water in its deeper sections.

Historically, Moonee Ponds Creek was known as Moonee Moonee Chain of Ponds, which is descriptive of this waterway. Moonee Ponds Creek is used as aquatic habitat by Growling Grass Frog and the remaining pools of water are likely to be utilised as breeding habitat.
At the time of assessment, the remaining pools were drying out and unsuitable as breeding habitat. However, this is likely to vary from year to year and the creek is considered breeding and aquatic habitat.

Growling Grass Frog were not detected in Moonee Ponds Creek itself. However the species was heard calling in an adjacent quarry lake outside Melbourne Airport land.

Deep Creek

The section of Deep Creek located adjacent to the project area contains high-quality Growling Grass Frog habitat. A total of 12 were found in this section of Deep Creek, where it contained permanent waterbodies with floating aquatic vegetation.

The majority of Deep Creek is lined with basalt rocks, an ideal habitat feature for Growling Grass Frog. A single Growling Grass Frog was recorded in the large quarry dam towards the north of Deep Creek. Several Common Long-necked Turtles *Chelodina longicollis* and Murray River Turtles *Emydura macquarii* were also found in the dam.

Maribyrnong River

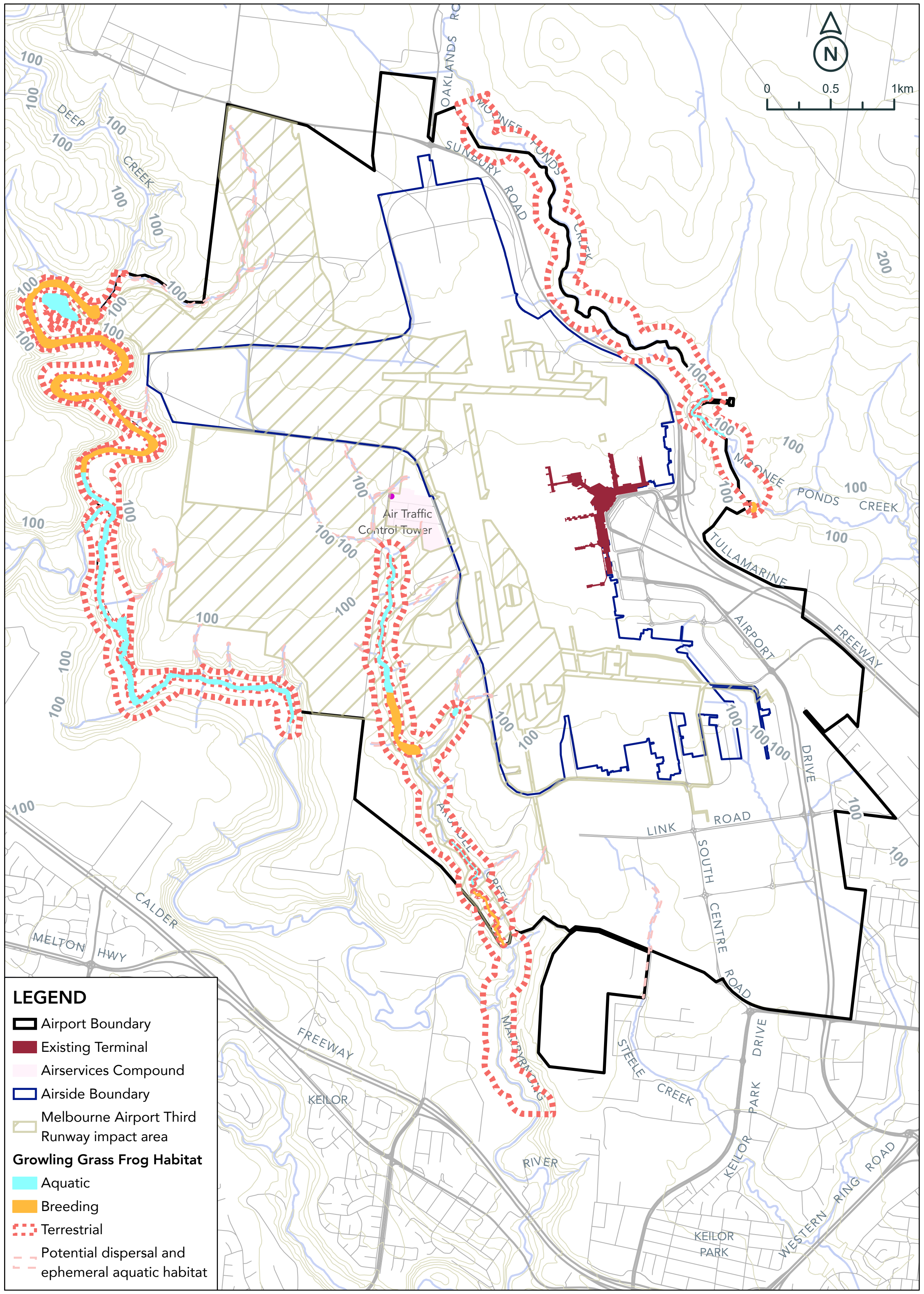
Maribyrnong River is wide and fast-flowing, and its extremely steep banks make access difficult. For this reason, it is likely that Growling Grass Frogs would use this section only as a dispersal corridor rather than breeding habitat. Maribyrnong River was not surveyed for Growling Grass Frog due to this poor access.

Other waterways, drainage lines and farm dams

Figure B5.20 depicts the habitat value for other waterbodies within Melbourne Airport land. Many of these smaller drainage lines and farm dams are an unsuitable aquatic or breeding habitat for Growling Grass Frog.

Most of the drainage lines were dry and contained little to no water. The dams are located in paddocks with livestock access, resulting in highly turbid water, pugged embankments and little to no aquatic vegetation. Although these areas have not been considered habitat for Growling Grass Frog some were mapped as 'potential dispersal and ephemeral aquatic habitat'. Impacts to these areas are to be considered for possible indirect impacts to the Growling Grass Frog further downstream (due to sedimentation and altered hydrology).

Figure B5.20
Growling Grass Frog habitat – Melbourne Airport's Third Runway



B5.5.3.2
Golden Sun Moth

Targeted surveys for the Golden Sun Moth confirmed the presence of this species only in the Golden Sun Moth survey site Northern area, where eight males were recorded in one of the four surveys (Appendix B5.C). Before the targeted surveys began, one single male was recorded within the project area on the 6 December 2019, flying in the Golden Sun Moth survey site Northern area.

Golden Sun Moths were recorded flying within Chilean Needle-grass habitat north of the Grey Box Woodland, characterised by Chilean Needle-grass ground cover with scattered occurrences of native Wallaby Grass and Spear Grass. The Golden Sun Moth habitat is bounded by Sunbury Road to the north, the Grey Box Woodland to the south, east and west. The north-west section of the Golden Sun Moth habitat is bounded by a pasture-improved paddock (Phalaris dominated).

Golden Sun Moth records and habitat within the project area can be viewed in Figure B5.19. Golden Sun Moth habitat was classified as all suitable habitat for the species connected to where the moths were recorded. There are 9.74 hectares of Golden Sun Moth habitat within the impact area; the broader contiguous patch of Golden Sun Moth habitat is 12.68 hectares.

Although the survey area expands further in the Northern area than where Golden Sun Moth habitat was mapped, some areas in the survey area did not constitute typical Golden Sun Moth habitat, such as a pasture-improved paddock. However, this was included in the survey due to the scattered presence (<5% cover) of Chilean Needle-grass.

The Golden Sun Moth was not recorded in any other survey area. Due to the extent and previous effort (Figure B5.10) of Golden Sun Moth surveys, it is highly unlikely to be present within these areas.

B5.5.3.3
Striped Legless Lizard

The Striped Legless Lizard was not detected within the project area during targeted surveys (Appendix B5.C). This is despite the substantial survey effort within suitable habitat during at a time when known nearby populations were observed to be active.

There has been a substantial survey effort for Striped Legless Lizard at Melbourne Airport. A total of 62 tile grids and 52 pit-fall traps have been surveyed over approximately 840 hectares of potential habitat to date with no record of the species being detected. It is therefore considered unlikely that the species is present within the project area.

With records of the species within five kilometres south of Melbourne Airport, and recently recorded within five kilometres north of it (Biosis, 2020 unpublished), it is probable that potential habitat at Melbourne Airport would have been colonised by the species.

It is possible that bulk earthworks required to establish the airfield within the project area rendered the area unsuitable. It is also possible that the long history of land utilised for farming purposes – including pasture improvement, cropping, stocking and, recently, small-block farming (in the Barbiston Road area) – caused a local extinction of the species. It is also possible the species was never present.

B5.5.3.4
Swift Parrot

There are 68.02 hectares of suitable foraging habitat for the Swift Parrot located within the impact area (Figure B5.19). The broader Grey Box Woodland at Melbourne Airport is 154 hectares in size, representing a large intact area of key tree species (Grey Box) that provide nectar and lerp foraging opportunities for the Swift Parrot.

Five Swift Parrots were recorded within the Grey Box Woodland in April 2019 (Steele & Peter, 2019). Targeted surveys for the species occurred fortnightly between March and April, and weekly between April and May 2019. Only one other bird has previously been recorded within the Grey Box Woodland, in 1991 (Beardsell, 1991).

In the broader landscape, there are regular records of Swift Parrots in the past 10 years from Bulla, Woodlands Historic Park and Keilor (Birddata, 2020).

Previous survey effort included targeted surveys of varying durations and efforts within the Grey Box Woodland, Melbourne Airport in the following years: 1990, 1991 (one individual detected), 1994-95, 1997, 1998, 1999, 2001-02, 2009, 2014 (Grey Box Woodland and Barbiston Road), 2015, 2016, 2019 (five individuals detected).

B5.5.3.5
Australian Grayling

Historic records exist south of the project area in the Maribyrnong River from 2002 (Victorian Biodiversity Atlas, recorded by Tarmo Raadik) and in 2015 in the Maribyrnong River (Victorian Biodiversity Atlas, recorded by Frank Amtstaetter). Suitable habitat for the species is present throughout the Maribyrnong River and its tributaries.

B5.5.3.6
Grey-headed Flying-fox

There are 68.02 hectares of suitable foraging habitat for the Grey-headed Flying-Fox within the Grey Box Woodland in the impact area. The broader Grey Box Woodland at Melbourne Airport is 154 hectares in size, with a large intact area of foraging habitat when it is in flower between March and May.

The Grey-headed Flying-fox is considered a high-risk species for aircraft wildlife collision, with 22 strikes reported in the past five years at Melbourne Airport (Biosis, 2021). Several occurred at the northern end of the airfield, suggesting a possible association with the woodland. The Yarra Bend camp (a 'camp' being where a group of bats roost) most likely to support flying-foxes that forage in the woodland is about 22 kilometres south-east of the airport. This would mean the bats' direct flight route to the woodland is potentially across aircraft flight paths.

A 2018 assessment by Ecology and Infrastructure International recorded a total of 20 Grey-headed Flying Fox over four of the six survey nights across Melbourne Airport land. There was no consistent or predictable stream of movement of Grey-headed Flying-fox entering the same section of airspace each night. The report confirmed that the species visits flowering trees planted within the airport boundary and the Grey Box Woodland.

B5.5.3.7
FFG Act listed species

Four species listed under the Victorian FFG Act were detected during the current survey (Appendix B5.C). Another five species listed under the Act were either recorded within the project area during previous surveys or exist within database records. They include:

- Swift Parrot (previous assessment)
- Grey-headed Flying-fox (previous assessment)
- Growling Grass Frog (current assessment)
- Golden Sun Moth (current assessment)
- Hooded Robin (database record)
- Speckled Warbler (database record)
- Little Eagle (database record)
- Tussock Skink (current assessment)
- Murray River Turtle (current assessment).

Habitat for the Platypus occurs adjacent to the project area. Although no habitat is present within the project area, recent database records from adjacent waterways warrant potential impacts to the species to be considered.

Habitat in the project area for the four EPBC listed species: Swift Parrot, Grey-headed Flying-fox, Growling Grass Frog and Golden Sun Moth (described in detail above).

There is one database record each for Hooded Robin and Speckled Warbler within the Grey Box Woodland.

Tussock Skink was recorded broadly across the project area during the tile-grid checks. The species was recorded airside and landside in Plains Grassland habitat. Plains Grassland within the project area appears to be providing good habitat for the species, with 17 individuals recorded during the checks.

One Murray River Turtle was recorded in the quarry dam above Deep Creek. Although it is native to the Murray River and tributaries in northern Victoria, there is thought to be a local naturalised population around Melbourne established from pet release. However, habitat at Melbourne Airport is outside its native range and unlikely to provide critical habitat for the species.

B5.5.4
Threatened ecological communities

Two EPBC Act-listed TECs and two FFG Act-listed TECs were recorded in the project area and will be impacted by the development. These are described below. The results of the assessments against condition thresholds and EVC benchmarks are in Appendix B5.D.

EPBC Act-listed TECs

B5.5.4.1
Grey Box (Eucalyptus microcarpa) Grassy Woodland and Derived Native Grassland of South-eastern Australia

Community background

Grey Box Grassy Woodland is listed as an endangered ecological community under the EPBC Act.

Although this community may occur on a range of substrates it typically occurs in landscapes of low relief on productive soils derived from alluvial or colluvial materials. It also occurs where the original tree canopy has been cleared but the native ground layer is intact, resulting in a derived-native-grassland condition state.

It is found along the transitional landscape zone between the temperate woodlands and forests of the lower slopes and tablelands, and the semi-arid communities further inland. Outliers occur in rainshadow areas of southern Victoria. The community is generally dominated by Grey Box with a sparse shrub layer, and a species-rich ground layer of grasses and herbs.

The community provides valuable habitat for fauna including resident and transient visitors particularly birds.

The main ongoing threats to this community are incremental clearing for a variety of purposes (cropping, infrastructure and maintenance); inappropriate grazing regimes; fragmentation into small remnants; loss or decline of mature trees; lack of natural regeneration; invasive exotic species; salinity; misuse of herbicides; firewood collection; and the addition of fertilisers to develop pastures (TSSC, 2010). There is no adopted or prepared recovery plan for this ecological community.

In southern Victoria, large intact examples of the Grey Box Grassy Woodland community (i.e. those >50 hectares in size) are now restricted to three remnant stands: Eynesbury Woodland and Pinkerton Forest (both near Melton) and Melbourne Airport. The remaining occurrences of Grey Box near Melbourne are isolated trees along road or rail corridors, and highly modified small patches.

Occurrence in the project area

The Grey Box threatened community aligns with EVC71 Hills Herb-rich Woodland and EVC 803 Plains Woodland.

These EVCs were recorded as large stands of remnant and restored woodland in the north of the project area (landside) and as derived grassland between the existing runways and woodland remnants. Grey Box is the dominant canopy species in treed remnants; there is strong evidence of suppressed Grey Box recruitment in regularly-slashed derived native grassland areas.

Listing advice and the supporting policy statement describe this community in two condition states: an intact woodland form, and a derived native grassland form where tree cover has been historically removed (TSSC, 2010).

The community was recorded in both these condition states and restored along the northern boundary of the project area. A summary of the results used to verify community occurrence is provided in Table B5.12. All ground-layer cover-plot data and woodland-tree demographic data used to verify assigning woodland stands to the TEC are provided in Appendix B5.D. In accordance with the listing advice, only samples from the highest-quality areas were used to define whether a larger patch of functional woodland habitat qualified as the community (TSSC, 2010, page 10).

Some restored and naturally regenerated woodland habitat occurs north of the main stands of EVC 71 and EVC 803 in the project area. It is contiguous with remnant woodland vegetation and functions as part of the larger patch of habitat supporting native flora, woodland birds, mammal, reptiles, frogs and invertebrates.

This area is structurally different from the old-growth remnant woodland as it generally lacks large old trees and tree spacing is closer. However, native shrubs occur in the understorey; and the ground layer supports native grasses, herbs, cryptogams and a well-developed litter layer. Natural processes such as native plant recruitment also occur in this restored area.

The restored area was sampled to identify whether it qualifies as the listed TEC. This approach was used because the advice in the TEC policy statement (DSEWPaC, 2012a, pages 17 and 63) states diagnostic and condition assessments of woodland patches should also include areas that have naturally regenerated or been restored/revegetated. Results from restored-area samples were aggregated with other results for the overall determination of TEC presence because the restored areas are now considered to be part of a larger patch of functional woodland habitat.

The current assessment recorded a total patch size of 154 hectares of the treed condition state (extending beyond the project area) of which 68.02 hectares is in the impact area; and 15.68 hectares of the derived native-grassland condition state, of which 10.72 hectares is in the impact area (Figure B5.19).

B5.5.4.2
Natural Temperate Grassland of the Victorian Volcanic Plain

Community background

The NTGVVP is listed as a critically endangered ecological community under the EPBC Act. It generally occurs in low-lying areas on soils of volcanic origin – typically heavy grey to red cracking clays with poor drainage. Remnant patches of this community are mostly small and fragmented in a landscape impacted by ongoing clearing.

This TEC is dominated by one or more of the following native tussock-forming grass genera: Kangaroo Grass *Themeda* spp., Wallaby Grass *Rytidosperma* spp., Spear Grass *Austrostipa* spp. and/or Tussock Grass *Poa* spp. (TSSC, 2008). Native herbs often have a scattered or mosaic presence among the native grasses, while trees and large woody shrubs are sparse to absent.

The NTGVVP community is complex and variable where the composition and appearance of species are influenced by seasonal weather patterns and land management practices (TSSC, 2008).

There is no adopted or prepared Recovery Plan for this ecological community.

Table B5.12
Verification for presence of Grey Box Grassy Woodland TEC

Criteria	Thresholds	Results
Tree cover	If tree crown cover is at least 10%, the 'treed' condition state is present. If tree crown cover is less than 10%, the 'derived grassland' condition state is present.	Aerial imagery and on-ground observations indicate that tree crown cover is >10% in EVC 71 and most patches of EVC 803. Four patches of EVC 803 have tree crown cover <10%, but evidence Grey Box was once dominant and are therefore derived grassland.
Dominant tree species	For treed patches, Grey Box must be the dominant or co-dominant tree species in the canopy layer. For derived grassland, there must be evidence that the vegetation was once woodland dominated or co-dominated by Grey Box.	Grey Box is the dominant tree species in all patches of EVC 803 and EVC 71, including restored areas and areas in the derived grassland condition state. Only minor occurrences of River Red-gum and Yellow Box are present. The presence of regenerating but slashed Grey Box, large Grey Box stumps, slashed woodland shrub species, nearby treed Grey Box Woodland and historical aerial imagery showing tree cover >10% support the conclusion that the areas of derived grassland once had a canopy dominated by Grey Box.
Patch size	Patch must be greater than 0.5 ha to firstly qualify as the community and then different native cover and diversity thresholds apply based on a 2 ha threshold for patches in the 'treed' condition states	All derived grassland patches are greater than 0.5 ha. All treed 'patches' are greater than 2 ha and are considered contiguous functional examples of the ecological community despite minor fragmentation caused by roads, tracks and fences. Functioning of the ecological community relates to wildlife movement, water and nutrient cycling and recruitment processes. Therefore, the condition threshold is met.
Weediness	The vegetation cover of non-grass weeds in the ground layer is less than 30% at any time of the year. Any site that has >30% cover of non-grass weeds in the ground layer is not the community.	Point intercept transect results for treed patches and cover estimates for derived grassland indicate that total vascular plant cover (i.e. native and non-native plants excluding cryptogams and bare ground) in treed areas is 36% and in derived areas is 69%. Of this plant cover, non-grass weeds occupy 4.3% cover in treed areas and 12.5% in derived grassland. Therefore, non-grass weeds proportionally occupy less than 30% of all plant cover (i.e. 12% non-grass weeds in treed areas and 18% in derived grassland). Therefore, the condition threshold is met and on average treed and derived grassland areas are not dominated by non-grass weeds.
Tree stem size and density	For treed patches ≥2 ha in size there must be at least 8 trees/ha that are >60 cm DBH or hollow-bearing. For treed patches ≥2 ha in size that do not meet the large tree and hollow tree density requirements above there must be at least 20 live trees/ha that are >12 cm DBH	All treed patches of EVC 803 and EVC 71 are >2 ha. Tree sampling undertaken (n=31 x 1 ha samples) indicates a mean density of 15 trees/ha that are >60 cm DBH. Hollow tree sampling undertaken (n=31 x 1 ha samples) indicates a mean density of 11 hollow-bearing trees/ha. Therefore, the condition threshold is met. The second threshold test for this criterion is not relevant.
Species richness/ diversity	For treed patches <2 ha there must be at least 8 perennial native species in the mid and ground layers For derived patches there must be at least 12 perennial native species in the ground layer.	All treed patches of EVC 71 and EVC 803 are >2 ha so this test does not apply. All derived grassland patches contain at least 19 perennial native species in the ground layer.
Perennial native species cover	For treed patches ≥2 ha with at least 8 trees/ha that are >60 cm DBH or hollow-bearing, perennial native grasses must make up ≥10% perennial native grass cover in the ground layer. For all other patches (derived grassland, treed patches <2 ha in size or treed patches ≥2 ha in size with at least 20 live trees/ha that are >12 cm DBH), perennial native species must make up ≥50% of total perennial ground layer vegetation cover.	Point intercept transect results for treed patches with grass cover (all of which are >2 ha) indicate that total vascular plant cover (i.e. native and non-native plants excluding cryptogams and bare ground) in treed areas is 35% and in derived areas is 68%. Of this plant cover, perennial native grasses occupy 5.4% cover in treed areas and 37% in derived grassland. Therefore, perennial native grass cover proportionally occupies at least 10% of all plant cover (i.e. 15% perennial native grass cover in treed areas and 54% in derived grassland). Therefore, the condition threshold is met. Cover estimates for derived grassland indicate that total vascular plant cover (i.e. native and non-native plants excluding cryptogams and bare ground) is 69%. Of this plant cover, perennial native species occupy 49% cover. Therefore, perennial native grass cover proportionally occupies at least 50% of all plant cover (i.e. 71% perennial native species cover in derived grassland). Therefore, the condition threshold is met for derived grassland.

Table B5.13
Verification for presence of Natural Temperate Grassland of the Victorian Volcanic Plain TEC

Criteria	Thresholds	Results
Location	With limited exceptions, the grassland patch must be associated with Quaternary basalt soils within the Victorian Volcanic Plain bioregion.	Most (if not all) NTGVVP patches within the project area occur on basalt-derived soils of the Victorian Volcanic Plain. Geology maps position most of the project area within Quaternary Newer Volcanics geology (Qvn; DNRE 1997), with the exception of watercourses and Radar Hill.
Perennial native flora cover	Native flora must make up ≥50% of total vegetation cover, excluding introduced annuals, within the grassland patch.	Vegetation cover within all NTGVVP patches is ≥50% native, allowing for some small-scale disturbances. Plains Grassland was not mapped as NTGVVP if native flora made up <50% of total vegetation cover.
Dominant grass genera	Grasses in the genera *Themeda*, *Rytidosperma*, *Austrostipa* and/or *Poa* make up ≥50% of total native species cover.	*Themeda*, *Rytidosperma*, *Austrostipa* and/or *Poa* make up ≥50% of total native species cover in all NTGVVP patches within the project area, although *Themeda* and *Poa* are rare.
Weediness	For grassland patches where *Themeda*, *Rytidosperma*, *Austrostipa* and/or *Poa* are the dominant native genera, one of the following thresholds must be met • *Themeda*, *Rytidosperma*, *Austrostipa* and/or *Poa* must also make up ≥50% of total perennial tussock cover or • Perennial non-grass weeds must be <30% of total vegetation cover.	All NTGVVP patches within the project area meet one or both of these thresholds. One NTGVVP patch within the project area does not meet the first of these thresholds, but nevertheless meets the second threshold. Three NTGVVP patches within the project area do not meet the second of these threshold, but nevertheless meet the first threshold. All other NTGVVP patches meet both thresholds.
Native forb cover	For grassland patches where *Themeda*, *Rytidosperma*, *Austrostipa* and/or *Poa* are not the dominant native species, native forbs must make up ≥50% of total vegetation cover during spring-summer (September to February).	Native forbs make up <50% of total vegetation cover in all NTGVVP patches. However, *Themeda*, *Rytidosperma*, *Austrostipa* and/or *Poa* make up ≥50% of total native species cover in all NTGVVP patches within the project area, meaning this condition threshold is not applicable.
Patch size	For a native vegetation remnant ≤1 ha, the grassland patch must be ≥0.05 ha and the crown cover of shrubs/trees >1 m tall must be ≤5%. For a native vegetation remnant >1 ha, the grassland patch must be ≥0.5 ha and there must be <2 mature trees per ha.	All NTGVVP patches within the project area satisfy this size threshold. No NTGVVP patches are <0.05 ha. Where NTGVVP patches are part of a native vegetation remnant >1 ha, the NTGVVP patch is ≥0.5 ha.

Occurrence in the project area

The NTGVVP community is associated with EVC 132_61 Heavier-soils Plains Grassland which was recorded throughout the project area, particularly in locations with a history of active land management (e.g. grazing, slashing and mowing).

To some extent, past and present management regimes including regularly slashing and mowing are likely to have maintained NTGVVP in a similar way to fire – by reducing biomass accumulation from introduced species, particularly weedy grasses. However, these management regimes are also likely to have influenced the composition of NTGVVP across the project area. For example, NTGVVP in the project area is generally species poor and dominated by Wallaby Grass and/or Spear Grass. Kangaroo Grass and native herbs are rare and scattered, certainly not dominant. A summary of the results used to justify community occurrence is provided in Table B5.13.

The Heavier-soils Plains Grassland areas that did not satisfy the key diagnostic characteristics or condition thresholds of NTGVVP were dominated either by other native grasses (such as Silky Blue-Grass and Red-leg Grass) or by high-threat weeds (including Blanket Weed *Galenia pubescens*, Chilean Needle-grass and Serrated Tussock).

The current assessment recorded 97.89 hectares of NTGVVP within the impact area. Of this, 79.61 hectares were confirmed, 10.49 hectares 'assumed' and 7.79 hectares 'estimated' (Figure B5.19). The total of 97.89 hectares of NTGVVP proposed to be lost from within the impact area includes patches extending beyond the impact area that, if retained, would no longer meet the size threshold requirements to qualify as NTGVVP.

B5.5.4.3
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains

No vegetation corresponding to this TEC occurs within the project area. Wetland EVCs within the project area (e.g. EVC 821 Tall Marsh) do not meet the condition thresholds for this EVC due to one or both of the following:

- Absence of native wetland graminoids and/or native wetland forbs characteristic of the TEC
- Significant cover (greater than 25 per cent vegetative cover) of contra-indicative species (e.g. Cumbungi *Typha* spp.) and hydrological features of contra-indicative EVCs (e.g. Tall Marsh EVC 821, which within the project area is characterised by a near permanent waterbody).

FFG Act listed TECs

B5.5.4.4
Victorian Temperate Woodland bird community

This community is defined by a group of bird species totally or largely restricted to temperate woodland habitats, and which are commonly associated with Box Iron- Bark, Yellow Box, Cypress Pine (and other) woodland tree species (SAC 2001).

The full list of bird species associated with this community is provided within the Final Recommendation on Nomination for Listing (SAC 2001). It includes a large percentage of the species recorded in the woodland by current and previous assessments.

Many other species associated with this community are likely to utilise the woodland within Woodlands Historic Park to the immediate north of the project area, increasing the likelihood that they may visit the Grey Box Woodland at Melbourne Airport.

This TEC corresponds directly with the Grey Box Woodland TEC described above in Section B5.5.4.1, of which there is 64.34 hectares within the impact area. Listed woodland birds within this community that have been recorded or may occur are Swift Parrot, Speckled Warbler, Jacky Winter and Hooded Robin.

B5.5.4.5
Western (Basalt) Plains Grassland

The Western (Basalt) Plains Grassland Community is an open-grassland community found mainly on undisturbed, poorly-drained heavy clay soils on the basalt plains of western Victoria. The soils are usually waterlogged in winter; and very hard, dry and cracking in summer. Vegetation is characteristically dominated by perennial native grasses with very few eucalypts and shrubs.

There are no minimum patch size or condition thresholds for this community; its presence is generally considered affiliated with the presence of EVC 132 Plains Grassland. This TEC corresponds directly with all Plains Grassland EVC 132 mapped within the project area in a degraded form. There are 169.3 hectares of Plains Grassland within the impact area. Better quality examples of this TEC correspond with the NTGVVP TEC described above in Section B5.5.4.2.

B5.5.5
Listed migratory bird species

No listed migratory bird species were recorded during the current ecological assessment. Rufous Fantail and White-throated Needletail have previously been recorded from within the project area.

B5.6
ASSESSMENT OF POTENTIAL IMPACTS

This significant impact self-assessment details the extent of impacts to threatened species, ecological communities, listed migratory species and relevant ecological features on Commonwealth land resulting from M3R in relation to the EPBC Act.

Potential impacts on significant ecological values were assessed in accordance with the significant impact assessment framework outlined in Section B5.4.

In order to assess the likely impacts of the M3R project on ecological values, it is assumed that all vegetation and fauna habitat within the impact area will be removed either temporarily for construction or permanently for the proposed infrastructure.

B5.6.1
Description of proposed impacts

The impacts from the proposed construction of M3R have been assessed for the disturbance/removal of native vegetation and habitat for the majority of the project area but excluding those areas subject to existing approvals and 65.5 hectares classified as 'landside area not assessed' (Figure B5.1).

The development of M3R will result in a new north-south three-kilometre-long runway with associated taxiways and other associated infrastructure. This impact assessment reviews the potential impacts likely to occur within the impact area for only the M3R project. Native vegetation and fauna habitat located within the Taxiway Zulu and Northern Access project impact area and 'landside area not assessed' have not been included in this impact assessment.

Project impacts to ecological values include:

- Removal and modification of native vegetation and habitats
- Likely significant impact to Golden Sun Moth, Growling Grass Frog and Swift Parrot
- Likely significant impact to Natural Temperate Grassland of the Victorian Volcanic Plain and Grey Box Woodland TECs
- Likely significant impact to the environment on Commonwealth land.

B5.6.1.1
Removal of native vegetation and fauna habitat

The project will require the removal of 255.29 hectares of native vegetation, which is significantly less the initially proposed 403.86 hectares of native vegetation. This native vegetation supports threatened species habitat, and represents two listed TECs in places.

Other areas of non-native vegetation and waterways also support threatened species habitat. Table B5.14 gives a summary of native vegetation, TECs (as a subset of this vegetation) and species habitat within the impact area. These numbers form the basis for the impact assessments of the project.

B5.6.2
Impacts to the environment on Commonwealth land

For actions on, or adjacent to, Commonwealth land, impacts on the environment as a whole must be considered. This section assesses the likelihood of M3R having a significant impact on the environment as a whole on Commonwealth land for criteria relevant to ecology and biodiversity only.

It has been assessed in accordance with 'Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies Significant impact guidelines 1.2 EPBC Act 1999' (DSEWPaC, 2013) (ecological or biodiversity matters only).

Table B5.14
Native vegetation, TECs and threatened fauna habitat in the impact area (Figure B5.18 and Figure B5.19)

Vegetation Type	Impact area (hectares)
Vegetation community (EVC)	
653 Aquatic Herbland	0.01
68 Creekline Grassy Woodland	1.33
895 Escarpment Shrubland	0.76
71 Hills Herb-rich Woodland	10.89
132 Plains Grassland	169.30
55 Plains Grassy Woodland	0.25
803 Plains Woodland	71.01
641 Riparian Woodland	1.26
821 Tall Marsh	0.49
EPBC listed TEC* (*subset of EVCs above)	
Grey Box Grassy Woodlands and Derived Grasslands of South-eastern Australia – treed condition state (EVC 71 and parts of EVC 803)	68.02
Grey Box Grassy Woodlands and Derived Grasslands of South-eastern Australia – derived native grassland (treeless EVC 803)	10.72
Natural Temperate Grassland of the Victorian Volcanic Plain (total) (EVC 132)	97.89
FFG listed TEC* (*subset of EVCs above)	
Victorian Temperate Woodland Bird Community	68.02
Western (Basalt) Plains Grassland	169.30
Fauna habitat	
Golden Sun Moth	9.75
Growling Grass Frog	64.34
Swift Parrot	68.02
Grey-headed Flying-fox	68.02

B5.6.2.1
Impacts on landscapes and soils

In considering impacts on landscapes and soils, the following criteria are relevant (Table B5.15).

B5.6.2.2
Impacts on coastal landscapes and process

In considering impacts on coastal landscapes and process, the following criteria are relevant (Table B5.16).

Table B5.15
Landscape and soils significant impact criteria assessment

Criteria	Likelihood of significant impact	Justification
Is there a real chance or possibility that the action will:		
Substantially alter natural landscape features	Almost certain	Grey Box Woodland The project would result in removal of just under half of the Grey Box Woodland which constitutes 68.02 ha out of 154 ha west of Radar Hill. This is a significant reduction in impact than initially proposed with the removal of the entire 154 ha of woodland and Radar Hill. It is now proposed to retain Radar Hill and the higher quality eastern portion of the Grey Box Woodland. The western half of the woodland will be levelled through earthworks, resulting in changes to vegetation cover, topography and underlying geology. The Grey Box Woodland is a significant landscape geologically and ecologically. It is one of the southernmost extents of the Grey Box Woodland community in Victoria, occurring on and around an outlier of the Central Victorian Uplands bioregion. It is one of the only three examples of this community located south of the Great Dividing Range (the others being Eynesbury and Pinkerton Forest) and its presence in the landscape has been noted on historical maps and plans dating back to 1840 (e.g. Kemp 1840). The reduction in size of the Grey Box Woodland is a much better outcome than the full removal of the woodland and Radar Hill but will still alter the natural landscape features of the project area. Arundel Creek Arundel Creek flows from north to south through the middle of the project area. Arundel Creek is a narrow waterway and is interspersed with small farm dams and two large dams. Arundel Creek flows into the Maribyrnong River downstream. The natural landscape within the project area is characterised by Deep Creek to the west, Maribyrnong River to the south, Moonee Ponds Creek to the east and Arundel Creek through the middle. Arundel Creek does not provide connectivity between waterways that would have otherwise been isolated. Arundel Creek is the catchment for a large area within the project area, predominantly the existing hard surface areas associated with the runway and taxiways. The creek itself is highly modified to manage the catchment. The creek is approximately 6 km long and it is proposed to impact approximately 4.5 km of the creek during construction, including the upper tributaries and drainage lines within the impact area. Whilst Arundel Creek is already a modified feature in the landscape, the further modification of sections of this waterway could be considered as significantly altering the landscape features within the project area.
Cause subsidence, instability or substantial erosion	Not applicable	Not assessed in this report
Involve medium or large-scale excavation of soil or minerals	Not applicable	Not assessed in this report

Table B5.16
Coastal landscapes and process significant impact criteria assessment

Criteria	Likelihood of significant impact	Justification
Is there a real chance or possibility that the action will:		
Alter coastal processes, including wave action, sediment movement or accretion, or water circulation patterns	Rare	The impact area is not located within the vicinity of coastal environments and no works are proposed within tidal, estuarine or sand dune environments. All waterways within the impact area eventually discharge into Port Phillip Bay however water flows and sedimentation loads will not exceed current base levels (Beca, 2020) it is therefore unlikely that any measurable indirect impacts to Port Phillip Bay would occur as a result of the project.
Permanently alter tidal patterns, water flows or water quality in estuaries		
Reduce biological diversity or change species composition in estuaries		
Extract large volumes of sand or substantially destabilise sand dunes		

B5.6.2.3
Impacts on ocean forms, ocean processes and ocean life

In considering impacts on ocean forms, ocean processes and ocean life, the following criteria are raised in Table B5.17.

B5.6.2.4
Impacts on water resources

In considering impacts on water resources, the following criteria are raised in Table B5.18.

Table B5.17
Ocean forms, ocean processes and ocean-life significant impact criteria assessment

Criteria	Likelihood of significant impact	Justification
Is there a real chance or possibility that the action will:		
Reduce biological diversity or change species composition on reefs, seamounts or in other sensitive marine environments	Rare	The impact area is not located within the vicinity of coastal environments. An Environmental Management Plan (EMP) will be developed and will include mitigation measures to include sediment control where necessary and include a plan for management of spills from machinery to ensure potential spills are localised and minimal. No impacts to marine environments are expected to occur as a results of the project. All waterways within the impact area eventually discharge into Port Phillip Bay however water flows and sedimentation loads will not exceed current base levels (Beca, 2020) it is therefore unlikely that any measurable indirect impacts to Port Phillip Bay would occur as a result of the project.
Alter water circulation patterns by modification of existing landforms or the addition of artificial reefs or other large structures		
Substantially damage or modify large areas of the seafloor or ocean habitat, such as sea grass		
Release oil, fuel or other toxic substances into the marine environment in sufficient quantity to kill larger marine animals or alter ecosystem processes		
Release large quantities of sewage or other waste into the marine environment		

Table B5.18
Water Resources Significant Impact Criteria Assessment

Criteria	Likelihood of significant impact	Justification
Is there a real chance or possibility that the action will:		
Measurably reduce the quantity, quality or availability of surface or ground water.	Likely	Impacts to Arundel Creek will include modifying the catchment area, upper reaches and dams of Arundel Creek, stabilisation of the banks, new sedimentation and retarding basins. Outflow and sediment rates into the remainder of the creek will be highly managed and remain at baseline levels (Beca, 2020). It is likely that surface water in the upper reaches of Arundel Creek and the existing dams will be reduced in quantity and quality during construction. The long term impacts will include the modification of the upper reaches of Arundel Creek.
Channelise, divert or impound rivers or creeks or substantially alter drainage patterns, or measurably alter water table levels?	Likely	

B5.6.2.5
Impacts on plants

In considering impacts on plants, the following criteria are raised in Table B5.19.

B5.6.2.6
Impacts on animals

In considering impacts on animals, the following criteria are raised in Table B5.20.

Table B5.19
Plants Significant Impact Criteria Assessment

Criteria	Likelihood of significant impact	Justification
Is there a real chance or possibility that the action will:		
Involve medium or large-scale native vegetation clearance.	Almost certain	The project will result in the large-scale permanent removal of 255.29 ha of native vegetation, of which 176.64 ha constitutes EPBC Act listed TECs and 237.32 ha of FFG Act listed TECs on Commonwealth land (overlap occurs between EPBC and FFG TECs).
Involve any clearance of any vegetation containing a listed threatened species which is likely to result in a long-term decline in a population or which threatens the viability of the species.	Unlikely	No listed threatened plants are present within the impact area and no impacts to listed threatened plant species are expected.
Introduce potentially invasive species.	Possible	A number of invasive species are already established within the project area and local area. For example, infestations of Serrated Tussock and Chilean Needle-grass are currently common in the local area. Nevertheless, there is potential for invasive species, particularly novel high threat weeds not previously recorded within the project area, to be introduced during construction and operation of the project. There is also the potential for construction activities to further spread established weeds. During construction, this potential will be minimised by adopting a vehicle and machinery hygiene procedure, to ensure all vehicles and machinery that arrive at the project area are free of soil and other material that may contain weed propagules. During operation of the third runway, there is a risk of novel high threat weeds arriving via aircraft, management vehicles or maintenance machinery and becoming established. Ongoing vigilance and prompt treatment of any newly established invasive species is the main control against this operational risk. There is therefore a real possibility that the project may introduce invasive species into the project area.
Involve the use of chemicals which substantially stunt the growth of native vegetation.	Rare	There will be no use of chemicals which will impact plants.
Involve large-scale controlled burning or any controlled burning in sensitive areas, including areas which contain listed threatened species?	Rare	The proposed impact does not include burning.

Table B5.20
Animals Significant Impact Criteria Assessment

Criteria	Likelihood of significant impact	Justification
Is there a real chance or possibility that the action will:		
Cause a long-term decrease in, or threaten the viability of, a native animal population or populations, through death, injury or other harm to individuals.	Almost certain	The removal of 255.29 hectares of native vegetation including woodland, grassland and riparian communities as well as non-native vegetation and modification of waterways is likely to reduce available habitat for native wildlife including mammals, woodland birds, waterbirds, reptiles, frogs and invertebrates. Local wildlife populations will lose important habitat and refuge sites in a rapidly urbanising landscape on the fringe of Melbourne, and this will further jeopardise local abundance and diversity of fauna. The project will create a potential physical and functional barrier to species using woodland and riparian habitats and will limit movement for breeding and foraging activities. For EPBC Act listed species there will be significant impacts to Swift Parrot, Growling Grass Frog and GSM as a result of habitat loss and alteration to waterways (**Section B5.6.3**). Whilst there is no formal significant impact criteria for FFG Act listed species a substantial amount of native vegetation proposed for removal represents known and potential habitat for FFG listed species. Tussock Skink The removal of 169.30 ha of Plains Grassland and fragmentation of this habitat type on the landscape scale is likely to reduce and fragment available habitat for the Tussock Skink, listed as endangered under the FFG Act in Victoria. Whilst a relatively widespread species across Victoria the lowland, western volcanic plains population present within the impact area is restricted to grassy, treeless areas. It is generally accepted that this habitat type which corresponds with Natural Temperate Grassland has declined in extent by more than 98% since European arrival in Victoria (TSSC 2008). In the early 2000s, it was estimated that 5000 ha of Natural Temperate Grassland remained (Barlow and Ross 2002). If anything, the extent of this TEC is likely to be less now. It can therefore be considered that the removal of 169.30 hectares of Plains Grassland from within the impact area is likely to have a substantial impact on the species. Other FFG Act species recorded or likely to occur within the impact area (or immediately adjacent for aquatic species) include: • Little Egret • Plumed Egret • Eastern Great Egret • Freckled Duck • Hardhead • Blue-billed Duck • Musk Duck • Grey Goshawk • White-bellied Sea-Eagle • Black Falcon • Little Eagle • Powerful Owl • Turquoise Parrot • Common Sandpiper • Marsh Sandpiper • Common Greenshank • Hooded Robin • Speckled Warbler • Brush-tailed Phascogale • Yellow-bellied Sheathtail Bat • Common Bent-wing Bat (eastern ssp.) • Platypus • Brown Toadlet • Murray River Turtle • Australian Mudfish Whilst potential and known habitat for these species may be reduced as a result of the project it is unlikely to result in a long-term decline in a population, or threaten the viability of any of the species.
Displace or substantially limit the movement or dispersal of native animal populations.	Almost certain	
Substantially reduce or fragment available habitat for native species.	Almost certain	
Reduce or fragment available habitat for listed threatened species which is likely to displace a population, result in a long-term decline in a population, or threaten the viability of the species.	Almost certain	
Introduce exotic species which will substantially reduce habitat or resources for native species.	Rare	The proposed works will not result in the introduction of exotic fauna species.
Undertake large-scale controlled burning or any controlled burning in areas containing listed threatened species?	Rare	The proposed impact does not include burning.

B5.6.3 Impacts to threatened species and ecological communities

The following tables present the significant impact assessments for threatened species and ecological communities located within the impact area. Where there are specific significant impact guidelines published for a species or TEC, these are used in place of the generic Significant Impact Guidelines 1.1.

B5.6.3.1 Threatened species

Golden Sun Moth

For the Golden Sun Moth, there is a real chance or possibility of a significant impact on the species if the action results in, or exceeds, the following impact thresholds (Table B5.21). Based on the assessment below, a significant impact on this species is considered likely.

Table B5.21
Significant impact assessment for the critically endangered Golden Sun Moth

Ecological element affected	Impact threshold	Comment	Likelihood of significant impact	Justification
Significant impact guidelines for the critically endangered Golden Sun Moth (Synemon plana) DEWHA, 2009				
Large or contiguous habitat area (>10 ha).	Habitat loss, degradation or fragmentation >0.5 ha.	• Habitat is a similar or connected area within which the GSM is found during surveys or known from records. The function of the area may include, but is not limited to: feeding, breeding, dispersal.	Almost certain	The total contiguous GSM habitat patch is 12.68 ha of which 9.75 ha is proposed for removal within the impact area. Significant impact is likely.
Small or fragmented habitat area (<10 ha).	Any habitat loss, degradation or fragmentation.	• Small areas of habitat are more likely to suffer significant impacts from loss, degradation and fragmentation than larger areas. • The limited dispersal ability of GSM means habitat areas separated by >200 m are effectively isolated and should be considered as separate habitat areas. • Extremely small, isolated and degraded habitat patches (for example <0.25 ha) may support populations of GSM but are unlikely to contribute to the overall ecological health of the species.	Not applicable – habitat area > 10 ha	Not applicable
Habitat connectivity.	Fragmentation of a population through the introduction of a barrier to dispersal.	Barriers to dispersal could include: breaks in habitat of >200 m; structures that prohibit movement (for example buildings, solid fences).	Not applicable	The area of habitat proposed for retention is along the northern boundary of Melbourne Airport, allowing opportunities for dispersal to continue over Bulla Road (assuming this is where dispersal is occurring).

Grey-headed Flying-fox

A significant impact is considered unlikely on Grey-headed Flying-fox based on the assessment in Table B5.22.

Swift Parrot

A significant impact is considered likely to occur on Swift Parrot based on the assessment in Table B5.23.

Table B5.22
Significant impact assessment for the vulnerable Grey-headed Flying-fox

Significant Impact Criteria	Likelihood of significant impact	Justification
Significant Impact Guidelines for vulnerable species (DoE, 2013)		
Lead to a long-term decrease in the size of an important population of a species. Reduce the area of occupancy of an important population). Fragment an existing important population into two or more populations.	Rare	The closest camp of Grey-headed Flying-fox is located in Yarra Bend Park approximately 20 km south-east of the project area. Grey-headed Flying-fox have been recorded utilising food trees in the Grey Box Woodland, golf course and other planted trees in Melbourne Airport (Ecology and Infrastructure International, 2018). However the number of the individuals recorded were low (20 over 6 survey nights) and it is not expected that the habitat present is a critical food source for the survival of the species. Although the scale of tree removal proposed in the Grey Box Woodland is large, it is unlikely that this would lead to a long-term decrease in the size of any population, reduce the area of occupancy or fragment any population. There is a large expanse of suitable food trees for the species in the broader surrounding area and the Yarra Bend population is not reliant on potential food sources located within Melbourne Airport. It is likely that there will be an increased number of collisions with aircraft will be proportionate to the number of increased flights. However, the strike risk to Grey-headed Flying-fox may decrease as a result of the M3R project removing half of the available habitat within the Grey Box Woodland.
Adversely affect habitat critical to the survival of a species.	Rare	Whilst the species may visit the project area on occasion, the Grey Box Woodland and other trees located within the project area are unlikely to provide habitat critical to the survival of the species given the large extent of other available food sources for the species in the broader region.
Disrupt the breeding cycle of an important population.	Rare	No breeding population occurs within the project area.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Rare	The potential habitat located within the project area is not critical to the survival of the species therefore removal of Grey Box trees within the project area will not cause a decline in the species.
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.	Rare	The potential introduction of invasive species will be addressed by adopting a vehicle and machinery hygiene procedure, to ensure all vehicles and machinery that arrive at the project area are free of soil and other material that may contain weed propagules.
Introduce disease that may cause the species to decline.	Rare	The project will not introduce disease that may cause any impact on the species.
Interfere substantially with the recovery of the species.	Rare	The potential habitat located within the project area is not subject to any recovery plan for the species.

Table B5.23
Significant impact assessment for the critically endangered Swift Parrot

Significant Impact Criteria	Likelihood of significant impact	Justification
Significant Impact Guidelines for critically endangered species (DoE, 2013)		
Lead to a long-term decrease in the size of a population.	Possible	The Swift Parrot occurs as a single, migratory population (Saunders & Tzaros, 2011). The Recovery Plan states that *'the clearance of nesting, roosting or foraging habitat may have a significant impact on the population. Such impact are most likely to be significant where a proposal or activity may result in loss of habitat in, or adjacent to priority foraging, nesting and roosting sites'* (Saunders & Tzaros, 2011). The Grey Box Woodland is not a priority habitat listed in the recovery plan. However it does possess phenological characteristics likely to be of importance to the Swift Parrot (large intact area of key tree species) (Saunders & Tzaros, 2011). Therefore, key threats to the species that are a direct or indirect result of the project are addressed below. The below list of key threats is listed in the Recovery Plan for the species (Saunders & Tzaros, 2011). Each of the identified threats to Swift Parrot has the potential to compromise long-term survival of the species, and when more than one threat is present, the cumulative effect is likely to be substantially greater than the sum of individual threats (Saunders & Tzaros, 2011). Habitat loss Whilst the habitat present within the impact area constitutes approximately 0.0011% of the species range (using the full extent of occurrence estimated as 57,000km^2 on mainland Australia (Garnett et al 2011)) the use of other available habitat is dependent on prevailing climatic conditions and corresponding food availability (Saunders & Tzaros, 2011). The project proposes to remove 68.02 ha of Swift Parrot habitat from one of the most southern examples of the species' available habitat on mainland Australia. There is also a growing risk that in any one year, large-scale intense bushfires can reduce a large proportion of available habitat for the species. Whilst the habitat present in the impact area comprises only a small area of total available habitat for the species, it is unknown whether this habitat may represent a critical food source for the species under differing environmental conditions. Climate change Loss of nesting trees and large areas of foraging habitat due to increased wildfires across the species range, stochastic flowering of Eucalypts as a result of drought and as a direct result of climate change, induced by anthropogenic emissions of greenhouse gases, is likely to pose a significant threat to the Swift Parrot. Increased air traffic as a result of the construction of the third runway is likely to contribute to increased emissions of greenhouse gases. Collision mortality The risk of collision with aircraft will be reduced if approximately half of the suitable habitat surrounding the airport is removed (i.e. removal of 68.02 hectares of the 154 ha Grey Box Woodland). No Swift Parrot deaths have been recorded at Melbourne Airport as a result of collision with aircraft to date. It is unlikely that there would be increased collision mortality as a result of the project.
Reduce the area of occupancy of the species.	Almost certain	68.02 ha of suitable habitat will be removed. This constitutes approximately 0.0011% of the species range (using the full extent of occurrence estimated as 57,000km^2 on mainland Australia (Garnett et al, 2011)).
Fragment an existing population into two or more populations.	Rare	The Swift Parrot occurs as a single, migratory population (Saunders & Tzaros, 2011) and as such removal of habitat in the project area cannot fragment the population.
Adversely affect habitat critical to the survival of a species.	Possible	Habitat critical to the survival of the Swift Parrot includes; those areas of priority habitat for which the Swift Parrot has a level of site fidelity or possess phenological characteristics likely to be of importance to the Swift Parrot, or are otherwise currently identified by the recovery team. Whilst the habitat present within the project area is not a priority habitat site listed within the recovery plan it includes a large patch of mainland foraging habitat dominated by a key tree species (Grey Box) and the species has been confirmed as using the site on multiple occasions and therefore possesses the phenological characteristics likely to be of importance to the Swift Parrot.
Disrupt the breeding cycle of a population.	Rare	No breeding population occurs within the project area or the adjacent larger Grey Box Woodland. All breeding habitat for the species is located in Tasmania.
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.	Possible	As per the first criterion.

Significant Impact Criteria (cont.)	Likelihood of significant impact (cont.)	Justification (cont.)
Significant Impact Guidelines for critically endangered species (DoE, 2013) (cont.)		
Result in invasive species that are harmful to a critically endangered species becoming established in the critically endangered species' habitat.	Rare	The proposed impact is to remove all habitat for the species therefore there will be no opportunity to introduce invasive species into the habitat as it will be removed. The potential introduction of invasive species will be addressed by adopting a vehicle and machinery hygiene procedure, to ensure all vehicles and machinery that arrive at the project area are free of soil and other material that may contain weed propagules.
Introduce disease that may cause the species to decline.	Rare	The project will not introduce disease that may cause any impact on the species.
Interfere with the recovery of the species.	Likely	The removal of Swift Parrot habitat from the impact area is not aligned with the following Recovery Actions listed in the Recovery Plan: • 2.1 Manage and protect nesting and foraging habitat.

Growling Grass Frog

For assessment of the project against the significant impact criteria, it is essential to define a significant population of Growling Grass Frog and understand whether the population present within the project area is 'important'.

An 'important population' of the Growling Grass Frog is described as follows:

'Any viable population is considered to be an important population for the persistence and recovery of the Growling Grass Frog. For this species, a viable population is one which is not isolated from other populations or water bodies, such that it has the opportunity to interact with other nearby populations or has the ability to establish new populations when water bodies fill and become available' (DEWHA, 2009b).

The Growling Grass Frog populations in Arundel Creek, Deep Creek, the Maribyrnong River and Moonee Ponds Creek are considered viable populations and therefore important populations for the purposes of assessment under the EPBC Act.

No impacts to Moonee Ponds Creek or the terrestrial habitat surrounding it is expected as a result of the project. The significant impact assessment has been undertaken for the Arundel Creek and Deep Creek/ Maribyrnong River populations of Growling Grass Frog.

A significant impact is considered likely to occur on Growling Grass Frog for the population present within Arundel Creek; however, it is unlikely a significant impact would occur to the population in Deep Creek/ Maribyrnong River based on the assessment in Table B5.24.

Table B5.24
Significant impact assessment for the vulnerable Growling Grass Frog

Ecological element affected	Impact threshold	Comment	Arundel Creek		Deep Creek / Maribyrnong River	
			Assessment	Justification	Assessment	Justification
Significant impact guidelines for the vulnerable Growling Grass Frog (Litoria raniformis) Nationally threatened species and ecological communities EPBC Act policy statement 3.14. (DEWHA, 2009b)			**Significant impact guidelines for the vulnerable Growling Grass Frog (Litoria raniformis) Nationally threatened species and ecological communities EPBC Act policy statement 3.14. (DEWHA, 2009b) (cont.)**			
Habitat degradation in area supporting an important population.	• Permanent removal or degradation of terrestrial habitat (for example between ponds, drainage lines or other temporary/permanent habitat) within 200 m of a water body in temperate regions, or 350 m of a water body in semi-arid regions, that results in the loss of dispersal or overwintering opportunities for an important population. • Alteration of aquatic vegetation diversity or structure that leads to a decrease in habitat quality. • Alteration to wetland hydrology, diversity and structure (for example any changes to timing, duration or frequency of flood events) that leads to a decrease in habitat quality. • Introduction of predatory fish and/or disease agents.	• Habitat is a connected area that supports one or more key ecological functions for this species. These functions may include, but are not limited to: foraging, breeding, dispersal, shelter. • Any action that results in the degradation of habitat such that the recruitment, survival or dispersal rates of an important population are lowered may have a significant impact on the species. • Habitat quality increases with: – increasing wetland area, – water permanence, and – aquatic vegetation cover. • Habitat quality decreases with: – the degree of development in the terrestrial zone (that is, Roads, buildings etc.), and – the presence of predatory fish.	Almost certain	• 63.16 ha of GGF habitat will be modified within or adjacent to Arundel Creek as a result of the project which would result in the loss of aquatic and terrestrial habitat and modification of aquatic habitat. • Impacts downstream will be managed in line with Melbourne Water requirements to maintain baseline outflow and sedimentation rates through mechanical management. As a result no downstream offsite impacts are likely. • Strict hygiene protocols are to be established to ensure Chytrid fungus not introduced downstream.	Rare	• There is 1.18 ha of terrestrial habitat located within the impact area. • There will be no impacts to aquatic habitat. • Impacts to terrestrial habitat adjacent to Deep Creek and the Quarry are likely to include temporary disturbance through the upgrade of an existing road. The road once complete will not fragment habitat or act as a barrier to movement.
Isolation and fragmentation of populations.	Net reduction in the number and/or diversity of water bodies available to an important population. Removal or alteration of available terrestrial or aquatic habitat corridors (including alteration of connectivity during flood events). Construction of physical barriers to movement between water bodies, such as roads or buildings.	• Habitat connectivity could be provided by a linear water body (for example creekline) or by suitable terrestrial habitat between waterbodies. Individuals may use a range of terrestrial and aquatic habitats as movement corridors between water bodies, including floodways or grassy fields. • Any isolation of water bodies, through destruction of habitat, or creation of a barrier such that movement or migration between waterbodies is less likely to have a significant impact on the species.	Almost certain	There will be no fragmentation as the entire upper section of the water body is proposed for modification to the extent that is unlikely to constitute suitable habitat post-construction, however there will be a net reduction in the number of waterbodies and diversity of waterbodies available to an important population.	Rare	The upgrade of an existing road may temporarily isolate individuals located within the quarry from Deep Creek however this will only be temporary during the construction phase.

Australian Grayling

A significant impact is considered unlikely on Australian Grayling, based on the assessment in Table B5.25.

White-throated Needletail

A significant impact is considered unlikely on White-throated Needletail, based on the assessment in Table B5.26.

Table B5.25
Significant impact assessment for the vulnerable Australian Grayling

Significant Impact Criteria	Likelihood of significant impact	Justification
Significant Impact Guidelines for vulnerable species (DoE, 2013)		
Lead to a long-term decrease in the size of an important population of a species.	Rare	There is no population of the species present within the impact area. This assessment addresses downstream impacts to the species which is present within the Maribyrnong River. Effects on waterways controllable and during short-term construction period only. Permanently altered run-off and water quality to be managed by design and relevant permit conditions to ensure integrity of adjacent waterways as habitat for the species. No breeding population occurs within the project area and downstream impacts are to be managed through the implementation of an EMP so that outflow and sediment rates remain at base levels. The potential introduction of invasive species will be addressed by adopting a vehicle and machinery hygiene procedure, to ensure all vehicles and machinery that arrive at the project area are free of soil and other material that may contain weed propagules. It is likely that pest species present within Arundel Creek will already by occupying the Maribyrnong River therefore introduction of new pest species is unlikely through the removal of a portion of Arundel Creek. The project will not introduce disease that may cause any impact on the species. The potential habitat located within the project area is not subject to any recovery plan for the species.
Reduce the area of occupancy of an important population).		
Fragment an existing important population into two or more populations.		
Adversely affect habitat critical to the survival of a species.		
Disrupt the breeding cycle of an important population.		
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.		
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.		
Introduce disease that may cause the species to decline.		
Interfere substantially with the recovery of the species.		

Table B5.26
Significant impact assessment for the vulnerable White-throated Needletail

Significant Impact Criteria	Likelihood of significant impact	Justification
Significant Impact Guidelines for vulnerable species (DoE, 2013)		
Lead to a long-term decrease in the size of an important population of a species.	Rare	The species occurs at numerous and widespread sites in eastern Australia. It is likely that the species utilises all of the airspace at Melbourne Airport with the airspace above the woodland providing preferable habitat for the species. There is an incidental record of the species from 2010 (Birdlife Australia) over Sky Road in Melbourne Airport and other records surrounding the Airport. The species is known to have a preference for foraging above wooded areas and is known to roost in the canopy and hollows of trees in in forests and woodlands. Potential impacts to this species include: • Increased risk of collision with Aircraft as a result of increased air traffic. • Removal of preferable foraging and potential roosting areas within and above the Grey Box Woodland. The White throated Needletail spends its non-breeding time in Australia and when in Australia the species is widespread and numerous. Potential impacts as a result of M3R are not expected to have a significant impact on this species.
Reduce the area of occupancy of an important population).		
Fragment an existing important population into two or more populations.		
Adversely affect habitat critical to the survival of a species.		
Disrupt the breeding cycle of an important population.		
Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.		
Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat.		
Introduce disease that may cause the species to decline.		
Interfere substantially with the recovery of the species.		
Draft EPBC Act referral guidelines for 14 birds listed migratory under the EPBC Act (DoE, 2015)		
Is the proposed activity within the species range (maps, page 10, Department of Energy 2015).	Almost certain	The project area is located within the core non-breeding range for the species in Australia.
Is the proposed activity likely to substantially modify, destroy or isolate an area if important habitat for the species.	Rare	Important habitat is described as: *Non-breeding habitat only: Found across a range of habitats, more often over wooded areas, where it is almost exclusively aerial. Large tracts of native vegetation, particularly forest, may be a key habitat requirement for species. Found to roost in tree hollows in tall trees on ridge-tops, on bark or rock faces. Appears to have traditional roost sites* (DoE 2015). Whilst the Grey Box Woodland is a relatively large example of wooded vegetation Grey Box trees are relatively small compared to tall forest trees. With limited records of the species in the local area it unlikely that the woodland provides significant roosting habitat for the species.
Seriously disrupt the lifecycle of an ecologically significant proportion of the population.	Rare	The nationally ecologically significant proportion of the population is 10 individuals and globally 100 individuals. The potential increased collision risk as a result of the project is unlikely to disrupt the lifecycle of the population.

B5.6.3.2
Threatened ecological communities

Grey Box Grassy Woodlands and Derived Native Grasslands of South-eastern Australia Grey Box

There are 78.74 hectares of this community in the impact area proposed to be cleared (68.02 hectares in treed condition state and 10.72 hectares as derived native grassland). Based on the extent and condition of this community in the project area, and the proposed impacts, it is concluded that the project is likely to lead to a significant impact on the Grey Box Grassy Woodland and Derived Native Grasslands of South-Eastern Australia threatened ecological community. An assessment and justification for this decision is provided in Table B5.27.

Table B5.27
Significant impact assessment for Grey Box Grassy Woodland

Significant Impact Criteria	Likelihood of significant impact	Justification
Significant Impact Guidelines for critically endangered / endangered community) (DoE, 2013)		
Reduce the extent of an ecological community.	Almost certain	Grey Box woodlands are widespread across inland Victoria and NSW with outliers just north and west of Melbourne. Impacts will occur on a southern outlier of the geographic extent of this community. The airport woodland is one of three large patches of this community left in southern Victoria. More broadly, it is estimated that only 10 to 15% of its original extent remains (DSEWPC 2012). The removal of up to 68.02 ha out of 154.00 ha of woodland and 10.72 ha out of 15.68 ha of derived native grassland is likely to significantly reduce the extent of the Grey Box community in Victoria.
Fragment or increase fragmentation of an ecological community.	Almost certain	Reducing the total extent of the Grey Box Woodland from 169.68 ha to 90.94 ha (removing 78.74 ha) will reduce the total area of habitat available in the area. The edge ratio to interior will increase, potentially changing the properties of the remaining habitat. At a landscape scale in southern Victoria the reduction in size of this example of the community will increase functional fragmentation for vagrant species such as woodland birds that are an important component of the community. The reduction in size of the woodland will further reduce opportunity for dispersal of plant propagules to other woodland sites within the broader landscape.
Adversely affect habitat critical to the survival of an ecological community.	Possible	There is no adopted or made Recovery Plan for this ecological community and no critical habitats have been formerly identified by the Australian Government. However, removal of 78.74 ha of woodland stand and areas of derived grassland is likely to increase serious or long-term impacts on habitat critical to the survival of the community in a broader context in Victoria and southern Australia.
Modify or destroy abiotic factors necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.	Almost certain	Removal of 78.74 ha of the woodland is likely to result in long term disturbance to soil and topography in the local area.
Cause a substantial change in the species composition of an occurrence of an ecological community, including a decline or loss of functionally important species, for example through regular burning or flora and fauna harvesting.	Possible	Clearing almost half of the woodland and associated derived native grasslands will reduce community integrity and functionality (e.g. reduction in habitat for small native mammals and woodland birds, reduced flora species richness, potential reduced genetic exchange across the community in southern Victoria due to fragmentation). The project will not introduce disease that may cause any impact on the species.
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including but not limited to: *- Assisting invasive species establishment* *- Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.*	Likely	Fragmentation of the woodland will increase the edge effects on the remaining 90.94 hectares by reducing the interior area. It is well documented that fragmentation and increased edge effects assist the establishment of invasive species further into the core of large habitat patches.
Interfere with the recovery of an ecological community.	Likely	There is no adopted or made Recovery Plan for this ecological community and therefore recovery priorities (actions and locations) have not been formerly articulated by the Australian Government. The action of clearing the entire woodland and associated derived native grasslands will cause a significant loss of opportunity to protect and manage one of the last remaining large (>100 ha) Grey Box remnants in southern Victoria.

Natural Temperate Grassland of the Victorian Volcanic Plain

It is estimated that 97.89 hectares of Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) would need to be removed for the project. This includes 7.79 hectares of inaccessible areas where Natural Temperate Grassland was estimated to be present (estimated via nocturnal or binocular assessments) and 10.49 hectares of inaccessible areas where NTGVVP was assumed to be present.

Regardless of whether the estimated and assumed areas are NTGVVP or not, removal of at least 97.89 hectares of confirmed NTGVVP for this project is likely to constitute a significant impact on this TEC. A justification for this conclusion is provided as part of the significant impact self-assessment in Table B5.28.

Table B5.28
Significant impact assessment for Natural Temperate Grassland

Significant Impact Criteria	Likelihood of significant impact	Justification
Significant Impact Guidelines for critically endangered / endangered community) (DoE, 2013)		
Reduce the extent of an ecological community.	Almost certain	It is inherently difficult to estimate the extent of treeless threatened ecological communities at landscape scales. Nevertheless, it is generally accepted that Natural Temperate Grassland has declined in extent by more than 98% since European arrival in Victoria (TSSC, 2008). In the early 2000s, it was estimated that 5000 ha of Natural Temperate Grassland remained (Barlow and Ross, 2002). The extent of this TEC is likely to be less now. Removal of 97.89 ha of Natural Temperate Grassland from the project area amounts to removal of at least 2% of the estimated remaining extent of this TEC, near the eastern limit of the TEC's distribution. In the context of the historical decline in Natural Temperate Grassland, this impact is highly likely to be considered significant.
Fragment or increase fragmentation of an ecological community.	Almost certain	It is estimated that more than 95% of known patches of Natural Temperate Grassland are less than 10 ha in size, as a result of fragmentation by clearing and modification of the TEC over time (TSSC, 2008). The project would result in the fragmentation of at least six patches of Natural Temperate Grassland greater than 10 ha in size. On a broader landscape scale, it would result in complete removal of three patches greater than 10 ha in size. The project would therefore cause the fragmentation of a TEC, which is highly likely to be considered a significant impact.
Adversely affect habitat critical to the survival of an ecological community.	Almost certain	No Recovery Plan has been prepared or adopted for this TEC and no critical habitats have been formerly identified by the Commonwealth Government. However, given that less than 2% of the TEC is estimated to still exist, most areas that continue to support the TEC are likely to be considered critical habitat, particularly if those areas support moderate to high quality examples of the TEC. The project area is estimated to currently support 105.85 ha of moderate quality Natural Temperate Grassland (weighted average score of 48.76 out of 100). The project would result in permanent removal of 97.89 ha of this grassland and therefore adversely affect habitat that is likely to be critical to the survival of the TEC, given the broader context.
Modify or destroy abiotic factors necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns.	Almost certain	Construction of a new runway, taxiways and ancillary infrastructure is likely to result in long term disturbance to soil, topography and hydrology necessary for persistence of the TEC across most of the project area.
Cause a substantial change in the species composition of an occurrence of an ecological community, including a decline or loss of functionally important species, for example through regular burning or flora and fauna harvesting.	Almost certain	Decline of Natural Temperate Grassland typically involves the sequential loss of the following functionally important species or floristic groups: loss of warm-season grasses (e.g. Kangaroo Grass), followed by decline in native forb diversity, followed by loss of cool-season grasses (e.g. Tussock Grass, Wallaby Grass and Spear Grass). Various stages of this decline are noticeable with the project area. For example, Kangaroo Grass is rare while native forb diversity is low. Permanent removal of Natural Temperate Grassland within the project area would result in loss of all remaining functionally important species from this occurrence of the TEC. Any Natural Temperate Grassland that persists or regenerates within the project area is likely to have reduced species richness and be subject to more intensive management regimes (e.g. mowing) post-construction, thereby resulting in permanently reduced flora and fauna assemblages.

Significant Impact Criteria (cont.)	Likelihood of significant impact (cont.)	Justification (cont.)
Significant Impact Guidelines for critically endangered / endangered community) (DoE, 2013) (cont.)		
Cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including but not limited to: *- Assisting invasive species establishment* *- Causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community.*	Almost certain	Construction of the project will result in fragmentation of Natural Temperate Grassland within the local area. Fragmentation is likely to increase the susceptibility of remaining Natural Temperate Grassland to weed invasion.
Interfere with the recovery of an ecological community.	Likely	No Recovery Plan has been prepared or adopted for this TEC and therefore recovery priorities (actions and locations) have not been formerly articulated by the Commonwealth Government. However, the action of clearing at least 2% of the estimated remaining area of this TEC, particularly at the eastern edge of the TEC's distribution, is likely to interfere with the TEC's recovery.

Table B5.29
Significant impact assessment for listed migratory species

Species	Significant Impact Criteria	Likelihood of significant impact	Justification
Draft EPBC Act referral guidelines for 14 birds listed migratory under the EPBC Act (DoE, 2015)			
Fork-tailed Swift	Is the proposed activity within the species range (maps, page 10, DoE, 2015).	Almost certain	The project area is located within the core range for the species in Australia.
	Is the proposed activity likely to substantially modify, destroy or isolate an area if important habitat for the species.	Rare	Important habitats for the species include all aerial habitats. Potential impacts to the species as a result of the project includes risk of collision with aircraft. The increased risk of collision with aircraft is unlikely to substantially modify, destroy or isolate an area of important habitat
	Seriously disrupt the lifecycle of an ecologically significant proportion of the population.	Rare	Potential impacts unlikely to disrupt the lifecycle of an ecologically significant proportion of a population for any of the species. A nationally ecologically significant proportion of Fork-tailed Swift is 100 individuals (DoE, 2015). With less than 7 records in the broader region in the past 20 years reduction in the population by 100 individuals is highly unlikely.
Significant impact to Fork-tailed Swift is unlikely			
Rufous Fantail	Is the proposed activity within the species range (maps, page 13, DoE, 2015).	Almost certain	The project area is located within the core range for the species in Australia.
	Is the proposed activity likely to substantially modify, destroy or isolate an area if important habitat for the species.	Rare	Important habitat for the species defined as: *Moist, dense habitats, including mangroves, rainforest, riparian forests and thickets, and wet eucalypt forests with a dense understorey. When on passage a wider range of habitats are used including dry eucalypt forests and woodlands and Brigalow shrublands* (DoE, 2015). There will be no substantial modification, removal, destruction or isolation of habitat within the project area.
	Seriously disrupt the lifecycle of an ecologically significant proportion of the population.	Rare	A nationally ecologically significant proportion of Rufous Fantail is 4,800 individuals (DoE, 2015). Potential impacts unlikely to disrupt the lifecycle of an ecologically significant proportion of a population for any of the species.
Significant impact to Rufous Fantail is unlikely			

Species (cont.)	Significant Impact Criteria (cont.)	Likelihood of significant impact (cont.)	Justification (cont.)
Draft EPBC Act referral guidelines for 14 birds listed migratory under the EPBC Act (DoE, 2015) (cont.)			
Satin Flycatcher	Is the proposed activity within the species range (maps, page 12, DoE, 2015).	Almost certain	The project area is located within the core range for the species in Australia.
	Is the proposed activity likely to substantially modify, destroy or isolate an area if important habitat for the species.	Rare	Important habitats for the species are described as: *Eucalypt forest and woodlands, at high elevations when breeding. They are particularly common in tall wet sclerophyll forest, often in gullies or along water courses. In woodlands they prefer open, grassy woodland types. During migration, habitat preferences expand, with the species recorded in most wooded habitats except rainforests. Wintering birds in northern Qld will use rainforest - gallery forests interfaces, and birds have been recorded wintering in mangroves and paperbark swamps* (DoE, 2015). The increased risk of collision with aircraft or the removal of habitat is unlikely to substantially modify, destroy or isolate an area of important habitat.
	Seriously disrupt the lifecycle of an ecologically significant proportion of the population.	Rare	A nationally ecologically significant proportion of Satin Flycatcher is 1,700 individuals (DoE, 2015). Potential impacts unlikely to disrupt the lifecycle of an ecologically significant proportion of a population for any of the species.
Significant impact to Satin Flycatcher is unlikely			
White-throated Needletail	Refer to Table B5.26		
Industry guidelines for avoiding, assessing and mitigating impacts on EPBC Act listed migratory shorebird species (DoEE, 2017)			
Latham's Snipe	Will there be a loss of important habitat?	Rare	Project area is not identified as internationally important for the species and no individuals have been recorded at Melbourne Airport, it is therefore unlikely that habitat within the project area would support more than 18 individuals. Significant impact unlikely.
	Will there be degradation of habitat leading to a substantial reduction in numbers?		
	Increased disturbance leading to a substantial reduction in numbers?		
Significant impact to Latham's Snipe is unlikely			

B5.6.3.3
Listed migratory species

A significant impact is considered unlikely on listed migratory species, based on the assessment in Table B5.29.

B5.7 AVOIDANCE, MANAGEMENT AND MITIGATION MEASURES

B5.7.1.1
Pre-construction avoidance and minimisation of impacts

The key measure for reducing M3R's impacts on ecological values within the project area is to minimise the removal of native vegetation, terrestrial and aquatic habitat wherever possible (given the size and scale of the project, complete avoidance of impacts to ecological values is not possible.)

Refinement of the project area has significantly minimised impacts proposed to native vegetation and fauna habitat. The project will require the removal of 255.29 hectares of native vegetation – a significant reduction from the initially proposed 403.86 hectares. This results in retaining 148.57 hectares of native vegetation initially proposed for removal.

B5.7.1.2
Construction phase management and mitigation measures

Measures to mitigate and manage impacts on ecological values will be detailed in a Construction Environment Management Plan (CEMP) prepared before construction in accordance with the *Environmental Management Plan Guidelines* (DoE, 2014).

General details on management and mitigation measures during construction can be found in Chapter A5: Project Construction. Further details on measures to mitigate and manage impacts on ecological values can be found in **Chapter E2: Environment Management Framework** and will be included in the project-specific CEMP.

B5.7.1.3 Post-construction rehabilitation and adaptive management

Post-construction rehabilitation of the development footprint will focus on establishing an erosion-resistant ground condition. This will require a program of revegetation, erosion control, targeted weed management and ongoing monitoring.

Further details on post-construction rehabilitation and adaptive management will be found in **Chapter E2: Environment Management Framework** and be included in the project-specific CEMP.

B5.7.1.4 Offsets

The provision of appropriate offsets in accordance with the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012b) will be established and secured for any residual impacts to significant ecological values that cannot be eliminated by avoidance, minimisation and management. The key ecological values proposed to be offset include:

- Loss of 97.89 hectares of Natural Temperate Grassland of the Victorian Volcanic Plain TEC
- Loss of 68.02 hectares of Grey Box Grassy Woodland (treed condition state) TEC
- Loss of 10.72 hectares of Grey Box Grassy Woodland (derived native grassland) TEC
- Loss of 9.75 hectares of Golden Sun Moth habitat
- Loss of 64.34 hectares of aquatic and terrestrial Growling Grass Frog habitat
- Loss of 68.02 hectares of Swift Parrot habitat.

The proposed offset management strategy is detailed in **Chapter E3: Offset Management Strategy**. By offsetting the large-scale and significant native vegetation removal for the project, the proposed offset strategy will contribute conservation gains that will mitigate significant impacts to the environment as a whole on Commonwealth land.

Although offsets for the removal of native vegetation or species-specific offsets are not triggered under *the Victorian Planning and Environment Act 1987*, those offsets secured under EPBC Environmental Offsets Policy will substantially secure habitat for the Victorian FFG Act-listed species likely to occur or which do occur within the impact area – along with native vegetation offsets potentially proportionate to what would be required under the Victorian *Planning and Environment Act 1987* if relevant.

B5.8 CONCLUSION

Refined design efforts have greatly reduced the impact area. and subsequently the impact to native vegetation and fauna habitat initially associated with M3R.

The project is highly likely to result in a significant impact to the following EPBC Act and FFG Act-listed threatened species and ecological communities:

- Natural Temperate Grassland of the Victorian Volcanic Plain
- Grey Box Grassy Woodland (treed and derived native grassland condition states)
- Swift Parrot
- Growling Grass Frog
- Golden Sun Moth.

It is also considered highly likely the project will result in a significant impact to the environment on Commonwealth land due to large-scale clearing of native vegetation; the removal of threatened ecological communities and species habitat; loss of habitat for local wildlife populations; and substantial alteration to landscape features through removal of the majority of Arundel Creek and approximately half the Grey Box Woodland.

Although other EPBC Act-listed threatened species and migratory species may occasionally use the project area – and in some cases will do so regularly, for example the Grey-headed Flying-fox – significant impacts are not expected to occur to these species as a result of the project.

Table B5.30 summarises the ecological values that would be impacted by the project through direct loss of native vegetation and impacts on threatened species habitat.

Measures to mitigate and manage impacts to ecological values will be detailed in a CEMP. This will contain a requirement for the monitoring of impact – in addition to reviews of mitigation measures and effectiveness during construction – to ensure that the full extent of impacts is accurately documented, and that the nominated offsets meet the legislative requirements outlined in the offset management strategy for the project.

Residual impacts to EPBC Act-listed threatened species and ecological communities are to be offset as per the EPBC Act Environmental Offsets Policy (DSEWPaC, 2012b). The proposed offset management strategy is detailed in **Chapter E3: Offset Management Strategy**.

By offsetting the large-scale and significant native vegetation removal for the project, the proposed offset strategy will contribute conservation gains that will mitigate significant impacts to the environment as a whole on Commonwealth land.

A summary of the potential impacts associated with the project and proposed mitigation and management measures (in accordance with the significance assessment framework) is contained in **Table B5.31**.

Table B5.30
Native vegetation, threatened ecological communities and threatened fauna habitat in the impact area (Figure B5.18 and Figure B5.19)

Vegetation Type	Impact area (ha)
Vegetation community (EVC)	
653 Aquatic Herbland	0.01
68 Creekline Grassy Woodland	1.33
895 Escarpment Shrubland	0.76
71 Hills Herb-rich Woodland	10.89
132 Plains Grassland	169.30
55 Plains Grassy Woodland	0.25
803 Plains Woodland	71.01
641 Riparian Woodland	1.26
821 Tall Marsh	0.49
EPBC listed TEC* (*subset of EVCs above)	
Grey Box Grassy Woodlands and Derived Grasslands of South-eastern Australia – treed condition state (EVC 71 and parts of EVC 803)	68.02
Grey Box Grassy Woodlands and Derived Grasslands of South-eastern Australia – derived native grassland (treeless EVC 803)	10.72
Natural Temperate Grassland of the Victorian Volcanic Plain (total) (EVC 132)	97.89
FFG listed TEC* (*subset of EVCs above)	
Victorian Temperate Woodland Bird Community	68.02
Western (Basalt) Plains Grassland	169.30
Fauna habitat	
Golden Sun Moth	9.75
Growling Grass Frog	64.34
Swift Parrot	68.02
Grey-headed Flying-fox	68.02

Table B5.31
Impact assessment summary

Environment aspect & baseline condition	Assessment of original impact						Mitigation and/or management measures	Assessment of residual impact				
	Original Impact	Mitigation inherent in design/practice	Duration	Significance: Severity	Significance: Likelihood	Significance: Impact		Residual Impact	Duration	Significance: Severity	Significance: Likelihood	Significance: Impact
Natural Temperate Grassland 97.9 ha of a critically endangered TEC within the impact area.	Direct removal of 97.9 ha of this TEC.	Minimise permanent removal where possible.	Permanent	Major	Almost certain	Extreme	Adequate offsite offsets secured in line with EPBC Act Offsets Policy.	Any residual impact proposed to be compensated by permanent protection of a greater area of this community offsite.	Permanent	Minor	Almost certain	Medium
Grey Box Woodland (treed state) 68.02 ha of this vulnerable TEC within the impact area.	Direct removal of 68.02 ha of this Federal TEC which also corresponds to the Victorian Temperate Woodland Bird Community.	Minimise permanent removal where possible.	Permanent	Major	Almost certain	Extreme	Adequate offsite offsets secured in line with EPBC Act Offsets Policy.	Any residual impact proposed to be compensated by permanent protection of a greater area of this community offsite.	Permanent	Minor	Almost certain	Medium
Grey Box Woodland (derived grassland state) 10.72 ha of this vulnerable TEC within the impact area.	Direct removal of 10.72 ha of this TEC.	Minimise permanent removal where possible.	Permanent	Major	Almost certain	Extreme	Adequate offsite offsets secured in line with EPBC Act Offsets Policy.	Any residual impact proposed to be compensated by permanent protection of a greater area of this community offsite.	Permanent	Minor	Almost certain	Medium
Golden Sun Moth habitat 9.75 ha of habitat within the impact area	Direct removal of 9.75 ha of habitat	Minimise permanent removal where possible.	Permanent	Major	Almost certain	Extreme	Adequate offsite offsets secured in line with EPBC Act Offsets Policy.	Any residual impact proposed to be compensated by permanent protection of a greater area of habitat offsite.	Permanent	Minor	Almost certain	Medium
Growling Grass Frog habitat 64.34 ha of terrestrial and aquatic habitat within the impact area.	Direct removal of 64.34 ha terrestrial and aquatic habitat within the impact area.	Minimise permanent removal where possible.	Permanent	Major	Almost certain	Extreme	Adequate offsite offsets secured in line with EPBC Act Offsets Policy.	Any residual impact proposed to be compensated by permanent protection of a greater area of habitat offsite.	Permanent	Minor	Almost certain	Medium
Swift Parrot habitat 68.02 ha of habitat within the impact area.	Direct removal of 68.02 ha habitat within the impact area.	Minimise permanent removal where possible.	Permanent	Major	Almost certain	Extreme	Adequate offsite offsets secured in line with EPBC Act Offsets Policy.	Any residual impact proposed to be compensated by permanent protection of a greater area of habitat offsite.	Permanent	Minor	Almost certain	Medium
Grey-headed Flying Fox habitat Foraging habitat present in the form of planted trees, scattered native trees and woodland EVCs.	Direct removal of planted trees, scattered trees and 68.02 ha of Grey Box Woodland habitat that represents potential foraging habitat.	Minimise permanent removal where possible.	Permanent	High	Almost certain	Extreme	Impact is not a significant impact as defined under EPBC Act and does not require offsets. However, offsets obtained for Grey Box Woodland are expected to also benefit this species.	Permanent removal of potential foraging habitat compensated by securing offsets for Grey Box Woodlands.	Permanent	Minor	Almost certain	Medium
Listed Migratory species Five migratory fauna species have medium to high potential to occur in the project area.	Direct removal of native vegetation and fauna habitat that is occupied or utilised on occasion by migratory species	Minimise permanent removal where possible.	Permanent	High	Almost certain	Extreme	Impact is not a significant impact as defined under EPBC Act and does not require offsets. However, offsets obtained for the project are expected to also benefit these species.	Permanent removal of potential habitat compensated by securing offsets for Grey Box Woodland, Natural Temperate Grassland and Growling Grass Frog habitat.	Permanent	Minor	Almost certain	Medium
Native vegetation 255.29 ha of native vegetation within the impact area.	Direct removal of 255.29 ha of native vegetation of which 176.63 ha is native vegetation that constitutes an EPBC Act TEC and 237.32 ha of native vegetation that corresponds to one of three Victorian FFG Act listed communities.	Minimise permanent removal where possible.	Permanent	Major	Almost certain	Extreme	Adequate offsite offsets secured in line with EPBC Act Offsets Policy.	Any residual impact proposed to be compensated by permanent protection of a greater area of this community offsite.	Permanent	Minor	Almost certain	Medium
FFG Act listed communities 237.32 ha of native vegetation that corresponds to one of three Victorian FFG Act listed communities.	Direct removal of 237.32 ha of native vegetation that corresponds to one of three Victorian FFG Act listed communities.	Minimise permanent removal where possible.	Permanent	Major	Almost certain	Extreme	Values mostly correspond to those that will be offset in accordance with EPBC Act listed communities.	Any residual impacts to be mitigated through offsets provided for corresponding EBPC Act communities.	Permanent	Minor	Almost certain	Medium
Arundel Creek Highly disturbed waterway within an agricultural environment containing habitat for species of state and national significance.	Modification of approximately 4.5 km of streamline and alteration to hydrological and ecological features.	Down stream flows are proposed to be maintained, with no predicted alterations to flow volumes.	Permanent	High	Almost certain	Extreme	Offset measures implemented as compensatory measures for GGF will improve ecological values of an offsite wetland for significant species.	Modification of approximately 4.5 km of streamline and major alteration to hydrological and ecological features, with improvement to similar waterway off site.	Permanent	Minor	Almost certain	Medium

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APPENDIX B5.A
DETAILED SURVEY METHODS

This appendix describes the:

- Detailed native vegetation survey methods
- Detailed threatened ecological community assessment methods
- Detailed targeted fauna survey methods for:
  - Golden Sun Moth
  - Growling Grass Frog
  - Striped Legless Lizard.

Detailed native vegetation survey methods

Vegetation assessments followed a three-step approach:

- Identifying and mapping all native vegetation using the Victorian EVC classification system
- Identifying and mapping all areas of native vegetation that satisfy the criteria for a TEC listed under the EPBC Act
- Assessing the quality of all TECs present.

Native vegetation patches and scattered trees were identified and mapped using the ArcGIS Collector app on a GPS-enabled tablet.

This mapping relied on definitions provided in the Victoria Planning Provisions (VPP) (DELWP, 2020) and Guidelines for the Removal, Destruction or Lopping of Native Vegetation (DELWP, 2017). Key definitions are outlined in **Table B5.A.1**. Patches of native vegetation were assigned to appropriate Ecological Vegetation Classes (EVCs) with reference to EVC benchmarks for the appropriate bioregion (DSE, 2004a ; DSE, 2004b), NatureKit's EVC modelling (DELWP, 2020), maps dating back to 1840 (Kemp, 1840; DoL c.,1849; Hoddle, 1850; DoD, 1915; DoD, 1938; DCLS, 1946), geological mapping (Mines Department, 1970; Mines Department, 1973; DNRE, 1997; Senversa, 2020, unpublished) and previous studies (McDougall, 1987; Biosis, 2015; Biosis, 2019).

Vegetation patches were mapped at a scale of 10 square metres (0.001 hectares) for the following reasons:

- The EPBC Act Offset Assessment Guide (DSEWPaC 2012) requires a scale of at least 0.01 hectares for quantifying impacts on threatened ecological communities. Melbourne Airport's mapping, on a 0.001-hectare scale (i.e. one order of magnitude finer resolution), allows for accurate addition and rounding of impacts
- A scale of 0.001 hectares is the scale required to map 0.001 habitat hectares (assuming a perfect vegetation condition score) which is the scale required by DELWP's Native Vegetation Offset Register for securing offset sites in Victoria
- A scale of 10 square metres was approximately within the resolution of the error of the GPS-enabled tablet.

Table B5.A.1
Key definitions used for identifying and mapping native vegetation at Melbourne Airport

Term	Definition	Reference
Native vegetation	Plants that are indigenous to Victoria, including trees, shrubs, herbs, and grasses.	VPP, cl. 73.01
Patch of native vegetation	An area of vegetation where at least 25% of total perennial understorey plant cover is native or any area with three or more native canopy trees where the drip line of each tree touches the drip line of at least one other tree, forming a continuous canopy (Note that the Current Wetlands Map has been excluded from this definition).	DELWP, 2017 p.6
Scattered tree	A native canopy tree that does not form part of a patch.	DELWP, 2017 p.6
Canopy tree	A mature tree (i.e. it is able to flower) greater than 3 metres in height and normally found in the upper layer of the relevant vegetation type (EVC).	DELWP, 2017 p.35
Ecological Vegetation Class (EVC)	A native vegetation type classified on the basis of a combination of its floristics, lifeforms and ecological characteristics.	DELWP 2017, p.35

Detailed Threatened Ecological Communities (TEC) assessment methods

Vegetation corresponding to a Threatened Ecological Communities (TEC) listed under the EPBC Act (a Matter of National Environmental Significance or MNES) was identified and mapped using ArcGIS Collector on a GPS-enabled tablet. EVC mapping helped identify the potential presence of TECs. The following TECs were identified and mapped within the project area:

- Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia (endangered)
- Natural Temperate Grassland of the Victorian Volcanic Plain (critically endangered).

The specific methods used for these TECs are outlined below. When mapping TECs, the following considerations applied:

- Only naturalised flora species were considered. Planted vegetation was not considered as contributing to total vegetation cover
- Vegetation boundaries were mapped as they appeared on the ground at the time of the assessment. For example, the presence and cover of introduced annuals is not considered when mapping Natural Temperate Grassland of the Victorian Volcanic Plain. When introduced species that may have annual or perennial life histories (e.g. Ox-tongue Helminthotheca echioides) were encountered, only the life history traits that the plants appeared to be exhibiting at the time of the assessment were considered. Therefore, if plants appeared to be one year old and persisting in favourable conditions (e.g. high-nutrient drainage lines) they were considered perennial. When there was doubt, it was assumed the plants were annual.

Natural Temperate Grassland of the Victorian Volcanic Plain

A field checklist was devised for determining the presence of this community (see the end of this section). It relied on the diagnostic characteristics and condition thresholds outlined in the listing advice (TSSC, 2008). Where the listing advice was unclear, clarity was sought from the Natural Temperate Grassland Information Sheet (DSEWPaC, 2011) and, if required, from guidance provided by the Commonwealth Government's Department of the Environment and Energy (and its predecessors).

The field checklist was used to identify the presence or absence of NTGVVP in areas mapped as suitable EVCs (e.g. Heavier-soils Plains Grassland). The checklist was also used in areas of predominantly introduced vegetation previously mapped as NTGVVP to confirm they no longer satisfied the key diagnostic characteristics and condition thresholds of the TEC. All field data for NTGVVP was collected between 18 November 2019 and 14 February 2020 by Michael Goddard, Samantha Barron, Matt Dell, Jane Kenny, Jack Tate, Matt Gibson and Josh Howard.

The field checklist relies on accurate plant-cover estimates being obtained. To ensure that assessments were consistent and standardised, cover estimates were made with reference to predefined cover charts.

Where cover estimates were close to a condition threshold, gridded 1x1 metre quadrats were used to objectively sample plant covers within the grassland patch and confirm the veracity of the cover estimates.

The 1x1 metre quadrats were gridded with 10 horizontal and 10 vertical string lines, resulting in 100 intersection points at which flora species were recorded (allowing for an objective estimate of the percentage cover of each plant species across the square metre). Where the gridded 1x1 metre quadrats were used, patches were randomly sampled to avoid sampling bias.

The listing advice includes minimum contiguous size thresholds for a grassland patch to qualify as NTGVVP. It uses terms such as 'native vegetation remnant' and 'grassland patch' (TSSC, 2008 p.3).

For the purpose of assessing size thresholds, the 'grassland patch' was taken to be the NTGVVP patch rather than the (generally larger) Heavier-soils Plains Grassland patch. In addition, the 'native vegetation remnant' was taken to be the contiguous 'patch of native vegetation' as defined in **Table B5.A.1** rather than a contiguous area of one or more TECs. DAWE confirmed that this was an appropriate interpretation of the listing advice (J. Vranjic, DAWE, pers. comm., March 2020).

This literal interpretation of the NTGVVP Listing Advice size thresholds had the following implications for grassland patches that otherwise met all other key diagnostic characteristics and condition thresholds for NTGVVP:

- The grassland patch was not considered to be NTGVVP if the grassland patch was less than 0.05 hectares even if all other key diagnostic characteristics and condition thresholds were met
- Where the grassland patch was contiguous with other native vegetation that did not satisfy key diagnostic characteristics or condition thresholds for NTGVVP, together forming a native vegetation remnant of one hectare or less, the grassland patch was considered to be NTGVVP only if the grassland patch was at least 0.05 hectares
- Where the grassland patch was contiguous with other native vegetation that did not satisfy key diagnostic characteristics or condition thresholds for NTGVVP, together forming a native vegetation remnant of more than one hectare, the grassland patch was considered to be NTGVVP only if the grassland patch was at least 0.5 hectares.

This literal interpretation results in an anomaly whereby small patches of grassland (at least 0.05 hectares but less than 0.5 hectares) are considered to be NTGVVP when they are part of small native vegetation remnants (one hectare or less) but not when they form part of larger vegetation remnants (greater than one hectare). In effect, small patches of grassland with greater connectivity with surrounding native vegetation are less likely to meet the minimum size thresholds for NTGVVP. DAWE has confirmed that this anomaly is nevertheless the correct interpretation of the listing advice (J. Vranjic, DAWE, pers. comm., 19 March 2020).

Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia

In order to determine if areas of Hills Herb-rich Woodland EVC 71 and Plains Woodland EVC 803 (both the treed and derived grassland condition states) met the key diagnostic characteristics and condition thresholds to qualify as the Grey Box Grassy Woodland TEC, a range of floristic, cover and structural data was collected. A field checklist was devised for determining the presence of this community (end of this section). The criteria to classify an area as the listed TEC include:

1. Dominant tree species (i.e. presence of Grey Box)
2. Patch size
3. Weediness
4. Tree cover
5. Tree stem size and density
6. Species richness/diversity
7. Perennial native species cover.

Criteria 1, 2, 4 and 6 can readily be addressed through simple observations, patch mapping, ground-based or aerial photograph interpretation of canopy cover estimates and floristic surveys of a patch. Criteria 3, 5 and 7 require collection of plant cover and lifeform type information, as well as collection of woodland demographic data.

To ensure a transparent and replicable approach to collecting data on plant cover, lifeforms and woodland demographics, a randomised method was applied to all areas of treed Hills Herb-rich Woodland EVC 71 and Plains Woodland EVC 803; while a holistic checklist approach was used for any derived grassland condition states (similar to the checklist approach for Natural Temperate Grassland). All field data collection was undertaken by Matt Looby, Michael Goddard, Jack Tate, Jane Kenny, Jack Fursdon and Imogen Merlo between 8 January and 10 February 2020.

Method for treed condition state:

Survey design and randomisation

All patches of EVC 71, EVC 803 and immediately surrounding areas (mostly contained within the Airport woodland and adjacent airside derived-native grassland areas) were overlaid with a 100-metre x 100 metre (one hectare) grid surface in a GIS environment. Within each grid square, a central point (centroid) was also allocated in the GIS. From this, 216 grid squares and 216 centroids were established with unique identifiers to assist with randomisation of survey effort. The grid and centroids were then loaded to handheld GPS-capable tablets running the Collector for ArcGIS app with aerial photography and topographic base maps.

Point intercept transects for cover data

For collecting ground-layer plant cover, a lifeform schema was developed for use with a 50-metre point intercept transect method. 'Ground-layer plant cover' was defined as a species observed as less than 1 metre tall. The lifeform schema and coding for point intercept field data collection included:

- N = native grass
- A = annual native forb
- F = perennial native forb
- S = native sub-shrub
- W = annual non-grass weed
- X = perennial non-grass weed
- G = annual grass weed
- P = perennial grass weed
- C = cryptogams
- O = litter/logs
- B = bare soil/rock
- R = rubbish.

A field-data-sheet template is provided at the end of this method statement.

The location of point intercept transects was randomised at two levels to determine where data would be collected:

- The grid centroid to be surveyed was selected using a random number generator application (e.g. grid 1 to 216).
- The degrees bearing for the transect direction was then generated using a random number generator (i.e. zero to 360).

Field method for point intercept transects

The following process was applied in the field for the 50-metre point intercept transects:

Each randomly selected survey point (i.e. grid centroid) was navigated to on foot or vehicle using Collector for ArcGIS.

A random compass bearing was generated and a measuring tape then pegged at the grid centroid and extended from the random bearing for 50 metres.

Meta-data on the survey site was firstly collected, such as:

- Recorders
- Date
- Time
- Grid/centroid ID
- Bearing (degrees)
- Transect (always 50 metres long)
- EVC.

Two operators (one observer and one scribe) then collected ground-layer cover data at one-metre intervals along the tape, starting at the one-metre mark and ending at the 50-metre mark (i.e. 50 cover hits along the transect).

Each hit was assigned to the codified life-form scheme described earlier in the data sheet template at the end of this method statement.

Analysis for point intercept transects

In total, 47 point intercept transects were completed across the two EVCs in treed and derived grassland condition states to objectively determine non-grass weed cover and native grass cover. This equates to 2350 data points across the contiguous patches of EVC 71 and EVC 803.

This data was entered into a spreadsheet and analysed to determine native ground-layer cover totals and native grass proportional cover from:

- Native grass cover
- Perennial native forb cover
- Annual native forb cover
- Native sub-shrub cover
- Introduced ground layer plant cover total and proportional cover from:
  - Annual non-grass weed cover
  - Perennial non-grass weed cover
  - Annual grass weed cover
  - Perennial grass weed cover
- Other ground layer cover totals from:
  - Cryptogam cover
  - Litter/log cover
  - Bare soil/rock cover
  - Rubbish cover
  - Total vascular plant (vegetative) cover.

Raw data results are provided in Appendix B5.D. All samples were analysed to determine proportional cover of non-grass weeds. The samples with native grass cover present were analysed to determine proportional cover of perennial native grasses (as per TSSC 2010).

Woodland tree demographic data collection

Tree-size density data (Diameter at Breast Height, DBH) and the presence of hollows are important criteria for determining the presence of the TEC. Tree demographic data was collected in a randomised subset set of the one-hectare grid squares described above.

The large-tree DBH size threshold used in the EPBC TEC listing advice is greater than 60 centimetres DBH; the large-tree size threshold is greater than or equal to 70 centimetres DBH in the bioregional benchmarks for EVC 71 and EVC 803.

On this basis, all trees greater than 60 centimetres DBH (i.e. above 60.1 centimetres DBH) were measured in the randomly selected grid squares, and ground observations were used to determine whether a tree was hollow-bearing or not. Other tree variables such as health and stem morphology were also collected. The DBH data and additional variables were also used to determine large-tree density and health scores for VQA habitat hectares in EVC 71 and EVC 803.

Field method for woodland trees

The following process was applied in the field for tree data collection:

- Each randomly selected grid square was navigated to either on foot or vehicle using Collector for ArcGIS
- Every tree in the one-hectare grid square greater than 60 centimetres DBH was mapped as a point using a data-collection layer in Collector for ArcGIS. Tree variables measured included:
  - Species name
  - DBH in cm
  - Hollows present (Yes/No)
  - Multi-stemmed below DBH (Yes/No)
  - Canopy health (<30%, 30-70%, >70%)
  - Coordinates.
- Two operators (one measuring DBH and looking for hollows by eye or with binoculars, the other entering data) used the boundaries of the one-hectare grid square on the tablet to collected all tree data
- For derived grassland areas and fragmented woodland areas in the airside zone, all individual trees were mapped.

Analysis for woodland trees

In total, 31 grid squares were surveyed (31 hectares) to determine the mean tree and hollow density values per hectare. This data was entered into a spreadsheet and analysed to determine density values. A total of 457 trees with a DBH greater than 60 centimetres were mapped in the 31 grid plots, and used for analysis of mean large tree and hollow density per hectare.

Individuals trees mapped in derived grassland areas, and fragmented woodland areas in the airside zone, were excluded from the analysis of summary statistics. This data was used separately to test whether airside areas met the TEC condition thresholds.

Tree data results summaries are provided in Appendix B5.D.

Method for derived grassland condition state

The method for assessing the derived grassland condition state of Grey Box Woodland was the same as used for assess Natural Temperate Grassland. However, a separate field checklist was devised, based on the diagnostic characteristics and condition thresholds outlined in the Grey Box Woodland listing advice (TSSC, 2010, at the end of this section).

Cover estimates were made with reference to predefined cover charts. Where cover estimates were close to a condition threshold, gridded 1x1 metre quadrats were used to objectively sample plant covers within the grassland patch and to confirm the veracity of cover estimates.

Quality assessments

The quality of native vegetation corresponding to a TEC was assessed using the habitat hectare (vegetation quality assessment) methodology (DSE, 2004).

DAWE has endorsed the habitat hectare methodology as an appropriate means of assessing the condition of threatened ecological communities such as Natural Temperate Grassland and Grey Box Woodland in Victoria. The habitat hectare score comprised the following:

- A condition score (out of 75) incorporating values for understorey, lack of weeds, recruitment, organic litter and, where relevant, large trees, canopy cover and logs. The following qualifications should be noted:
  - Condition scores were determined with reference to relevant EVC benchmarks maintained by DELWP
  - Where components of the score were not relevant (e.g. values for large trees, canopy cover and logs are not part of the benchmark for Heavier-soils Plains Grassland) the condition score was standardised to provide a score out of 75
  - The condition score considered only the condition of native vegetation corresponding to the threatened ecological community. The condition of any contiguous vegetation of the same EVC was not considered. For example, where a patch of Natural Temperate Grassland TEC formed part of a broader patch of Heavier-soils Plains Grassland EVC, the condition score only considered what was present within the smaller Natural Temperate Grassland patch
  - In accordance with the habitat hectare methodology, vegetative life forms in the understorey were 'assessed according to their current appearance and height, not according to their predicted mature expression' (DSE, 2004 p.18) with reference to the life-form category definitions provided in Appendix 6 of the Vegetation Quality Assessment Manual (DSE, 2004 p.58). As a result, if a grass species (e.g. Spear Grass Austrostipa spp.) that would normally have an inflorescence more than one metre in height had been slashed to a height of 20 centimetres, it was recorded as a medium tufted graminoid rather than a large tufted graminoid. Similarly, if both woody and non-woody individuals of a species (e.g. Berry Saltbush *Atriplex semibaccata* or Ruby Saltbush *Enchylaena tomentosa* var. *tomentosa*) were observed, they were recorded in both shrub (woody) and herb (non-woody) life -orm categories.
- A landscape score (out of 25), incorporating values for patch size, percentage of native vegetation in the surrounding area (neighbourhood) and distance to core area. The following qualifications should be noted:
  - Patch size was taken to be the size of the entire contiguous patch of native vegetation (as defined in the table above) rather than the size of the threatened ecological community that may have been a subset of the broader patch of native vegetation. For example, where a patch of Natural Temperate Grassland TEC was part of a larger patch of contiguous Heavier-soils Plains Grassland EVC patch, patch size was taken to be the size of the broader Heavier-soils Plains Grassland patch. This means that threatened ecological communities, buffered by areas of native vegetation that did not meet the criteria of the threatened ecological community, nevertheless received slightly higher patch-size values than threatened ecological communities with no native vegetation buffers
  - Percentage of native vegetation in the neighbourhood was determined with reference to contemporary native vegetation mapping that had been completed in the surrounding area as part of the same project and, where areas of the neighbourhood had not been assessed, DELWP's 2005 EVC modelling via NatureKit.

Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) Field Checklist

	Habitat zone:	Date:	Recorder: MG / SMB / JDT / JK		
1.	Time since mowing/grazing/burning:	Days	Weeks	Months	
2.	Do native flora make up ≥50% of total vegetation cover, ex. introduced annuals? % cover of all native flora (incl. native annuals): % cover perennial weeds:				Y / N
3.1	Do *Themeda*, *Rytidosperma*, *Austrostipa* and/or *Poa* (circle genera that are present) make up ≥50% native cover AND ≥50% of total perennial tussock cover? % cover of *Themeda/Rytidosperma/Austrostipa/Poa*: % cover of all perennial tussocks (native and introduced):				Y / N
3.2	If total perennial tussock cover represented by *Themeda*, *Rytidosperma*, *Austrostipa* and/or *Poa* is <50%, then is ground cover of native forbs (wildflowers) ≥50% of total vegetation cover during spring-summer (September to February)? % cover of all vegetation (native and introduced, ex. moss, lichen and introduced annuals): % cover of native forbs:				Y / N
3.3	Do *Themeda*, *Rytidosperma*, *Austrostipa* and/or *Poa* (circle genera that are present) make up ≥50% native cover AND is cover of perennial non-grass weeds <30% of total vegetation cover at any time of the year? % cover of all vegetation (native and introduced, ex. moss, lichen and introduced annuals): % cover of perennial non-grass weeds:				Y / N
4.1	For native vegetation remnant of ≤1ha: is contiguous grassland patch ≥0.05ha AND do shrubs/trees >1m tall have % crown cover of ≤5%? Area (ha) of contiguous grassland patch: % crown cover of shrubs and trees >1m tall:				Y / N
4.2	For native vegetation remnant of >1ha: is contiguous grassland patch ≥0.5ha AND are there <2 mature (*not defined) trees/ha? Area (ha) of contiguous grassland patch: # mature trees within patch:				Y / N
5.	Is NTGVVP present (i.e. responded Y to 2, 3 and 4)? If Y, proceed to VQA.				Y / N

The following field checklists were used to assess the presence/absence of Natural Temperate Grassland and the derived grassland condition state of Grey Box Woodland.

Grey Box Grassy Woodland (GBW) and Derived Grasslands (DG) of South-Eastern Australia

	Habitat zone: Date: Recorder: MG / SMB		
	Time since mowing/grazing/burning: Days Weeks Months		
1b.	Is Grey Box the (co-)dominant tree species in the canopy layer or is no canopy present?	Y / N
1c.	Do non-grass perennial weeds make up <30% of total perennial GL vegetation cover? Ground Layer (GL) is undefined but assumed to include all vascular plants <1m high. % cover of all perennial GL vegetation: % cover of perennial non-grass weeds in GL: % cover of perennial grass weeds in GL:	Y / N
1a.	Is the GBW or DG patch ≥0.5ha? Area (ha) of GBW or DG patch (may include small disturbances e.g. tracks):	Y / N
	If canopy is well developed (≥10% crown cover) and patch <2ha, proceed to 2. If canopy is well developed (≥10% crown cover) and patch ≥2ha, proceed to 3 and 4. If canopy is absent or less developed (<10% crown cover), proceed to 5.	
2a.	Do perennial native species make up ≥50% of total perennial GL vegetation cover? % cover of all perennial GL vegetation: % cover of all perennial native species in GL:	Y / N
2b.	Are there ≥8 perennial native species in the mid and ground layers? Mid Layer (ML) and GL include all vascular plants <4m high. Number of perennial native species in ML and GL:	Y / N
3a.	Are there ≥8 trees/ha that are hollow-bearing or have DBH ≥60cm? Number of trees that are hollow-bearing or have DBH ≥60cm:	Y / N
3b.	Do perennial native grasses make up ≥10% of the vegetative cover in the GL? % cover of all perennial GL vegetation: % cover of perennial native grasses in GL:	Y / N
4a.	Are there ≥20 trees/ha that have DBH ≥12cm? Number of trees that have DBH ≥12cm:	Y / N
4b.	Do perennial native species make up ≥50% of total perennial GL vegetation cover? % cover of all perennial GL vegetation: % cover of all perennial native species in GL:	Y / N
5a.	Does woodland density not meet criteria 3a or 4a OR is DG present (<10% crown cover) with evidence (presence of species from canopy/ML, tree stumps, logs, nearby GBW and/or historical records) that it was once woodland (co-)dominated by Grey Box?	Y / N
5b.	Do perennial native species make up ≥50% of total perennial GL vegetation cover? % cover of all perennial GL vegetation: % cover of all perennial native species in GL:	Y / N
5c.	Are there ≥12 perennial native species in the GL? Number of perennial native species in GL:	Y / N
6a.	Is GBW present (i.e. responded Y to all of 1 and all of 2, 3 or 4)? If Y, proceed to VQA.	Y / N
6b.	Is DG present (i.e. responded Y to all of 1 and all 5)? If Y, proceed to VQA.	Y / N

Point intercept transect method for ground layer

N = native grass, A = annual native forb, F = perennial native forb, S = native sub-shrub, W = annual non-grass weed, X = perennial non-grass weed, G = annual grass weed, P = perennial grass weed, C = cryptogams, O = litter/logs, B = bare soil/rock, R = rubbish

Recorders:	Date:	Time:	Site:
1 ha plot ID			
Bearing (degrees)			
Transect (m)			
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2			
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4			
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Detailed targeted fauna survey methods

Golden Sun Moth

Previous surveys

A desktop review was undertaken of all previous Golden Sun Moth survey reports at the Melbourne Airport. These reports included:

- GAGIN, 2008. Habitat Assessment and Presence of Synemon plana (Golden Sun Moth), Melbourne Airport, Tullamarine. Report prepared for Australia Pacific Airports Melbourne
- GAGIN, 2009. Second Report Presence of the Golden Sun Moth Synemon plana Melbourne Airport 2008. Report prepared for Australia Pacific Airports Melbourne
- GAGIN, 2010. Survey for the Presence of Golden Sun Moth Synemon plana Melbourne Airport, Tullamarine 2009. Report prepared for Australia Pacific Airports Melbourne
- Biosis, 2015. Flora and fauna assessment of the Runway Development Program, Melbourne Airport: Existing conditions and impact assessment report. Authors: Kay K, Smales I & Byrne A, Biosis Pty Ltd, Melbourne
- Biosis, 2019. Melbourne Airport Golden Sun Moth habitat survey. Letter report to Australia Pacific Airports Melbourne. Author: Campbell, K, Biosis Pty Ltd, Melbourne.

This data was utilised to compile Figure B5.10, which outlines the previous surveys for the species. This information was then used to determine whether adequate survey effort existed for the species; and, if not, what the level of additional survey was to be.

It was determined there were no surveys undertaken within the Melbourne Airport's Third Runway project area in the last three years. Therefore an updated assessment for the entire project area was to occur.

Habitat assessment

Before the Golden Sun Moth's flight season between October and November, the entire project area was traversed by one zoologist experienced in Golden Sun Moth habitat surveys to determine the project area's habitat values.

The project area was subsequently classified as:

- Not habitat
  - Pasture-improved paddocks
  - Paddocks with no food plants
  - Degraded areas covered in fill with no food plants
  - Areas of infrastructure, roads, stockpiles etc.
- Potential habitat
  - Any areas where there was cover of known food plants.

All areas of potential habitat located within and immediately adjacent to the project area were subject to targeted surveys.

The areas of potential habitat were divided into five survey areas. Each was assessed four times during the targeted surveys. Targeted survey areas for Golden Sun Moth are shown in Figure B5.10.

A summary of the survey areas and habitat descriptions are provided in Table B5.A.2 below.

Table B5.A.2
M3R Golden Sun Moth survey sites and details

GSM survey site	Site size (ha)	Transect type	Number of surveyors	Distance between transects	GSM survey site
GSM survey site Northern area	62.88	Walk	3	Approx. 100 meters	North of the woodland open Grey Box Woodland with mixed understory of Chilean Needle Grass Nassella neesiana, Blanket Weed Galenia pubescens, Serrated Tussock Nassella trichotoma, scattered wallaby grass Rytidosperma sp. and Spear Grass Austrostipa sp. there are also some larger expanses of open Chilean Needle Grass patches throughout. Area up the hill from Deep Creep tributary. Characterised by Serrated Tussock and Chilean Needle Grass. Thistles and Blanket weed. Sub-optimal habitat but scattered Wallaby Grass present.Sunbury Road Paddock. A mix of Phalaris Phalaris aquatica, brassicas and scattered occurrence of Chilean Needle Grass and Wallaby Grass. HIAL disturbed ground story.
GSM survey site McNabs Road West	178.81	All areas of native grassland walked. In some degraded areas transects were driven	2	Approx. 100 meters	Broad area that includes habitat ranging from high cover of wallaby grass and optimal habitat to degraded areas with scattered occurrence of wallaby grass and paddocks dominated by Chilean Needle Grass, Rye Lolium Sp., Oat Avena sp., Phalaris and grazed by cattle in areas.
GSM survey site Arundel Creek	71.32	Walked/ driven were possible	2	Approx. 100 meters	Predominantly Phalaris, Oat, Blanket Weed, one square patch of Chilean Needle Grass. Includes some areas dominated by Wallaby Grass.
GSM survey site Southern area	50.66	Walk	2	Approx. 100 Meters	Areas of native grassland dominated by Wallaby Grass and other areas dominated by Phalaris with scattered occurrences of Chilean Needle Grass, Brassica Sp., Oat and Wallaby Grass.
GSM survey site Airside	172	Walk	2	Approx. 100 meters	Dominated by Wallaby Grass and Spear Grass throughout with scattered areas of Chilean Needle Grass and Serrated Tussock.

Targeted surveys

Targeted surveys were conducted on 8, 17, 23, 24 and 29 December 2019. All the surveys were conducted on days of appropriate weather conditions as set out in the survey guidelines within the *Significant impact guidelines for the critically endangered golden sun moth* (*Synemon plana*) (DEWHA, 2009a). The weather conditions and results of the targeted surveys are in Appendix B5.C.

Adults of the species, especially males, can be observed during their diurnal flights. However, their flights are generally restricted to sunny days with little wind and when temperatures are above 20°C by 10 am. The capacity to detect the species is therefore limited to active searching when conditions are precisely appropriate.

To detect any Golden Sun Moths within the site, two or three ecologists experienced in Golden Sun Moth identification walked transects approximately 100 metres apart. Where possible, transects were driven across the survey sites.

Growling Grass Frog

Previous surveys

Targeted surveys for Growling Grass Frog were previously undertaken in Deep Creek, Moonee Ponds Creek, Arundel Creek and surrounding waterbodies located on Melbourne Airport land in 2019 (Biosis, 2019b). The current habitat values and distribution for the species are well known for Melbourne Airport.

Since the previous surveys undertaken in 2019, new land was acquired at 270 and 300 Arundel Road. This land had not been subject to previous surveys, and was surveyed in February 2020 to determine habitat values for Growling Grass Frog and presence/absence of the species.

Habitat assessment

Suitable habitat was identified during diurnal site investigations of Arundel Creek, Moonee Ponds Creek, Deep Creek and surrounding farm dams and drainage lines within Melbourne Airport in January 2019; and the section of Arundel Creel located at 270 and 300 Arundel Road in January 2020.

Particular attention was given to identifying sections of waterways considered to be high-value breeding habitat for Growling Grass Frogs. (Breeding habitat was defined as permanent, still or slow-moving waterbodies with floating and emergent aquatic vegetation and lined with basaltic rock.) Nocturnal targeted surveys for Growling Grass Frog were focused on these potential breeding habitats.

Access to the Maribyrnong River beyond the confluence of Jackson's Creek was not possible, the area being inaccessible due to heavy thistle infestations at the time with no visible access tracks to the area. A visual habitat assessment from the escarpment above the Maribyrnong River was made for this location.

It is important to have an understanding of Growling Grass Frog habitat and presence across all waterbodies at Melbourne Airport, not just in the sections of the waterways located within the impact area. Therefore the results for surveys across all waterbodies are included within this report.

Further information defining habitat classifications is set out in Table B5.A.3. Growling Grass Frog habitat at Melbourne Airport can be viewed in Figure B5.18.

Targeted surveys

Targeted surveys for adult Growling Grass Frogs were conducted over four nights: 22, 23, 24 and 31 January 2019; and the section of Arundel Creek located at 270 and 300 Arundel Road on the 30 January and 10 February 2020.

Two zoologists surveyed suitable waterbodies and streams within Melbourne Airport for the species by listening for the characteristic calls of adult males and using call playback (broadcasting recorded calls) to elicit response calls. Call playback points were established in sections of waterways considered to be breeding or aquatic habitat.

Spotlighting was undertaken to actively search for individuals of the species. Opportunistic listening for calls was undertaken during all visits to the project area. Waterbodies where Growling Grass Frog were not detected during the first survey were visited again for a second survey one week later; waterbodies where Growling Grass Frog were detected during the first survey were visited once.

Targeted surveys for Growling Grass Frogs followed the Growling Grass Frog survey protocol within the Survey guidelines for Australia's threatened frogs: Guidelines for detecting frogs listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (DEWHA, 2010).

Table B5.A.3
M3R Growling Grass Frog habitat classification

Growling Grass Frog habitat classification	Habitat value	Description of classification and rationale
Breeding	High	• Areas of habitat suitable for Growling Grass Frog to breed in. • Permanent, still or slow-moving waterbodies with floating and emergent aquatic vegetation and lined with basaltic rock.
Aquatic	High	• Areas of predominantly aquatic habitat that have been assessed by zoologists during targeted survey for the species. • Aquatic vegetation is diverse and of moderate to high abundance; hydroperiod likely to be constant; still or slow-moving water with low turbidity. • Growling Grass Frog records from the particular waterbody or those immediately adjacent.
Terrestrial	High	• Terrestrial habitat generally includes a 100-metre buffer around waterways known to support Growling Grass Frogs which is utilised for foraging/ movement during the active season. The 100-metre buffer has been further refined and reduced or expanded in areas of suitable adjacent habitat. For example, where a steep escarpment abuts a waterway, the top of an escarpment is not terrestrial habitat and the buffer from the waterway has been reduced following landforms and contours. In areas of low-lying flood plains, the 100-metre buffer has been expanded to incorporate the low-lying floodplain.
Potential dispersal and ephemeral aquatic habitat	Low	• Small waterways or tributaries that are unlikely to provide suitable long-term habitat for Growling Grass Frog but where an impact on these waterways is required to be assessed for its potential to have indirect impacts on breeding, aquatic or terrestrial habitat (above). • These waterways have little or no aquatic vegetation present, the period in which the waterbody contains water is intermittent; likely to be dry for extended periods and/or water level is generally low or absent. • Sections of waterbodies that were not suitable aquatic habitat for Growling Grass Frog during the FY19 targeted survey, however during periods of appropriate rainfall have the potential to become aquatic/ breeding habitat. During other times these waterways are predominately used as movement corridors. • The majority of this habitat type at Melbourne Airport does not provide connectivity to other waterbodies.

For each night of survey, weather data was recorded at the beginning, middle and end of the survey period (only the start and end temperatures were recorded for 2020) (Table B5.A.4).

Striped Legless Lizard

Previous surveys

Suitable potential habitat for Striped Legless Lizard is present within the project area. Potential habitat areas are tussock-forming grasslands, especially where growing on cracking soils.

Previous surveys for Striped Legless Lizard at Melbourne Airport failed to detect the species. A review of recent database records revealed a record on the Atlas of Living Australia from 2011 (ALA, 2020) approximately four kilometres south of the southern point of the project area. There is an additional record from 2017 within 10 kilometres of the project area in the Victorian Biodiversity Atlas database (Appendix B5.C).

A desktop assessment was undertaken of all previous reports where Striped Legless Lizard surveys had been undertaken at Melbourne Airport. These reports included:

- Biosis, 2014. Melbourne Airport Business Park: Striped Legless Lizard survey 2013. Draft report for Australia Pacific Airports (Melbourne). Author: I. Smales, Biosis Pty Ltd, Melbourne.
- Biosis, 2015. Flora and fauna assessment of the Runway Development Program, Melbourne Airport: Existing conditions and impact assessment report. Authors: Kay K, Smales I & Byrne A, Biosis Pty Ltd, Melbourne.

This data was utilised to compile Figure B5.9 which outlines previous survey effort for the species at Melbourne Airport. This information was then used to determine whether adequate survey effort existed for the species; and if not, what the level of additional survey should be. It was recommended that, due to the presence of suitable habitat that had not been subject to previous targeted surveys, additional surveys for Striped Legless Lizard were warranted.

Targeted survey

The artificial shelter (tile surveys) technique was used for targeted surveys because it is widely recognized as the most effective technique to survey for the species.

Twenty survey grids – each grid comprising 50 tiles set out at five-metre spacing between tiles, arranged in a grid of 10 x 5 tiles, giving a total of 1000 tiles – were placed in areas of suitable habitat within the project area. Landside on 12-13/8/2019 and airside on 19/8/2019, targeting areas of suitable habitat not subject to previous surveys. The tile grid locations can be seen in Figure B5.15.

All tiles were checked once a week by two zoologists from the 18/9/2019 until the end of December 2019; a total of 15 checks were undertaken for each tile grid during the targeted survey. A final check was conducted in conjunction with the decommissioning of the survey grids. All species detected during the surveys were recorded, along with weather details at the time of survey (Appendix B5.C).

Table B5.A.4
Weather information recorded during Growling Grass Frog surveys over four nights.

Survey date		Temperature (°C)	Cloud cover (%)	Wind speed (avg km/h)	Humidity (%)
22/1/2019	start	22.7	0	8	66
	mid	21	0	0	70
	end	20	0	3	70
23/1/2019	start	20.5	5	6.4	64
	mid	22	0	0	70
	end	18	0	0	74
24/1/2019	start	32	0	0	33
	mid	33	0	0	34
	end	31	0	0	30
31/1/2019	start	16.4	20	9	50.8
	mid	16.4	20	5	50
	end	16.4	25	1	51
30/1/2020	start	28	0	11	26
	end	18	0	6	31
10/2/2020	start	20.1	80%	22	88
	end	19	100%	12	89

APPENDIX B5.B
FLORA AND ECOLOGICAL COMMUNITIES

Summary

- Flora species recorded from the project area
- Significant flora with potential to occur in the project area
- Significant ecological communities with potential to occur in the project area

Flora species recorded from the project area

Notes to tables:

EPBC Act:	DEPI 2014a:
CR - Critically Endangered EN - Endangered VU - Vulnerable PMST – Protected Matters Search Tool	e - endangered v - vulnerable r - rare k - poorly known
FFG Act:	**Noxious weed status:**
L - listed as threatened under FFG Act P - protected under the FFG Act (public land only)	SP - State prohibited species RP - Regionally prohibited species RC - Regionally controlled species R - Restricted species # - Native species outside natural range

The following flora species were recorded within the project area during native vegetation surveys.

Table B5.B.1
Flora species recorded from the project area

Status	Scientific Name	Common Name
Indigenous species		
P	*Acacia acinacea* s.s.	Gold-dust Wattle
	Acacia implexa	Lightwood
P	*Acacia mearnsii*	Black Wattle
	Acacia melanoxylon	Blackwood
	Acacia paradoxa	Hedge Wattle
P	*Acacia pycnantha*	Golden Wattle
	Acaena agnipila	Hairy Sheep's Burr
	Acaena echinata	Sheep's Burr
	Aizoaceae spp.	Ice Plant
	Allocasuarina verticillata	Drooping She-oak
	Anthosachne scabra s.s.	Common Wheat-grass
	Arthropodium minus	Small Vanilla-lily
P	*Asperula conferta*	Common Woodruff
	Atriplex semibaccata	Berry Saltbush
	Austrostipa bigeniculata	Kneed Spear-grass
	Austrostipa curticoma	Short-crown Spear-grass
	Austrostipa densiflora	Dense Spear-grass
	Austrostipa elegantissima	Feather Spear-grass
	Austrostipa gibbosa	Spurred Spear-grass
	Austrostipa mollis	Supple Spear-grass
	Austrostipa oligostachya	Fine-head Spear-grass
	Austrostipa scabra subsp. *falcata*	Rough Spear-grass
	Austrostipa spp.	Spear Grass
	Barbula crinita	Dusky Beard-moss
	Bothriochloa macra	Red-leg Grass
	Bromus spp.	Brome
	Bursaria spinosa subsp. *spinosa*	Sweet Bursaria
	Callistemon sieberi	River Bottlebrush
P	*Calocephalus citreus*	Lemon Beauty-heads
	Carex breviculmis	Common Grass-sedge
	Carex inversa	Knob Sedge
P	*Cassinia longifolia*	Shiny Cassinia
P	*Cheilanthes austrotenuifolia*	Green Rock-fern
	Chloris truncata	Windmill Grass
	Clematis microphylla s.s.	Small-leaved Clematis
	Convolvulus angustissimus subsp. *angustissimus*	Blushing Bindweed
	Convolvulus spp.	Bindweed
	Crassula decumbens var. *decumbens*	Spreading Crassula
	Crassula sieberiana s.l.	Sieber Crassula
	Cynoglossum suaveolens	Sweet Hound's-tongue
	Cyperus spp.	Flat Sedge
	Daucus glochidiatus	Australian Carrot
	Dianella revoluta s.l.	Black-anther Flax-lily
	Dichondra repens	Kidney-weed
	Dichanthium sericeum	Silky Blue-grass
	Einadia nutans	Nodding Saltbush
	Eleocharis acuta	Common Spike-sedge
	Enchylaena tomentosa var. *tomentosa*	Ruby Saltbush
	Enneapogon nigricans	Dark Bottle-washers
	Enteropogon acicularis	Spider Grass
	Epilobium billardiereanum subsp. *intermedium*	Variable Willow-herb
	Epilobium hirtigerum	Hairy Willow-herb
	Epilobium pallidiflorum	Showy Willow-herb
	Epilobium spp.	Willow Herb
P	*Eremophila deserti*	Turkey Bush
	Eryngium ovinum	Blue Devil
I	*Eucalyptus camaldulensis*	River Red-gum
	Eucalyptus camaldulensis var. *camaldulensis*	River Red-gum
	Eucalyptus melliodora	Yellow Box
	Eucalyptus microcarpa	Grey Box
	Eutaxia microphylla var. *microphylla*	Common Eutaxia
	Geranium spp.	Crane's Bill
P	*Gnaphalium* spp.	Cudweed
	Gonocarpus tetragynus	Common Raspwort
	Goodenia ovata	Hop Goodenia
	Haloragis heterophylla	Varied Raspwort
	Hypnum cupressiforme var. *cupressiforme*	Common Plait-moss
	Isolepis cernua	Nodding Club-sedge
	Isolepis inundata	Swamp Club-sedge
	Isolepis spp.	Club Sedge
	Juncus bufonius	Toad Rush
	Juncus flavidus	Gold Rush
	Juncus pauciflorus	Loose-flower Rush
	Juncus spp.	Rush
	Juncus subsecundus	Finger Rush
	Lachnagrostis aemula s.l.	Leafy Blown-grass
	Lachnagrostis filiformis s.s.	Common Blown-grass
P	*Laphangium luteoalbum*	Jersey Cudweed
	Lemna spp.	Duckweed
	Leptodontium paradoxum	Tall Beard-moss
	Linum spp.	Flax
	Lobelia anceps	Angled Lobelia
	Lomandra filiformis subsp. *coriacea*	Wattle Mat-rush
	Lomandra longifolia	Spiny-headed Mat-rush
	Lythrum hyssopifolia	Small Loosestrife
	Maireana decalvans s.s.	Black Cotton-bush
	Maireana spp.	Bluebush
	Melicytus dentatus s.l.	Tree Violet
	Microlaena stipoides var. *stipoides*	Weeping Grass
P	*Microseris walteri*	Yam Daisy
P	*Microtis* spp.	Onion Orchid
	Myriophyllum spp.	Water Milfoil
	Ottelia ovalifolia subsp. *ovalifolia*	Swamp Lily
	Oxalis perennans	Grassland Wood-sorrel
	Oxalis spp.	Wood Sorrel
P	*Ozothamnus obcordatus*	Grey Everlasting
	Panicum effusum	Hairy Panic
	Persicaria hydropiper	Water Pepper
	Phragmites australis	Common Reed
	Pimelea linifolia	Slender Rice-flower
	Pimelea spp.	Rice Flower
	Poa labillardierei	Common Tussock-grass
	Portulaca oleracea	Common Purslane
	Rumex brownii	Slender Dock
	Rumex spp.	Dock
	Rytidosperma auriculatum	Lobed Wallaby-grass
	Rytidosperma bipartitum s.s.	Leafy Wallaby-grass
	Rytidosperma caespitosum	Common Wallaby-grass
	Rytidosperma duttonianum	Brown-back Wallaby-grass
	Rytidosperma erianthum	Hill Wallaby-grass
	Rytidosperma fulvum	Copper-awned Wallaby-grass
	Rytidosperma racemosum var. *racemosum*	Slender Wallaby-grass
	Rytidosperma setaceum	Bristly Wallaby-grass
	Rytidosperma spp.	Wallaby Grass
	Rytidosperma tenuius	Purplish Wallaby-grass
	Salsola tragus	Prickly Saltwort

Status (cont.)	Scientific Name (cont.)	Common Name (cont.)
Indigenous species (cont.)		
	Schoenoplectus tabernaemontani	River Club-sedge
	Schoenus apogon	Common Bog-sedge
	Sclerolaena muricata var. *villosa*	Grey Roly-poly
	Sclerolaena spp.	Copperburr
P	*Senecio quadridentatus*	Cotton Fireweed
	Senna artemisioides s.l.	Desert Cassia
	Spergularia spp.	Sand Spurrey
	Themeda triandra	Kangaroo Grass
	Tortula antarctica	Bristly Screw-moss
	Tortula muralis	Common Wall-moss
	Tricoryne elatior	Yellow Rush-lily
	Triglochin striata	Streaked Arrowgrass
	Triquetrella papillata	Common Twine-moss
	Typha domingensis	Narrow-leaf Cumbungi
	Typha spp.	Bulrush
	Verbena spp.	Verbena
P	*Vittadinia cuneata*	Fuzzy New Holland Daisy
P	*Vittadinia muelleri*	Narrow-leaf New Holland Daisy
	Wahlenbergia communis s.s.	Tufted Bluebell
	Walwhalleya proluta	Rigid Panic
Introduced species		
	Acacia baileyana	Cootamundra Wattle
	Agave spp.	Agave
	Aira elegantissima	Delicate Hair-grass
	Aira spp.	Hair Grass
	Aloe spp.	Aloe
	Anthoxanthum odoratum	Sweet Vernal-grass
	Arctotheca calendula	Cape weed
R	*Asparagus asparagoides*	Bridal Creeper
	Asparagus officinalis	Asparagus
	Asphodelus fistulosus	Onion Weed
	Austrostipa verticillata	Bamboo Spear-grass
	Avena barbata	Bearded Oat
	Avena fatua	Wild Oat
	Avena sativa	Oat
	Avena spp.	Oat
	Bartsia trixago	Bellardia
	Berkheya rigida	African Thistle
	Brassica fruticulosa	Twiggy Turnip

Status (cont.)	Scientific Name (cont.)	Common Name (cont.)
Indigenous species (cont.)		
	Brassica spp.	Turnip
	Briza maxima	Large Quaking-grass
	Briza minor	Lesser Quaking-grass
	Bromus alopecuros	Mediterranean Brome
	Bromus catharticus	Prairie Grass
	Bromus diandrus	Great Brome
	Bromus hordeaceus	Soft Brome
	Bromus rubens	Red Brome
RC	*Carthamus lanatus*	Saffron Thistle
	Cassinia sifton	Drooping Cassinia
	Catapodium rigidum	Fern Grass
	Cenchrus clandestinus	Kikuyu
	Cenchrus spp.	Burr Grass
	Centaurium erythraea	Common Centaury
	Centaurium spp.	Centaury
	Centaurium tenuiflorum	Slender Centaury
	Cerastium glomeratum s.l.	Common Mouse-ear Chickweed
	Chenopodium album	Fat Hen
	Chloris gayana	Rhodes Grass
RC	*Chrysanthemoides monilifera*	Boneseed
RC	*Cirsium vulgare*	Spear Thistle
RC	*Convolvulus arvensis*	Common Bindweed
	Cortaderia spp.	Pampas Grass
	Corymbia citriodora subsp. *citriodora*	Lemon-scented Gum
	Cotula coronopifolia	Water Buttons
	Cucumis myriocarpus subsp. *myriocarpus*	Paddy Melon
	Cupressus spp.	Cypress
RC	*Cynara cardunculus* subsp. *flavescens*	Artichoke Thistle
	Cynodon dactylon var. *dactylon*	Couch
	Cyperus eragrostis	Drain Flat-sedge
	Dactylis glomerata	Cocksfoot
	Daucus carota	Carrot
	Delairea odorata	Cape Ivy
RC	*Dittrichia graveolens*	Stinkwort
	Ecballium elaterium	Squirting Cucumber
RC	*Echium plantagineum*	Paterson's Curse
	Ehrharta erecta	Panic Veldt-grass
	Ehrharta longiflora	Annual Veldt-grass

Status (cont.)	Scientific Name (cont.)	Common Name (cont.)
Indigenous species (cont.)		
	Eleusine spp.	Crows-foot Grass
	Eleusine tristachya	American Crows-foot Grass
RC	*Eragrostis curvula*	African Love-grass
	Erigeron bonariensis	Flaxleaf Fleabane
	Erigeron canadensis s.l.	Canadian Fleabane
	Erigeron spp.	Fleabane
	Eruca vesicaria subsp. *sativa*	Purple-vein Rocket
	Eucalyptus cladocalyx	Sugar Gum
	Festuca arundinacea	Tall Fescue
R	*Foeniculum vulgare*	Fennel
	Galenia pubescens var. *pubescens*	Galenia
	Gaudinia fragilis	Fragile Oat
	Gazania spp.	Gazania
RC	*Genista monspessulana*	Montpellier Broom
	Geranium dissectum	Cut-leaf Crane's-bill
	Helminthotheca echioides	Ox-tongue
	Hirschfeldia incana	Buchan Weed
	Holcus lanatus	Yorkshire Fog
	Hordeum leporinum	Barley-grass
	Hordeum marinum	
	Hordeum murinum s.l.	Barley-grass
	Hordeum spp.	Barley Grass
RC	*Hypericum perforatum* subsp. *veronense*	St John's Wort
	Hypochaeris radicata	Flatweed
RC	*Juncus acutus* subsp. *acutus*	Spiny Rush
	Juncus articulatus subsp. *articulatus*	Jointed Rush
	Juncus effusus subsp. *effusus*	Soft Rush
	Juncus ensifolius	Sword Rush
	Lactuca serriola	Prickly Lettuce
	Leontodon saxatilis subsp. *saxatilis*	Hairy Hawkbit
	Lepidium africanum	Common Peppercress
	Lepidium heterophyllum	Perennial Fieldcress
	Linum trigynum	French Flax
	Lolium perenne	Perennial Rye-grass
	Lolium rigidum	Wimmera Rye-grass
	Lophopyrum ponticum	Tall Wheat-grass
RC	*Lycium ferocissimum*	African Box-thorn

Status (cont.)	Scientific Name (cont.)	Common Name (cont.)
Indigenous species (cont.)		
	Lysimachia arvensis	Pimpernel
RC	*Marrubium vulgare*	Horehound
	Medicago polymorpha	Burr Medic
	Medicago spp.	Medic
	Melilotus indicus	Sweet Melilot
	Melilotus spp.	Melilot
	Modiola caroliniana	Red-flower Mallow
	Nassella hyalina	Cane Needle-grass
	Nassella leucotricha	Texas Needle-grass
R	*Nassella neesiana*	Chilean Needle-grass
RC	*Nassella trichotoma*	Serrated Tussock
	Olea europaea	Olive
R	*Opuntia* spp.	Prickly Pear
RC	*Opuntia stricta*	Common Prickly-pear
R	*Oxalis pes-caprae*	Soursob
	Oxalis spp. (naturalised)	Wood Sorrel
	Parapholis strigosa	Slender Barb-grass
	Parentucellia latifolia	Red Bartsia
	Paspalum dilatatum	Paspalum
	Paspalum distichum	Water Couch
	Petrorhagia dubia	Velvety Pink
	Phalaris aquatica	Toowoomba Canary-grass
	Phalaris spp.	Canary Grass
RC	*Physalis hederifolia*	Sticky Ground-cherry
	Plantago coronopus	Buck's-horn Plantain
	Plantago lanceolata	Ribwort
	Poa annua s.s.	Annual Meadow-grass
	Polycarpon tetraphyllum	Four-leaved Allseed
	Polygonum aviculare s.s.	Hogweed
	Polypogon monspeliensis	Annual Beard-grass
	Raphanus raphanistrum	Wild Radish
	Roepera sessilifolia	Cape Twin-leaf
	Romulea rosea	Onion Grass
RC	*Rosa rubiginosa*	Sweet Briar
RC	*Rubus anglocandicans*	Common Blackberry
	Rumex conglomeratus	Clustered Dock
	Rumex crispus	Curled Dock
R	*Salix* spp.	Willow
	Salvia verbenaca var. *verbenaca*	Wild Sage
	Schinus molle	Pepper Tree
RC	*Scolymus hispanicus*	Golden Thistle

Status (cont.)	Scientific Name (cont.)	Common Name (cont.)
Indigenous species (cont.)		
	Scorzonera laciniata var. *laciniata*	Scorzonera
	Setaria parviflora	Slender Pigeon Grass
RC	*Solanum linnaeanum*	Apple of Sodom
	Solanum nigrum s.s.	Black Nightshade
	Sonchus asper s.s.	Rough Sow-thistle
	Sonchus oleraceus	Common Sow-thistle
	Sporobolus africanus	Rat-tail Grass
	Stenotaphrum secundatum	Buffalo Grass
	Symphyotrichum subulatum	Aster-weed
	Tragopogon spp.	Salsify
	Tribolium spp.	Desmazeria
	Trifolium angustifolium var. *angustifolium*	Narrow-leaf Clover
	Trifolium arvense var. *arvense*	Hare's-foot Clover

Status (cont.)	Scientific Name (cont.)	Common Name (cont.)
Indigenous species (cont.)		
	Trifolium campestre var. *campestre*	Hop Clover
	Trifolium glomeratum	Cluster Clover
	Trifolium pratense	Red Clover
	Trifolium spp.	Clover
	Trifolium striatum	Knotted Clover
RC	*Ulex europaeus*	Gorse
	Vicia hirsuta	Tiny Vetch
	Vicia sativa	Common Vetch
	Vicia spp.	Vetch
	Vinca major	Blue Periwinkle
	Vulpia bromoides	Squirrel-tail Fescue
	Vulpia muralis	Wall Fescue
	Vulpia myuros	Rat's-tail Fescue
	Vulpia spp.	Fescue
RC	*Xanthium spinosum*	Bathurst Burr

Significant flora with potential to occur in the project area

The following table includes the listed flora species that have potential to occur within the project area. The list is sourced from the Victorian Biodiversity Atlas and the Protected Matters Search Tool (DAWE, accessed on 6 March 2020).

Table B5.B.2
Listed flora species recorded/predicted to occur within 10 km of the project area.

Scientific name	Common name	Conservation status			Most recent database record	Habitat description	Likely occurrence in project area	Likelihood of occurrence in project area and rationale for likelihood
		EPBC	VIC	FFG				
National significance								
Amphibromus fluitans	River Swamp wallaby-grass	VU		I	2008, PMST	Largely confined to permanent swamps, mainly along the Murray River between Wodonga and Echuca, with scattered records from southern Victoria.	Low	Some dam edges offer potential habitat but are of low suitability for the species due to the dominance of introduced grasses, as a result of historical land uses and, presumably, elevated nutrient loads.
Dianella amoena	Matted Flax-lily	EN	e	L	2014, PMST	Lowland grassland and grassy woodland, on well-drained to seasonally waterlogged fertile sandy loam soils to heavy cracking clays.	Low	Most grassland within the project area is highly modified and species-poor, having recolonised land that has been subject to earthworks and/or rock removal. Historical land uses and disturbances mean that this species is unlikely to be present. The extent and coverage of vegetation surveys over the past decade is likely to have detected an important population if one existing in the project area.
Diuris basaltica	Small Golden Moths	EN	e	L	1965, PMST	Plains Grassland dominated by tussock-forming perennial grasses (including Kangaroo Grass), often with embedded surface basalt.	Negligible	No recent records from the local area. Most grassland within the project area is highly modified and species-poor, having recolonised land that has been subject to earthworks and/or rock removal.
Diuris fragrantissima	Sunshine Diuris	EN	e	L	1974, PMST	Grassland dominated by Themeda trianda, on plains with heavy basalt soils and embedded boulders. Only known extant population is in Sunshine.	Negligible	No recent records from the local area. Most grassland within the project area is highly modified and species-poor, having recolonised land that has been subject to earthworks and/or rock removal. Only known extant population is approximately 12 km south of the project area.

Scientific name (cont.)	Common name (cont.)	Conservation status (cont.)			Most recent database record (cont.)	Habitat description (cont.)	Likely occurrence in project area (cont.)	Likelihood of occurrence in project area and rationale for likelihood (cont.)
		EPBC	VIC	FFG				
National significance (cont.)								
Dodonaea procumbens	Trailing Hop-bush	VU	v		PMST	Sandy or clay soils in low-lying, winter-wet areas in grasslands, woodlands and low-open forest. In Victoria, the species is largely confined to the south-west.	Negligible	Although some suitable habitat may exist within the project area (e.g. in the woodland), the species has never been recorded from the local area or during detailed vegetation surveys within the project area over the past decade. The project area is outside the known distribution for the species, the nearest record being approximately 45 km west.
Glycine latrobeana	Clover Glycine	VU	v	L	1995, PMST	Grasslands and grassy woodlands, particularly those dominated by Kangaroo Grass. Widespread but sporadic distribution.	Low	Limited records within the local area. Most recent record is old >20yrs. Suitable habitat present on-site, however modification of the project area means that site is unlikely to support a population.
Lachnagrostis adamsonii	Adamson's Blown-grass	EN	v	L	PMST	Low-lying, seasonally wet or swampy areas of plains communities, often in slightly saline conditions.	Low	Suitable habitat with moist saline soils is not present or very limited in the project area and most records of this species are from south-west Victoria with only a few occurrences near Craigieburn north of Melbourne.
Lepidium hyssopifolium s.s.	Basalt Peppercress	EN	e	L	1982	Basalt plains grassland and woodland communities.	Negligible	Limited records within the local area. Most recent record is old >20yrs. Suitable habitat present on-site, however modification of the project area means that site is unlikely to support a population.
Leucochrysum albicans subsp. *tricolor*	White Sunray	EN	e	L	PMST	Grasslands of the Victorian Volcanic Plains, primarily on acidic clay soils derived from basalt, with occasional occurrences on adjacent sedimentary, sandy-clay soils.	Low	Potential grassland habitat in the project area is modified and species poor. This species is generally known from intact species rich basalt plains grasslands in south-west Victoria. This obvious species is likely to have been detected during the past decade of vegetation surveys if it were present.
Pimelea spinescens subsp. *spinescens*	Spiny Rice-flower	CR	e	L	2015, PMST	Primarily grasslands featuring a moderate diversity of other native species and inter-tussock spaces, although also recorded in grassland dominated by introduced perennial grasses.	Low	Suitable habitat present on-site. Recent record <20 yrs. Project area is unlikely to support a population due to the high levels of past landscape modification and current land management practices. The extent and coverage of vegetation surveys over the past decade is likely to have detected a population if one existing in the project area.

Scientific name (cont.)	Common name (cont.)	Conservation status (cont.)			Most recent database record (cont.)	Habitat description (cont.)	Likely occurrence in project area (cont.)	Likelihood of occurrence in project area and rationale for likelihood (cont.)
		EPBC	VIC	FFG				
National significance (cont.)								
Prasophyllum frenchii	Maroon Leek-orchid	EN	e	L	PMST	Grassland and grassy woodland environments on sandy or black clay loam soils, that are generally damp but well drained.	Low	Very little suitable habitat present on-site and records of this species are from south-east of Melbourne or in south-west Victoria. The project area is unlikely to support a population due to the high levels of past landscape modification and current land management practices. The extent and coverage of vegetation surveys over the past decade is likely to have detected a population if one existing in the project area.
Prasophyllum suaveolens	Fragrant Leek-orchid	EN	e	L	1962	Open, species rich grasslands dominated by Themeda triandra on poorly draining red-brown soils in western Victoria.	Negligible	Limited records within the area. Closest record is old >20 yrs. Habitat is also highly modified and is likely unsuitable.
Pterostylis cucullata subsp. *cucullata*	Leafy Greenhood	VU	e	L	2015, PMST	Protected areas of stabilised coastal sand dunes within scrub communities with an open ground layer; occasionally in Coastal Manna Gum woodland.	Negligible	Suitable habitat not present in the project area as this subspecies is known mostly from coastal scrub habitats.
Rutidosis leptorhynchoides	Button Wrinklewort	EN	e	L	2015, PMST	Higher quality Plains Grassland and Grassy Woodland in Western Victoria, particularly those with fertile soil and light timber cover.	Negligible	Recent record <20 yrs. Project area is unlikely to support a population due to the high levels of land modification and land management practices. The species is generally only known from relatively undisturbed native grassland remnants.
Senecio macrocarpus	Large-headed Fireweed	VU	e	L	2015, PMST	Grassland, shrubland and woodland habitats on heavy soils subject to waterlogging and/or drought conditions in summer.	Negligible	Recent record <20 yrs. Project area is unlikely to support a population due to the high levels of land modification and land management practices. This large obvious herb is likely to have been detected during the past decade of vegetation surveys if an important population was present.
Senecio psilocarpus	Swamp Fireweed	VU	v		PMST	Seasonally inundated herb-rich swamps, growing on peaty soils or volcanic clays.	Negligible	No suitable habitat located within the project area, species is not known to be present in the local area.
Thesium australe	Austral Toad-flax	VU	v	L	1904	Most commonly in damp grassland and woodland, including subalpine grassy heathlands.	Negligible	No suitable habitat located within the project area, species is not known to be present in the local area.
Xerochrysum palustre	Swamp Everlasting	VU	v	L	2005, PMST	Sedge-swamps and shallow freshwater marshes and swamps in lowlands, on black cracking clay soils.	Negligible	Recent record <20 yrs, however, the project area does not support suitable wetland habitat.

Scientific name (cont.)	Common name (cont.)	Conservation status (cont.)			Most recent database record (cont.)	Habitat description (cont.)	Likely occurrence in project area (cont.)	Likelihood of occurrence in project area and rationale for likelihood (cont.)
		EPBC	VIC	FFG				
National significance (cont.)								
Acacia rostriformis	Bacchus Marsh Wattle		v	L	2009	Occurs in low hilly areas in Eucalyptus woodland.	Negligible	No suitable habitat located within the project area, species is not known to be present in the local area. This large obvious large shrub is likely to have been detected during the past decade of vegetation surveys if a population was present.
Allocasuarina luehmannii	Buloke		e	L	2009	Non-calcareous soils in drier areas on slopes and plains; often in woodlands associated with Grey Box.	Low	Recent record <20 yrs. Suitable habitat present. This large obvious large tree is likely to have been detected during the past decade of vegetation surveys if a population was present in the project area.
Amphibromus pithogastrus	Plump Swamp Wallaby-grass		e	L	1989	Seasonally damp depressions in grassland or grassy wetland.	Negligible	Limited records within the area. Closest record is old >20 yrs. Habitat is modified and unsuitable.
Atriplex billardierei	Glistening Saltbush		x	L	1980	Scattered along sandy seashores from the western to eastern extremities of Victoria.	Negligible	This is a coastal species that is considered extinct in Victoria.
Botrychium australe	Austral Moonwort		v	L	1983	Lowland forest and scrubland to subalpine grasslands, lightly wooded plains, at the base of granitic hills, alongside subalpine streams, and in some disturbed environments.	Negligible	There are limited records within the area and the most recent record is >20 yrs. Habitat is not suitable for the species.
Carex tasmanica	Curly Sedge		v	L	2001	Seasonally wet areas, such as around drainage lines and freshwater swamps, on fertile, clay soils derived from basalt.	Negligible	Limited records within the area. Closest record is old >20 yrs. Habitat is modified and unsuitable.
Comesperma polygaloides	Small Milkwort		v	L	2014	Grasslands on the western basalt plains; less commonly in grassy woodlands between Bendigo and the Wimmera.	Negligible	No suitable habitat located within the project area, species is not known to be present in the local area. This obvious large shrub is likely to have been detected during the past decade of vegetation surveys if a population was present.
Cullen parvum	Small Scurf-pea		e	L	2006	Lowland grasslands, including pastures and occasionally in otherwise disturbed grassy areas.	Low	Limited records within the local area. Most recent record is old >20yrs. Suitable habitat present on-site, however modification of the project area means that site is unlikely to support a population.
Cullen tenax	Tough Scurf-pea		e	L	2013	Lowland grasslands, including pastures and occasionally in otherwise disturbed grassy areas.	Low	Limited records within the local area. Most recent record is old >20yrs. Suitable habitat present on-site, however modification of the project area means that site is unlikely to support a population
Diuris palustris	Swamp Diuris		v	L	1979	Grasslands and open woodlands, often in swampy depressions; confined to the west of the State.	Negligible	No suitable habitat located within the project area, species is not known to be present in the local area. Most recent record is old >20yrs.
Diuris punctata	Purple Diuris		v	L	1982	Fertile, loamy soils and periodically wet areas in lowland grasslands, grassy woodlands, heathy woodlands and open heathlands.	Negligible	No suitable habitat located within the project area, species is not known to be present in the local area. Most recent record is old <20yrs.
Eucalyptus leucoxylon subsp. *megalocarpa*	Large-fruit Yellow-gum		e	L	1996	Coastal, near Nelson.	Negligible	This large obvious large tree is likely to have been detected during the past decade of vegetation surveys if a remnant (not planted) population was present in the project area.
Geranium sp. 1	Large-flower Crane's-bill		e	L	2016	The habitat requirements of this species are poorly known.	Negligible	There are limited species records within the local area. Habitat may be present, but the species potential to persist on the site is unknown due to limited habitat information.
Leiocarpa leptolepis	Pale Plover-daisy		e	L	1912	Grasslands and grassy woodlands, often in disturbed areas. In Victoria, confined to one known population approximately 4km east of Mildura.	Negligible	Species is not known to be present in the local area. One old record >20 yrs.
Pterostylis truncata	Brittle Greenhood		e	L	1931	Grassland and grassy woodland habitats, largely to the west of Melbourne.	Negligible	Species is not known to be present in the local area. One old record >20 yrs.
Thelymitra gregaria	Basalt Sun-orchid		e	L	1953	Open, species-rich grassland dominated by Themeda triandra on poorly draining soils of the volcanic plains.	Negligible	Species is not known to be present in the local area. One old record >20 yrs.

Significant ecological communities with potential to occur in the project area

The following table includes the listed ecological communities with potential to occur within the project area. The list is sourced from the Victorian Biodiversity Atlas and the Protected Matters Search Tool (DAWE, accessed on 6 March 2020).

Table B5.B.3
Listed ecological communities predicted to occur within 10 km of the project area.

Ecological community	Status	Comments
Grassy Eucalypt Woodland of the Victorian Volcanic Plain Critically Endangered Community	EPBC	EVC 55 in the project area has affinities with this community when River Red-gum is dominant canopy species but all patches of this EVC recorded are less than 0.5 ha and highly fragmented so therefore do not meet the size condition thresholds to qualify as a TEC (TSSC, 2009).
Grey Box (Eucalyptus microcarpa) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia Endangered Community	EPBC	Grey Box is the most common Eucalypt within treed areas of the project area and is present as a regenerating species in derived native grassland. It is associated with EVC 71 and EVC 803.
Natural Temperate Grassland of the Victorian Volcanic Plain Critically Endangered community	EPBC	This community is present as a naturally treeless native grassland throughout the project area.
Seasonal Herbaceous Wetlands (Freshwater) of the Temperate Lowland Plains Critically Endangered Community	EPBC	Wetland EVCs in the project area do not represent this community as associated wetland vegetation does not fit the key landscape setting and floristic diagnostics. This is due to the wetland EVCs present occurring in creek systems (and not as depressional wetlands), the lack of low growing wetland grass and herb species, and the dominance of large emergent graminoids that are contra-indicator species for this community.
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland Critically Endangered	EPBC	The eucalypt species that define this community are not present in the project area except for the occasional Yellow Box tree which is associated with EVC 71 and EVC 803 that represent the Grey Box Grassy Woodland community listed above.
Grey Box - Buloke Grassy Woodland Community	FFG	The Grey Box Woodland present in the project area does not represent this community as there are no Buloke (Allocasuarina luehmannii) trees within the Woodland and hence does not fit the description of this community.
Victorian Temperate Woodland Bird Community	FFG	This community includes the woodlands stands in the project area. Listed woodland birds within this community that have been recorded or may occur are Swift Parrot, Brown Treecreeper, Speckled Warbler, Yellow-tufted Honeyeater, Fuscous Honeyeater, Black-chinned Honeyeater, Painted Honeyeater, Jacky Winter, Red-capped Robin, Hooded Robin and Diamond Firetail.
Western (Basalt) Plains Grassland i.e. all the Plains Grassland that we have mapped	FFG	This FFG listed community will be similar to the EPBC grassland community present in the project area.
Western Basalt Plains (River Red Gum) Grassy Woodland	FFG	EVC 55 in the project area has affinities with this community when River Red-gum is dominant canopy species but all patches of this EVC are highly modified and unlikely to represent this community.

APPENDIX B5.C
FAUNA

Summary

- Fauna recorded from the project area.
- Significant fauna with potential to occur in the project area.
- Migratory fauna with potential to occur within 10 kilometres of the project area.

Fauna species recovered from the study

Note to tables

EPBC Act: EX – Extinct CR – Critically Endangered EN – Endangered VU – Vulnerable CD – Conservation Dependent PMST – Protected Matters Search Tool	Vic ex - extinct cr – critically endangered en – endangered vu – vulnerable nt – near threatened dd – data deficient rx – regionally extinct PS – pest species (CaLP Act) (DSE 2009; DSE 2013)
FFG Act: L – Listed as threatened under FFG Act N – Nominated for listing as threatened I – determined ineligible for listing	Most recent database records are from the Victorian Biodiversity Atlas unless otherwise specified as follows: PMST – Protected Matters Search Tool Birdlife – Birdlife Australia database search or manual interrogation of Birdlife Australia Bird data

The following table includes a list of fauna recorded from the project area (current assessment and FY19 Growling Grass Frog surveys).

Table B5.C.1
Fauna Recorded from the project area

Scientific Name	Common Name	Status			Survey Method				
		EPBC	VIC	FFG	Incidental	SLL Tile survey	M3R GGF Spotlighting/ Call Play back	GSM survey	FY19 GGF surveys
Indigenous Species									
Birds									
Acanthiza chrysorrhoa	Yellow-rumped Thornbill				X				
Acanthiza pusilla	Brown Thornbill				X				
Alauda arvensis	Eurasian Skylark				X				
Anas superciliosa	Pacific Black Duck				X				
Anthus novaeseelandiae	Australasian Pipit				X				
Aquila audax	Wedge-tailed Eagle				X				
Ardea pacifica	White-necked Heron				X				
Artamus cyanopterus	Dusky Woodswallow				X				
Cacatua galerita	Sulphur-crested Cockatoo				X				
Cacatua tenuirostris	Long-billed Corella				X				
Cacomantis pallidus	Pallid Cuckoo				X				
Chrysococcyx lucidus	Shining Bronze-Cuckoo				X				
Cincloramphus mathewsi	Rufous Songlark				X				

Scientific Name (cont.)	Common Name (cont.)	Status (cont.)			Survey Method (cont.)				
		EPBC	VIC	FFG	Incidental	SLL Tile survey	M3R GGF Spotlighting/ Call Play back	GSM survey	FY19 GGF surveys
Indigenous Species (cont.)									
Birds (cont.)									
Coracina novaehollandiae	Black-faced Cuckoo-shrike				X				
Cormobates leucophaea	White-throated Treecreeper				X				
Corvus mellori	Little Raven				X				
Dacelo novaeguineae	Laughing Kookaburra				X				
Egretta novaehollandiae	White-faced Heron				X		X		
Eolophus roseicapilla	Galah				X				
Falco berigora	Brown Falcon				X				
Glossopsitta concinna	Musk Lorikeet				X				
Gymnorhina tibicen	Australian Magpie				X				
Lalage tricolor	White-winged Triller				X				
Malurus cyaneus	Superb Fairy-wren				X				
Manorina melanocephala	Noisy Miner				X				
Melithreptus brevirostris	Brown-headed Honeyeater				X				
Ninox boobook	Southern Boobook						X		
Ocyphaps lophotes	Crested Pigeon				X				
Pardalotus punctatus	Spotted Pardalote				X				
Pardalotus striatus	Striated Pardalote				X				
Petrochelidon nigricans	Tree Martin				X				
Platycercus elegans	Crimson Rosella				X				
Platycercus eximius	Eastern Rosella				X				
Psephotus haematonotus	Red-rumped Parrot				X				
Ptilotula penicillata	White-plumed Honeyeater				X				
Rhipidura albiscapa	Grey Fantail				X				
Rhipidura leucophrys	Willie Wagtail				X				
Smicrornis brevirostris	Weebill				X				
Synoicus ypsilophorus	Brown Quail				X			X	
Taeniopygia guttata	Zebra Finch				X				
Threskiornis spinicollis	Straw-necked Ibis				X				
Todiramphus sanctus	Sacred Kingfisher				X				
Trichoglossus haematodus	Rainbow Lorikeet				X				
Vanellus miles	Masked Lapwing				X				

Scientific Name (cont.)	Common Name (cont.)	Status (cont.)			Survey Method (cont.)				
		EPBC	VIC	FFG	Incidental	SLL Tile survey	M3R GGF Spotlighting/ Call Play back	GSM survey	FY19 GGF surveys
Indigenous Species (cont.)									
Mammals									
Macropus giganteus	Eastern Grey Kangaroo				X				
Pseudocheirus peregrinus	Eastern Ring-tailed Possum						X		X
Tadarida australis	White-striped Freetail Bat						X		
Wallabia bicolor	Black-tailed Wallaby				X				
Reptiles									
Amphibolurus muricatus	Tree Dragon				X				
Chelodina longicollis	Eastern Snake-necked Turtle		dd				X		X
Christinus marmoratus	Marbled Gecko				X				
Ctenotus robustus	Large Striped Skink					X			
Emydura macquarii	Murray River Turtle		vu						X
Eulamprus tympanum tympanum	Southern Water Skink								X
Lampropholis guichenoti	Pale-flecked Garden Sunskink					X			
Lerista bougainvillii	Bougainville's Skink					X			
Parasuta flagellum	Little Whip Snake					X			
Pseudemoia pagenstecheri	Tussock Skink		vu			X			
Pseudonaja textilis	Eastern Brown Snake								X
Saproscincus mustelinus	Weasel Skink					X			
Tiliqua scincoides	Common Blue-tongued Lizard					X			
Frogs									
Crinia signifera	Common Froglet						X		X
Limnodynastes dumerilii	Eastern Banjo Frog						X		X
Limnodynastes peronii	Striped Marsh Frog						X		X
Limnodynastes tasmaniensis	Spotted Marsh Frog					X	X		X
Litoria ewingii	Southern Brown Tree Frog				X		X		X
Litoria lesueuri	Southern Stony-creek Frog								X
Litoria raniformis	Growling Grass Frog	VU	en	L	X		X		X
Litoria verreauxii verreauxii	Verreaux's Tree Frog								X

Scientific Name (cont.)	Common Name (cont.)	Status (cont.)			Survey Method (cont.)				
		EPBC	VIC	FFG	Incidental	SLL Tile survey	M3R GGF Spotlighting/ Call Play back	GSM survey	FY19 GGF surveys
Indigenous Species (cont.)									
Fish									
Anguilla australis	Southern Shortfin Eel						X		
Invertebrates / crustaceans									
Cherax destructor destructor	Common Yabby								
Synemon plana	Golden Sun Moth	CR	cr	L	X			X	
Introduced species									
Cyprinus carpio	European Carp								X
**Mus musculus*	House Mouse		PS						
Rattus rattus	Black Rat						X		
Vulpes vulpes	Red Fox		PS		X				

The following table includes a list of listed fauna species that have potential to occur within the project area. The list is sourced from the Victorian Biodiversity Atlas, the Protected Matters Search Tool (DoEE; accessed on 20.02.2020) and Birdlife Australia Records (Birdlife Australia; accessed 11.03.2020).

Table B5.C.2
Listed Fauna

Scientific name	Common name	Conservation status			Most recent database record	Other records	Habitat description	Likely occurrence in project area	Rationale for likelihood ranking
		EPBC	VIC	FFG					
National Significance									
Pedionomus torquatus	Plains-wanderer	CR	cr	L	1979	PMST	Native grassland with a sparse, open structure.	Low	There is no structurally suitable habitat to support a population of the species within the project area and the species is now very rarely recorded in Southern Victoria.
Rostratula australis	Australian Painted-snipe	EN	cr	L	1977	PMST	Generally found in shallow, terrestrial freshwater wetlands with rank, emergent tussocks of grass, sedges and rushes. Australian Painted Snipe can occur in well-vegetated lakes, swamps, inundated pasture, saltmarsh and dams.	Low	Dams and waterways within the project area do not provide suitable habitat for this species.
National Significance (cont.)									
Botaurus poiciloptilus	Australasian Bittern	EN	en	L	1950	PMST	Occurs in wetlands with tall, dense vegetation where it forages in shallow water. Prefers permanent freshwater habitats, particularly when dominated by sedges, rushes and reeds.	Low	Dams and waterways within the project area do not provide suitable habitat for this species.
Calyptorhynchus banksii graptogyne	Red-tailed Black-Cockatoo (south-eastern)	EN	en	L	1846		The south-eastern Red-tailed Black-Cockatoo only occurs in the south-east of South Australia and south-west Victoria. Red-tailed Black-Cockatoos rely on stringybark, buloke and gum woodland habitats and scattered trees throughout the range for feeding and nesting. They are highly nomadic, moving throughout their range in response to food availability.	Negligible	The contemporary range of this species does not extend east of the Grampians.
Polytelis swainsonii	Superb Parrot	VU	en	L	1846		Found along timbered waterways and nearby well-watered woodlands. It is found in the Riverina area of New South Wales and Victoria and Northern New South Wales in winter.	Negligible	The species does not naturally occur in the Melbourne region.
Polytelis anthopeplus	Regent Parrot	VU	vu	L	1897		Two separate populations: eastern population are found in south-western New South Wales, north-western Victoria and the Murray Mallee region of South Australia, this population is found in River Red Gum, floodplain, woodland and mallee habitats. The western population is found in south west Western Australia where they are found in open forest and woodland.	Negligible	This record is of aviary escapees (VBA record interrogation). The species does not naturally occur in the Melbourne region.
Neophema chrysogaster	Orange-bellied Parrot	CR	cr	L	1977		Coastal vegetation including saltmarshes, dunes, pastures, shrublands, sewage plants, saltworks, islands, and beaches.	Negligible	No suitable habitat.

Scientific name (cont.)	Common name (cont.)	Conservation status (cont.)			Most recent database record (cont.)	Other records (cont.)	Habitat description (cont.)	Likely occurrence in project area (cont.)	Rationale for likelihood ranking (cont.)
		EPBC	VIC	FFG					
National Significance (cont.)									
Lathamus discolor	Swift Parrot	CR	en	L	2019	Birdlife, PMST	A range of forests and woodlands, especially those supporting nectar-producing tree species. Also well-treed urban areas.	Recorded	The species was recorded from the Grey Box Woodland within the project area in 2019 (Steele & Peter 2019). The Grey Box Woodland represents a large example of intact habitat for the species in the southern extent of its mainland range. Other scattered eucalyptus and planted trees may also provide foraging habitat for the species on occasion however scattered trees are unlikely to provide significant habitat for the species.
Hirundapus caudacutus	White-throated Needletail	VU	vu	L	2010	Birdlife, PMST	An almost exclusively aerial species within Australia, occurring over most types of habitat, particularly wooded areas.	High	It is likely that the species utilises all of the airspace at Melbourne Airport with the woodland providing preferable habitat for the species. Additional interrogation of Birdlife Australia's online database (Birddata) revealed there is an incidental record of the species from 2010 (Birdlife Australia) over Sky Road in Melbourne Airport and other records surrounding the Airport. The species is known to have a preference for foraging above wooded areas and is known to roost in the canopy and hollows of trees in in forests and woodlands.
Thinornis rubricollis rubricollis	Hooded Plover (eastern)	VU	vu	L		PMST	Sandy ocean beaches, estuaries and inland lakes.	Negligible	No suitable habitat.
Sternula nereis	Fairy Tern	VU	en	L	1977		Fairy Terns inhabit coastal environments including intertidal mudflats, sand flats and beaches. Nests above high-water mark on sandy shell-grit beaches.	Negligible	No suitable habitat.

Scientific name (cont.)	Common name (cont.)	Conservation status (cont.)			Most recent database record (cont.)	Other records (cont.)	Habitat description (cont.)	Likely occurrence in project area (cont.)	Rationale for likelihood ranking (cont.)
		EPBC	VIC	FFG					
National Significance (cont.)									
Charadrius mongolus	Lesser Sand Plover	EN	cr		1978		A migratory species that forages on exposed sand and mudflats. High tide roost sites are often located on beaches. This species has been recorded at Mud Islands within Port Phillip Bay, and Reef Island within Westernport Bay. The species has also previously been recorded along the coastline at the Western Treatment Plant.	Negligible	No suitable habitat.
Numenius madagascariensis	Eastern Curlew	CR	vu	L	1977	PMST	Large intertidal sandflats, banks, mudflats, estuaries, inlets, sewage farms, saltworks, harbours, coastal lagoons and bays.	Negligible	No suitable habitat.
Limosa lapponica	Bar-tailed Godwit	VU			1977		Bar-tailed Godwits inhabit estuarine mudflats, beaches and mangroves. They are common in coastal areas around Australia. They are social birds and are often seen in large flocks and in the company of other waders.	Negligible	No suitable habitat.
Calidris ferruginea	Curlew Sandpiper	CR	en	L	1977	PMST	Large intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms.	Negligible	No suitable habitat.
Grantiella picta	Painted Honeyeater	VU	vu	L		PMST	A migratory species that breeds in southern Australia, it occupies dry open woodlands and forests located on the inland foothills of the Great Dividing Range. Typically forages for fruit and nectar in mistletoes and in tree canopies.	Low	No records of the species in the local area and rarely recorded in the Melbourne area. Not detected in any of the surveys undertaken in the Grey Box Woodland.
Anthochaera phrygia	Regent Honeyeater	CR	cr	L	1971	PMST	A range of dry woodlands and forests dominated by nectar-producing tree species.	Low	Now very rarely recorded in the Melbourne area. Not detected in any of the surveys undertaken in the Grey Box Woodland.

Scientific name (cont.)	Common name (cont.)	Conservation status (cont.)			Most recent database record (cont.)	Other records (cont.)	Habitat description (cont.)	Likely occurrence in project area (cont.)	Rationale for likelihood ranking (cont.)
		EPBC	VIC	FFG					
National Significance (cont.)									
Dasyurus maculatus maculatus (SE mainland population)	Spot-tailed Quoll	EN	en	L	1883	PMST	Rainforest and wet and dry sclerophyll forests and woodlands.	Negligible	This species is locally extinct.
Dasyurus viverrinus	Eastern Quoll	EN	rx	L	1902		The Eastern Quoll is a medium-sized carnivorous marsupial that once occupied a broad range of forest, woodland and grassland habitats in Victoria. The species is now restricted to Tasmania and is considered to be extinct on mainland Australia.	Negligible	The species is now extinct in the wild in Victoria.
Perameles gunnii Victorian subspecies	Eastern Barred Bandicoot (Mainland)	EN	ew	L	2003	PMST	Tall, dense native grasslands and grassy woodlands. The species was once widespread throughout western Victoria, the species is now considered 'extinct in the wild' in Victoria.	Negligible	This species is locally extinct. The 2003 record relates to the captive population introduced to Woodlands Historic Park.
Pteropus poliocephalus	Grey-headed Flying-fox	VU	vu	L	2017	PMST	Rainforest, wet and dry sclerophyll forest, woodland and urban areas.	Recorded	The species is known to forage in flowering eucalypts within the project area (Ecology and Infrastructure International 2018). The closest 'camp' for the species is located approximately 20km south-east of the project area. Habitat present within the project area is unlikely to provide important habitat critical for the survival of this species.
Delma impar	Striped Legless Lizard	VU	en	L	2017	PMST	Natural temperate grassland, grassy woodland and exotic grassland.	Low	Extensive targeted surveys were undertaken for the species as part of the current ecological assessments. The species was not detected during the current assessment or during any of the numerous previous assessments undertaken.

Scientific name (cont.)	Common name (cont.)	Conservation status (cont.)			Most recent database record (cont.)	Other records (cont.)	Habitat description (cont.)	Likely occurrence in project area (cont.)	Rationale for likelihood ranking (cont.)
		EPBC	VIC	FFG					
National Significance (cont.)									
Tympanocryptis pinguicolla	Grassland Earless Dragon	EN	cr	L	1990	PMST	A specialist inhabitant of natural temperate grassland. All records are from around Melbourne, however, potential grassland habitat is scattered throughout the Victorian Volcanic Plain bioregion. The last confirmed sighting of the species was at Little River in 1969. Despite extensive surveys throughout its potential range since then, no populations have been found and the species may be extinct.	Low	This species has not been reliably recorded in the wild for 50 years. It is therefore potentially extinct.
Litoria raniformis	Growling Grass Frog	VU	en	L	2020	PMST	Occupies a variety of permanent and semi-permanent water bodies generally containing abundant submerged and emergent vegetation, within lowland grasslands, woodlands and open forests.	Recorded	Growling Grass Frog have been recorded from Arundel Creek and Moonee Ponds Creek within the project area and Deep Creek and the Maribyrnong River adjacent to the project area. Breeding, aquatic and terrestrial habitat for the species occurs within the project area.
Prototroctes maraena	Australian Grayling	VU	vu	L	2015	PMST	Adults inhabit cool, clear, freshwater streams.	Medium	Targeted surveys between 2013 and 2014 (Biosis 2015) did not record the species within the project area however the species is known to occur downstream from the project area in the Maribyrnong River and is therefore likely to utilise similar suitable habitat in the portion of the Maribyrnong River adjacent to the project area. Permanently altered run-off and water quality to be managed by design and relevant permit conditions to ensure integrity of adjacent waterways as habitat for the species.

Scientific name (cont.)	Common name (cont.)	Conservation status (cont.)			Most recent database record (cont.)	Other records (cont.)	Habitat description (cont.)	Likely occurrence in project area (cont.)	Rationale for likelihood ranking (cont.)
		EPBC	VIC	FFG					
National Significance (cont.)									
Galaxiella pusilla	Dwarf Galaxias	VU	en	L		PMST	Occurs in relatively shallow still or slow flowing water bodies including streams, wetlands, drains, that in many instances are ephemeral and partially dry up over summer. Typically requires abundant marginal and aquatic vegetation.	Negligible	No Dwarf Galaxias were detected during previous aquatic surveys (Biosis 2015). This species has not been recorded from the Maribyrnong or Yarra River catchments.
Maccullochella macquariensis	Trout Cod	EN	cr	L	1908		Found within faster flowing sections of the Murray River and its tributaries, in deep holes or amongst fallen timber and other debris. Also occurs in upper reaches of rivers where water is clear and there is little fallen timber.	Negligible	Project area is outside accepted range of the species. Historic records represent failed translocations.
Maccullochella peelii	Murray Cod	VU	vu	L	1981	PMST	Found within the Murray River catchment usually in sluggish turbid rivers, in deep holes or amongst fallen timber and other debris. Also occurs in upper reaches of rivers where water is clear and there is little fallen timber. There is also a large viable population of the species in the Yarra River Catchment.	Low	The database records represent failed translocations. There are no contemporary records of this species from the Maribyrnong catchment.
Macquaria australasica	Macquarie Perch	EN	en	L	1970		Streams with clear water and deep, rocky holes with abundant cover.	Negligible	Project area is outside accepted range of the species. Historic records represent failed translocations.
Bidyanus bidyanus	Silver Perch	CR	vu	L	1981		Found in lowland rivers within the Murray-Darling Basin commonly found in deeper water adjacent to large woody habitats. Has been widely stocked in reservoirs and farm dams.	Negligible	Project area is outside accepted range of the species. Historic records represent failed translocations.
Synemon plana	Golden Sun Moth	CR	cr	L	2017	PMST	Natural temperate grassland, grassy woodland and pasture supporting spear grasses and wallaby grasses and exotic grassland dominated by Chilean needle grass.	Recorded	Species recorded from a small area of suitable habitat north of the Grey Box Woodland. The species was not recorded anywhere else within the project area during extensive current and previous surveys for the species. It is unlikely that that species occurs anywhere else in the project area.

Scientific name (cont.)	Common name (cont.)	Conservation status (cont.)			Most recent database record (cont.)	Other records (cont.)	Habitat description (cont.)	Likely occurrence in project area (cont.)	Rationale for likelihood ranking (cont.)
		EPBC	VIC	FFG					
National Significance (cont.)									
Paralucia pyrodiscus lucida	Eltham Copper Butterfly	EN	en	L	1922		Drier sclerophyll forests and woodlands supporting Sweet Bursaria Bursaria spinosa, especially along ridgelines. Presence of ants of the genus Notoncus is necessary for this species to be present.	Low	Planted habitat for this species occurs within the regeneration area of the woodland however, the species has not been recorded from the local area for close to 100 years, the nearest known population is in the Eltham – Greensborough area.
State Significance									
Geopelia cuneata	Diamond Dove		nt	L	2009		Drier woodlands and scrub, spinifex and mulga.	Low	This species is a vagrant to southern Victoria.
Lewinia pectoralis	Lewin's Rail		vu	L	1991		Inhabits densely vegetated wetlands, including swamps, farm dams, saltmarshes, lakes and small pools that can range from fresh to saline water. May also use riverine forest.	Low	Confined to vicinity of watercourses and dams however there is limited suitable habitat present in the project area for this species. May fly over the project area.
Porzana pusilla	Baillon's Crake		vu	L	2015		Well-vegetated permanent and temporary fresh and brackish wetlands.	High	This species is likely to occur along Arundel Creek.
Burhinus grallarius	Bush Stone-curlew		en	L	1846		This species generally occurs in open woodland habitats, including mallee and mulga, which have a sparse layer of small shrubs, grass and litter.	Negligible	This species is now extinct in southern Victoria.
Ardeotis australis	Australian Bustard		cr	L	1846		Grassland, open dry woodlands of mallee and mulga, arid heathland saltbush and bluebush.	Negligible	This species is now extinct in southern Victoria.
Egretta garzetta	Little Egret		en	L	2008		Swamps, billabongs, floodplain pools, mudflats, mangroves and channels; breeds in trees standing in water.	High	Suitable habitat present in watercourses and dams.
Ardea intermedia plumifera	Plumed Egret		en	L	1982		Densely-vegetated freshwater wetlands including lakes, swamps and billabongs. Breeds in trees standing in water.	High	Suitable habitat present along watercourses
Ardea alba modesta	Eastern Great Egret		vu	L	2014		Prefer shallow water, particularly when flowing, but may be seen on any watered area, including damp grasslands.	High	Suitable habitat present in watercourses and dams.
Ixobrychus dubius	Australian Little Bittern		en	L	1980		Inhabits terrestrial wetlands, preferably with dense emergent vegetation.	Low	Lack of suitable habitat. May rarely fly over the project area.

Scientific name (cont.)	Common name (cont.)	Conservation status (cont.)			Most recent database record (cont.)	Other records (cont.)	Habitat description (cont.)	Likely occurrence in project area (cont.)	Rationale for likelihood ranking (cont.)
		EPBC	VIC	FFG					
National Significance (cont.)									
Stictonetta naevosa	Freckled Duck		en	L	2014		Large freshwater wetlands, generally with dense vegetation.	Medium	May occasionally use the large water storage dams on Arundel Creek.
Oxyura australis	Blue-billed Duck		en	L	2015		Deep, freshwater wetlands.	Medium	May visit the large water storage dams along Arundel Creek on occasion, may fly over the project area.
Accipiter novaehollandiae	Grey Goshawk		vu	L	2009		Favours tall, wet forests in gullies but can occur in woodlands, dry forests, wooded farmlands and suburban parks. Relies on mature forests for breeding.	Medium	May occasionally use the Grey Box Woodland and to a lesser extent planted trees within the project area.
Haliaeetus leucogaster	White-bellied Sea-Eagle		vu	L	2009		Coastal areas such as beaches and estuaries, inland wetlands and major inland streams.	Medium	May visit waterways and dams in the project area on occasion, in particularly the Maribyrnong River and potentially the large water storage dams on Arundel Creek.
Falco subniger	Black Falcon		vu	L	2011	Birdlife	Woodlands, open country and around terrestrial wetlands areas, including rivers and creeks. Mostly hunts over open plains and undulating land with large tracts of low vegetation.	High	Areas of grassland and woodland area suitable habitat for this species.
Ninox strenua	Powerful Owl		vu	L	2007		Eucalypt forests and woodlands, well-treed urban areas.	Medium	Although not previously recorded, this species may use the Grey Box Woodland. Targeted surveys for the species have not been undertaken.
Neophema pulchella	Turquoise Parrot		nt	L	2000		Grassy open forest and woodland	Medium	The species may use the Grey Box woodland on rare occasions.
Hydroprogne caspia	Caspian Tern		nt	L	2007		Coastal waters and inland lakes and rivers.	Low	Lack of suitable habitat. May rarely fly over the project area.
Melanodryas cucullata	Hooded Robin		nt	L	2002		Occupies a range of open woodlands including those dominated by Eucalypts, Acacias and Callitris spp. with an understorey of smaller trees, shrubs and grasses.	Recorded	Grey Box Woodland and woodland area along Barbiston Road provide suitable habitat for the species, one individual was recorded within the Grey Box Woodland in 2002. Species is an uncommon visitor to the local area, normally located north of the Great Dividing Range.
Pomatostomus temporalis	Grey-crowned Babbler		en	L	1846		Open forests and woodlands.	Negligible	The species is locally extinct.
Pyrrholaemus sagittatus	Speckled Warbler		vu	L	2019		Occurs in open forest and Box Ironbark Woodlands, usually with scattered shrubs and a cover of acacias. Seldom seen far from dense patches of shrubs.	Recorded	Habitat on-site is limited to woodland areas. The species was recorded in the Grey Box Woodland in the project area in 1990. The species has been recorded reliably across multiple years in nearby Woodlands Historic Park with the latest in 2019.
Stagonopleura guttata	Diamond Firetail		nt	L	1990		Occurs mostly in the lowlands and foothills in the north of Victoria. It has specific habitat requirements, which include grassy woodlands with tree cover for refuge and an undisturbed ground layer with grasses.	Low	There is a lack of contemporary records of this species from the local area including in the nearby Woodlands Historic Park. However, suitable habitat occurs in the Grey Box Woodland and adjacent grassland.
Phascogale tapoatafa	Brush-tailed Phascogale		vu	L	2017		Occurs in dry foothill forest, which is open with sparse ground cover. Favours areas dominated by box, ironbark and Stringybark eucalypts.	Medium	Due to the isolation of Melbourne Airport from other suitable habitat and known populations we consider it unlikely that there is a resident population of the species utilising suitable habitat in the Grey Box Woodland. A database record from 2017 at Oaklands Junction confirms that the species is in the nearby region however it is unknown whether that record is from a nearby unknown population or was a young dispersing male. Surveys for this species have not been undertaken in the project area.
Saccolaimus flaviventris	Yellow-bellied Sheathtail Bat		dd	L	2016		Occurring in most environments from treeless deserts to wet forests. The species roosts singly or in colonies typically in tree hollows, but where trees are absent they are known to utilise the burrows of terrestrial mammals.	High	Species recorded form Bulla Hill and School Hill approximately 1.5km north west of the project area (Biosis 2016). Treed areas, in particular the woodland provide habitat for this species in the project area.
Miniopterus schreibersii oceanensis	Common Bent-wing Bat (eastern ssp.)		vu	L	2013		A variety of treed and treeless habitats. Roosts in caves and man-made structures.	High	Treed areas, in particular the woodland provide habitat for this species in the project area.

Scientific name (cont.)	Common name (cont.)	Conservation status (cont.)			Most recent database record (cont.)	Other records (cont.)	Habitat description (cont.)	Likely occurrence in project area (cont.)	Rationale for likelihood ranking (cont.)
		EPBC	VIC	FFG					
National Significance (cont.)									
Pseudophryne bibronii	Brown Toadlet		en	L	2010		A wide variety of woodland, forest and grassland habitats.	Medium	Suitable habitat present for the species around waterways and in woodland areas within the project area. Species has not been recorded within Melbourne Airport however typical ecological surveys undertaken at Melbourne Airport have been outside of the male calling season for the species.
Neochanna cleaveri	Australian Mudfish		cr	L	2008		Freshwater habitats with abundant aquatic vegetation such as streams, backwaters, billabongs and floodplain wetlands.	Medium	Suitable habitat present within the project area in Arundel Creek and Moonee Ponds Creek when inundated.
Jalmenus icilius	Amethyst Hairstreak Butterfly		vu	L	2015		Larvae eat a wide range of plants favouring Acacia species and Cassia species. It is generally common except in the south-eastern end of its range in central and western Victoria, where it is now very scarce.	Low	One recorded from similar habitat within 10km of the project area. Records of this species in the Melbourne area are very uncommon and the species has not been observed during other various ecological surveys at Melbourne Airport to date.

The following table includes a list of migratory fauna species recorded, or predicted to be recorded, within 10 kilometres of the project area. The list is sourced from the Victorian Biodiversity Atlas, the Protected Matters Search Tool (DoEE; accessed on 20.02.2020) and Birdlife Australia Records (Birdlife Australia; accessed 11.03.2020).

Table B5.C.3
Migratory species recorded or predicted within 10km of project area

Scientific name	Common name	Most recent record
Gallinago hardwickii	*Latham's Snipe*	2014
Plegadis falcinellus	*Glossy Ibis*	2011
Hirundapus caudacutus	*White-throated Needletail*	2007
Apus pacificus	*Fork-tailed Swift*	2007
Pandion haliaetus	*Osprey*	PMST
Ardenna tenuirostris	*Short-tailed Shearwater*	2008
Stercorarius parasiticus	*Arctic Jaeger*	2008
Sterna hirundo	*Common Tern*	2006
Hydroprogne caspia	*Caspian Tern*	2007
Thalasseus bergii	*Crested Tern*	2013
Charadrius mongolus	*Lesser Sand Plover*	1978
Charadrius bicinctus	*Double-banded Plover*	2004
Numenius madagascariensis	*Eastern Curlew*	1977
Limosa lapponica	*Bar-tailed Godwit*	1977
Actitis hypoleucos	*Common Sandpiper*	PMST
Tringa nebularia	*Common Greenshank*	PMST
Calidris ferruginea	*Curlew Sandpiper*	1977
Calidris acuminata	*Sharp-tailed Sandpiper*	2009
Calidris alba	*Sanderling*	1977
Calidris melanotos	*Pectoral Sandpiper*	PMST
Motacilla flava	*Yellow Wagtail*	PMST
Rhipidura rufifrons	*Rufous Fantail*	2014
Myiagra cyanoleuca	*Satin Flycatcher*	2010
Monarcha melanopsis	*Black-faced Monarch*	PMST

APPENDIX B5.D
VEGETATION CONDITION ASSESSMENTS

Summary

- Assessments of vegetation and ecological community condition.

Vegetation condition data

Field checklists were used to assess the presence/absence of Natural Temperate Grassland and the derived grassland condition state of Grey Box Woodland (see Appendix B5.A).

Natural Temperate Grassland of the Victorian Volcanic Plain

Table B5.D.1
Natural Temperate Grassland within the impact area – results of assessments against condition thresholds and EVC benchmarks

Habitat Zone			1A	2A	2B	4A	5A	5B	6A	7B	8A
Bioregion			VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP
EVC #: Name			132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG
Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) criteria		2	Y	Y	Y	Y	Y	Y	Y	Y	Y
		3.1	Y	Y	Y	Y	Y	Y	Y	Y	Y
		3.2	N	N	N	N	N	N	N	N	N
		3.3	Y	Y	Y	Y	Y	Y	Y	Y	Y
		4.1	Y	Y	NA	Y	NA	Y	Y	NA	NA
		4.2	NA	NA	Y	NA	Y	NA	NA	Y	Y
EPBC Listed Community present			NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP
		Max Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Old Trees	10	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Canopy Cover	5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Lack of Weeds	15	4	4	7	7	4	4	4	4	7
	Understorey	25	5	5	10	5	10	10	10	15	10
	Recruitment	10	6	6	3	6	10	3	10	3	3
	Organic Matter	5	4	4	4	4	4	4	4	4	4
	Logs	5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Total Site Score		19	19	24	22	28	21	28	26	24
	EVC standardiser (x 75/55)		1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
	Adjusted Site Score		25.91	25.91	32.73	30.00	38.18	28.64	38.18	35.45	32.73
Landscape Value	Patch Size	10	1	2	2	1	8	8	1	4	4
	Neighbourhood	10	5	5	5	5	5	5	3	3	5
	Distance to Core	5	3	3	3	3	4	4	3	4	4
	Total Landscape Score		9	10	10	9	17	17	7	11	13
HABITAT SCORE		100	34.91	35.91	42.73	39.00	55.18	45.64	45.18	46.45	45.73
Habitat points = #/100		1	0.35	0.36	0.43	0.39	0.55	0.46	0.45	0.46	0.46
Habitat Zone area (ha)			0.13	0.75	2.85	0.06	23.93	0.75	0.34	2.61	6.19
Habitat Hectares (Hha)			0.04	0.27	1.22	0.02	13.21	0.34	0.15	1.21	2.83

Habitat Zone (cont.)			9B	15A	18A	18B	19A	19B	23A	25A
Bioregion			VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP
EVC #: Name			132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG
Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) criteria		2	Y	Y	Y	Y	Y	Y	Y	Y
		3.1	Y	Y	Y	Y	Y	Y	Y	Y
		3.2	N	N	N	N	N	N	N	N
		3.3	Y	Y	Y	Y	Y	Y	Y	Y
		4.1	NA	NA	Y	NA	NA	Y	NA	NA
		4.2	Y	Y	NA	Y	Y	NA	Y	Y
EPBC Listed Community present			NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP
		Max Score	Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Old Trees	10	NA	NA	NA	NA	NA	NA	NA	NA
	Canopy Cover	5	NA	NA	NA	NA	NA	NA	NA	NA
	Lack of Weeds	15	4	4	0	4	4	4	4	4
	Understorey	25	10	10	15	10	10	10	15	15
	Recruitment	10	6	3	3	3	3	3	6	6
	Organic Matter	5	4	4	4	4	4	4	4	5
	Logs	5	NA	NA	NA	NA	NA	NA	NA	NA
	Total Site Score		24	21	22	21	21	21	29	30
	EVC standardiser (x 75/55)		1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
	Adjusted Site Score		32.73	28.64	30.00	28.64	28.64	28.64	39.55	40.91
Landscape Value	Patch Size	10	4	8	8	8	8	8	6	6
	Neighbourhood	10	2	3	3	3	3	3	4	4
	Distance to Core	5	4	4	4	4	4	4	4	4
	Total Landscape Score		10	15	15	15	15	15	14	14
HABITAT SCORE		100	42.73	43.64	45.00	43.64	43.64	43.64	53.55	54.91
Habitat points = #/100		1	0.43	0.44	0.45	0.44	0.44	0.44	0.54	0.55
Habitat Zone area (ha)			0.28	0.36	0.71	0.34	6.16	1.63	11.59	4.02
Habitat Hectares (Hha)			0.12	0.16	0.32	0.15	2.69	0.71	6.21	2.21

Table B5.D.2
Natural Temperate Grassland within the impact area – results of assessments against condition thresholds and EVC benchmarks

Habitat Zone			26A	26B	27A	28A	29A	32A	34A	41A	41D
Bioregion			VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP
EVC #: Name			132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG
Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) criteria		2	Y	Y	Y	Y	Y	Y	Y	Y	Y
		3.1	Y	Y	Y	Y	Y	Y	Y	Y	Y
		3.2	N	N	N	N	N	N	N	N	N
		3.3	Y	Y	Y	Y	Y	Y	Y	Y	Y
		4.1	NA	Y	Y	NA	Y	NA	NA	NA	Y
		4.2	Y	NA	NA	Y	NA	Y	Y	Y	NA
EPBC Listed Community present			NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP
		Max Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Old Trees	10	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Canopy Cover	5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Lack of Weeds	15	7	4	4	4	4	4	2	7	7
	Understorey	25	5	5	10	5	10	15	5	15	10
	Recruitment	10	3	3	6	3	3	6	3	10	3
	Organic Matter	5	4	4	4	4	4	4	4	5	5
	Logs	5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Total Site Score		19	16	24	16	21	29	14	37	25
	EVC standardiser (x 75/55)		1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
	Adjusted Site Score		25.91	21.82	32.73	21.82	28.64	39.55	19.09	50.45	34.09
Landscape Value	Patch Size	10	6	6	1	2	1	6	2	8	8
	Neighbourhood	10	4	4	4	5	3	4	5	5	5
	Distance to Core	5	4	4	3	3	3	4	3	4	4
	Total Landscape Score		14	14	8	10	7	14	10	17	17
HABITAT SCORE		100	39.91	35.82	40.73	31.82	35.64	53.55	29.09	67.45	51.09
Habitat points = #/100		1	0.40	0.36	0.41	0.32	0.36	0.54	0.29	0.67	0.51
Habitat Zone area (ha)			4.08	0.73	0.10	1.08	0.07	6.81	1.14	13.60	0.50
Habitat Hectares (Hha)			1.63	0.26	0.04	0.34	0.03	3.65	0.33	9.18	0.26

Habitat Zone (cont.)			42A	77A	90A	90B	90D	90E	90F	95A
Bioregion			VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP
EVC #: Name			132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG
Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) criteria		2	Y	Y	Y	Y	Y	Y	Y	Y
		3.1	Y	Y	Y	Y	Y	Y	Y	Y
		3.2	N	N	N	N	N	N	N	N
		3.3	N	Y	Y	Y	Y	Y	Y	Y
		4.1	Y	NA	Y	NA	NA	NA	Y	NA
		4.2	NA	Y	NA	Y	Y	Y	NA	Y
EPBC Listed Community present			NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP
		Max Score	Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Old Trees	10	NA	NA	NA	NA	NA	NA	NA	NA
	Canopy Cover	5	NA	NA	NA	NA	NA	NA	NA	NA
	Lack of Weeds	15	6	4	6	6	2	6	9	7
	Understorey	25	5	15	5	5	5	5	5	15
	Recruitment	10	6	6	3	3	6	3	3	6
	Organic Matter	5	4	5	4	4	4	4	5	4
	Logs	5	NA	NA	NA	NA	NA	NA	NA	NA
	Total Site Score		21	30	18	18	17	18	22	32
	EVC standardiser (x 75/55)		1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
	Adjusted Site Score		28.64	40.91	24.55	24.55	23.18	24.55	30.00	43.64
Landscape Value	Patch Size	10	1	4	8	8	8	8	8	8
	Neighbourhood	10	4	4	4	4	4	4	4	5
	Distance to Core	5	3	4	4	4	4	4	4	4
	Total Landscape Score		8	12	16	16	16	16	16	17
HABITAT SCORE		100	36.64	52.91	40.55	40.55	39.18	40.55	46.00	60.64
Habitat points = #/100		1	0.37	0.53	0.41	0.41	0.39	0.41	0.46	0.61
Habitat Zone area (ha)			0.20	4.15	0.66	10.33	1.27	1.45	0.53	0.45
Habitat Hectares (Hha)			0.07	2.19	0.27	4.19	0.50	0.59	0.24	0.27

Table B5.D.3
Natural Temperate Grassland within the impact area – results of assessments against condition thresholds and EVC benchmarks

Habitat Zone			97A	98A	100A	102A	102B	124A	130A	136A	138A
Bioregion			VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP
EVC #: Name			132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG
Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) criteria		2	Y	Y	Y	Y	Y	Y	Y	Y	Y
		3.1	Y	Y	Y	Y	Y	Y	Y	Y	Y
		3.2	N	N	N	N	N	N	N	N	N
		3.3	Y	Y	Y	Y	Y	Y	Y	Y	Y
		4.1	NA	Y	Y	Y	Y	Y	Y	Y	Y
		4.2	Y	NA	NA	NA	NA	NA	NA	NA	NA
EPBC Listed Community present			NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP
		Max Score	Score	Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Old Trees	10	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Canopy Cover	5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Lack of Weeds	15	4	0	6	6	6	6	9	9	9
	Understorey	25	15	5	5	5	10	5	5	5	5
	Recruitment	10	3	3	3	3	3	3	3	3	3
	Organic Matter	5	4	4	4	5	5	5	4	4	4
	Logs	5	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Total Site Score		26	12	18	19	24	19	21	21	21
	EVC standardiser (x 75/55)		1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
	Adjusted Site Score		35.45	16.36	24.55	25.91	32.73	25.91	28.64	28.64	28.64
Landscape Value	Patch Size	10	8	1	1	2	2	1	1	1	1
	Neighbourhood	10	5	2	3	3	3	3	2	2	1
	Distance to Core	5	4	3	3	3	3	3	3	3	3
	Total Landscape Score		17	6	7	8	8	7	6	6	5
HABITAT SCORE		100	52.45	22.36	31.55	33.91	40.73	32.91	34.64	34.64	33.64
Habitat points = #/100		1	0.52	0.22	0.32	0.34	0.41	0.33	0.35	0.35	0.34
Habitat Zone area (ha)			0.75	0.21	0.09	0.63	0.97	0.23	0.13	0.51	0.37
Habitat Hectares (Hha)			0.39	0.05	0.03	0.21	0.40	0.08	0.04	0.17	0.12

Habitat Zone (cont.)			140A	142A	146A	148A	188A	190A	194A	198A
Bioregion			VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP
EVC #: Name			132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG
Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) criteria		2	Y	Y	Y	Y	Y	Y	Y	Y
		3.1	Y	Y	Y	Y	Y	Y	Y	Y
		3.2	N	N	N	N	N	N	N	N
		3.3	Y	Y	Y	Y	Y	Y	N	Y
		4.1	Y	Y	Y	Y	NA	NA	NA	NA
		4.2	NA	NA	NA	NA	Y	Y	Y	Y
EPBC Listed Community present			NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP
		Max Score	Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Old Trees	10	NA	NA	NA	NA	NA	NA	NA	NA
	Canopy Cover	5	NA	NA	NA	NA	NA	NA	NA	NA
	Lack of Weeds	15	6	6	6	0	4	4	0	7
	Understorey	25	5	5	5	5	5	5	15	5
	Recruitment	10	6	3	3	6	6	3	3	3
	Organic Matter	5	4	4	4	4	4	4	4	4
	Logs	5	NA	NA	NA	NA	NA	NA	NA	NA
	Total Site Score		21	18	18	15	19	16	22	19
	EVC standardiser (x 75/55)		1.36	1.36	1.36	1.36	1.36	1.36	1.36	1.36
	Adjusted Site Score		28.64	24.55	24.55	20.45	25.91	21.82	30.00	25.91
Landscape Value	Patch Size	10	1	1	1	1	6	8	8	4
	Neighbourhood	10	2	1	3	2	4	4	5	4
	Distance to Core	5	3	3	3	3	4	4	4	4
	Total Landscape Score		6	5	7	6	14	16	17	12
HABITAT SCORE		100	34.64	29.55	31.55	26.45	39.91	37.82	47.00	37.91
Habitat points = #/100		1	0.35	0.30	0.32	0.26	0.40	0.38	0.47	0.38
Habitat Zone area (ha)			0.43	0.01	0.55	0.32	11.24	1.45	0.65	0.48
Habitat Hectares (Hha)			0.15	0.004	0.17	0.09	4.49	0.55	0.30	0.18

Table B5.D.4
Natural Temperate Grassland within the impact area – results of assessments against condition thresholds and EVC benchmarks

Habitat Zone (cont.)			200A	202A	206A	212A	214A	216A	234A
Bioregion			VVP	VVP	VVP	VVP	VVP	VVP	VVP
EVC #: Name			132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG
Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) criteria		2	Y	Y	Y	Y	Y	Y	Y
		3.1	Y	Y	Y	Y	Y	Y	Y
		3.2	N	N	N	N	N	N	N
		3.3	Y	Y	Y	Y	Y	Y	Y
		4.1	Y	NA	NA	Y	NA	NA	Y
		4.2	NA	Y	Y	NA	Y	Y	NA
EPBC Listed Community present			NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP
		Max Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Old Trees	10	NA	NA	NA	NA	NA	NA	NA
	Canopy Cover	5	NA	NA	NA	NA	NA	NA	NA
	Lack of Weeds	15	4	4	0	4	4	4	9
	Understorey	25	5	10	10	5	10	15	5
	Recruitment	10	3	6	3	3	3	6	6
	Organic Matter	5	4	4	4	4	4	4	4
	Logs	5	NA	NA	NA	NA	NA	NA	NA
	Total Site Score		16	24	17	16	21	29	24
	EVC standardiser (x 75/55)		1.36	1.36	1.36	1.36	1.36	1.36	1.36
	Adjusted Site Score		21.82	32.73	23.18	21.82	28.64	39.55	32.73
Landscape Value	Patch Size	10	1	2	1	1	4	6	1
	Neighbourhood	10	4	3	3	3	4	4	2
	Distance to Core	5	3	3	3	3	4	4	3
	Total Landscape Score		8	8	7	7	12	14	6
HABITAT SCORE		100	29.82	40.73	30.18	28.82	40.64	53.55	38.73
Habitat points = #/100		1	0.30	0.41	0.30	0.29	0.41	0.54	0.39
Habitat Zone area (ha)			0.25	0.50	0.68	0.16	1.20	1.94	0.01
Habitat Hectares (Hha)			0.07	0.20	0.20	0.05	0.49	1.04	0.002

Habitat Zone (cont.)			4050A	4077A	4099A	4103A	4104A	TOTAL
Bioregion			VVP	VVP	VVP	VVP	VVP	
EVC #: Name			132_61: PG	132_61: PG	132_61: PG	132_61: PG	132_61: PG	
Natural Temperate Grassland of the Victorian Volcanic Plain (NTGVVP) criteria		2	Y	Y	Y	Y	Y	
		3.1	Y	Y	N	Y	Y	
		3.2	N	N	N	N	N	
		3.3	N	Y	Y	Y	Y	
		4.1	NA	Y	Y	Y	Y	
		4.2	Y	NA	NA	NA	NA	
EPBC Listed Community present			NTGVVP	NTGVVP	NTGVVP	NTGVVP	NTGVVP	
		Max Score	Score	Score	Score	Score	Score	
Site Condition	Large Old Trees	10	NA	NA	NA	NA	NA	
	Canopy Cover	5	NA	NA	NA	NA	NA	
	Lack of Weeds	15	6	6	6	6	6	
	Understorey	25	5	5	5	5	10	
	Recruitment	10	6	3	3	6	3	
	Organic Matter	5	5	2	4	5	3	
	Logs	5	NA	NA	NA	NA	NA	
	Total Site Score		22	16	18	22	22	
	EVC standardiser (x 75/55)		1.36	1.36	1.36	1.36	1.36	
	Adjusted Site Score		30.00	21.82	24.55	30.00	30.00	
Landscape Value	Patch Size	10	8	1	1	1	1	
	Neighbourhood	10	4	1	1	1	1	
	Distance to Core	5	3	3	3	3	3	
	Total Landscape Score		15	5	5	5	5	
HABITAT SCORE		100	45.00	26.82	29.55	35.00	35.00	
Habitat points = #/100		1	0.45	0.27	0.30	0.35	0.35	
Habitat Zone area (ha)			0.80	0.11	0.16	0.47	0.15	**135.29**
Habitat Hectares (Hha)			0.36	0.03	0.05	0.16	0.05	**66.03**

Grey Box Woodland and Derived Grasslands of South-Eastern Australia

Table B5.D.5
Grey Box Woodland within the impact area – results of assessments against condition thresholds and EVC benchmarks

Habitat Zone			53A	93A	93B	208B	210	3001	3002	3003
Bioregion			VVP	VVP	VVP	VVP	VVP	VVP	VVP	VVP
EVC #: Name			803: PW	803: PW	803: PW	803: PW	803: PW	803: PW	803: PW	803: PW
Grey Box Grassy Woodlands (GBW) and Derived Grasslands (DG) of South-Eastern Australia criteria		1B	Y	Y	Y	Y	Y	Y		
		1C	Y	Y	Y	Y	Y	Y		
		1A	Y	Y	Y	Y	Y	Y		
		2A	NA	NA	NA	NA	NA	NA		
		2B	NA	NA	NA	NA	NA	NA		
		3A	NA	NA	NA	NA	Y	Y		
		3B	NA	NA	NA	NA	Y	Y		
		4A	NA	NA	NA	NA	Y	NA		
		4B	NA	NA	NA	NA	Y	Y		
		5A	Y	Y	Y	Y	N	N		
		5B	Y	Y	Y	Y	NA	NA		
		5C	Y	Y	Y	Y	NA	NA		
EPBC Listed Community present			GBW-DG	GBW-DG	GBW-DG	GBW-DG	GBW	GBW	GBW	GBW
		Max Score	Score	Score	Score	Score	Score	Score	Score	Score
Site Condition	Large Old Trees	10	0	0	3	3	6	4	4	6
	Canopy Cover	5	0	0	0	3	5	3	3	3
	Lack of Weeds	15	4	4	4	7	7	4	4	0
	Understorey	25	15	15	15	15	10	15	15	15
	Recruitment	10	5	10	5	10	10	10	6	6
	Organic Matter	5	4	5	5	5	5	5	5	3
	Logs	5	0	0	0	0	0	4	4	5
	Total Site Score		28	34	32	43	43	45	41	38
	EVC standardiser (x 75/55)		NA	NA	NA	NA	NA	NA	NA	NA
	Adjusted Site Score		28	34	32	43	43	45	41	38
Landscape Value	Patch Size	10	8	8	8	8	8	8	8	8
	Neighbourhood	10	5	5	5	6	4	4	4	4
	Distance to Core	5	4	4	4	4	4	4	4	4
	Total Landscape Score		17	17	17	18	16	16	16	16
HABITAT SCORE		100	45	51	49	61	59	61	57	54
Habitat points = #/100		1	0.45	0.51	0.49	0.61	0.59	0.61	0.57	0.54
Habitat Zone area (ha)			4.09	1.27	4.75	4.46	2.13	4.12	2.97	6.30
Habitat Hectares (Hha)			1.84	0.65	2.33	2.72	1.26	2.51	1.70	3.40

Habitat Zone			3004	3005	3006	3007	TOTAL
Bioregion			VVP	VVP	VVP	CVU	
EVC #: Name			803: PW	803: PW	803: PW	71: HHrW	
Grey Box Grassy Woodlands (GBW) and Derived Grasslands (DG) of South-Eastern Australia criteria		1B					
		1C					
		1A					
		2A					
		2B					
		3A					
		3B					
		4A					
		4B					
		5A					
		5B					
		5C					
EPBC Listed Community present			GBW	GBW	GBW	GBW	
		Max Score	Score	Score	Score	Score	
Site Condition	Large Old Trees	10	6	10	0	8	
	Canopy Cover	5	3	5	3	5	
	Lack of Weeds	15	4	9	9	9	
	Understorey	25	15	20	15	20	
	Recruitment	10	6	10	6	6	
	Organic Matter	5	3	3	3	5	
	Logs	5	4	4	2	5	
	Total Site Score		41	61	38	58	
	EVC standardiser (x 75/55)		NA	NA	NA	NA	
	Adjusted Site Score		41	61	38	58	
Landscape Value	Patch Size	10	8	8	8	8	
	Neighbourhood	10	3	5	4	5	
	Distance to Core	5	4	4	4	4	
	Total Landscape Score		15	17	16	17	
HABITAT SCORE		100	56	78	54	75	
Habitat points = #/100		1	0.56	0.78	0.54	0.75	
Habitat Zone area (ha)			3.23	71.82	20.01	43.45	**168.61**
Habitat Hectares (Hha)			1.81	56.02	10.81	32.59	**117.63**

Chapter B6
Indigenous Cultural Heritage

Summary of key findings:

- A detailed assessment of Indigenous cultural heritage values within Melbourne Airport's Third Runway (M3R) study area has been completed. This assessment was undertaken in accordance with the requirements of the Commonwealth and Victorian governments.
- The assessment identified 33 previously recorded Aboriginal cultural heritage places within the study area. These consisted of stone artefact scatters, low density artefact distributions, and scarred trees. The results of the survey and test excavations (stage 1 of the Cultural Heritage Management Plan's complex assessment) have combined a large number of these existing values. There are now 14 Aboriginal places in the study area, with final Aboriginal place numbers still to be determined for some of them.
- Melbourne Airport is currently preparing a Cultural Heritage Management Plan (CHMP) 16792 (Biosis Pty Ltd 2020) in consultation with Wurundjeri Woi-wurrung Cultural Heritage Aboriginal Corporation (Wurundjeri). Wurundjeri is the Registered Aboriginal Party (RAP) for the region that includes Melbourne Airport. The CHMP will detail the findings of the assessment, and the specific heritage management requirements to be implemented to avoid, manage and mitigate impacts to heritage values. These measures are likely to include, at a minimum, cultural inductions for people working on M3R and procedures for the archaeological salvage and reburial of cultural material.
- The CHMP will be evaluated by Wurundjeri and follows best practice under the Victorian state heritage legislation.

CHAPTER B6 CONTENTS

CHAPTER B6 FIGURES

CHAPTER B6 FIGURES (cont.)

CHAPTER B6 TABLES

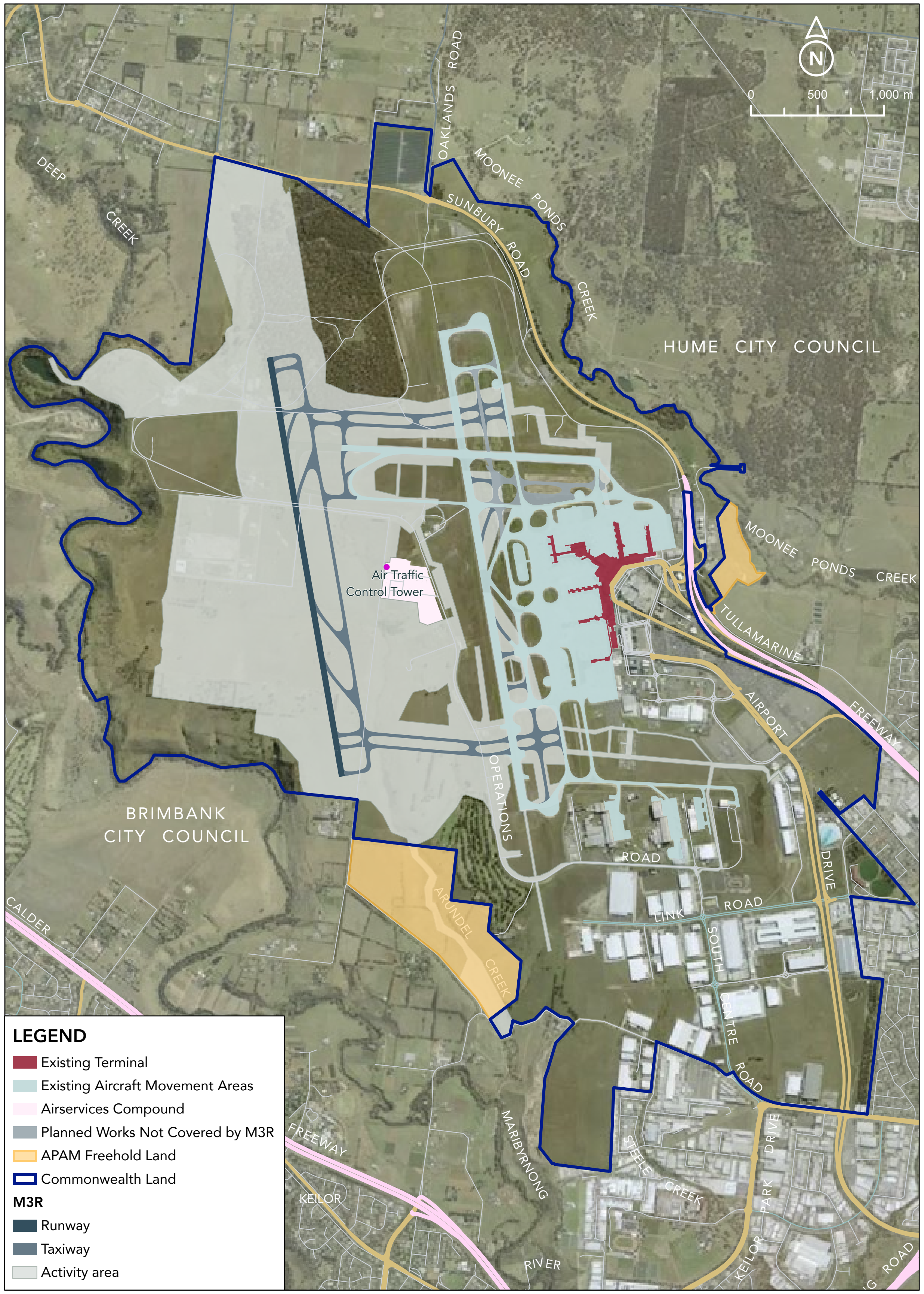
B6.1 INTRODUCTION

This chapter describes the Indigenous cultural heritage values of the project area (referred to as the study area) and the legislation and policy requirements applicable to Melbourne Airport's Third Runway (M3R). It also outlines the associated assessment methodology for identification of Indigenous cultural heritage values. In addition, it provides an assessment of the potential impacts, then identifies measures to specifically avoid, manage, mitigate and/or monitor these impacts.

For the purposes of this chapter, the study area refers to the M3R disturbance footprint (**Figure B6.1**).

Note: at the time of drafting, a Cultural Heritage Management Plan (CHMP) investigation was in progress. Final Aboriginal place numbers and measures to specifically avoid, manage, mitigate and/or monitor impacts cannot therefore be finalised at this time. However, an indication of the potential impacts and impact risk is provided based on the M3R footprint. Final measures to specifically avoid, manage, mitigate and/or monitor impacts on identified Aboriginal places are subject to the completion of the CHMP and further consultation with the Wurundjeri Woi-wurrung Cultural Heritage Aboriginal Corporation (Wurundjeri), the Registered Aboriginal Party (RAP) for the region that includes Melbourne Airport.

Figure B6.1
Extent of the cultural heritage study area



B6.2 METHODOLOGY

B6.2.1 Methodology and assumptions

Aboriginal Victoria does not have jurisdiction on Commonwealth land under the Airports Act 1996 (Airports Act) Section 112 (2), and therefore the provisions of the Victorian Aboriginal Heritage Act 2006 do not apply on Melbourne Airport land. However, to manage potential impacts to Aboriginal cultural heritage at Melbourne Airport in a way that is comprehensive, Cultural Heritage Management Plans (CHMPs) can be completed on a voluntary basis under the Victorian Aboriginal Heritage Act. They are an appropriate management methodology to ensure that Commonwealth requirements under the Airports Act 1996 (Cth) (the Airport Act) and the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) are met. This process also ensures detailed consultation with the Wurundjeri.

A Notice of Intent to prepare a voluntary CHMP under the Aboriginal Heritage Act was submitted on behalf of Melbourne Airport to the Secretary, Department of Premier and Cabinet (DPC), and Wurundjeri which is the relevant Registered Aboriginal Party (RAP), before the commencement of the CHMP. Aboriginal Victoria (AV) has allocated number 16792 to this assessment.

Once approved by the evaluating authority (i.e. the Wurundjeri), the approved CHMP 16792 will be made available to Melbourne Airport for use in ongoing planning and construction requirements for M3R.

Investigation and assessment of cultural (Indigenous) heritage values was undertaken in accordance with relevant Victorian and Commonwealth heritage guidelines and criteria. These guidelines and criteria include:

- Victorian Aboriginal Heritage Regulations 2018 (Aboriginal Heritage Regulations (Vic) 2018)
- Guide to Preparing Aboriginal Cultural Heritage Management Plans (Aboriginal Victoria 2016)
- Guidelines for Conducting and Reporting on Aboriginal Cultural Heritage Investigations (Aboriginal Victoria 2012)
- Standards for Recording Victorian Aboriginal Heritage Places and Objects (Aboriginal Affairs Victoria 2008; 2013)
- Guidelines for the Assessment of Places for the National Heritage List (Commonwealth of Australia 2009)
- Commonwealth Heritage List criteria (Commonwealth of Australia 2020).

CHMP 16792 will also include separate long term maintenance conditions for cultural heritage places. These will address the ongoing conservation of cultural heritage places during standard operations and land management activities at Melbourne Airport.

The investigation of cultural heritage values under CHMP 16792 includes a review of the region's history, and background research of state databases and resources (the 'desktop assessment'), a field survey (the 'standard assessment'), archaeological excavations (the 'complex assessment') and a significance assessment in order to understand the study area's cultural heritage values and their level of importance. At the time of this submission, the CHMP desktop assessment, standard assessment and stage 1 of the complex assessment have been completed. The complex assessment completed to date (i.e. stage 1) is the minimum level of investigation required to inform the nature, extent and significance of the Indigenous heritage places within the study area.

The complex assessment method was determined and agreed to between Biosis (on behalf of Melbourne Airport) and Wurundjeri at the post-standard assessment project meeting on 25 February 2020. Subsequently, the scope and aims of stage 1 of the complex assessment were communicated to Wurundjeri's Heritage Unit Manager and Elders via email correspondence on 22 September 2020. It was explained that the stage 1 excavations would be completed within the framework of the previously agreed method, and were required to inform this chapter of the MDP. Wurundjeri responded and indicated they had no further comments on this approach.

Methodology for each stage of the investigation is discussed below, and the results of investigations presented in Section B6.4. Throughout the CHMP process, consultation in the form of formal meetings, email correspondence and representative attendance during field assessment with Wurundjeri occurred. All Traditional Owner consultation was carried out following:

- Guidelines for Ethical Research in Australian Indigenous Studies (Australian Institute of Aboriginal and Torres Strait Islander Studies 2012)
- Victorian Aboriginal Heritage Act 2006 (Aboriginal Heritage Act (Vic) 2006), and Regulations 2018 (Aboriginal Heritage Regulations (Vic) 2018)
- Guidelines for Conductions and Reporting on Aboriginal Cultural Heritage Management Plans (Aboriginal Victoria 2012)
- Ask First – A Guide to respecting Indigenous heritage places and values (Australian Heritage Commission 2002).

B6.2.2 Desktop assessment

A desktop assessment was undertaken to establish known and potential cultural heritage values in the study area. The assessment included consultation with Indigenous stakeholders, a review of historic aerial photography, and searches of applicable heritage registers and reports. The results were used to develop a predictive model of heritage potential in the study area, which was then used to guide the field survey.

The Australian Heritage Database and the Victorian Aboriginal Heritage Register (VAHR) were searched for information on cultural heritage values in the study area. The Australian Heritage Database includes World and National Heritage Lists. The VAHR contains all records of Indigenous cultural values and heritage places across Victoria.

B6.2.3 Standard assessment survey

The standard assessment field survey was undertaken to ground truth (through direct observation and measurement) the predictive model and predictive statement developed in the desktop assessment, identify and record Indigenous heritage places (referred to on the VAHR and in the Victorian Aboriginal Heritage Regulations 2018 as 'Aboriginal cultural heritage places' and 'Aboriginal places'), and identify areas with potential for Indigenous heritage. The field survey targeted the previously unassessed areas of the M3R footprint. The areas assessed by the previous Runway Development Plan (RDP) CHMP 12774 did not require re-survey unless a recorded Aboriginal place within M3R was located there.

The field survey was undertaken in one phase, in November and December 2019. It was conducted on foot across the M3R footprint (outside areas covered by an existing CHMP) apart from some airside locations where access was precluded. CHMP 12774 has documented that airside areas have been heavily impacted by existing airport and runway constructions. These areas were recorded as part of the 'modified basalt plains' landform within the CHMP.

The field survey produced a series of identified and potential locations for cultural heritage, which were mapped along with results of the desktop assessment to provide locations for further investigation. These were then examined on site in detail. Visible surface features were recorded using digital photography (with a Nikon AW120 camera). Location features were recorded with Trimble Differential Global Positioning System with GNSS Receiver (accurate to +/-1 metre after processing) and transferred to ArcGIS for digital mapping.

B6.2.4 Complex assessment test excavation

Archaeological test excavations for stage 1 phase of the CHMP complex assessment were carried out to obtain the minimum level of data required to determine the nature, extent and significance of known cultural heritage places, and also identify those areas where there is potential for archaeological deposits to be present. These excavations have been undertaken around locations of known places which showed surface evidence of cultural material during the field survey, suggesting the presence of subsurface features in the area. Excavations were also undertaken where ground conditions were too obscured to show any evidence of surface material, and where the predictive model indicates cultural material is likely to be present (e.g. Arundel Creek floodplain). The test excavations completed to date have focused on establishing the stratigraphy and spatial extent of Indigenous cultural heritage places using a combination of hand and mechanical excavation in order to more fully discuss the potential impact to these places by M3R.

The full CHMP excavation methodology was endorsed by Wurundjeri Elders during the CHMP consultation process. The now completed stage 1 program was also endorsed, as this operates within the full CHMP methodology. Proposed updates to known and newly identified Indigenous heritage places were also endorsed by the Elders via the Cultural Heritage Unit for Wurundjeri following provision of the stage 1 field results.

Note: although stage 1 of testing has been undertaken to inform this technical chapter, the full complex assessment must be completed for CHMP 16792. Some sections of this report cannot be completed, as formal heritage management actions for each Indigenous place can be determined only at the completion of the CHMP field assessment. Further consultation is also required with Wurundjeri to determine specific management conditions required within the CHMP and once this fieldwork is complete.

B6.2.5 Significance assessment

A significance assessment of each Indigenous heritage place using Commonwealth Heritage List criteria (CHL) (Commonwealth of Australia, 2020) and the CHMP significance assessment process was undertaken to understand the heritage values at each heritage place and their level of importance. These criteria are discussed in more detail in Section B6.3.2.2.

Note: the significance assessment is informed by the stage 1 results of the complex assessment for CHMP 16792. The current assessment proposes a number of updates to known and newly recorded cultural heritage values within the M3R footprint. Based on the results obtained to date, it is unlikely that the remaining extent of complex assessment will identify additional cultural heritage material that will alter the extent or nature of the newly defined places, which in turn inform their significance.

B6.3 STATUTORY AND POLICY REQUIREMENTS

Knowledge of cultural heritage legislation is essential when assessing sites, places or items of cultural heritage significance. Commonwealth and Victorian requirements applicable to cultural heritage values in the study area are discussed in this section.

B6.3.1 Commonwealth legislation

Melbourne Airport is located on Commonwealth land. The Airports Act and EPBC Act are the key pieces of legislation that set the regulatory framework for M3R and this assessment, as discussed in Chapter A8: Assessment and Approvals process. However, consideration has also been given to relevant Victorian legislation (including environmental planning instruments, policies, and guidelines) where appropriate.

B6.3.1.1 Airports Act 1996

Section 112(2) of the Airports Act states that 'the land use, planning and building controls within Part 5 of the Commonwealth Act operate to the exclusion of a law of a state'. In Victoria this is applicable to land use planning legislation such as the Victorian *Planning and Environment Act 1987* and the *Aboriginal Heritage Act*.

Under the Airports Act, it is understood that the intention is to 'cover the field' of heritage protection. However, the preference of Melbourne Airport when assessing heritage is to address all requirements under the Commonwealth legislation, while also considering the requirements of Victorian legislation to inform recommendations and follow best practice.

Therefore the implications for the project were assessed in relation to both Commonwealth and Victorian legislation:

- Matters listed under the EPBC Act, associated policy statements and significant impacts guidelines including:
    - Matters of National Environmental Significance (MNES) *Significant impact guidelines 1.1* of the EPBC Act (Commonwealth of Australia 2013a), and;
    - Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies *Significant impact guidelines 1.2* of the EPBC Act (Commonwealth of Australia 2013b).
- Matters listed under the Aboriginal Heritage Act and the Aboriginal Heritage Regulations.

B6.3.1.2 Environment Protection and Biodiversity Act 1999 – Significant Impact Guidelines 1.2

A significant impact on the environment is an impact that is 'important, notable, or of consequence, having regard to its context or intensity' as defined in *Actions on, or impacting upon Commonwealth land, and actions by Commonwealth agencies, Significant impact guidelines 1.2 Environment Protection and Biodiversity Conservation Act 1999 (Significant impact guidelines 1.2)* (DSEWPC, 2013). The significance of an impact is determined according to criteria outlined in the Significant impact guidelines 1.2.

A significant impact is considered likely if there is 'a real or not remote chance or possibility' of the impact occurring. There does not need to be a greater than 50 per cent chance of the significant impact happening.

The likelihood of a significant impact is assessed according to the sensitivity, value and quality of the environment that is impacted and according to the intensity, duration, magnitude and geographic extent of the impacts as described in these requirements.

Under the Significant Impact Guidelines 1.2, step 4 outlines self-assessment criteria to determine if an impact is considered significant. Of relevance to this chapter are impacts on heritage, specifically whether M3R would:

- Permanently destroy, remove or substantially alter the fabric (physical material including structural elements and other components, fixtures, contents, and objects) of a heritage place?
- Involve extension, renovation, or substantial alteration of a heritage place in a manner which is inconsistent with the heritage values of the place?
- Involve the erection of buildings or other structures adjacent to, or within important sight lines of, a heritage place which are inconsistent with the heritage values of the place?
- Substantially diminish the heritage value of a heritage place for a community or group for which it is significant?
- Substantially alter the setting of a heritage place in a manner which is inconsistent with the heritage values of the place?
- Substantially restrict or inhibit the existing use of a heritage place as a cultural or ceremonial site?

The assessment of potential impacts outlined in Section B6.5, once finalised, will adequately address these questions. Harm will be mitigated through avoidance and mitigation strategies as discussed in Section B6.6. Based on assessments completed to date, the impacts to Indigenous cultural heritage and the whole of environment are considered significant as defined by the *Significant impact guidelines 1.2*. A discussion on the acceptability of this impact is contained in Chapter E6: Summary Commitments and Conclusion.

B6.3.1.3 Australian Heritage Council Act 2003

The Australian Heritage Council Act 2003 (Cth) (AHC Act) provides for the establishment of the Australian Heritage Council (AHC) which is the principal advisory group to the Commonwealth Government on heritage issues and administers the National Heritage List (NHL). The NHL covers places with outstanding natural, Indigenous or historic heritage value to the nation. The AHC assesses whether a nominated place has heritage values against of the nine relevant criteria and makes a recommendation to the Minister on that basis. The Minister makes the final decision on listing and may take into account social and economic matters.

B6.3.2 Victorian legislation

B6.3.2.1 Aboriginal Heritage Act 2006

The Aboriginal Heritage Act is administered by AV and is the Victorian Government's key cultural heritage legislation for Indigenous heritage. The Aboriginal Heritage Act identifies and protects Indigenous heritage places and objects in Victoria. This includes Indigenous artefacts and objects, Indigenous archaeological sites, historic buildings, story places, and cultural knowledge. The Aboriginal Heritage Act established the VAHR that records all the Indigenous heritage places and objects listed above.

However, because AV does not have jurisdiction on Commonwealth land the provisions of the Aboriginal Heritage Act do not apply to Commonwealth property. Obtaining an approved CHMP or Cultural Heritage Permit would be the normal process for obtaining statutory approval for any works that may cause harm to places listed on the VAHR. As discussed in Section B6.2, while AV does not have jurisdiction on Commonwealth land, Melbourne Airport will meet the standards of state heritage assessment, and a voluntary CHMP under the Aboriginal Heritage Act was considered appropriate to facilitate this.

The Wurundjeri Woi-wurrung Cultural Heritage Aboriginal Corporation (Wurundjeri) is the RAP for the region that includes the study area. The RAP elected to evaluate the CHMP on 12 September 2019.

B6.3.2.2 Description of significance criteria

A significance assessment of each Indigenous heritage place has been undertaken using Commonwealth and Victorian standard significance criteria and thresholds to understand heritage values and their level of importance. These criteria are applied with a 'significance threshold' to judge the level of significance of a place's heritage value by considering how important these values are.

Significance assessments of heritage on Commonwealth land use the Commonwealth Heritage List (CHL) criteria. Items of state or local significance can be listed on the CHL if they are located on Commonwealth land. To reach the threshold for the National Heritage List a place must have 'outstanding' heritage value to the nation by comparing it to other, similar types of places. To be entered in the CHL, a place must have 'significant' heritage value. Under the CHL nomination process, nominations must set out the qualities or values of the place that make it significant by indicating how the place meets one or more of the Commonwealth heritage significance criteria.

The CHL criteria (Commonwealth of Australia, 2020) are:

1. The place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history
2. The place has significant heritage value because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history
3. The place has significant heritage value because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history
4. The place has significant heritage value because of the place's importance in demonstrating the principal characteristics of:
    a. a class of Australia's natural or cultural places; or
    b. a class of Australia's natural or cultural environments
5. The place has significant heritage values because of the place's importance in exhibiting particular aesthetic characteristics values by a community or cultural group
6. The place has significant heritage value because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period
7. The place has significant heritage value because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons
8. The place has significant heritage value because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history
9. The place has significant heritage value because of the place's importance as part of Indigenous tradition.

The NHL criteria (Commonwealth of Australia, 2009) are:

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

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

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

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

i. A class of Australia's natural or cultural places

ii. A class of Australia's natural or cultural environments.

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

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

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

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

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

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

Cultural heritage value assessments for Indigenous heritage in Victoria are broadly defined in the Burra Charter as the 'aesthetic, historic, scientific or social values for past, present or future generations' (Marquis-Kyle and Walker, 1994). Although there are no formal guidelines for the assessment of significance of Indigenous archaeological places in Victoria, the definition of cultural heritage significance under section 4 of the Aboriginal Heritage Act includes archaeological, anthropological, contemporary, historical, scientific, social or spiritual significance and significance in accordance with Indigenous tradition. These criteria are typically condensed and assessed as cultural and scientific significance as part of the CHMP process in Victoria.

Many Indigenous heritage places have cultural significance to a specific Indigenous community. It is common practice in Victoria for the Indigenous community to determine the cultural significance of Indigenous heritage places. This determination is typically provided as a statement of cultural significance (either verbally or in written format) during CHMP consultation. The Indigenous community may not always provide a statement of cultural significance, particularly if cultural information is considered dangerous or is culturally restricted. A broad statement of cultural significance may also be provided for an area or cultural places where the traditional owner group(s) have only limited knowledge of ancestral occupation of that area.

Scientific significance is based on the capacity of Indigenous places to provide us with historical, cultural or social information. The scientific significance assessment methodology is based on scores for research potential (divided into 'place contents' and 'place condition') and for representativeness. This system is derived from Bowler (1981). Place contents refers to all tangible cultural materials and organic remains associated with human activity at a place. Place condition refers to the degree of disturbance and integrity of the place to the contents of a place at the time it was recorded. The representativeness of an Indigenous cultural heritage place is assessed by whether the place is common, occasional or rare in a given region. Assessments of representativeness are subjective and can be affected by current knowledge of the distribution and number of Indigenous places, and vary from place to place depending on the extent of archaeological research. The determination of scientific significance for a heritage place is expressed as a statement of significance.

In this instance, Indigenous heritage values have been assessed against the relevant NHL and CHL criteria, and the thresholds in **Figure B6.1** applied, to determine the level at which the place is considered significant. Note that all Indigenous heritage values are protected under the Aboriginal Heritage Act, which does not provide significance thresholds to listings. The VAHR, however, does record different levels of significance which are important in determining appropriate management requirements.

Table B6.1
Significance thresholds

Definition	Threshold
High Significance – Place / element of outstanding or exceptional heritage value that embodies National and Commonwealth criteria in its own right and makes an irreplaceable contribution to the significance of the place as a whole.	National / state Significance: Likely to fulfil criteria for listing on the NHL or VAHR
Moderate Significance – Place / element of heritage value that meets Commonwealth heritage significance in its own right or contributes to the significance of the place as a whole.	State Significance: Likely to fulfil criteria for listing on the VAHR or CHL
Minor Significance – Place / element of heritage value that has some Commonwealth significance in its own right or contributes to the significance of the place as a whole.	Local Significance: Likely to fulfil criteria for listing on the VAHR or CHL.
Negligible Significance – Place / element does not meet Commonwealth or state heritage significance in its own right or is intrusive to the significance of the place as a whole.	Unlikely to fulfil criteria for any heritage listings.

B6.4 EXISTING CONDITIONS

This section details the existing conditions of the study area, and the results of the cultural heritage assessment.

B6.4.1 Desktop assessment

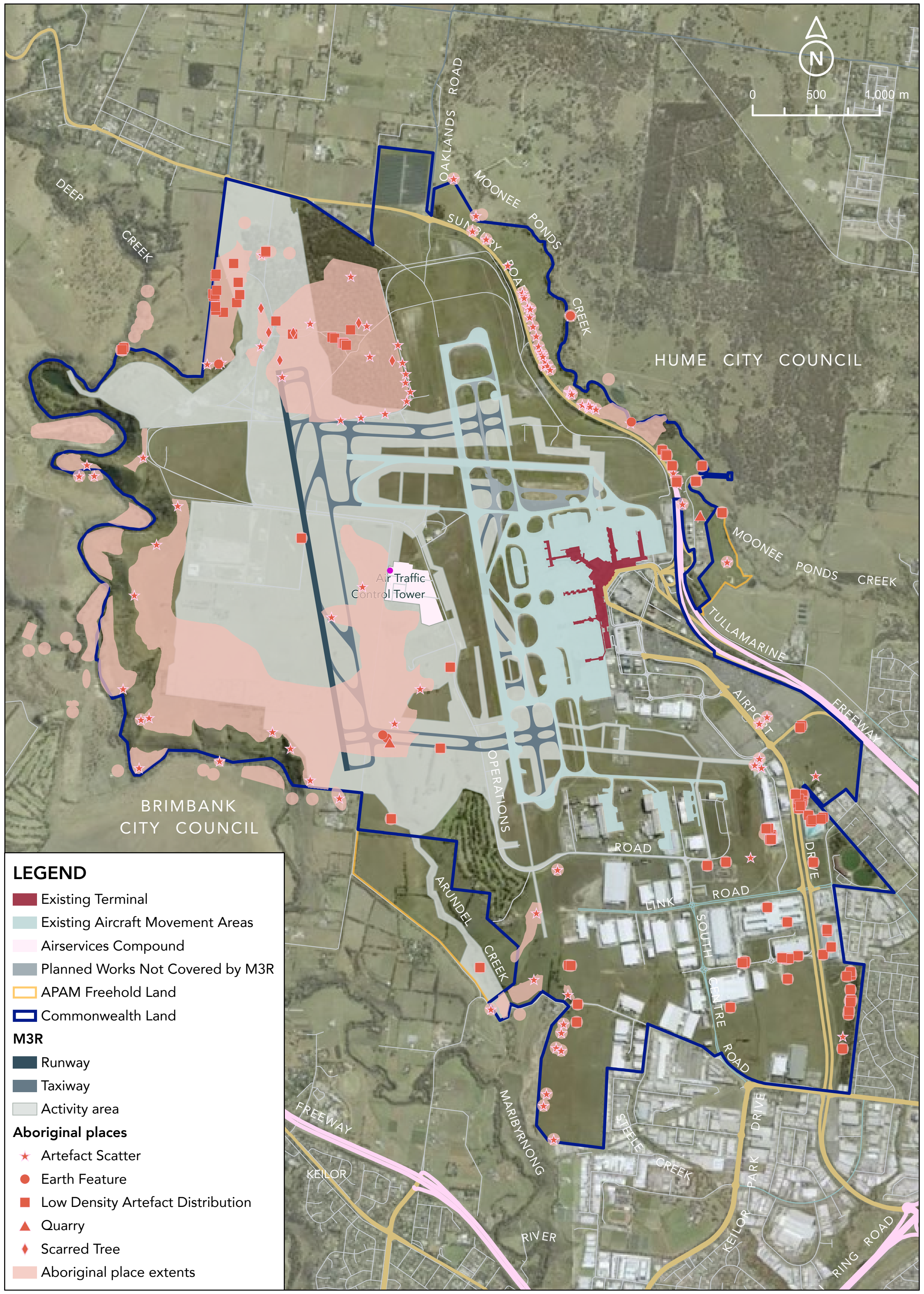
B6.4.1.1 Heritage register searches

At the commencement of M3R, there were 33 previously recorded Indigenous archaeological places within the study area registered on the VAHR (**Table B6.2** and **Figure B6.2**). The places comprise 79 individual place 'components', which include the single GPS point locations of all isolated artefacts and Low Density Artefact Distribution (LDAD) registrations. Components also include individual scarred trees and earth features, where part of a multi-component place such as VAHR 7822-3872 (Glenara Creek 1).

Table B6.2
Heritage register search results – VAHR places in the study area

Name	Register	Listing No.	Place Type
Radar Hill 1	VAHR	7822-0800	Artefact scatter
Radar Hill 2	VAHR	7822-0801	Artefact scatter
Radar Hill 3	VAHR	7822-0802	Scarred tree
Radar Hill 4	VAHR	7822-0803	Artefact scatter
Radar Hill 5	VAHR	7822-0804	Scarred tree
Radar Hill 6	VAHR	7822-0805	Artefact scatter
Radar Hill 7	VAHR	7822-0806	Scarred tree
Radar Hill 9	VAHR	7822-0808	Artefact scatter/earth feature
Radar Hill 10	VAHR	7822-0809	Artefact scatter
Radar Hill 11	VAHR	7822-0810	Artefact scatter
Radar Hill 12	VAHR	7822-0811	Artefact scatter
Radar Hill 13	VAHR	7822-0812	Artefact scatter
Radar Hill 14	VAHR	7822-0813	Artefact scatter
Radar Hill 15	VAHR	7822-0814	Scarred tree
Radar Hill 16	VAHR	7822-0815	Artefact scatter
Radar Hill 17	VAHR	7822-0816	Artefact scatter
Radar Hill 18	VAHR	7822-0817	Artefact scatter
Radar Hill 19	VAHR	7822-0818	Artefact scatter
Radar Hill 22	VAHR	7822-0821	Artefact scatter
Radar Hill 24	VAHR	7822-1116	Artefact scatter
Radar Hill 25	VAHR	7822-1117	Artefact scatter
Melbourne Airport SE 3	VAHR	7822-1335	Artefact scatter
Melbourne Airport Unigas 2	VAHR	7822-1803	Artefact scatter
Arundel Creek LDAD	VAHR	7822-3857	LDAD
Mansfield Road LDAD	VAHR	7822-3858	LDAD
Glenara Creek LDAD	VAHR	7822-3863	LDAD
Deep Creek Escarpment 1	VAHR	7822-3864	Artefact scatter
Upper Maribyrnong Escarpment	VAHR	7822-3871	Artefact scatter/Earth mound
Glenara Creek 1	VAHR	7822-3872	Artefact scatter/Scarred trees
Glenara Creek LDAD 2	VAHR	7822-4081	LDAD
APAM Grey Box Forest LDAD	VAHR	7822-4178	LDAD
Arundel Creek LDAD 2	VAHR	7822-4312	LDAD
Link Road Ridge Artefact Scatter	VAHR	7822-4287	Artefact scatter

Figure B6.2
Previously recorded Indigenous cultural heritage places in the study area



The majority of these Indigenous places are artefact distributions (including isolated artefacts and LDADs). The remainder are scarred trees, earth features and multi-component places which comprise two or more of these place types at the same location. Spatial distribution of these places indicates that artefact distributions are most commonly located along incised river valley edges and alluvial terraces, and areas where high levels of natural ground exposure have occurred. Isolated artefacts are also located throughout the landscape over the flat basalt plains landform in lower densities. Scarred trees are present in remnant vegetation and wooded areas, primarily contained in the Grey Box Woodland located within the north of the study area.

B6.4.1.2
Previous reports

The study area is in close proximity to the Keilor Archaeological Site (VAHR 7822-0010), which was the focus of some of the earliest archaeological investigations in Victoria. The name and extent of archaeological works at the place has been updated due to recent works detailed in part below. The new name attributes traditional language and is now referred to as Murrup Tamboore (VAHR 7822-4277). In addition, the Maribyrnong River, associated creek lines and surrounding volcanic plains have also been subjected to a number of large-scale archaeological survey programs. Outside Murrup Tamboore, archaeological excavation has mainly been associated with developments located on volcanic/basalt plain landforms. The previous archaeological assessment for the Melbourne Airport Runway Development Program (RDP) CHMP 12774 recorded a number of new Indigenous values and places. Many of these were recorded over large sections of land, based on their unique geomorphological context and encompassing landforms. The study area for CHMP 12774 covers approximately two-thirds of the M3R study area.

A discussion of archaeological investigations at Murrup Tamboore, CHMP 12774 and the results of archaeological surveys and excavations in areas surrounding the study area is given below. A summary of report findings is provided in **Table B6.3**.

Murrup Tamboore (VAHR 7822-4277), formerly known as the Keilor Archaeological Site (VAHR 7822-0010) site

An Aboriginal cranium (Aboriginal ancestral remains) was identified at Keilor (the junction of Dry Creek, now known as Arundel Creek, and the Maribyrnong River) in 1940 by James White and provoked immediate archaeological interest. The former Keilor Archaeological Site (VAHR 7822-0010) has subsequently produced a significant body of work focusing on the archaeology and geomorphology of the site. White had taken the cranium to the National Museum of Victoria, and the site was then visited by a party of museum specialists in December 1940. It was immediately identified that the relationship of the skull with complex alluvial terraces indicated a considerable age for the find. A number of publications were subsequently produced in early 1940s by museum staff in regards to the skull, its geomorphological context, and artefacts surrounding the find (Adam 1943; Mahony 1943a; Mahony 1943b; Mahony 1944; Wunderly 1943; Keble and MacPherson 1946). Ongoing work has been undertaken at the archaeological site in recent years, however the results of these investigations have yet to be published. The Keilor site holds a high amount of cultural significance for the Wurundjeri people. The place provides a direct relationship for the Wurundjeri to the Keilor region, including Maribyrnong River, Arundel Creek and their associated archaeological deposits.

While Mahony (1943a) identified the potential for age, a more detailed study of the geomorphology of the site was undertaken by Keble and Macpherson (1946). Keble and MacPherson produced a geological map of the site, initially identifying three terraces in descending age and labelling them as the Keilor, Braybrook and Maribyrnong. Keble and MacPherson did caution that the Keilor skull may have belonged to a relatively recent burial cut into older deposits. However the find still generated considerable interest in the area; and led to Mitchell subsequently surveying Aboriginal campsites at Keilor, Altona and along the Maribyrnong River in the 1940s although no archaeological excavation was undertaken (Mitchell 1948).

Edmund Gill then undertook a series of studies on the Keilor cranium and geomorphology through the 1950s to early 1970s; focusing on dating the cranium (Gill 1953; Edmund D Gill 1955; E.D. Gill 1955; Gill 1954) and investigating its stratigraphic providence (Gill 1966; Gill and Tindale 1969). Gill concluded that the cranium had been located in the river terrace as a result of secondary deposition rather than burial as raised previously by Keble and MacPherson (Edmund D Gill 1955). Gill subsequently argued that the age of the cranium would be the same as the deposit, and identified the stratigraphic context of the cranium as being located in what he termed the B horizon of the Doutta Galla Silt, sediments roughly 15,000 years old in age (Gill 1966). The Doutta Galla Silt was a reinterpretation by Gill of Keble and Macpherson's Braybrook terrace as an erosion surface cut into the Keilor terrace.

Mulvaney began an excavation of the Keilor site after being introduced to the site by Gill in 1962, adjacent to Gill's believed location for the cranium. The excavation was washed away in a flash flood in 1963, ending the work. Mulvaney did believe that he had identified a hearth feature (Brown, 1995, p. 7). Gallus had also been introduced to the site in 1953 by Gil, and he began excavations with the Archaeological Society of Victoria in 1966 through to 1974. Gallus subsequently produced a number of publications (1971, 1972 and 1983) detailing the results of these excavations and, in conjunction with the results of Koonalda Cave, to argue for a Pleistocene age for Indigenous colonisation of Australia, theorise that *Homo erectus* may have arrived in Australia before *Homo sapiens*, and that Australia may have been an area of independent biological and cultural evolution for modern humans (Gallus 1970).

Table B6.3
Previous reports summary

Report	Summary
Presland, (1983)	Presland (1983) undertook the first large scale archaeological survey of the Melbourne metropolitan area. The study area is located in Survey Unit 1, the Yarra and Maribyrnong Rivers and their associated floodplains. In discussing resource availability, Presland notes that Silurian silcrete outcrops are known to occur below surface basalt layers around Keilor and along the Maribyrnong River. In Survey Unit 1, Presland recorded 10 new Indigenous cultural heritage places, six scarred trees near Carrum Swamp and four stone artefact scatters on the Maribyrnong River, none of which are located in the study area.
Rhodes, (1989)	Rhodes (1989) undertook an archaeological survey of the upper Maribyrnong River Valley, Deep Creek and Jacksons Creek, which included eastern portions of the study area. Rhodes recorded 50 Indigenous cultural heritage places consisting of 36 artefact scatters, three isolated finds, three quarries, two scarred trees and one contact site. In assessing site distribution patterns by landform, Rhodes noted that the majority of places were located on alluvial terraces (46 per cent), hill slopes (28 per cent) and the escarpment edge (20 per cent). Only three places were located on the river channels, being predominantly scarred trees, and no places were noted on river cliffs. Rhodes also noted that the limitation of scarred trees to river channels was most likely due to the survival of remnant native vegetation in these areas. Silcrete quarries were limited to hill slope landforms where appropriate erosion actions had occurred to expose underlying Silurian deposits.
Rhodes, (1990) and du Cros, (1990)	Rhodes (1990) and du Cros (1990) conducted separate archaeological surveys for a study of Keilor and Sydenham respectively, which covered portions of Rhodes' 1989 survey. Rhodes' 1990 study included the southern half of the current study area while du Cros undertook her survey overlapping the south-west corner of the present study area along the Maribyrnong River. While both Rhodes and du Cros surveyed across large areas of volcanic plains, the vast majority of Indigenous cultural heritage places were recorded in incised river valleys (10 of the 12 places identified by Rhodes and 16 of the 19 places identified by du Cros). Sites outside of river valleys consisted of small, low density artefact scatters or isolated finds, with overall trends in river valleys conforming to those identified in Rhodes' 1989 survey.
Marshall, (1995)	Marshall (1995b) undertook a survey of an alluvial terrace on the Maribyrnong River in the south west of the present study area to inform approvals for the removal of 2 metres of topsoil from the terrace. Marshall identified the terrace as belonging to the 'Maribyrnong terrace' dated to the Holocene and first identified by Keble and MacPherson (1946) at the downstream Keilor site. An artefact scatter of 68 flaked stone artefacts was identified across the extent of terrace and Marshall recommended that test excavation be undertaken, which was performed later in 1995 (Marshall, 1995a).
Marshall, (1995)	Marshall (1995a) excavated 23 shovel probes across the terrace to depths between 25 and 57 centimetres in silty clay, recovering a total of 238 artefacts. The limited depth of excavation was due to the hardness of silty clay encountered. Despite only recovering cultural material in the first 35 centimetres of deposit, Marshall expected that more cultural material would be present at depths below the extent of excavation. The excavation results indicated that the artefacts were recovered from a disturbed context, with Indigenous cultural material being mixed with modern European material. Marshall recommended that the first 35 centimetres of top soil will subsequently be stockpiled on site to retain as much cultural material as possible.
Vines, (1995)	Vines (1995) undertook an archaeological survey of the Grey Box Woodland, which includes small northern portions of the study area, with his study area including the granite intrusion at Radar Hill. Vines identified a total of 23 Indigenous cultural heritage places, including eight isolated artefacts, five scarred trees and ten surface artefact scatters. All of the four larger artefact scatters (VAHR 7822-0800, 0808, 0819 and 0820) were located in close proximity to water (Deep Creek) while smaller scatters and isolated finds were found across the Grey Box Woodland area. No archaeological excavation was undertaken, but Vines noted that VAHR 7822-0800, 0808, 0819 and 0820 appeared to be relatively in situ and had potential for archaeological deposits.
Newby and Muir, (1998)	Newby and Muir (1998) surveyed a proposed pipeline route along the northern edge of the study area, along the boundary between the airfield and Grey Box Woodland into Deep Creek. No Indigenous cultural heritage material was identified during the survey. Although the survey area included part of the Maribyrnong River escarpment and associated slopes, Newby and Muir determined that their study area was of low archaeological potential due to disturbance and steepness of the slope.
Clark, (2002)	Clark (2002) undertook a survey (Report #2165) of south-eastern portions of Melbourne Airport to identify potential heritage constraints and inform planning for future expansion at the airport. Generally the survey was hampered by very poor ground surface visibility, with three Indigenous cultural heritage places being identified in areas of exposure or disturbance. These places were two isolated finds, VAHR 7822-1334 (Melbourne Airport 2) and VAHR 7822-1335 (Melbourne Airport SE 3), identified in places of disturbance; and one large artefact scatter VAHR 7822-1333 (MELBOURNE AIRPORT 1) identified on exposures of the Maribyrnong River escarpment.
Smith, Mialanes, Kiddell and Reeves, (2010)	Smith, Mialanes, Kiddell and Reeves, (2010) undertook a CHMP (#10901) for the Kings Road Interchange at Taylors Lakes, southwest and outside of the study area. The complex assessment included the excavation of five 1 x 1 metre test pits and ninety-three 30 x 30 centimetre shovel probes across volcanic plain landforms. All excavation locations were relatively shallow with an average depth of 30 centimetres or less in depth being achieved and the maximum excavation depth being 50 centimetres. Soil deposits were consistent across the CHMP 10901 area, being shallow deposits of softer clay, silty clay or silt over compacted clays. Only one artefact was located subsurface at VAHR 7822-2401, with surface artefacts being identified at VAHR 7822-1311, -1766, -1764 and -2400.
Albrecht, (2012)	Albrecht (2012) undertook a CHMP (#12136) for a proposed development at 77 Keilor Park Drive in Tullamarine, outside and south of the study area. A standard archaeological survey identified partial disturbance by previous building constructions; however the remaining area had been used for grazing and farming activities. A total of three 1 x 1 metre test pits and four 40 x 40 centimetres shovel probes were excavated to a maximum depth of 35 centimetres as part of the complex assessment. The test pits revealed previous soil disturbance, whilst the shovel probe transect appeared to be less disturbed. No Indigenous cultural heritage places were identified as part of archaeological investigations.
Croker et al, (2012)	Croker et al, (2012) completed a CHMP (#12067) for portions of the Maribyrnong River riverbanks and alluvial terraces in 2012 to inform weed removal and revegetation activities. The activity area includes south west portions of the current study area. Ground surface visibility was relatively poor at 5 per cent, but three new Indigenous cultural heritage places were identified: two artefact scatters, VAHR 7822-3301 and 3302, on lower simple slopes (i.e. slopes between hill crests and foots) directly above river terraces; and a scarred tree, VAHR 7822-3303, on an alluvial terrace. None of these places are located in the study area.
Lawler, (2012)	Lawler (2012) undertook a CHMP (#11956), which overlaps slightly with the south-west boundary of the study area and borders the activity area for CHMP 10901. The CHMP was located on the volcanic plains landform. One 1 x 1 metre test pit and 35 shovel probes of 40 x 40 centimetres were excavated. As with CHMP 10901, the average excavation depth was relatively shallow at 20 centimetres or less and no excavation point went deeper than 40 centimetres. The vast majority of excavation points encountered loam and stone fill associated with a nearby road, before bottoming out on compacted clay. No Indigenous cultural material was identified during the assessment.
Minos & Noble, (2012)	Minos & Noble (2012) completed a voluntary CHMP (#12237) for a proposed 10 hectare construction worksite compound, overlapping the south-east boundary of the study area. There were two previously recorded Indigenous places within 300 metres of the activity area; VAHR 7822-1335 (Melbourne Airport SE 3) being an isolated artefact and VAHR 7822-3480 (Steele Creek North), a low density artefact scatter. Despite limited ground surface visibility, the field survey identified two artefacts on exposed ground. These artefacts were registered as VAHR 7822-3519 (Operations Road, Melbourne Airport). The test excavations consisted of 131, 400x400 millimetre shovel test pits and three 1x1 metre Test Pits. No subsurface Indigenous cultural heritage material was identified, due to past land use and erosion. The results of the complex assessment indicated this area has low sensitivity for cultural heritage material. Management conditions included a surface salvage of identified artefacts as harm could not be avoided to the material.
Noble, (2012)	Noble (2012c) completed a CHMP (#12333) for an extension of Airside Road in Tullamarine, located west of Airport Drive and south of its intersection with Mercer Drive. This CHMP overlaps the current study area in the south most-east section. Two previously recorded Indigenous places were located in the activity area, Artefact Scatters VAHR 7822-1335 (Melbourne Airport SE 3) and VAHR 7822-1803 (Melbourne Airport Unigas 2). The Desktop Assessment concluded that there is low potential for further cultural heritage material to be present in the activity area. The standard assessment was undertaken by pedestrian survey and noted poor ground surface visibility and the presence of occasional basalt floaters. A man made channel and other disturbances near Steele Creek were also were noted. During the complex assessment, three shovel probe transects were excavated across the basalt plain landform. The shovel probes showed that the topsoil had been stripped and instead silty clay was present over bedrock. The maximum excavated depth of the shovel test pits was 230 millimetres. It was concluded that the land had undergone extensive disturbance and was of low sensitivity for Indigenous cultural heritage material. No Indigenous cultural heritage places were located.
Noble and Filihia, (2013)	Noble and Filihia (2013) undertook a CHMP (#12498) for the Business Park Development at Airport Drive and Steele Creek, south of the study area. A pedestrian survey of the land was undertaken to confirm the location of previously recorded Aboriginal places and to determine the location of any previously unrecorded places. Although Indigenous new places were recorded during the survey, not all previously recorded places were relocated, particularly isolated artefacts. An extensive subsurface excavation program was undertaken, comprising 448 test holes, 12 test pits and 18 machine transects. Excavation reached to 38 centimetres onto a basal clay unit. Subsurface deposits were shallow and Indigenous places generally consisted of low density artefact scatters. Sixteen new Indigenous places were recorded as a result of the test excavations.
Wheeler, (2013)	Following on from CHMP 12067, a further Standard Assessment CHMP (#12389) was undertaken to the north following Deep Creek. The activity area is located adjacent to part of the north-west boundary of the current study area. Ground surface visibility was limited to about 5 per cent visibility with five new Indigenous cultural heritage places identified. Places included artefact scatter VAHR 7822-3572 (Deep Creek AS 1), which was recorded on an alluvial terrace; LDADs VAHR 7822-3568 (Deeper Creek LDAD) and VAHR 7822-3577 (Deep Creek LDAD 2) recorded on simple slopes; and rock shelters VAHR 7822-3578 (Deep Creek RS2) and VAHR 7822-3579 (Deep Creek RS1) recorded on granite outcrops on simple slopes above Deep Creek.
Robb, Houghton and Wood, (Biosis Pty Ltd 2014)	Robb, Houghton and Wood (2015) completed a CHMP (#13257) for the proposed Business Park at Melbourne Airport, located in two areas, one approximately 50 metres east and the other approximately 500 metres south of the current study area. No Indigenous places were identified during the standard assessment, however ground surface visibility was very poor resulting in unsatisfactory effective survey coverage. The activity areas are located on low lying plains impacted by varying degrees of disturbance and land modification, including the realignment of Steele Creek, construction of the wetlands, importation of fill, roads, agricultural and historical activities. Two 1x1 metre Test Pits and 48 shovel test probes were excavated between the two activity area locations. The stratigraphy proving to be a fairly consistent thin soil profile of silts over clay, the result of weathering basaltic lava flows. Some locations recorded different profiles, such as in proximity to the swamp, where soils contained a darker, moist clay, or other locations where evidence of extensive ground disturbance were noted; these pits contained blue metal, gravels or general fill. The testing was very shallow, with most probes extending to between 100-180 millimetres, and the deepest extending to 220-240 millimetres. No Indigenous places were recorded during the complex assessment.

Report (cont.)	Summary (cont.)
Vines and Berelov, (Biosis 2016)	Vines and Berelov (2016) undertook a CHMP (#13202) for the replacement of High Intensity Approach Light (HIAL) structures within the eastern approach to 09/27 at Melbourne Airport. The activity area is located along Sunbury Road, encompassing a section of Moonee Ponds Creek, and is predominantly within the present study area. Two LDADs, VAHR 7822-3822 (Marker Road Tullamarine LDAD) and VAHR 7822-3992 (Sunbury Road LDAD) were recorded during the standard assessment. The LDADs consisted of several artefacts located on the elevated ground at the top of the valley side near the present Sunbury Road. Other surface artefacts were found eroding out of the alluvial deposit of the creek bank. Areas of archaeological potential were identified as relatively flat ground on the elevated rises at the top of the valley sides, and the alluvial deposits of the Moonee Ponds Creek. Extensive areas of disturbance were noted across the activity area due to grading, road construction and excavation for foundations and underground services. Three 1x1 metre Test Pits were excavated during the complex assessment. Test Pit 3 was located on the elevated basalt clay on the eastern side of Sunbury Road, closest to the current study area. The Test Pit recorded a disturbed topsoil layer with grass, roots and gravel inclusions for the first 100-200 millimetres, overlying dark grey basalt clay from depths of 1000-1500 millimetres. Five 400x400 millimetre shovel test pits were also excavated to test the presence and potential extent of Indigenous cultural heritage and determine the nature of the stratigraphy of the landforms. No Indigenous cultural heritage was found during the excavations.
Oataway, (Biosis 2017)	The subsequent archaeological salvage for CHMP 13202, place VAHR 7822-3229 (Sunbury Road 3), was undertaken by Oataway (2017). The salvage method involved the stripping of topsoils to 200 millimetres within the light tower construction areas. The soils were then stockpiled, secured and left to dry out before being sieving through 5 millimetre mesh (mechanical table/hand sieves). Soils consisted of mixed fill materials within some thin grey/brown silts within the excavated sediments. Grass roots, concrete and gravel fragments, and other modern rubbish was also recorded in the stockpiled material. Two silcrete flakes were recorded during the salvage excavation. These materials were added to the existing registration and extent for Indigenous place VAHR 7822-3229 (Sunbury Road 3). The extent was not changed as a result of the salvage. While manual excavation techniques and methods have generally been employed for small to medium sized activities in the Tullamarine area, the use of mechanical stripping and sieving was determined to be appropriate to cover the proposed light tower footprint. The use of mechanical sieve table also more readily separated the natural sediment from fill material in the mixed deposit, which lead to the identification of the two silcrete artefacts.
Holzheimer, (2018)	Holzheimer (2018) completed a CHMP (#15230) for the Sunbury Road safety infrastructure upgrade works on land directly east of the current study area, crossing through at the current activity area's most northern east point at Sunbury Road. At the commencement of the CHMP, a total of 15 previously recorded Indigenous places were located within the activity area. The desktop assessment identified a number of places that had been recorded along the banks of the Moonee Ponds Creek as surface scatters. The standard assessment recorded 29 surface artefacts on the informal vehicle tracks or around the base of trees. Of the 29 identified artefacts, 20 artefacts were located within pre-existing Indigenous places VAHR 7822-3230, VAHR 7822-3231 and VAHR 7822-3228. The additional 9 artefacts were recorded as new Indigenous place VAHR 7822-4166 and the remaining 12 previously recorded places were unable to be relocated. The standard assessment found that significant changes had occurred across the activity area since the previously recorded Indigenous places had been registered, including erosion, land use, vegetation growth and die-back. The initial phase of the complex assessment included the excavation of a single 1x1 metre Test Pit, and 34, 500x500 millimetre shovel test pits positioned along the proposed cut drain and shoulder construction of Sunbury Road. Subsurface cultural material was identified in three testing locations, leading to the excavation of an additional 19 radial shovel test pits and three 1x1 metre Test Pits. All subsurface material was included within the LDAD registration of VAHR 7822-4166.
Oataway & Vines, (Biosis Pty Ltd 2018)	Oataway & Vines (Biosis Pty Ltd 2018b) completed a voluntary standard assessment CHMP (#15234) for the realignment of Marker Road, removal of existing structures, installation a number of aviation Jet Fuel storage and construction of a Shared User Path within the Sunbury Road Reserve following the tree-line. The activity area is located to the east of Tullamarine Freeway, between Marker Road and approximately 130 metres south-east of the current study area. Previous assessments undertaken for CHMP 13202 in 2016 and CHMP 14981 in 2017 directly north of the current study area had indicated that the western Moonee Ponds Creek terrace has been largely disturbed by a range of previous impacts including construction of the Tullamarine Freeway and the previous stage of runway lighting structures. The previously recorded Indigenous place VAHR 7822-3227 (Sunbury Road 1 IA) was not able to be relocated during the standard assessment. No areas of archaeological potential or natural ground surface identified during the standard assessment, as such it was decided in consultation with the RAP to complete the current CHMP at the level of standard assessment. An additional 5-10 metres of land was added to the north-eastern extent of the activity area in August 2018. This area was surveyed on 27 November 2017 under a 'GAPS study' of the Melbourne Airport estate (Oataway, White, & Fitzgerald, 2018) which identified this new section of land to be a continuation of the disturbances noted during the standard assessment. No further investigation was required.
Oataway & White, (Biosis Pty Ltd 2019)	Oataway & White (Biosis Pty Ltd 2019) completed a mandatory CHMP (#16193) for a proposed solar farm located at the corner intersection of Sunbury Road and Oaklands Road, Oaklands Junction, at the very north of the Melbourne Airport estate and approximately 75 metres north of the current study area. The desktop assessment determined that the activity area had been primarily used for pastoral activities including land clearing and stock grazing since European settlement. The activity area contained no previously recorded Indigenous places, with the closest located approximately 160 meters to the east, VAHR 7822-1248 (Oaklands 1 IA). Previous archaeological surveys completed have found there to be no ground surface visibility within the activity area. The results of previous archaeological investigations along the Moonee Ponds Creek escarpment have found that the cultural material is most likely to be identified within eroded, disturbed surface contexts or in low densities in subsurface contexts. The complex assessment involved the excavation of one 1x1 metre Test Pit, 66 shovel test pits, excavated across four linear transects orientated north-south across the activity area, and 16 radial shovel test pits. Three stone artefacts were found during the complex assessment and subsequently, a new Indigenous place was recorded VAHR 7822-4317 (Oaklands Junction LDAD). The place comprises two stone artefacts (1 silcrete; 1 quartzite) recorded in a shovel test pit between a depth of 0-100 millimetres, and one silcrete piece recorded in a different shovel test pit at a depth of 0-100 millimetres. The stone artefacts were found in shallow clayey silt deposits which appear to have been subjected to historic ploughing, stock trampling and other overground farming activities. They are therefore not considered to be found in situ.

The excavation program undertaken by Gallus excavated a trench 3.81 x 3.3 metres situated above what was termed the Keilor Terrace or Doutta Galla Silt, where Gallus excavated to a depth of 8.38 metres (Gallus, 1983, pp. 12-14). The stratigraphy identified by Gallus included a layer of Doutta Galla Silt between 1.8 and 3.73 metres above what he termed 'D' Clay, between 1.8 x 8.38 metres. The excavations by Gallus uncovered a large number of artefacts, the deepest find being at 6.87 metres (Gallus, 1983, p. 14). The total number of artefacts recovered by Gallus is difficult to determine as the artefact analysis methodology he used and his determinations of artefacts have been called into question (Witter & Simmons, 1978; Mulvaney, 1998).

Being under question, the work by Gallus prompted requirements for further investigation; and subsequently the Victorian Archaeological Survey and La Trobe University ran an excavation program from 1977 to 1982. Three 3 x 3 metre test pits were sited immediately above the alluvial terrace sediments located over the D-Clay identified by Gallus and Gill and Burke (1990). It was hoped this location would provide representative samples of early and late cultural material, and that the relationship between the D Clay and alluvial terrace deposits would be better defined (Burke, 1990, p. 10). The three pits (A, B and Z) were dug in arbitrary 10 centimetre spits (with some possible deviation), to depths of 3 metres (A), 7.2 metres (B) and 1.7 metres (Z) with Pit B being tup to a sterile layer of gravel.

A total of 1,989 artefacts were recovered with over 64.16% (n=1237) of the assemblage being located within a plough zone (spits 1-6); 23.55% (n=454) in the Doutta Galla Silt (spits 7-27); 11.15% (n=215 in the D Clay (spits 28-55); and 1.14% (n=22) in the Older Dry Creek Alluvium (spits 56-76) (Munro, 1998). The plough zone is a unit of the Doutta Galla Silt, which is suggested by Munro as Holocene in age due to the presence of a microlithic industry (Munro, 1998, p. 22). Charcoal from a 'hearth layer' in the Doutta Galla Silt below the plough zone has been carbon dated to 13,300 years BP +1000/-900 (Burke, 1990, p. 6). Dates for layers below the Doutta Galla Silt have been informed by the geomorphological investigations of the river terraces near the Keilor Site, undertaken by Bowler (1970), Joyce and Anderson (1976), Coutts and Cochrane (1977) and Tunn (1998). Investigations by Joyce and Anderson have carbon dated the D Clay, considered part of the Arundel terrace (Arundel B terrace) from 40,000 to 20,000 years BP (Joyce & Anderson, 1976),and Coutts and Cochrane (1977) have given estimates for the Older Dry Creek Alluvium (Arundel A terrace) at between 50,000 to 40,000 years BP.

Analyses of the artefacts recovered by the Victorian Archaeological Survey and La Trobe University program have been undertaken by Burke (1990) and Munro (1998). Both Burke and Munro note that finer grained raw material is used much more frequently in the plough zone (ratio of fine to course being 5:1) while coarser material becomes more common to depth (ratio of fine to course being 2:1 in hearth layer) (Burke, 1990; Munro, 1998). Munro also identifies the plough zone assemblage as being consistent with the Australian small tool tradition, with no blade technology being present in the Pleistocene hearth layer (1998, p. 31). The studies by Burke (1990) and Munro (1998) indicate that much less artefactual material is present in the D Clay than argued by Gallus, although his assemblage does not appear to have been re-examined.

Recently the place was surveyed in 2018 as part of a joint archaeological assessment conducted by Aboriginal Victoria, La Trobe University and Wurundjeri RAP. The place was subject to re-survey and test excavations across two periods in April and June 2018 through a cultural heritage permit (RAP F18/853 WTP/0015) by Dr Rebekah Kurpiel as part of the La Trobe University archaeology programme. Cultural material was identified in subsurface and surface contexts on an alluvial terrace landform in vicinity of the Maribyrnong River. As part of the joint assessment, updated plans were produced with respect to the earlier surveys and excavation carried out there, with this data submitted to the VAHR under its updated registration number VAHR 7822-4427 and including the new place name, Murrup Tamboore. Recorded materials include worked and unworked stone and charcoal, which was subsequently reburied as an object collection component within the place extent in June 2019.

A request was made by Biosis for additional contextual details of the results of these excavations to include in this report, but no information has been able to be provided by Wurundjeri at this time.

Runway Development Program: CHMP 12774

Ford, James-Lee, Houghton, Ashton and Vines (Biosis Pty Ltd 2017) completed a CHMP (12774) for the Runway Development Program (RDP) at Melbourne Airport, Tullamarine. Their activity area measures about 1184 hectares over multiple land parcels including large portions of the existing east-west runway (09/27) and north-south runway (16L/34R) at the airport. The RDP activity area comprises approximately 622 hectares, or 61 per cent of the current M3R activity area.

The activity area is bound by the airside (active runways) areas to the north and east, to the west by rural land and Deep Creek, and the Maribyrnong River to the west and south. The CHMP was prepared for the proposed third runway at Melbourne Airport and extension of 09/27: incorporating a wide variety of construction-specific activities such as access roads, compounds, land reshaping, utilities installation, foundations, topsoil stripping, runway construction and other infrastructure.

Due to the constraints of ongoing design for the activity, the authors considered that all these activities were likely to impact all buried former land surfaces, particularly across the basalt (volcanic) plains landform. The desktop assessment identified 25 previously recorded Indigenous cultural heritage places within the activity area, most comprising artefact scatters and isolated artefacts. The desktop assessment also highlighted that high levels of disturbance have already occurred over the eastern portions of the activity area.

This has been primarily associated with the existing runway construction. Agricultural practices were also considered likely to have impacted a large part of the west of the activity area to some degree, which have remained as rural properties.

Of the 25 previously recorded places in the activity area, 17 were relocated by the survey; one place was determined to actually be located outside the activity area; one was determined to be destroyed and two others could not be relocated. New artefact scatters were located along the Arundel Creek and Maribyrnong River/Deep Creek corridors.

The complex assessment involved the excavation of 49, 1x1 metre test pits across the activity area. 21 test pits were excavated over the basalt plains landform, 16 across the escarpment landforms, five across the cliffs and hillslopes, and seven across the alluvial terraces. A total of five shovel probe transects consisting of 52 400x400 millimetre shovel probes were excavated along the Sunbury Access Road in the north of the activity area. The mechanical testing program involved the excavation of 447 test trenches of 10x1.2 metres across the activity area. The mechanical program primarily tested those landforms where the majority of proposed impacts would occur: the basalt plains, escarpment and hillslope landforms. In addition, a total of 108 extent mechanical trenches were excavated to assess artefact densities occurring at densities greater than one artefact per square metre. These clusters occurred on well-defined escarpment edges along the Maribyrnong River, Deep Creek and Arundel Creek.

Ten new Indigenous cultural heritage palaces were recorded following the results of the complex assessment, including a large number of existing Indigenous places which were merged into the new registrations.

Summary of previous archaeological findings in the region

Large-scale archaeological surveys of waterways in the surrounding region of the study area (particularly the Maribyrnong River, Arundel Creek, Deep Creek and Jacksons Creek) provide relatively consistent results in terms of Indigenous heritage patterning. Stone artefacts, scarred trees, quarries and skeletal remains are identified in and on the alluvial terraces and escarpment edges of these waterways, typically wherever there is good ground surface visibility. Archaeological assessments over the past decade on the surrounding volcanic plains landform have shown that Indigenous cultural material appears much less frequently, with most cultural material being LDAD.

More intensive investigations have been undertaken on alluvial terraces, driven through excavations by Gallus, the Victorian Archaeological Survey and La Trobe University. Investigations of alluvial terraces have typically involved deep excavations in alluvial silts and clays to depths of more than seven metres, which have found cultural material dating to the Holocene and Pleistocene periods. A summary by report is provided in Table B6.3.

B6.4.1.3 Historical and ethno-historical background

This section provides background for the history of the study area. The Australian Heritage Commission developed a historic theme framework (Australian Heritage Commission 2001) for use at the national, state or local level to assist in the identification, assessment, interpretation and management of heritage places. This has subsequently been updated according to the *Guidelines for the assessment of place for the National Heritage List* (Australian Heritage Council 2009) and for the Victorian framework (Heritage Council Victoria 2010). Understanding these themes and their relevance to the study area can be important in establishing and understanding heritage significance. Australian historic themes relevant to the study area and cultural heritage are provided in Table B6.4. Predominately, these themes relate to the Indigenous life pre- and post- European contact.

Table B6.4
Australian historic themes relevant to the study area

Primary theme	Secondary theme	Tertiary theme
2 Peopling Australia	2.1 Living as Australia's earliest inhabitants	
	2.6 Fighting for land	2.6.1 Resisting the advent of Europeans and their animals
		2.6.2 Displacing Indigenous people

Ethno-history

Prior to European colonisation, the Victorian landscape was delineated by socio-dialectical groups who shared a common language, and who as a group identified as owning particular areas of land, with individually owned tracts of country. This was a system of spatial organisation based on land tenure (Clark 1990). Howitt (1996) identified a large portion of south central Victoria as holding a confederation of five language groups; together they comprised the Kulin Nation. Kulin is a common word for human being among the *Bun wurrung*, *Woi wurrung*, *Djadja wurrung*, *Wada wurrung* and *Daung wurrung*, who shared cultural and linguistic similarities as well as being economically and socially affiliated. The Kulin groups also had common religious beliefs and creation legends.

Indigenous groups mapped natural features as boundaries for their ranges, estates and economic territories. The *Woi wurrung* held land from the Werribee River to Mount Macedon and Mount William in the north, and the Dandenong Ranges and Warragul to the east. The *Woi wurrung* included the *Gunung willam baluk* and *Marin baluk* clans, who occupied territory in the vicinity of the study area. The *Gunung willam baluk* occupied a territory extending east and north of the Maribyrnong River and Jacksons Creek. Also known as the Mount Macedon tribe, they inhabited the Mount Macedon area, extending south to the Werribee River near Bacchus Marsh, and north to Lancefield and the Mount William stone quarry of which they are custodians. The *Marin baluk* clan were located to the west and south of the Maribyrnong River as far south as Koroit Creek, with Sunbury recorded as the location for their headquarters (Barwick 1984; Vines 1995).

Land ownership and access rights or responsibilities centred on the smaller named groups that formed the broader language grouping. These groups are often called 'clans' or 'local descent groups', however as Wesson (2000) reasons, they are better described as 'named groups', as the membership structure of these groups, and their degree of division from other groups, could vary. In most instances, primary allegiance was owed to this named group, although this could vary according to context and location. Commonly, named groups were led by senior elders who exercised internal political and religious authority, as well as being recognised as their spokesperson when dealing with other groups (Atkinson and Berryman 1983). Particularly influential group leaders could also assume authority over the leaders of other culturally affiliated groups (Wesson 2000).

At the time of contact with Europeans, the clans were led by *Ngurungaeta*, or clan heads. Ningulabul (c. 1771-1847/51) was the *Ngurungaeta* of the *Gunung willam baluk* clan, and was succeeded by his son, also Ningulabul (c. 1809/12-1853). Bungarim (c. 1800-1848) was the *Ngurungaeta* of the *Marin baluk* clan, and his son was Marmbul (c. 1822-1848) (Barwick 1984; Vines 1995). Ningulabul was part of a joint custodianship with Murrum Murrumbean (*Talling willam*, *Gunung willam* patriline) of sacred sites near Gisborne important to many neighbouring *Woi wurrung*, *Djadja wurrung*, and *Watha wurrung* clans. Marriages with adjacent 'waa' clans like *Marin baluk* resulted in owner-manager bonds for the management of Mt William quarry. In the 1840s, Clarke (1990) records that the quarry was managed by old Ningulabul, his sons, and Murrum Murrumbean, in addition to Bungarim (the *Marin baluk Ngurangaeta*) and Billibellary (*Ngurangaeta*) and Bebejan, sons of sisters of Ningulabul and 'heiresses in quarry rights'. Ningulabul's authority as *Ngurungaeta* and marriage connections allowed his sons: Ningulabul, Winberri/Windberry and Nerrim-bin-uk/Nurmbinuck/Young Winberri to pass safely through the land of different remote tribes. In October 1840, their travels summoning the distant clans to a large-scale initiation in Melbourne were interpreted as an invitation to war by officials (Clark 1990).

Economy, resource availability and utilisation

Likely plant resources available to the region's Indigenous people would have been the tree canopies of River Red-gum *Eucalyptus camaldulensis*; Manna Gum *Eucalyptus viminalis ssp. viminalis*; Blackwood *Acacia melanoxylon*; Drooping Sheoak *Allocasuarina verticillata*; Black Wattle *Acacia mearnsii*; and Lightwood *Acacia implexa* (DELWP 2020). In addition to the tree canopy, many species available in the understory were harvested for food and material resources. The gum of the Golden Wattle *Acacia pycnantha* was eaten or else mixed with water and nectar to produce a sweet drink (Gott 1991). Roots such as the Yam Daisy *Microserus scapigera* and Pink Bindweed *Convolvulus erubescens*, seeds and fruits were important staples in the Indigenous diet, as well as for medicine (Gott & Conran, 1991; Coutts, 1979). Roots were roasted in hot coal-fired earth ovens, or ground and mixed with water to form dough which was baked in ovens (Zola and Gott 1992). River Mint *Mentha australis* was used to treat coughs and colds (Gott 1991).

The basalt plains and its many waterways would have contained a wide range of faunal species hunted by the Indigenous people. A vast array of species are known to occur, and have been recorded, within the geographic region (Global Biodiversity Information Facility 2019). The open grassland environment would have supported various small mammals, as well as larger species such as Eastern Grey Kangaroo *Macropus giganteus*, Brushtail Possum *Trichosurus vulpecula*, Swamp Wallaby *Wallabia bicolor*, and Emu *Dromaius novaehollandiae* (Global Biodiversity Information Facility 2019). Seasonal variation is likely to have occurred, as the geographic region contains a highly seasonal water sources and flora species that are dependent on the seasonally changing water availability (Gott 1991). Overall, higher numbers of mammalian and bird species would have been available during the summer months, which would have resulted in more intensive hunting of certain species. These species were hunted by Indigenous people for their meat, and the pelts used to make clothing and other items (Gott 1991).

Given the close proximity of the geographic region to waterways (such as the Maribyrnong River, Moonee Ponds Creek, Arundel Creek, Steele Creek and Deep Creek) Indigenous occupation in this area is likely to have been focused on aquatic resources which were less susceptible to variations in seasonality (Gott 1991). These would have provided a wider range of resources for Indigenous people than the plains, with Freshwater mussels *Vesunia ambiguousa*, Shortfin eels *Anguilla australis*, waterbirds and lizards a reliable food source throughout most of the year (Global Biodiversity Information Facility 2019). Prior to European settlement, the geographic region would have provided extensive subsistence resources for Indigenous people. Species such as the Eastern Quoll *Dasyurus viverrinus*, Redbellied Pademelon *Thylogale billardierii* and Long-nosed Potoroo *Potorous tridactylus* were recorded at the time of European settlement but have largely or wholly disappeared since (Land Conservation Council, Victoria 1991:107). The introduction of the rabbit, fox, cat, house mouse and hare have greatly reduced the native fauna through predation and resource competition, and these introduced species are now widespread across the geographic region.

Post-contact history

The rapid European colonisation of the Melbourne region altered Indigenous society across the state. The increased presence of settlers on Indigenous land resulted in Indigenous dispossession from the land and diminished access to resources. These factors, combined with population decline from introduced diseases and conflict, transformed Indigenous pre-contact society to be orientated around colonial activity, such as movement onto camps to the outskirts of towns or relying on European industry for livelihood.

John Aitken was the first European settler to move into the *Gunung willam baluk* and *Marin baluk* clan areas in 1836, taking up a 10 square mile pastoral run at Mount Aitken, roughly 30 kilometres north-west of the study area. Aitken was helped by local Indigenous people at Dromana to unload his sheep, and initially he appeared to have attempted to foster good relationships with the Mount Macedon Tribe by distributing rations of rice, sugar and flour (Sayers 1969). However, he clashed with the *Gunung willam baluk* clan on a number of occasions, particularly in 1838 when the clan made deliberate attempts against squatters on their land. Aitken recorded in April of that year that 40 Indigenous people approached his station armed with spears and three guns. Mounted on horseback, Aitken was able to outmanoeuvre the group and dispose them of two of the guns, although he narrowly avoided being struck by a tomahawk in doing so. The *Gunung willam baluk* then departed but targeted George Evans' run at Sunbury, spearing sheep and threatening a shepherd. Shepherd Samuel Fallon was killed and disembowelled shortly thereafter (Symonds 1985). By this time, Aitken's relationship with the *Gunung willam baluk* appears to have deteriorated to the point that he no longer tolerated their 'trespass' on his run.

In 1839 an Aboriginal Protectorate Scheme was established in Victoria. Appointed Protectorates provided religious instruction, rations, homes and medical care to Indigenous people whilst recording population information (Broome 2005); a pretext of encouraging Indigenous Victorians to adopt a European lifestyle. Edward Stone Parker was assigned to the Mount Macedon district in 1839 and built a hut at Jacksons Creek where he lived for a year, before moving to the Loddon River (Symonds 1985).

Official inquiries into the welfare of Indigenous people were held in 1849 and again in 1858. Although informants at the inquiries remarked on the rapid fall in the Indigenous population, it was a number of years before any action was taken. The latter inquiry led to the formation of the Aboriginal Protection Board in 1860 which encouraged Indigenous people to move onto reserves. A special 'Aborigines Act' was passed in 1869, which gave the Governor of Victoria power to dictate where Indigenous people in Victoria could reside; what activities they could undertake on and off reserves or stations; and the authority to take charge of Indigenous children (Christie, 1979). Eventually, what remained of the Kulin tribes were gathered and sent to live at Coranderrk and other mission settlements, isolated from their traditional lands (Barwick 1984; Vines 1995).

George Sinclair Brodie came to Port Phillip with John Pascoe Fawkner's party in May 1836 from Van Diemen's Land with 500 sheep and headed north to settle at Deep Creek near Bulla (Billis and Kenyon 1974; Moloney 1998:200). With his brother Richard Brodie, he took up the 9,078 acre squatting lease for the *Bulla Bulla* run (Spreadborough and Anderson 1983:259), to the north of the present activity area where he built the first slab huts. In the same year, an additional lease of three and a half square miles was acquired, which included a homestead section of 640 acres. By 1852, Brodie had 4,000 acres of freehold land in the district (Vines 1993). The majority of land in the activity area was sold by the Crown to Kaye, Chapman and Kaye, Fawkner, Grant, McNab and McNab, Thomson and Duncan, Annand, Oakden and Bonthorne in 1850 (Itellya 2013).

Although the initial violence between settlers and Indigenous people appears to have been largely restricted to the 1830s, the memories of this early conflict seem to have influenced incoming settlers long afterwards. The McNab family took up property in the study area in 1848. Their first homestead (the original Victoria Bank) is recorded as having defensive slit windows long after attacks had occurred on Aitken's run (Gibbs 1998). Gibbs (1998) also notes that John McNab recorded being chased home by Indigenous people, although details of this event are scant. The history of early conflict between settlers and *Woi wurrung* people is reflected in the naming of the locality 'Tullamarine'. The name is said to derive from a woman called Tullymarine, whose husband Bunja Logan stole potatoes from John Gardiner's farm in 1838, and who was later responsible for one of the attacks on Aitken. After Bunja Logan escaped from gaol by setting fire to the thatched roof, he disappeared into the mountains with Tullymarine and their children (Symonds 1985:73; Vines 1995).

The discovery of gold in Victoria prompted a rush of prospectors to the Bendigo and Mount Alexander goldfields. Passing through the outer districts of Melbourne, the prospectors travelled up the road which would later become the Tullamarine Freeway and crossed Moonee Ponds Creek north of the activity areas (Weaver 1993). The prosperity that followed from the gold rush resulted in much agricultural land in the wider region becoming residential and industrial, as people settled around the crossing areas in order to make a living providing goods and services to those travelling to and from Melbourne (Weaver 1993). From this original settlement, the surrounding land was auctioned to farmers who relocated to the region attracted by the plentiful grasslands which they cleared and cultivated or utilized for pastoral grazing, eventually establishing Tullamarine Village in the 1950s (Lennon 1993).

The township of Bulla, located north-west of the activity area and east of a crossing over Deep Creek, was established to service road traffic along a track between Melbourne and Bendigo. Now called Sunbury Road, the track has been previously referred to as the Mt Macedon Route, Lancefield Road, Lancefield Bulla Road and Deep Creek Road. At the junction of the Mt Macedon Route with Oaklands Road (at the north-east corner of the Grey-Box Woodland, in Section 17 A, north of the present activity area) the Oaklands Junction Village formed around the Inverness Hotel, built by Alexander Kennedy in the 1850s. After the initial gold rush and formalisation of the Colony of Victoria in 1851, a series of government Acts encouraged closer settlement of land.

Squatting licences were cancelled, and many of the large pastoral leases subdivided and sold at auction or made open for selection for farming and agricultural purposes (Serle 1963). Economic conditions favoured larger properties, and the majority of land sold in the activity area in 1850 would later be consolidated by families such as the Mansfields and McNabs, who built a number of homesteads across the study area.

The increase of farming in Victoria during the 1850s required more intensive land divisions to secure stock, mark property boundaries, manage crops, establish stock yards, and protect the home and garden from farm animals. Properties located on volcanic plains took advantage of the volcanic basalt scattered on the land as a convenient fencing material. The construction of drystone basalt walls also helped to clear the land of rocks for cropping activities. Drystone walls were mainly constructed between 1850 and 1880, after which time barbed wire and other cheaper fencing materials made drystone walls uneconomical. However, a few were still built or maintained until after WWII (Moloney 1998:66).

Typically, agricultural land use is likely to have minimal impacts on Indigenous cultural material, with intensive subsurface disturbance likely to be localised to construction areas around homesteads and outbuildings. Ploughing is likely to have disrupted the integrity of archaeological deposits for the first 300mm across much of the activity area, with deeper disruption potentially present along alluvial river flats/terraces where market gardening has taken place. Clearance of native vegetation to maximise grazing potential may have removed potential scarred trees, however it is highly likely that mature native vegetation still survives along major watercourses.

Establishment of the airport

Aircraft landed in paddocks at Tullamarine in the 1920s, and there was a satellite aerodrome of Essendon Fields Airport on the east side of Melrose Drive during World War II. Gowrie Park was also used for aviation. Aerial Transport Ltd purchased 560 acres at Tullamarine for the establishment of an airport (Vines 1995:38). In 1959, the Commonwealth Government acquired a further 5,300 hectares (13,000 acres) of grassland in Tullamarine (Lucas 2010) and construction of Melbourne's new international airport began in 1962 .Construction of the runways involved significant earthworks in subsoils and the removal of surface soils in the majority of construction areas. Runway construction preceded the construction of terminal infrastructure, which was completed in the early 1970s.

On 27 November 1962, then prime minister Robert Menzies announced a five-year plan to provide Melbourne with a $45 million 'jetport' by 1967. The first sod was turned in November 1964 and Melbourne Airport was opened to international operations on 1 July 1970 by the prime minister at the time, John Gorton. Domestic flights were transferred to Melbourne Airport on 26 June 1971. Expansion works, including extending runways, were completed in 1973, which allowed Boeing 747s to use the airport.

A review of historic aerial photos (from 1931, 1945, 1960, 1980 and 1990) indicate that the majority of active airport areas (runways, taxiways, terminals, hangers etc) have been subject to major ground disturbing works with little potential for Indigenous heritage to remain. The construction of the runways had resulted in the clearance of the Grey Box Woodland's east and southern extent, where the tree line had become more diffuse and scattered. However, a thin band of trees appears to have been retained on the opposing east side of the runway perimeter access track (the area which is today designated as the active airside perimeter security fence). The intersection at Oaklands Junction has also been cleared, although the former roadways are still clearly visible leaving behind a transected triangular shape. Outside these active airport areas, the majority of the study area has remained relatively unchanged from earlier agricultural uses. Natural soil surfaces and the potential for Indigenous heritage still remains, even if the topsoil has been disturbed by ploughing or other agricultural uses.

Land use within the Grey Box Woodland

Aerial imagery was sourced over consecutive runs to better illustrate the prior extent and impacts to the Grey Box Woodland located at the north of the activity area. Imagery was sourced from available film runs in 1946 and 1951, which cover the northern portion of the activity area, from as far as Moonee Ponds Creek in the east to Deep Creek in the west. The 1946 imagery shows that the majority of the area south of the Grey Box Woodland is cleared and used for agricultural purposes. This area has become subject to high levels of overground activity and development associated with the airport's construction. Well defined roads, and also informal tracking, are present across the pasture in this 1946 imagery, visible to the south and south-east of the Grey Box Woodland. Some of these linear tracks appear to culminate in a farming dam, suggesting repeat agricultural practices and possible stock movement towards this water source. The dam also appears in line with a shallow drainage marked by sparse vegetation, running north-south. The Grey Box Woodland's southern tree line appears to be primarily drawn against a shared parcel boundary running east-west, and can be seen in continuation in each direction across the cleared paddocks. The later 1951 imagery covers the entire northern extent of the activity area. In this imagery, the Grey Box Woodland appears to become much denser towards its northernmost extent while becoming diffuse the further south it extends. There are also wide clearings within its central portion. Linear tracks appear to be located along the northern extent, indicated by imagery highlights that contrast strongly against the tree line. The track indicates constant use of the tree line as the main navigation route, possibly also used to reach the intersection at Oaklands Junction. Notably, within the centre of Grey Box Woodland, the larger clearing has now been established for use as the airport radar installation (Radar Hill). Access roads extend from the hill to the Grey Box Woodland west boundary road, and south-west towards the former Glen Alice homestead area (which was also removed during runway construction, although some small debris appears to be left behind).

Desktop assessment conclusions

The study area comprises the basalt plains geomorphological unit that also covers the majority of the established airport facilities, wide areas of undeveloped agricultural land, and the Grey Box Woodland within the north of the activity area. basalt plains are dissected by the incised river and creek valleys of the Maribyrnong River, Deep Creek and Arundel Creek. A large portion of the plains landform has been modified by airport construction activities. The Maribyrnong River and Deep Creek corridor is located on the western and southern boundary of the study area and likely to offer complex archaeological deposits. Located centrally within the study area, Arundel Creek is likely to be heavily impacted by past airport and agricultural activities but still has potential for cultural material.

The review of state heritage databases identified 33 Indigenous places comprising 79 individual components located within the study area. These comprise 20 artefact scatters, six LDADs, four scarred trees and three multicomponent places. The multicomponent places comprise the combined registration of 7822-3871 (Upper Maribyrnong Escarpment) comprising eight artefact scatter components and two earth features within the activity area, VAHR 7822-3872 (Glenara Creek 1) comprising one artefact scatter and two scarred trees, and VAHR 7822-0808 (Radar Hill 9) which includes a scarred tree and an earth feature.

Previous archaeological assessments in the study area and wider region have found that artefact scatters are most likely to be located along incised river valley edges and alluvial terraces, with isolated artefacts potentially located throughout the landscape in lower densities. Artefact scatters located on volcanic plains are likely to have only shallow unconsolidated cultural deposits, while alluvial terraces may have the potential for deep stratified cultural deposits. Quarries may be present wherever suitable stone material is exposed, mostly along incised river and creek valley slopes. Earth mounds are likely to be present on river and creek flats. Scarred trees have the potential to be present wherever mature remnant native vegetation survives.

European settlement occurred during the first phases of European arrival in Victoria. Today, despite encroachment of residential suburban development and the construction of Melbourne Airport, the study area remains relatively rural in nature (see **Chapter B7: European Heritage**). As a result, outside of the Melbourne Airport construction footprint, which has been subject to significant earth work activities, cultural material has a strong potential of surviving albeit with some disturbance from agricultural activities. The presence of early homestead sites, and records of Indigenous people and European settlers, also suggest there may be some potential for post-contact (i.e. post-European settlement) archaeology.

B6.4.2 Survey

B6.4.2.1 Methodology

For the purpose of the standard assessment, the study area was divided into survey units. These areas had, to date, not been subject to prior archaeological survey at the level of a CHMP. They were initially surveyed according to their separate locations within the study area. The standard assessment was undertaken in accordance with Aboriginal Victoria's (2008; 2013) guidelines regarding the identification and recording of Indigenous cultural heritage material.

The standard assessment was completed by traversing the study area on foot at intervals of approximately 5 metres between survey participants. During the survey of the Grey Box Woodland section, wider transect intervals were walked due to the overall low ground surface visibility within the woodland and the presence of obstructions such as vegetation and fallen branches which prohibited undertaking regular linear transects. An opportunistic survey was also conducted where feasible, to further inspect areas of increased ground surface visibility and other features in the woodland (such as mature trees) for evidence of cultural modification.

Systematic survey coverage was undertaken of the study area's previously unassessed land, and views of the study area recorded using a Nikon AW120 camera. Field notes were also taken recording the ground conditions of each survey unit, the vegetation type, landform and details of areas of archaeological potential for Indigenous cultural heritage. Data for previously recorded Indigenous places was reviewed in the field; this included the spatial display of previously recorded places on a Trimble R1 GNSS receiver DGPS and the use of original paper 'site cards' to assist in the relocation of Indigenous places which were not subject to prior assessment or were not able to be relocated under CHMP 12774.

All previously recorded Indigenous places within M3R were revisited during the survey. However, the encompassing lands previously surveyed under the previous RDP project (i.e. 09/27) CHMP 12774 were not required to be methodically re-surveyed as part of CHMP 16792. This approach was established following prior consultation and agreement with Wurundjeri during the initial project consultation meeting.

Figure B6.3
View north along watercourse channel, on east bank of upper reaches of Glenara Creek and edge of Grey Box Woodland (K.Oataway 6/11/19)

Figure B6.4
View south-west of relocated Scarred Tree VAHR 7822-3872-2 (Glenara Creek 1)

Figure B6.5
Newly recorded silcrete artefact on eroded area against north-west boundary of activity area (K.Oataway 6/11/19)

B6.4.2.2
Survey Results

The standard assessment was completed over multiple field days between 6 and 27 November 2019.
The ground survey was supervised by Kym Oataway and Kim White (Heritage Advisors [HA]), Biosis Pty Ltd. Of the 33 previously identified places within the study area, 15 were unable to be relocated during the survey and 15 were relocated (some required updates to their primary GPS co-ordinates). A further three were determined to have been previously collected at their time of recording, subject to archaeological salvage or likely destroyed at their recorded location with no likelihood for any tangible remains of the place to be present. A total of 131 new surface artefacts were identified during the survey, 47 attributed to previously recorded Indigenous places (artefact scatters).

Glenara Creek

The area around Glenara Creek mostly comprises undeveloped agricultural land. Past historic occupation has been identified along here in the north-west of the study area, including former farming dams, a historic heritage 'boiling-down' works site, and a potential sheep-wash associated with early settler George Coghill. A number of previously recorded Indigenous places are located along the creek line (observed as little more than a dry, shallow drainage below the elevated hillslope on the west side). The area is still widely covered by agricultural grasses on the west side of the creek line, and scattered trees with leaf litter along the creek line and to the east where it borders the Grey Box Woodland. A small concentration of newly recorded surface artefacts were located on an eroded part of the slope directly north of Coghill's dam, and another modern farming dam further north again along the drainage.

Grey Box Woodland and Radar Hill

Within the Grey Box Woodland, the effectiveness of the survey was hindered by the covering understorey and leaf litter (Figure B6.6). Although wide areas of ground appeared to be exposed as a result of erosion and some prior disturbances, visibility was hindered by the prevailing grasses, low shrubs and abundance of trees and broken tree branches across the ground. The north extent of the woodland comprises much younger growth planted after the construction of the airport. These areas were demonstrated to be cleared in historic aerial imagery in 1945-6. It is likely that these fringes of the woodland were exploited for sources of timber following initial land clearance and settlement. It is unclear what the full extent of the woodland once comprised. Only one previously recorded place, VAHR 7822-0801 (Radar Hill 2) is located here, which may demonstrate the impact of prior clearing, leading to the possible destruction of scarred trees and displacement of any artefact distributions.

As the survey moved further south through the woodland, the topography changed from flat basalt plains to the gradual north incline of the granite hill formation, Radar Hill (Figure B6.7). There are noticeably more mature trees in this area, although some could still potentially be regrowth following initial European exploitation. There are occasional clearings and depressions indicative of prior excavation and soil movement. The former tracks and firebreaks, as initially recorded by Vines (1995) and as depicted on the Radar Hill VAHR place site cards, have mostly become overgrown. Some firebreaks are only just perceptible along linear clearings or in areas of marked young regrowth between mature species. One new standing (dead) scarred tree was identified in the south of the woodland approaching the airside perimeter fence. It is likely the tree was culturally modified in the past, but it is in only fair to poor health.

Arundel Creek

The southern part of the study area comprises undeveloped land either side of Arundel Creek (Figure B6.8). Parts of the hillslopes, particularly above the west bank, appear subject to prior disturbances and are now eroding. Most of the area is covered by agricultural grasses, although impacts of prior land modifications were noted. These included the reshaping of the creek line, possible deposition of alluvial sediments on the floodplain area, and subsequent modern infrastructure. A number of isolated surface artefacts were identified but, due to their isolated recording, are likely to represent the displacement of material in the immediate landscape rather than a dense concentration in the area of recording.

B6.4.2.3
Survey conclusions

The survey confirmed the location and nature of high-sensitivity landforms in the study area, namely hillslopes and escarpments. These landforms were anticipated to be sensitive for low to moderate densities of stone artefacts. Flat and low relief basalt plains were considered to have a much lower potential for artefacts. The survey confirmed the presence of stone artefacts in the study area but generally confined to discrete areas of erosion along the gullies above Glenara and Arundel creeks. Leaf litter, grasses and broken branches obscured large portions of the ground within the Grey Box Woodland; however, large areas of ground exposure were identified on the crest of the granite hill. A moderate density of stone artefacts was also located here. The highly eroding sediments and presence of granite floaters indicates a shallow soil profile on the hill crest and upper slope. It is likely that a proportionally higher number of stone artefacts occur on the ground's surface, with a much lower potential for subsurface artefacts to be present here. The survey allowed the predictive model from the desktop assessment to be refined through ground truthing detail for landforms, land use disturbance and new Indigenous cultural material finds. The results of the survey confirmed the presence of new cultural heritage places on known sensitive landforms. The survey also recorded new stone artefacts found in association with older, previously recorded places. The survey has thereby updated the conditions and records for the extent and nature of Indigenous places within the study area.

Figure B6.6
Young regrowth over basalt plains landform within north sections of the Grey Box Woodland, view east (C.Manning 12/11/19)

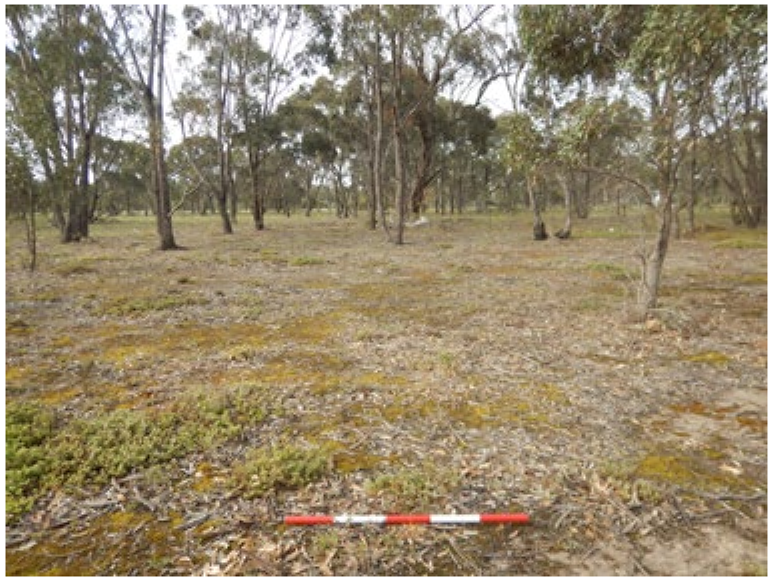


Figure B6.7
Eroded crest of the granite hill facing south-east showing sample of identified surface artefacts (pink flags) (K.White 12/11/19)

Figure B6.8
View north from southern end of activity area over hillslopes and floodplains of the Arundel Creek corridor (E.Nuridin 6/11/19)

Table B6.5
Indigenous cultural heritage places assessed during survey

VAHR place number and name	VAHR place type	Results	Condition rating
VAHR 7822-0800 (Radar Hill 1)	Artefact Scatter	Not located	Very poor
VAHR 7822-0801 (Radar Hill 2)	Artefact Scatter	Located	Very poor
VAHR 7822-0802 (Radar Hill 3)	Scarred Tree	Located	Poor
VAHR 7822-0803 (Radar Hill 4)	Artefact Scatter	Not located	-
VAHR 7822-0804 (Radar Hill 5)	Scarred Tree	Located	Good
VAHR 7822-0805 (Radar Hill 6)	Artefact Scatter	Located	Very poor
VAHR 7822-0806 (Radar Hill 7)	Scarred Tree	Not located	-
VAHR 7822-0808 (Radar Hill 9)	Earth feature/Artefact Scatter	Located	-
VAHR 7822-0809 (Radar Hill 10)	Artefact Scatter	Located	Very poor
VAHR 7822-0810 (Radar Hill 11)	Artefact Scatter	Located	Very poor
VAHR 7822-0811 (Radar Hill 12)	Artefact Scatter	Located	Poor
VAHR 7822-0812 (Radar Hill 13)	Artefact Scatter	Not located	-
VAHR 7822-0813 (Radar Hill 14)	Artefact Scatter	Not located	-
VAHR 7822-0814 (Radar Hill 15)	Scarred Tree	Located	Poor
VAHR 7822-0815 (Radar Hill 16)	Artefact Scatter	Not located	-
VAHR 7822-0816 (Radar Hill 17)	Artefact Scatter	Located	Poor
VAHR 7822-0817 (Radar Hill 18)	Artefact Scatter	Located	Poor
VAHR 7822-0818 (Radar Hill 19)	Artefact Scatter	Not located	Fair
VAHR 7822-0821 (Radar Hill 22)	Artefact Scatter	Not located	Fair
VAHR 7822-1116 (Radar Hill 24)	Artefact Scatter	Not located	-
VAHR 7822-1117 (Radar Hill 25)	Artefact Scatter	Located	Fair
VAHR 7822-3857 (Arundel Creek LDAD)	LDAD	Not located	Collected
VAHR 7822-4312 (Arundel Creek LDAD 2)	LDAD	Not located	Poor
VAHR 7822-3863 (Glenara Creek LDAD)	LDAD	Not located	Fair
VAHR 7822-4081 (Glenara Creek LDAD 2)	LDAD	Not located	Fair
VAHR 7822-3872 (Glenara Creek 1)	Artefact Scatter and Scarred Trees	Located	**Component 1** Fair **Component 2** Good **Component 3** Poor
VAHR 7822-3871 (Upper Maribyrnong Escarpment)	Multi-component place	Located	Good
VAHR 7822-4178 (APAM Grey Box Forest LDAD)	LDAD	Located	Poor
VAHR 7822-3858 (Mansfield Road LDAD)	LDAD	Not located	Fair
VAHR 7822-1803 (MELBOURNE AIRPORT UNIGAS 2)	Artefact Scatter	Not located	Destroyed
VAHR 7822-1335 (Melbourne Airport SE 3)	Artefact Scatter	Not located	Destroyed
VAHR 7822-3864 (Deep Creek Escarpment 1)	Artefact Scatter	Located	Fair
VAHR 7822-4287 (Link Road Ridge Artefact Scatter)	Artefact Scatter	Located	Good

Figure B6.9
Excavation of a trench on the basalt plains above Glenara Creek, view north towrdas Sunbury Road

Figure B6.10
View of shallow drainage line connecting to farming dam, dissecting the basalt plains landform (west edge of Grey Box Woodland in background)

Figure B6.11
Location of reinstated test pit 1 on the crest of the granite hill landform

B6.4.3
Test excavation results

Note: The complex assessment for CHMP 16792 has not yet been completed. Preliminary CHMP subsurface testing was completed under a stage 1 phase in order to provide sufficient information to inform this technical chapter. The following sections therefore reference the extent of Indigenous cultural heritage located within M3R in light of the stage 1 CHMP results only.

Archaeological test excavations were undertaken between September and November 2020 under the stage 1 approach to CHMP 16792. Targeted testing was completed in order to understand the underlying geology and geomorphology of these landforms, and how Indigenous cultural materials have been preserved within this stratigraphy.

Stage 1 of the test excavations included:

- five one square metre manually excavated test pits,
- 25 one by 10 metre mechanical trenches,
- five, one by five metre mechanical trenches, and
- 16 one by two metre mechanical trenches.

The size of the mechanical trenches excavated depended on whether there were any ecological constraints present at each test location. The majority of the one by two metre mechanical trenches were excavated along the Arundel Creek floodplains within the south of the study area, where Growling Grass Frog habitat zones and various native grass communities are present.

Forty Indigenous stone artefacts were recorded across the study area at 13 individual test locations. The highest quantity of artefacts were recorded in Test Pit 1 (n= 18) located on the crest of the granite hill formation located in the Grey Box Woodland (also known as Radar Hill). The test excavations also identified generally low density concentrations of stone artefacts elsewhere within the study area. Artefacts were generally recorded within shallow depths (100mm to 200mm) on the basalt plains landform around the Grey Box Woodland, and on the lower hillslope beside part of Arundel Creek.

B6.4.3.1
Basalt plains and hillslopes landforms

The majority of testing focused on the basalt plains and hillslopes landform units, which had largely uniform soil profiles of shallow silty clays. The basalt plains extend across the low relief landscape on all sides of the granite hill landform in the north of the study area. The basalt plains also extend to the west boundary of the study area (and airport estate) beyond the shallow drainage line of Glenara Creek (Figure B6.9 and Figure B6.10). The focus of the Stage 1 CHMP testing was conducted in this area; a series of one by 10 metre mechanical trenches were excavated at approximately 100 metre intervals over the landform. The testing demonstrated a very consistent profile of shallow blocky clay-silt deposits to between 150mm to 200mm overlaying a slightly plastic clay base.

There is evidence of greater levels of disturbance within the topsoils from the trenches located closer to Sunbury Road. At the time of excavation, the deposits across the basalt plains and hillslopes were generally dry and blocky (attributed to prolonged soil truncation as a result of ploughing and stock trampling over the areas by Glenara Creek). This profile was also confirmed by the excavation of test pit 5 near the west boundary of the estate. The test pit recorded a blocky, indurated silty clay over a moist clay base at 150mm to 170mm. The test pit was located near to previously recorded surface artefacts from the earlier survey but no cultural material was recorded within it.

Around the margins of the Grey Box Woodland there is nearly a complete absence of topsoil accumulation. This is largely due to historic land clearance, modern land use activities and ongoing erosion. This was consistent with the observations made during the survey. There are large areas within and around the edge of the current Grey Box Woodland that have been subject to extensive erosion and sheet wash. These natural weathering processes have been compounded by historic ground disturbance works such as utilities construction, the former Radar Hill installation, perimeter security fencing, creation of firebreaks, and exposed vehicle access tracks that meander through the woodland. These cumulative impacts led to the identification of stone artefacts in generally exposed surface contexts with very little to no stratified soil profiles present. Very low densities of stone artefacts were identified around the margins of the granite hill, both on the surrounding basalt plains (MT 24) and on the edge of the granite landform itself (test pits 3 and 4 and MT 24) as discussed below. This material most likely represents displacement of cultural material over the basalt plains and granite hill landform but also less frequently traversed portions of these landforms.

B6.4.3.2
Granite Hill landform

Three one square metre test pits were excavated within the granite hill landform also known as Radar Hill. The excavations sought to investigate the presence and extent of a subsurface context to the cultural material recorded on the crest of the hill after a moderate density of stone artefacts was identified during the standard assessment survey. Test pit 1 was excavated on the crest and to the south of the concentration of exposed surface artefacts (Figure B6.11). The area was selected which appeared from the surface to be less extensively eroded or exposed by past land use. Services detection was undertaken for the immediate area prior to excavations. This confirmed that a number of electrical and communications services are still present on or under the surface scatter. Some of these probably related to the earlier radar installation site but some are active communications lines which run towards the runway areas.

Test pit 1 recorded a profile of course silt and highly degraded rock structure (to 50 per cent deposit) with some degraded granite throughout. This was excavated to the depth of undulating granite rock between

300mm to 320mm. Eighteen stone artefacts were recorded within the upper 200mm of the pit, thereby demonstrating some potential for artefacts to be present below ground surface. Subsequently, test pit 2 was excavated at an open area to the east, and just below the elevation of the crest. Test pit 2 is approximately 80 metres east of test pit 1 and recorded a consistent coarse clayey silt with gravel inclusions. No cultural material was identified in test pit 2 however, indicating the scatter on the crest of the hill is a localised flaking occurrence or evidence of periodic revisitation. Evidence of displacement of surface material off the north-west side of the crest was noted during the survey, where extensive erosion has occurred and further artefacts were identified. This area coincided with existing nearby recorded artefacts as part of VAHR 7822-4178 (APAM Grey Box Woodland LDAD).

Isolated artefacts were also recorded within test pit 3 and MT 23 at the south-western edge of the hill and Grey Box Woodland. This area is located by the modelled boundary of the granite hill and basalt plains landforms. MT 23 demonstrated a profile of loosely compacted silt over moderately plastic clay base at 100mm to 200mm. The profile appears consistent with the basalt plains landform, however is starkly contrasted to the profile of nearby test pit 3 (Figure B6.12; located approximately 100 metres to the south-east). The test pit recorded a moist clayey silt increasing in gravel component with depth. The soil contained frequent inclusions of rounded basalt pieces (2mm to 5mm) and angular quartz pieces, and was a notably pale grey-brown in colour compared to the darker brown silt of MT 23. Test pit 3 was excavated to 390mm onto a fairly flat, damp plastic clay base.

This profile may be representative of the former profile for nearby recorded Indigenous place VAHR 7822-0805 (Radar Hill 6) located within 40 metres to the east (Figure B6.13). This existing place is a broad surface scatter located on a former firebreak and has been subject to a high degree of erosion and modern overgrown activity. The contrasting stratigraphy of test pit 3 and MT 23 appears to show the prevailing landform units within the topsoils. While there is a clear concentration of cultural material associated with the granite hill landform (particularly on the crest), there is a fairly consistent low density of artefacts around the lower slope of the hill, with material also distributed across the adjoining basalt plains (Figure B6.14).

Test pit 4 was excavated on a protruding contour band on the mid-slope of the granite hill formation, approximately 300 metres south-west of the hill crest. The profile of Test pit 4 was consistent with that of test pit 2, comprising dry, granitic silt which overlays a hard sandy clay base at 270mm. One silcrete artefact was recorded between 100 mm and 200mm.

B6.4.3.3
Arundel Creek floodplain landform

The stage 1 testing also sought to investigate the south of the study area, on the east side of Arundel Creek (based on the impact area for M3R). This area is primarily located in an open paddock used for stock management and grazing. The paddock is located adjacent to the residential driveway at 100 Annandale Road, with Annandale Road running to the immediate south where it crosses the creek (Figure B6.15). Testing during stage 1 of the complex assessment was limited in size to one by two metre mechanical trenches due to working within and near to multiple ecological constraints.

The testing demonstrated a clear change in geomorphological processes within this paddock. Areas that were slightly elevated and set back from the creek line recorded a silt topsoil unit of variable depth, overlying a silty-clay context. Generally, where the upper silt is present, the clay component increased with depth to an excavation limit of between 500mm and 550mm.

Figure B6.12
Excavation of test pit 3 from the CHMP assessment

Figure B6.13
View towards VAHR 7822-0805 (Radar Hill 6) from location of test pit 3

Figure B6.14
Low relief area near to test pit 3 and at edge Granite Hill landform, looking west towards basalt plains landform

Figure B6.15
View south of the lower slope to floodplain landforms above Arundel Creek

This depth is considered to be the end of the artefact-bearing deposits, due to the consistency of the clay content and absence of any further artefactual material being uncovered in these lower deposits. Cultural material was identified in only some of these trenches but generally confined to the upper 200mm to 300mm where the soil is primarily a coarse silt composition and well above the deeper clay concentrated unit, where there was an absence of any artefacts.

The mechanical trenches located closer to the creek line, at a much lower elevation, recorded almost no topsoil and excavation was unable to penetrate the highly compacted plastic clay unit encountered between 100mm and 150mm; this is a notably different very dark-brown to black composition and resulting from successive periods of waterlogging and then erosion in dry seasons. MT 28 was located at the lower slope margin on the edge of the creek floodplain unit, and recorded three silcrete artefacts in the upper 100mm. This suggests that the recorded artefacts have become displaced into the floodplain unit as a result of ongoing weathering and erosion from the slopes above.

Based on the composition of the silt and artefact bearing deposits on the lower slope, including artefact typology (mostly broken flaked pieces) it was clear that the material, soils and other inclusions (primarily observed natural siliceous cobble and stone fragments) was consistent with nearby Aboriginal place VAHR 7822-4286 (Annandale Road Ridge Exposure). VAHR 7822-4286 is not located within the M3R footprint but was recorded along with VAHR 7822-4287 (Link Road Ridge Artefact Scatter) by nearby in-progress CHMP 15771 (CHMP 15771 is being prepared by Biosis on behalf of Melbourne Airport under a separate activity and had commenced assessment prior to M3R). The CHMP 15771 activity area includes the parcel of land on the opposing north-east side of the property driveway at 100 Annandale Road. Notably, the paddock under investigation for M3R shares the same prevailing hillslope where VAHR 7822-4286 (Annandale Road Ridge Exposure) is located. The current stage 1 testing for M3R along Arundel Creek sought to investigate this same landform. Mechanical testing was also completed on both sides of Arundel Creek further north within the activity area to determine if there is any extension of a similar silt and artefact bearing deposit, however none was identified. (Figure B6.16 and Figure B6.17) Testing further north along the floodplain (creek side areas) demonstrated a strongly indurated clay deposit under the current pastoral grass cover. MT 41 was recorded north of the silt deposits on the same east side of Arundel Creek. The trench recorded a slightly damp and mixed silty-clay unit. Excavation of deeper deposits was completed to better understand the stratigraphic contexts and geomorphological processes. The intent of the excavation was to consider whether deeper, stratified contexts of alluvium or similar exist below the recent clay deposit. The upper dark silty-clay material increased in clay component to a depth of about 900mm, where there was a clear contact onto a sandy clay unit containing some basalt inclusions.

Excavation was ceased at this point. It was determined that if further excavation of the substrata needed to be undertaken, then additional excavation, sieving and spoil controls may need to be established to investigate this deposit. A review of available geotechnical data for Melbourne Airport (detailed within the CHMP's desktop assessment) was also undertaken to determine if further machine excavation was required to assess the potential for cultural material to exist in this unit.

B6.4.3.4 Testing from European (non-Indigenous) heritage excavations

Concurrent historical excavations were undertaken in January-February 2020 for known and potential historical heritage sites within the M3R study area. This body of work follows on from previous non-Indigenous excavations which were also undertaken between 2014 and 2015 for the preparation of the RDP.

Excavations were completed near to the current CHMP assessment's test pit 3 (TP 3), as part of the M3R European (non-Indigenous) heritage assessment. The excavations focused on the site of George Coghill's Boiling-Down Works at Glencairne. Among the demolition rubble of the boiling-down works' ruined walls and foundations, seven Indigenous stone artefacts were also identified. These stone artefacts are likely to have been deposited over the nearby clay-silt soils, which were then extracted for building materials and mortar for the boiling-down works site. The artefacts may have now also been redeposited as part of the demolition material and fill on the site. These artefacts, combined with the single artefact identified in TP 3 of the CHMP and nearby VAHR 7822-0805 (Radar Hill 6), demonstrate a low to moderate density of material across the area. There is some potential for stone artefacts to exist within secondary contexts, despite the historic and modern disturbances in this immediate area.

The artefacts may have originally been deposited on the former ground surface in association with the Glenara Creek margins and ephemeral tributaries. The area near to TP 3 and Coghill's Boiling-Down Works may have once been a low relief area where water accumulated during wet periods. The proximity of this location to the incised Glenara Creek would have provided an abundant amount of natural resources for Aboriginal people in the past. The stone artefacts identified to date appear to have been subject to ongoing weathering (erosion, sheet wash), historic landscaping (Boiling-Down Works site) and modern overground activities (Grey Box Woodland and airport firebreaks).

A second historic place was investigated in the west of the study area, on the west bank of Glenara Creek. This place is attributed as Kennedy's Hut Site. One silcrete Indigenous stone artefact was identified during excavation of a debris layer located at the rear of the site. A short course of external brick flooring was recorded in this area, suggesting the artefacts had become dispersed within an area of refuse/dumping associated with the hut. Other modern materials recorded in this context included buttons, pins, lead pencil tips, fragments of clay pipe and porcelain/ceramic dolls/figurines. No Indigenous cultural material was identified near the Kennedy Hut site; however, the location of Indigenous place Radar Hill 19 (VAHR 7822-0818) is nearby, about 150 metres to the east on the opposite side of the Glenara drainage line. This suggests that a low distribution of stone artefacts may have been deposited along the creek line in the past, and which have become exposed over time on the surface and also displaced by the construction and subsequent demolition of the historic hut site and any of its ancillary features.

The artefacts from the historic excavations have been identified in secondary contexts and without a clear stratigraphic profile. It is to be determined if these artefacts will be included within an existing LDAD registration within M3R or may be considered 'un-provenanced' under a separate new registration.

The results of the excavations at the two European sites where these artefacts were found is detailed further in **Chapter B7: European Heritage**.

B6.4.3.5 Test excavation conclusions

The results of the standard assessment identified 33 Indigenous places within the M3R study area. The results of the test excavation resulted in a large number of previously recorded Indigenous cultural heritage place records being merged into larger landform registrations. As a result of the test excavations there are 14 Indigenous places recorded within the M3R study area (**Figure B6.18**).

Table B6.6 presents the summary of excavations completed under stage 1 of the complex assessment according to the landforms investigated.

Figure B6.16
View north on east side of Arundel Creek along floodplain unit

Figure B6.17
View south on west side of Arundel Creek along floodplain unit, near drainage mains outfall infastructure

The approach to recording Aboriginal places on the VAHR based on landform was initially endorsed by Wurundjeri during consultation in the CHMP project meetings (standard assessment meeting, 25 February 2020) and during subsequent email correspondence with Wurundjeri's Cultural Heritage Unit Manager, Matthew Chamberlain (via Kim White, Biosis Pty Ltd, 9 November 2020). The Wurundjeri Elders indicated they did not have any concerns with the approach proposed.

The test excavation results confirmed a number of general observations both from the survey and about the investigated landforms:

A number of previously recorded places within the M3R footprint have been subject to disturbance in previously developed parts of the study area.

The high proportion of previously recorded places (namely artefact scatters) are in poor condition due to the impact of ongoing erosion (e.g. within the Grey Box Woodland and Granite Hill areas) in naturally shallow and erosional soil profiles.

Stone artefacts were also identified in disturbed contexts associated with two European heritage places: Kennedy's Hut Site and Coghill's Boiling-Down Works.

The Basalt Plains landform has very limited potential for surviving cultural heritage materials in subsurface contexts. The existing topsoils are very shallow and are more likely to be affected/displaced by ground disturbance. Stone artefact distributions on this landform are predominantly found in eroded or surface contexts within areas used for pastoral activities. It is noted, however, that artefacts are still able to be located within disturbed contexts.

The Granite Hill landform (also known as Radar Hill) is a focal point for past Aboriginal occupation of the area and within the M3R footprint; as demonstrated by the presence of more concentrated deposits of artefacts, particularly in surface contexts and some areas of preserved subsurface archaeological deposits.

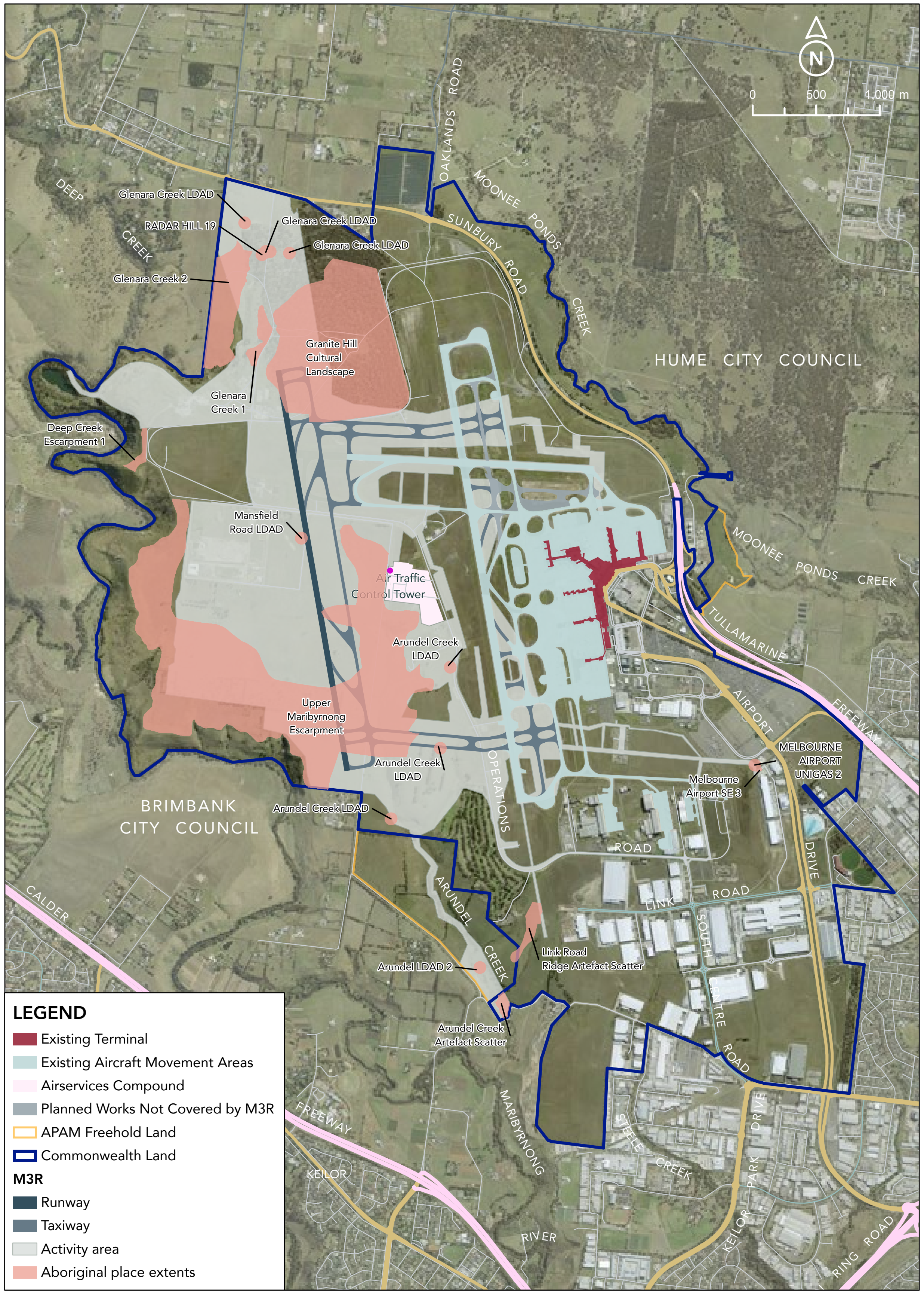
There is potential for shallow subsurface archaeological deposits on the lower hillslopes approaching Arundel Creek. There is a much lower likelihood for stone artefacts to exist on the current floodplain landform associated with Arundel Creek. Further investigation is required to investigate the potential deep alluvial deposits located adjacent and within the floodplain.

The results for the floodplain landform highlight the research potential of such waterways as Arundel Creek and its associated geomorphological process. Similar to the significance of the alluvial terrace landforms investigated by the RDP CHMP 12774, these waterway channels can present opportunities to further examine the complex geomorphology within the Melbourne Airport estate. This helps to determine the potential for archaeological deposits in these areas; and the likelihood of cultural materials, primarily stone artefacts, to exist within different stratigraphic profiles below the present ground surface. The current extent of testing has determined the relative archaeological potential of the lower hillslope and floodplain landforms associated with Arundel Creek, limited to the south of M3R. Only limited archaeological information has been collected to inform this technical chapter. Larger test samples are required to comprehensively interpret past Aboriginal land use within these landforms, which will be determined through implementation of the complete CHMP subsurface testing methodology.

Table B6.6
Summary Results of the Test Excavations

Landform assessed	Testing type completed	Results – soil profiles	Results – artefact occurrence	Indigenous places recorded (VAHR)
Granite Hill (includes lower slopes and intersection with basalt plains)	Three, 1x1 metre test pits Two, 1x10 metre mechanical trenches	Little to no topsoil preserved in highly eroded areas. Some silt deposits containing degraded granite over granite or clay base, to 320-390 millimetres.	TP1: 18 artefacts TP3: 1 artefact TP 4: 1 artefact MT 23: 1 artefact	TBD (Granite Hill Cultural Landscape)
Basalt plains	One, 1x1 metre test Pit 25, 1x10 metre mechanical trenches Three, 1x5 metre mechanical trenches	Little to no preserved topsoil, silty clay and blocky clays to 100-200 millimetres in depth.	MT 1: 1 artefact MT 24: 1 artefact MT 37: 1 artefact	TBD (Glenara Creek 2); VAHR 7822-4287 (Link Road Ridge Artefact Scatter)
Arundel Creek Floodplain (and lower hillslope)	16, 1x2 metre mechanical trenches	Indurated block clay on floodplain adjacent to edge of creek. Coarse clayey silts overlying silty clay to 500-550 millimetres on lower slope face.	MT 28: 2 artefacts MT 30: 6 artefacts MT 32: 1 artefact MT 33: 3 artefacts MT 35: 2 artefacts MT 36: 2 artefacts	TBD (Arundel Creek Artefact Scatter)
Historic excavations	Uncovering of surface features and removal of rubbish and demolition debris	Rubbish, weed removal and demolition debris	Seven stone artefacts across two sites	TBD (Kennedy's Hut and Coghill's Boiling Down Works)

Figure B6.18
Indigenous cultural heritage places in the study area



B6.4.4 Place inventory

B6.4.4.1 Aboriginal places in M3R (after CHMP stage 1 test excavations)

Additional Indigenous cultural heritage material was identified during the survey component under CHMP 16792 across the Glenara Creek, Grey Box Woodland and Arundel Creek survey areas. Under stage 1 of the CHMP complex assessment completed in late 2020, a number of new Aboriginal place registrations have been determined in consultation with Wurundjeri.

Table B6.7 to Table B6.19 provides information on the Indigenous cultural heritage places identified in the study area as a result of the survey and test excavations conducted to date. These places are also shown in Figure B6.18.

Note: Until the CHMP Complex Assessment has been fully completed, it is possible that minor alterations to the contents of these registrations will be required, such as addition of further artefacts or test locations within the defined extents. This is a process administered by the VAHR Aboriginal place registration and approvals process. Such minor changes are unlikely to substantially change the extent or nature of the Aboriginal places detailed here, and will therefore not alter their attributed level of significance.

Table B6.7
Place inventory for VAHR TBD (Granite Hill Cultural Landscape)

VAHR TBD (Granite Hill Cultural Landscape)	
Place type	Multi-component place (Artefact Scatter and Scarred-trees)
Description	This new place has been recorded to reflect this prominent granite hill crest as part of a 'whole of landscape' approach to determining known cultural heritage values and the potential for further unidentified values to be present in the immediate area. Additional, unidentified material will most likely include further concentrations of isolated and low density stone artefact distributions in surface and subsurface contexts. Such material may not be visible on the surface due to prevailing understorey and leaf litter cover, and likely also exists in areas not subject to test excavations given the large extent of the place. The place includes a moderate density of stone artefacts on the hill crest, which have been subject to some prior disturbances leading to their exposure. A lower density of artefacts exists in eroded area on the upper slope. A diffuse distribution of artefacts are located on the lower granite hill slope, near to the junction of this landform with the surrounding flat basalt plains. A consistent distribution of surface artefacts is present around the highly eroded external airside perimeter security fence line, at the edge of the Grey Box Woodland, to the east and south sides. This place extent includes a section of known values on the basalt plains to the north, whereas the east and southern boundaries are defined by the granite landform and its abrupt boundary with the modern airport airside and runway areas. The west boundary is defined by a combination of the granite landform and recorded values as a result of the in progress CHMP assessment. Four existing scarred trees are located within the place with one new tree determined to 'most likely' have been culturally modified identified during the survey.
Images	**Figure B6.19 Exposed boulder on crest of granite hill landform, view east** 

Table B6.8
Place inventory for VAHR TBD (Glenara Creek 2)

VAHR TBD (Glenara Creek 2)	
Place type	Artefact Scatter
Description	The place is defined by the area covered by previously recorded Indigenous places VAHR 7822-4081 (Glenara Creek LDAD 2), VAHR 7822-0808 (Radar Hill 9), VAHR 7822-1116 (Radar Hill 24) and VAHR 7822-1117 (Radar Hill 25). A low density of newly recorded artefacts was also identified within this extent by the current assessment (one subsurface and 12 surface artefacts). The place is primarily defined by the low density of surface artefacts recorded across the elevated basalt plains landform within the north-west of M3R and a narrow section of escarpment landform. The place predominantly comprises a low density of surface artefacts across the extent which includes the merged locations of the VAHR 7822-0808, VAHR 7822-1116 and 7822-1117; these are highly eroding artefact distributions above the Glenara Creek gully in the south of the place. Most of the surface artefacts recorded at the basalt plains level have been subject to prior agricultural activities such as ploughing and stock trampling and grazing. Therefore, there is unlikely to be very extensive intact subsurface profiles within the place extent. Only one stone artefact was collected during Stage 1 of the CHMP Complex Assessment at a depth of between 0-100 millimetres.
Images	**Figure B6.20 View north across top of basalt plains at Glenara Creek 2** 

Table B6.9
Place inventory for VAHR TBD (Arundel Creek Artefact Scatter)

VAHR TBD (Arundel Creek Artefact Scatter)	
Place type	Artefact Scatter
Description	The place is a low density artefact scatter on a lower slope on the east side of Arundel Creek, in the very south of M3R. This is a newly recorded place based on the extent of testing completed in Stage 1 of the CHMP. Testing was undertaken by mechanical trenches excavated in short transect across the lower slope and on the floodplain unit above Arundel Creek. Testing on the low elevation floodplain unit recorded almost no topsoil development and encountered a compact clay unit between 100-150 millimetres. Testing on the lower slope face recorded a clear silt topsoil deposit to between 200-300 millimetres, overlying a silty clay context to depths between 500-550 millimetres. Cultural material was identified in the majority of trenches on the lower slope above the floodplain level, with artefacts recorded in the upper 200-300 millimetre. Trench MT 28 was located at the transition between the lower slope margin and the creek floodplain. Three silcrete artefacts were identified in the upper 100 millimetres in the highly compact clay deposit. This suggests that the artefacts have become displaced over the floodplain unit as a result of ongoing weathering and erosion out of the silt profile on the slopes above. The material recorded at this place appears consistent with nearby Aboriginal place VAHR 7822-4286 (Annandale Road Ridge Exposure) further upslope on the same hillside (outside M3R footprint). The newly recorded place Arundel Creek Artefact Scatter comprises 17 subsurface artefacts across six positive test locations.
Images	**Figure B6.21 View south of Arundel Creek Artefact Scatter, across low hillslope and floodplain** 

Table B6.10
Place inventory for VAHR 7822-4287 (Link Road Ridge Artefact Scatter)

VAHR 7822-4287 (Link Road Ridge Artefact Scatter)	
Place type	Artefact Scatter
Description	The place is a moderate density artefact scatter located across a prominent ridgeline in the south of M3R, with excellent views along the Arundel Creek valley. The place was first recorded by nearby CHMP 15771, which is currently in preparation by Biosis on behalf of APAM for other works. CHMP 15771 recorded two surface artefacts and 191 subsurface artefacts from a total of three 1x1 metre test pits, and fourteen 50x50 centimetre shovel test pits (STPs). 52 artefacts were recorded in a single STP in Transect 2 (STP 7) demonstrating the highly concentrated nature of this place along the ridge spine. In line with the 'landform' approach of this assessment, the place extent has been updated to reflect the full ridgeline crest which runs to the south. The northern extent of the place has also increased based on identification of an artefact in a test trench where the ridge approaches the basalt plains landform in the north.
Images	**Figure B6.22 View of VAHR 7822-4287 facing south, ridge crest in distant middle-ground** 

Table B6.11
Place inventory for VAHR 7822-0818 (Radar Hill 19)

VAHR 7822-0818 (Radar Hill 19)	
Place type	Artefact Scatter
Description	The place was unable to be relocated. The area is located near to the Gate 4 access road (to the east). The ground is covered with leaf litter which obscured vision of the ground's surface and any cultural material present. The place comprises a single silcrete artefact, which may have become displaced or obscured from vision.
Images	**Figure B6.23 Location of previously recorded place VAHR 7822-0818 (Radar Hill 19) looking south-west towards Glenara Creek gully** 

Table B6.12
Place inventory for VAHR 7822-1335 (Melbourne Airport SE 3)

VAHR 7822-1335 (Melbourne Airport SE 3)	
Place type	Artefact Scatter
Description	26 artefacts collected in surface salvage associated with CHMP 10442 in 2012 and place was consequently destroyed. The place location has since been subject to disturbance as part of internal roads and infrastructure near the roundabout connecting Airport Drive and Mercer Drive. No further investigation was determined to be required as part of the current assessment.

Table B6.13
Place inventory for VAHR 7822-1803 (Melbourne Airport UNIGAS 2)

VAHR 7822-1803 (MELBOURNE AIRPORT UNIGAS 2)	
Place type	Artefact Scatter
Description	The place was subject to the most recent reassessment under CHMP 12333. Due to the importation of fill, the cultural material present was determined to have no provenance, The current survey observed the place to have been subject to disturbance as part of internal roads and infrastructure near the roundabout connecting Airport Drive and Mercer Drive. No further investigation was determined to be required as part of the current assessment.

Table B6.14
Place inventory for VAHR 7822-3857 (Arundel Creek LDAD)

VAHR 7822-3857 (Arundel Creek LDAD)	
Place type	Low Density Artefact Distribution
Description	The place was collected at the time of recording during CHMP 12774. The components of this place comprise two stone artefacts located on the west bank of Arundel Creek, and two within the undeveloped land west of Operations Road, identified during concurrent historical heritage investigations.

Table B6.15
Place inventory for VAHR 7822-3858 (Mansfield Road LDAD)

VAHR 7822-3858 (Mansfield Road LDAD)	
Place type	Low Density Artefact Distribution
Description	Two artefacts were found during subsurface excavations as part of CHMP 12774. It is likely the place primarily existed as a low density subsurface distribution on the basalt plain landform. No further investigation was determined to be required as part of the current assessment.

Table B6.16
Place inventory for VAHR 7822-3863 (Glenara Creek LDAD)

VAHR 7822-3863 (Glenara Creek LDAD)	
Place type	Low Density Artefact Distribution
Description	The place location was revisited during the survey but no cultural heritage material was able to be identified at the original component locations, primarily due to prevailing grass and leaf litter cover. Additional isolated surface artefacts identified during the survey across the northern assessment area (basalt plains and outer margins of the Grey Box Woodland) will be added to this registration under a VAHR 'Record Edit' process.
Images	**Figure B6.24 Location of previously recorded place VAHR 7822-3863 (Glenara Creek LDAD) adjacent to access road looking south** 

Table B6.17
Place inventory for VAHR 7822-3864 (Deep Creek Escarpment 1)

VAHR 7822-3864 (Deep Creek Escarpment 1)	
Place type	Artefact Scatter
Description	VAHR 7822-3864 is a large Artefact Scatter located on the eastern escarpment of Deep Creek. The place is located on a crest and is bounded by cliffs and steep slopes to the west and south and by disturbance associated with runway construction to the east and north. CHMP 12774 merged previously recorded places VAHR 7822-0365 into this place. The place was revisited during the current survey but no new artefacts were recorded.

Table B6.18
Place inventory for VAHR 7822-3871 (Upper Maribyrnong Escarpment)

VAHR 7822-3871 (Upper Maribyrnong Escarpment)		
Place type	Artefact Scatters	
Description	VAHR 7822-3871 is a wide covering multi-component place comprising a diffuse 'background scatter' of stone artefacts, and a number of higher density 'artefact clusters'. The escarpment was revisited and views of the place were recorded with digital camera. At the time of survey, the majority of the place extent is under medium grass growth which has dried after the change to the summer period. The place appears to be in good conditions, following the prior assessment by CHMP 12774. Some parts of the middle and lower hillslopes above Arundel Creek (e.g. component -13; cluster) are exposed and are likely subject to ongoing erosion, where no vegetation matter is present to stabilise the area.	
Images	**Figure B6.25 Location of VAHR 7822-3871 (Upper Maribyrnong Escarpment) looking north along Arundel Creek valley (eastern extent of place)**	
	Figure B6.26 Location of VAHR 7822-3871 (Upper Maribyrnong Escarpment) looking northwest along Arundel Creek valley (northern extent of place)	

Table B6.19
Place inventory for VAHR 7822-3872 (Glenara Creek 1)

VAHR 7822-3872 (Glenara Creek 1)		
Place type	Artefact Scatter and Scarred Trees	
Description	Three surface artefacts were identified within the existing place extent (VAHR 7822-3872-1), in eroding areas of ground. Two were located near the artefact scatter PGC, and one near to the Component 3 scarred tree. The two scarred tree components were re-inspected, with component 2 (VAHR 7822-3872-2) appearing to be in good health, although component 3 (VAHR 7822-3872-3) appeared to be in poor health.	
Images	**Figure B6.27 View eroded ground near new artefacts within previously recorded place VAHR 7822-3872-1 (Glenara Creek 1)**	
	Figure B6.28 View south-west of relocated Scarred Tree VAHR 7822-3872-2 (Glenara Creek 1)	
	Figure B6.29 View north of relocated Scarred Tree VAHR 7822-3872-3 (Glenara Creek 1)	

Table B6.20
Place inventory for VAHR 7822-4312 (Arundel Creek LDAD 2)

VAHR 7822-4312 (Arundel Creek LDAD 2)	
Place type	Low Density Artefact Distribution
Description	The specific components of the place were unable to be located during the current survey. The place location appears to be subject to significant flood damage at the creek line. This may have displaced the material remains from the area, or the artefact has been obscured by grass cover. A number of new surface artefacts were identified along the hillslopes above Arundel Creek during the survey portion of the current assessment. Due to their proximity to the existing VAHR components, these will be added under a 'Record Edit' process for this place. The place now comprises a total of five surface artefacts (four newly recorded and one existing), however only the existing component is located within the M3R footprint.
Images	**Figure B6.30 Location of previously recorded place VAHR 7822-4312 (Arundel Creek LDAD 2) looking south-east across creek floodplain** 

B6.4.4.2 Previously recorded and retired/merged Aboriginal places

Table B6.21 to Table B6.42 presented below detail those Indigenous places previously recorded within the study area and which have now been merged within one of the new places. The place locations were subject to survey during the CHMP Standard Assessment. The information is provided below as a recorded of each the site contents for each new place.

Table B6.21
Place inventory for VAHR 7822-0800 (Radar Hill 1)

VAHR 7822-0800 (Radar Hill 1)	
Place type	Artefact Scatter
Description	The place GPS location was revisited. The area is in a deteriorated state with few spatial references to identify the location of the previously registered scatter. One isolated artefact was identified on part of the same unformed/exposed track. The track is now disused and is largely covered by leaf litter. It is unclear if the artefact is related to the place and may be indicative of displacement of materials over time, or a low density continuation of material in the vicinity.
Images	**Figure B6.31 Previously recorded location of VAHR 7822-0800 (Radar Hill 1) showing existing ground conditions looking north** 

Table B6.22
Place inventory for VAHR 7822-0801 (Radar Hill 2)

VAHR 7822-0801 (Radar Hill 2)	
Place type	Artefact Scatter
Description	The place GPS location was revisited. No cultural material was able to be identified. The line of a prior firebreak or informal track appears to run across the location east-west. The original site card indicates the place on a firebreak abutting a fence line. It seems more likely that on this basis, the place is more accurately located on the exposed access track further to the north of the current ACHRIS entry. Cultural material was recorded in this latter assessed area.
Images	**Figure B6.32 Register location of previously recorded place VAHR 7822-0801 (Radar Hill 2)** 

Table B6.23
Place inventory for VAHR 7822-0802 (Radar Hill 3)

VAHR 7822-0802 (Radar Hill 3)	
Place type	Scarred Tree
Description	The place GPS position was revisited. No potential standing scarred tree representing the original place card was noted here. A fallen, dead tree was recorded within 50 metres of this area which displayed a scar mark. The scar face is partially laid against the ground but it was not thought to be the result of cultural modification. Subsequently, the mud map on the place card was used to relocate the place much further north-west, roughly central in the existing GBW extent. The scarred tree is in poor health with the base of the tree extensively burrowed by animal activity. The scar is angled as depicted in the place card and follows the main trunk orientation.
Images	**Figure B6.33 Relocated scarred tree VAHR 7822-0802 (Radar Hill 3) view of scar side looking south**

Table B6.24
Place inventory for VAHR 7822-0803 (Radar Hill 4)

VAHR 7822-0803 (Radar Hill 4)	
Place type	Artefact Scatter
Merged with	VAHR TBD (Granite Hill Cultural Landscape)
Description	The place GPS position was revisited. No cultural material was able to be identified here. The area is covered by medium thick grass, but is located on the edge of wider eroded areas. The place is located downslope of a much larger concentration of cultural material and exposed granite on the crest of Radar Hill. It is probable that the existing ground conditions obscure the extent of the place and its prior identifying features.
Images	**Figure B6.34 Location of previously recorded place VAHR 7822-0803 (Radar Hill 4) looking north-east**

Table B6.25
Place inventory for VAHR 7822-0804 (Radar Hill 5)

VAHR 7822-0804 (Radar Hill 5)	
Place type	Scarred Tree
Merged with	VAHR TBD (Granite Hill Cultural Landscape)
Description	The place was relocated near to its existing ACHRIS record. The tree is in good health and the main south-facing scar is well preserved. The tree base is surrounded by boxthorn. A second smaller scar is located on the north side of the tree and is hollowed with a great amount of regrowth present.
Images	**Figure B6.35 Relocated scarred tree VAHR 7822-0804 (Radar Hill 5) view of scar side looking north**

Table B6.26
Place inventory for VAHR 7822-0805 (Radar Hill 6)

VAHR 7822-0805 (Radar Hill 6)	
Place type	Artefact Scatter
Merged with	VAHR TBD (Granite Hill Cultural Landscape)
Description	The place was relocated at its existing ACHRIS record. The scatter covers a wide area along a heavily eroded prior firebreak. The area has most likely been subject to prior vehicle activity as well. The distribution of artefacts becomes diffuse at the northern extent, where the current level of exposure narrows. The ground exposure continues to the south and west in small area of new vegetation growth and also to the east below more establish young growth. Further material was unable to be located here however, in part due to accumulated leaf litter over this surface.
Images	**Figure B6.36 Relocated area of VAHR 7822-0805 (Radar Hill 6) view south-east**

Table B6.27
Place inventory for VAHR 7822-0806 (Radar Hill 7)

VAHR 7822-0806 (Radar Hill 7)		
Place type	Scarred Tree	
Merged with	VAHR TBD (Granite Hill Cultural Landscape)	
Description	The place GPS position was revisited. No mature trees bearing cultural modification could be located in this immediate area. One tree was recorded further north of the place, however. The visible scar is elevated much higher above the ground, and faces approximately south-east. The dimensions of the scar do not appear to match those of the original place card however, unless the scar has deteriorated since initial recording.	
Images	**Figure B6.37 Probable relocated scarred tree VAHR 7822-0806 (Radar Hill 7) view of scar side looking north-west**	

Table B6.28
Place inventory for VAHR 7822-0808 (Radar Hill 9)

VAHR 7822-0808 (Radar Hill 9)		
Place type	Earth feature/Artefact Scatter	
Merged with	VAHR TBD (Granite Hill Cultural Landscape)	
Description	The place was unable to be relocated during the initial CHMP survey. Low GSV hindered the ability to relocate the place. Subsequently, one silcrete artefact was located on the eroding embankment above the creek line during visitation of the area for a separate historic heritage survey.	
Images	**Figure B6.38 View of previously recorded place VAHR 7822-0808 (Radar Hill 9) over shallow gully on north side of Glenara Creek**	

Table B6.29
Place inventory for VAHR 7822-0809 (Radar Hill 10)

VAHR 7822-0809 (Radar Hill 10)		
Place type	Artefact Scatter	
Merged with	VAHR TBD (Granite Hill Cultural Landscape)	
Description	The place was revisited with two surface artefacts recorded within 10 metres of the GPS location. Further isolated artefacts were also noted north and south within 100 metres of the place. The place is located on the landside (west of the perimeter security fence). The area is highly eroded on the prior firebreak; now the airside perimeter security fence. Sheet wash is continuing to cut into the underlying sediments approaching the fence line. Large ant colonies are also located across the area, obscuring vision of the obscured ground in some parts.	
Images	**Figure B6.39 Location of relocated place VAHR 7822-0809 (Radar Hill 10) looking south along perimeter security fence line**	

Table B6.30
Place inventory for VAHR 7822-0810 (Radar Hill 11)

VAHR 7822-0810 (Radar Hill 11)		
Place type	Artefact Scatter	
Merged with	VAHR TBD (Granite Hill Cultural Landscape)	
Description	Similar to above place VAHR 7822-0809, this place is located along the west side to the perimeter security fence, along the south-east of the Grey Box Woodland. One silcrete artefact was located near to the place GPS location. The area is highly eroded which a variety of imported materials also present in the area contributing to disturbance and obscuring the natural sediments of the area.	
Images	**Figure B6.40 Location of previously recorded place VAHR 7822-0810 (Radar Hill 11) looking south along perimeter security fence line**	

Table B6.31
Place inventory for VAHR 7822-0811 (Radar Hill 12)

VAHR 7822-0811 (Radar Hill 12)	
Place type	Artefact Scatter
Merged with	VAHR TBD (Granite Hill Cultural Landscape)
Description	The place was located along the west side of the perimeter security fence. Five artefacts were identified in the vicinity of the place GPS location. The area is in poor condition and subject to erosion.
Images	**Figure B6.41 View of relocated place VAHR 7822-0811 (Radar Hill 12) looking south along perimeter security fence line** 

Table B6.32
Place inventory for VAHR 7822-0812 (Radar Hill 13)

VAHR 7822-0812 (Radar Hill 13)	
Place type	Artefact Scatter
Merged with	VAHR TBD (Granite Hill Cultural Landscape)
Description	The place was unable to be relocated. It is likely the continued erosion of the area has lead to displacement of material, and also the obscuring of artefacts by sediment and other rubbish material along the fence line. The area is slightly narrower between the fence line and also sparse vegetation extending from the GBW, which limited visibility of the ground surface.
Images	**Figure B6.42 View of previously recorded place VAHR 7822-0812 (Radar Hill 13) looking north along perimeter security fence line** 

Table B6.33
Place inventory for VAHR 7822-0813 (Radar Hill 14)

VAHR 7822-0813 (Radar Hill 14)	
Place type	Artefact Scatter
Merged with	VAHR TBD (Granite Hill Cultural Landscape)
Description	The place was unable to be relocated. It is likely the continued erosion of the area has led to displacement of material, and also the obscuring of artefacts by sediment and other rubbish material along the fence line.
Images	**Figure B6.43 View of relocated place VAHR 7822-0813 (Radar Hill 14) looking south along perimeter security fence line** 

Table B6.34
Place inventory for VAHR 7822-0814 (Radar Hill 15)

VAHR 7822-0814 (Radar Hill 15)	
Place type	Scarred Tree
Merged with	VAHR TBD (Granite Hill Cultural Landscape)
Description	The place was relocated near the original place recording. The tree is in poor to good health and appears to be decaying. One branch is still alive with leaves still attached, although the main trunk limb appears dead at the canopy end. A number of large branches have fallen around the base of the tree. The south-facing scar appears to be well preserved.
Images	**Figure B6.44 Relocated scarred tree VAHR 7822-0814 (Radar Hill 15) showing scar side looking north** 

Table B6.35
Place inventory for VAHR 7822-0815 (Radar Hill 16)

VAHR 7822-0815 (Radar Hill 16)	
Place type	Artefact Scatter
Merged with	VAHR TBD (Granite Hill Cultural Landscape)
Description	The place was unable to be located. Material may have become displaced due to prolonged erosion along the perimeter security fence line, or by vegetation regrowth along the edge of the Grey Box Woodland understorey.
Images	**Figure B6.45 View of surveyed area at recorded location of VAHR 7822-0815 (Radar Hill 16) looking east along perimeter security fence line** 

Table B6.36
Place inventory for VAHR 7822-0816 (Radar Hill 17)

VAHR 7822-0816 (Radar Hill 17)	
Place type	Artefact Scatter
Merged with	VAHR TBD (Granite Hill Cultural Landscape)
Description	The place was relocated. Four surface artefacts were identified in the vicinity of the place. The fence-line is eroding along the GBW side, with a gentle slope proceeding southwards from the Granite Hill formation to the north (Radar Hill).
Images	**Figure B6.46 View of surveyed area at recorded location of VAHR 7822-0816 (Radar Hill 17) looking east along perimeter security fence line** 

Table B6.37
Place inventory for VAHR 7822-0817 (Radar Hill 18)

VAHR 7822-0817 (Radar Hill 18)	
Place type	Artefact Scatter
Merged with	VAHR TBD (Granite Hill Cultural Landscape)
Description	The place was relocated by the perimeter security fence line. Two artefacts were identified by the place co-ordinate.
Images	**Figure B6.47 View of surveyed area at recorded location of VAHR 7822-0817 (Radar Hill 18) looking east along perimeter security fence line** 

Table B6.38
Place inventory for VAHR 7822-0821 (Radar Hill 22)

VAHR 7822-0821 (Radar Hill 22)	
Place type	Artefact Scatter
Merged with	VAHR TBD (Granite Hill Cultural Landscape)
Description	The place location was revisited, following the relocation of nearby scarred tree VAHR 7822-0802 (RADAR HILL 3). The area appears to be stable and located on flat ground. Prior access tracks are present in the area as well as discrete areas of disturbance, including underground cabling and an area of rock pilling. Leaf litter and boxthorn obscures a large area, making it difficult to reference the original place card. No cultural material was identified in the vicinity of the place.
Images	**Figure B6.48 Approximate location of VAHR 7822-0821 (Radar Hill 22) based on original site recording information, looking north** 

Table B6.39
Place inventory for VAHR 7822-1116 (Radar Hill 24)

VAHR 7822-1116 (Radar Hill 24)	
Place type	Artefact Scatter
Merged with	VAHR TBD (Glenara Creek 2)
Description	The place was unable to be relocated during the survey,
Images	**Figure B6.49 View over location of previously recorded place VAHR 7822-1116 (Radar Hill 24) looking west over shallow gully** 

Table B6.40
Place inventory for VAHR 7822-1117 (Radar Hill 25)

VAHR 7822-1117 (Radar Hill 25)	
Place type	Artefact Scatter
Merged with	VAHR TBD (Glenara Creek 2)
Description	The place could not be located at the existing GPS position but six additional artefacts were recorded in close vicinity, in an area of exposed sands eroded from the mid-slope near to Glenara Creek.
Images	**Figure B6.50 Area of high erosion where artefacts were identified near to previously recorded place VAHR 7822-1117 (Radar Hill 25)** 

Table B6.41
Place inventory for VAHR 7822-4081 (Glenara Creek LDAD 2)

VAHR 7822-4081 (Glenara Creek LDAD 2)	
Place type	Low Density Artefact Distribution
Merged with	VAHR TBD (Glenara Creek 2)
Description	Although the specific components of the place could not be relocated, three new artefacts were identified in the area.
Images	**Figure B6.51 Location of previously recorded place VAHR 7822-4081 (Glenara Creek LDAD 2) looking north-west** 

Table B6.42
Place inventory for VAHR 7822-4178 (APAM Grey Box Forest LDAD)

VAHR 7822-4178 (APAM Grey Box Forest LDAD)	
Place type	Low Density Artefact Distribution
Merged / Retired with	The place has been merged in its entirety with the Granite Hill Cultural Landscape (VAHR TBD).
Description	The place comprises a number of surface artefacts recorded within the Grey Box Woodland and along the landside perimeter security fence line by a previous non-CHMP survey. Not all components were able to be relocated, however additional cultural material was recorded in the vicinity of a concentration on the west slope of Radar Hill. Eleven artefacts were located along an area that appears to be a former track or firebreak for the now removed radar installation. The exposure is highly eroded along its extent, with sheet wash cutting into the underlying sediment. Grass and vegetation obscures ground visibility on either side. Only a low density of material was identified around the middle to upper slope of Radar Hill, despite further wide areas of ground exposure.
Images	**Figure B6.52 View of highly eroded area at location of previously recorded components of place VAHR 7822-4178 (APAM Grey Box Forest LDAD) looking east** 

B6.4.5 Significance assessment

A significance assessment of each Indigenous cultural heritage place is summarised in Table B6.43. The RAP field representatives who participated in the CHMP were not aware of any specific traditional information about the Indigenous cultural heritage within the study area. The representatives commented that cultural heritage places are considered to have high cultural significance as they represent their ancestors' use of the land. A number of Wurundjeri representatives commonly comment on the Grey Box Woodland as a significant area for cultural heritage, particularly owing to the scarred trees located there. For some representatives, this is also informed by previous cultural heritage survey work they have participated in at Melbourne Airport. This has given them an opportunity to survey and locate existing places, and in some instances assist in identifying new material such as stone artefacts.

Additional Indigenous cultural heritage material was identified during the survey under CHMP 16792 across the Glenara Creek, Grey Box Woodland and Arundel Creek survey areas. Stage 1 of the complex assessment has been completed and serves to determine the extent, nature and significance of those new places listed in Section B6.4.4.1. The spatial extent (boundaries) of these new places are primarily defined by the key landforms discussed in Section B6.4.3 and informed by the extent of test excavation completed to date.

Table B6.43
Significance assessment for Aboriginal cultrual heritage places in the study area

VAHR place number and name	Commonwealth Heritage List criteria	Significance threshold	Statement of significance
VAHR TBD (Granite Hill Cultural Landscape)	Criterion 1. Criterion 9	Moderate – the site is of state significance.	Proposed place Granite Hill Cultural Landscape is a large multi-component place within the north of the M3R study area. The place comprises a large portion of the current extant Grey Box Woodland, located over the granite hill geological landform, also known as 'Radar Hill'. The place comprises a moderate density of stone artefacts on the hill crest, a low density artefact distribution on the lower slope margins of the hill and in areas subject to erosion. This new place also combines four existing Scarred Tree components, which are in various conditions of health, some in good health and others in a deteriorating state. The individual components (predominantly surface artefact distributions) are common place types in the local region, however the connection of these components is tightly bound to the granite hill formation as a focus of past Indigenous occupation. The place provides information about the exploitation of multiple resources and site patterning across the regional landscape. The scarred tree components are also limited in occurrence for the region. For these reasons, proposed place Granite Hill Cultural Landscape is considered to be of moderate significance.
VAHR TBD (Glenara Creek 2)	Criterion 9	Minor – the site is of local significance.	Proposed place Glenara Creek 2 is a low density artefact scatter primarily located over the basalt plains landform in the north-west of the M3R study area. It is a common place type in the local region and has limited stratigraphic integrity. The place has limited potential to provide new information about the exploitation of raw stone materials and site patterning across the regional landscape due to the low artefact density and history of impacts by pastoral activities. The place has combined a number of earlier place registrations and include additional surface material identified by the current CHMP 16792 survey. For these reasons, proposed place Glenara Creek 2 is considered to be of minor significance.
VAHR TBD (Arundel Creek Artefact Scatter)	Criterion 9	Minor – the site is of local significance.	Proposed place Arundel Creek Artefact Scatter is a low density artefact scatter and is a common place type in the local region. The place has limited potential to provide new information about the exploitation of raw stone materials and site patterning across the regional landscape due to the low artefact density and common representativeness of its contents. It is representative of an extension to a nearby artefact scatter which shares the same hillslope. For these reasons, proposed place Arundel Creek Artefact Scatter is considered to be of minor significance.
VAHR 7822-0818 (Radar Hill 19)	Criterion 9	Minor – the site is of local significance.	VAHR 7822-0818 is a low density artefact scatter and is a common place type in the local region. The place has limited potential to provide new information about the exploitation of raw stone materials and site patterning across the regional landscape due to the low artefact density. For these reasons, VAHR 7822-0818 is considered to be of minor significance.
VAHR 7822-3857 (Arundel Creek LDAD)	Criterion 9	Minor – the site is of local significance.	VAHR 7822-3857 is a low density artefact scatter and a common site in the local region. Artefacts are located in a disturbed context. The place has limited potential to provide new information about the exploitation of raw stone materials and site patterning across the regional landscape due to the low density of artefacts. For these reasons, VAHR 7825-3857 is considered to be of minor significance.
VAHR 7822-4312 (Arundel Creek LDAD 2)	Criterion 9	Minor – the site is of local significance.	VAHR 7822-4312 is a low density artefact scatter and is a common place type in the local region. The place has limited potential to provide new information about the exploitation of raw stone materials and site patterning across the regional landscape due to the low artefact density. For these reasons, VAHR 7822-4312 is considered to be of minor significance.
VAHR 7822-3863 (Glenara Creek LDAD)	Criterion 9	Minor – the site is of local significance.	VAHR 7822-3863 is a low density artefact scatter and is a common site in the local region. The place has limited potential to provide new information about the exploitation of raw stone materials and site patterning across the regional landscape due to the low artefact density. For these reasons, VAHR 7825-3863 is considered to be of minor significance.
VAHR 7822-3872 (Glenara Creek 1)	Criterion 1 Criterion 9	Moderate – the site is of state significance.	VAHR 7822-3872 is a low density artefact scatter with surface and subsurface components as well as two scarred trees. The place has limited potential to provide new information about the exploitation of raw stone materials and site patterning across the regional landscape, but is in good condition and displays a range of components. For these reasons, VAHR 7825-3866 is considered to be of moderate significance.
VAHR 7822-3871 (Upper Maribyrnong escarpment)	Criterion 1 Criterion 9	Moderate – the site is of state significance.	VAHR 7825-3871 is a large low density artefact scatter with surface and subsurface components as well as a silcrete quarry identified within a gully leading into the Arundel Creek. The place has only shallow archaeological deposits with no stratigraphic features. As a large place with multiple interrelated components, VAHR 7825-3871 has high potential to provide new information about the exploitation of raw stone materials and site patterning across the regional landscape. For these reasons, VAHR 7825-3871 is considered to be of moderate significance.
VAHR 7822-3858 (Mansfield Road LDAD)	Criterion 9	Minor – the site is of local significance.	VAHR 7822-3858 is a low density artefact scatter and is a common place type in the local region. The place has limited potential to provide new information about the exploitation of raw stone materials and site patterning across the regional landscape due to the low artefact density. For these reasons, VAHR 7822-3858 is considered to be of minor significance.
VAHR 7822-1803 (Melbourne Airport Unigas 2)	Criterion 9	Minor – the site is of local significance.	VAHR 7822-1803 is an isolated artefact occurrence and is a common place type in the local region. The place has limited potential to provide new information about the exploitation of raw stone materials and site patterning across the regional landscape due to the low artefact density. The place has been previously assessed under CHMP 12333 which could not relocate the place and it was considered to have been destroyed. Therefore, it is determined that no physical remains are left at the place. For these reasons, VAHR 7822-1803 is considered to be of minor significance.
VAHR 7822-1335 (Melbourne Airport SE 3)	Criterion 9	Minor – the site is of local significance.	VAHR 7822-1335 is a low density artefact scatter and is a common place type in the local region. The place has limited potential to provide new information about the exploitation of raw stone materials and site patterning across the regional landscape due to the low artefact density. The place has been previously assessed and subject to archaeological salvage under CHMP 10442. Therefore, it is determined that no physical remains are left at the place. For these reasons, VAHR 7822-1335 is considered to be of minor significance.
VAHR 7822-3864 (Deep Creek Escarpment 1)	Criterion 1 Criterion 9	Moderate – the site is of state significance.	VAHR 7825-3864 is a low density artefact scatter and is a common site in the local region. Artefacts are located in a disturbed context. The place has limited potential to provide new information about the exploitation of raw stone materials and site patterning across the regional landscape due to the low density of artefacts. The potential for further investigation of the relationship between Indigenous cultural material and the Bellno homestead does provide limited opportunities for further research. For these reasons, VAHR 7825-3864 is considered to be of moderate significance.
VAHR 7822-4287 (Link Road Ridge Artefact Scatter)	Criterion 1 Criterion 9	Moderate – the site is of state significance.	VAHR 7822-4287 is a large artefact scatter with a primarily high density subsurface component as well as low density surface component. The place directly overlooks the Arundel Creek valley and its drainages with excellent vantage over a wide landscape. The place has relatively shallow but very intact subsurface archaeological deposits. The location of the place also demonstrates more complex stratigraphic and geomorphological processes unique to the landscape it is situated in. As a relatively large and moderate-density place, but with artefacts that are fairly common in form and representativeness, VAHR 7825-4287 has moderate potential to provide new information about the exploitation of raw stone materials and site patterning across the regional landscape. For these reasons, VAHR 7825-4287 is considered to be of moderate significance.

B6.5 ASSESSMENT OF POTENTIAL IMPACTS

The assessment of potential impacts uses the project-specific severity criteria developed for the cultural heritage assessment (described in **Table B6.44** as well as the significance ratings for cultural heritage sites in **Table B6.43**). Duration of impact and likelihood of impact are as described in *Chapter A8: Assessment and Approvals Process* of the *M3R content development guide*. A number of cultural heritage places will be impacted by the M3R development. Impacts will result from excavation and filling to prepare runways, airside areas, access roads, service facilities and other infrastructure.

The significance assessment criteria for assessing impacts to cultural heritage have been developed in accordance with the significant assessment framework for M3R described in *Section A8.3 of Chapter A8: Assessment and Approvals Process.* This follows an approach that requires an initial assessment of the baseline condition of the heritage place and anticipated impacts of the development as proposed, incorporating standard mitigation, followed by a determination of the residual impacts once additional measures are taken into consideration to lower the severity or likelihood of an impact occurring.
The significance assessment criteria for assessing impacts to Indigenous heritage have been developed in accordance with the significant assessment framework for M3R (refer to **Section B6.4.5** significance assessment).

The method for implementation of these avoidance and mitigation measures must be approved within the CHMP by Wurundjeri, and determined through consultation to be appropriate to best minimise impacts to Indigenous cultural heritage throughout the construction of M3R.

However, because of the complexity of M3R it may not be possible to avoid direct impacts to a given Indigenous place and certain mitigation measures may therefore be required as stipulated by the CHMP in agreement with the RAP. Mitigation actions are generally developed with respect to the nature, extent and significance of each place. Nominally, such mitigation requirements are achieved through a program of methodical archaeological salvage excavation and detailed site recording, which will record and preserve information of cultural heritage values. This information is also utilised in the production of an archaeological salvage report for all Indigenous places investigated. The report further details the nature of the cultural material collected. It provides a resource detailing the archaeological importance of each place, its nature and site formation processes within the broader landscape, and which seeks to answer additional research questions posed at the completion of the CHMP assessment.

Cultural heritage values not directly impacted by the M3R (where applicable) may be managed through providing temporary exclusion fencing and established no-go zones and other non-invasive protection measures to ensure works do not impact upon preserved parts of places. It is noted that under the requirements of the Regulations, harm avoidance should be explored by the CHMP Sponsor for each Indigenous place in the first instance. Harm avoidance is also the preferred option of the RAP where this is feasible.

Note: The following assessment of potential impacts is based on the test excavation results obtained after completion of stage 1 of the complex assessment under CHMP 16792. This includes the assessment of impacts based on the updated spatial extent, nature and significance of all Indigenous cultural heritage within the M3R disturbance footprint. However, final cultural heritage management actions for each recorded Aboriginal place can only be fully determined following further consultation with Wurundjeri and the completion of the total complex assessment program.

Table B6.44
Severity criteria

Impact severity	Description
Major	Adverse non reversible impacts to heritage places / objects of national significance. Meets NHL Criteria.
High	Adverse non reversible impacts to heritage places / objects of state significance. Meets VAHR criteria for high significance.
Moderate	Adverse non reversible impacts to heritage places / objects of regional significance. Meets VAHR criteria for moderate significance.
Minor	Adverse non reversible impacts to heritage places / objects of local significance. Meets VAHR criteria for low significance.
Negligible	Minor works without adverse impacts.

B6.6 AVOIDANCE, MANAGEMENT AND MITIGATION MEASURES

Works will be undertaken in compliance with any specific requirements of CHMP 16792 currently under assessment. The consultation process will establish precise methods for harm mitigation and/or minimisation for each Indigenous place to be directly impacted by the proposed works. It is expected that, should further design be able to minimise impacts to Indigenous places, these places will then be avoided and protected following a methodology reached in agreement with the RAP.

The specific requirements of CHMP 16792 are anticipated to include conditions for:

- Cross cultural inductions with site contractors involved in ground disturbance activities
- Compliance inspections staged at key ground disturbance and construction works completion
- Repatriation and/or reburial of cultural material
- Encouraging cultural awareness through interpretative signage or other educational platforms
- Avoidance actions per cultural heritage place where practical
- Other mitigation actions prior to the proposed works such as archaeological salvage.

Most of these measures for harm avoidance, management and mitigation will involve the expertise of a heritage adviser, suitably qualified in archaeology, to oversee the implementation of these requirements (including works required on site). Heritage officers and field representatives for the RAP will be invited to participate in a number of these measures such as salvage and cultural awareness sessions. The timing and function of RAP's involvement, where appropriate, will be determined during the CHMP consultation process.

The CHMP will also list specific contingency plans to be followed during M3R. The contingency plans assist the CHMP Sponsor (i.e. Australia Pacific Airports (Melbourne)) to monitor and ensure compliance with the management requirements within the plan. The contingency plans will also include a step-by–step set of actions to take in the event that unexpected additional cultural heritage material (including suspected human remains) is uncovered during works, including recording, custody and future management requirements.

The contingency plans will be outlined in Section 2 of the approved CHMP.

Once approved by the evaluating authority (the RAP/ Wurundjeri) the approved CHMP 16792 will be made available to Melbourne Airport for use in ongoing planning and construction requirements for M3R.

Note: Because CHMP 16792 has not been completed and approved, the specific management requirements cannot be included in this chapter. However, it is likely that the majority of Indigenous places listed within the place inventory (**Section B6.4.4**) will be either wholly or partially located within the M3R disturbance footprint and will therefore be subject to some level of harm. The impact assessment summary provided in **Table B6.47** indicates the Indigenous places likely to require some form of harm mitigation through archaeological salvage. The impact assessment summary is informed by the newly defined extent of the Indigenous places investigated during the stage 1 complex assessment and the comparable measures proposed under the prior RDP CHMP 12774. The precise methods and timing of any avoidance, management and mitigation measures will be fully determined in CHMP 16792 once approved.

B6.7 CONCLUSIONS

B6.7.1 Cultural heritage values

B6.7.1.1 Previously recorded Indigenous places

The start of the cultural heritage assessment identified 33 existing Indigenous cultural heritage places within M3R. These predominately consisted of artefact scatters and low density artefact distributions, with some scarred trees also present in the Grey Box Woodland. The list of previously recorded places is below for ease of reference (**Table B6.45**)

Table B6.45
Previously recorded VAHR places in M3R

Name	Listing No.	Place Type
Radar Hill 1	7822-0800	Artefact scatter
Radar Hill 2	7822-0801	Artefact scatter
Radar Hill 3	7822-0802	Scarred tree
Radar Hill 4	7822-0803	Artefact scatter
Radar Hill 5	7822-0804	Scarred tree
Radar Hill 6	7822-0805	Artefact scatter
Radar Hill 7	7822-0806	Scarred tree
Radar Hill 9	7822-0808	Artefact scatter/earth feature
Radar Hill 10	7822-0809	Artefact scatter
Radar Hill 11	7822-0810	Artefact scatter
Radar Hill 12	7822-0811	Artefact scatter
Radar Hill 13	7822-0812	Artefact scatter
Radar Hill 14	7822-0813	Artefact scatter
Radar Hill 15	7822-0814	Scarred tree
Radar Hill 16	7822-0815	Artefact scatter
Radar Hill 17	7822-0816	Artefact scatter
Radar Hill 18	7822-0817	Artefact scatter
Radar Hill 19	7822-0818	Artefact scatter
Radar Hill 22	7822-0821	Artefact scatter

Name (cont.)	Listing No. (cont.)	Place Type (cont.)
Radar Hill 24	7822-1116	Artefact scatter
Radar Hill 25	7822-1117	Artefact scatter
Melbourne Airport SE 3	7822-1335	Artefact scatter
Melbourne Airport Unigas 2	7822-1803	Artefact scatter
Arundel Creek LDAD	7822-3857	LDAD
Mansfield Road LDAD	7822-3858	LDAD
Glenara Creek LDAD	7822-3863	LDAD
Deep Creek Escarpment 1	7822-3864	Artefact scatter
Upper Maribyrnong Escarpment	7822-3871	Artefact scatter/ Earth mound
Glenara Creek 1	7822-3872	Artefact scatter/ Scarred trees
Glenara Creek LDAD 2	7822-4081	LDAD
APAM Grey Box Forest LDAD	7822-4178	LDAD
Arundel Creek LDAD 2	7822-4312	LDAD
Link Road Ridge Artefact Scatter	7822-4287	Artefact scatter

The location of a number of the individual places in the table above has been updated based on the survey and test excavations as part of in-progress CHMP 16792. As a result, a large number of smaller individual locations have been merged into spatially larger landform places. This was primarily conducted across the granite hill and Grey Box Woodland areas, as the previously recorded places share this same prominent landform.

There are now 14 Indigenous places within M3R. New place registrations are currently subject to VAHR registration and approval based on the CHMPs standard assessment survey and stage 1 of the complex assessment. The updated 14 recorded Indigenous places in M3R are listed below in Table B6.46 with the indication of the places that have now been merged into larger recordings.

The types of Indigenous places in the study area range from smaller distributed and isolated artefact occurrences with low local significance, to large extensive places of high state significance. These have been listed below according to their updated conditions: new registrations, updated registrations and existing (unchanged) registrations based on the assessment conducted to date under CHMP 16792.

B6.7.1.2 Current Indigenous places

Two places are new registrations that will be submitted to the VAHR and will merge a number of previously recorded VAHR places. These are Granite Hill Cultural Landscape and Glenara Creek 2. Another new place, Arundel Creek Artefact Scatter, was first identified during the CHMP complex assessment and is a new Indigenous place within M3R which does not contain any previously recorded places. Places that have been updated as a result of the survey and excavations are then presented, and lastly, places which did not require any changes are listed.

Note: The list of places provided below is indicative of the registrations to be approved by the VAHR. This list is also determined by the current results, at the time of writing this chapter, obtained from stage 1 of the CHMP complex assessment. Additional fieldwork required for the completion of the CHMP may require registration of further cultural heritage material or updates to the place contents of current registrations. This material may coincide with the spatial extents already presented in Figure B6.18, as well as remaining test areas outside these extents. Based on the current results, any additional unidentified material is likely to exist as isolated or low density artefact distributions in shallow topsoils and on the surface within areas of prior erosion or disturbance. The identification of any such material is unlikely to constitute a highly significant new Indigenous place even if it requires a new VAHR registration. Further isolated artefact occurrences are likely to be included within one of the existing registrations within M3R as individual points, such as attached to one of the existing nearby Low Density Artefact Distribution (LDAD) registrations.

Table B6.46
Current Indigenous places within M3R showing merged places

Place name		VAHR number	Place Type
VAHR TBD (Granite Hill Cultural Landscape)			
Merged places	Radar Hill 1	VAHR 7822-0800	Artefact Scatter
	Radar Hill 2	VAHR 7822-0801	Artefact scatter
	Radar Hill 3	VAHR 7822-0802	Scarred tree
	Radar Hill 4	VAHR 7822-0803	Artefact scatter
	Radar Hill 5	VAHR 7822-0804	Scarred tree
	Radar Hill 6	VAHR 7822-0805	Artefact scatter
	Radar Hill 7	VAHR 7822-0806	Scarred tree
	Radar Hill 10	VAHR 7822-0809	Artefact scatter
	Radar Hill 11	VAHR 7822-0810	Artefact scatter
	Radar Hill 12	VAHR 7822-0811	Artefact scatter
	Radar Hill 13	VAHR 7822-0812	Artefact scatter
	Radar Hill 14	VAHR 7822-0813	Artefact scatter
	Radar Hill 15	VAHR 7822-0814	Scarred tree
	Radar Hill 16	VAHR 7822-0815	Artefact scatter
	Radar Hill 17	VAHR 7822-0816	Artefact scatter
	Radar Hill 18	VAHR 7822-0817	Artefact scatter
	APAM Grey Box Forest LDAD	VAHR 7822-4178	Low Density Artefact Distribution
VAHR TBD (Glenara Creek 2)			
Merged places	Glenara Creek LDAD 2	VAHR 7822-4081	Low Density Artefact Distribution
New and updated places			
Arundel Creek Artefact Scatter		TBD	Artefact scatter
Link Road Ridge Artefact Scatter		VAHR 7822-4287	Artefact scatter
Arundel Creek LDAD 2		VAHR 7822-4312	Low Density Artefact Distribution
Unchanged places			
Radar Hill 19		VAHR 7822-0818	Artefact scatter
Arundel Creek LDAD		VAHR 7822-3857	Low Density Artefact Distribution
Glenara Creek 1		VAHR 7822-3872	Artefact scatter/Scarred-trees
Glenara Creek LDAD		VAHR 7822-3863	Low Density Artefact Distribution
Upper Maribyrnong Escarpment		VAHR 7822-3871	Artefact scatter
Mansfield Road LDAD		VAHR 7822-3858	Low Density Artefact Distribution
MELBOURNE AIRPORT UNIGAS 2		VAHR 7822-1803	Artefact scatter
Melbourne Airport SE 3		VAHR 7822-1335	Artefact scatter
Deep Creek Escarpment 1		VAHR 7822-3864	Artefact scatter

B6.7.2 Potential impacts

Large portions of Indigenous cultural heritage places within the study area will most probably be removed by construction of compounds, haul road or proposed infrastructure. Threats to cultural heritage within the study area include:

- Removal and/or modification of topsoils, impacting surface artefacts and shallow archaeological deposits on the basalt plains and granite hill landforms.
- Removal and/or modification of subsoils with archaeological deposits, impacting archaeological deposits on the floodplain, lower hillslopes associated with waterways and alluvial terraces.
- Removal of vegetation, including scarred trees.
- Modification of natural landscape values impacting intangible attributes.
- Of the 14 cultural heritage places located in the study area, it is likely that all will be impacted by the proposed development to some extent.

In addition, a number of long-term maintenance actions within the study area will be considered under CHMP 16792 including:

- Removing general rubbish
- Slashing or removal of vegetation by hand or machine when required
- Spraying with herbicide to eradicate weeds
- Grading or ploughing to establish and maintain firebreaks
- Establishment of drainage channels
- Establishment and maintenance of all-weather access tracks
- Temporary stockpiling of soils, rubbish or vegetation
- Removal or cleaning of topsoil to deal with contaminated soils issues.

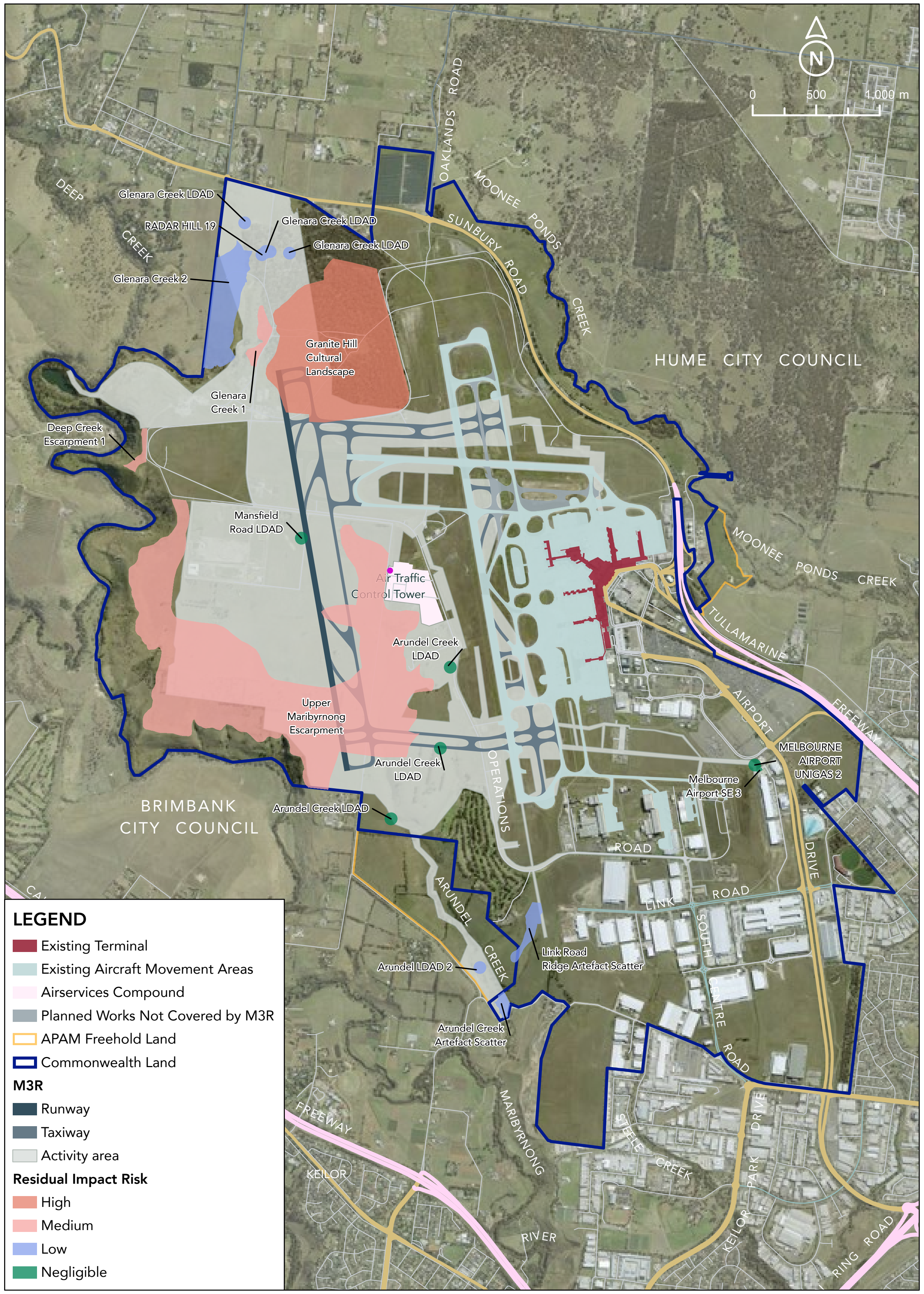
Note: The following potential impact assessment provided in is based on the footprint of M3R as provided by Melbourne Airport. This will be further refined based on the proposed construction design and impact area once fully developed; and also in consideration of details required to eventually complete the CHMP impact assessment and in order to meet CHMP approval. A figure presenting the Aboriginal places and their assessed level of residual risk is also presented in Figure B6.53.

Table B6.47
Impact assessment summary

Aspect of the Environment	Baseline Condition	Description and characterisation of potential impact						Mitigation of management measures	Description of Residual Impact				
		Potential Impact	Mitigation inherent in design / practice	Significance Assessment					Impact	Significance Assessment			
				Temporal	Severity	Likelihood	Impact Risk			Temporal	Severity	Likelihood	Impact Risk
Construction / Operations								**Construction / Operations (cont.)**					
VAHR TBD (Granite Hill Cultural Landscape)	Moderate local significance	Direct impacts from runway footprint	Minimal options to reduce impacts due to topographic locations.	Permanent	High	Almost Certain	High	To be determined – archaeological salvage likely	Removal of surface artefacts, archaeological deposits and scarred trees from footprint	Permanent	High	Almost Certain	High
VAHR TBD (Glenara Creek 2)	Low local significance	Direct impacts from runway footprint and access roads	Minimal options to reduce impacts due to topographic locations.	Permanent	Minor	Almost Certain	Medium	To be determined – archaeological surface collection likely	Removal of surface artefacts from footprint and earthworks	Permanent	Minor	Almost Certain	Low
VAHR TBD (Arundel Creek Artefact Scatter)	Low local significance	Direct impacts from water treatment measures	Minimal options to reduce impacts due to topographic locations.	Permanent	Minor	Almost Certain	Medium	To be determined – archaeological salvage likely	Removal of archaeological deposits from footprint and earthworks	Permanent	Minor	Almost Certain	Low
VAHR 7822-0818 (Radar Hill 19)	Low local significance	Direct impacts from runway footprint and earthworks	Minimal options to reduce impacts due to topographic locations.	Permanent	Minor	Almost Certain	Medium	To be determined – archaeological surface collection likely	Removal of surface artefacts from footprint and earthworks	Permanent	Minor	Almost Certain	Low

Aspect of the Environment (cont.)	Baseline Condition (cont.)	Description and characterisation of potential impact (cont.)						Mitigation of management measures (cont.)	Description of Residual Impact (cont.)				
		Potential Impact	Mitigation inherent in design / practice	Significance Assessment					Impact	Significance Assessment			
				Temporal	Severity	Likelihood	Impact Risk			Temporal	Severity	Likelihood	Impact Risk
Construction / Operations (cont.)								**Construction / Operations (cont.)**					
VAHR 7822-3857 (Arundel Creek LDAD)	Low local significance	Direct impacts from runway footprint	Minimal options to reduce impacts due to topographic locations.	Permanent	Minor	Almost Certain	Low	None - Impacted artefacts have already been salvaged	None	Temporary	Negligible	Almost Certain	Negligible
VAHR 7822-4312 (Arundel Creek LDAD 2)	Low local significance	To be determined – artefacts may be avoided	Minimal options to reduce impacts due to topographic locations.	Permanent	Minor	Almost Certain	Low	To be determined – artefacts may be avoided	Removal of surface artefacts from footprint and earthworks	Temporary	Minor	Almost Certain	Low
VAHR 7822-3863 (Glenara Creek LDAD 1)	Low local significance	Direct impacts from runway footprint and earthworks	Minimal options to reduce impacts due to topographic locations.	Permanent	Minor	Almost Certain	Medium	To de determined – archaeological surface collection likely for surface artefacts	Removal of surface artefacts from footprint and earthworks	Permanent	Minor	Almost Certain	Low
VAHR 7822-3872 (Glenara Creek 1)	Moderate regional significance	Direct impacts from runway footprint and earthworks	Minimal options to reduce impacts due to topographic locations.	Permanent	Minor	Almost Certain	Medium	To de determined – archaeological salvage likely	Removal of surface artefacts, scarred trees from footprint and earthworks	Permanent	Moderate	Almost Certain	Medium
VAHR 7822-3858 (Mansfield Road LDAD)	Low local significance	Direct impacts from runway footprint	Minimal options to reduce impacts due to topographic locations.	Permanent	Negligible	Almost Certain	Negligible	None - Impacted artefacts have already been salvaged	None	Temporary	Negligible	Rare	Negligible
VAHR 7822-1803 (Melbourne Airport UNIGAS 2)	Low local significance	Direct impacts from roads and infrastructure	Minimal options to reduce impacts due to topographic locations.	Permanent	Negligible (place subject to prior harm)	Almost Certain	Negligible	None – place has already been impacted.	None	Temporary	Negligible	Rare	Negligible
VAHR 7822-1335 (Melbourne Airport SE 3)	Low local significance	Direct impacts from roads and infrastructure	Minimal options to reduce impacts due to topographic locations.	Permanent	Negligible (place subject to prior harm)	Almost Certain	Negligible	None – place has already been impacted.	None	Temporary	Negligible	Rare	Negligible
VAHR 7822-3864 (Deep Creek Escarpment 1)	Moderate local significance	Potential impacts from runway footprint and earthworks	Minimal options to reduce impacts due to topographic locations.	Permanent	Moderate	Almost Certain.	High	To de determined – archaeological salvage likely if impacted	Removal of surface artefacts, archaeological deposits from footprint and earthworks	Permanent	Moderate	Almost Certain	Medium
VAHR 7822-4287 (Link Road Ridge Artefact Scatter)	Moderate local significance	Direct impacts from runway footprint- extension of 16R/34L.	Minimal options to reduce impacts due to topographic locations.	Permanent	Moderate	Almost Certain	Medium	To de determined – archaeological salvage likely	Removal of archaeological deposits from footprint and earthworks	Permanent	Low	Almost Certain	Low
VAHR 7822-3871 (Upper Maribyrnong escarpment)	High regional significance	Direct impacts from runway footprint	Minimal options to reduce impacts due to topographic locations.	Permanent	High	Almost Certain	Extreme	To de determined – archaeological salvage likely	Removal of surface artefacts, archaeological deposits from footprint and earthworks	Permanent	Moderate	Almost Certain	Medium

Figure B6.53
Assessment of residual risk for Aboriginal cultural heritage places in the study area



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Chapter B7
European Heritage

Summary of key findings:

- A detailed assessment of European heritage has been completed to ascertain the heritage values of the development area and immediate surrounds of Melbourne Airport's Third Runway (M3R).
- Research was carried out to identify existing and previously unassessed heritage sites. This was facilitated through consultation with historical societies, experts and Heritage Victoria (HV), field surveys and excavation. The sites' historical significance was assessed using Commonwealth Heritage Criteria, and HV criteria and thresholds.
- The study identified 16 existing and potential historical sites of heritage value. Of these, 10 required further assessment in the form of targeted excavations. The sites mainly relate to early European settlement in the Tullamarine area in the mid to late-19th century and consist of early residential homesteads, farms and early industrial development. Only one homestead, Aucholzie, was found to have surviving built structures. The other sites were either ruins, building foundations with remnant occupational and demolition deposits, or more modern and ephemeral archaeological deposits.
- Of the sites identified, two were determined to have no remaining significant archaeological deposits or features. In the case of the Glen Alice Outbuildings, this was due to construction of the existing east-west runway (09/27). In the case of Glenara Sheep Dam, this was due to reconstruction of the dam on Glenara Creek. Four sites are located nearby but outside M3R's development footprint. They are: Barbiston Farm Complex, Bellno Farmstead and Quarry, Oaklands Junction, and Radar Hill Track.
- The remaining 10 sites will be directly impacted by M3R. They are: Aucholzie Homestead, Coghill's Sheepwash and Dam, Coghill's Boiling-Down Works, Fawkner Land Co Settlement, Grants Bluestone Culvert, Kennedy's Hut Site, Oakbank Farm Homestead, Roseleigh Homestead, Seafield Farm and Victoria Bank Homestead.
- The proposed impacts before mitigation are assessed as minor, moderate or high due to sites being of either local or regional significance. The exception is Coghill's Boiling-Down Works, assessed as extreme. Salvage and recording of all sites will be done before any impact so that their heritage value can be documented and retained. This means any harm will be mitigated and the potential impact reduced. Coghill's Boiling-Down Works is considered a unique surviving example of early Victorian industry and assessed as being of state significance. Even after the salvage, recording and documenting of this site, the residual impact is considered to be high because of its significance.

CHAPTER B7 CONTENTS

CHAPTER B7 FIGURES

CHAPTER B7 TABLES

B7.1 INTRODUCTION

This chapter describes the European heritage values of the project area (i.e. the study area), applicable legislation and policy requirements, the potential impacts of Melbourne Airport's Third Runway (M3R) and associated assessment methodology. Where required, measures to specifically avoid, manage, mitigate and/or monitor impacts are described. This work was undertaken for Melbourne Airport by ecological and heritage consulting firm Biosis.

For the purposes of this chapter, 'study area' refers to the M3R development footprint and immediate surrounds (**Figure B7.1**) that may be impacted by M3R. The historical places identified are:

- Aucholzie Homestead
- Barbiston Farm Complex
- Bellno Quarry and Homestead
- Coghill's Sheepwash and Dam
- Coghill's Boiling-Down Works at Glencairne (previously Glencairne Homestead)
- Grants Road Bluestone Culvert
- Kennedy's Hut Site
- Oakbank Farm Homestead
- Oaklands Junction
- Seafield Farm
- Roseleigh Homestead
- Victoria Bank Homestead
- Fawkner Land Co Settlement
- Radar Hill Track

All sites identified in the study area have been listed in **Table B7.1**. Note that names of some sites have changed as a result of the additional investigations outlined in this report (the table lists the old and new names). Note that the Airport Construction Site (previously Glen Alice Homestead) and Glenara Sheep Dam are not listed above because they are determined to have no remaining significant archeological deposits or features.

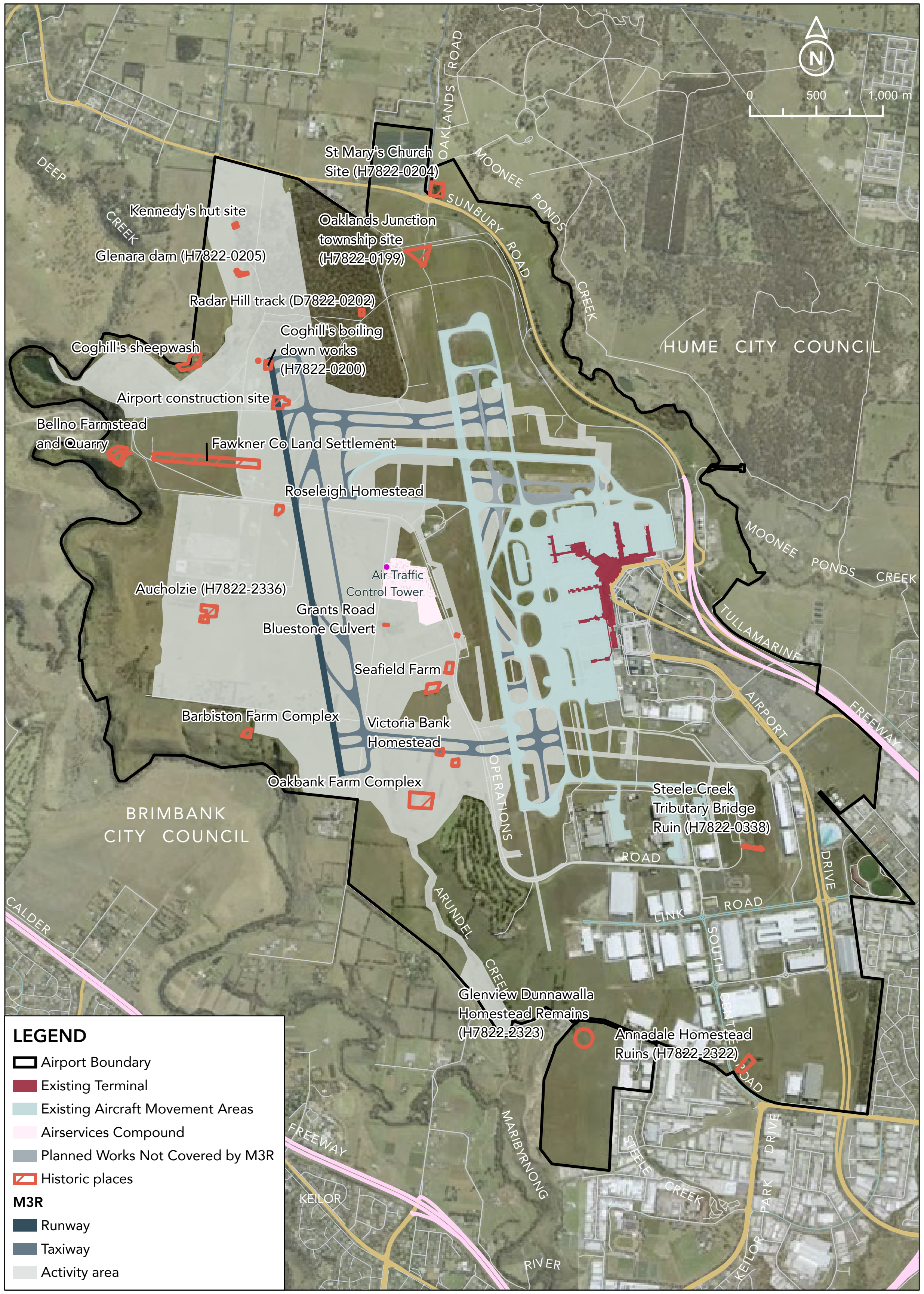
NB New names are used hereafter unless referring to their former Victorian Heritage Inventory (VHI) designations.

Table B7.1
All European heritage sites identified in the study with current and former names

Current name	Previous name (2016)	Register	Listing No.	Description
Airport construction site (delisted)	Glen Alice Homestead	VHI	D7822-0201	The Glen Alice Homestead site has been removed from the inventory. The farm buildings were located near the western end of the 09L/27R but were destroyed during the construction of the runway and service road. Other concrete footings and slabs near Perimeter Rd appear to relate to post WWII sheds and construction of the airport.
Aucholzie Homestead		VHI	H7822-2336	Remains of homestead complex
Barbiston Farm Complex		Unlisted		Remains of homestead complex
Bellno Farmstead and Quarry		Unlisted		Remains of homestead complex
Coghill's Sheepwash and Dam (delisted)	Coghill's Dam	VHI	D7822-0203	Coghill's Dam was removed from the VHI. It was originally registered from historical sources as a bluestone spillway. Further research and test excavations confirmed the site's identification.
Coghill's Boiling-Down Works	Glencairne Homestead Site	VHI	H7822-0200	This site was mistakenly identified as Coghill's Homestead but further research and test excavations confirmed the identification of this site as Coghill's Boiling-Down Works, on the Glencairne estate. The actual location of the Glencairne homestead and stables is the adjacent property to the west of the airport land.
Glenara Sheep Dam		VHI	H7822-0205	Remains of sheep wash and dam along "Glenara" creek drainable line. Modern reconstruction of the dam has removed evidence of any 19th century features.
Grants Rd Bluestone Culvert		Unlisted		Bluestone culvert
Kennedy's hut site	Coghill's Hut	Unlisted		Remains of early hut.
Oakbank Farm Homestead		Unlisted		Remains of homestead complex.
Oaklands Junction	Oaklands Junction Township Site	VHI	H7822-0199	Oaklands Junction is the remains of several structures including a bluestone culvert and building foundations associated with the small 19th century settlement.
Radar Hill Track (delisted)	Radar Hill Track	VHI	D7822-0202	Earth and gravel track through grey box woodland, possibly connecting Glencairne to Oaklands Junction.
Roseleigh Homestead		Unlisted		Remains of homestead complex.
Seafield Farm (school not identified)	Seafield Farm and Seafield National School	Unlisted		Remains of homestead complex, following excavation and further survey it was determined that the school site was probably destroyed by road and taxiway.
Victoria Bank Homestead		Unlisted		Remains of homestead complex.
Fawkner Land Co Settlement		Unlisted		Remains of early settlement, may retain archaeological remains and some elements such as building footings, drains and former roadways.

Source: Biosis Pty Ltd 2020

Figure B7.1
Map of the study area showing historical places



Source: Biosis Pty Ltd

B7.2
METHODOLOGY AND ASSUMPTIONS

The European heritage assessment study area included only Commonwealth-owned and controlled land. The study area is therefore exempt from the requirements of the Victorian Heritage Act 2017 (the Heritage Act). It is noted however, that some heritage sites in the study area were, at the time of assessment, listed on Victorian heritage databases including the VHI.

Although the study area is exempt from the requirements of the Heritage Act, consultation has been undertaken with HV for the heritage places assessed as part of M3R development and planning. This included providing HV with an indicative survey and excavation method for each site believed to require further assessment in order to determine their significance. HV had no objections to the proposed methodologies.

Investigation and assessment of European (non-Indigenous) heritage values was undertaken in accordance with Commonwealth and Victorian heritage guidelines and criteria. These guidelines and criteria include the:

- Guidelines for the Assessment of Places for the National Heritage List (Australian Heritage Council 2009)
- Guidelines for Investigating Historical Archaeological Artefacts and Sites (Heritage Victoria 2015)
- Charter for the Conservation of Places of Cultural Significance (Burra Charter) (Australia ICOMOS 2013)
- Guidelines for Conducting Historical Archaeological Surveys (Heritage Council of Victoria (Heritage Victoria) 2008)
- The Victorian Heritage Register Criteria and Threshold Guidelines (Heritage Victoria 2019).

The investigation of European heritage values included desktop assessment, field survey, test excavations, and significance assessment. These were to better understand the European heritage values in the study area and their importance. Methodology for each stage of investigation is discussed below and the results presented in **Section B7.4**.

B7.2.1
Desktop assessment

A desktop assessment was undertaken to establish known and potential European heritage values in the study area. It included consultation with stakeholders, a review of historic aerial photography, and searches of applicable heritage registers and reports. The results were used to develop a predictive model of heritage potential to guide the field survey.

To identify relevant local bodies that potentially hold historical documentation of sites associated with the study area, contact was made with the Hume District Library Service and the Broadmeadows Historical Society and Museum including the Hume Global Learning Centres. Hume Libraries, Keilor Historical Society, Broadmeadows Historical Society and Hume City Council were all subsequently contacted and consulted for information on the study area.

Commonwealth and Victorian heritage databases and registers were also searched for information on European heritage values in the study area. These included VHI, Victorian Heritage Register (VHR), HERMES heritage online database (managed by Heritage Victoria), VICPlan, City of Hume Planning Scheme heritage overlay (HO), National Trust Register and the Australian heritage database. The Australian heritage database includes world, national and Commonwealth heritage lists as well as the Australian national shipwreck database and the register of the National Estate.

Additional historical research was undertaken by historian and architect Graeme Butler.

B7.2.2
Consultation

The current M3R assessment follows previous investigations conducted for the earlier Runway Development Program (RDP) at Melbourne Airport and incorporates the previous results. The following organisations were consulted for the RDP report and the current assessment:

- Broadmeadows Historical Society and Museum
- Hume District Library
- Tullamarine Library
- Keilor Historical Society
- Hume City Council
- Ray Gibb (local historian).

Discussions were also held with the principal archaeologist at HV, Jeremy Smith, to provide an indicative methodology for the assessment of sites within the study area. A meeting was held at HV's office on 16 January 2020. It was noted that, because the archaeological sites do not come under the jurisdiction of the Heritage Act, there was no requirement for meeting specifications of state legislation or guidelines. Upon review, HV provided a written statement (dated 20 January 2020) confirming that the proposed heritage investigations and methodology accorded with those of HV (Heritage Victoria 2015). HV advised any European heritage sites that will not be directly impacted by M3R should not be investigated or disturbed. Heritage Victoria also advised that, as sites within Commonwealth land could not be included under Victorian legislation, the existing VHI sites within the airport property would be removed from the VHI.

B7.2.3
Survey

The field survey was undertaken to 'ground truth' (through direct observation and measurement) the predictive model developed in the desktop assessment, and to identify and record European heritage values. The survey also sought to confirm the conditions of known heritage sites and identify those areas with the potential for new and previously unassessed European heritage sites.

The field survey was undertaken in several stages. Initial surveys and assessments were completed between 2013 and 2016 for the RDP historical technical report. A subsequent survey for the expanded M3R footprint was undertaken in January 2020. It was conducted by vehicle and on foot for sites determined to need further assessment. The sites identified as either previously recorded or with new historic features are listed in Table B7.2.

This field survey produced a series of potential locations for European heritage. These were then mapped, along with desktop assessment results, to provide locations for further investigation which were then surveyed on foot to record their features. Visible surface features were recorded using digital photography (with a Nikon AW120 camera). Locations of visible features were recorded with a Samsung Toughpad tablet using the Trimble Differential Global Positioning System (DGPS) with GNSS R1 receiver (accurate to +/- one metre after processing) and transferred to ArcGIS for digital mapping. Detailed site plans were prepared using tape and compass transect over graphical drawing and trace paper. These were subsequently redrafted using Adobe Illustrator with reference to field notes, aerial imagery and site photographs.

Table B7.2
European heritage sites identified in surveys

Current Name	Description	Register	Listing No.
Airport Construction Site	Initially identified as Glen Alice homestead outbuildings, but requiring further survey and testing to confirm.	VHI	D7822-0201
Aucholzie Homestead	Substantial but dilapidated brick homestead and extensive outbuildings (assessed but requires further investigation).	VHI	H7822-2336
Barbiston Farm Complex	Remains of former timber house and outbuildings.	Unlisted	
Bellno Farmstead and Quarry	Remains of small stone cottage.	Unlisted	
Coghill's Sheepwash and Dam	Earth dam with stone spillway, timber structure and glass, metal and ceramic artefacts, delisted by HV (possibly in error).	VHI	D7822-0203
Coghill's Boiling-Down Works	Stone and brick rubble, initially recorded as Glencairne Homestead, redefined following further research.	VHI	H7822-0200
Glenara Sheep Dam	Little evidence of 19th century earth dam and sheepwash, probably destroyed by 20th century reconstruction.	VHI	H7822-0205
Grants Road Bluestone Culvert	Four cell bluestone culverts on former public road within dense Elm coppice from naturalised avenue.	Unlisted	
Kennedy's Hut Site	Ephemeral hut site with stone footings and glass and ceramic artefact scatter (unassessed requiring further investigation).	Unlisted	
Oakbank Farm Homestead	Footings and paving from homestead and farm buildings.	G	
Oaklands Junction	Footings visible as crop marks of Inverness Hotel, store, culvert and other structures.	VHI	H7822-0199
Radar Hill Track	Earth and gravel track through Grey Box Woodland, possibly connecting Glencairne to Oaklands Junction.	VHI	D7822-0202
Roseleigh Homestead	Former timber farmhouse and outbuildings (assessed as destroyed by recent demolition and site clearing).	Unlisted	
Seafield Farm (school not identified)	Footings of bluestone homestead, cistern, outbuildings and other structures.	Unlisted	
Victoria Bank Homestead	Extensive stone ruins including cellar and cistern.	Unlisted	
Fawkner Land Co Settlement	Remains of early settlement, may retain archaeological remains and some elements such as building footings, drains and former roadways.	Unlisted	

B7.2.4
Test excavation

Selective hand-test excavations were carried out at three heritage sites to determine the presence and integrity of any archaeological deposits. The initial manual testing was completed at Kennedy's Hut, Coghill's Boiling-Down works and Coghill's Sheepwash Dam. Background research determined the Glen Alice and Aucholzie homestead sites would not benefit from this selective process and require larger stripping by use of machine excavator later in the test program. Background research and a site survey determined there was no further archaeological value to the Glenara sheepwash and dam site so no further investigation was considered necessary.

Hand excavation began in test pits measuring approximately 1 x 1 metre or 50 x 50 centimetres in locations determined from matching plans and aerial photographs. These locations were confirmed on site and located on or adjacent to visible features such as exposed structural stone work or areas of noticeable flat ground where structural components may be present. These were followed by more extensive excavations using both mechanical and hand methods to further expose identified archaeological features and deposits. Specific methods used for each heritage place are further described in Section B7.4.3.1. However, in general, mechanical excavation was used where little evidence of in-situ occupation deposits or intact structure could be found; and where large amounts of overburden and demolition rubble had to be removed to access the occupation layers.

B7.2.5
Significance assessment

A significance assessment of each European heritage place was done using Commonwealth Heritage List criteria (CHL) (Commonwealth of Australia 2020) and Heritage Victoria criteria and thresholds (Australian Heritage Council 2009; Heritage Victoria 2015). This was in order to understand the heritage values at each heritage place and their level of importance. The criteria are discussed in more detail in Section B7.3.2.3 of this chapter.

B7.3
STATUTORY AND POLICY REQUIREMENTS

Knowledge of cultural heritage legislation is essential when assessing sites, places or items of cultural heritage significance. The Commonwealth and Victorian requirements applicable to cultural heritage values in the study area are discussed in this section.

B7.3.1
Commonwealth legislation

Melbourne Airport is located on Commonwealth land. The *Airports Act 1996* (Airports Act) and *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (the EPBC Act) are the key pieces of legislation that set the regulatory framework for the M3R development and this assessment (as discussed in **Chapter A8: Assessment and Approvals Process**). However, consideration has also been given to relevant Victorian legislation (including environmental planning instruments, policies and guidelines) where appropriate.

B7.3.1.1
Airports Act 1996

Section 112(2) of the Airports Act states 'the land use, planning and building controls within Part 5 of the Commonwealth Act operate to the exclusion of a law of a state'. In Victoria this applies to land use planning legislation such as the Victorian *Planning and Environment Act 1987* and the *Heritage Act 2017*.

Under the Airports Act, it is understood that the intention is to 'cover the field' of heritage protection. However, Melbourne Airports' preference for assessing heritage is to address all requirements under the Commonwealth legislation while also considering the requirements of Victorian legislation to inform recommendations and follow best practice. Therefore, the implications for the project were assessed in relation to both Commonwealth and Victorian legislation:

- Matters listed under the EPBC Act, associated policy statements and significant impact guidelines
- Matters listed under the Victorian Heritage Act.

B7.3.1.2
Environment Protection and Biodiversity Conservation Act 1999 – Significant Impact Guidelines 1.2

The *Actions on, or impacting upon Commonwealth land*, and *actions by Commonwealth agencies, Significant Impact Guidelines 1.2 Environment Protection and Biodiversity Conservation Act 1999* (Significant Impact Guidelines 1.2) (DSEWPC 2013) defines a significant impact as an impact which is 'important, notable, or of consequence, having regard to its context or intensity'

A significant impact is considered likely if there is 'a real or not remote chance or possibility' of the impact occurring (there does not need to be a greater than 50 per cent chance of the significant impact happening). The likelihood is assessed according to the sensitivity, value and quality of the environment impacted; and according to the intensity, duration, magnitude and geographic extent of the impacts as described in these requirements.

Under the Significant Impact Guidelines 1.2, Step 4 outlines the self-assessment criteria used to determine if an impact is considered significant. Of relevance to this MDP chapter are the impacts on heritage, specifically whether M3R will:

- Permanently destroy, remove or substantially alter the fabric (physical material including structural elements and other components, fixtures, contents, and objects) of a heritage place

- Involve extension, renovation, or substantial alteration of a heritage place in a manner which is inconsistent with the heritage values of the place
- Involve the erection of buildings or other structures adjacent to, or within important sight lines of, a heritage place which are inconsistent with the heritage values of the place
- Substantially diminish the heritage value of a heritage place for a community or group for which it is significant
- Substantially alter the setting of a heritage place in a manner which is inconsistent with the heritage values of the place
- Substantially restrict or inhibit the existing use of a heritage place as a cultural or ceremonial site.

The assessment of potential impacts in Section B7.5 is considered to adequately address these concerns. While harm will be mitigated through various mitigation strategies (as discussed in Section B7.6) the impacts to European heritage sites and the whole of the environment are considered significant as defined by the Significant Impact Guidelines 1.2. A discussion on the acceptability of this impact is contained in Chapter E6: Summary Commitments and Conclusion.

B7.3.1.3
Australian Heritage Council Act 2003

The *Australian Heritage Council Act 2003* (Cth) (the AHC Act) provides for the establishment of the Australian Heritage Council. This is the principal advisory group to the Commonwealth Government on heritage issues and administers the National Heritage List (NHL). The NHL covers places with outstanding natural, Indigenous or historic heritage value to the nation. The Australian Heritage Council assesses if a nominated place has heritage values according to nine criteria then makes a recommendation to the Minister on that basis. The Minister makes the final decision on listing and may take into account social and economic matters. There are no sites located within the study area listed on the NHL.

B7.3.2
Victorian legislation

B7.3.2.1
Planning and Environment Act 1987

The Victorian Planning and Environment Act 1987 as amended in 2000 provides for land use planning controls in all municipalities in Victoria that are prepared and administered by state and local government authorities. Heritage Overlays (HOs) are one of these planning controls. They include places of local heritage significance as well as heritage precincts. There are no HOs in the study area.

B7.3.2.2
Heritage Act 2017

The Heritage Act administered by Heritage Victoria (HV) and is the Victorian Government's key cultural heritage legislation. It identifies and protects heritage places and objects of significance to Victoria. These include historical archaeological sites and artefacts, historical buildings, structures and precincts, gardens, trees, cemeteries, cultural landscapes, shipwrecks, relics and significant objects. The Heritage Act established the VHR for sites of state significance and the VHI for sites with historical archaeological values. It also established the Heritage Council of Victoria as the overarching body responsible for implementing heritage protection in the state. At the time of assessment, the following VHI sites were located within the study area:

- Glenara Sheep Dam (H7822-0205)
- Oaklands Junction (H7822-0199)
- Glencairne Homestead (H7822-0200) (new name: Coghill's Boiling-Down Works)
- Aucholzie Homestead (H7822-2336).

It should be noted HV does not have jurisdiction on Commonwealth land and therefore the provisions of the Heritage Act do not apply to Commonwealth property that is part of the present study area. Following this application, the assessment results provided in this chapter will avoid using former VHI place designations and labels. These listings are included only in Table B7.1 and Table B7.2, in order to clearly demonstrate the current heritage place names against those within prior assessments; particularly in instances where the place name has been completely updated such as Coghill's Boiling-Down Works.

Obtaining a 'consent to damage' would be the normal process for obtaining statutory approval for any works that may cause harm to sites listed on the VHI. Although HV has no jurisdiction on Commonwealth land, Melbourne Airport wishes to meet standards of state heritage assessment and management. As such, discussions were held with the principal archaeologist at Heritage Victoria, Jeremy Smith, to give an indicative methodology for the heritage assessment of sites within the study area. A meeting was held at HV's office on the 16 January 2020. It was noted that because the archaeological sites (including those listed on the VHI) are not under jurisdiction of the Heritage Act there was no requirement for meeting specifications of neither Victorian legislation nor guidelines. Upon review, HV provided a written statement (dated 20 January 2020) confirming that the proposed heritage investigations and methodology accorded with those of HV (Heritage Victoria 2015). HV advised that any European heritage sites that will not be directly impacted by M3R should not be investigated or disturbed. HV also recommended a professional conservator be engaged to manage conservation and curation of artefacts collected during the investigations.

B7.3.2.3
Description of significance criteria

A significance assessment of each European heritage place has been undertaken using Commonwealth and Victorian standard significance criteria and thresholds to understand heritage values and their level of importance.

Significance assessments of heritage on Commonwealth land use Commonwealth Heritage List (CHL) criteria. Items of state or local significance can be listed on the CHL if they are located on Commonwealth land. To reach the threshold for the NHL, a place must have 'outstanding' heritage value to the nation by comparing it to similar types of places; to be entered in the CHL a place must have 'significant' heritage value. Under the CHL nomination process nominations must set out the qualities or values of a place that make it significant by indicating how it meets one or more Commonwealth heritage significance criteria.

The CHL 'significance' criteria (Commonwealth of Australia 2020) are:

1. The place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history
2. The place has significant heritage value because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history
3. The place has significant heritage value because of the place's potential to yield information that will contribute to an understanding of Australia's natural or cultural history
4. The place has significant heritage value because of the place's importance in demonstrating the principal characteristics of:
   a. a class of Australia's natural or cultural places; or
   b. a class of Australia's natural or cultural environments
5. The place has significant heritage values because of the place's importance in exhibiting particular aesthetic characteristics values by a community or cultural group
6. The place has significant heritage value because of the place's importance in demonstrating a high degree of creative or technical achievement at a particular period
7. The place has significant heritage value because of the place's strong or special association with a particular community or cultural group for social, cultural or spiritual reasons
8. The place has significant heritage value because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history
9. The place has significant heritage value because of the place's importance as part of Indigenous tradition.

The NHL 'outstanding' criteria (Commonwealth of Australia 2009) are:

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

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

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

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

   I. A class of Australia's natural or cultural places

   II. A class of Australia's natural or cultural environments.

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

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

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

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

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

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

Significance assessments of heritage in Victoria typically use the HV criteria, which encompass Burra Charter categories of aesthetic, historic, scientific and social significance. The HV criteria are applied with a threshold that allocates places of state significance to the VHR and places that have historical archaeological values of local significance to the VHI. Heritage places of local significance with no archaeological values are typically allocated to Heritage Overlays on local planning schemes, protected under the Planning and Environment Act 1987.

The Heritage Victoria Criteria (Heritage Victoria 2019) are:

a) Importance to the course, or pattern, of Victoria's cultural history

b) Possession of uncommon, rare or endangered aspects of Victoria's cultural history

c) Potential to yield information that will contribute to an understanding of Victoria's cultural history

d) Importance in demonstrating the principal characteristics of a class of cultural places and objects

e) Importance in exhibiting particular aesthetic characteristics

f) Importance in demonstrating a high degree of creative or technical achievement at a particular period.

g) Strong or special association with a particular present-day community or cultural group for social, cultural or spiritual reasons

h) Special association with the life or works of a person, or group of persons, of importance in Victoria's history.

Once a place has been assessed against the Heritage Victoria criteria and CHL criteria, the thresholds in **Table B7.3** are applied to determine the level at which the place is considered significant.

Table B7.3
Significance thresholds

Significance	Definition	Threshold
High	Place / element of outstanding or exceptional heritage value that embodies Commonwealth criteria in its own right and makes an irreplaceable contribution to the significance of the place as a whole.	National / state Significance: Likely to fulfil criteria for listing on the NHL or VHR
Moderate	Place / element of heritage value that meets Commonwealth heritage significance in its own right or contributes to the significance of the place as a whole.	State Significance: Likely to fulfil criteria for listing on the VHR, VHI or CHL
Minor	Place / element of heritage value that has some Commonwealth significance in its own right or contributes to the significance of the place as a whole.	Local Significance: Likely to fulfil criteria for listing on the, VHI, CHL or HO.
Negligible	Place / element does not meet Commonwealth or state heritage significance in its own right or is intrusive to the significance of the place as a whole.	Unlikely to fulfil criteria for any heritage listings

B7.4 EXISTING CONDITIONS

This section details the existing conditions of the study area and the results of the European heritage assessment.

B7.4.1 Desktop assessment

B7.4.1.1 Heritage register searches and existing assessments

There were 14 European heritage sites in the study area (**Table B7.4**). The majority had been identified and assessed during previous investigations for RDP.

Among previously-assessed sites, the Glen Alice Homestead (current name: Airport Construction Site) was originally mapped within the footprint of runway 09/27 but is believed to have been destroyed during runway construction and was delisted from the VHI. There was determined to be potential for archaeological remains associated with the homestead's dairying works to be present, and ancillary structures located further north beyond the runway construction area.

Coghill's Sheepwash and Dam was subsequently delisted as part of Heritage Victoria's reassessment of sites. There are no statutory obligations for delisted sites they remain on the VHI as a historical record.

There are additional European heritage values previously recorded in close proximity to the study area. The vast majority relate to early European settlement in the mid to late- 19th century and are either homestead sites, agricultural or road infrastructure.

Table B7.4
Heritage register search results

Current Name
Aucholzie Homestead
Barbiston Farm Complex
Bellno Farmstead and Quarry
Coghill's dam (Coghill's Sheepwash and Dam)
Glenara Sheep Dam
Glencairne Homestead (Coghill's Boiling-Down Works)
Glen Alice Homestead (Airport Construction Site)
Grants Road Bluestone Culvert
Oakbank Farm Homestead
Oaklands Junction
Radar Hill Track
Roseleigh Homestead
Seafield Farm
Victoria Bank Homestead

B7.4.1.2 Previous reports

Historic archaeological studies associated with specific developments and broad regional studies have been carried out within two kilometres of M3R (**Table B7.5**). They largely identified farming complexes; including homesteads, drystone walls and sheep dips associated with 19th century settlement. Many of these heritage sites have been built from bluestone. This was a readily-available stone that was commonly used, particularly in the early and mid-19th century until other building materials such as brick and concrete became more common.

B7.4.1.3 Historical and ethno-historical background

This section provides background for the history of the study area. The Australian Heritage Commission developed a historic theme framework for Australia (Australian Heritage Commission 2001) to be used at the national, state or local level to help with the identification, assessment, interpretation and management of heritage sites (Sayers 1969:50).

These Australian historic themes predominantly relate to the early settlement and agricultural history of Tullamarine and are used to help understand the significance of heritage values in a larger national context. The framework has been more recently refined to fit the Victorian context under the Heritage Council Victoria (2010). Themes relevant to the study area and European heritage are shown in **Table B7.6** and **Table B7.7**.

Early squatters and conflict with Indigenous people

When the Tullamarine area was sparsely settled during the squatting period (1835 to c. 1850) the open grassland along the Maribyrnong River and Deep and Jacksons creeks was among the first to be grazed by the new settlers. They initially occupied the area in a manner inconsistent with prevailing Indigenous laws and land uses at the time. From 1844 (under a system of de-pasturing licences at £10 per run) these settlers were legalised and from 1847 required to lodge applications for annual leases. In 1836, John Aitken was the first European settler to move into the region, taking up a 10-square mile pastoral run at Mount Aitken (roughly 30 kilometres north-west of the M3R development footprint). Both this region and the M3R footprint are within the country of the Woi wurrung (associated with the Gunung willam baluk and Marin baluk clans (Clark 1990) and often referred to by early settlers as the Mount Macedon Tribe).

Table B7.5
Previous reports summary

Report	Summary
Weaver. (1991)	Weaver (1991) conducted a broad scale survey of the Moonee Ponds area, recording four historic sites along Moonee Ponds Creek. These included: Moonee Ponds Creek 12 and 13 (bluestone lined ford and drystone walls, respectively) thought to date to the period 1834-1851; Moonee Ponds Creek 10, an open cut quarry, was not able to be dated earlier than 1960; and Moonee Ponds Creek 11, which was not discussed. Weaver noted the stretch of the creek north of Mickleham Road was relatively undeveloped compared to that of the rest of the survey area, and there was potential for further sites associated with 19th century settlement to be encountered in the Moonee Ponds region.
Vines. (1995)	Vines (1995) was commissioned to prepare a cultural heritage study and management proposal for the Grey Box Woodland, located directly north of the M3R development footprint. Vines identified seven historic archaeological sites including Oaklands Junction, Glencairne Homestead, Glen Alice Homestead, Disused Road, Coghill's Dam, St Mary's Church Site and the Glenara Sheep Wash (H7822-0199 to -0205). Vines (1995, p. 67) stated that: "…the historic archaeological sites which survive in the study area attest to a range of European occupation from the first travellers who crossed the Keilor-Werribee Plains, when the area was only sparsely settled by pioneering squatters, to the development of a [sic] distinct communities in the mid nineteenth century, and the gradual decline of the original settlements in favour of the main towns". Vines noted that the Oaklands Junction, Glencairne Homestead, Glenara Sheep Wash and Coghill's Dam had potential for highly significant historic archaeological evidence, and should be protected from any damage or destruction from future construction.
Marshall. (1995)	Marshall (1995) undertook a survey of Barbiston Road, within the present M3R development footprint, but did not record any historic archaeological sites.
Weaver. (1998)	Weaver (1998) recorded Whittenbury Homestead 1 (H7822-0251) during the field survey of a property at Moonee Ponds Creek, Attwood. The site is located between the quarry and Mickleham Road, east of the development footprint. A farm complex, covering an area of approximately 100 x 100 metres, features a brick-lined sheep dip, a concrete exit ramp, timber fence posts and a possible shearing shed. Weaver suggested that the complex may be associated with Chandos, a property located on former section 6.
Hill et al. (1999)	Hill (1999) assessed the Mickleham Road duplication project at Attwood. One previously recorded historic archaeological site was present in Hills study area and a further fifteen sites associated with 19th century settlement were recorded nearby.
Clark. (2002)	Clark (2002) covered much of the M3R development footprint and areas further east. One previously unrecorded historic archaeological site, Steele Creek Tributary Bridge Ruin (H7822-0388), was recorded and consisted of the remains of a bluestone bridge or culvert over a tributary of Steele Creek. This site is located east of the development footprint.
Clark and Anderson. (2006)	Clark and Anderson (2006) examined land south of Annandale Road, south of the present M3R development footprint. There were no previously recorded historic archaeological sites and no previously unrecorded sites were identified during the survey.
Vines et al. (2017)	The RDP Technical report was prepared for a proposed east-west runway development. This identified and assessed many of the sites in the current report during field survey and test excavation.

Prepared by Australian section, Imperial General Staff: 1938 Victoria, Sunbury [Cartographic Material]. Melbourne: Great Britain War Office: By authority H.J. Green, Govt. Printer. http://handle.slv.vic.gov.au/10381/149198.

Table B7.6
Heritage register search results

Primary theme	Secondary theme	Tertiary theme
2 Peopling Australia	2.4 Migrating 2.6 Fighting for land	2.4.2 Migrating to seek opportunity 2.6.1 Resisting the advent of Europeans and their animals 2.6.2 Displacing Indigenous people
3 Developing Local, Regional and National Economies	3.5 Developing primary production 3.8 Moving goods and people	3.5.1 Breeding animals 3.8.5 Moving goods and people on land 3.8.9 Moving goods and people by air
6 Educating	6.2 Establishing schools	-
8 Developing Australia's Cultural Life	8.14 Living in the country and rural settlements	-

Prepared by Australian section, Imperial General Staff: 1938 Victoria, Sunbury [Cartographic Material]. Melbourne: Great Britain War Office: By authority H.J. Green, Govt. Printer. http://handle.slv.vic.gov.au/10381/149198.

Table B7.7
Victorian historic themes relevant to the study area

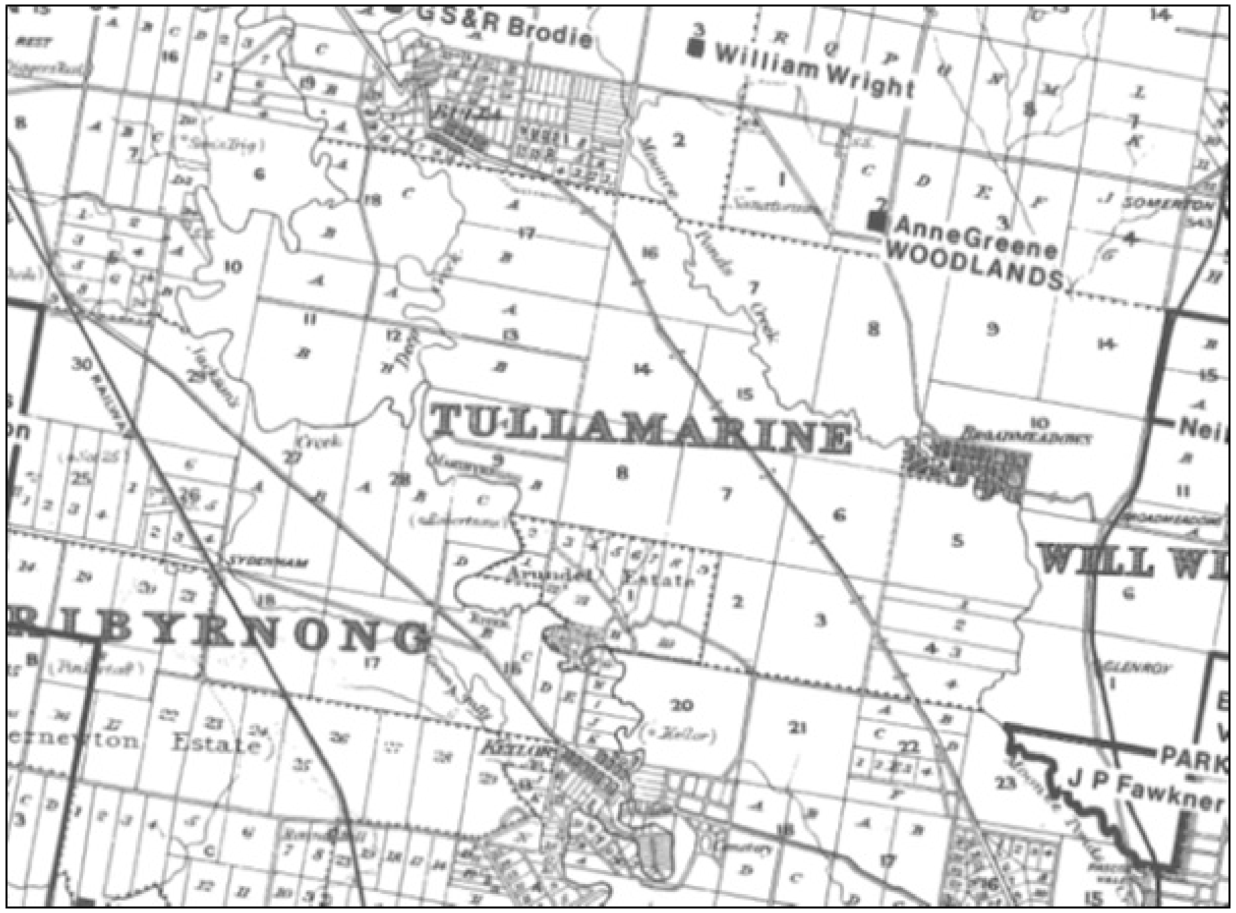
Primary theme	Secondary theme
2 Peopling Victoria's places and landscapes	2.2 Exploring, surveying and mapping 2.3 Adapting to diverse environments 2.4 Arriving in a new land 2.5 Migrating and making a home 2.6 Maintaining distinctive cultures 2.7 Promoting settlement
3 Connecting Victorians by transport and communications	3.4 Linking Victorians by road in the twentieth century 3.6 Linking Victorians by air 3.7 Establishing and maintaining communications
4 Transforming and managing land and natural resources	4.1 Living off the land 4.3 Grazing and raising livestock 4.4 Farming
5 Building Victoria's industries and workforce	5.1 Developing a manufacturing capacity
6 Building towns, cities and the garden state	6.6 Marking significant phases in development of Victoria's settlements, towns and cities
8 Developing Australia's Cultural Life	8.14 Living in the country and rural settlements

On his arrival in Victoria, Aitken was helped by local Indigenous people at Dromana to unload his sheep. He initially appears to have attempted to foster good relations with the Mount Macedon Tribe by distributing rations of rice, sugar and flour (Sayers 1969:50). However, he clashed with the Gunung willam baluk clan on a number of occasions particularly in 1838 when the clan made deliberate attempts against squatters on their land. Aitken recorded in April of that year that 40 Indigenous people approached his station armed with spears and three guns. Mounted on horseback, Aitkens was able to outmanoeuvre the group and dispossess them of two of the guns, although he narrowly avoided being struck by a tomahawk in doing so. The Gunung willam baluk then left but targeted George Evans's run at Sunbury, spearing sheep and threatening a shepherd. Shepherd Samuel Fallon was killed and disembowelled shortly after (Symonds 1985). By this time, Aitken's relationship with the Gunung willam baluk appears to have deteriorated to the point that he no longer tolerated their 'trespass' on his run.

Although the initial violence between settlers and Indigenous people appears to have been largely constrained to the 1830s, the memories of this early conflict seem to have influenced incoming settlers long afterwards. The McNab family took up property in the study area in 1848 and their first homestead (the first Victoria Bank) is recorded as having defensive slit windows long after attacks had occurred on Aitkens run (Itellya 2013). Gibbs also notes John McNab recorded being chased home by Aborigines although details are scant.

The history of early conflict between settlers and Woi wurrung people is also reflected in the naming of the locality 'Tullamarine'. It is said to derive from a woman

Figure B7.2
Map of early allotments and squatters runs in the vicinity of Tullamarine



Source: Spreadborough and Anderson 1983

called Tullymarine, whose husband Bunja Logan stole potatoes from John Gardiner's farm in 1838 and was later responsible for one of the attacks on Aitken. After Bunja Logan escaped from gaol by setting fire to the thatched roof, he disappeared into the mountains with Tullymarine and their children (Symonds 1985:73; Vines 1995).

More information on the Indigenous history of the study area can be found in **Chapter B6: Indigenous Cultural Heritage**.

Early landholders and the speculators of Tullamarine

Land surveying was undertaken in the Tullamarine Parish in 1842, with most of the parish divided into 640 acre sections and some smaller blocks near creeks (Geelong Advertiser, 22 August 1842). The Tullamarine Parish was the last to be sold from the Moonee Chain of Ponds survey (only one or two sections of the Tullamarine Parish were sold in the first Crown land sales for the parish in 1842). The large size of the lots may have been beyond the means of most new immigrants; and also many of the sections were likely withheld from sale due to the depressed economic conditions of the time. There was however a demand for small farms, and some of the 640 acre sections were bought, subdivided and re-sold by speculators such as John Pascoe Fawkner in the 1840s. Other new owners subdivided their sections and leased them to tenant farmers. Much of the Tullamarine parish was not granted until about 1850 (Itellya 2013).

Most of the current study area is within land originally acquired by a small number of mainly Scottish settlers in the late 1840s and early 1850s (see **Figure B7.2**).

Alexander Kennedy bought section 17 Lot A (485 acres) on 11 May 1849. Traversed by the Mt Alexander Road, it was a suitable location on which to erect an inn to serve travellers. This was the Inverness Hotel managed by Alexander's son Henry. The lot south of Kennedy's was 17B, purchased by George Coghill, the son of William Coghill, who acquired land to the east of the study area as well as other squatting holdings around Victoria. Coghill also partnered with Fawkner to acquire Lot 13A as part of their Co-operative Freehold and Land Investment Society venture. Coghill erected a bluestone homestead and stables and named the property Glencairne, establishing a boiling-down works as early as 1849. He applied for a slaughtering licence from the police bench 'for his melting establishment on the

Salt Water River', indicating he may already have been operating at this date (The Argus, 27 February 1849:4).

With the onset of the Victorian gold rushes, service towns grew on the Mount Macedon Road to the north-east (later known as Mount Alexander Road) as they formed some of the primary routes to the Bendigo and Castlemaine goldfields. Tullamarine, Keilor, Bulla and Sunbury and the small community at Oaklands Junction, immediately north of M3R, served both travellers and the local community. This was one of the earliest recorded tracks within the Port Phillip District and also used from 1837 as an alternative route to Sydney Road by travellers from the Murray River. Oaklands Junction Village was at the corner of Mount Macedon and Oaklands roads, and comprised a blacksmith, shop, post office and the Inverness Hotel (Moloney 1998).

Scottish squatters and settlers were particularly prominent in the Tullamarine area. Many had migrated in the 1830s and 1840s during the turmoil of the highland clearances and the lowland agrarian revolution in Scotland, where improvers switched from tenanting subsistence farmers or 'cotters', to more productive sheep grazing in enclosed fields (Prentis 2008). As a result, there was both a shortage of work for dispossessed farmworkers and a shortage of land for the better-off farmers (known as tacksmen) who had their own leases and aspired to improve their circumstances (Devine 2011). The generally high level of education, strong Presbyterian values (highlighting hard work and improvement, application of scientific principles to improvements in agriculture, animal husbandry and breeding) and the integration and adoption of capitalism into these values, made the Scots particularly well adapted to colonial conditions. An example of this was the introduction and improvement of the Ayrshire cattle breed. Some of the most prominent breeders included McNab, Grant, Ritchie and Gibson (Prentis 2008).

The Tullamarine families were closely acquainted through various social connections. For example, their children attended the Seafield School on land donated by John Grant of Seafield Farm; and under the supervision of the Board of Advice for the School District of Keilor, of which Grant and Ritchie were members. They were also acquainted through worship at the Bulla Presbyterian Church (established in 1858 on land donated by Ann Greene) and through marriages over several generations. For example, John Grant, later of Seafield, who married Mary McNab in 1846; Malcolm Ritchie, of Aucholzie, Keilor, who married Jane Gray, daughter of Donald Gray, in 1856; and Angus Francis Grant, of Yarrawonga, son of John Grant of Seafield, who married Elizabeth Ritchie, eldest daughter of Malcolm Ritchie, of Aucholzie, in 1880.

Community was also established through other institutions. Members of the Grant, McNab and Ritchie families took roles on the roads' board and later in shire councils. Opposition to the Melbourne establishment (and in particular the Melbourne Hunt Club stationed at Oaklands Junction) provided a cause for collaboration when a number of farmers established the Field, Fence and Chattel Preservation League to protect their crops and livestock from damage by the hunt (The Australasian, 19 June 1869:20). The Inverness Hotel at Oaklands Junction was perhaps the interface between the two groups and, while it typically served a more egalitarian social function, this sometimes came with unexpected interactions such as when Edward Hagenay was charged with hitting Malcolm Ritchie over the head with a shovel during an altercation over roads' board matters (Hagenay 1864).

Victoria Co-operative Freehold and Land Investment Society

John Pascoe Fawkner was prominent in Melbourne's early history and played an important role in the development of Tullamarine. He opposed the dominance of the squatters and attempted to weaken their grip by encouraging more people onto the land. To this end, he established the Victoria Co-operative Freehold and Land Investment Society to purchase large Crown allotments funded by weekly contributions from society members (Moloney and Johnson 1998). The land was then subdivided into small blocks and allocated to members in proportion to their contributions. Although the scheme was generally a success in the late 1840s and early 1850s, the Tullamarine subdivisions mostly failed. A subdivision of 45 allotments was attempted at section 10, west of M3R (Figure B7.2), and although many allotments had water frontage most were very small (approximately 6 to 10 acres) on stony and steep land. Remnant drystone walls are indicative of the small subdivision parcels (Moloney and Johnson 1998).

Sections 13A and 13B, on the east side of Deep Creek (Figure B7.2) along the alignment of Mansfield Road (near the centre of the present development footprint) were purchased in Fawkner's name by the Victoria Cooperative Freehold and Land Investment Society in December 1850. Section 13B of 415 acres was purchased solely in his name, while section 13A of 246 acres was purchased by Fawkner and George Coghill. The subdivision of section 13A took place in September 1852: Coghill took the northern 133 acres and added them to his Glencairne estate, while Fawkner took the southern 113 acres of section 13A for the Co-operative subdivision. In November 1850, a grant of lots 1, 2 and 3 (of 18 acres each) had been contracted by Fawkner to William Trotman for a total of £39.

Fawkner undertook the sale of his village allotments through a share issue, with each lot or share sold for 10 shillings. Purchasers included Joseph Amos, Patrick Rogers, Charles Snooks, Donald Gray, Samuel Lees, William Warr, Thomas Brown, John Taylor, John Riley, Archibald Butters and William Trotman. Some were resold for much greater sums in the late 1850s, and by 1867 Walter Clark had purchased Trotman's lot in the north-east corner of village.

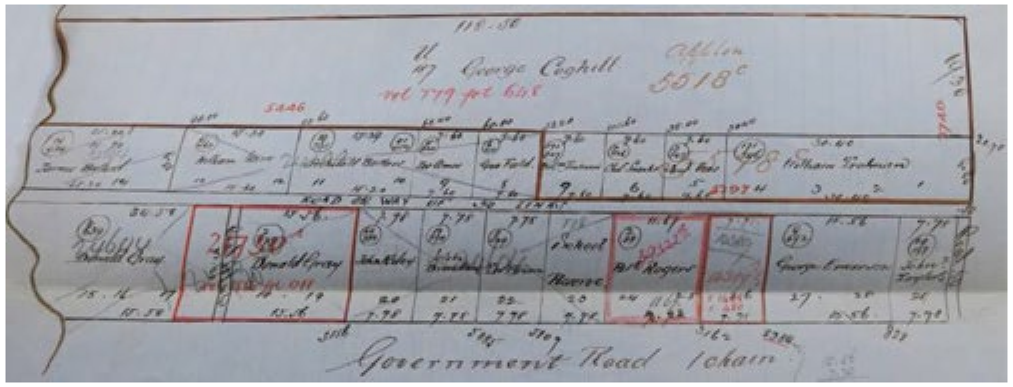
A share certificate from the society (Figure B7.3) depicts a small village against the backdrop of Mount Macedon dotted with gabled cottages resembling prefabricated iron houses set along both sides of a roadway. These appear to correspond with the plan of subdivision for the estate showing the settlers' names (Figure B7.4). The alignment of the road through the village can still be discerned on aerial photographs of the airport. The footing or at least one cottage, Donald Gray's Bellno, was found during the survey which suggests the possibility of other remains within the airport.

The subdivision of section 13 seems to have been even less successful than that of section 10, as little documentation remains. Surviving remnants of the subdivision plan for section 13B indicate 35 parcels (Moloney and Johnson 1998). Blocks varied in size from 6 to 18 acres, and the road alignment comprised two unformed crossroads (most likely Bassett Rad and Panton Drive). Apart from the Mansfield family (who went on to buy most of the estate) it is unclear whether many original purchasers of the subdivided parcels attempted to live on their land, the area being described as a dismal plain and steep valley. In 1856, George Coghill mortgaged his property Glencairne (northern half of section 13A, 17B and part of section 16) to Henry Miller.

Coghill's half of section of 13A and Fawkner's section 13A lots 1-14 later became Glen Alice, which was

Figure B7.3
Fawkner's subdivision of part of A/CP13, Tullamarine Parish Plan, RGO application 5518C, 1875 JP Fawkner

Figure B7.4
Part of a share certificate issued to William Trotman by Fawkner to buyers, appears to depict the proposed village with Mount Macedon in the rear



Source: Public Records Office of Victoria 5518 bought by David Mansfield who built the homestead in bichrome brick in about 1900. It was sold in 1939 for a poor price and thought to be demolished around 1965. William Trotman purchased three lots of the section 13 subdivision but soon moved to Springvale. By 1867, Mrs Trotman was widowed and she sold seven lots (another four had since been purchased, making a total of 42 acres) to Walter Clark of Glenara (Moloney and Johnson 1998). The Roseleigh homestead owned by Ernest Mansfield (Walter's brother) was situated on the south side of Mansfield Road in section 13B. Section 7 was also subdivided under Fawkner's Co-op, located partly in the south-east corner of the present development footprint (Itellya 2013).

Some landowners took advantage of the speculators' subdivisions to enlarge their own properties. Kennedy sold his section to Clark in the 1850s and Coghill's heirs sold section 17B in 1864, also to Clark. George Coghill died in early 1864 and it appears none of his family wished to operate the farm or boiling-down works. The sale indicated substantial improvements including:

> *800 ACRES. Valuable Farming and Grazing Property.*
>
> *GLENCAIRN.*
>
> *With Substantial Bluestone Dwelling house, Boiling Down Establishment, Plant, etc.*
>
> *Situate on the Deep Creek, within 12 Miles of Melbourne.*
>
> *The Property of the late George Coghill, Esq.*
>
> *To Farmers, Graziers, Speculators, and others. GEMMELL, M'CAUL, and Co. have received instructions from the executors of the late George Coghill, Esq., to SELL by AUCTION, at their rooms, 36 Collins street west, in September, That valuable property, situate on the Deep Creek, known as GLENCAIRN, and comprising 800 acres fine AGRICULTURAL AND GRAZING LAND, Securely fenced, and subdivided into paddocks.*
>
> *The property has a frontage of 64 chains 80 links to the Main Government Road, and also a frontage to the DEEP CREEK, from which there is a never-failing supply of water. The Dwelling house is built of bluestone, and contains six rooms, kitchen, servants'-room, men's hut. Also,*
>
> *Very commodious bluestone stables, cart sheds, storehouse, and salting-room.*
>
> *The Garden is well stocked with choice fruit-trees, and securely fenced by a stone wall. There is also erected on the property a boiling-down house and stock-yard, within one mile of the dwelling house.*
>
> *The Boiling-down Plant In complete working order, consisting of steam boilers, iron steam vats, force pump, coolers, wooden vats, weights, and scales.*
>
> *The auctioneers is calling attention to this valuable property, would remind intending purchasers that as grazing-paddock for stock such an opportunity as the present Is seldom met with. The distance from town is only 12 miles, and the property is well timbered, and has a never falling supply of water. There is also abundance of splendid bluestone and granite, and valuable deposits of kaolin. (The Argus 16 July 1864:2)*

In the late 1850s and early 1860s Walter Clark owned properties that he leased to a number of people. These included Gilbert Alstone `Blacksmith's forge, house, + land £40 GAV, £32 NAV; James Dewar `Store, dwelling, garden and land' £32/10/- GAV, £26 NAV; and Thomas Chadwick `Inverness Hotel + Agl land £140 GAV, £100 NAV. This indicates his holdings included the hotel and a number of other buildings on Section 17A (Bulla District Road Board rate book A/CP17 parts, November 1863: 201-203 (Shire of Bulla 1863)).

By 1892, Clark's Glenara estate encompassed approximately 1300 acres south of the Bulla Township between Oaklands Junction and the Maribyrnong River. By the time of his death in 1873, the Glenara estate was 4079 acres. In 1887, the homestead block of about 830 acres was purchased by his son Alistair Clark, one of Australia's best-known horticulturalists and rosarians. The garden became the site for the breeding of many plant species for more than 60 years.

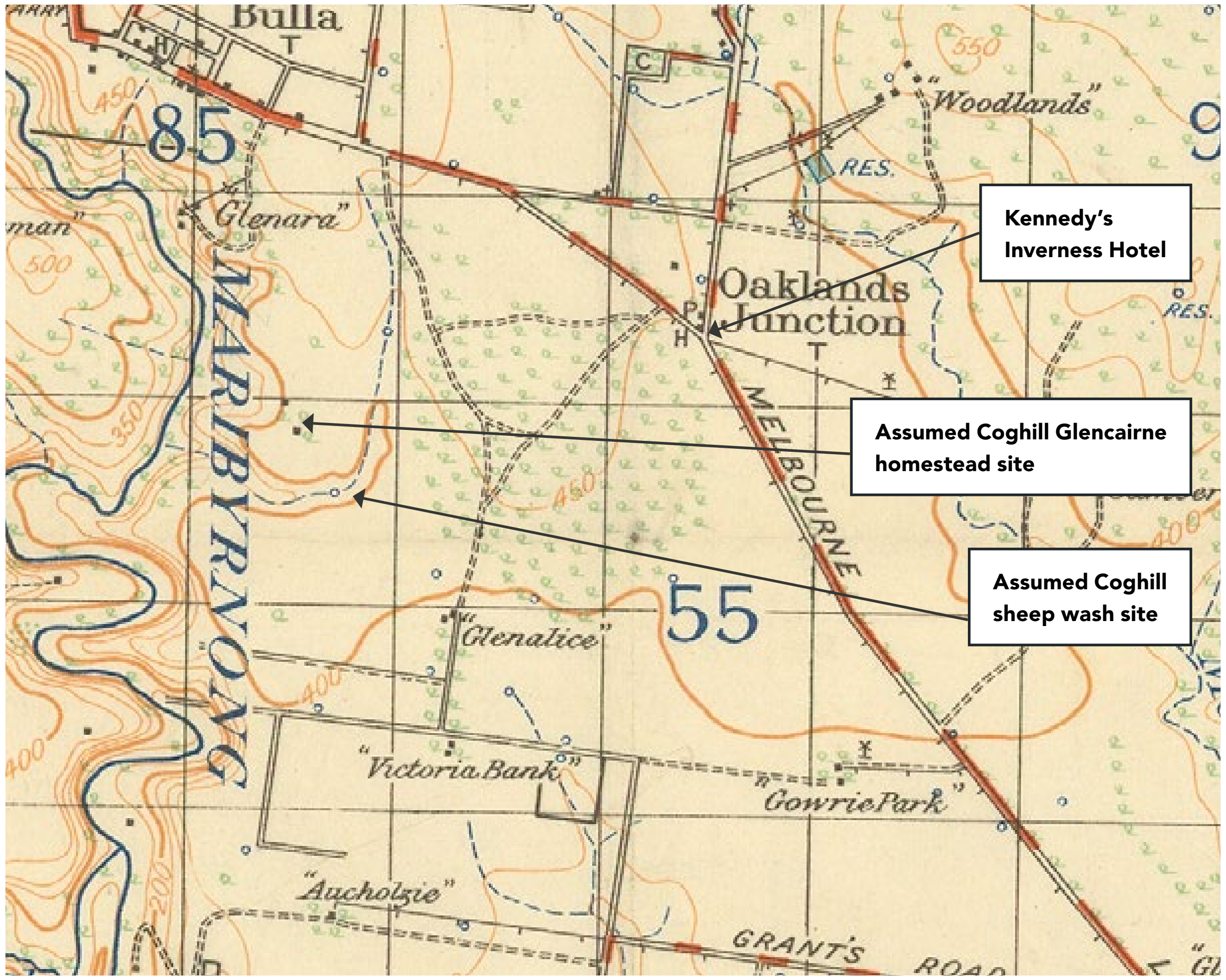
Although the boiling-down works appears not to have operated after Clark's purchase of the property, it was still referred to as 'the boiling-down works on Glenara' many years later (The Sunbury News, 4 June 1910:2).

The Mansfield Family

The Mansfield family arrived in Australia in 1849. They were miners and labourers who, despite being unsuccessful in the gold rush, still made enough money to buy a few of Fawkner's Tullamarine parcels. In 1850, John, Samuel and Isaac Mansfield bought land in Fawkner's section 13B subdivision. Eventually, John Mansfield bought 36 acres and the family purchased most of the blocks either side of Mansfield Road. Roseleigh cottage (on the south side of Mansfield Road) was the main farm and probably built around 1865. By 1888, the Mansfield estate was owned by David, Samuel and John Mansfield.

The Mansfield's grew hay and bred draught horses. The youngest of the three brothers, David reportedly acquired his father's property upon his father's death in 1867, and apparently became wealthy by supplying hay for horses during the Boer War (Mansfield 2007). David built the polychrome Italianate villa Glen Alice on the north side of Mansfield Road (section 13A) which was later demolished to make way for Melbourne Airport's east-west runway (09/27). In 1998, Roseleigh cottage in section 13B was also scheduled for demolition to enable construction of a new runway (Moloney and Johnson 1998).

Figure B7.5
Oaklands Junction in the early 20th century showing locations of Kennedy's Inverness Hotel and Coghill's properties (prepared by Australian Section, Imperial General Staff 1938)



Prepared by Australian section, Imperial General Staff: 1938 Victoria, Sunbury [Cartographic Material]. Melbourne: Great Britain War Office: By authority H.J. Green, Govt. Printer. http://handle.slv.vic.gov.au/10381/149198.

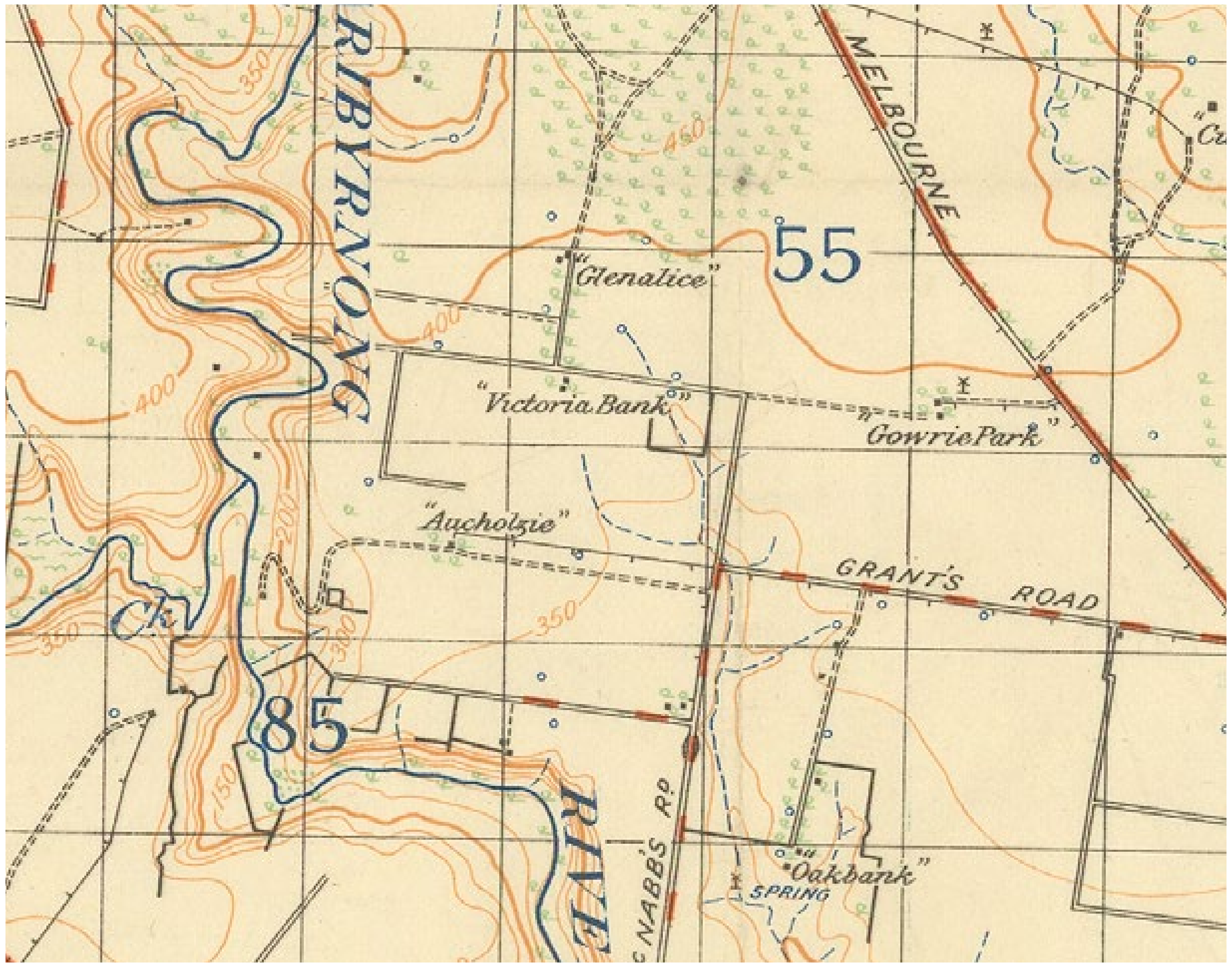
Ritchie brothers

John, James and Malcolm Ritchie came from a small village called Aucholzie in Aberdeenshire, Scotland. By December 1852, they were described as 'farmers of Merri Creek' when they purchased section 12B from Kaye, Chapman and Kaye, (the original purchasers of Crown sections 11, 12 & 13). Section 12B is bound by Deep Creek to the east and Jacksons Creek to the south, on the eastern boundary of the M3R development footprint. The Ritchies went on to purchase part of section 11B, all of 12B and, east of Deep Creek, parts of section 13A and 13B. They called this land Aucholzie. Malcolm Ritchie also held the Overpostle farm on Tullamarine Island and by 1883 had amassed over 1005 acres. The property was put up for sale when James Ritchie died in 1886. However, the sale did not go ahead and instead Malcolm Ritchie undertook further improvements. Advertisements were placed by the Scottish architect AE Duguid for tenders to construct a new brick house on Aucholzie (Figure B7.6) in 1889 (Moloney and Johnson 1998).

McNab brothers and John Grant

The McNab family arrived in Port Phillip on the David Clarke, landing in 1839. They initially bought land in Collins Street but within a couple of seasons sold up and moved to Campbellfield, where they leased land for nearly a decade. Angus McNab was the youngest of the five well-known McNab brothers, whose families appropriately celebrated their centenary in October 1939 with about 100 descendants. Like the Grants, the McNabs were Presbyterians and probably worshipped at the church at Oaklands. John and Duncan McNab purchased land in Tullamarine in 1850 in partnership with John Grant (see below) who had settled there in 1848. They subsequently divided Crown allotment 8 between them.

Figure B7.6
Early homesteads in the development footprint (prepared by Australian Section, Imperial General Staff 1938)



Prepared by Australian section, Imperial General Staff: 1938 Victoria, Sunbury [Cartographic Material]. Melbourne: Great Britain War Office: By authority H.J. Green, Govt. Printer. http://handle.slv.vic.gov.au/10381/149198.

Duncan McNab bought the middle 160-acre section of section 8, called it Victoria Bank, and lived there until 1869. In 1880, his sons Angus and John McNab returned and a second Victoria Bank was established. This was either on 95 acres between the north side of Barbiston Road and Aucholzie (section 9A), previously owned by the widow Ritchie, or on the south side of Mansfield Road (section 13B) (Figure B7.6).

John McNab (who married Mary Grant in 1846) owned the southern 160 acres of section 8 and called it Oakbank (Figure B7.6). Oakbank later absorbed the original Victoria Bank to the north, as well as part of the Upper Keilor Estate and properties owned by Love and Turner. Oakbank had a reputation for the finest herd of Ayrshire cows in Australia and was later known for its Shropshire sheep stud flock (Figure B7.7).

John Grant of Renewan Farm in Inverness-shire on Scotland's River Spey arrived in Sydney in 1838. He occupied a farm on Merri Creek in Campbellfield from 1839 for 11 years until he could buy land himself.

He acquired the northern 320 acres of section 8, which he named Seafield. When he died in 1904 at the age of 93 it was noted that:

> *"…[along] with his brother-in-law, Duncan McNab, he laid the foundation of the famous herds of Ayrshire cattle, the breeding of which was still being continued on the neighbouring farms by the descendants of these two old pioneers. Mr. Grant was for many years a member of the Keilor Shire Council, and was the last of the original trustees of the old established Presbyterian Church at Bulla." (The Argus, 8 November 1904:6)*

Grant also purchased part of section 9A at the south corner of Barbiston and McNabs roads, and later donated land for the Seafield National School (1859-1884). The school was located where the existing north-south runway (16L/34R) would meet Incinerator Road should the runway continue that far. He was also a shire councillor in Bulla and a founder of the Bulla Presbyterian Church.

Figure B7.7
Oakbank's Shropshire stud flock, with homestead behind

Source: The Sydney Mail and New South Wales Advertiser 1904

Establishment of the Airport

Aircraft first landed in paddocks at Tullamarine in the 1920s then during World War II there was a satellite aerodrome of Essendon Fields Airport on the east side of Melrose Drive. Gowrie Park was also used for aviation. Aerial Transport Ltd purchased 560 acres at Tullamarine, for the establishment of an airport (Vines 1995:38).

In 1959, the Commonwealth Government acquired a further 5,300 hectares (13,000 acres) of grassland in Tullamarine (Lucas 2010) and in 1962 construction of Melbourne's new international airport began. Runway construction involved significant earthworks in subsoils and the removal of surface soils in the majority of construction areas. This preceded construction of the terminal infrastructure, not finished until the early 1970s.

On 27 November 1962, then Prime Minister Robert Menzies announced a five-year plan to provide Melbourne with a $45 million 'jetport' by 1967. The first sod was turned in November 1964 and Melbourne Airport was opened to international operations on 1 July 1970 by the then Prime Minister John Gorton. Domestic flights were transferred to Melbourne Airport on 26 June 1971. Expansion works, including extending runways, were completed in 1973, allowing Boeing 747s to use the airport.

A review of aerial photography from 1931, 1945, 1960, 1980 and 1990 indicates the majority of active airport areas (runways, taxiways, terminals, hangers, etc) have been subject to major ground disturbing works. There was therefore little potential for European heritage to survive among the main constructed concrete and bitumen surfaces. However, grassed areas adjacent to the runways and taxiways appear to have been only cleared level with the surface, so archaeological features may survive on the airside (as attested by features evident at Oaklands Junction and along the Fawkner Land Co Settlement laneway). The construction of the runways had resulted in the clearance of the Grey Box Woodland's east and southern perimeter, where the tree line had become more diffuse and scattered. Here, two historic homesteads sites were located in Glencairne and Glen Alice (including ancillary buildings and potential dairying works). The intersection at Oaklands Junction has also been cleared (although the former roadways are still clearly visible) leaving behind a triangular shape and surface evidence of the building foundations. Similarly, the laneway running through the Fawkner Land Co Settlement can also be discerned as crop marks in grass on the airside. Outside these active airport areas, the majority of the study area remains relatively unchanged from earlier agricultural uses. Natural soil surfaces and the potential for European heritage sites in the form of structural foundations and occupational deposits remain, even though topsoil has been disturbed by ploughing or other agricultural uses.

B7.4.2
Field survey results

The survey undertaken for the M3R investigations identified 16 sites of historical interest within the study area as listed in Table B7.8. These are also displayed in Figure B7.1. These sites predominately relate to former homestead complexes, many of which have been demolished but archaeological deposits and foundations remain.

Aucholzie is the only homestead complex with surviving structures, the remaining homestead sites are limited to ruins and building foundations.

Glenara Sheep Dam was revisited but appeared to have been substantially altered by modern reconstruction. Some areas of flattened ground above the creek line and apparently constructed timber beams were identified at the edge of the creek gully. Further investigation was deemed necessary to determine if any structural remains could be present in these areas.

Observation of demolished building materials and large bluestone blocks indicated the potential for structural footings at Kennedy's Hut Site and Coghill's Boiling-Down Works. Vegetation overgrowth, and demolition and other stockpiled materials, prevented visibility of true extent of archaeological remains at these places.

Field survey of two areas of archaeological potential was not possible due to restricted access to airside sites (Oaklands Junction and the Fawkner Land Co Settlement). Both areas are considered likely to retain archaeological remains and some elements such as building footings, drains and former roadways can be identified from crop marks seen in aerial photographs.

Crop marks occur when grass or other vegetation either dries off early where above solid structures such as foundations, or stays green longer where it grows over artificial depressions such as drains and other backfilled excavations. Features can therefore be readily identified if aerial photographs are taken at the right time of year.

Parts of the Oaklands Junction site including footings of the Inverness Hotel were visible in the 1990s when the site was first recorded (Nearmap aerial photos show the footings of several buildings at this site).

The Fawkner Land Co Settlement can be traced by crop marks along the former village lane that divided the allotments. Comparison of the linear feature located just south of, and extending west from the western end of the east-west runway (09/27), with the settlement's subdivision plan (Figure B7.3) show that this feature corresponds closely with the width of the road reservation left between the allotments. As at least one building site from this settlement has been identified (Donald Gray's Bellno) there are potentially other buildings or structures (some of which may be shown on the share-certificate illustration) that may still survive as archaeological remains (Figure B7.4).

Following the background research desktop assessment, the field survey did not identify any built heritage values or other features requiring further assessment. As noted above, Aucholzie is the only homestead complex with surviving structures. It stands in a heavily deteriorated state (partial wall collapses, stripped interior, roof tiles removed etc). Grants Road Bluestone Culvert is the only other partially-standing site. All other sites exist as archaeological deposits, remains or parts of other historic infrastructure (e.g. the Coghill and Glenara sheepwash and dams).

Table B7.8
European heritage sites identified during the survey within M3R

Current Name	Description
Aucholzie Homestead	Remains of homestead complex
Barbiston Farm Complex	Remains of homestead complex
Bellno Farmstead and Quarry	Remains of homestead and quarry
Coghill's Sheepwash and dam	Coghill's Dam has been removed from the inventory. It was originally registered from historical sources as a bluestone spillway. Further research and test excavations confirmed the identification of this site.
Coghill's Boiling Down Works (previously Glencairne Homestead)	This site was mistakenly identified as Coghill's Homestead but further research and test excavations confirmed the identification of this site, while the actual location of the Glencairne homestead and stables have been identified on the adjacent property to the west of the airport land.
Glenara Sheep Dam	Remains of sheep wash and dam along 'Glenara' creek drainage line. Reconstruction has removed nineteenth century remains.
Airport construction site (previously Glen Alice Homestead)	The Glen Alice Homestead site has been removed from the inventory. It was located near the present Perimeter Rd and on the north side of 09/27. Concrete footings and slabs of outbuildings related to the Glen Alice Homestead appear to relate to post WWII sheds. The homestead site was destroyed during the construction of the runway and service road.
Grants Road Bluestone Culvert	Bluestone culvert
Kennedy's hut site	Remains of early hut
Oakbank Farm Homestead	Remains of homestead complex
Oaklands Junction (unable to be directly surveyed)	Oaklands Junction is the remains of several structures including a bluestone culvert and building foundations associated with the small 19th century settlement.
Seafield Farm (school not identified)	Remains of homestead complex, following excavation and further survey it was determined that the school site was probably destroyed by road and taxiway construction
Roseleigh Homestead	Remains of homestead complex
Victoria Bank Homestead	Remains of homestead complex
Fawkner Land Co Settlement (Unable to be directly surveyed)	Remains of early settlement, may retain archaeological remains and some elements such as building footings, drains and former roadways.
Radar Hill Track	Historic crushed stone and gravel trackway running through Grey Box Woodland towards Glencairne Homestead.

B7.4.3
Test excavations

B7.4.3.1
Excavation methodology

Consultation was undertaken with HV for the above heritage sites assessed as part of M3R development and planning (refer to Section B7.2). The consultation process included providing HV with an indicative survey and excavation method for each site that Melbourne Airport believed required further assessment in order to determine its significance (a summary of the proposed excavation methodology for each site is detailed in Table B7.9). Where significant features such as large structural/foundation stones were uncovered, further excavation was undertaken to determine their extent in order to uncover a more complete 'site extent' of the structural remains. Excavations were predominantly limited to removing surface litter, vegetation and demolition layers to determine the site orientation and nature. The test excavations sought to preserve the level of any remnant and intact occupational deposits. The results provided additional context to both existing background information and new research undertaken concurrently to the field program.

B7.4.3.2
Excavation results

Previous excavations of the Victoria Bank and Bellno homesteads, and Barbiston, Oakbank and Seafield farms revealed a series of nineteenth century small farm buildings of various forms. Additional excavation was undertaken at the Coghill's Boiling-Down Works (previously Glencairne Homestead) revealing well preserved foundation stonework. The excavations recorded sufficient structural remains to provide a fairly complete site plan. This included the number of potential rooms, orientation of buildings, divisions of internal and external areas, and separation of the demolition layer and potential occupational layer.

Excavations at the Kenney's Hut site demonstrated this was an early occupation of a small domestic building dating from the mid-nineteenth century; while excavations at Coghill's Sheepwash and Dam were less conclusive, revealing various structures and mid-nineteenth century artefacts.

The potential archaeological deposits associated with the Airport Construction Site (previously Glen Alice Homestead) outbuildings and Glenara Sheep Dam were investigated but no significant features identified. The site was determined to have little archaeological value. Following excavation, it was determined that the Airport Construction Site (previously Glen Alice Homestead) represented mid to late-twentieth century structures probably associated with construction of the Melbourne Airport runways. Select mechanical stripping was conducted at the Aucholzie Homestead, which helped to reveal additional external features and sample of depositional finds. Results from these sites are discussed among those previously assessed sites in the place inventory (Section B7.4.4).

Based on the test excavations and contextual information from the background assessment, updates were made to more accurately name each place and assess its condition. The revised names and descriptions have been included in the various tables to this report.

Test excavations could not be undertaken of the Oaklands Junction and Fawkner Land Co Settlement sites due to restrictions on works on the airside. However, assessments from historical sources and aerial photographs can be used to assess the potential archaeological values of these sites.

B7.4.4
Place inventory

The following place inventory tables (Table B7.10 to Table B7.25) provide information on all European historical sites identified in the M3R development footprint or which may be impacted. The sites are closely associated with the Tullamarine region's 19th century settlement, farming and road infrastructure. Due to the largely rural nature of the study area and lack of development since the 1960s (except Melbourne Airport) the study area largely retains these remains of early settlement (see Figure B7.1).

Table B7.9
Excavation methodlogy

Archaeological site	Description	Proposed investigation
Kennedy's Hut site	A small earth and stone levelled platform with brick, glass and ceramic fragments is believed to be from a mid-19th century hut	Hand excavation of a trench across the site, and test pits in vicinity of potential artefact dumps, expanded to determine nature and extent of deposits and features.
Coghill's Sheepwash and Dam	Breached earth dam wall with timber and stone structural remains and level building platforms nearby.	Hand excavation to expose structural remains and other feature with one to three trenches, plus test pits at building platform sites.
Coghill's Boiling-Down Works (previously Glencairne Homestead)	Coghill's 1840-50s bluestone and brick Boiling-Down Works site.	Scrape back recent disturbed fill layer with backhoe, hand excavation of trench across site plus test pits at exposed structural features.
Airport Construction Site (previously Glen Alice Homestead)	Concrete slabs thought to relate to farm buildings.	Scrape area near former structures by mechanical excavator – at least two transects to determine if artefacts are present.
Aucholzie Homestead	C1889 brick homestead and outbuildings with possible earlier bluestone structure in rear.	Scrape area of rubble behind existing building with m echanical excavator to determine if evidence of earlier structure is present – hand excavate to determine structural form and stratigraphy if any structure found.
Barbiston Farm Complex	Extensive surface scatter of artefacts stone paving and timber structures among boxthorn hedges and other garden plants.	Test pit along north edge of building (hand). Open area excavation of eastern part of building (machine and hand).
Bellno Homestead	Bluestone foundations of two room cottage with fireplace and extensive artefact scatter Fragmentary remains of bluestone footings, post holes, fire place foundations and extensive disturbed artefact scatter.	Test pit in north west corner of building (hand). Test pit near middle of south wall at presumed entrance (hand). Test pit in south east corner of building (hand). Open area excavation at western end of building (hand). Open area excavation at south east of building (hand).
Oakbank Farm Homestead	Traces of former homestead, paved area near south entrance, driveway and garage, circular brick tank within larger square bluestone lined in-ground tank and scattered artefacts.	Trench (machine). Asbestos material scattered through the soil in many areas, so it is determined that hand excavation and sieving is not appropriate.
Seafield Farm	Base layer of wall footings, stone lined tank with occupation and demolition rubble fill	Test pits along north and south walls (hand). Test pit near north west corner (outside building line) (hand). Test pit west of northern end of building (hand). Open area excavation of northern part of building (machine and hand).
Victoria Bank Homestead	Foundations and partly standing walls of three-room bluestone cottage with deep cellar, stone lined circular underground tank, traces of timber extension and stone paved veranda	Test pit in north east corner of building (hand). Test pit in north west of paved veranda (hand). Test pit on western entrance to building (hand). Open area excavation in north and middle room (hand). Open area excavation around cellar room (hand, with clearance of cellar fill and collapsed wall rubble by machine.

Table B7.10
Place inventory for Aucholzie Homestead

Aucholzie	
Type	Remains of homestead complex
History	The Ritchie brothers, John, James and Malcolm, acquired extensive landholdings in the Tullamarine district in the 1850s and 1860s. By 1883 they had about 1005 acres, which was known as Aucholzie and encompassed part of section 11B, all of 12B, and parts of section 13A and 13B. The original Aucholzie is a locality on the River Dee in Aberdeenshire, Scotland, and appears to have been the ancestral home of the Ritchies. James Ritchie died in August 1883. The following year, John and Charles Ritchie were living at Cobaw near Lancefield. It appears that Malcolm then became the principal owner of the land that the brothers had jointly acquired. In 1889, architect A E Duguid advertised for tenders for the erection of a residence at 'Aucholzie'. This homestead was built for Malcolm Ritchie, probably because his relatively wealthy status and family were not suited to the original, nearly 50-year-old, bluestone and mud mortared house on the site. Duguid accepted the tender to erect a substantial brick villa in June 1889.
Description	The existing brick house is clearly the 1889 home built by Malcolm Ritchie when he took over the farm. Surrounding sheds are from the early to mid-twentieth century, as indicated by most of them being evident on 1940s aerial photographs. A collection of cut bluestone to the west of the farm yard, and a possible group of foundations with slate immediately behind the house, are potentially remains of the original 1850s homestead. There may be a cellar under this, but not within the later house. The area to the north and west of the house is also likely to contain the domestic refuse from the household, which would have been deposited.
Condition	Standing structures remaining and also potential for archaeological deposits.
Images	**Figure B7.8** **Looking north-east at Aucholzie residence during stripping works outside of structure** 
	Figure B7.9 **Brickwork exposed during stripping works at Aucholzie residence** 

Table B7.11
Place inventory for Barbiston Farm Complex

Barbiston Farm Complex	
Type	Remains of homestead complex
History	Barbiston Farm was one of several properties established in the late 1840s and early 1850s in the Tullamarine area. It initially comprised a small bluestone homestead and several outbuildings, with the homestead paddock well defined by windbreaks of peppercorns and cypress trees and later sugar gums. The role of the farm in Victoria's cattle breeding was described much later in the Australasian in 1933 as follows: *"The Barbiston Ayrshire stud was established by the late Mr. Richard Gibson in the Tullamarine district. Near Melbourne, in "the early days" has played an important part in the progress of the brood throughout Australia, although not to the same extent as the famous Oakbank stud of Messrs. McNab Bros. It was founded on several cows bred in New Zealand and stock purchased from the late Mr. J. E. Pennell, a New South Wales breeder, who imported cattle from the Drumlanrig stud of the Duke of Breeleuch (Scotland), which are at the of some of the best Ayrshires in Australia today."* Although absorbed into larger adjacent properties, it appears to have continued in use as a dwelling until demolished for the airport in the 1960s. Aerial photos show a series of buildings within several farm yards edged by windbreaks and hedges. The trees remain, but most areas within the yards have been demolished. Remaining stone, brick, timber and metal from buildings, and glass, ceramic and metal domestic refuse are widely scattered. A particular concentration of ceramic and glass appears to be a dump site just beyond the garden gate facing out to the escarpment edge.
Description	A scatter of late nineteenth and early twentieth century domestic artefacts, tree rows, remnant fencing, dry stone walls and cut bluestone indicate the former homestead and farm complex. The fences from the property indicate small pens adjacent to a large stable and not far from the homestead, typical of stud farms.
Condition	There are no standing structures remaining, but potential for archaeological deposits remain.
Images	**Figure B7.10** **Barbiston Farm, constructed in the 1870s**

Collins, J. T. 1966. Keilor. "Barbiston Farm." Photography. http://search.slv.vic.gov.au/MAIN:Everything:SLV_VOYAGER1674223

Figure B7.11
Barbiston Farm foundations following excavation

Table B7.12
Place inventory for Bellno Farmhouse and Quarry

Bellno Farmhouse and Quarry	
Type	Remains of homestead complex
History	It is possible that the hut site relates to either the very first occupation as part of Coghill's Glencairne pastoral property or the first occupant leasing or buying from Fawkner's land society. Lots 15-19 in John Pascoe Fawkner's co-operative subdivision of section 13A, Parish of Tullamarine, were conveyed to Donald Gray, who named the property 'Bellno'. Donald Gray was Malcolm Ritchie's father in law and Malcolm owned property on both sides of Deep Creek. Located on the north side of Mansfields Road, the eastern boundary was 540 metres up what was called Grays Hill. A ford on Deep Creek was in line with Loemans and Mansfield Road. A 'slate freestone' quarry was described in this location in 1862, "running along the steep cliffs beneath Mr Gray's house" and while the existing quarry workings appear to be basalt, the lower strata comprise mudstone and other measures, which may have been considered usable as slate.
Description	The site comprises the footings and base course of a two-room bluestone cottage, measuring about 6 x 11 metres. Superimposition of one wall against another indicates the western room was constructed separately and the eastern room added later – although this might only be weeks or months after the original structure was completed. To the west are a series of stone walled stock pens, partly formed from massive boulders, and partly from well-made dry stone walling. These extend for about 70 metres, and are about 12 metres wide. A four-metre-wide roadway runs beside the yards, with a second boulder wall opposite (north side). The structures are all on a narrow tongue of land projecting out over the Deep Creek valley. Steep slopes are about 30 metres to the north and 40 metres to the south. The southern escarpment has been quarried. No specific history has been found for the quarry. At present it can only be speculated that it was an early exploitation, possibly by the landowner as a supplement to their farming income. The size of the quarry means it is unlikely to have been a stand-alone commercial venture, but may have been opportunistic or related to a specific stone construction contract in the immediate area. This might have been for one of the many local bluestone homesteads and public buildings, or for road projects, such as the Grants Road culvert.
Condition	There are no standing structures remaining, but further potential for archaeological deposits remain.
Images	**Figure B7.12** **Bellno wall foundations obscured by thistles looking north, 2014**

Figure B7.13
West end of Bellno showing fireplace and flagstone floor

Table B7.13
Place inventory for Kennedy's Hut

Kennedy's Hut	
Type	Early settler's residence
History	Crown Allotment 17A was purchased in 1849 by Alexander Kennedy, who left his son Henry to run the Inverness Hotel on property at Oaklands Junction. It can be assumed that the remainder of the property was grazed and that this hut site was a cottage leased either to a tenant farmer or used by a farm manager. It is possibly mentioned in the estate listings for Walter Clarke's Glenara property and later sales notices suggests that there were a number of cottages on the larger property, but the location of these is uncertain. The hut site appears to have only been occupied for a short time.
Description	Bluestone foundations of buildings and external paving present, with some later brick course work present. Limited occupational deposits present. A level platform has been formed of rounded boulders and clay behind a cut stone wall on the east side, and partly benched into the slightly rising slope to the west. Small round stones have been used to create a cobbled veranda pavement with large flagstones in the midpoint suggesting the entrance doorway. Window glass fragments were found in localised areas on either side. The total area is about 10 x 6 metres. A brick paved area near the north west may be associated with an out building. Extensive scatters of glass and ceramics occur for up to 50 metres from the cottage.
Condition	Fair – some intact occupation deposit and demolition layers.
Images	**Figure B7.14** **Kennedy's Hut site during initial excavation looking over threshold and exterior paving, facing south-west, 2020**  **Figure B7.15** **Detail of brick paving at rear of Kennedy's Hut site, 2020** 

Table B7.14
Place inventory for Coghill's Boiling-Down Works at Glencairne

Coghill's Boiling-Down Works at Glencairne	
Type	Early industrial complex for processing of animal material and tallow production
History	George Coghill acquired crown allotment 17 B in 1850 and established his Glencairne homestead shortly after. He is likely to have occupied the area earlier as his father was located to the east on the Cumberland property and had grazing licence over the area. In 1849, Coghill applied for a slaughtering licence for his 'Melting establishment' so it appears to have constructed this works by that time. Confirmation of the boiling down works is found in the estate sale notice after his death in 1864 when the property and boiling down works were sold to Walter Clarke of Glenara.
Description	Substantial bluestone foundations for walls, internal and yard paving with brick course work, including for a boiler setting and furnaces for melting vats. A substantial bluestone masonry wall runs around the large site evidently enclosing an area of about 15 x 20 metres. There are two openings for cart entrances, one on the north side, and another on the east which has intentionally formed cart ruts in the bluestone cobble paving. A large area of stone paving is located in the south east part of this enclosed yard, however, much of the yard appears to have been earth. A stone paved drain also runs along the north side outside the wall. A large quantity of butchered sheep and cattle bone was found in this drain. Bones were also found both inside and outside the yard wall near the eastern entrance adjacent to the supposed melting vat furnace. Potential for further occupational deposits to be present.
Condition	Fair – large areas of disturbed material from both the airport construction and more recent bulldozing, but there are still intact occupation deposits and structural remains.
Images	**Figure B7.16** **Excavated boiler setting at Coghill's Boiling-Down Works site facing west, 2020**  **Figure B7.17** **Stone paving and cart track in yard at Coghill's Boiling-Down Works site facing east, 2020** 

Figure B7.18
Plan of boiling down works after preliminary excavations 2020

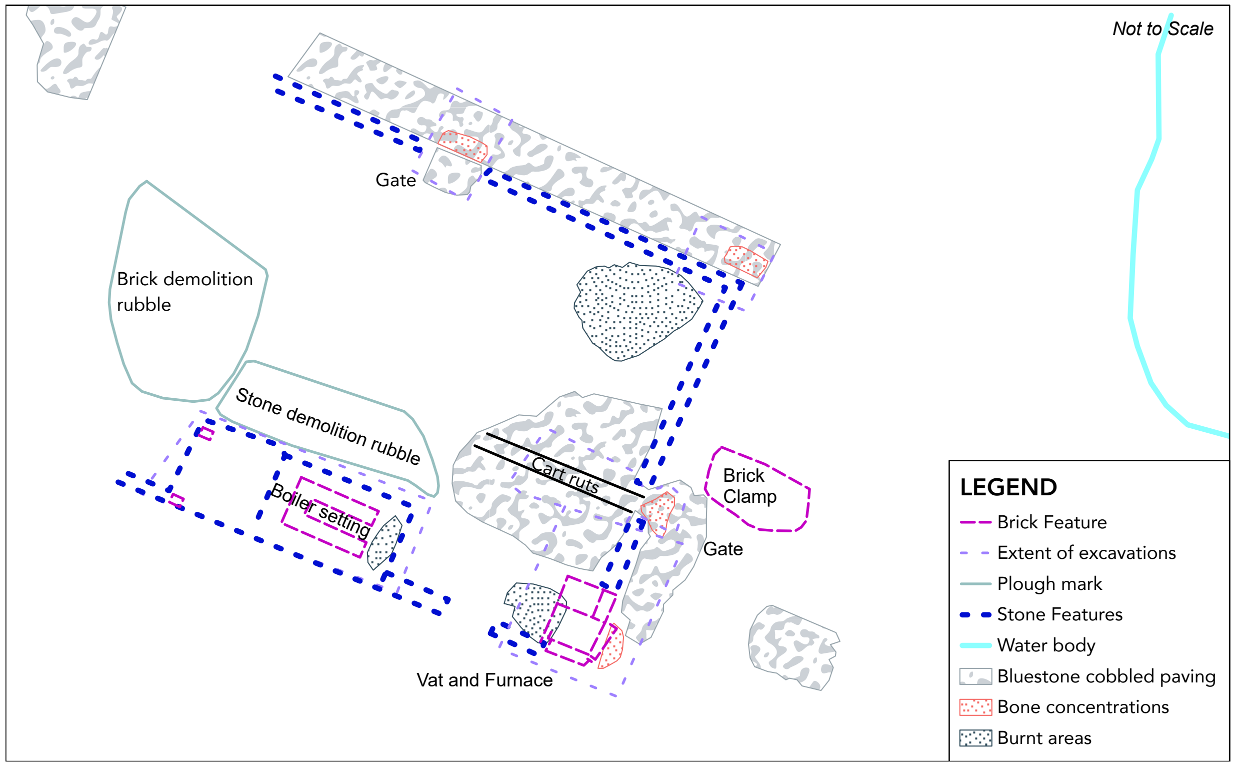


Table B7.15
Place inventory for Oakbank Farm Homestead

Oakbank Farm Homestead	
Type	Remains of homestead complex
History	John and Duncan McNab and John Grant jointly purchased section 8, Parish of Tullamarine, in 1850, possibly having squatted briefly in the area prior. They created three farms between them: Oakbank in the south; Victoria Bank in the middle; and Seafield in the north. The McNabs were renowned for improving the Ayrshire cattle breed, with their bloodstock sold at auction at high prices, and winning prizes at agricultural shows. John McNab built and ran the Oakbank property, later absorbing Victoria Bank. John married Mary Grant in 1857, while Mary's brother John Grant had married John McNab's sister Mary McNab in 1846. John McNab died in 1884, but his wife and sons continued to run the farm. In 1913, William McNab is recorded as running the farm with his brothers. John and Mary McNab's son Angus Duncan McNab married Elizabeth Meikle, from Queensland, and their only son was John Alexander Grant McNab, who, with his sons, Ian, Alex and Keith, farmed Oakbank until it was compulsorily acquired for the airport circa 1960.
Description	As the Oakbank farm appears to have been the main property and longest lived of the McNab/Grant undertakings, the archaeological remains might also be extensive. Located at the southern end of a long avenue of sugar gums, which formed the main driveway between the three farms known as Oakbank Lane, the site comprises a series of building and shed foundations, cobbled areas from pens and tracks, and remains of various footings from equipment and other structures. The main house site is within a tree lined yard, where a mound of cut stone, mortar, plaster and some timber has been heaped. This has evidently been pushed up following removal of the bulk of the building stone, some of which would appear to have been pushed into the large stone lined dam to the south west. Several large stones, probably from lintels or window sills, are also evident. A large stone-lined cistern with brick dome remnants is located near the south east corner of the house. Other features on the site include stone paving from the stables and sheds, stone paving along the driveway west of the house, a larger livestock shed to the south, concrete floor, probably from a dairy, north east of the house, and two in-ground, brick-lined tanks, one near the larger shed and another further south.
Condition	There are no standing structures remaining, but potential for archaeological deposits remain.

Oakbank Farm Homestead (cont.)

Images

Figure B7.19
Mound of cut stone on Oakbank homestead site, looking north, 2013

Figure B7.20
Edge of brick cistern at Oakbank homestead site, 2016

Table B7.16
Place inventory for Glenara Sheep Dam

Glenara Sheep Dam	
Type	Sheepwash and dam
History	A dam is marked on several early plans of the Glenara property, and may have pre-dated Walter Clarke's ownership, as it is the only water source on Allotment 17A originally purchased in 1849 by Alexander Kennedy. The dam may have been utilised for watering stock by the Melbourne Airport which has managed the Grey Box Woodland using sheep grazing to keep grass down since the 1960s. It appears the dam was reconstructed in the last 20 years.
Description	When first recorded in the 1990s, features including a stone lined sheep dip were described at this site. The dam appears to have been reconstructed in recent decades with a modified earth bank wall, excavated spillway and concrete diffusion structure in the water channel upstream.
Condition	Poor - no archaeological features remain

Table B7.17
Place inventory for Oaklands Junction

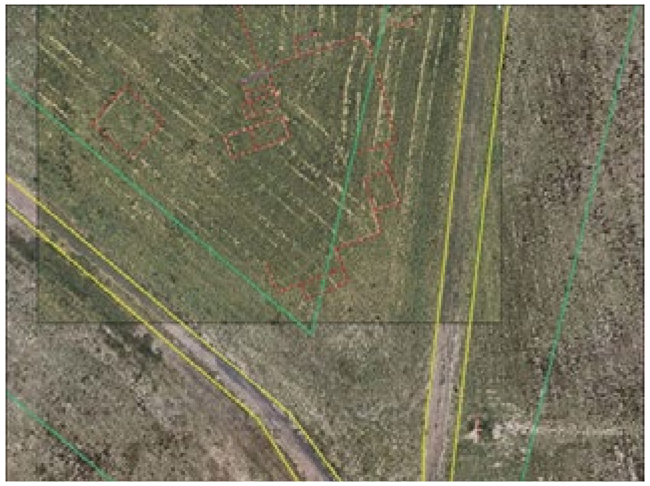
Oaklands Junction	
Type	Former settlement
History	The earliest European occupation of the airport and its surrounds was by squatters in the late 1830s, but it was not until the gold rush period of the 1860s that permanent residences were constructed near the M3R development footprint. This was the township of Oaklands Junction which was originally developed as a stopover for people heading from Melbourne to the goldfields. During the previous assessment, an arched, bluestone culvert associated with Oaklands Junction was noted. The culvert was assessed as being relatively intact and it was determined that there is potential for additional historic features or objects associated with the historic place to be identified.
Description	Foundations of buildings and bluestone culvert evident. Various fragments of ceramics and bottle glass observed. Likely additional material currently obscured by vegetation. Footings of several buildings are visible as crop marks in aerial photographs.
Condition	Fair
Images	**Figure B7.21** **Bluestone culvert, looking south, 2016** 
	Figure B7.22 **Oaklands Junction building footings visible as crop marks in Nearmap aerial image Jan 2020** 

Table B7.18
Place inventory for Airport Construction Site

Airport Construction Site	
Type	Airport construction site (previously identified as Glen Alice outbuildings)
History	Glen Alice Homestead was constructed in about 1900 by the David Mansfield. In the mid-20th century a dairy and other outbuildings were added to the north of the homestead, however, these now appear to have been within the airside and were demolished for the east west runway and taxiway, along with the homestead, around 1965. Foundations of other buildings just north of the airside perimeter fence now are considered to be related to airport construction activities in the 1960s, possibly including a concrete batching plant, elevated fuel storage tank and material storage buildings or shelters. By the 1980s these buildings themselves had been demolished.
Description	Several concrete slabs with holding down bolts set into the perimeter are evident with crushed rock screenings spread around them. These are in a wide levelled area, excavated about one metre into natural ground on the north side. Separate footings for an elevated tank were found on the south side of the slabs. No significant archaeological deposits were identified.
Condition	No significant archaeology
Images	**Figure B7.23** **Example of ground stripping below modern concrete slab construction during investigations 2020** 

Table B7.19
Place inventory for Radar Hill Track

Radar Hill Track	
Type	Earth and gravel vehicle track
History	Several tracks are noted from historical maps passing either side of, and running through the middle of, the Grey Box Woodland. Tracks shown on early Tullamarine and Bulla Parish Plans indicate distinct routes to Mt Alexander passed to the north-east and south-west of the woodland. Later plans including the 1918 Ordnance Survey indicate tracks connecting Oaklands Junction with Glencairne and Glen Alice Homesteads. Prior to 1864, Coghill's Glencairne property only had road access at the Mt Alexander Road, so it is likely any track to his homestead went through the woodland, passed his Boiling-Down Works and Dam and across the gully to his homestead at the western end of the block.
Description	A number of tracks are evident within the Grey Box Woodland, some clearly associated with operation of the airport (for example, giving access to the former radar installation). Others appear to be earlier tracks pre-dating the establishment of the airport. These are sometimes deeply rutted and eroded due to the scouring of the loose granitic soils.
Condition	No significant archaeology evident – potential for isolated historic artefacts

Images

Figure B7.24
Existing track across Radar Hill 2020

Table B7.20
Place inventory for Coghill's Sheepwash and Dam

Coghill's Sheepwash and Dam	
Type	Sheepwash and Dam
History	Historical references note a bluestone lined spillway and timber dam constructed on Coghill's property in the 1840s. The dam is on what was George Coghill's Glencairne, purchased in 1850, but possibly occupied earlier. Glencairne Homestead ruin is located about 300 metres north west and Coghill's Boiling-Down Works is 400 metres east. A dam with "a never failing water supply" is mentioned in the 1864 Estate sale, and maps identify this location as the Glenara sheepwash later, after Walter Clarke had added Section 17A to his Glenara Estate.
Description	A breached earth dam wall crosses Glenara Creek about 800 metres from its junction with Deep Creek. A small cut bluestone paved spillway is near the north side of the dam and two timber posts with tenon cuts on their tops, stand near the base of the dam. Remnants of a riveted wrought iron ship's tank are in a small gully to the north, and areas of artificially terraced flats extend to the west of this gully and a cart track runs along the hillside from the flat to the west. A dense deposit of mid-19th century glass and ceramic was located on the edge of this flat. The features suggest that wool scouring may have occurred here as well as washing the fleece on the sheep.
Condition	Fair – scattered 19th century artefacts and some features evident.

Images

Figure B7.25
Femnant timber uprights within gully at Coghill's Sheepwash and Dam, looking west along Glenara Creek gully

Figure B7.26
Stone spillway on the dam wall, looking south 2020

Table B7.21
Place inventory for Grants Road Bluestone Culvert

Grants Road Bluestone Culvert	
Type	Bluestone culvert
History	Grants Road was established in the original survey of the Parish of Tullamarine between sections 14 and 15 to the north and sections 7 and 8 to the south. It initially extended across the middle of the parish to the Mount Alexander Road (now Melrose Drive). The first government land sales in the parish were in 1842, when eighteen large allotments were put up for sale. The allotments were between 300 and 900 acres, but mostly square mile blocks of about 640 acres. Among these was Portion 8, which was on the south side of Grants Road. However, it appears that much of this land went unsold. The next and more successful sales were in 1849. The first evidence of road construction is in 1868, when tenders were called for "…160 cubic yards of 2 inch bluestone metal to be laid on [sic] Grant's-road, In the parish of Tullamarine". The Shire of Bulla recorded £36/10/8 paid to the Keilor Roads Board for road works on Grants Road. These early works were evidently insufficient as complaints about the condition of the road re-occurred over the years. For example, in 1901, the Shire of Bulla received evidence from Duncan McNab that the steepness of the water tables (drains) and condition of the surface was so bad that vehicles were in danger of overturning. Planting was also undertaken (along the Tullamarine boundary) as part of these improvements. This is probably the date of the original elm trees and the sugar gums further to the east. More substantial works, including drainage and metaling, were also carried out in 1914.
Description	The Grants Road culvert is a four-cell box culvert constructed entirely of bluestone with long stone lintels over dwarf walls and a stone paved base. Angled cutwaters extend on the upstream side with wing walls either end. Stone-lined drains direct water from two separate channels. The downstream face of the culvert has failed with wing walls, piers and lintels having fallen into the waterway. The surrounding land is covered in a dense copse of elm trees, which appear to have spread from a small number of now dead or senescent trees planted as an avenue either side of the crossing.
Condition	Although the culvert has failed in some sections, the culvert is still in use.
Images	**Figure B7.27** **North side of culvert showing cutwaters, 2013**

Table B7.22
Place inventory for Roseleigh Homestead

Roseleigh Homestead	
Type	Remains of homestead complex
History	The Roseleigh homestead was built in the mid to late 1860s as part of the settlement scheme established by J P Fawkner as the Victoria Co-operative Freehold and Land Investment society. Among the purchasers were Isaac Mansfield and his sons John, George and Samuel. Another son, David, later also acquired property here. By 1888 the Mansfield estate encompassed much of the eland in Section 13 B on either side of Mansfield Road, owned jointly by the brothers. Roseleigh cottage, on the south side of Mansfield Road, may have been Isaac's original homestead, although it has also been suggested it was built as a wedding present for David Mansfield, the youngest of the three brothers. David is also said to have inherited Roseleigh on his father's death in 1867. The Mansfields grew hay and bred draught horses with David apparently becoming wealthy during the Boer War supplying hay for horses. By the 20th century Roseleigh was home to David's son Ernest and his family while David had built and occupied Glen Alice opposite.
Description	The Roseleigh homestead site has been demolished, with only tree plantings and stock yards remaining. The vast majority of building materials have been removed from site. However, there may be some potential for archaeological deposits to remain, albeit in a heavily disturbed context.
Condition	Poor – there are no standing structures remaining, and only limited potential for archaeological deposits.
Images	**Figure B7.28** **The former Roseleigh homestead (prior to demolition)**

Table B7.23
Place inventory for Seafield Farm

Seafield Farm	
Type	Remains of school and homestead complex
History	John Grant established the Seafield Farm, on the northern part of Section 8, Parish of Tullamarine, in 1850. He married John McNab's sister Mary McNab in 1846. The property was run by the 'Misses Grant' in the 1900s, presumably daughters or sisters of John Grant. John Grant is said to have given the land for the Seafield National School (No. 546) which operated from 1859 and was located "where the runway crosses the line of Grants Lane" according to some accounts. In 1856, the Commissioners of National Education received a preliminary application for the establishment of the Seafield School. The school closed in 1884 when the Conders Lane School (SS 2613) opened in Tullamarine.
Description	The site of the Seafield Farm is marked by several mature trees and stone paved areas. Shallow concrete and brick spoon drains run across the site from east to west, with stone foundations of a probably four-room cottage immediately north with a square bluestone-lined cistern (or possibly cellar) on the west side. A possible haystack base formed from basalt slabs and other stone paved areas are to the south and west of these features. A concrete lined cistern formed from corrugated iron lies to the north east. Four trees mark the former stock yards with some sections of intact stone paving. No evidence of the Seafield School has been found.
Condition	There are no standing structures, but potential for archaeological deposits remain.
Images	**Figure B7.29** **Cut stone from Seafield Homestead, 2013**

Figure B7.30
Foundations of Seafield Homestead following mechanical excavation, 2014

Table B7.24
Place inventory for Victoria Bank Homestead

Victoria Bank Homestead	
Type	Remains of homestead complex
History	Duncan McNab established Victoria Bank on about 180 acres in the middle part of section 8, Parish of Tullamarine, in 1850. In 1869, Duncan moved to Lilydale, but his son Angus McNab continued running the farm until at least 1913 (although it is unclear if this was the first or second Victoria Bank). The first Victoria Bank was later absorbed as part of the Oakbank farm. The second Victoria Bank was later established by one of the McNab sons on the west side of McNabs Road. John McNab evidently had some contact with the Aboriginal population of the district. In later life, he accounted how, as a boy, he was chased by Aborigines while on his way home. It has also been reported that the Victoria Bank homestead had "slit windows which allowed rifle fire at hostile aborigines but were too narrow to permit entry for the attackers". Incidents leading to such defensive measures have been recorded, such as when Tullamarine led an attack on John Aitken's Mount Aitken station near Sunbury.
Description	The Victoria Bank site comprises a modest bluestone ruin of three to four rooms with a deep cellar at the south end and a large stone lined cistern to the east. The house block is ringed by peppercorn trees and some evidence of cobbled yards and other timber outbuildings can be seen. There are extensive surface scatters of domestic artefacts including ceramics, glass, metal and some timber. Fragments of square terracotta tile marked 'GLEW' are from a former dairy or laundry floor. Such paving tiles were made by a handful of manufacturers in Victoria from the 1850s, with Glew's product being among the better quality. The cellar is about 1.5 metres deep and measures 3 x 5 metres. Stairs enter from the south, possibly from an external cellar door. The house overall measures six metres by 13 metres with at least three rooms evident from stone foundations measuring 60 centimetres thick. Stone paving to the south of the stone footings suggest a garden and possibly a former timber structure. The 1930s and 1940s aerial photographs only show a small single building roughly central among the tree rows while later images show it was demolished by 1970.
Condition	Good – substantial structural remains and occupation deposits were found intact, and there is further potential from the cistern fill and unexcavated parts of the interior of the building and surrounds.
Images	**Figure B7.31** **Cistern/in-ground tank in foreground, cellar and house ruins behind, looking west, 2013**

Figure B7.32
Victoria Bank cellar following excavation 2014

Table B7.25
Place inventory for Fawkner Land Co Settlement

Fawkner Land Co Settlement	
Type	Former settlement
History	The Victoria Co-operative Freehold and Land Investment Society was established in the late 1840s by John Pascoe Fawkner to provide small landholdings for settlers and break the power of the squatters. A number of allotments were subdivided on either side of Mansfield Road, and shares allocated to the society members. Several people took up these farms, but eventually most moved away and the land was absorbed into a few larger holdings. The footings of one house from the settlement (Donald Gray's Bellno) remain as evidence while David Mansfield's Roseleigh homestead was a late survivor of this settlement.
Description	Linear features corresponding to the lane running between the individual allotments are visible on aerial photographs indicating the form of the roadway, table drains and fenceline embankments survive beneath the mown grass on the airside. The survival of one building site (Bellno) suggests there is potential for archaeological remains of other structures relating to the settlement to be present.
Condition	Fair – the extent of surviving archaeology is unknown.
Images	**Figure B7.33** **Aerial photograph 2016, showing laneway and position of Bellno and Roseleigh**

B7.4.4.1
Significance assessment

A significance assessment of each European heritage place is summarised in and uses the criteria outlined in Section B7.3.2.3:

Table B7.26
Significance assessment for European heritage sites in M3R

Site	Applicable Heritage Victoria criteria	Applicable Commonwealth Heritage List criteria	Significance threshold	Statement of significance
Aucholzie Homestead	**Criterion (a)** Importance to the course, or pattern, of Victoria's cultural history. **Criterion (c)** Potential to yield information that will contribute to an understanding of Victoria's cultural history.	**Criterion 1.** The place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history.	Moderate-the site is of regional significance. Meets VHI criteria. Meets CHL criteria.	Aucholzie is of historical significance as an early farm settlement marking the initial phase of occupation and improvement in the Tullamarine area under the Ritchie family, a notable family of livestock improvers and part of the Melbourne establishment. The site has considerable archaeological evidence for the arrangement of the farm and material culture related to its occupation and operation in the period 1850 to 1960. The potential for intact archaeological deposits related to the 1850s house and cellar and underfloor areas from both periods is very high. While it was determined there may be potential for Indigenous contact associated with this site, no Indigenous cultural material was identified during the current historic assessment. The 1889 house was once an attractive and substantial villa with considerable aesthetic interest in the architectural elements – white moulded brick string course and brackets, Flemish bond with bands of tuck-pointing and elaborate bay windows, etc. However, its ruinous condition has substantially impacted on this. The surrounding landscape is evocative of 19th century plantings with sugar gums, peppercorns, a Moreton Bay fig and conifers. The Ritchie family descendants and local historians have an association with the site, but due to its isolation from public access, this has been substantially diminished.
Barbiston Farm Complex	**Criterion (a)** Importance to the course, or pattern, of Victoria's cultural history. **Criterion (c)** Potential to yield information that will contribute to an understanding of Victoria's cultural history.	Meets CHL criteria: **Criterion 1.** The place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history.	Low – the site is of local significance. Meets VHI criteria. Meets CHL criteria.	Barbiston Farm is of historical significance as one of the local 19th century properties that reflect early settlement patterns along the Maribyrnong River. It is of importance for its association with the prosperous stock and station agent and Ayrshire cattle breeder Richard Gibson, and as the centre of the subsequent prominent Fox family's large farm and extensive landholding.

Site (cont.)	Applicable Heritage Victoria criteria (cont.)	Applicable Commonwealth Heritage List criteria (cont.)	Significance threshold (cont.)	Statement of significance (cont.)
Bellno Farmhouse and Quarry	**Criterion (a)** Importance to the course, or pattern, of Victoria's cultural history. **Criterion (c)** Potential to yield information that will contribute to an understanding of Victoria's cultural history.	Meets CHHL criteria: **Criterion 1.** The place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history.	Moderate – the site is of regional significance. Meets VHI criteria. Meets CHL criteria.	The stone hut foundations and associated dry stone walled stock pens are potentially of high archaeological and historical significance for their possible association with the earliest phase of European settlement in the district, either relating to the first squatter occupancy, or more probably Donald Gray, one of the few to take up land under John Fawkner's Victoria Co-operative Freehold and Land Investment Society. As such, the site provides information regarding material cultural and settlement behaviour in the 1840s and 1850s. Although little is known about the quarry, it may be of both historical and archaeological significance for evidence of early exploitation of local stone and potentially in association with the adjacent stone hut site. Excavations have indicated that archaeological components to the site survive.
Coghill's Sheepwash and Dam	**Criterion (a)** Importance to the course, or pattern, of Victoria's cultural history. **Criterion (c)** Potential to yield information that will contribute to an understanding of Victoria's cultural history.	Meets CHL criteria: **Criterion 1.** The place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history.	Moderate – the site is of regional significance. Meets VHI criteria. Meets CHL criteria.	The site is significant for evidence of early pastoral activity in the region and association with George Coghill. Mid-19th century artefact deposits and structural remains provide insight into methods of animal husbandry and the behaviours of the estate workers.
Kennedy's Hut	**Criterion (a)** Importance to the course, or pattern, of Victoria's cultural history. **Criterion (c)** Potential to yield information that will contribute to an understanding of Victoria's cultural history. **Criterion (h)** Special association with the life or works of a person, or group of persons, of importance in Victoria's history.	Meets CHL criteria: **Criterion 1.** The place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history. **Criterion 8.** The place has significant heritage value because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history.	Moderate – the site is of regional significance. Meets VHI criteria. Meets CHL criteria.	Kennedy's hut site is of historic significance as an early residence in the Tullamarine region. It is possible that, like nearby Oaklands Junction site, the hut acted as a stopover for people heading from Melbourne to the goldfields. The site has archaeological evidence for the early settlement and occupation of the encompassing pastoral estate from the mid-19th century, and its association to other early residences including Glencairne and Glenara. The site is also significant for its association with Alexander and Henry Kennedy who built and ran the Inverness hotel at Oaklands Junction. This association provides further context to the chronology of settlement and management of early farming practices at Tullamarine.
Coghill's Boiling-Down Works at Glencairne	**Criterion (a)** Importance to the course, or pattern, of Victoria's cultural history. **Criterion (c)** Potential to yield information that will contribute to an understanding of Victoria's cultural history. **Criterion (f)** Importance in demonstrating a high degree of creative or technical achievement at a particular period. **Criterion (h)** Special association with the life or works of a person, or group of persons, of importance in Victoria's history.	Meets CHL criteria: **Criterion 2.** The place has significant heritage value because of the place's possession of uncommon, rare or endangered aspects of Australia's natural or cultural history. **Criterion 8.** The place has significant heritage value because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history.	High - the site is of state significance: Meets VHI criteria. Likely to fulfil criteria for listing on the CHL or VHR.	Coghill's Boiling-Down Works is of historic significance as one of the earliest examples of industrial development in Victoria, and a very rare example of an early boiling down works with archaeological remains. This association provides further context to the chronology of Coghill's estate and management of early farming practices at Tullamarine. This includes the documented down-turn in the production of wool and adaption to new farming practices as a result. Excavations have indicated that well preserved archaeological remains survive.

Site (cont.)	Applicable Heritage Victoria criteria (cont.)	Applicable Commonwealth Heritage List criteria (cont.)	Significance threshold (cont.)	Statement of significance (cont.)
Airport Construction Site	Does not meet criteria	Does not meet criteria	No significance	This site has little significance because of its recent date and lack of substantial archaeological remains.
Glenara Sheep Dam	Does not meet criteria	Does not meet criteria	No significance	This site has little significance because modern impacts have removed any potential archaeological remains.
Grants Road Bluestone Culvert	**Criterion (a)** Importance to the course, or pattern, of Victoria's cultural history. **Criterion (c)** Potential to yield information that will contribute to an understanding of Victoria's cultural history. **Criterion (f)** The importance of the place or object in demonstrating or being associated with scientific or technical innovations or achievements	Does not meet criteria	Low-the site is of local significance. Meets HO criteria.	The Grants Road culvert is a locally rare type of early road structure, which reflects the first efforts made by local roads boards to improve communication and access in the then- thinly populated communities. The stonework reflects the locally available materials and traditional skills in roadmaking. This particular culvert is unusual for the very large spanning lintels used to cover the box culvert cells.
Oakbank Farm Homestead	Criterion (a) Importance to the course, or pattern, of Victoria's cultural history. Criterion (c) Potential to yield information that will contribute to an understanding of Victoria's cultural history.	Meets CHL criteria: **Criterion 1.** The place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history. **Criterion 8.** The place has significant heritage value because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history.	Moderate-the site of regional significance. Meets VHI criteria. Meets CHL criteria.	Oakbank is of historical significance as an early farm settlement marking the initial phase of occupation and improvement in the Tullamarine area under a notable family of livestock improvers, famous for introducing Ayrshire cattle in Victoria, and having the finest breeding herd in the country. The site has considerable archaeological evidence for the arrangement of the farm and material culture related to its occupation and operation in the period 1850 to 1960.
Oaklands Junction	**Criterion (a)** Importance to the course, or pattern, of Victoria's cultural history. **Criterion (c)** Potential to yield information that will contribute to an understanding of Victoria's cultural history.	Does not meet criteria	Low-site is of local significance. Meets VHI criteria	Oaklands Junction is of historic significance as an early stopover for people heading from Melbourne to the goldfields. The site has archaeological evidence for the arrangement and development of the site, including its role as a local gathering place for social events such as hunting.
Radar Hill Track	**Criterion (a)** Importance to the course, or pattern, of Victoria's cultural history. **Criterion (c)** Potential to yield information that will contribute to an understanding of Victoria's cultural history.	Does not meet criteria	Low-the site is of local significance. Meets VHI criteria.	The former track through the Grey Box Woodland is of historic and archeologically significance for its potential to reveal evidence of early occupation and use of the area by graziers and travellers.

Site (cont.)	Applicable Heritage Victoria criteria (cont.)	Applicable Commonwealth Heritage List criteria (cont.)	Significance threshold (cont.)	Statement of significance (cont.)
Roseleigh Homestead	**Criterion (a)** Importance to the course, or pattern, of Victoria's cultural history. **Criterion (c)** Potential to yield information that will contribute to an understanding of Victoria's cultural history.	Does not meet criteria	Low-the site is of local significance. Meets VHI criteria.	The former Roseleigh, property, comprising cottage and associated outbuildings, is of local historical impacts due to its associations with the 1851 John Pascoe Fawkner land co-operative estate on sections 13A and 13B Parish of Tullamarine; and the Mansfield family. The structures have been removed and while there is some potential for archaeological deposits they will have been heavily disturbed by the demolition process.
Seafield Farm and Seafield National School	**Criterion (a)** Importance to the course, or pattern, of Victoria's cultural history. **Criterion (c)** Potential to yield information that will contribute to an understanding of Victoria's cultural history.	Meets CHL criteria: **Criterion 1.** The place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history.	Low-the site is of local significance. Meets VHI criteria. Meets CHL criteria.	The Seafield homestead is historically significant as part of the initial phase of occupation of the region. The site however, has limited archaeological potential due to clearance for the airport. The Seafield School was a short-lived but locally important example of pioneering communities undertaking civic improvements as part of the establishment of settlements. However, the site of the school has not been found and was probably destroyed during construction of the north-south runway.
Victoria Bank Homestead	**Criterion (a)** Importance to the course, or pattern, of Victoria's cultural history. **Criterion (c)** Potential to yield information that will contribute to an understanding of Victoria's cultural history.	Meets CHL criteria: **Criterion 1.** The place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history. **Criterion 8.** The place has significant heritage value because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history.	Moderate – the site is of regional significance. Meets VHI criteria. Meets CHL criteria	Victoria Bank is a historically significant early farm settlement marking the initial phase of occupation and improvement in the Tullamarine area under a notable family of livestock improvers, famous for introducing Ayrshire cattle in Victoria, and having the finest breeding herd in the country. The site has considerable archaeological evidence for the arrangement of the farm and material culture related to its occupation and operation in the period 1850 to 1900. In particular, the site has potential for sealed deposits in the bottom of the cellar and underfloor deposits capped by the collapsed bluestone walls.
Fawkner Land Co Settlement	**Criterion (a)** Importance to the course, or pattern, of Victoria's cultural history. **Criterion (c)** Potential to yield information that will contribute to an understanding of Victoria's cultural history.	Meets CHL criteria: **Criterion 1.** The place has significant heritage value because of the place's importance in the course, or pattern, of Australia's natural or cultural history. **Criterion 8.** The place has significant heritage value because of the place's special association with the life or works of a person, or group of persons, of importance in Australia's natural or cultural history.	Moderate possibly state or regional significance. Meets VHI criteria. Meets CHL criteria	Fawkner's 'Victoria Co-operative Freehold and Land Investment Society' settlement represents a unique attempt at establishing a privately sponsored 'yeoman farmer' community through a cooperative share system and allocation of small holdings to farmers. While the scheme ultimately failed it is historically important for demonstrating the role of John Pascoe Fawkner as a reformer and radical, and for its role in attempts to break the power of the squatters both politically and in the way they locked up land preventing closer settlement. The potential survival of archaeological remains associated with any of the occupants would be of great significance.

Table B7.27
Severity criteria

Impact severity	Criteria against heritage discipline
Major	Adverse, permanent, irreversible impacts, to heritage sites / places generally but not exclusively of national importance. Heritage place / feature meet NHL Criteria.
High	Generally adverse, permanent, irreversible impacts to heritage sites / places of state significance. Heritage place / feature meet VHI criteria for high significance.
Moderate	Generally adverse, irreversible impacts to heritage sites / places of regional significance. Consider cumulative impact of multiple instances. Heritage place / feature meets VHI criteria for moderate significance.
Minor	May be adverse or beneficial impacts to heritage sites / places of local significance. Heritage place / feature meets VHI criteria for low significance.
Negligible	Minor works without foreseeable adverse impacts.
Beneficial	N/A

B7.5 ASSESSMENT OF POTENTIAL IMPACTS

The assessment of potential impacts uses the project-specific severity criteria developed for the assessment of European heritage (described in **Table B7.27**) as well as the significance ratings for European heritage sites in **Table B7.26**. The duration of impact and likelihood of impact are as described in **Chapter A8: Assessment and Approvals Process**.

Impacts by the proposed M3R development will result from excavation and filling to prepare runways, airside areas, access roads, service facilities and other infrastructure. Permanent impacts are anticipated to occur to all sites listed within the place inventory (**Section B7.4.4**).

Avoidance, management and mitigation measures are discussed further in **Section B7.6**.

The proposed impacts to the European heritage sites may include:

- Land reshaping to facilitate the development (including a combination of cut and fill)
- Underground utilities will be extended throughout development area (including water, stormwater, electricity, telecommunications and fibre optics)
- General site logistics (including provision for access, laydown, plant compounds and vehicle haulage areas)
- General site establishment works (including concrete building foundations, and construction of other associated structures).

The works include the following impacts to the ground surface and have the potential to impact on surface and subsurface archaeological deposits, features and objects:

- Stripping of topsoil over some works areas
- The construction of drains, underground services, concrete foundations, associated landscaping and earthworks
- Underground services (such as water, sewer, stormwater, electricity, gas, telecommunications and fibre optics) will be excavated to standard depths generally not exceeding one metre
- Construction of M3R will involve temporary and permanent excavation to various depths (depending on size, style, construction materials, building methods and function) - much of which will be in excess of one metre.

B7.6 AVOIDANCE, MANAGEMENT AND MITIGATION MEASURES

Proposed avoidance, management and mitigation measures are outlined in this section and in **Chapter E2: Environmental Management Framework**. They entail undertaking salvage excavations and archaeological watching briefs (monitoring) on the sites impacted by M3R. Sites where impacts can be avoided or minimised will be protected during works by temporary exclusion fencing and the inclusion of appropriate instructions in works and environmental management plans.

It is proposed that the following mitigation measures will only be undertaken if M3R's design is unable to avoid impacts to these sites. Options for specific harm minimisation may be determined on a case-by-case basis once further detailed construction impacts are known. Due to this level of uncertainty, specific harm mitigation measures should be undertaken for all places located within the study area before ground works and construction activities take place.

B7.6.1.1
Archaeological excavation – mitigation measures

Impacts from M3R are predicted to occur at the majority of sites listed in the place inventory. Based on the provided disturbance footprint, four of these places are located nearby but outside the disturbance footprint extent. They are:

- Bellno
- Barbiston Farm Complex (considered already salvaged)
- Oaklands Junction
- Radar Hill Track

Harm mitigation actions are provided below in consideration of the level of assessment and investigations already conducted to date for M3R. Should M3R not impact these locations, the harm avoidance measures in Section B7.6.1.3 will apply instead. No mitigation actions have been outlined for the Airport Construction Site or Glenara Sheep Dam as these are determined to have no remaining significant archeological deposits or features.

It is noted that HV does not have jurisdiction on Commonwealth land and therefore a 'consent to disturb' is not required under the Victorian Heritage Act. An archaeological salvage program will therefore be designed for each European site of significance that accords to 'best practice' approach, and HV's guidelines to conducting archaeological salvage of historic heritage places and objects. This includes development of a research design, salvage methodology and artefact conservation policy for all sites that are to be impacted. A professional conservator is proposed to be engaged to manage conservation and curation of artefacts. The process for artefact collection, management (including conservation, where required) and storage is further detailed in Section B7.6.1.6.

The proposed salvage measures are shown in Table B7.28.

The following excavation methods will be utilised where required across the European heritage sites to be impacted by the proposed M3R works:

- Mechanical excavation will be used where there is a low likelihood of significant intact archaeological deposits. Areas will be scraped progressively in 10 centimetre layers, and the excavated surface and spoil examined for artefacts and features.
- Utilising hand excavation (shovels and trowels), sections of the sites will be cleared. The topsoil will be excavated and transported to an established culturally sterile area.
- The topsoil will be examined for contemporary artefacts corresponding to each excavation area.
- Hand excavation (trowels) will be utilised to expose features for recording and also ensure any contextual artefacts are preserved in situ. Portable artefacts will be bagged for post-excavation analysis.
- Onsite recording will follow archaeological best practice. All exposed structures, features and contextual artefacts will be plotted in plan and cross section, and photographed in situ. A Trimble Geo Xh 3000 will ensure sub-metre accuracy for site location within the wider landscape context. Features considered to be well preserved or contributing to the significance of the site will also be recorded utilising photogrammetry.
- At the completion of the excavation, the site can be backfilled.

The proposed areas for salvage are shown in Table B7.29.

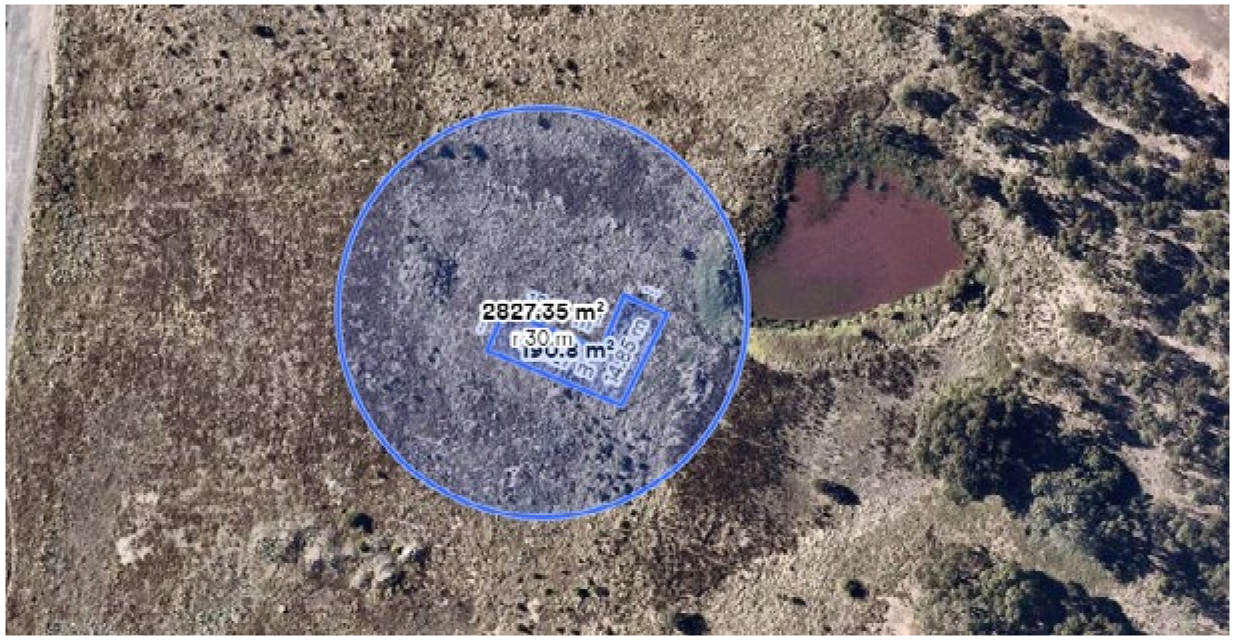
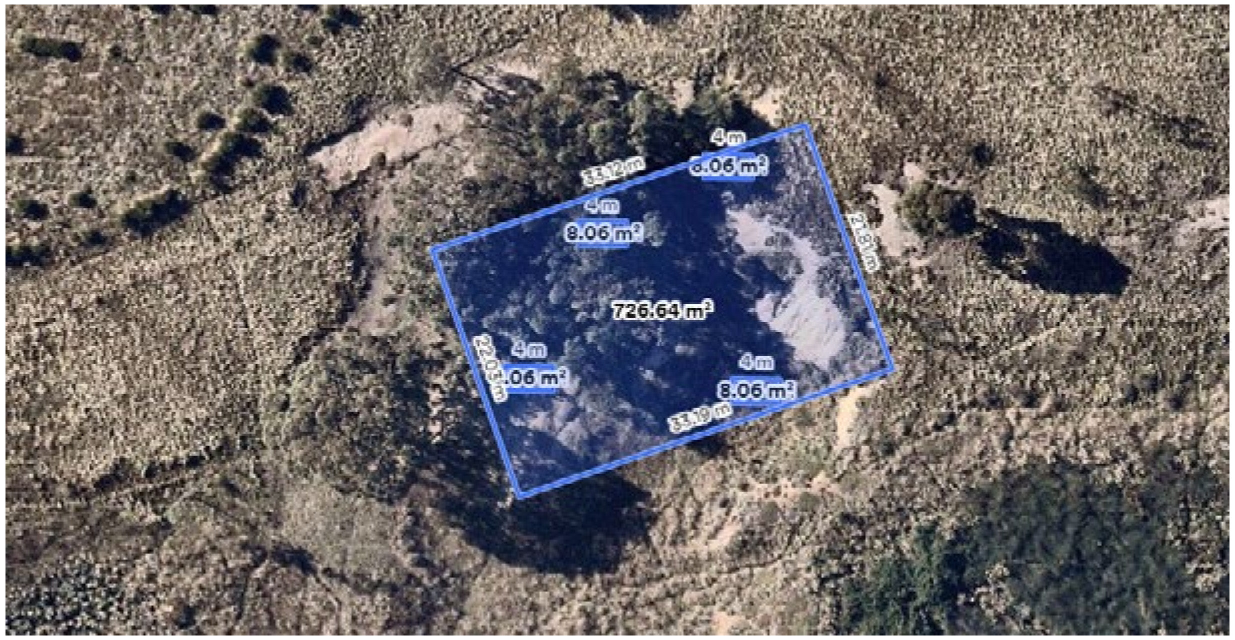
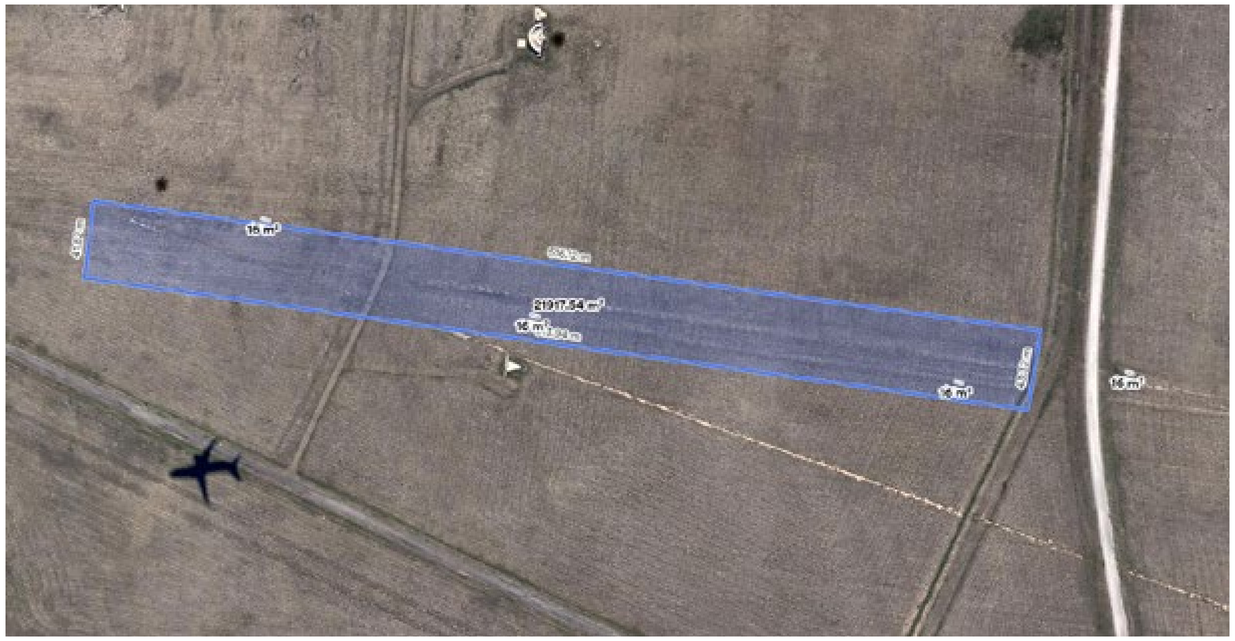
Following excavation, artefacts will be bagged by provenance and entered into an onsite catalogue before removal from the site, following the process outlined in Section B7.6.1.6. If the assemblage is deemed to be of high significance (assessed on a place-by-place basis) it will be recommended for lodgement with HV's Artefact Repository. If the assemblage is of low significance it will be offered to APAM for interpretative or display purposes or otherwise discarded. The disposal method will be supplied to HV for record keeping.

Table B7.28
Archaeological excavation requirements for European heritage sites

Site name	Methodology	Area of salvage
Aucholzie	Archival recording of standing structures and monitoring of demolition and clearance of area around homestead and near yard.	30m radius mechanical
Bellno (if not avoided)	Completion of hand excavation of building footprint and three metres surrounding, Monitoring mechanical excavation within 10 metres of building footprint and clearance of well.	4 x 8 metre hand excavation 10 metre radius mechanical
Coghill's Boiling-Down Works at Glencairne	Hand excavation of remaining structures and artefact deposits around boiler setting, vat and stone paving, monitoring mechanical excavation in area within 50 metres of site.	15 x 15 metre hand excavation 50 metre radius mechanical excavation
Coghill's Sheepwash and Dam	Mechanical clearance of features with selective hand excavation if significant archaeological deposits exposed.	20 x 30 metre machine Up to four areas 2 x 4 metre hand excavation
Fawkner Land Co Settlement	Monitoring of stripping of topsoil in area of former laneway and selectively along frontages (according to impacts from construction) to determine if any evidence of former cottages or archaeological deposits remain. Mechanical salvage excavation and detailed hand excavation if significant intact archaeological deposits or features are uncovered.	Monitoring area about 20 metres either side of laneway for about 500 metres, with a provision for at least five areas hand excavations of at least 4 x 4 metres if required to investigate significant features and deposits dependant on area to be impacted.
Grants Bluestone Culvert	Detailed measured drawings and photography to be prepared prior to demolition and monitoring of stripping of surface to expose underlying bluestone structure and removal of the structure using a mechanical excavator to foundation level so that internal structure and footings can be recorded.	Monitor extent of bluestone structure up to two metres up and downstream and a section excavated through the roadway at the embankment and abutment.
Kennedy's Hut site	Hand excavation of remaining building footprint and test trenches along front of veranda and select areas adjacent to building, surface collection of artefacts within 50 metres of building footprint.	12 x 8 metre open area excavation Three 1 x 10 metre trenches 50 metre radius surface collection
Oakbank Farm Homestead	Monitoring of mechanical excavation of site once asbestos contamination has been managed, including exposure of footings and clearance of cistern.	20 x 20 metre mechanical Two 5x5 metre hand excavation if significant deposits found
Oaklands Junction (if not avoided)	Machine clearance of vegetation over footings and building footprint followed by hand excavation of features and artefacts exposed at hotel and store, plus selective testing along linear features (e.g. drains and walls).	20 x 10 metre, 10 x 10 metre, 8 x 8 metre building footprints 40 metres of linear features
Roseleigh	Monitoring of mechanical excavation in area of house and outbuilding, hand excavation if any intact archaeological deposits exposed.	15 x 20 metre machine Up to 2 x 4 metre area for selective hand excavation
Seafield Farm	Monitoring of mechanical excavation of remainder of site including completion of clearance of cistern.	15 metre radius mechanical
Victoria Bank	Completion of hand excavation of building footprint and three metres surrounding, Monitoring mechanical excavation within 20 metres of building footprint, including clearance of cistern.	12 x 6 metre hand excavation 20 metre radius mechanical
Radar Hill Track (if not avoided)	Monitoring of stripping of topsoil in area of former track. Mechanical salvage excavation and detailed hand excavation if significant intact archaeological deposits or features are uncovered.	Monitoring area of track and five metres either side for about 500 metres Up to two 2 x 2 metre hand excavations if required

Table B7.29
Archaeological excavation areas for European heritage sites

Site name	Area of salvage	Imagery
Aucholzie	30 metre radius mechanical	
Bellno (if not avoided)	4 x 8 metre hand excavation 10 metre radius mechanical	

Coghill's Boiling-Down Works at Glencairne	15 x 15 metre hand excavation 50 metre radius mechanical excavation	
Coghill's Sheepwash and Dam	20 x 30 metre machine Up to four areas 2 x 4 metre hand excavation	
Fawkner Land Co Settlement	Monitoring area about 20 metres either side of laneway for about 500 metres, with a provision for at least five areas hand excavations of at least 4 x 4 metres if required to investigate significant features and deposits dependant on area to be impacted.	

Site	Excavation scope	
Grants Bluestone Road Culvert	Monitor extent of bluestone structure up to two metres up and downstream and a section excavated through the roadway at the embankment and abutment.	
Kennedy's Hut site	12 x 8 metre open area excavation Three 1 x 10 metre trenches 50 metre radius surface collection	
Oakbank Farm Homestead	20 x 20 metre mechanical Two 5x5 metre hand excavation if significant deposits found	

Oaklands Junction (if not avoided)	20 x 10 metre, 10 x 10 metre, 8 x 8 metre building footprints 40 metres of linear features	
Roseleigh Homestead	15 x 20 metre machine Up to 2 x 4 metre area for selective hand excavation	

Seafield Farm

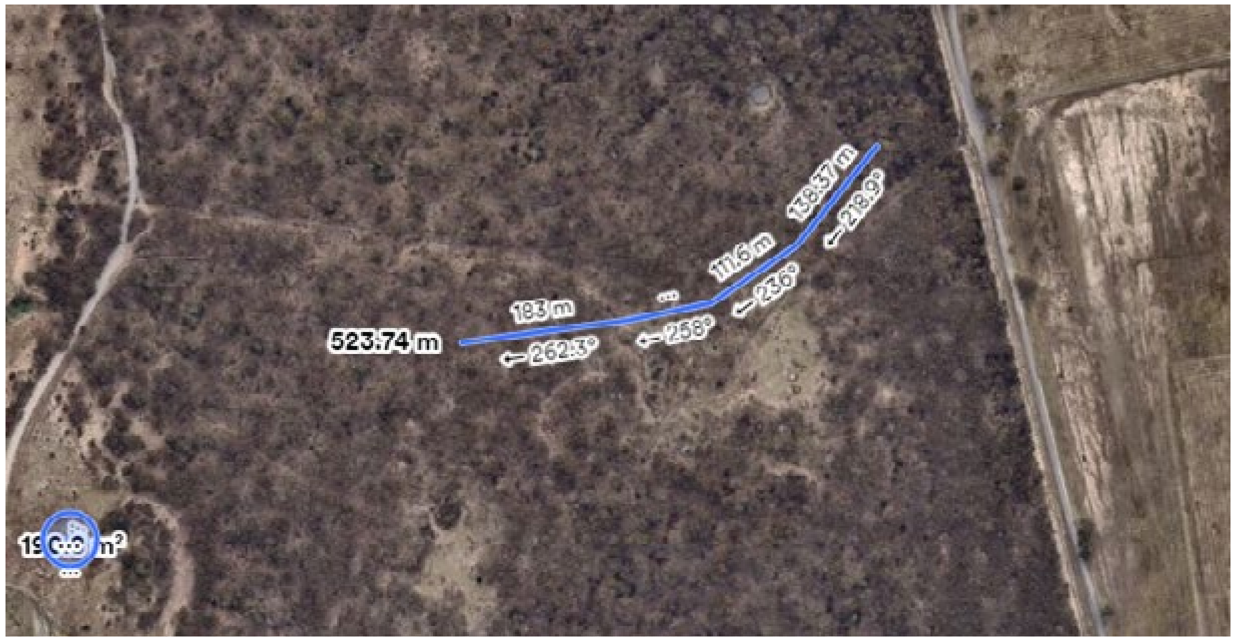
15 metre radius mechanical

Victoria Bank

12 x 6 metre hand excavation (or two areas of 9 x 4 and 9 x 6)
20 metre radius mechanical

Radar Hill Track (if not avoided)

Monitoring area of track and five metres either side for about 500 metres
Up to two 2 x 2 metre hand excavations if required



B7.6.1.2
Archival recording – mitigation measures

Measured drawings and archival photographic recording of the standing structures at Aucholzie will be undertaken prior to the salvage works and watching brief described in Table B7.28. Archival recording will be undertaken in accordance with the following guidelines: *Photographic Recording of Heritage Items Using Film or Digital Capture* (NSW Heritage Office 2006) and *Technical Note: Photographic Recording for Heritage Places and Objects* (Heritage Victoria 2006).

B7.6.1.3
Temporary fencing – avoidance measures

The majority of European heritage sites identified in the place inventory (Section B7.4.4) are proposed to be destroyed following completion of mitigation measures.

Four places are nearby but located outside the disturbance footprint. These are:

- Bellno
- Barbiston Farm Complex (which is considered already salvaged)
- Oaklands Junction
- Radar Hill Track

Prior to M3R works commencing, it is recommended that temporary protective fencing is established around the extent of these places to protect them from incidental harm.

It is also recommended that the extent of all historic heritage places within, and those located immediately near to the study area (as listed above), are displayed on site and with construction plans for the life of all ground disturbance activities.

Should further significant features be uncovered during the salvage excavations outlined above or during the proposed works, temporary fencing should be established around the feature until completion of the salvage works or until an initial assessment can be made of the significance of the material. The process for managing unexpected finds is further detailed in Section B7.6.1.5.

B7.6.1.4
No actions

No further actions are required for the Airport construction site (previously Glen Alice Homestead) and Glenara Sheep Dam as they are considered destroyed and have no heritage value. No further assessment at Barbiston homestead is required, as previous excavations have demonstrated only minor archaeological materials and this site can be considered already salvaged.

B7.6.1.5
Unexpected finds process

Significant historic archaeological artefacts more than 75 years old are nominally protected under the Victorian Heritage Act 2017. As noted throughout this chapter, HV does not have jurisdiction on Commonwealth land and therefore the provisions of the Heritage Act do not apply. The *Airports (Environmental Protection) Regulations 1997* outline the duty of care that must be taken in relation to environment and heritage site attributes.

In some instances, historic artefacts may be found in locations and at times when no archaeological supervision is present. In these cases, the following unexpected finds process will be followed to identify and assess unexpected finds.

Induction and information

In the first instance, the foreman of works on site or other responsible project manager will have taken part in an induction demonstrating the nature of the archaeological materials that could be found during works and the procedures to follow. A copy of the historical excavation report that has informed this chapter, and relevant supporting documentation that describes the heritage values of the heritage places and this protocol, will be kept on site and be made familiar to workers on site.

Procedure

If significant archaeological deposits, structures or other features are identified during the course of works (especially in areas not subject to the above mitigation actions or monitoring requirements) works in the area must stop immediately and the work area made safe. The following process can then be followed:

1. Discovery
   a. If suspected historic cultural heritage is identified, all activity must stop within the extent of the finds. The historic cultural heritage must be left in place, and protected from harm or damage.
2. Notification
   a. The person in charge of the activity must notify the relevant Melbourne Airport Program Manager and the Melbourne Airport Environment and Sustainability Team immediately.
   b. Melbourne Airport must notify the Archaeologist or Heritage Advisor of the identification of historic cultural heritage as soon as practical.
   c. Following consultation with the Archaeologist or Heritage Advisor, Melbourne Airport will advise the Commonwealth Airport Environment Officer and may also request the Archaeologist or Heritage Advisor notify Heritage Victoria following site assessment.
3. Assessment
   a. A site assessment will determine if the artefacts are:
      i. In-situ and part of a significant deposit based on determining their age, extent, formation and other factors as appropriate.
   b. The location, extent, depth and other site formation data will be recorded.
   c. If the artefacts or deposit constitute a new previously unrecorded historic archaeological place or feature:
      i. If works cannot proceed without harming the archaeological deposit and it is not considered to be covered by an existing place assessment, a new assessment of significance must be undertaken by the Archaeologist/Heritage Advisor.
4. Artefact management
   a. Artefacts or deposits determined to be significant will be managed in accordance with the artefact management and conservation procedure outlined in Section B7.6.1.6.
5. Impact mitigation or salvage
   a. An appropriate impact mitigation or salvage strategy will be determined by the Archaeologist or Heritage Advisor in consultation with Melbourne Airport.
6. Curation and further analysis
   a. The treatment of salvaged historic cultural heritage must be in accordance with the artefact management and conservation process developed in Section B7.6.1.6.

B7.6.1.6
Artefact management and conservation

Artefact management in the field

It is not anticipated that large quantities of significant archaeological artefacts will be recovered from the salvage and mitigation measures. This is partly due to the deteriorated/partly demolished nature of the historic heritage places investigated within the study area. Based on initial test excavations to date, the primary archaeological remains comprise robust, large structural building remains (walls, foundation, flooring, etc). A large quantity of animal bone has been recorded at Coghill's Boiling-Down Works, associated with this place's historic function. The test excavation results indicate more bone will likely be uncovered during salvage.

Artefacts found during the test excavations, salvage and/or monitoring will be processed and catalogued using the Heritage Victoria catalogue template; and cataloguing and artefact packaging will be carried out to meet the requirements specified in Heritage Victoria's *Guidelines for Investigating Historical Archaeological Artefacts and Sites 2015*.

Included below is an artefact collection and discard policy, developed to guide the collection, curation, conservation and retention or discarding of artefacts (Praetzellis & Costello, 2002).

Artefact retention in the field

If fragile artefact material is uncovered that cannot be safely excavated without specialist advice, the remains will be protected in-situ (as recommended by the conservator) until removal can be safely carried out.

If fragile artefacts are excavated that cannot be safely processed within the archaeology team's skill and experience, the nominated project conservator will be consulted to provide conservation advice (remotely, on-call or on-site as appropriate).

Field conservation carried out by Biosis will be limited to the artefact cleaning processes outlined below.

Artefact storage and transport

Initially, all artefacts will be bagged by provenance (context) and entered into an onsite catalogue. Following fieldwork/site investigation works, artefacts will be stored on site in a secure, enclosed and locked vehicle and/or site office. The artefacts will be packed and transported to the Biosis office (38 Bertie Street, Port Melbourne) at the completion of every field day.

Artefacts will be sorted into material type as soon as possible, and stored in class type.

Robust and stable artefacts will be cleaned at the Biosis office under the supervision and guidance of experienced personnel.

For fragile and at-risk artefacts, cleaning will not be undertaken before consulting the nominated project conservator. Artefacts will be stored as per conservator advice until cleaning can be carried out safely. Cleaning of these artefacts will be undertaken according to the methodology outlined by the conservator.

Significance assessment

A significance-based assessment of the artefact assemblage will be carried out. If the assemblage is deemed to be of high significance (assessed on a place-by-place basis) it will be recommended for lodgement with Heritage Victoria's Artefact Repository. If the assemblage is of low significance it will be offered to APAM for interpretative or display purposes, or otherwise discarded.

Sampling and discard policy

Based on the outcomes of the significance assessment, further sampling and discard may be appropriate. The disposal method for any discard will be supplied to Heritage Victoria for record keeping.

Artefact conservation

A professional conservator will be engaged to evaluate conservation requirements, advise on basic conservation actions and undertake specialist conservation works if required. The nominated conservator is:

Kristine Allinson
BA (Hons) Archaeology and Ancient History
MA Cultural Material Conservation (Objects)
Objects Conservator
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Kristine is ICS' Melbourne-based Objects Conservator, specialising in the conservation of archaeological artefacts. She applies a practical approach to her understanding of a broad range of cultural materials and their deterioration processes, including ceramics, metals, glass, wood, leather and composite objects. She maintains up-to-date knowledge about the statutory requirements for archaeological conservation in Victoria. Kristine has a special interest in historical and ancient archaeology, and the conservation of archaeological materials. In her current role, she provides conservation advice and treatment, and assists with the onsite analysis of artefacts during archaeological excavations. Kristine is a current member of both the Australian Institute for the Conservation of Cultural Material (AICCM) and Australasian Society of Historical Archaeology (ASHA).

Conservation assessment

Based on the outcomes of the significance assessment, a conservation assessment of the assemblage will be undertaken by a professional conservator. In circumstances where the entire assemblage is deemed of low significance, a conservation assessment will not be carried out.

The conservation assessment will detail the condition and conservation needs of the assemblage based on the significance assessment.

Conservation

Conservation decisions will depend on both the condition of the object and its archaeological significance.

Conservation of artefacts will be undertaken with the objective of slowing deterioration, arresting organic decay and stabilising corrosion.

B7.7 CONCLUSIONS

B7.7.1 European heritage values

Within and immediately next to the M3R development footprint, the European heritage assessment identified 14 European heritage sites that possess values in alignment with Heritage Victoria and Commonwealth Heritage criteria. Of these, 10 are anticipated to be directly impacted by M3R. These sites consist predominately of homesteads and residential/farming amenities, with Coghill's Boiling-Down Works a unique site relating to early farming industry. Two additional sites were investigated (Glenara sheep dam and Glen Alice outbuildings) but no evidence for archaeological deposits or features were found.

The following 10 European heritage sites have been identified in the development footprint:

- Aucholzie Homestead
- Coghill's Sheepwash and Dam
- Coghill's Boiling-Down Works at Glencairne (previously Glencairne Homestead)
- Grants Road Bluestone Culvert
- Kennedy's Hut Site
- Oakbank Farm Homestead
- Seafield Farm
- Roseleigh Homestead
- Victoria Bank Homestead
- Fawkner Land Co Settlement

B7.7.2 Potential impacts

Within M3R, it is assumed that large portions of European heritage sites will be removed by construction of compounds, haul roads or proposed infrastructure. Potential impacts to European heritage within the development footprint may result from the removal and/or modification of topsoils and subsoils thereby impacting surface artefacts, features and archaeological deposits. A summary of the impact assessment is provided in Table B7.30.

The following is a brief discussion of the high and medium impacts, and their management or mitigation strategies. Archaeological salvage will occur at the following sites:

- Aucholzie Homestead
- Coghill's Sheepwash and Dam
- Coghill's Boiling-Down Works at Glencairne (previously Glencairne Homestead)
- Grants Road Bluestone Culvert
- Kennedy's Hut Site
- Oakbank Farm Homestead
- Seafield Farm
- Roseleigh Homestead
- Victoria Bank Homestead
- Fawkner Land Co Settlement

Archaeological salvage and watching briefs will occur at each site listed in Table B7.28 prior to works proceeding. This is designed to best manage the existing heritage values already identified and to record and recover select artefacts and features before they are permanently destroyed. This method will provide further data relating to each site and add to the knowledge about European settlement in the Tullamarine area. This strategy will assist in reducing the original impacts from 'High' or 'Medium' to 'Low' for a number of these sites.

Coghill's Boiling-Down Works at Glencairne is considered of high state significance. The cumulative impact for the complete removal of this unique and early site of colonial industry in Victoria is considered within the residual impact assessment rating.

B7.7.2.1 Avoid, minimise and offset potential impacts

Works within M3R will impact 10 European heritage sites that cannot be avoided by the proposed works. Prior to M3R works commencing, mitigation measures in the form of archaeological salvage of these 10 sites will be undertaken in compliance with the 'best practice methods for archaeological salvage in Victoria (in accordance with Heritage Victoria standards). It is noted that the Barbiston Farm Complex has already been assessed and it was determined no further salvage was required for the site. The works will avoid four places and provision has been made for specific mitigation actions due to their proximity to the development footprint.

A summary of the potential impact assessment is provided in Table B7.30.

Table B7.30
Impact assessment summary

Environment aspect & baseline condition	Assessment of original impact: Original Impact	Mitigation inherent in design/practice	Significance: Duration	Severity	Likelihood	Impact	Mitigation and/or management measures	Assessment of residual impact: Residual Impact	Significance: Duration	Severity	Likelihood	Impact
Construction (and Operation)							**Construction (and Operation) (cont.)**					
Aucholzie Homestead Low local significance	Direct impacts from construction	Minimal options to reduce impacts due to topographic locations	Permanent	Minor	Almost Certain	Medium	Archival recording and archaeological salvage	None	Permanent	Negligible	Almost Certain	Low
Barbiston Farm Complex Low local significance	Design avoids impact	Minimal options to reduce impacts due to topographic locations	Permanent	Minor	Almost Certain	Medium	None required. Salvage completed.	None	Permanent	Negligible	Almost Certain	Low
Bellno Farmstead and Quarry Moderate regional significance	Design avoids impact	Minimal options to reduce impacts due to topographic locations	Permanent	Moderate	Almost Certain	High	Provision for archaeological salvage if harm cannot be avoided.	None	Short-Term	Negligible	Almost Certain	Low
Kennedy's Hut Site Moderate regional significance	Direct impacts from construction	Minimal options to reduce impacts due to topographic locations	Permanent	Moderate	Almost Certain	High	Archaeological salvage.	None	Permanent	Negligible	Almost Certain	Low
Coghill's Boiling-Down Works High state significance	Direct impacts from construction	Minimal options to reduce impacts due to topographic locations	Permanent	High	Almost Certain	Extreme	Archaeological salvage.	None	Permanent	Moderate	Almost Certain	High
Coghill's Sheepwash and Dam Low local significance	Direct impacts from construction	Minimal options to reduce impacts due to topographic locations	Permanent	Minor	Almost Certain	Medium	Archaeological salvage.	None	Permanent	Negligible	Almost Certain	Low
Fawkner Land Co Settlement Unknown (potential moderate significance depending on monitoring results)	Direct impacts to part of place from construction	Minimal options to reduce impacts due to topographic locations	Permanent	Unknown	Almost Certain	Unknown	Archaeological salvage.	None	Permanent	Negligible	Almost Certain	Low

Environment aspect & baseline condition	Assessment of original impact		Significance				Mitigation and/or management measures	Assessment of residual impact	Significance			
	Original Impact	Mitigation inherent in design/practice	Duration	Severity	Likelihood	Impact		Residual Impact	Duration	Severity	Likelihood	Impact
Construction (and Operation)							**Construction (and Operation) (cont.)**					
Grants Road Bluestone Culvert Low local significance	Direct impacts from construction	Minimal options to reduce impacts due to topographic locations	Permanent	Minor	Almost Certain	Low	Archaeological salvage.	None	Permanent	Negligible	Almost Certain	Low
Oakbank Farm Homestead Moderate regional significance	Direct impacts from construction	Minimal options to reduce impacts due to topographic locations	Permanent	Moderate	Almost Certain	Medium	Archaeological salvage.	None	Short Term	Negligible	Almost Certain	Low
Oaklands Junction Low local significance	Design avoids impact	Minimal options to reduce impacts due to topographic locations	Permanent	Minor	Almost Certain	Low	Provision for archaeological salvage if harm cannot be avoided	None	Permanent	Negligible	Almost Certain	Low
Radar Hill Track Low local significance	Design avoids impact	Minimal options to reduce impacts due to topographic locations	Permanent	Minor	Almost Certain	Low	Provision for archaeological salvage if harm cannot be avoided.	None	Permanent	Negligible	Almost Certain	Low
Roseleigh Homestead Low local significance	Direct impacts from construction	Minimal options to reduce impacts due to existing infrastructure	Permanent	Minor	Almost Certain	Medium	Archaeological salvage.	None	Permanent	Negligible	Almost Certain	Low
Seafield Farm Low local significance	Direct impacts from construction	Minimal options to reduce impacts due to topographic locations	Permanent	Minor	Almost Certain	Medium	Archaeological salvage.	None	Permanent	Negligible	Almost Certain	Low
Victoria Bank Homestead Moderate regional significance	Direct impacts from construction	Minimal options to reduce impacts due to topographic locations	Permanent	Moderate	Almost Certain	High	Archaeological salvage.		Permanent	Negligible	Almost Certain	Low

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Chapter B8 Surface Transport

Summary of key findings:

- An assessment has been completed to understand the impact that increased transport activity will have on the performance of the internal and external road networks that serve Melbourne Airport. This assessment considers both the construction and operational phases of Melbourne Airport's Third Runway (M3R).
- The assessment found that the overall difference between the Build and No Build scenarios is generally moderate (i.e. reduced road network performance of between 5 per cent and 20 per cent), with conditions becoming increasingly congested as years progress – although this varies depending on location and mode. Without mitigation, the impact of the Build scenario on some elements of the transport network may be greater, with demands exceeding capacities more regularly than under the No Build scenario.
- A range of mitigation measures were identified and assessed, including a need to support further development of the proposed Melbourne Airport Rail link (to be undertaken independently of this Major Development Plan) and its potential to alleviate operational challenges.

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B8.1
INTRODUCTION

This chapter describes the baseline surface-transport conditions of the study area; applicable legislation and policy requirements; potential impacts of Melbourne Airport's Third Runway (M3R) on future transport-network conditions under both Build (i.e. with a new runway in a north-south alignment) and No Build (i.e. no new runway) scenarios; and specific measures to avoid, manage, mitigate and/or monitor these impacts. Strategic modelling and associated analysis were undertaken for Melbourne Airport by technical professional-services consulting firm Jacobs.

For the purpose of this chapter, the study area refers to the airport and surrounding transport infrastructure within approximately five kilometres of the terminals.

B8.2
METHODOLOGY AND ASSUMPTIONS

B8.2.1
Purpose

The objectives of the surface-transport impact assessment are to:

- Determine the local and regional transport network impacts associated with the implementation of M3R, based on comparison of Build versus No Build scenarios
- Determine the transport network requirements to accommodate future surface transport demands associated with M3R
- Identify mitigation measures to address adverse impacts on surface transport
- Provide surface transport demand data from the transport models to inform other runway environmental impact assessment studies.

B8.2.2
Methodology

The surface transport impact assessment was split into three phases: baseline assessment, construction impact assessment and operational impact assessment.

The baseline assessment reviewed the existing transport network conditions (see **Chapter A2: Need for the Project**).

The construction impact assessment considered the temporary demands on the external transport network generated by traffic associated with construction of the new north-south runway (16R/34L). Mitigation measures were identified to manage these impacts.

The operational impact assessment considered the future operating conditions incorporating M3R (Build scenario) in comparison to the No Build scenario (i.e. no third runway) on external and internal road networks. Mitigation measures were identified to manage these impacts.

This assessment used strategic modelling as the foundation for its methodology, using the Victorian Integrated Transport Model (VITM). VITM is a traditional four-stage strategic transport model used extensively by the Victorian Government's Department of Transport (DoT). It is a comprehensive multi-modal analytical tool which forecasts Average Annual Weekday Travel (AAWT) for metropolitan Melbourne and its surrounding areas and can be used to estimate future-year private vehicle, public transport and freight travel demand in response to various transport infrastructure and land use planning scenarios. VITM includes a dedicated sub-model for Melbourne Airport, which separately models trip generation, distribution and mode choice for airport-related travel.

Detailed modelling using VITM (including full four-step model runs) was previously undertaken as part of the east-west aligned Runway Development Plan (RDP) proposal. This work was carried out in 2017–18 and included assessment of the above scenarios (albeit for different years).

As part of the planning assessment for the new north-south runway, the same detailed modelling using VITM was unable to be undertaken by APAM (as directed by DoT). Instead of using VITM directly to undertake full model runs (as was undertaken for the RDP assessment), the project team adopted a different methodology to complete the surface transport assessment requirements promulgated in the *Airports Act 1996* (Cth).

The methodology for this assessment used the same VITM outputs as in the RDP assessment, specifically the trip volume matrices. These outputs were used to inform an assessment of the future operating conditions for M3R. The previous modelling outputs were factored-up to account for the change in assessment years and revised passenger/employee numbers (i.e. comparing differences between M3R instead of RDP). Overall, this methodology enables a good understanding of changes in traffic flows between the Build and No Build scenarios.

Where this chapter discusses any comparison in assumptions/inputs etc. between the previous modelling (for RDP) and the current analysis for M3R, the details from the former are hereafter referred to as the 'reference assessment'. It is noted that the assumptions applied for the previous modelling may not all still apply, and as such a review of these assumptions has been undertaken and is discussed in **Section B8.2.4**.

For this assessment, the key M3R planning assessment years apply: 2026 (opening year), 2031 (opening plus five years) and 2046 (opening plus 20 years). Traffic conditions for each of these years were determined by interpolating the VITM future-year forecasts (2021, 2031 and 2046) and reference assessment results, while also taking into account step-changes in traffic demand that are predicted to occur with changes to the transport network (described in more detail in **Section B8.2.4.3**).

Due to no VITM models being re-run for this assessment, the implications have been considered and potential impacts on key findings are discussed in **Section B8.2.5**.

The assessment of the internal road network performance was undertaken using microsimulation modelling. A microsimulation model of the airport's landside road network has been developed, used for internal planning and to inform design on a range of projects. The microsimulation modelling used for this assessment was based on 2018 traffic conditions, and was calibrated and validated to DoT standards. The model area includes the Tullamarine Freeway, to the Mickleham Road north-facing ramps; it does not include the Business Park road network.

B8.2.3
Consultation

Prior to undertaking the technical work for this assessment, the project team consulted with DoT on the project's evaluation requirements and obtained broad agreement on the approach, in terms of a strategic modelling foundation based on VITM. The importance of this was noted, as having the assessment underpinned by VITM ensures that the assumptions adopted were consistent with the Victorian Government's long-term plans.

As noted above, some of the assumptions applied for the previous modelling may no longer be current, as such a review of these assumptions has been undertaken and is discussed in **Section B8.2.4**.

B8.2.4
Assumptions

Assumptions used to inform the modelling analysis include:

- Future year airport passenger data
- Future year airport employment data
- Future year transport networks.

Other demographic forecasts (e.g. population, non-airport employment) were unchanged.

B8.2.4.1
Future year airport passenger data

Passenger forecasts were based on the detailed hourly airline movement forecasts (outlined in **Chapter A2: Need for the Project**). For the purposes of this assessment, the number of passengers on a 'representative busy day' in each forecast year has been adopted as the 'design day' for the transport assessment. The selected representative busy day is Thursday's flight schedule from the 'design week' developed by APAM (2019) for each forecast year.

The forecast design-day passenger demands for AM peak, PM peak and daily, for the Build and No Build scenarios, are shown in **Table B8.1** and **Table B8.2** respectively. (Note that interpolation calculations between the reference and current passenger forecasts were done for this assessment.)

Table B8.1
Design day passenger forecasts (Build scenario)

Year	AM peak				PM peak				Daily				Total
	Domestic		International		Domestic		International		Domestic		International		
	Arr.	Dep.	Arr.	Dep.	Arr.	Dep.	Arr.	Dep.	Arr.	Dep.	Arr.	Dep.	
2019	3,092	6,705	2,875	3,055	8,550	9,444	1,851	2,535	41,116	40,969	16,550	16,960	**115,595**
2026	4,131	8,427	4,413	4,596	10,140	11,424	2,718	3,676	49,435	49,488	24,398	24,769	**148,090**
2031	4,885	10,038	5,378	5,432	12,042	12,811	3,448	4,267	58,305	58,351	29,923	30,275	**176,854**
2046	7,534	13,636	9,579	8,973	16,989	17,395	5,811	6,987	81,392	81,423	47,722	48,130	**258,667**

Table B8.2
Design day passenger forecasts (No Build scenario)

Year	AM peak				PM peak				Daily				Total
	Domestic		International		Domestic		International		Domestic		International		
	Arr.	Dep.	Arr.	Dep.	Arr.	Dep.	Arr.	Dep.	Arr.	Dep.	Arr.	Dep.	
2019	3,092	6,705	2,875	3,055	8,550	9,444	1,851	2,535	41,116	40,969	16,550	16,960	**115,595**
2026	4,131	8,427	4,413	4,596	10,140	11,424	2,718	3,676	49,435	49,488	24,398	24,769	**148,090**
2031	3,849	8,085	5,618	5,005	11,553	12,073	3,074	3,981	54,171	53,990	29,951	30,339	**168,451**
2046	4,150	8,743	5,840	5,203	12,328	12,878	3,267	4,199	57,953	57,737	31,404	31,807	**178,901**

Several assumptions were made in determining how passenger forecasts were input into the AM peak (7am–9am) and PM peak (3pm–6pm) periods which are analysed in the transport assessment:

- AM peak passenger forecasts include the total number of passengers with:
  - Domestic flight departures 8am–10am
  - Domestic flight arrivals 6:30am–8:30am
  - International flight departures 9am–11am
  - International flight arrivals 6am–8am
- PM peak passenger forecasts include the total number of passengers with:
  - Domestic flight departures 4pm–7 pm
  - Domestic flight arrivals 2:30pm–5:30pm
  - International flight departures 5pm–8pm
  - International flight arrivals 2pm–5pm

The above AM and PM peak flight departure and arrival time periods were chosen in order to account for typical lag times in arrivals/departures before and after flights.

B8.2.4.2
Future year airport employment data

Employment forecasts for Melbourne Airport (comprising full-time and part-time combined jobs) are for the SA2 zone ('Statistical Area Level 2', which refers to a medium-sized geographical area representing a community) representing Melbourne Airport, shown in **Table B8.3**.

Table B8.3
Employment forecasts

Year	No Build Scenario	Build Scenario
2019	18,567	18,567
2026	22,164	22,161
2031	23,674	24,145
2046	27,616	30,837

B8.2.4.3
Future year transport network

A review of key changes to the transport network in future years was undertaken on a project-by-project basis, given the absence of a publicly accessible Victorian Transport Plan. For this assessment, expected changes to the transport network were sourced from the *2018 Melbourne Airport Master Plan* (for changes to the transport network within the airport estate), and VITM and Victorian Government announcements (for changes to the external network).

VITM reference-case models include a comprehensive listing of all future transport projects and their timing in relation to the standard VITM forecast years of 2021, 2031 and 2046. Some of these projects are expected to influence the distribution of traffic travelling to and from Melbourne Airport. Where required, assumptions were made on the timing of these projects (including comparison to the timing adopted in the reference assessment).

These projects, and the assumptions made to inform the analysis, are described in more detail below.

Internal Airport Road Network

As detailed in the *2018 Melbourne Airport Master Plan* (MP18), a number of enhancements to the airport's internal road network are proposed in order to increase capacity and improve performance.

The highest priority is the Elevated Roads Project, which is the subject of two separate MDPs (Stages 1 and 2). It includes a new airport exit from the Tullamarine Freeway and a continuous grade-separated road link into the Terminal 4 and Terminal 1/2/3 multi-storey car parks (i.e. it will be elevated above the surface roads). It also includes expanded drop-off and pick-up facilities for Terminals 1/2/3 (and several other features not particularly relevant to this assessment). It is scheduled for construction in the short-term (i.e. it has a less than five-year timeframe).

Further road enhancements include two new north-facing ramp connections with the Tullamarine Freeway (i.e. a northbound on-ramp and an off-ramp for southbound freeway traffic). These connections are longer term (with a five to 15 year timeframe) and scheduled to coincide with major changes to the external road network (notably Bulla Bypass, outlined below).

In addition, Airport Drive is proposed to be widened to six lanes between Sharps Road and Mercer Drive (i.e. from two lanes in each direction to three lanes each direction). This is proposed to be implemented in the 2030s.

The airport road network plan is further outlined in **Section B8.3.4.1**.

For this assessment, the Elevated Roads Project was assumed to be operational in 2026 and the other road enhancements in 2031. It is noted that the airport road projects included in the VITM reference model are based on an older road network plan and differ slightly from the current plan described above. However, this is not expected to have a significant impact on the results, given the core connections are still provided and the directional distributions are based more on the wider network than on the airport roads.

Bulla Bypass and Melbourne Airport Link

Bulla Bypass is a proposed four-kilometre road corridor connecting Sunbury Road to Somerton Road (including a 1.5 kilometre duplication of Somerton Road's western end). It would provide an alternate crossing of Deep Creek and bypass of the Bulla township, which are bottlenecks to the Sunbury Road corridor's operational capacity. Its efficacy is largely dependent on the parallel opening of Melbourne Airport Link (MAL).

MAL is a proposed five-kilometre road corridor to connect the southern segment of Sunbury Road to Bulla Bypass/Somerton Road, and with the future Outer Metropolitan Ring (OMR, outlined below). It is further understood that construction of MAL would also involve a 2.5 kilometre duplication of the southernmost segment of Sunbury Road, essentially integrating with the Tullamarine Freeway. Combined with Bulla Bypass, MAL would provide a significant improvement to the capacity of the main connecting road corridor north of Melbourne Airport, which is currently a two-lane road (one-lane each direction) with several bottlenecks. While some airport-generated traffic would benefit, the main beneficiaries of these road projects would be residents of Sunbury and the Sunbury/Northern growth corridors.

For this assessment, Bulla Bypass and MAL were assumed to be operational in 2031 as four-lane roads (based on the VITM reference model), with MAL widened to six lanes in 2046. However, guidance from DoT indicates it is likely that this entire infrastructure package will open at the same time in 2046, rather than be staged. This would have relatively minor impacts on traffic volumes in the Melbourne Airport locality due to the Bulla Bypass and the four-lane MAL serving only the Sunbury area and some of the northern growth area.

Outer Metropolitan Ring

The Outer Metropolitan Ring (the OMR) is a proposed 100-kilometre high-speed orbital transport corridor aligned through Melbourne's outer north and outer west. Planning for OMR includes options for an ultimate freeway-standard road with four to six lanes in each direction. The OMR (combined with MAL) is expected to have a significant impact on the distribution of airport-generated traffic to and from the northern and western suburbs. A significant amount of traffic from the M80 Western Ring Road will be redistributed to the OMR, resulting in more traffic approaching the airport from the north rather than the Tullamarine Freeway. The timing of the OMR will be subject to future planning and funding (although it is included in the 2046 VITM reference model).

For this assessment, the OMR was assumed to be operational in 2046.

Melbourne Airport Rail

The Melbourne Airport Rail (MAR) link is a proposed new rail connection between the terminals and Melbourne CBD. MAR is a joint Commonwealth and Victorian Government project. The Victorian Government has indicated that construction will begin in 2022 with a target completion date for MAR of 2029, subject to relevant Victorian and Commonwealth planning, environment and other approvals. As outlined in MP18, land has been reserved for a rail alignment and station within the airport, consistent with the Victorian Government's preferred 'Sunshine Route' announced in 2018.

Given the long planning and construction lead times, a rail link by 2031 is not considered a certainty. As such, for this assessment the project team adopted a conservative approach of undertaking the traffic analysis assuming that MAR is not operational. For clarity, this is hereafter referred to as 'without MAR' assumptions. This was applied to both the Build and No Build scenarios, in 2031 and 2046.

Note that the proposed Suburban Rail Loop (SRL) project was not incorporated in the analysis (consistent with current VITM reference models that do not include SRL). This is not expected to impact the findings of the 2026 or 2031 analysis and, given the uncertainty around SRL, it's unclear if it would have any impact on the findings of the 2046 analysis.

All other future year public transport enhancements detailed in the VITM reference models were left unchanged.

Other transport projects

In addition to the projects listed above, two other major transport projects are worth noting. The first is the West Gate Tunnel, included in all future-year models; the second is North East Link, included only in the 2046 VITM model. This has become a limitation given that North East Link is now anticipated to open in 2027. Notwithstanding, this is anticipated to have limited impacts on the overall traffic volume forecasts between 2027 and 2046 due to its distance from the airport. (Although North East Link will potentially change travel routings to the airport, its impact upon the local network will be limited as vehicles will continue to use the same principal airport-access points.)

Finally, it is noted that all other future year transport network assumptions employed for the reference assessment (not discussed above) also apply to the current assessment. The works completed recently as part of the CityLink Tulla Widening (CTW) project were modelled as being operational in all assessment years.

No additional future year transport network projects were assumed.

Summary

Maps of the major external (i.e. non-airport) transport projects described above are shown in Figure B8.1 (for the broader metropolitan area) and Figure B8.2 (for the vicinity of Melbourne Airport). A summary of the major transport-project assumptions used in this assessment is shown in Table B8.4.

B8.2.5 Limitations

The analysis undertaken for this MDP has accepted the modelling structure and process inherent within the VITM modelling suite used for the reference assessment. The base year for the VITM model, for which the model was calibrated and validated against observed data, is 2011. No further work was undertaken, as part of this project, in updating, rerunning, validating or calibrating the model.

While the base year is not particularly recent, and no further model work was undertaken, the analysis still incorporates the fundamental network details that influence regional travel patterns, such as MAR and OMR. As such, this limitation, while acknowledged, is not expected to have any significant implications on the analysis outcomes.

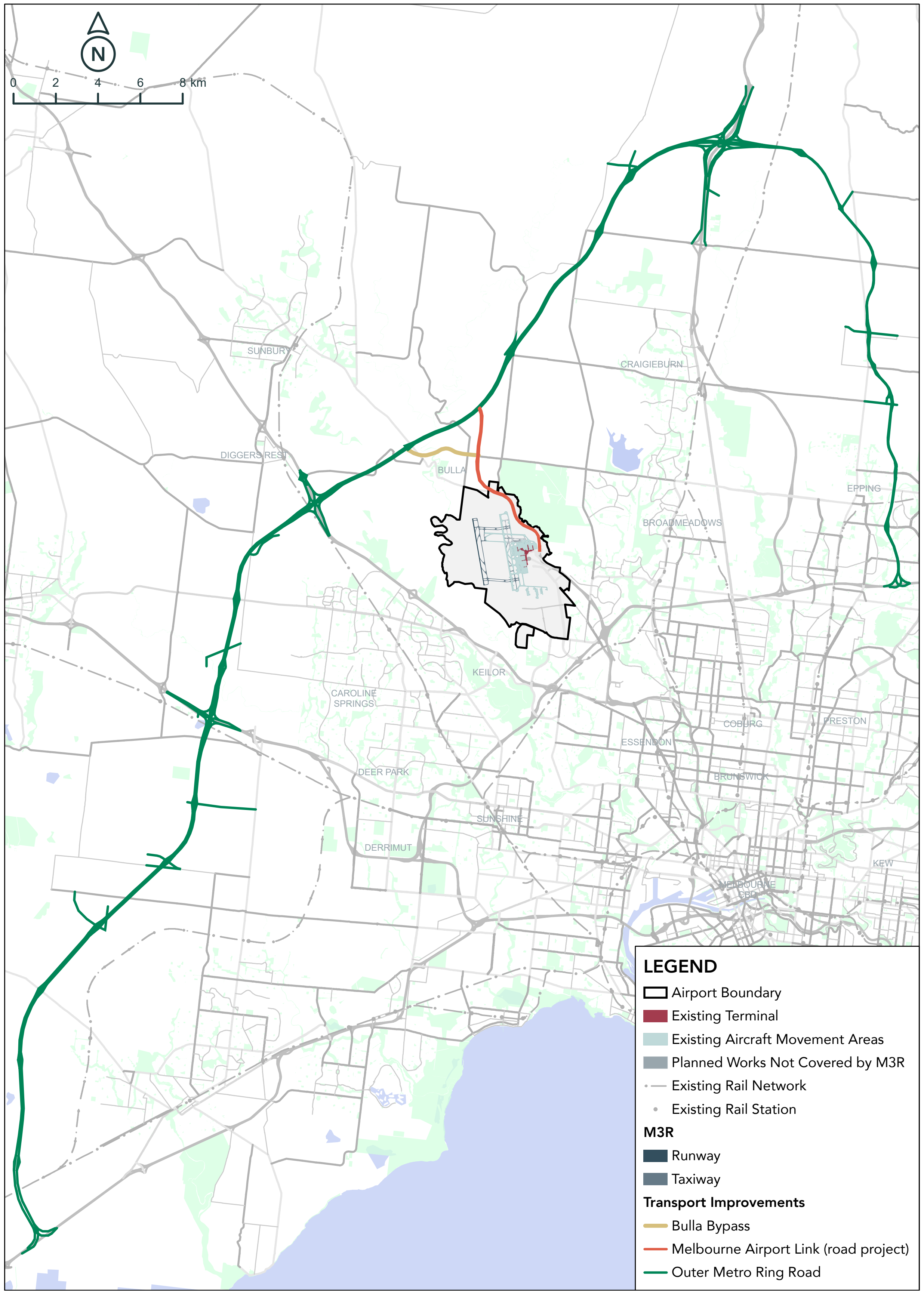
As mentioned in Section B8.2.4.1, this assessment adopted a 'representative busy day' as the basis for the transport modelling. As the representative busy day corresponds to a greater number of passenger movements than an average weekday, the number of forecast car trips on the road network in the vicinity of the airport was typically higher than would be generated from the VITM reference-case models. This should be taken into account when interpreting the modelling outputs reported in Section B8.6.2.

Table B8.4
Summary of major transport project assumptions

Year	Runway scenario	Internal projects		External projects			
		Elevated Roads Stages 1 & 2	Other ramp connections to freeway	CTW	OMR	MAL / Bulla Bypass	MAR
2026	Build	✓	×	✓	×	×	×
	No Build	✓	×	✓	×	×	×
2031	Build	✓	✓	✓	×	✓	×
	No Build	✓	✓	✓	×	✓	×
2046	Build	✓	✓	✓	✓	✓	×
	No Build	✓	✓	✓	✓	✓	×

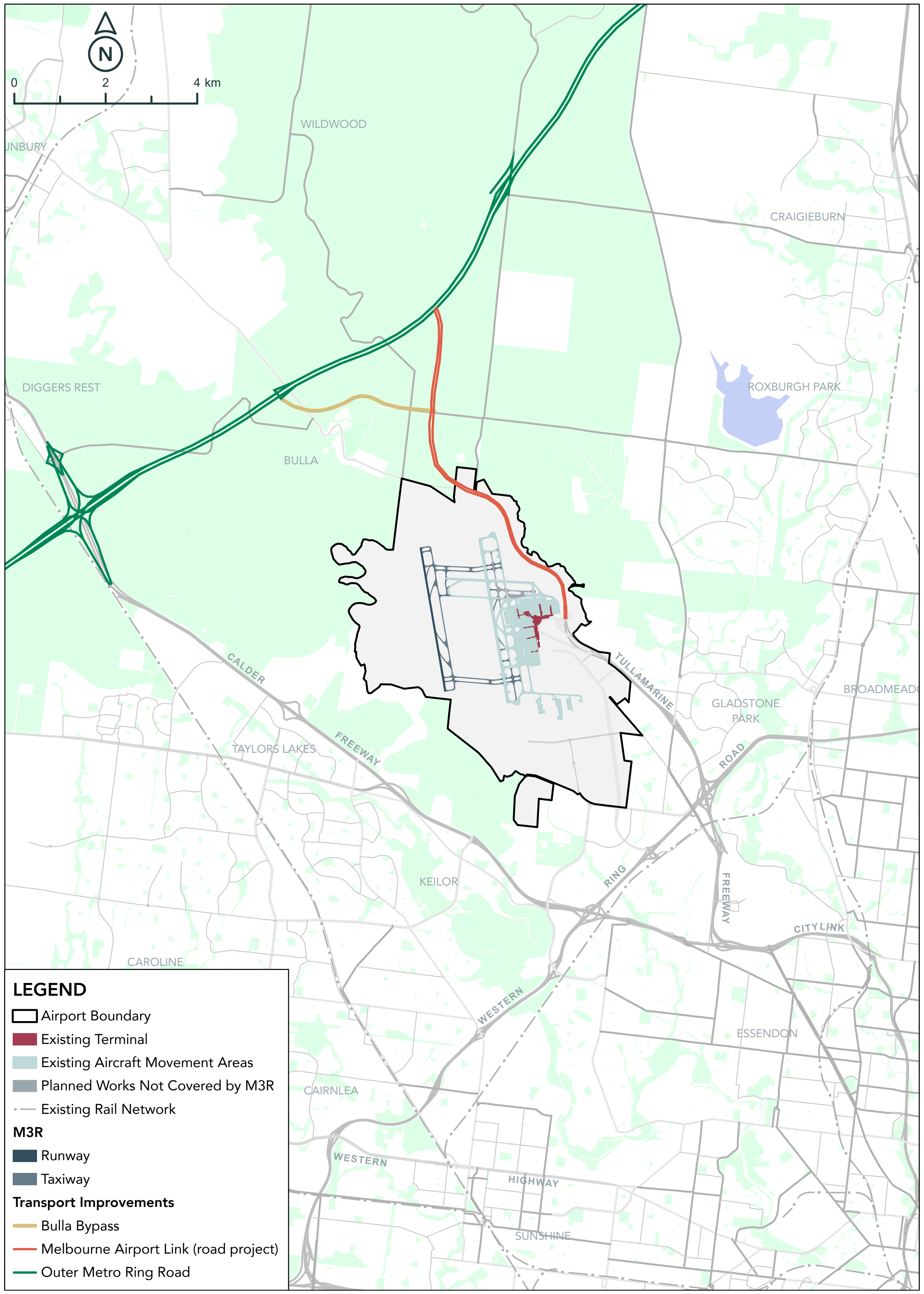
✓ *Project included in this assessment*
× *Project excluded from this assessment*

Figure B8.1
Major transport network improvement projects relevant to M3R (broader metropolitan area)



Note: Based on 'without MAR' assumptions

Figure B8.2
Major transport network improvement projects relevant to M3R (in vicinity of airport)



Note: Based on 'without MAR' assumptions

B8.3 STATUTORY AND POLICY REQUIREMENTS

B8.3.1 Commonwealth Government

B8.3.1.1 Airports Act 1996

Sub-section (1) of Section 91 states that an MDP, or a draft of such a plan, must set out:

(ga) the likely effect of the proposed developments that is set out in the major development plan, or the draft of the major development plan, on:

(i) traffic flows at the airport and surrounding the airport;

B8.3.1.2 Infrastructure Priority List

Infrastructure Australia (IA) is an independent statutory body providing advice to government and industry regarding Australia's infrastructure needs. IA prepares the *Infrastructure Priority List* of nationally-significant infrastructure projects and initiatives. Projects included in this document of relevance to this assessment, in addition to M3R, are the MAR and OMR projects outlined in Section B8.2.4.3.

B8.3.2 Victorian Government

B8.3.2.1 Transport Integration Act 2010

The *Transport Integration Act 2010* enables transport decisions to be made, powers exercised, or functions performed in line with broadly-stated principles.
The Act:

- Aims to ensure that transport agencies work together towards the common goal of an integrated and sustainable transport system
- Makes it clear that the transport system needs to be sustainable on a triple-bottom-line basis (in terms of economic, environmental social analysis)
- Provides a framework – vision, objectives and principles; along with coordinated institutional arrangements for integrated transport policy and operations
- Recognises that the transport system should be conceived and planned as a single system performing multiple tasks
- Integrates land use and transport planning and decision making by extending the policy framework to agencies that significantly impact on the transport system
- Establishes transport bodies with consistent charters to deliver outcomes aligned to the overall vision and objectives.

This means that external network transport projects can be implemented, providing they can be supported through a triple-bottom-line assessment.

B8.3.2.2 Plan Melbourne 2017–2050

Plan Melbourne 2017–2050, released in 2017 by Department of Environment, Land, Water and Planning (DELWP) is the Victorian Government's metropolitan planning strategy. It provides a guide on how growth in the city and suburbs will be managed through to 2050. The strategy seeks to integrate long-term land use, infrastructure and transport planning in order to meet the city's future environmental, population, housing and employment needs.

Plan Melbourne 2017–2050 specifies Melbourne Airport as a designated Transport Gateway and Place of State Significance.

Plan Melbourne 2017–2050 identifies a suite of proposed transport initiatives. Those of relevance to M3R over the assessment period include the OMR and the proposed MAR (noting that the CTW project identified in the document has already been delivered).

B8.3.2.3 Victoria's 30-year infrastructure strategy

Infrastructure Victoria (IV) is an independent statutory authority which provides expert advice and guides decision-making on Victoria's infrastructure needs and priorities. IV released its 30-year infrastructure strategy for Victoria in 2016. The strategy presents a summary of IV's analysis of Victoria's infrastructure needs and priorities over the next 30 years and covers all forms of infrastructure including transport.

The strategy includes a recommendation to 'upgrade and, over time, construct high-capacity public transport links between Melbourne Airport and the CBD to create strong interstate and global links with the central city' (Recommendation 10.9). In particular, IV recommends the delivery of on-road priority to bus services linking Melbourne Airport to central Melbourne within 10 years (Recommendation 10.9.1); with delivery of a rail line to Melbourne Airport within 15–30 years once the additional capacity of the airport bus is close to being exceeded (Recommendation 10.9.1).

B8.3.3 Local Government

B8.3.3.1 Hume Integrated Land Use and Transport Strategy (HILATS)

The *Hume Integrated Land Use and Transport Strategy* (HILATS) (Hume City Council, 2011) outlines land use and transport initiatives aimed at improving transport options for Hume residents, workers and visitors. HILATS aims to create more accessible, liveable and sustainable communities within the Hume municipality, giving residents improved access to jobs, education, shopping and community facilities by expanding the range of transport choices and modes.

Although major transport projects are the responsibility of the Victorian and Commonwealth Governments, the Hume City Council supports a number of key road and freight projects relevant to this MDP including:

- Bulla Bypass
- Upgrades to Sunbury Road, Somerton Road and Mickleham Road
- Support for improved public transport services to the airport, including the MAR.

B8.3.4
Melbourne Airport

B8.3.4.1
2018 Melbourne Airport Master Plan: Ground Transport Plan

The *2018 Melbourne Airport Master Plan* includes a Ground Transport Plan that outlines how Melbourne Airport's vision for an interconnected ground transport system will be achieved (note: the plan is also included in the proposed 2022 Master Plan). The five strategic objectives of the 2018 Ground Transport Plan are:

- Increase terminal access and egress capacity to accommodate forecast passenger demand
- Expand forecourt capacity to meet forecast passenger demand
- Improve the safety and experience of passengers by reducing vehicle–pedestrian conflicts in the forecourt and increasing the separation distance between vehicles and the terminal building
- Accommodate increases in freight movements in and around the cargo estate and the Melbourne Airport Business Park
- Manage travel demand, particularly for employee travel.

The key elements of the Ground Transport Plan are described in Section 14 of the *2018 Melbourne Airport Master Plan* and shown in Figure B8.3. The Elevated Roads Project directly responds to the first three objectives noted above, and is of most relevance to this transport assessment (as summarised earlier in Section B8.2.4.3).

B8.4
DESCRIPTION OF SIGNIFICANCE CRITERIA

The assessment of significance has applied the framework described in Chapter A8: Assessment and Approvals Process.

Project-specific criteria for severity have been developed for the surface transport assessment. These are described in Table B8.5.

Table B8.5
Severity criteria – surface transport assessment

Severity	Description
Major	• Major adverse impact on flow of external roads and key intersections during peak periods • Reduced performance by >50 per cent when compared to the No Build scenario • Transport users experience highly significant disruptions to the accessibility and amenity of transport infrastructure as a result of the Build scenario (or construction phase works)
High	• High adverse impact on flow of external roads and key intersections during peak periods • Reduced performance of 20-50 per cent when compared to the No Build scenario • Transport users experience reasonably significant disruptions to the accessibility and amenity of transport infrastructure as a result of the Build scenario (or construction phase works)
Moderate	• Moderate adverse impact on flow of external roads and key intersections during peak periods • Reduced performance of 5-20 per cent when compared to the No Build scenario • Transport users would experience some disruptions to the accessibility and amenity of transport infrastructure as a result of the Build scenario (or construction phase works)
Minor	• Minor adverse impact on flow of external roads and key intersections during peak periods • Reduced performance of 1-5 per cent when compared to the No Build scenario • Transport users may perceive some minor disruptions to the accessibility and amenity of transport infrastructure as a result of the Build scenario (or construction phase works)
Negligible	• Negligible impact on flow of external roads and key intersections during peak periods • Reduced performance of less than one per cent when compared to the No Build scenario • Transport users are unlikely to perceive any impact to the accessibility and amenity of transport infrastructure as a result of the Build scenario (or construction phase works)
Beneficial	• Reduced traffic flows on external roads and key intersections during peak periods • Improved performance when compared to the No Build scenario • Transport users would experience improvements to the accessibility and amenity of transport infrastructure as a result of the Build scenario (or construction phase works)

Figure B8.3
Melbourne Airport ground transport plan 2018

The significance assessment framework has been developed to apply to both the construction and operational phases, and assess the level of impact in relation to each of these criteria. It is consistent with assessments undertaken on other major transport infrastructure projects. Where quantitative data is not available for the assessment, qualitative assessments are necessary.

The key areas identified that need to be considered include differences in:

- Traffic volumes on external roads and key intersections during peak periods (or changes in public transport demands for the public transport assessment)
- Performance of the network compared to the scenario without the scheme using the Volume to Capacity Ratio (VCR) as the main measure
- The accessibility and/or amenity of transport infrastructure (qualitative assessment).

B8.5 EXISTING CONDITIONS

B8.5.1 Road network

B8.5.1.1 External road network

The road network in the area is strongly influenced by the convergence of three motorway corridors (Tullamarine Freeway, M80 Ring Road and Calder Freeway) that intersect south of the airport. The arterial road network in the area largely functions to feed to and from these motorway corridors. The airport itself is also a strong influence on the network, with several road corridors aligned directly to the terminals.

The external road network in the vicinity of Melbourne Airport is shown in Figure B8.4.

For this assessment, in order to understand the traffic changes that could be expected as a result of M3R, the analysis examines 10 road corridors in the area. They include the three motorway corridors (at multiple points) and selected points in the arterial network. Combined, these points form a cordon around the airport; understanding the traffic changes at these points will provide a strategic understanding of the key changes to the surrounding road network as a result of M3R.

Table B8.6 lists the 10 road corridors reported on throughout this chapter. Existing traffic volumes on these roads, as determined from 2019 traffic count surveys, are shown in Table B8.7, which correspond with the locations shown in Figure B8.4.

For this assessment, the Airport Drive corridor south of Mercer Drive has been included in the external road network, not the internal road network; only the corridor's segments north of Mercer Drive are included in the assessment of the internal road network, where traffic activity is heavily influenced by the terminal precincts (i.e. Airport Drive south of Mercer Drive is not as heavily influenced by the terminal precincts).

In terms of traffic activity, the terminals can be described as high-traffic-generating areas, active from early morning to late evening, with peak activities that generally correspond to commuter peak periods.

There are also employment areas located throughout the airport, as well as large employment areas located in the adjacent suburbs of Tullamarine and Keilor Park. They include light industrial, warehouse and logistics land-uses, resulting in high amounts of commercial traffic (including heavy vehicles).

Table B8.6
Roads assessed in study area

Road	Function	Number of lanes	Speed limit
Calder Freeway	Freeway	2–4 lanes each direction (varies)	80–100 km/h (varies)
Western Ring Road	Freeway	4 lanes each direction	100 km/h
Tullamarine Freeway	Freeway	3–4 lanes each direction (varies)	100 km/h
Keilor Park Drive	Arterial Road	2 lanes each direction	80 km/h
Sharps Road	Arterial Road	2 lanes each direction	70 km/h
Mickleham Road	Arterial Road	2–3 lanes each direction (varies)	70 km/h
Broadmeadows Road / Johnstone Street	Arterial Road	1–2 lanes each direction (varies)	70 km/h
Melrose Drive	Arterial Road / Collector Road	1–2 lanes each direction (varies)	60 km/h
Airport Drive	Arterial Road	2 lanes each direction	60–80 km/h (varies)
Sunbury Road	Arterial Road	1 lane each direction	80 km/h

Table B8.7
2019 traffic volumes on selected roads

Location	Direction	Current traffic volumes		
		AM peak	PM peak	Daily
1. Calder Freeway west of Keilor Park Drive	Westbound	2,300	4,100	42,400
	Eastbound	4,700	3,600	53,300
2. Calder Freeway east of Western Ring Road	Westbound	2,800	5,100	51,700
	Eastbound	4,600	3,500	52,500
3. Western Ring Road east of Tullamarine Freeway	Eastbound	3,800	4,300	55,300
	Westbound	5,300	5,300	71,300
4. Western Ring Road west of Tullamarine Freeway	Southbound	4,100	4,300	54,600
	Northbound	4,100	4,000	54,900
5. Western Ring Road south of Keilor Park Drive	Northbound	4,500	4,500	60,600
	Southbound	5,300	5,600	72,200
6. Tullamarine Freeway north of Mickleham Road	Northbound	2,900	3,500	47,800
	Southbound	4,400	3,200	53,900
7. Keilor Park Drive south of Tullamarine Park Road	Southbound	700	1,700	16,600
	Northbound	1,900	1,000	18,200
8. Sharps Road west of Melrose Drive	Eastbound	600	1,000	10,300
	Westbound	1,000	600	10,000
9. Mickleham Road north of Broadmeadows Road	Northbound	800	1,700	18,000
	Southbound	1,900	1,100	18,500
10. Broadmeadows Road east of Mickleham Road	Westbound	No data	No data	No data
	Eastbound	No data	No data	No data
11. Melrose Drive south of Mickleham Road	Northbound	1,000	1,700	17,500
	Southbound	1,700	1,200	18,500
12. Airport Drive north of Sharps Road	Southbound	400	800	9,300
	Northbound	700	500	11,700
13. Sunbury Road north of Airport	Northbound	500	1,300	11,800
	Southbound	1,400	700	12,400

Source: DoT, 2019 and APAM, 2019; traffic volumes shown above represent rounded numbers

Around the airport, traffic on the Tullamarine Freeway is strongly influenced by terminal activity. In recent years, residential growth in Sunbury has resulted in increased commuter traffic travelling through the Sunbury Road/Tullamarine Freeway corridor. For example, on the Tullamarine Freeway (west of Mickleham Road), outbound traffic comprises 94 per cent airport-generated traffic during the AM peak period, however this proportion is only 57 per cent during the PM peak, when there is a much larger proportion of non-airport traffic using this segment of the freeway.

B8.5.1.2 Internal road network

Within the airport boundary, APAM manages approximately 40 kilometres of roads. The internal road network serves a number of functions – most importantly, it provides passenger access to the terminal precincts (e.g. for drop-off/pick-up, car parking etc.). The network also allows for access and circulation between the various aviation-support businesses (including for associated employees). Finally, it supports activity in the Business Park (which includes some non-aviation businesses). The internal airport road network is shown in Figure B8.6.

Figure B8.4
External road network in the vicinity of Melbourne Airport

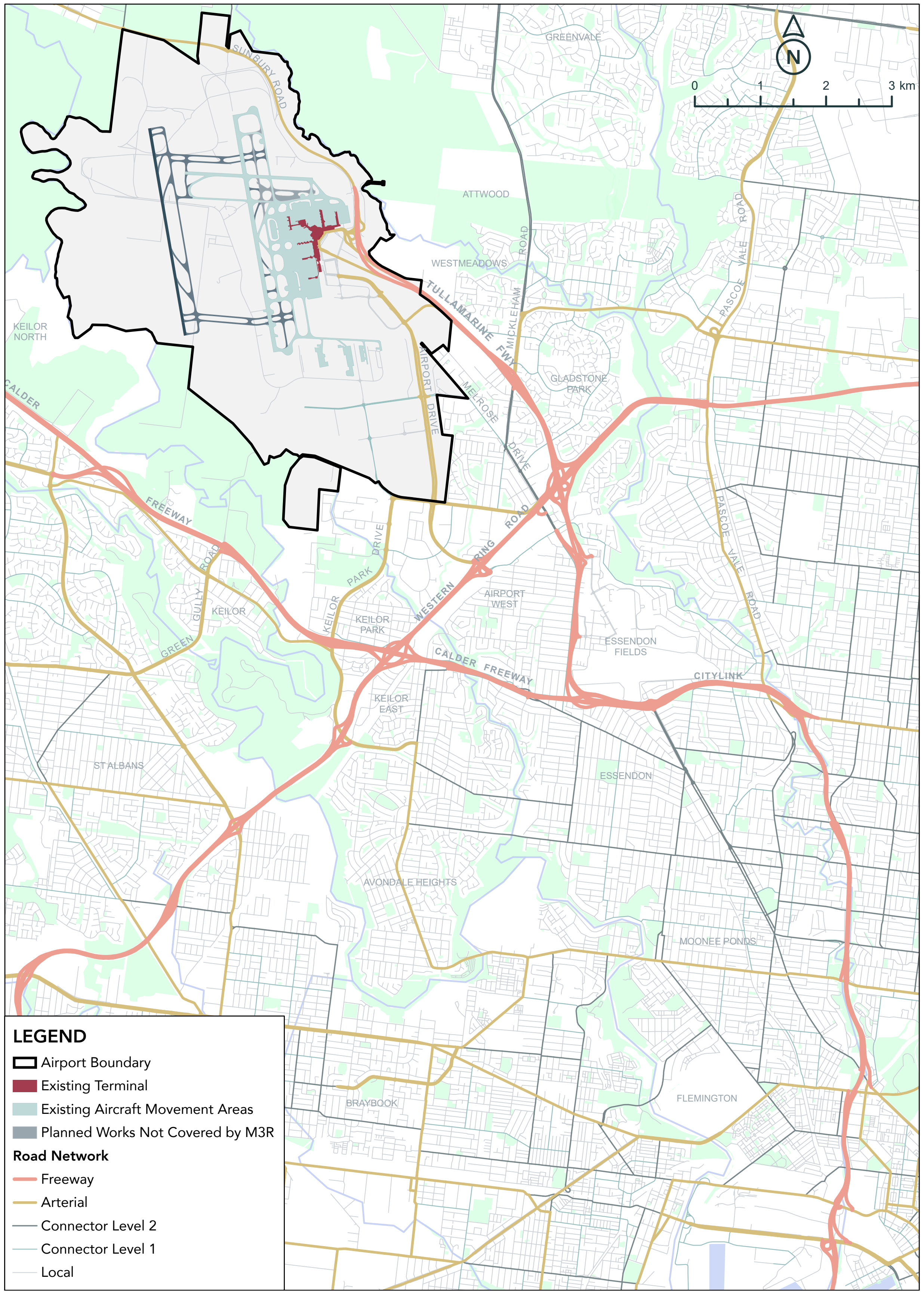


Figure B8.5
Traffic reporting sites in the vicinity of Melbourne Airport

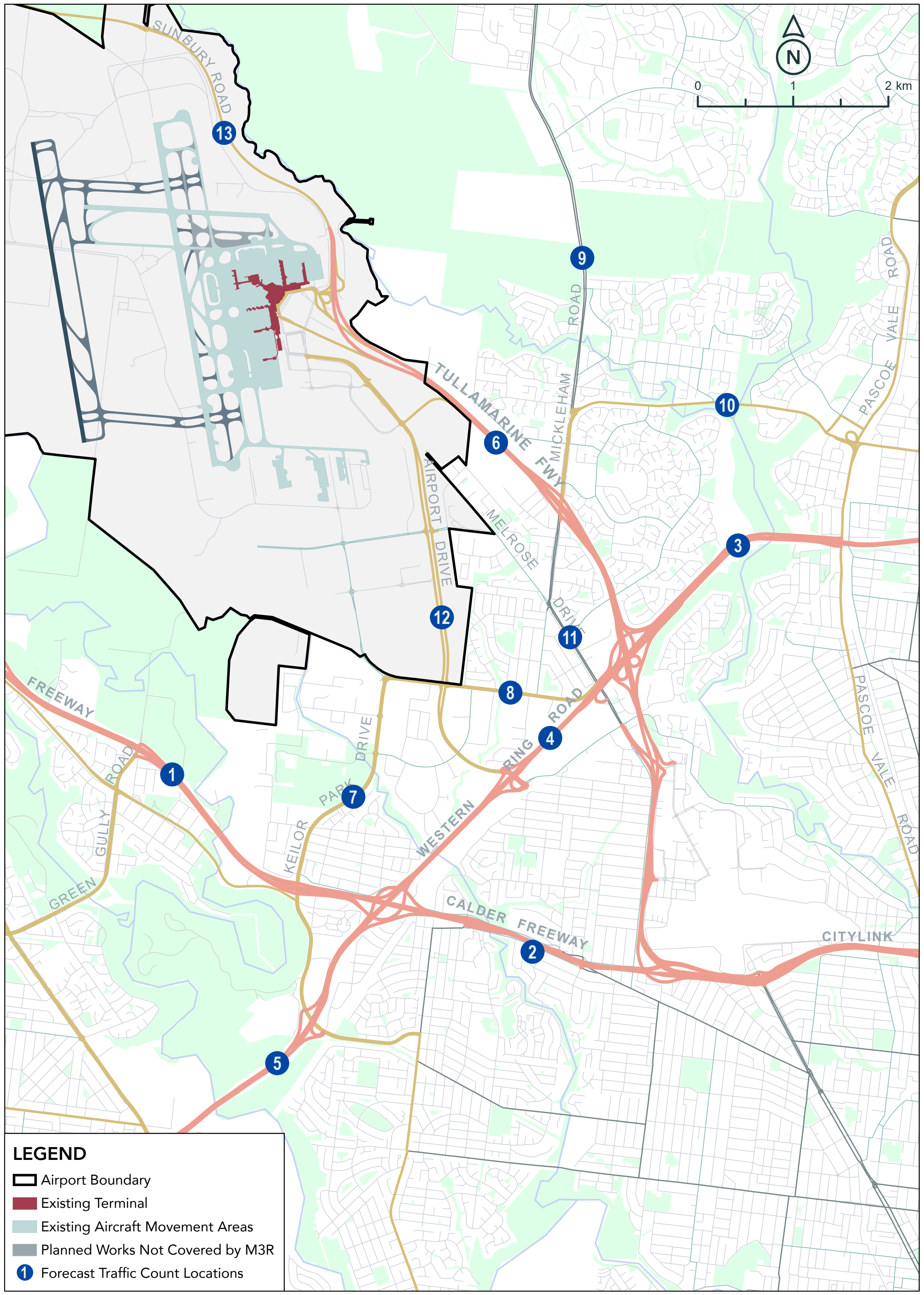
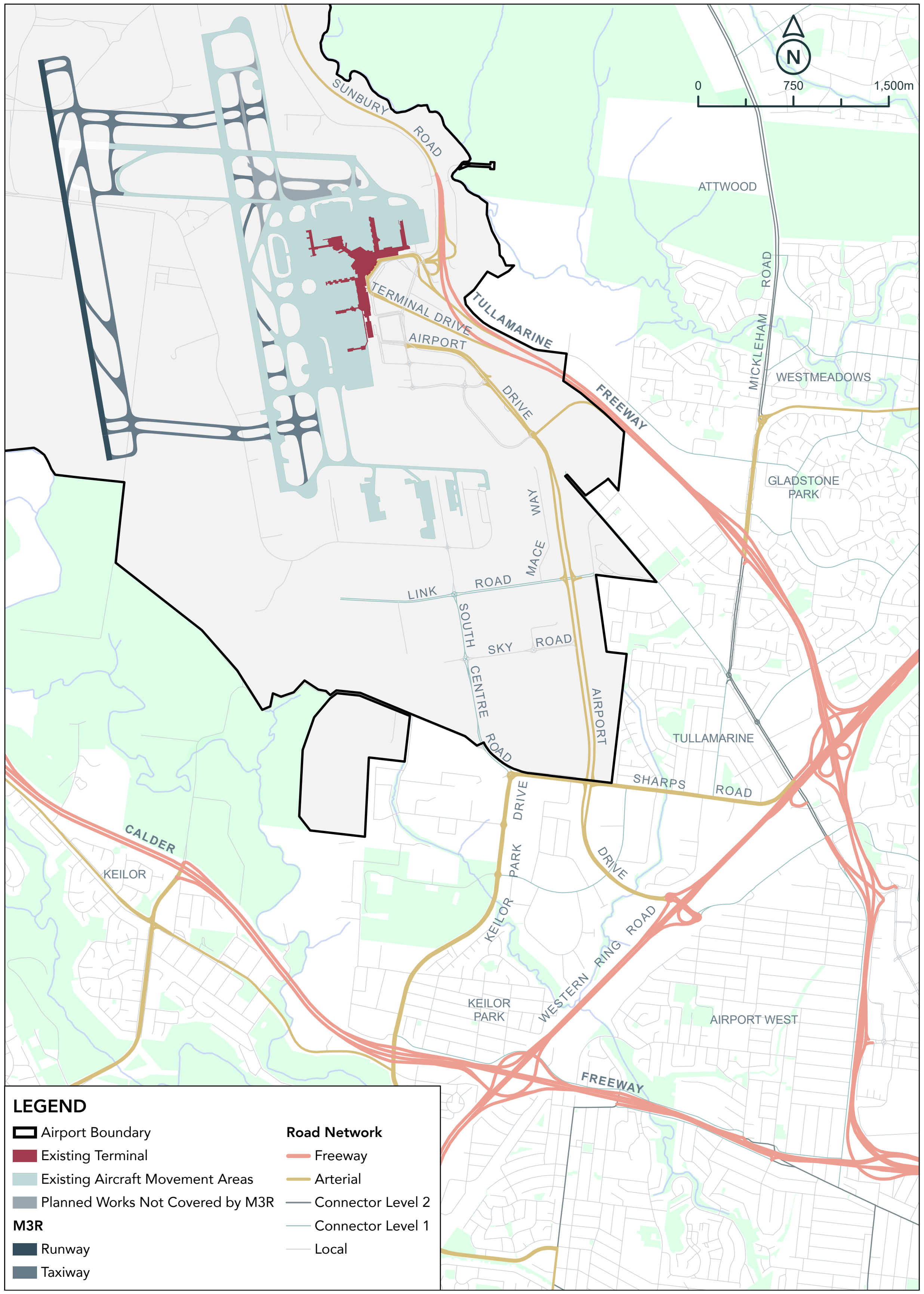


Figure B8.6
Melbourne Airport internal road network



Key roads in the internal network relevant to this assessment are described below:

- Terminal Drive is the main exit from the Tullamarine Freeway to reach the terminals (the ground forecourt that is the frontage for Terminals 1, 2 and 3), and is also used by several key bus routes (e.g. SkyBus and SmartBus)
- Airport Drive provides access to the terminals from the suburbs south of the airport, and links the Business Park to the rest of the airport; it interfaces with Sharps Road in the south and broadly aligns with Keilor Park Drive
- Centre Road provides an important circulation function adjacent to the terminal precincts by linking Airport Drive to the T1/2/3 ground forecourt (from the southern segments), and also linking traffic approaching from north of the airport (i.e. Sunbury Road) to the terminal precincts.

The Tullamarine Freeway is considered the primary access point to the airport and is used by 68 per cent of all vehicles entering and exiting the airport (average weekday). Airport Drive, South Centre Road and Watson Drive combined carry 26 per cent of all airport traffic, while Sunbury Road carries around six per cent of all airport traffic.

Current demand for passenger drop-off and pick-up regularly exceeds the capacity of the ground forecourt. On particularly busy days, during peak demand periods, traffic queues from the ground forecourt along Terminal Drive can extend onto the Tullamarine Freeway mainline (which represents a traffic queue of over 1,100 metres).

For this assessment, the internal road network has been assessed as a combined network, not on a road-by-road basis. This is considered appropriate given that future impacts to the internal road network are practically unrelated to M3R, and more profoundly related to the Elevated Roads Project (outlined in **Section B8.2.4.3**) which will result in fundamental changes in layout, capacity and operations of the internal road network. The impacts of the Elevated Roads Project have been investigated in detail as part of a separate MDP.

B8.5.2
Public transport network

Public transport connectivity to Melbourne Airport is provided via a range of bus services. These include SkyBus express bus services, Public Transport Victoria (PTV) bus routes, and privately-operated shuttle buses. A summary of the various bus services servicing the airport is provided in **Table B8.8**.

Table B8.8 shows that the VITM reference model includes the SkyBus 'Melbourne City Express' and PTV metropolitan bus routes. These are important, as this SkyBus service has the highest ridership out of all the above services (around 11 per cent of non-transfer passengers), while the SmartBus route provides a regular connection to nearby Broadmeadows train station (around 15-minutes travel time) thereby linking to the rail network.

The other bus services are not included in VITM, which may have a small effect on the results in this analysis. However, given this is a relatively small portion of airport users, this is not expected to result in any changes to the overall outcomes.

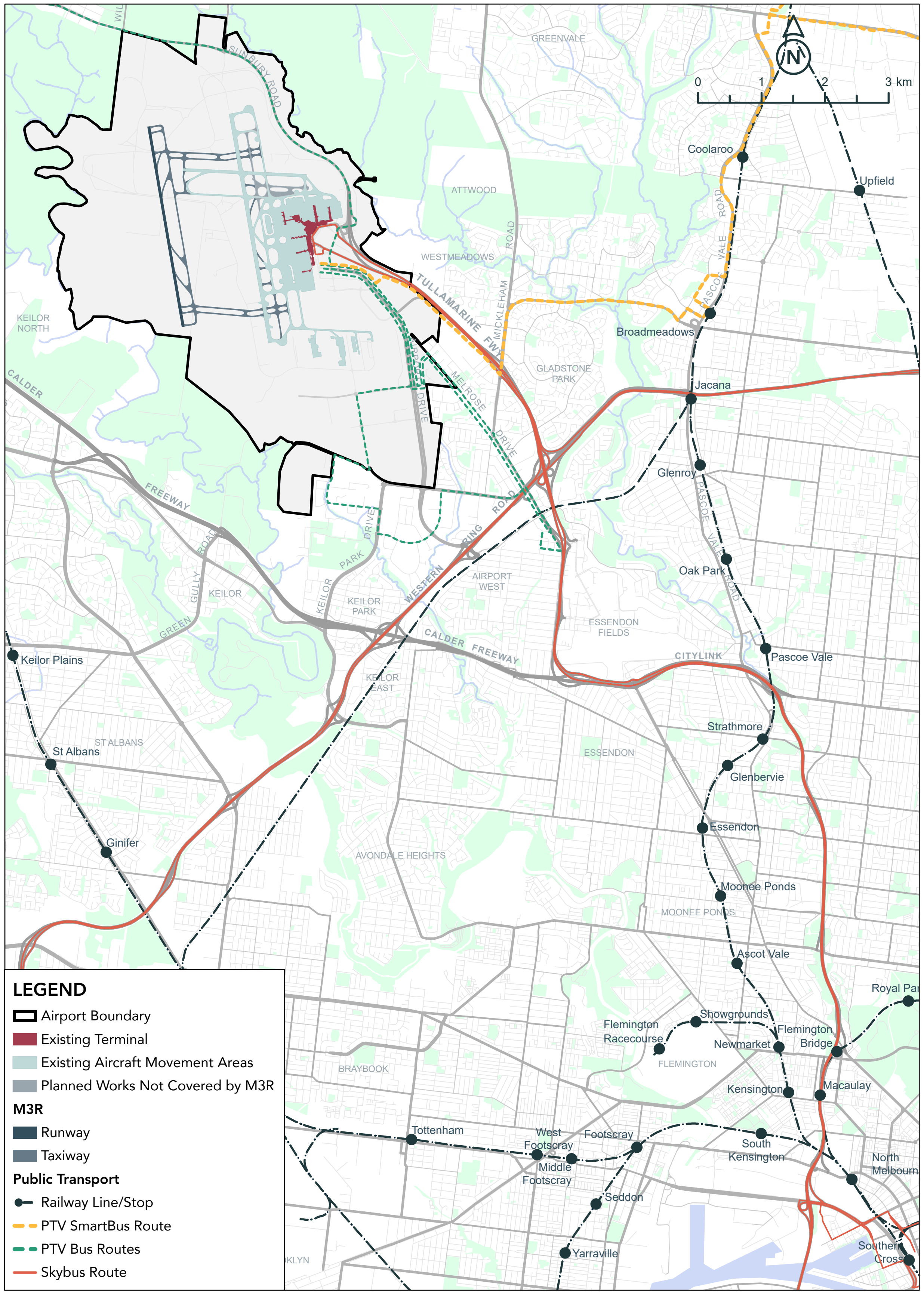
The route alignments of the SkyBus 'Melbourne City Express' and PTV bus routes servicing the airport are shown in **Figure B8.7**. These represent the bus services which are in VITM and captured in the analysis reported in this chapter.

Table B8.8
Summary of bus services connecting to Melbourne Airport

Bus service	Description	Service features	Included in VITM
SkyBus Melbourne City Express	Airport transfer to Melbourne CBD (Southern Cross Station)	High service frequency	✓
SkyBus – other services (six routes)	Airport transfer to Docklands, Southbank, St Kilda, Bayside/ Mornington Peninsula, Wyndham and Eastern suburb centres	Hourly service frequencies	×
PTV – SmartBus Route 901 Frankston to Melbourne Airport	Orbital bus route aligned through several major activity centres in northern, eastern and south-eastern suburbs	Regular service frequency	✓
PTV – local bus routes Routes 478, 479 and 482	Local bus services connecting to surrounding suburbs (Sunbury, Bulla, Tullamarine and Airport West)	Low service frequencies	✓
PTV – V/Line coach Barham to Melbourne via Heathcote	Long distance coach to designated towns in central Victoria via north-south alignment (Echuca/Heathcote/Lancefield)	Daily service	×
Privately operated shuttle buses (various bus operators)	Various operators providing airport transfers, including to regional centres (including Geelong, Ballarat and Bendigo)	Varies between operators	×

Source: SkyBus, PTV

Figure B8.7
Public Transport access to Melbourne Airport



B8.5.3
Active transport network

Melbourne Airport is located reasonably close to two strategic bicycle-riding routes in the surrounding area: the Western Ring Road Trail and the Moonee Ponds Creek Trail. These routes are designated as a 'Primary Route' (C1) and 'Main Route' (C2), respectively, in the Department of Transport's Strategic Cycling Corridors (SCC) network. These shared-use paths connect across northern and western metropolitan areas, and link with other strategic bicycle-riding routes in Melbourne. Currently, there are gaps in the external and internal network infrastructure to connect these paths to the airport, resulting in bicycle riders having to ride on the road, sharing with traffic (thereby limiting the appeal for some riders). The existing bicycle-riding network in the vicinity of the airport is shown in **Figure B8.8**.

Footpaths are provided on most roads within the airport to enable walking within precincts, with pedestrian-crossing facilities provided appropriate to the various road environments. Roads in the terminal precincts have the highest walking activity, and so these locations have additional facilities to enhance walking, such as wayfinding signage and a posted speed limit of 40 kilometres per hour in all roads in these areas.

B8.5.4
Existing ground transport demand

In 2019, Melbourne Airport generated an average weekday volume of around 124,000 vehicle trips to and from the airport. Traffic volumes during typical 'busy day' activities are up to eight per cent higher, most of which is attributable to passengers.

B8.5.4.1
Traffic demand by user type

Airport-generated traffic comprises several user groups, including passengers, employees, freight and other commercial traffic:

- Passenger-generated traffic comprise the majority of all traffic entering the airport precinct, estimated at around two-thirds of all airport-generated traffic.
- Workers at Melbourne Airport form a substantial component of the total transport demand, although they have different travel patterns to passengers and drive to different parts of the airport. The vast majority of the airport workforce travels by car (as shown in census data), which is not unusual for an outer suburban employment area with a relatively high proportion of shift-workers.
- Commercial trips associated with freight and logistics support the significant number of airport-related and non-airport related businesses located within the airport boundary. Commercial vehicles are estimated to represent at least 10 per cent of total airport traffic.

In addition to the above external trips, there are internal trips made by aviation support vehicles, emergency services, taxis (circulating from drop-off and pick-up) and rental vehicles (repositioning from storage yards to public rental area at the ground level of the Terminal 1/2/3 multi-storey car park).

B8.5.4.2
Mode share – passenger travel

Table B8.9 shows a breakdown of existing passenger travel modes from 2016-17 estimates. These mode shares are considered representative of existing (as in 2019) conditions.

Table B8.9
Passenger travel modes (2016/2017 estimates)

Passenger travel modes	Mode share
Public drop-off and pick-up (including rideshare)	37%
Taxi	19%
On-airport car parking	14%
SkyBus	10%
Other bus (including regional shuttles and charters)	9%
Off-airport car parking (shuttle transfer)	4%
VHA	4%
Rental car	3%

As shown above, around half of all passengers access the airport by private vehicle (rideshare breakdown unknown), either dropped-off/picked-up by friends/family or parking in an on-airport car park. Around a quarter of passengers arrive at the airport by bus, coach or other shuttle service (including off-airport parking). SkyBus is the dominant public transport service, its express service between the CBD and airport carrying around 10 per cent of all passengers.

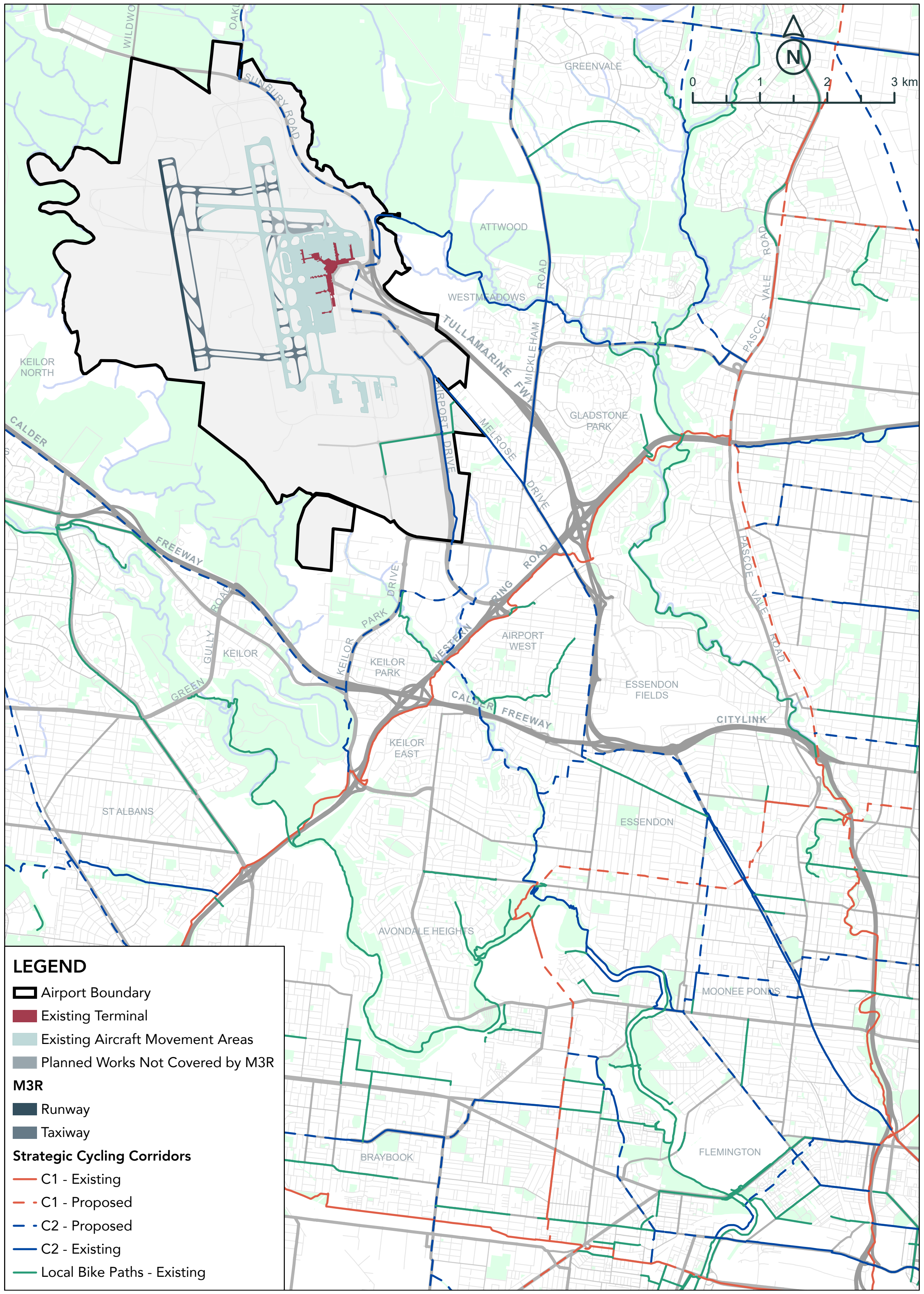
B8.6
ASSESSMENT OF POTENTIAL IMPACTS

B8.6.1
Construction impact assessment

The construction impact assessment provides a high-level overview of the construction traffic activity associated with M3R, and describes the general impacts on the surrounding road network that could be expected during construction works. (Note that details relating to fill requirements and construction routes have been broadly developed, and will be subject to further development as part of later design phases.)

This section does not include the full details normally associated with a Construction Traffic Management Plan (CTMP). A CTMP will be developed once the MDP has been approved, for submission to DoT and subject to separate approval. An overview of the details expected to be covered in the CTMP are described in **Section B8.7.1**.

Figure B8.8
Existing bicycle riding network in the vicinity of Melbourne Airport



B8.6.1.1
Construction zone

A construction zone will be established west of the existing north-south runway (16L/34R). It will be the designated area for plant and equipment laydown and storage during construction.

B8.6.1.2
Construction activity

Construction vehicle access routes

Two access points to the construction zone are proposed:

- From the north: utilising an access road connecting off Sunbury Road. Options are being considered for access to and from Sunbury Road, and the final arrangement will be subject to agreement with DoT (likely connections on Sunbury Road; at existing roundabouts at either Oaklands Road or Wildwood Road)
- From the south: via either Operations Road or McNabs Road. This would involve travel through the local/collector road network (managed by Melbourne Airport and Hume City Council respectively) to the arterial network at Sharps Road, Keilor Park Drive and/or the Calder Freeway.

Proposed construction access routes would be confirmed as part of the CTMP.

Construction hours and timeframes

The construction of M3R is expected to take place over a four to five year timeframe.

It is expected that construction operations will be continuous through the period, and in some phases will operate 24 hours a day, seven days a week. Where possible, construction traffic will avoid unnecessary travel during peak periods. Where required, any potential effects on peak period traffic will be managed through the use of on-site stockpile areas that will provide sufficient flexibility in the operation of truck movements to and from the site.

Allowing for downtime periods, it is assumed that construction activity will occur over approximately 312 days a year.

Construction workforce

It is expected that there will be up to 600 workers typically on the site at peak construction periods (with additional staff located off-site in supervision and project management related functions). The majority are assumed to drive to the site (i.e. vehicle occupancy of one person per car). As a result, there will be up to 600 arrivals and 600 departures a day to the construction site. Much of this traffic activity will occur at shift changeover times which are typically outside conventional commuter peak periods (although some overlap may occur).

It is expected that access for the construction workforce will be principally from Sunbury Road. The CTMP will identify access arrangements and shift times, and confirm that capacity is available to accommodate the expected workforce traffic throughout the duration of construction activity.

Construction vehicle activity levels

It is expected that the contractor will establish on-site asphalt and concrete batching plants to facilitate ease of material supply. Materials that will be hauled on public roads on a regular basis will include imported fill (although some fill will be sourced on-site), stone aggregate, sand, cement, ready-mix concrete and possibly precast culverts and precast tunnel items. The types of construction vehicles that can be expected to use public roads for delivering these materials and other construction equipment will include:

- On-road truck and trailer tippers – delivering imported fill, stone aggregate, sand and cement
- Ready-mix concrete trucks – delivering five cubic metres of concrete per trip, typically operating from 6am to 6pm Monday to Saturday (noting there will be some periods that require additional concrete trucks to deliver concrete for taxiway and runway tie-ins, so these works can occur when air traffic is low)
- Manufacturer's trucks – delivering precast concrete culverts and/or tunnel sections (unless in-situ options are adopted, which would require delivery of concrete materials) typically between 8am and 6pm
- Low loaders – to deliver construction equipment (this will be infrequent and occur mainly at the start and end of the construction period).

For the purposes of this assessment, it is assumed that the materials will be supplied to the works site as per the summary estimate shown in Table B8.10.

Table B8.10
Estimated likely supply routes for construction activity

Material supply	Access direction	Comments
Imported fill	North/South	Assume 70/30 split distribution in both scenarios
Stone aggregate, sand, cement	North/South	Assume 70/30 split distribution in both scenarios
Ready mix concrete	North/South	Assume 50/50 split distribution in both scenarios
AC	North/South	Assume 70/30 split distribution in both scenarios
Precast concrete culvert	North/South	Assume 50/50 split distribution in both scenarios
Culvert base materials	North/South	Assume 70/30 split distribution in both scenarios
Tunnel units	North/South	Assume 50/50 split distribution in both scenarios

B8.6.1.3 Road network assessment

Construction truck traffic generation

The main traffic impact of the construction activity will be from construction truck movements travelling to and from the site for delivery of materials and equipment. The impact of these truck movements on daily traffic operations is moderated by virtue of a four-year construction period and a 12-hour period each day.

Adopting the likely supply routes shown above in Table B8.10, the number of truck trips to and from the south (Operations Road) and the north (Sunbury Road) can be estimated as shown in Table B8.11.

Based on the quantities of materials calculated above, it is expected M3R could require around 270,000 heavy-vehicle trip deliveries. Each heavy-vehicle delivery trip would also result in the same number of empty vehicles exiting the site.

Given the deliveries will be spread across four to five years and spread throughout a workday, average hourly trips are expected to be up to around 18 trips per hour per direction. These trips will be further distributed north or south, depending on supply routes.

Construction-truck volumes, and their split between north/south routes, will be further detailed in the CTMP.

Construction traffic impact on northern access routes

The estimates above show that construction traffic generated from the project site to the northern access routes would be in the order of 296 truck trips per day. Hourly volumes would be up to 12 truck trips per hour per direction. These trips would all be distributed from the project site to Sunbury Road (interface point to be determined) before travelling on the surrounding network.

The extent of impacts this would have on the Sunbury Road corridor's operations would be largely dependent on how the construction access would interface with the corridor. There are two existing roundabouts on Sunbury Road (at Wildwood Road and Oaklands Road) that could provide access to the construction zone. Appropriate modifications to the intersection configurations would likely be required, particularly at Wildwood Road where a new southern leg would be required (subject to DoT approval).

To understand the indicative feasibility of a construction access from either roundabout, a preliminary review of the intersection performance was undertaken (analysed with existing and construction-traffic volumes). The review indicated that the increase in hourly traffic is not expected to significantly impact the peak-period operations, with the expected increase being consistent with typical day-to-day fluctuations in traffic flows.

Should access from either roundabout be unavailable, construction access could be proposed via Old Bulla Road or Gate 4. This may require modification to these intersections to allow for safe turning movements (the extent of such modifications is not known at this stage).

In terms of other impacts, a review of existing (as in early 2020) Sunbury Road traffic volumes indicate the road carries around 11,000 to 12,000 vehicles per day per direction, with heavy vehicles comprising between six and eight per cent. The estimates of truck volumes indicate M3R construction could result in an increase of up to two per cent additional truck volume proportions during the construction period. As such, further understanding from the CTMP (once the construction program has been developed) will be needed to confirm any potential impacts this additional heavy-vehicle proportion could have on the Sunbury Road corridor's surface, with potential mitigation measures identified in collaboration with DoT.

It is noted that the nearby Oaklands quarry is a potential source of construction material. If used, this could potentially reduce the number of truck movements on Sunbury Road and the wider road network by a substantial amount, thereby reducing impact on other traffic.

Based on the above, it is expected that M3R construction activity would have 'negligible' to 'minor' impacts on roads to the north of the construction site.

Construction traffic impact on southern access routes

The estimates in Table B8.11 show that construction traffic generated from the project site to the southern access routes would be in the order of 135 truck trips per day. Hourly volumes would be up to 10 truck trips per hour per direction. These trips would be distributed from the project site through the interfacing local/collector road network, which could be through one of the following routes:

- Operations Road/South Centre Road (managed by Melbourne Airport)
- McNabs Road/Arundel Road/Annandale Road (managed by Hume City Council).

From either route, the subsequent interface with the arterial road network is through Sharps Road, Keilor Park Drive, Calder Freeway and/or Western Ring Road.

The addition of construction traffic to the above local/collector roads could represent notable increases in terms of their daily proportions; however the actual volumes are considered to be relatively low, and as such not expected to have any significant impacts to the roads' operation. Notwithstanding, should these routes be needed for construction trucks, this may necessitate localised road improvements such as widening, pavement strengthening and/or bridge strengthening (and potentially rehabilitation works post-construction). Further site investigation will be required to determine the extent of any such works, which will need to be documented in the CTMP (and, if required, submitted to Hume City Council).

Regarding impacts to the arterial-road network, the additional truck traffic, when spread across multiple access routes and throughout the workday, would represent less than a one per cent increase in the current volumes. This should not impact network operations, with the expected increases being not inconsistent with typical day-to-day fluctuations in traffic flows.

Table B8.11
Estimated truck trips by direction by access route

Material supply	Quantity and units	Volume per load	Total trips	North	South
Imported fill	2,054,000.00 m^3	12 m^3	171,167	119,817	51,350
Stone aggregate, sand, cement	1,992,455.76 T	28 T	71,159	49,811	21,348
AC	209,147.36 T	28 T	7,470	5,229	2,241
Ready mix concrete	57,481.00 m^3	5 m^3	11,496	120	5,748
Precast culvert	480.00 units	2 units	240	980	120
Culvert base materials	7,000.00 m^3	5 m^3	1,400	3,420	420
Tunnel	30,465.20 m^3	5 m^3	6,093	3,047	3,047
One-way deliveries (over 4 years)			269,025	184,751	84,274
Two-way trips (over 4 years)			538,049	369,503	168,546
Per year (4 years)			134,512	92,376	42,137
Per day (312 days per year)			431	296	135
Average per hour over 12-hour day			36 trips per hour (18 trips each direction)	25 trips per hour (13 trips each direction)	11 trips per hour (6 trips each direction)

It is noted that the Arundel Road route could connect to the Calder Freeway at Green Gully Road. While the interchange is suitable for truck access, the westbound freeway off-ramp is currently uncontrolled and its configuration is not well-suited to accommodating larger heavy-vehicle traffic movements. As such, if this route is chosen, this location will need to be reviewed as part of the CTMP. However, as there are multiple access routes available, it is considered that there is opportunity to suitably manage heavy-vehicle movements.

Based on the above, it is expected that M3R construction activity would have 'negligible' to 'minor' adverse impacts on roads to the south of the construction site.

Summary – construction traffic impacts

Overall, it is expected that M3R construction activity would have 'negligible' to 'minor' adverse impacts on roads surrounding the construction site.

B8.6.1.4 Public transport assessment

As the construction truck access routes to the site are largely located away from bus routes, there will be little or no interface between the construction activity and public transport. The only potential interface may be between buses and trucks on the arterial and motorway network. However, these interfaces are likely to be negligible and not inconsistent with daily traffic conditions on such networks.

On this basis it is expected that there will be a negligible impact on public transport from the M3R construction activity.

B8.6.1.5 Active transport assessment

There is expected to be little or no interface between the construction activity and the active transport modes as the access routes to the site are away from any of the active transport corridors. Any potential interfaces between bicycle routes or footpaths and proposed truck routes will need to be reviewed as part of the CTMP, to ensure the paths remain safe for cyclists and pedestrians.

On this basis it is expected that there will be a negligible impact on active transport from the M3R construction activity.

B8.6.2 Operational impact assessment

B8.6.2.1 Approach to operational assessment

This assessment has adopted several key parameters to enable a comparison of the overall impact of M3R on road network operations. The severity criteria set out in Table B8.5 focuses on differences in traffic flow and performance. Traffic flow differences are most relevant at a daily level, and performance differences are most relevant in peak periods. As noted in Section B8.2.4.1, traffic volumes (for both the Build and No Build scenarios) were determined based on the design day at the airport. Therefore, the reported traffic flow and performance differences reflect the conditions likely to exist on that particular day in the M3R planning assessment year rather than an average day (or average weekday) in that year.

The operational impact assessment includes consideration of the following impacts:

- Traffic flow assessment – changes that M3R would have on traffic flows on the road network was assessed by determining the AM-peak, PM-peak and daily traffic volumes for both the Build and No Build scenarios
- Performance assessment – the associated impacts on the performance of the external road network were assessed by measuring changes to the Volume to Capacity Ratio (VCR), which are based on the traffic flow differences and derived from strategic model outputs; the performance of the internal road network was assessed by measuring changes in average travel speed and queue lengths (outputs from separate modelling analysis)
- Public transport assessment – changes in public transport mode share were assessed by applying changes in the demands on the public transport systems between the Build and the No Build scenarios. This was based on car trip and public transport trip numbers from the reference assessment
- Active transport assessment – a qualitative assessment was undertaken to understand any impacts M3R could have on active transport infrastructure and trips patterns.

B8.6.2.2
Traffic flow assessment

External roads

Estimated traffic flows have been determined for all assessment scenarios, corresponding with the locations reported in the baseline assessment (i.e. locations per **Figure B8.4**).

Summary tables showing the one-hour AM and PM peak traffic flow volumes, as well as daily traffic volumes, for 2026, 2031 and 2046, Build versus No Build, are shown in **Table B8.12**, **Table B8.13** and **Table B8.14** respectively. The 'difference' columns show the actual change and the percentage change in traffic volume that would result from the Build scenario in comparison to the No Build scenario.

Generally, the traffic flow assessment shows some increases in traffic flows under the Build scenario (compared to the No Build scenario), depending on the location in the road network. The traffic volume differences are relatively small in the early years, with only very marginal changes (likely due to differences in employment). In later years, the differences are greater as the Build scenario results in more passenger growth.

Based on the 2026 analysis of the Build versus No Build scenarios (shown in **Table B8.12**), the following observations are made:

- Most roads surrounding the airport experience little changes under the Build scenario, with differences around one per cent
- There is an increase in daily traffic flows on Airport Drive by around 25 per cent, although the actual numbers during the peak periods were low, less than 200 vehicles per hour

Based on the 2031 analysis of the Build versus No Build scenarios (shown in **Table B8.13**), the following observations are made:

- Most roads surrounding the airport experience low increases, of around one per cent, under the Build scenario
- Modest increases in traffic (though not exceeding 10 per cent) are observed on the Tullamarine Freeway, Sharps Road and Keilor Park Drive under the Build scenario
- The largest percentage increase in traffic volume under the Build scenario is observed on Airport Drive (around a 28 per cent increase in daily volumes in both directions).

Observations of the 2046 analysis of the Build versus No Build scenarios (shown in **Table B8.14**) are as follows:

- The traffic volume differentials are more widespread, with more roads experiencing increases up to around 10 per cent under the Build scenario
- There are clearer increases in daily traffic flows on the Tullamarine Freeway, Sharps Road and Keilor Park Drive under the Build scenario (around 15 to 20 per cent)
- The most significant increase in traffic volume under the Build scenario is on Airport Drive – around 10,000 additional vehicles per day per direction, which represents an 80 per cent increase compared to the No Build scenario.

Table B8.12
Design day traffic volume and percentage differences Build vs No Build – 2026

2026		Traffic volumes – No Build			Traffic volumes – Build			Differences in traffic volumes – Build compared to No Build		
Location	Direction	AM peak	PM peak	Daily	AM peak	PM peak	Daily	AM peak	PM peak	Daily
1. Calder Freeway west of Keilor Park Drive	Westbound	3,600	6,723	64,512	3,608	6,757	65,099	8 (+1%)	34 (+1%)	587 (+1%)
	Eastbound	6,577	4,550	69,725	6,565	4,589	70,523	-12 (-1%)	39 (+1%)	798 (+1%)
2. Calder Freeway east of Western Ring Road	Westbound	2,965	5,095	50,543	2,999	5,107	50,600	34 (+1%)	12 (+1%)	57 (+1%)
	Eastbound	5,518	3,663	55,565	5,528	3,664	55,715	10 (+1%)	1 (+1%)	150 (+1%)
3. Western Ring Road east of Tullamarine Freeway	Eastbound	5,609	6,629	79,453	5,558	6,675	80,015	-51 (-1%)	46 (+1%)	562 (+1%)
	Westbound	8,002	7,932	103,875	7,856	7,945	104,402	-146 (-2%)	13 (+1%)	527 (+1%)
4. Western Ring Road west of Tullamarine Freeway	Southbound	5,023	6,135	73,250	5,073	6,153	72,426	50 (+1%)	18 (+1%)	-824 (-1%)
	Northbound	5,642	5,871	76,018	5,589	5,905	76,049	-53 (-1%)	34 (+1%)	31 (+1%)
5. Western Ring Road south of Keilor Park Drive	Northbound	7,099	6,166	82,642	7,079	6,212	83,401	-20 (-1%)	46 (+1%)	759 (+1%)
	Southbound	5,401	6,576	79,859	5,366	6,646	80,452	-35 (-1%)	70 (+1%)	593 (+1%)
6. Tullamarine Freeway north of Mickleham Road	Northbound	6,630	6,412	81,788	6,044	6,482	83,108	-586 (-9%)	70 (+1%)	1,320 (+2%)
	Southbound	5,889	4,772	77,760	5,574	4,934	77,835	-315 (-5%)	162 (+3%)	75 (+1%)
7. Keilor Park Drive south of Tullamarine Park Rd	Southbound	928	1,475	17,168	926	1,520	17,944	-2 (-1%)	45 (+3%)	776 (+5%)
	Northbound	1,606	1,172	17,086	1,613	1,239	18,021	7 (+1%)	67 (+6%)	935 (+5%)
8. Sharps Road west of Melrose Drive	Eastbound	491	937	10,653	495	983	11,588	4 (+1%)	46 (+5%)	935 (+9%)
	Westbound	675	414	9,006	686	421	9,630	11 (+2%)	7 (+2%)	624 (+7%)
9. Mickleham Road north of Broadmeadows Rd	Northbound	814	1,392	17,109	801	1,386	17,137	-13 (-2%)	-6 (-1%)	28 (+1%)
	Southbound	1,288	1,058	17,385	1,316	1,056	17,570	28 (+2%)	-2 (-1%)	185 (+1%)
10. Broadmeadows Road east of Mickleham Road	Westbound	1,021	916	12,218	1,027	915	12,416	6 (+1%)	-1 (-1%)	198 (+2%)
	Eastbound	715	1,153	11,654	724	1,164	11,837	9 (+1%)	11 (+1%)	183 (+2%)
11. Melrose Drive south of Mickleham Road	Northbound	382	553	6,559	387	558	6,592	5 (+1%)	5 (+1%)	33 (+1%)
	Southbound	462	483	6,942	464	501	7,083	2 (+1%)	18 (+4%)	141 (+2%)
12. Airport Drive north of Sharps Road	Southbound	792	718	10,714	722	878	13,363	-70 (-9%)	160 (+22%)	2,649 (+25%)
	Northbound	1,054	744	9,531	1,153	864	11,815	99 (+9%)	120 (+16%)	2,284 (+24%)
13. Sunbury Road north of Airport	Northbound	734	3,240	23,368	688	3,214	23,416	-46 (-6%)	-26 (-1%)	48 (+1%)
	Southbound	3,122	857	21,653	3,067	865	21,472	-55 (-2%)	8 (+1%)	-181 (-1%)

The above AM and PM peaks represent one-hour periods. Forecasts based on 'without MAR' assumptions.

Table B8.13
Design day traffic volume and percentage differences Build vs No Build – 2031

2031		Traffic volumes – No Build			Traffic volumes – Build			Differences in traffic volumes – Build compared to No Build		
Location	Direction	AM peak	PM peak	Daily	AM peak	PM peak	Daily	AM peak	PM peak	Daily
1. Calder Freeway west of Keilor Park Drive	Westbound	3,613	6,756	65,008	3,655	6,809	65,846	42 (+1%)	53 (+1%)	838 (+1%)
	Eastbound	6,600	4,583	70,281	6,633	4,643	71,346	33 (+1%)	60 (+1%)	1,065 (+2%)
2. Calder Freeway east of Western Ring Road	Westbound	2,969	5,099	50,611	3,008	5,115	50,707	39 (+1%)	16 (+1%)	96 (+1%)
	Eastbound	5,518	3,666	55,614	5,528	3,667	55,780	10 (+1%)	1 (0%)	166 (+1%)
3. Western Ring Road east of Tullamarine Freeway	Eastbound	5,631	6,673	80,428	5,631	6,748	81,447	0 (0%)	75 (+1%)	1,019 (+1%)
	Westbound	8,043	7,976	104,931	7,985	8,016	105,989	-58 (-1%)	40 (+1%)	1,058 (+1%)
4. Western Ring Road west of Tullamarine Freeway	Southbound	5,028	6,179	74,128	5,084	6,220	73,425	56 (+1%)	41 (+1%)	-703 (-1%)
	Northbound	5,650	5,876	76,813	5,605	5,913	77,144	-45 (-1%)	37 (+1%)	331 (+1%)
5. Western Ring Road south of Keilor Park Drive	Northbound	7,143	6,223	83,854	7,230	6,309	85,221	87 (+1%)	86 (+1%)	1,367 (+2%)
	Southbound	5,426	6,633	81,051	5,456	6,741	82,211	30 (+1%)	108 (+2%)	1,160 (+1%)
6. Tullamarine Freeway north of Mickleham Road	Northbound	6,916	6,766	89,984	7,095	7,072	94,960	179 (+3%)	306 (+5%)	4,976 (+6%)
	Southbound	6,052	5,198	85,990	6,197	5,628	89,558	145 (+2%)	430 (+8%)	3,568 (+4%)
7. Keilor Park Drive south of Tullamarine Park Rd	Southbound	947	1,515	17,821	985	1,582	18,921	38 (+4%)	67 (+4%)	1,100 (+6%)
	Northbound	1,640	1,211	17,721	1,706	1,303	18,963	66 (+4%)	92 (+8%)	1,242 (+7%)
8. Sharps Road west of Melrose Drive	Eastbound	496	954	10,938	501	1,008	12,034	5 (+1%)	54 (+6%)	1,096 (+10%)
	Westbound	685	421	9,247	698	430	9,997	13 (+2%)	9 (+2%)	750 (+8%)
9. Mickleham Road north of Broadmeadows Rd	Northbound	815	1,396	17,208	805	1,391	17,280	-10 (-1%)	-5 (-1%)	72 (+1%)
	Southbound	1,290	1,060	17,466	1,319	1,060	17,694	29 (+2%)	0 (0%)	228 (+1%)
10. Broadmeadows Road east of Mickleham Road	Westbound	1,025	921	12,346	1,037	924	12,623	12 (+1%)	3 (+1%)	277 (+2%)
	Eastbound	717	1,161	11,772	730	1,175	12,014	13 (+2%)	14 (+1%)	242 (+2%)
11. Melrose Drive south of Mickleham Road	Northbound	383	554	6,579	390	560	6,623	7 (+2%)	6 (+1%)	44 (+1%)
	Southbound	463	484	6,963	467	503	7,115	4 (+1%)	19 (+4%)	152 (+2%)
12. Airport Drive north of Sharps Road	Southbound	825	771	11,608	849	973	14,963	24 (+3%)	202 (+26%)	3,355 (+29%)
	Northbound	1,105	815	10,462	1,343	988	13,357	238 (+22%)	173 (+21%)	2,895 (+28%)
13. Sunbury Road north of Airport	Northbound	746	3,279	24,050	735	3,283	24,460	-11 (-1%)	4 (+1%)	410 (+2%)
	Southbound	3,159	889	22,446	3,189	917	22,639	30 (+1%)	28 (+3%)	193 (+1%)

The above AM and PM peaks represent one-hour periods. Forecasts based on 'without MAR' assumptions.

Table B8.14
Design day traffic volume and percentage differences Build vs No Build – 2046

2046		Traffic volumes – No Build			Traffic volumes – Build			Differences in traffic volumes – Build compared to No Build		
Location	Direction	AM peak	PM peak	Daily	AM peak	PM peak	Daily	AM peak	PM peak	Daily
1. Calder Freeway west of Keilor Park Drive	Westbound	3,492	6,954	66,176	3,676	7,029	68,772	184 (+5%)	75 (+1%)	2,596 (+4%)
	Eastbound	6,786	4,382	72,149	6,871	4,467	74,587	85 (+1%)	85 (+2%)	2,438 (+3%)
2. Calder Freeway east of Western Ring Road	Westbound	3,306	5,375	54,683	3,745	5,489	56,543	439 (+13%)	114 (+2%)	1,860 (+3%)
	Eastbound	6,128	3,937	61,317	6,188	4,028	62,892	60 (+1%)	91 (+2%)	1,575 (+3%)
3. Western Ring Road east of Tullamarine Freeway	Eastbound	5,118	6,277	73,240	5,544	6,574	79,252	426 (+8%)	297 (+5%)	6,012 (+8%)
	Westbound	7,690	7,173	96,667	8,130	7,596	102,985	440 (+6%)	423 (+6%)	6,318 (+7%)
4. Western Ring Road west of Tullamarine Freeway	Southbound	4,293	5,495	58,811	4,478	5,521	58,690	185 (+4%)	26 (+1%)	-121 (-01%)
	Northbound	4,834	4,809	62,886	5,280	4,922	63,102	446 (+9%)	113 (+2%)	216 (+1%)
5. Western Ring Road south of Keilor Park Drive	Northbound	7,564	5,638	78,313	8,083	6,101	83,676	519 (+7%)	463 (+8%)	5,363 (+7%)
	Southbound	4,820	6,810	72,986	5,053	7,102	76,697	233 (+5%)	292 (+4%)	3,711 (+5%)
6. Tullamarine Freeway north of Mickleham Road	Northbound	7,047	7,304	102,385	9,080	8,559	124,169	2,033 (+29%)	1,255 (+17%)	21,784 (+21%)
	Southbound	6,453	5,892	96,739	7,735	7,670	118,222	1,282 (+20%)	1,778 (+30%)	21,483 (+22%)
7. Keilor Park Drive south of Tullamarine Park Rd	Southbound	741	1,412	17,402	868	1,604	20,104	127 (+17%)	192 (+14%)	2,702 (+16%)
	Northbound	1,528	1,075	17,939	1,815	1,337	20,876	287 (+19%)	262 (+24%)	2,937 (+16%)
8. Sharps Road west of Melrose Drive	Eastbound	600	967	12,262	594	1,033	13,696	-6 (-1%)	66 (+7%)	1,434 (+12%)
	Westbound	601	414	9,164	871	468	10,559	270 (+45%)	54 (+13%)	1,395 (+15%)
9. Mickleham Road north of Broadmeadows Rd	Northbound	737	1,453	16,635	695	1,439	16,665	-42 (-6%)	-14 (-1%)	30 (+1%)
	Southbound	1,251	947	16,442	1,264	946	16,789	13 (+1%)	-1 (-1%)	347 (+2%)
10. Broadmeadows Road east of Mickleham Road	Westbound	1,267	1,085	15,088	1,342	1,121	16,070	75 (+6%)	36 (+3%)	982 (+7%)
	Eastbound	821	1,311	14,740	781	1,337	14,929	-40 (-5%)	26 (+2%)	189 (+1%)
11. Melrose Drive south of Mickleham Road	Northbound	433	632	7,687	672	672	8,361	239 (+55%)	40 (+6%)	674 (+9%)
	Southbound	490	575	8,211	590	627	9,236	100 (+20%)	52 (+9%)	1,025 (+12%)
12. Airport Drive north of Sharps Road	Southbound	596	916	13,977	1,002	1,616	24,441	406 (+68%)	700 (+77%)	10,464 (+75%)
	Northbound	1,334	834	12,340	2,332	1,661	23,326	998 (+75%)	827 (+99%)	10,986 (+89%)
13. Sunbury Road north of Airport	Northbound	1,427	4,113	44,637	1,464	4,268	47,798	37 (+3%)	155 (+4%)	3,161 (+7%)
	Southbound	3,866	1,961	42,848	4,308	2,176	45,665	442 (+11%)	215 (+11%)	2,817 (+7%)

The above AM and PM peaks represent one-hour periods. Forecasts based on 'without MAR' assumptions.

Internal roads

Table B8.15 presents a summary of the total forecast internal-road traffic flows for the Build and No Build scenarios.

Traffic flows are expected to increase under the M3R Build scenario by up to around 11 per cent during the five years post-opening. By 2046, daily traffic flows are substantially increased, with an additional 40 per cent daily traffic flows compared to the No Build scenario. It is noted that traffic flows will increase over time even under the No Build scenario.

The forecast traffic flows on the internal network appear to increase by a higher degree than some roads on the external network. This is expected, given the convergence of traffic to the airport, particularly the high-traffic-generating terminal precincts.

Summary of project impacts on traffic flows

The overall impact of traffic flows from M3R will vary between roads. The traffic flows impact assessment has been combined with the performance assessment for the external and internal road networks (summarised in Section B8.6.2.3 and Section B8.6.2.4 respectively).

B8.6.2.3
Performance assessment – external road network

The performance of the external road network incorporating M3R has been determined based on measuring the VCR throughout the road network for all scenarios. VCRs are a standard metric in strategic transport modelling, used to understand future road performance conditions by measuring the level of congestion (given forecast traffic volumes and road capacity thresholds).

For this road performance assessment, the project team adopted the VCR colour-coded bands illustrated and described in Table B8.16 (Austroads, 2013).

Figure B8.9, Figure B8.10 and Figure B8.11 show the estimated road performance levels of the external road network (using the same locations reported in the baseline assessment and traffic flow assessment). Each compares performance (as VCRs) between Build and No Build scenarios. It is noted that the only roads where there is additional capacity programmed to be provided between 2026 and 2046 are Sunbury Road and Airport Drive.

Table B8.15
Daily airport trip forecasts – internal roads

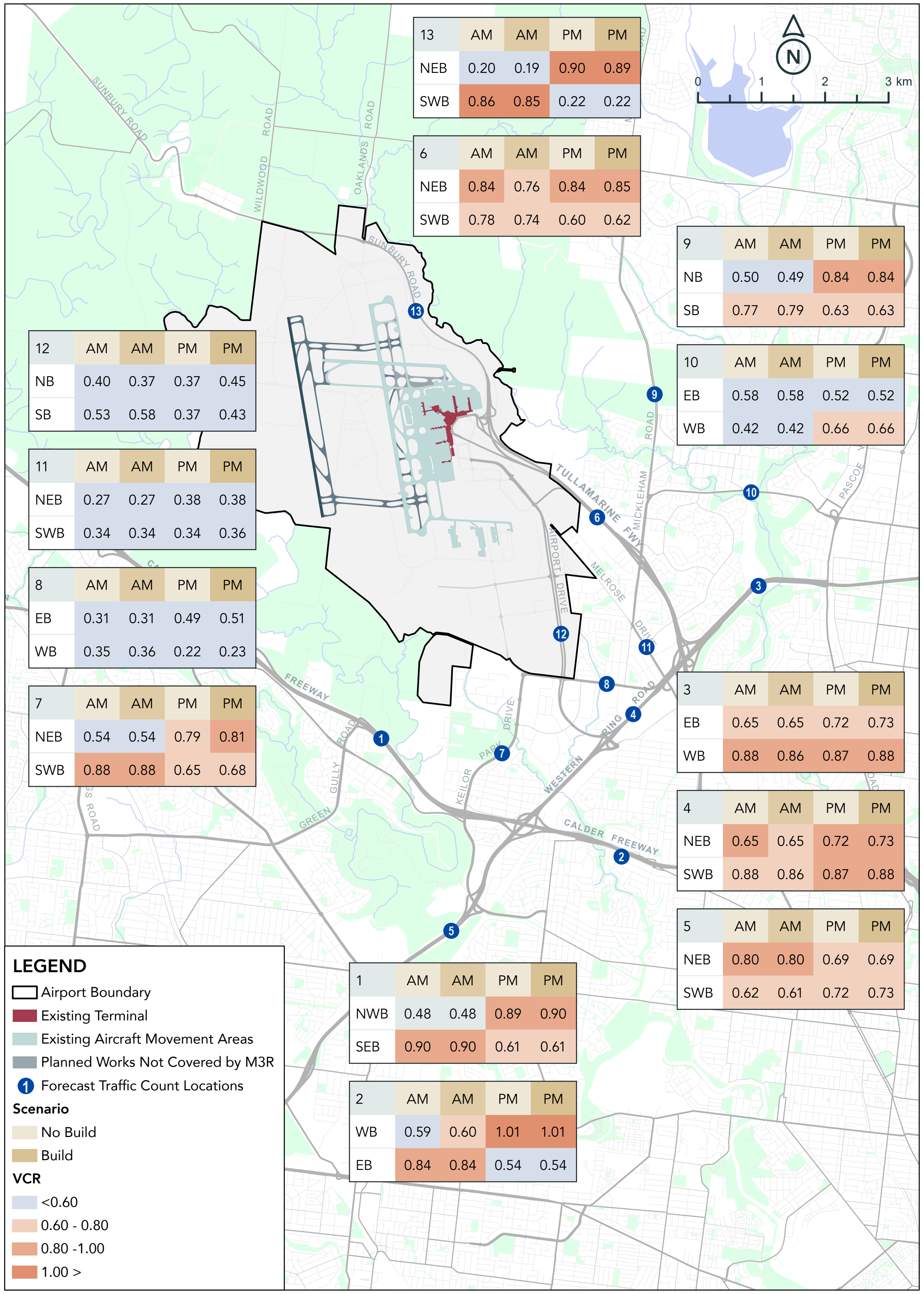
Year	Scenario	No. of car trips to airport	Increase in car trips (Build compared to No Build)
2026	No Build	151,296	+7.2%
	Build	162,257	
2031	No Build	164,933	+11.6%
	Build	184,139	
2046	No Build	185,749	+40.0%
	Build	260,115	

Forecasts based on 'without MAR' assumptions

Table B8.16
Volume to Capacity Ratio (VCR) categories of road performance levels

Colour code in Figures B8.9 to B8.11	VCR	Description of road performance conditions
	≤0.60	Free flow
	>0.60 – 0.80	Stable flow (acceptable/ satisfactory performance)
	>0.80 – 0.90	Approaching unstable to unstable flow (tolerable to intolerable)
	>1.00	Forced flow (congested)

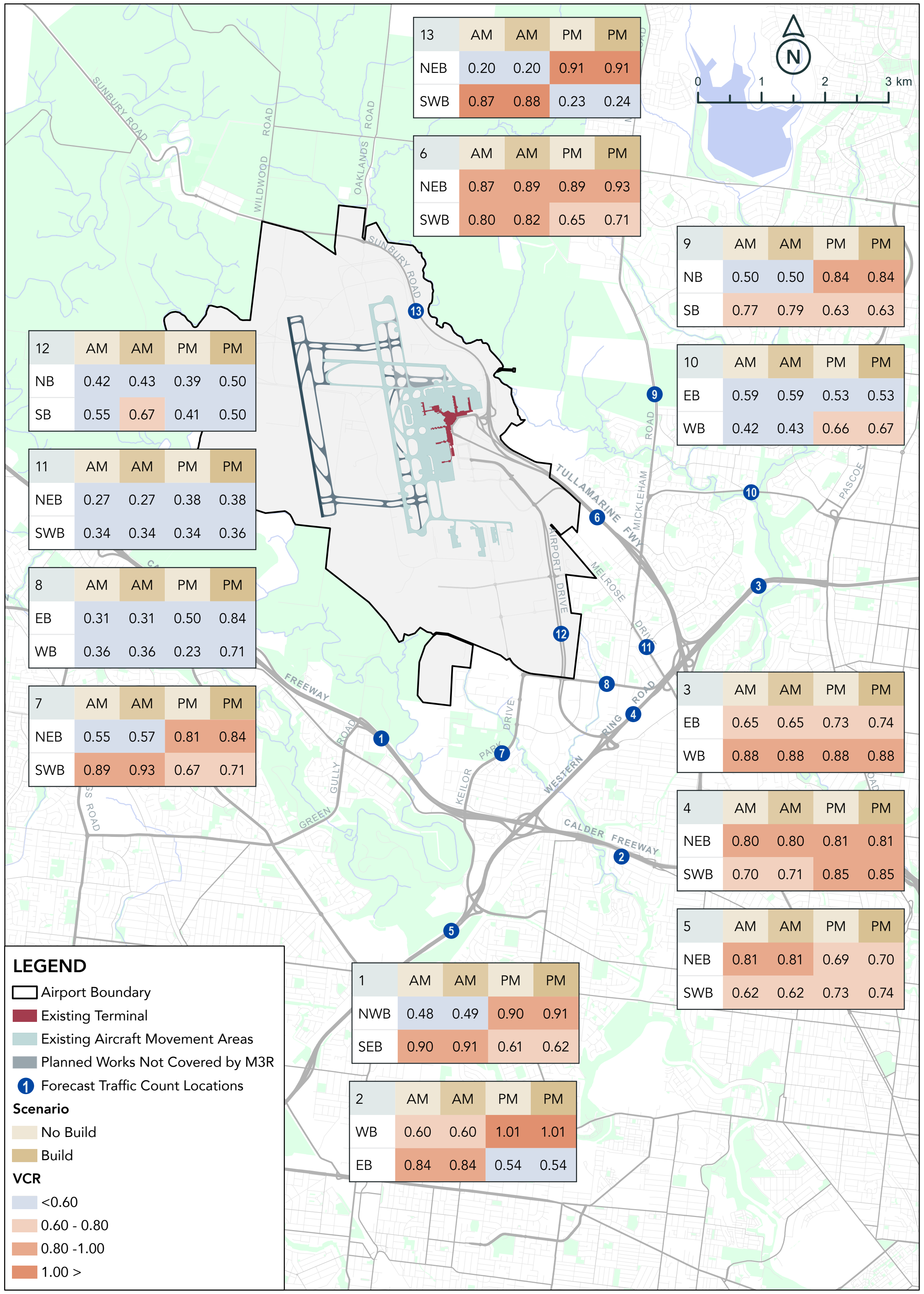
Figure B8.9
Difference in design day VCR between 2026 Build versus No Build



Each road is reported for each direction of traffic flow; abbreviations as follows:

NB North-bound; SB South-bound; EB East-bound; WB West-bound; NEB Northeast-bound; SEB Southeast-bound; NWB Northwest-bound; SWB Southwest-bound

Figure B8.10
Difference in design day VCR between 2031 Build versus No Build



13	AM	AM	PM	PM
NEB	0.20	0.20	0.91	0.91
SWB	0.87	0.88	0.23	0.24

6	AM	AM	PM	PM
NEB	0.87	0.89	0.89	0.93
SWB	0.80	0.82	0.65	0.71

9	AM	AM	PM	PM
NB	0.50	0.50	0.84	0.84
SB	0.77	0.79	0.63	0.63

10	AM	AM	PM	PM
EB	0.59	0.59	0.53	0.53
WB	0.42	0.43	0.66	0.67

12	AM	AM	PM	PM
NB	0.42	0.43	0.39	0.50
SB	0.55	0.67	0.41	0.50

11	AM	AM	PM	PM
NEB	0.27	0.27	0.38	0.38
SWB	0.34	0.34	0.34	0.36

8	AM	AM	PM	PM
EB	0.31	0.31	0.50	0.84
WB	0.36	0.36	0.23	0.71

7	AM	AM	PM	PM
NEB	0.55	0.57	0.81	0.84
SWB	0.89	0.93	0.67	0.71

3	AM	AM	PM	PM
EB	0.65	0.65	0.73	0.74
WB	0.88	0.88	0.88	0.88

4	AM	AM	PM	PM
NEB	0.80	0.80	0.81	0.81
SWB	0.70	0.71	0.85	0.85

5	AM	AM	PM	PM
NEB	0.81	0.81	0.69	0.70
SWB	0.62	0.62	0.73	0.74

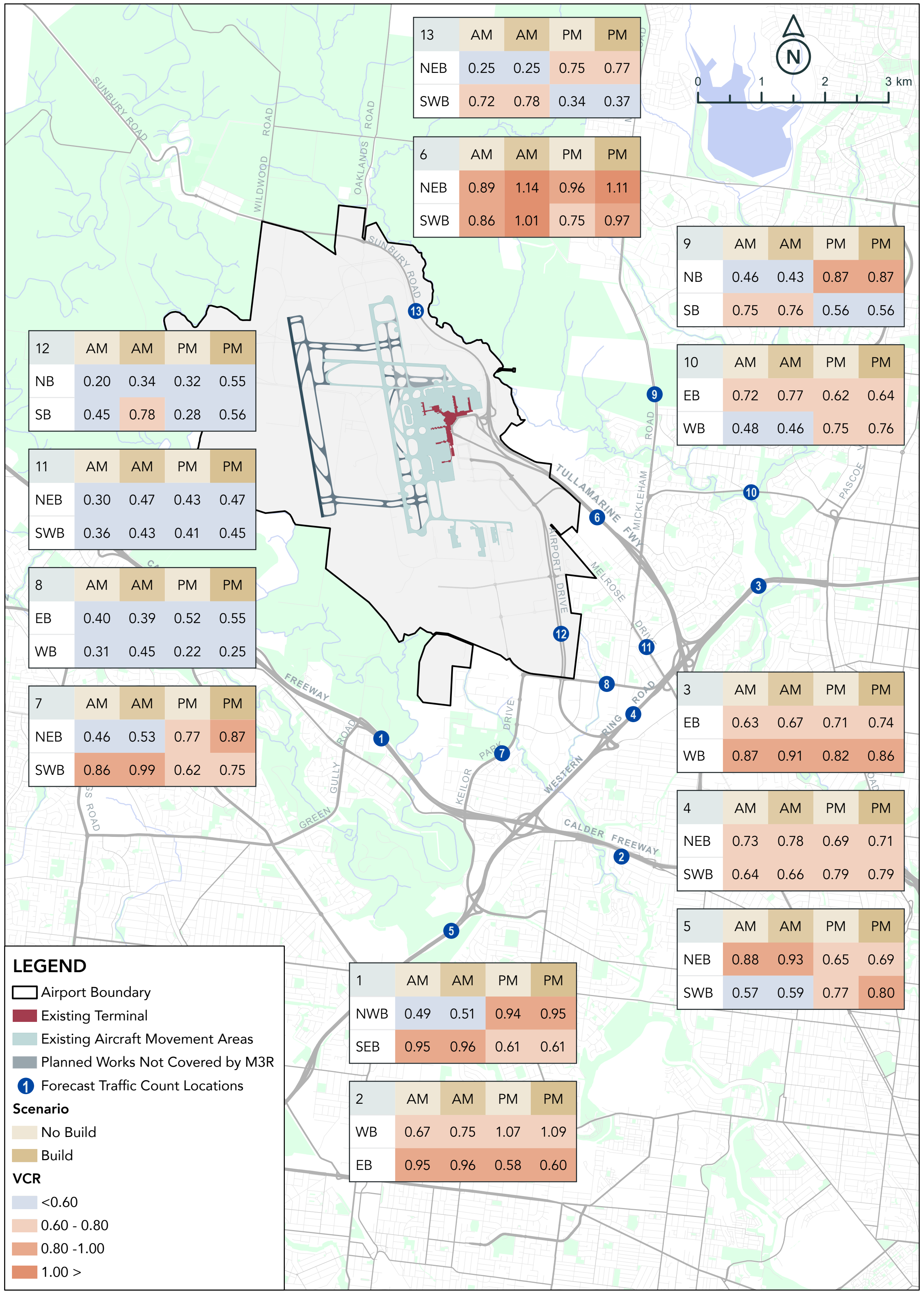
1	AM	AM	PM	PM
NWB	0.48	0.49	0.90	0.91
SEB	0.90	0.91	0.61	0.62

2	AM	AM	PM	PM
WB	0.60	0.60	1.01	1.01
EB	0.84	0.84	0.54	0.54

Each road is reported for each direction of traffic flow; abbreviations as follows:

NB North-bound EB East-bound NEB Northeast-bound NWB Northwest-bound
SB South-bound WB West-bound SEB Southeast-bound SWB Southwest-bound

Figure B8.11
Difference in design day VCR between 2046 Build versus No Build



13	AM	AM	PM	PM
NEB	0.25	0.25	0.75	0.77
SWB	0.72	0.78	0.34	0.37

6	AM	AM	PM	PM
NEB	0.89	1.14	0.96	1.11
SWB	0.86	1.01	0.75	0.97

9	AM	AM	PM	PM
NB	0.46	0.43	0.87	0.87
SB	0.75	0.76	0.56	0.56

10	AM	AM	PM	PM
EB	0.72	0.77	0.62	0.64
WB	0.48	0.46	0.75	0.76

12	AM	AM	PM	PM
NB	0.20	0.34	0.32	0.55
SB	0.45	0.78	0.28	0.56

11	AM	AM	PM	PM
NEB	0.30	0.47	0.43	0.47
SWB	0.36	0.43	0.41	0.45

8	AM	AM	PM	PM
EB	0.40	0.39	0.52	0.55
WB	0.31	0.45	0.22	0.25

7	AM	AM	PM	PM
NEB	0.46	0.53	0.77	0.87
SWB	0.86	0.99	0.62	0.75

3	AM	AM	PM	PM
EB	0.63	0.67	0.71	0.74
WB	0.87	0.91	0.82	0.86

4	AM	AM	PM	PM
NEB	0.73	0.78	0.69	0.71
SWB	0.64	0.66	0.79	0.79

5	AM	AM	PM	PM
NEB	0.88	0.93	0.65	0.69
SWB	0.57	0.59	0.77	0.80

1	AM	AM	PM	PM
NWB	0.49	0.51	0.94	0.95
SEB	0.95	0.96	0.61	0.61

2	AM	AM	PM	PM
WB	0.67	0.75	1.07	1.09
EB	0.95	0.96	0.58	0.60

Each road is reported for each direction of traffic flow; abbreviations as follows:

NB North-bound EB East-bound NEB Northeast-bound NWB Northwest-bound
SB South-bound WB West-bound SEB Southeast-bound SWB Southwest-bound

2026 performance

As shown in Figure B8.9, the 2026 analysis illustrates there is generally no difference in performance between Build and No Build scenarios. This corresponds with the very minor changes in traffic flow volumes between scenarios for this year.

The 2026 results show that several roads surrounding the airport would experience heavy congestion in the peak direction of travel (i.e. VCR between 0.8 and 1.0). These include several freeway segments, Mickleham Road (north of Broadmeadows Road) and Keilor Park Drive. Results are shown for both Build and No Build scenarios.

2031 performance

Based on the 2031 analysis of road performance levels shown in Figure B8.10, it is demonstrated that the Build scenario would not result in any major impact to performance levels on any roads, compared to the No Build scenario. No major increases in VCR were observed between Build and No Build scenarios. Slight increases in VCR (around +0.1) were observed on Airport Drive, however flow conditions would remain free-flow or stable.

Similar to the opening year results, the 2031 results continue to show several roads experiencing heavy congestion in the peak direction of travel (i.e. VCR between 0.8 and 1.0) on the same roads. These results are shown for both Build and No Build scenarios.

2046 performance

Based on the 2046 analysis of road performance levels shown in Figure B8.11, it is shown that the Build scenario would result in some deterioration in performance levels, compared to the No Build scenario. This is observed on road corridors closest to the airport, particularly those closest to Airport Drive:

- Slight increases in VCR (i.e. +0.1 to +0.2), resulting from the Build scenario, were observed on the following roads:
  - Tullamarine Freeway, north of Mickleham Road – although in the No Build scenario this corridor is already at unstable flow levels
  - Keilor Park Drive, south of Tullamarine Park Drive – the impacts to flows were noted only in the AM southbound and PM northbound directions
  - Sharps Road, west of Melrose Drive – however the increased VCR would not impact the road's performance, which would remain at stable levels
  - Melrose Drive, south of Mickleham Road – however the increased VCR would not impact the road's performance, which would remain at stable levels
- Airport Drive, north of Sharps Road, is estimated to experience larger increases in VCR, of around +0.2 to +0.3, as a result of the Build scenario – however the results show this would not impact the road's performance, which would remain at stable levels (likely due to the corridor's capacity increasing by 2046, i.e. additional lane each direction).

The implications of these impacts are that M3R would lead to some increases in travel time and delay on roads closest to the airport. The impacts to users on the arterial roads noted above would be generally low, given that the conditions generally stay in the same performance levels (with just slightly worse conditions). Finally, impacts to Tullamarine Freeway users are considered to be somewhat overestimated in this analysis, given that practically the corridor operations would be managed using VicRoads' Managed Motorways technology to manage traffic flows (such as through variable speed limit signage) which would minimise unstable flow conditions. Nevertheless, a modest increase in travel time to and from the airport could be expected for Tullamarine Freeway users, as a result of M3R.

Summary of project impacts on external road network

Table B8.17 presents a summary of the impact of the Build versus No Build scenario on road traffic operating conditions for the broader network, based on the parameters outlined in this assessment. The data indicates the impacts of the Build scenario are negligible in 2026, worsening slightly by 2031, and then progressively showing more significant impacts by 2046 – although this is dependent on location, with Airport Drive shown to experience disproportionate impacts compared to other surrounding roads.

Table B8.17
Impact assessment summary (without mitigation) – external road traffic conditions

Assessment factor	2026	2031	2046
AM peak traffic volume	Negligible	Minor	Minor to High
PM peak traffic volume	Negligible	Minor	Minor to High
Daily traffic volume	Negligible	Minor	Minor to High
AM and PM peak performance	Negligible	Negligible	Minor to Moderate
Overall assessment	**Negligible**	**Minor**	**Minor to High**

Overall, on a representative busy day it is expected that, without mitigation measures, the impact on the broader road network operating conditions due to implementation of M3R will be:

- Negligible impact in 2026
- Minor adverse impact in 2031
- Up to high adverse impact in 2046 (depending on location/road).

B8.6.2.4
Performance assessment – internal road network

The performance of the airport internal road network was determined using results from microsimulation modelling (noting that strategic modelling is unsuitable for measuring road performance of a small area). Analysis was undertaken for the entire forecourt and landside area (excluding the Business Park). The model area also includes the Tullamarine Freeway (around two kilometres either side of the terminal precinct). It includes the Elevated Roads Project Stages 1 and 2, although it does not include the north-facing ramps (as outlined in Section B8.2.4.3). As such microsimulation was unable to be completed for 2046 (as there is no design) – impacts for this year are broad estimates only. The reported metrics include average speed for travelling throughout the model network, and queue lengths on key access roads. These outputs are considered sufficient to understand future performance of the internal road network. Results are for AM and PM two-hour peak periods, covering short-to-medium term scenarios.

Average speed of traffic through the internal network

For context, under existing conditions (measured at 2018 for the microsimulation modelling) the analysis outputs showed an average speed of 45 kilometres per hour during the AM-peak period and 44 kilometres per hour during the PM-peak period.

At M3R opening year, for the Build scenario the outputs showed an average speed of 41 kilometres per hour during the AM peak period, and 40 kilometres per hour during the PM peak period. For the No Build scenario, similar outcomes could be expected (given the limited change in traffic flows for this year).

Five years after M3R opening, for the Build scenario the outputs showed an average speed of 37 kilometres per hour during the AM-peak period, and 39 kilometres per hour during the PM-peak period. For the No Build scenario, the average speed is expected to slightly improve, given the lower passenger demand for this year – in the order of five to ten per cent higher average speed.

By 2046, average speeds for the Build scenario are estimated to deteriorate to a noticeably lower speed (25–30 kilometres per hour). For the No Build scenario, the average speed is expected to be moderately better (35–40 kilometres per hour).

These findings indicate that M3R could result in slower average speeds (at around five to eight kilometres per hour slower) when compared to existing conditions. The Build scenario results in slightly slower average speeds compared to the No Build scenario. However, with traffic volumes increasing by around 30 per cent during this time, the comparatively low reduction in average speed is considered a good reflection of the additional road capacity in the internal road network resulting from the Elevated Roads Project (i.e. without this project the network performance would be even slower). The implication of these slower speeds is slightly longer travel times for traffic travelling through the airport roads.

Traffic queue lengths on key access roads

For context, under existing conditions (as in 2018) the most significant traffic queue is airport-bound traffic on Terminal Drive, with queues of 1,100 metres extending from the ground forecourt. This queue length generally matches the storage capacity of the Terminal Drive freeway exit ramp (meaning that further increases to this queue would have the undesirable result of traffic queues extending onto the Tullamarine Freeway).

At M3R opening year, for the Build scenario the outputs showed queue lengths on Terminal Drive extending only 200 metres. For the No Build scenario, similar outcomes could be expected (given the limited change in traffic flows for this year). The substantial reduction in traffic queues is attributed to the additional road infrastructure and increased capacity from the Elevated Roads Project.

Five years after M3R opening, for the Build scenario the outputs showed queue lengths on Terminal Drive extending around 350 metres. For the No Build scenario, the queue lengths could be expected to be slightly shorter (in the order of 30 per cent), given the lower passenger demand for this year.

Although traffic flows increase as a result of M3R, impacts to the airport internal road network are effectively mitigated as a result of the Elevated Roads Project (which redistributes traffic from the surface road network onto the elevated road links). While some queues are expected on the elevated road links (for traffic travelling to the new drop-off/pick-up facilities), the analysis outputs show these would be generally less than around 300 metres, which is within the road link's storage capacity of approximately 450 metres.

By 2046, queue lengths are broadly estimated to remain within storage capacity limits for both Build and No Build scenarios.

Summary of internal road network performance impacts

Overall, the principal finding of this performance assessment is that M3R is not expected to result in negative impacts to the internal road network which would then impact the external road network (i.e. traffic queues extending from Terminal Drive onto the Tullamarine Freeway).

In addition, it should be noted that, while increased traffic flows from passenger growth may result in slightly slower travel times, there are other benefits, mainly result from the Elevated Roads Project. For example, the redistribution of traffic away from the surface road network and forecourt will enable smooth travel for buses, which will remain in the forecourt.

Therefore, on a representative busy day it is expected that, without mitigation measures, the impact on internal road network operating conditions from the implementation of M3R will be:

- Negligible impact in 2026
- Minor adverse impact in 2031
- Moderate adverse impact in 2046.

B8.6.2.5
Public transport assessment

Public transport impacts were assessed by considering the changes in public transport trip demands between the Build and the No Build scenarios for the M3R planning assessment years (2026, 2031 and 2046).

As noted earlier, the analysis is based on the current SkyBus and PTV bus service levels (i.e. they are assumed to remain unchanged in all future years) and default public transport network changes in VITM. A summary of the changes in public transport trips as a result of M3R is set out in **Table B8.18**.

The results show that additional patronage is attracted to public transport when comparing the Build to the No Build scenarios, particularly in later years where the number of public transport trips increases by more than one-third under the Build scenario. Notwithstanding this increase in absolute trip numbers, it is noted that the overall share of travel by public transport increases only marginally over time. It is also noted that the results are broadly consistent with existing public transport mode share (outlined in **Section B8.5.4**); although, as stated earlier, modelled public transport does not include all existing bus services, such as privately-operated regional shuttles.

Nevertheless, the results represent a considerable increase in ridership levels. Existing public transport services (including SkyBus) are unlikely to be able to accommodate this increased demand without a significant increase in service capacity and/or service frequency. The implications of the increased public-transport trips (without mitigation) could be expected to include issues such as increased crowding at bus stops and on-board buses, resulting in longer dwell times (during boarding and alighting) which could impact travel time and reliability. Overall, no delays are expected when travelling via the airport road network – this is largely attributable to the outcomes of the Elevated Roads Project, which provides substantial improvements to bus travel time and reliability by removing drop-off/pick-up traffic from the surface road network (resulting in less traffic congestion in the forecourt).

Some caution should be exercised in the interpretation of these results, as VITM has some limitations in the way airport trips' mode choice is calculated. The most significant limitation is that the relative attractiveness of a public transport trip to and from the airport is based on the average daily time and cost relative to a car trip, rather than the time and cost during the different time periods. This has the effect of making the modelled mode share less sensitive to increasing traffic congestion in future years, when increasing car travel times are likely to increase the diversion of car trips to public transport, particularly during peak periods. This suggests that the number of public transport trips and the public transport mode share may be higher than estimated by the modelling.

Overall, on a representative busy day it is expected that, without mitigation measures, the impact on public transport operating conditions from the implementation of M3R will be:

- Negligible impact in 2026
- Minor adverse impact in 2031
- Moderate adverse impact in 2046.

Table B8.18
Daily public transport trips to airport – Build vs No Build

Year	Scenario	No. of PT trips	PT mode share	Increase in PT trips (Build compared to No Build)
2026	No Build	29,751	16.4%	+2.7%
	Build	30,990	16.0%	
2031	No Build	33,783	17.0%	+8.4%
	Build	37,099	16.8%	
2046	No Build	39,499	17.5%	+34.7%
	Build	55,247	17.5%	

Forecasts based on 'without MAR' assumptions

B8.6.2.6
Active transport assessment

The VITM assessment does not include any specific analysis of pedestrian or bicycle riding demands, as such a quantitative assessment cannot be made of the impacts of M3R on active transport.

In general, it could be expected that M3R will result in an increase in demand for bicycle-riding trips to the airport. As this increase is coming from a very low base, it should not result in any crowding issues. However, it may result in increased demand for bicycle parking and end-of-trip facilities – particularly for employees. Where such facilities are limited, the increased demand and limited facilities could risk discouraging bicycle-riding travel.

In later years, the increased number of people accessing the forecourt and ground-transport facilities could result in increased crowding during peak demand periods. Any high-demand locations could experience delays for users, without further management or additional facilities.

Overall, on a representative busy day it is expected that, without mitigation measures, the impact on active transport from the implementation of M3R will be:

- Negligible impact in 2026
- Negligible impact in 2031
- Minor adverse impact in 2046.

B8.7
AVOIDANCE, MANAGEMENT AND MITIGATION MEASURES

The transport impact assessment indicates M3R will result in some construction impacts, followed by ongoing operational impacts, which need to be planned for.

B8.7.1
Construction management and mitigation measures

A CTMP will be prepared in advance of the construction works, to provide greater clarity on the form and scale of the construction traffic, including the truck fleet that will bring plant and materials to and from the M3R works site. The CTMP will confirm access arrangements, timeframes, truck route haulage plans, and traffic analysis of the access points to the main roads adjacent to the airport site and any other relevant intersections. The CTMP will also include management/mitigation measures to minimise the impact of any truck movements to and from the construction site that occur during peak periods.

On this basis it is expected that the scale of the construction activity will be able to be managed and mitigated to the extent that it can be largely accommodated within the capacity of the existing networks with 'minor' adverse impact (see also **Chapter A5: Project Construction**).

B8.7.2
Operations management and mitigation measures

B8.7.2.1
Road network

The operational impact analysis has indicated that the growth associated with the Build scenario, in comparison to the No Build scenario, will have negligible impact in the early years of the assessment period. By 2031, some elements of the road network could be approaching capacity limits (under both Build and No Build scenarios), potentially resulting in some operational challenges (e.g. Tullamarine Freeway northbound traffic flows during peak periods). As M3R allows passenger growth to continue the additional traffic flows could exacerbate these operational challenges and result in 'minor' to 'high' adverse impacts (depending on location) if not addressed.

An important road link between the external network and the airport is the Tullamarine Freeway. The transport modelling shows that, under both the Build and No Build scenarios, the Tullamarine Freeway peak-hour volumes are forecast to be approaching or exceeding the corridor capacity limits. While these network conditions are partly attributable to passenger growth (with or without M3R), they are also attributable to population and employment growth in the northern and north-western suburbs of Melbourne. As such, any need for further freeway expansions would not be solely attributable to M3R. Nevertheless, Melbourne Airport will monitor the traffic growth over the forecast period and engage with DoT (and other Victorian Government agencies) to support infrastructure benefiting airport growth and nearby development zones. In the longer term, new road projects such as OMR and MAL will reduce the reliance on the Tullamarine Freeway as the critical access route to the terminals.

Any impacts of M3R on the external road network will to some extent be managed through a coordinated network of Intelligent Transport Systems (ITS) infrastructure, particularly within the airport internal network. Melbourne Airport proposes to work with DoT to establish such ITS infrastructure as part of the Elevated Roads Project, and have it directly connected to DoT traffic-management centres. This could be used to integrate with DoT's Managed Motorways system to assist in demand management of traffic flows on the freeway network during peak demand periods.

Regarding the airport internal road network, the delivery of the Elevated Roads Project will mitigate the impacts of increased traffic volumes, particularly under the Build scenario. This additional road infrastructure will ensure traffic queues do not extend onto the Tullamarine Freeway, and provides capacity to accommodate increased drop-off and pick-up activity which will occur under the Build scenario. It also avoids any delays to bus travel time through the internal road network. As stated earlier, Stages 1 and 2 of the Elevated Roads Project is the subject of separate MDPs. In the longer term, the proposed north-facing ramps will functionally integrate with the enhanced infrastructure from OMR and MAL, forming complementary links.

B8.7.2.2
Public transport

The transport modelling shows that by 2046 the Build scenario will result in 35 per cent more public transport trips to and from the airport (under 'without MAR' assumptions) compared to the No Build scenario. To mitigate the impacts of M3R on the public transport network, Melbourne Airport will work with DoT and bus operators to improve network coverage, service frequencies and operating spans to meet the expected future demand.

While the need for the MAR is not attributable to M3R, Melbourne Airport strongly supports a rail link to the airport to facilitate the airport's growth and reduce reliance on the road network. Melbourne Airport is currently working with the Victorian and Commonwealth Governments to ensure the needs of all airport users are appropriately considered.

B8.7.2.3
Summary

The implementation of these proposed improvements can be expected to mitigate many of the impacts of M3R. In summary the operational mitigation works will include:

- Work with DoT in the establishment of a coordinated network of ITS infrastructure within the airport internal network, which is directly connected to DoT traffic management centres including the Managed Motorways system (this will be stablished as part of the Elevated Roads Project)
- Coordinate the delivery of future internal road network infrastructure projects, to ensure they functionally integrate with external road network enhancements, particularly the proposed north-facing ramps and OMR/MAL projects
- Work with DoT and bus operators to improve on-road public transport in line with increased passenger growth.

To accommodate the overall expected growth of the airport (under both the Build and No Build scenarios) Melbourne Airport will also:

- Work with DoT to monitor and review traffic growth on the Tullamarine Freeway over the forecast period, so that infrastructure to support aviation growth and residential development can be delivered in a timely manner
- Work with the Victorian and Commonwealth Governments to develop the MAR proposal to ensure a viable and attractive rail solution is delivered that can reduce congestion levels on the road network.

More details on Melbourne Airport's ground transport proposals are provided in the *2018 Melbourne Airport Master Plan* (and proposed 2022 Master Plan).

B8.7.3
Management

The ongoing management of airport operations involves regular liaison with DoT and other relevant authorities in relation to surface access arrangements and improvements. It is relevant and appropriate that these arrangements continue through the process for implementation and operation of M3R.

The detailed CTMP will require engagement with DoT to confirm the location and format of the construction access arrangements on Sunbury Road. Discussions will also be required with DoT, Hume City Council and Brimbank City Council in relation to southern access route options through the road network.

Management of construction traffic will focus on minimising the impacts of the truck traffic operations. The CTMP will include operating plans and management measures to minimise any potential impact on the external road network.

B8.7.4
Monitoring

The modelling tools used in this impact assessment are based on a series of assumptions and projections of growth that are expected to be achieved in the future.

Growth projections will be monitored against actual outcomes and adjustments made to the planning of the airport as necessary. As APAM is required to review its Master Plan every five years, this is a suitable mechanism to review and update the surface transport networks to accommodate future demands and changes in travel trends.

Construction truck traffic will be monitored during the construction of M3R to ensure truck activity is not resulting in any unforeseen impacts on the surrounding road network. For example, it could be expected that contractors would monitor construction traffic volumes at access points to the works site.

Following the completion of M3R, APAM will continue to monitor traffic operations in and around the airport. In this way, changing trends will be identified and addressed efficiently and effectively.

B8.7.5
Significance assessment

The identified mitigation measures, together with the management and monitoring arrangements outlined above, will result in an effective strategy to manage the impacts of M3R-generated traffic and potentially improve the level of impact identified in this assessment.

Overall, the assessment of the construction of M3R indicates construction traffic will have a 'negligible' to 'minor' adverse impact on the transport network. The CTMP will be developed to detail the construction activity and management/mitigation measures to minimise potential impacts. These include identifying any upgrades to the road network that may be required such as widening, pavement strengthening or rehabilitation works.

The assessment of the future operating conditions with M3R and the implementation of suitable mitigation measures indicate that overall there will be 'minor' to 'moderate' adverse impacts on the transport network. The progressive upgrades to the internal road network will increase capacity and optimise traffic flows within the airport. These works can be expected to manage the increased demand anticipated by M3R, and mitigate negative impacts.

A summary of the pre-mitigation and post-mitigation assessment of ground transport impacts is shown in Table B8.19.

Table B8.19
Impact assessment and mitigation measures summary

Environment aspect & baseline condition	Assessment of original impact: Original Impact	Mitigation inherent in design/practice	Significance: Duration	Severity	Likelihood	Impact	Mitigation and/or management measures	Assessment of residual impact: Residual Impact	Significance: Duration	Severity	Likelihood	Impact
Construction							**Construction (cont.)**					
Construction activity impact on the northern access routes Sunbury Road traffic volumes are around 23,000 vehicles per day (two-way), with heavy vehicles comprising 6–8%. Corridor has several roundabouts, with varying demands and turning movements.	Addition of 296 daily two way truck trips, which will increase Sunbury Road heavy vehicle volumes by up to 2% additional. Also construction workforce traffic, which should occur outside typical commuter peak periods.	Development of a CTMP to outline construction routes, traffic analysis and management measures.	Short Term	Minor	Almost Certain	Medium	Refinement and application of CTMP, detailed to include management measures to minimise the impact of truck traffic on the road network. Analysis of the access to Sunbury Road to determine optimal intersection configuration. Collaboration with DoT to achieve optimal outcomes.	The impact will be reduced by optimising the construction's northern access location, and effective measures to minimise impacts of truck traffic on the road network.	Short Term	Minor	Almost Certain	Medium
Construction activity impact on the southern access routes Arterial roads south of the construction site include Sharps Road and Keilor Park Drive (20,000–35,000 vehicles/day). Freeways include Calder Freeway and Western Ring Road (~100,000 vehicles/day). Area also includes local and collector roads.	Addition of 135 daily two-way truck trips. Spread across multiple access routes, this represents less than 1% increase in the current volumes on the arterial and freeway roads. Localised impacts to local/collector road network.	Development of a CTMP to outline construction routes, traffic analysis and management measures.	Short term	Minor	Almost certain	Medium	Refinement and application of CTMP, detailed to include management measures to minimise the impact of truck traffic on the external road network. Review of the need for localised improvements to local/collector roads to accommodate the increased truck flows. Collaboration with DoT and Local Government to achieve optimal outcomes.	Any adverse impacts should be reduced through the implementation of a CTMP that is focussed on the specific needs of the project.	Short-term	Minor	Almost certain	Medium
Construction activity impact on public transport Buses travel along Sunbury Road and through arterial network, but have limited exposure to the proposed construction access routes.	The only potential interface may be between buses and trucks on the arterial and motorway network.	Development of a CTMP to outline construction routes, and management measures.	Short term	Negligible	Possible	Negligible	Refinement and application of CTMP, detailed to outline interface between construction traffic and bus routes. Collaboration with DoT and Local Government to achieve optimal outcomes.	Any adverse impacts should be reduced through the implementation of a CTMP that is focussed on the specific needs of the project.	Short-term	Negligible	Possible	Negligible
Construction activity impacts on active transport Bicycle and pedestrian activity may occur on the local/collector road network, but there is limited exposure to the proposed construction access routes.	There will be little or no interface between the construction activity and active transport modes.	Development of a CTMP to outline construction routes, and management measures.	Short term	Negligible	Unlikely	Negligible	Refinement and application of CTMP, detailed to outline any interfaces with existing bicycle and pedestrian activity.	Any adverse impacts should be reduced through the implementation of a CTMP that is focussed on the specific needs of the project.	Short-term	Negligible	Unlikely	Negligible
Operation							**Operation (cont.)**					
External road network operations – 2031 Tullamarine Freeway 2031 daily traffic volumes (No Build): 90,000 northbound 86,000 southbound Heavy congestion in peak direction of travel. Airport Drive 2031 daily traffic volumes (No Build): 10,500 northbound 11,600 southbound Free-flow/stable conditions.	Build is forecast to increase daily traffic flows on the Tullamarine Freeway by around 5%, but performance analysis indicates this will not change congestion levels (VCR increases < 0.05). Daily traffic flows on Airport Drive to increase by around 28%, however flow conditions would remain free-flow or stable.	In practice, Tullamarine Freeway operations are managed using DoT's 'Managed Motorways' technology. ITS infrastructure to be delivered as part of the Elevated Roads Project will enable a coordinated ITS network, connected to DoT traffic management centres, to assist in managing peak traffic conditions.	Medium term	Minor	Likely	Medium	Work with DoT in the establishment of a coordinated network of ITS infrastructure within the airport, connected to DoT traffic management centres. Work with the Victorian and Commonwealth Governments to develop the MAR proposal to ensure a viable and attractive rail solution is delivered that can reduce congestion levels on the road network.	The impact will be reduced through engagement with DoT regarding management of traffic flows on the freeway network. Implementation of MAR has potential to reduce reliance on car travel to the airport.	Medium term	Minor	Likely	Medium
External road network operations – 2046 By 2046, new road projects are expected to be complete (OMR, MAL and Bulla Bypass). Tullamarine Freeway 2046 daily traffic volumes (No Build): 102,000 northbound 97,000 southbound Heavy congestion in both directions. Airport Drive 2046 daily traffic volumes (No Build): 12,300 northbound 14,000 southbound Free-flow/stable conditions.	Build is forecast to increase daily traffic flows on the Tullamarine Freeway by around 20%, exceeding capacity limits. Airport Drive traffic flows to increase by around 80%, deteriorating performance (VCRs increases of 0.2 to 0.5). Other roads to also experience traffic flow increases of around 10–15% (Sharps Road, Keilor Park Drive, Melrose Drive) although resulting performance is not as concerning.	The OMR and MAL are likely to redistribute travel patterns, reducing reliance on the Tullamarine Freeway for travel to the airport. In practice, Tullamarine Freeway operations are managed using DoT's 'Managed Motorways' technology. Also, DoT has plans for further widening of the Tullamarine Freeway to 4-lanes each way, although there is no commitment to the timing.	Medium term	High	Likely	High	Work with DoT to monitor and review traffic growth on the Tullamarine Freeway over the forecast period, so that infrastructure to support aviation growth and residential development can be delivered in a timely manner Work with the Victorian and Commonwealth Governments to develop the MAR proposal to ensure a viable and attractive rail solution is delivered that can reduce congestion levels on the road network.	The impact will be reduced through close management and engagement with DoT and the Victorian Government in relation to further enhancements to the freeway network. Implementation of MAR has potential to reduce reliance on car travel to the airport.	Medium term	Moderate	Likely	Medium

Environment aspect & baseline condition (cont.)	Assessment of original impact (cont.)						Mitigation and/or management measures (cont.)	Assessment of residual impact (cont.)				
	Original Impact (cont.)	Mitigation inherent in design/practice (cont.)	Significance					Residual Impact (cont.)	Significance			
			Duration	Severity	Likelihood	Impact			Duration	Severity	Likelihood	Impact
Operation (cont.)							**Operation (cont.)**					
Internal road network operations – 2031 Completion of Elevated Roads Project stages 1 & 2. 2031 daily traffic flows to and from airport (No Build) is total 165,000 trips.	Build is forecast to result in an increase in daily traffic flows to the airport by 12%. Travel through the network will be slightly slower, however there is no concern of traffic queues extending outside of lane storage lengths.	Additional infrastructure from Elevated Roads Project provides capacity, resilience and flexibility to manage peak demands.	Medium term	Minor	Likely	Medium	Ongoing monitoring and management of ground transport operations to optimise throughputs.	Any adverse operational impact is predicted to be reduced through management of the network and planning of future expansions.	Medium term	Negligible	Likely	Negligible
Internal road network operations – 2046 Completion of additional network enhancements in accordance with Master Plans. 2046 daily traffic flows to and from airport (No Build) is total 185,000 trips.	Build is forecast to result in an increase in daily traffic flows to the airport by 40%. Travel through the network could be moderately slower, although traffic queues should remain within lane storage lengths.	Ongoing planning of ground transport facilities and operations to optimise delivery of new infrastructure, management measures and initiatives.	Medium term	Moderate	Likely	Medium	Coordinate the delivery of future internal road network infrastructure projects, to ensure they functionally integrate with external road network enhancements, particularly the proposed north-facing ramps and OMR/MAL projects.	The impact will be reduced through management of the network and delivery of future expansions.	Medium term	Minor	Likely	Medium
Public transport operations Completion of Elevated Roads Project stages 1 & 2 will redistribute dropoff/pick-up traffic away from the ground forecourt, enabling improved bus movements. Public transport daily trips increase from 30,000 to 40,000 under No Build.	Public transport demand to increase under Build, slightly in 2031 (8 per cent) but a more significant 35% increase in 2046 due to passenger growth. This could result in increased crowding at bus stops and on-board buses, increasing dwell times which could impact travel time and reliability.	Ongoing planning and monitoring of public transport operations and implementation of improvement measures to address issues.	Medium term	Moderate	Likely	Medium	Work with DoT and bus operators to improve on-road public transport in line with increased passenger growth. Work with the Victorian and Commonwealth Governments to develop the MAR proposal to ensure a viable and attractive rail solution is delivered that can reduce congestion levels on the road network.	The impact will be reduced through enhancements and expansions of public transport services to meet demand and improve travel time reliability.	Medium term	Minor	Likely	Medium
Active transport operations and safety Network and safety improvements for pedestrians and cyclists, in accordance with Master Plans.	Minimal impacts to pedestrian and cyclist activities, no impacts on pedestrian or cyclist facilities.	Ongoing planning of ground transport facilities to identify and optimise new infrastructure and management measures.	Medium term	Minor	Possible	Low	Ongoing monitoring and management of ground transport operations to identify pedestrian and cyclist needs, including any safety measures.	Any adverse operational impact is predicted to be reduced through planning for pedestrians and cyclists as part of road network upgrades.	Medium term	Negligible	Possible	Negligible

B8.8 CONCLUSION

B8.8.1 Construction phase assessment

The implementation of construction management mitigation measures, including the development of a CTMP, are considered to be effective in managing the construction traffic impacts.

The assessment of the construction of M3R indicates that construction traffic will have an overall negligible to minor adverse impact on the transport network.

B8.8.2 Operational phase assessment

The implementation of mitigation measures including ITS infrastructure and connectivity, and the delivery of internal airport road network projects, are considered to be effective in managing the adverse impacts of M3R. Ongoing monitoring of traffic growth on the Tullamarine Freeway will identify the need for further freeway enhancements to manage external network operations. On this basis, the impact of the operational phase is considered to be effectively mitigated and result in wider improvements.

Based on the expected implementation of the identified mitigation works, M3R will have an overall moderate to minor adverse impact on the surrounding transport network.

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Chapter B9 Ground-Based Noise and Vibration

Summary of key findings:

- The construction and operation of Melbourne Airport's Third Runway (M3R) will create different ground-based noise emissions during each phase.
- A detailed assessment has predicted the likely impacts of a worst-case scenario.
- Construction-noise impacts will be minimised by incorporating mitigation measures in the Construction Environmental Management Plan (CEMP).
- A small exceedance of operational noise objectives is predicted post opening of M3R with similar noise levels predicted in future scenarios.
- Vibration generated by construction activities is unlikely to exceed relevant criteria promulgated by contemporary guidelines. This is owing to the relatively large distances between vibration-generating activities and offsite receivers.

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B9.1
INTRODUCTION

This chapter addresses:

- Current ground-noise and vibration effects on the study area*
- Applicable legislation and policy requirements
- Potential impacts of M3R and associated assessment methodology and, where required, the measures to avoid, manage, mitigate and/or monitor these impacts.

*The study area is defined as an eight-kilometre radius from the airport that includes the closest "noise receivers" to M3R. It includes the full extent of predicted noise contours and is shown in **Figure B9.1**.*

B9.2
METHODOLOGY AND ASSUMPTIONS

This assessment has considered the following types and sources of noise and vibration during the construction and operation of M3R:

- Construction activities associated with the earthworks, pavement construction and associated infrastructure phases of M3R
- Existing ambient noise within the study area
- Surface access noise from road traffic associated with the airport, both now and in the future
- Ground-based aircraft movements: including aircraft on stand, aircraft taxiing to and from the runways, and routine engine testing in the designated areas.

Aircraft noise associated with aircraft operations from start of the take-off, to when the aircraft lands, is reported separately in **Chapter C4: Aircraft Noise and Vibration**.

The assessment of ground noise considers local circumstances and relevant guidance. This includes statutory and policy guidance issued by the Commonwealth and Victorian governments, and supporting guidance offered by national and international technical institutes (**Section B9.3**). The combined effects from ground noise and aircraft noise associated with the airport (i.e. the totality of ground-based noise and aircraft noise) are described in **Chapter C4: Aircraft Noise and Vibration**.

B9.2.1
Human response to noise

Excessive noise can interfere with speech communication, interrupt a wide range of different types of work (particularly activities requiring sustained concentration), disturb rest and relaxation, and (depending on the hours of operations) disrupt normal patterns of sleep. Continuous high noise levels for extended periods can also contribute to noise-induced hearing loss. Persistent lower noise levels outside residences can result in varying degrees of annoyance and "a feeling of displeasure" (Bergland et al, 1999).

Annoyance caused by noise is known to be affected by:

- Noise level and nature of noise: including whether the sound is constant, fluctuating, impulsive (causing a startle response), has low-frequency components (e.g. rumble/boom) or is high pitched (e.g. whine/whoosh)
- Occurrence of exposure: frequency of events and whether they are anticipated or randomly occur
- Time of day: can be influenced by acoustic factors (the relative level of background noise) and non-acoustic factors (the activities being disturbed and people's expectations of noise levels at different times).

While the 'loudness' of a noise is a purely subjective parameter, it is commonly accepted that a change in noise level of three decibels (dB(A)) is barely perceptible and that an increase or decrease of 10 dB(A) corresponds to a doubling or halving in perceived loudness respectively.

(These thresholds are derived from psychoacoustic testing.) A range of noise metrics (**Table B9.1**) is used to describe environmental noise. Some of these metrics have associated thresholds above which significant community effects are likely (WHO, 1999). These are generally associated with noise annoyance, although in recent years the health effects (other than sleep disturbance) of environmental noise are also a consideration and are considered in **Chapter D3: Health Impact**.

Table B9.1
Noise metrics

Symbol	Name	Description
$L_{Aeq(24h)}$	24-hour time average level	Average noise level across the entire day
$L_{A10(18h)}$	Daily noise level	Average of $L_{A10(h)}$ measurements between 0600-2200h – used to calculate road traffic noise
$L_{Aeq(15h)}$	Daytime noise level (also known as Ld)	Time average noise level across the day (0700-2200h)
$L_{Aeq(9h)}$	Night-time noise level (also known as Ln)	Time average noise level across the night (2200-0700h)
L_{AFmax}	Maximum noise level	Maximum instantaneous noise level in a given time interval
$L_{Aeq(15\ min)}$	15-minute average noise level	Time average noise level often used to describe construction and other forms of noise

At locations remote from the airport, noise generated by ground-based activities is typically much lower than airspace noise. The specific consideration of the health impacts, aside from annoyance, of ground-based sources is therefore excluded from the scope of this chapter.

B9.2.2
Human and structural response to vibration

Vibration is described as either 'transient' or 'continuous'. Transient vibration is temporarily sustained vibration that may be frequently repeated (e.g. impact piling). Continuous vibration is maintained for an indefinite period (e.g. drilling or tunnelling). Low and medium levels of vibration can be felt and may cause annoyance, particularly at night. Building fittings may also rattle and sensitive equipment may be affected. Higher levels of vibration may cause damage to buildings. Damage may be cosmetic, such as cracked plaster, but in rare cases structural damage may occur, such as the cracking of floor slabs or foundations.

Although the perception of vibration often leads to concerns of building damage, levels that can be felt are often an order of magnitude below the minimum threshold to cause damage to properties.

The impact of vibration depends on whether the vibration is continuous or transient. And because local geology has a significant effect on the transmission of vibration through the ground, the same activity at different locations may produce different levels of vibration. Furthermore, the type of building construction (including its foundations) affects the resulting internal vibration.

Vibration can be measured in several ways: as displacement, velocity or acceleration. For construction vibration, levels are typically presented in terms of the Peak Particle Velocity (PPV) in units of millimetres per second (mm/s).

B9.2.3
Methodology overview

The study area is defined as an eight-kilometre area from the boundary of the airport. It encompasses the closest noise receivers to M3R (**Section B9.4.1**) and captures the extent of the project's noise objectives. Outside the study area, noise is predicted to be below the noise objectives.

While it is expected that ground-based noise and vibration effects will be localised within three kilometres of the airport boundary, the extended area includes the principal surface access roads that extend beyond the immediate area surrounding the airport.

B9.2.3.1
Assessment scenarios

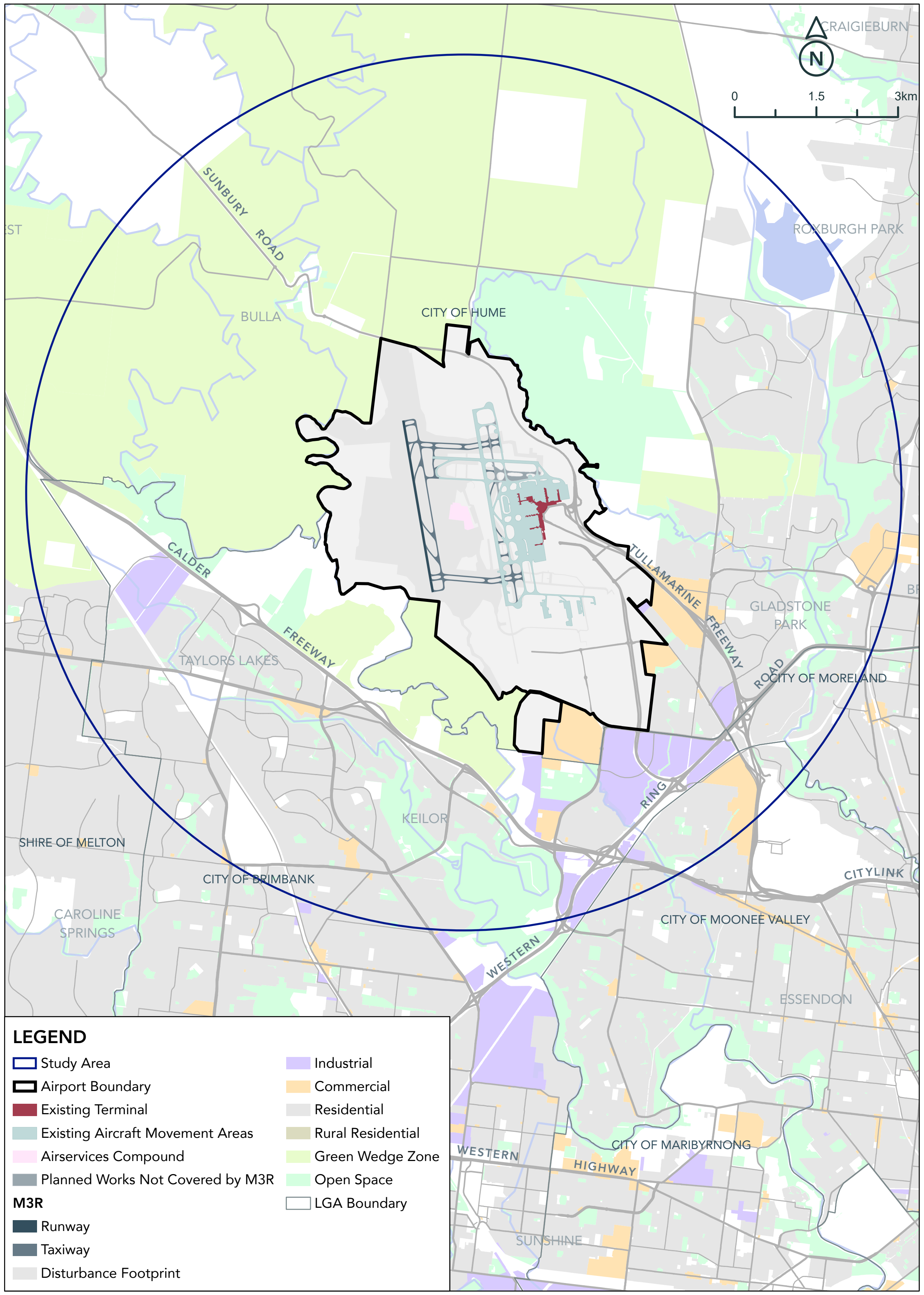
M3R has several defined assessment years which represent opening year and five and 20-years post-opening (**Table B9.2**) (**Chapter A8: Assessment and Approvals Process**).

The principal assessment scenario is a comparison of the forecast noise and vibration exposure before and shortly after opening the new infrastructure.

Table B9.2
M3R assessment years

Timeframe	Description	Year
Current	Existing runway configuration	2019
Opening year	Existing configuration with the M3R operational	2026
Five years	Five years from operational date	2031
20 years	Twenty years from operational date	2046

Figure B9.1
Ground-based noise study area



B9.3 STATUTORY AND POLICY REQUIREMENTS

Melbourne Airport is located on Commonwealth land. The Commonwealth Airports Act 1996 (Cth) (Airports Act) and Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) are the key pieces of legislation setting the regulatory framework for M3R and this assessment (see **Chapter A8: Assessment and Approvals Process** for details).

This assessment also takes guidance from Victorian environmental-planning instruments, policies and guidelines in developing appropriate noise and vibration objectives.

B9.3.1 Commonwealth

This section discusses Commonwealth requirements relevant to the assessment of ground-based noise and vibration from Melbourne Airport.

B9.3.1.1 Airports Act 1996

The preparation of a MDP as required by the Airports Act is the main approval document for M3R.

B9.3.1.2 Airports (Environment Protection) Regulations 1997

Supporting the Act are the Airports (Environment Protection) Regulations 1997 (Cth) (AEP Regulations). The latter provide a system of regulation and accountability for activities at airports that generate excessive noise and other environmental factors, and to promote improving environmental management practices.

Part 2 of Schedule 4 (Excessive Noise – Guidelines) of the AEP Regulations identifies the following sources of noise to be considered:

- Construction, maintenance or demolition of a building or other structure
- Road traffic on the site of an operator of an undertaking at an airport
- Rail traffic
- Ground-based engine testing of aircraft (including use of Auxiliary Power Units)
- Other sources: including aircraft refuelling and any activity not requiring an engine to be running (e.g. maintenance), operation of plant/machinery, passenger/freight movements to and from aircraft, and operation of fixed audible alarm or warning systems.

The Regulations explicitly do not apply to "noise generated by an aircraft in flight or when landing, taking off or taxiing at an airport".

The Regulations require that the operator of an undertaking at an airport take all reasonable and practicable measures:

- To prevent the generation of offensive noise from the undertaking; or
- If prevention is not reasonable or practicable – to minimise the generation of offensive noise from the undertaking.

In forming an opinion as to whether a noise is offensive, regard must be given to:

- The volume, tonality and impulsive character (if any) of the noise
- The time of day, and duration, of the noise
- Background noise levels at the time the noise is generated.

Schedule 4 (Excessive noise – Guidelines) of the Regulations provides guidance on what is considered excessive noise.

B9.3.2 Victorian Guidelines

The new Victorian environment protection legislation the Environment Protection Act 2017 as amended by the Environment Protection Amendment Act 2018 commenced on 1 July 2021. The new legislation is given effect by the Environment Protection Regulations 2021 (the new Regulations). The new Regulations replace the following legislative instruments:

- State Environment Protection Policy (Control of noise from Commerce, Industry and Trade), SEPP N-1
- State Environment Protection Policy (Control of Music Noise from Public Premises), SEPP N-2
- Environment Protection (Residential noise) Regulations 2018
- Environment Protection (Vehicle emissions) Regulations 2013.

The new Regulations set out a noise framework for residential, commercial, industrial and trade premises, as well as entertainment venues and events. The framework defines unreasonable noise, aggravated noise and other related concepts in relation to activities at these types of premises.

The new regulatory framework introduces a new reference document Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues (the Noise Protocol). The Noise Protocol outlines EPA's approach to the determination of noise limits and to the measurement, prediction and analysis of noise.

Noise limits established under the Noise Protocol take into account a range of factors including the existing noise levels and land zoning of noise sensitive receivers and their immediate surrounds. Establishing operational noise limits at noise sensitive receivers close to the airport boundary is difficult since the Noise Protocol does not account for Commonwealth land.

Similar to previous legislation, the new Regulations exclude noise from aircraft operations except for ground maintenance activities (i.e. engine testing). The new Regulations do not identify aircraft ground noise as a separate source of noise, nor do they include any guidance on noise limits for ground noise from aircraft; rather the new Regulations only discuss the noise from aircraft in flight. In this regard, the distinction between aircraft operations to which quantitative objectives of the Noise Protocol would be intended to apply, and those activities that would be exempt, is expected to mirror the AEP Regulations (i.e. objectives would not apply to noise generated by an aircraft in flight or when landing, taking off or taxiing at an airport). As such, "operational noise" is herein used to describe the airport's operations excluding these explicit aircraft operations.

B9.3.3
Guidance

This section sets out the relevant noise standards and guidance which are considered in assessing the impacts of M3R regarding ground noise and vibration.

The following guidelines and standards are applicable as they help to inform the approach to assessing ground-based noise and vibration. They are considered best practice:

- Noise limit and assessment protocol for the control of noise from commercial, industrial and trade premises and entertainment venues, Publication 1826.4 (May 2021)
- Civil construction, building and demolition guide, EPA Publication 1834, EPA Victoria (November 2020)
- World Health Organisation 'Guidelines for community noise' (1999)
- Australian/New Zealand Standard AS/NZS 2107:2016, Acoustics – Recommended design sound levels and reverberation times for building interiors
- Australian Standard AS 2021:2015, Acoustics – Aircraft noise intrusion – Building siting and construction
- Australian Standard AS 2436-2010, Guide to noise and vibration control on construction, demolition and maintenance sites
- British Standard BS 5228.1-2009, Code of practice for noise and vibration control on construction and open sites – Part 1: Noise
- British Standard BS 5228.2-2009, Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration
- German Standard DIN 4150-3:2016-12 Vibration in buildings – Part 3: Effects on structures
- Department of Transport (Welsh Office), Calculation of road traffic noise, HMSO, 1988.

B9.4
EXISTING CONDITIONS

The existing airport has two runways with four general approach/departure directions.

The airport terminals are to the east of the existing north-south runway (16L/34R).

Operational airport ground noise is generated by aircraft movements from and to the runways, for both scheduled passenger and freight traffic from the various terminals and freight areas.

A description of the existing airport is included in Chapter A1: Introduction.

B9.4.1
Sensitive receivers

Melbourne Airport is surrounded by sparse settlements made up of single dwellings, and the majority are a significant distance from the airport. The main residential areas are:

- Keilor Lodge, which is approximately 2.7 kilometres to the south-west of the airport
- Greenvale, which is approximately 2.7 kilometres to the north-east of the airport
- Westmeadows, which is approximately two kilometres to the east of the airport terminals.

Within each of these residential areas there is a number of schools, including early learning facilities, primary schools and colleges. There are several non-residential areas which would also be considered noise-sensitive, including two golf courses and the adjacent Woodlands Historic Park. While these open spaces have been rated against the relevant construction and operational criteria, the significance of the impacts has considered the transient usage of these spaces. While there are other non-residential locations (e.g. Organ Pipes National Park) their distance from the airport means noise levels are not significant. The assessment of potential impacts is reported in Section B9.6 (Construction) and Section B9.7 (Operation).

Table B9.3 summarises the main noise-sensitive receivers close to the airport (within a radius of 2.5 kilometres of the airport – see Figure B9.2). These receivers are indicative of single-receptor locations, and multiple locations representative of groups of receivers. Where road names are provided within the table, they indicate a cluster of dwellings.

Figure B9.2
Receiver locations

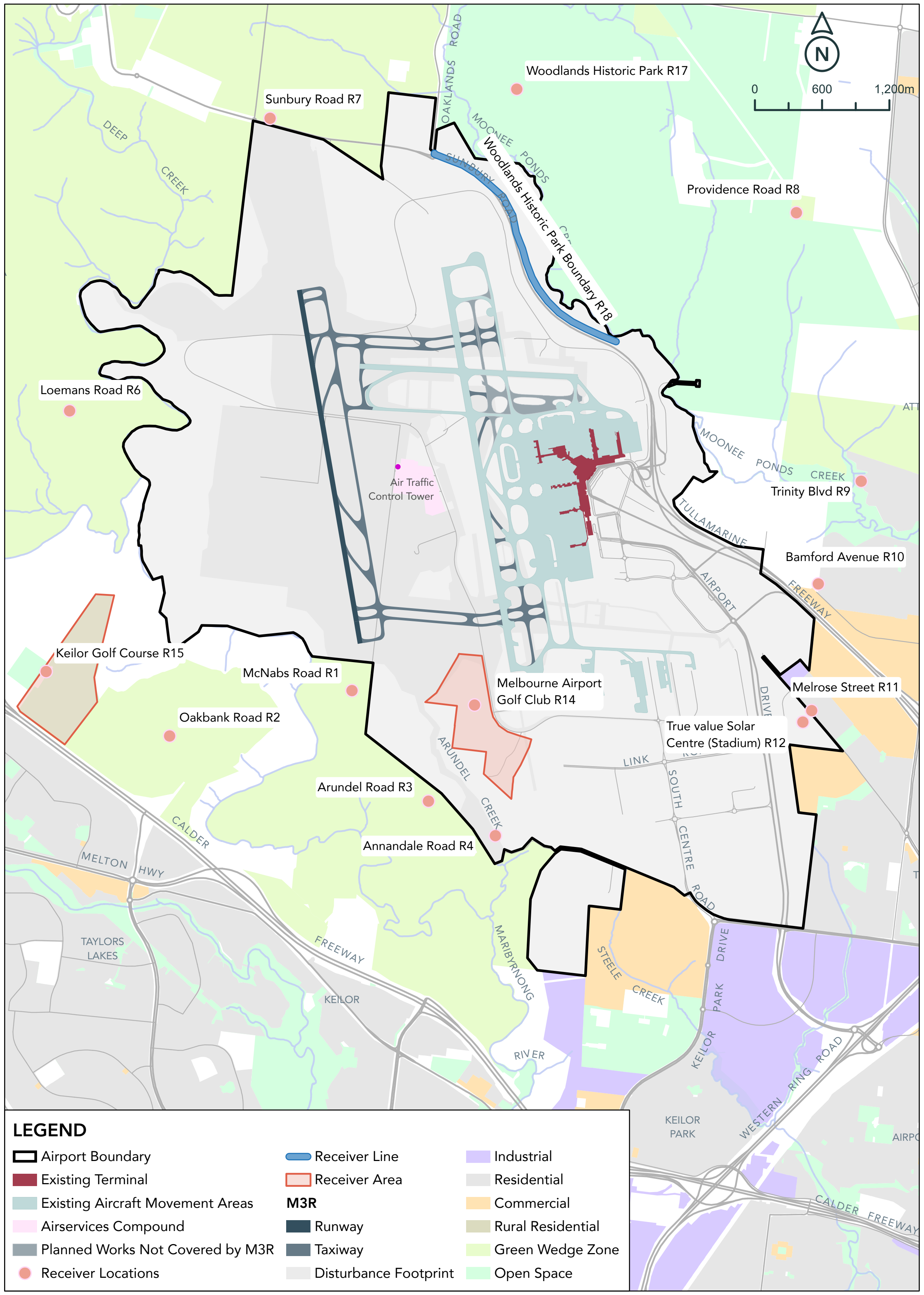


Table B9.3
Main receivers within 2.5 kilometres of airport boundary

Receiver	Address	Receiver type	Approximate distance to boundary of construction work site (m)
R1	McNabs Road	Residential	450[1]
R2	Oakbank Road	Residential	1,900
R3	Arundel Road	Residential	1,400
R4	Annandale Road	Residential	2,000
R5	Old Calder Highway	Residential	3,000
R6	Loemans Road	Residential	3,100
R7	Sunbury Road	Residential	1,000
R8	Providence Road	Residential	3,300
R9	Trinity Boulevard	Residential	3,600
R10	Bamford Avenue	Residential	3,100
R11	Melrose Drive	Residential	2,500
R12	True Value Solar Centre (stadium)	Recreational	2,500
R13	Melbourne Airport Golf Club (green)	Recreational	900
R14	Melbourne Airport Golf Club (clubhouse)	Recreational	1,400
R15	Keilor Golf Course (green)	Recreational	2,200
R16	Keilor Golf Course (clubhouse)	Recreational	2,400
R17	Woodlands Historic Park – main building	Recreational	2,400

1. An additional dwelling has recently been erected at 95-105 McNabs Road that is approximately 40 metres from the construction site. This building has occurred despite opposition by Melbourne Airport on the grounds of obstacle and noise impacts for its occupier. Without requisite planning approval it is therefore not explicitly considered in this impact assessment.

Table B9.4 provides an indication of the estimated noise environment for 2019 across the daytime and night-time periods respectively. Noise levels during the busy night-time hour are typically one to five dB(A) lower than during the day. The data only consider aircraft noise sources.

Table B9.4
Typical busy hour existing receiver noise levels 2019

Receiver	Address	L_{Aeq} dB(A)	
		Day (0700-2200)1	Night (2200-0700)2
R1	McNabs Road	50	47
R2	Oakbank Road	43	42
R3	Arundel Road	47	45
R4	Annandale Road	45	44
R5	Old Calder Highway	39	38
R6	Loemans Road	45	42
R7	Sunbury Road	48	45
R8	Providence Road	45	45
R9	Trinity Blvd	47	46
R10	Bamford Avenue	48	47
R11	Melrose Street	47	46
R12	True value Solar Centre (Stadium)	30	45
R13	Melbourne Airport Golf Club (green)	49	52
R14	Melbourne Airport Golf Club (club house)	46	47
R15	Keilor Golf Course (green)	47	40
R16	Keilor Golf Course (Club House)	48	42
R17	Woodlands Historic Park - main building	47	44

1. Typical busy hour daytime operations have been derived from historical data 0800-0900
2. Typical busy hour night-time operations have been derived from historical data 2300-0000

B9.4.2 Existing noise environment

Baseline noise levels vary across the study area, with those closest to the airport and main road infrastructure experiencing the highest noise levels. Long-term noise data covering several years, and shorter-term data over a few months, was acquired from Airservices Australia. The information provides an indication of the variation of noise levels across rural and urban locations, some of which are located near local roads. The Environmental Monitoring Unit (EMU) locations and primary noise sources are detailed in Table B9.5 together with the monitoring periods. A plan showing their location is included in Figure B9.3.

The existing noise environment data presented in this section was collected at the commencement of third-runway assessments in 2015. Ambient and background noise levels are unlikely to change significantly over time, except where a major development such as a new motorway or railway occurs. As such, the data remains relevant for the current assessment.

Project-specific existing noise data has also been measured for M3R and is discussed later in this section.

Table B9.5
ASA Environmental Monitoring Unit (EMU) locations

Environmental Monitoring Unit	Monitoring details	Noise environment
EMU 3 Keilor East (long-term)	Two-year period from 2013 until 2015	Road traffic and overflying aircraft
EMU 60 Keilor Bonfield (long-term)	Two-year period from 2013 until 2015	Calder Freeway and overflying aircraft
EMU 50 319 Keilor (short-term data available from mid-October 2014 only)	20 Oct 2014 until 1 Jan 2015	Road traffic, air handling equipment and aircraft
EMU 6 Coolaroo (long-term)	Two-year period from 2013 until 2015	
EMU 61 Thomastown (long-term)	Two-year period from 2013 until 2015	Road traffic and overflying aircraft
EMU 52 321 Diggers Rest (short-term – data available mid-October 2014 only)	20 Oct 2014 until 1 Jan 2015	Occasional road traffic and overflying traffic
EMU 64 Diggers Rest (long-term) – monitor decommissioned 20 May 2013	20 Oct 2014 until 1 Jan 2015	Road traffic and overflying aircraft

Airservices noise-monitoring information helps to illustrate the noise levels around the airport, covering several years' data. From this information, the study is able to observe the effects of variations in noise levels due to those factors that affect noise transmission such as weather.

Based on the entire dataset, background noise levels vary from around 25-40 dB(A) during the night-time up to 55-60 dB(A) during the daytime. Background noise levels during the evening are within the range 40-45 dB(A).

Analysis of EMU3 and EMU6 showed an elevation of background and ambient noise levels during the winter months, which is believed to be due to a combination of increased wind speeds (wind-induced noise) and potential elevation in noise levels from road traffic during wet road conditions. The data also showed aircraft (air noise) events as short-term elevations in the prevailing background noise levels.

Apart from M3R and the proposed Melbourne Airport Rail, there are no other known developments in the study area which would significantly alter the existing noise environment. The Melbourne Airport Rail link is likely to increase ambient noise levels in areas near to the railway, however background noise levels are unlikely to be affected. By omitting these increases in ambient noise, the current assessment may be considered slightly conservative. Changes in road traffic due to natural growth would also not result in any significant increase in the ambient and background noise environment as it would take at least a doubling in traffic volume to result in a perceptible change in the road traffic noise environment. Therefore, the data presented in this section can be assumed to be representative of the future noise environment.

The detailed noise data at each Airservices EMU site was analysed. It was found that EMU 3 – Keilor East displayed a typical seasonal and diurnal profile of the background noise data ($L_{A90,}$1hr). The data set was analysed in more detail to compute L_{A90} for each day, evening and night-time period. The data was analysed using a 25th percentile calculation of the $L_{A90,1hr}$ (i.e. the lowest 25 per cent of $L_{A90,1hr}$ measurements for each period, on each day). The approach is considered to be a conservative means of defining typical residential background noise levels. In summary, the background noise level during the day (0700-1800h) is approximately 45 dB(A), evening (1800-2200h) approximately 41 dB(A) and at night (2200-0700 h) approximately 39 dB(A).

Away from flight paths, selective noise monitoring was undertaken at key locations to establish the ambient noise levels during the day, evening and night periods. To enable a reliable assessment, monitoring was undertaken at eight locations to identify the source of noise and to enable a representative dataset for rating the existing noise environment and consequently M3R.

For each of the locations, monitoring was conducted when noise metrics had stabilised and during lulls in aircraft activity. Typically, this occurred within 30 minutes of arriving at the site and commencing observations. Monitoring was undertaken for at least 15 minutes; in most situations monitoring continued for longer periods.

Monitoring was conducted between 13 and 16 September 2015 at the locations detailed in Table B9.6. Noise monitoring was undertaken using a logging noise meter (Brüel & Kjær Type 2250) and the results are presented in Table B9.7. During the surveys the weather conditions were favourable for noise monitoring (albeit wind speeds were marginally higher than five metres per second during the day and evening periods).

Figure B9.3
Monitoring location plan – Airservices Environmental Monitoring Units

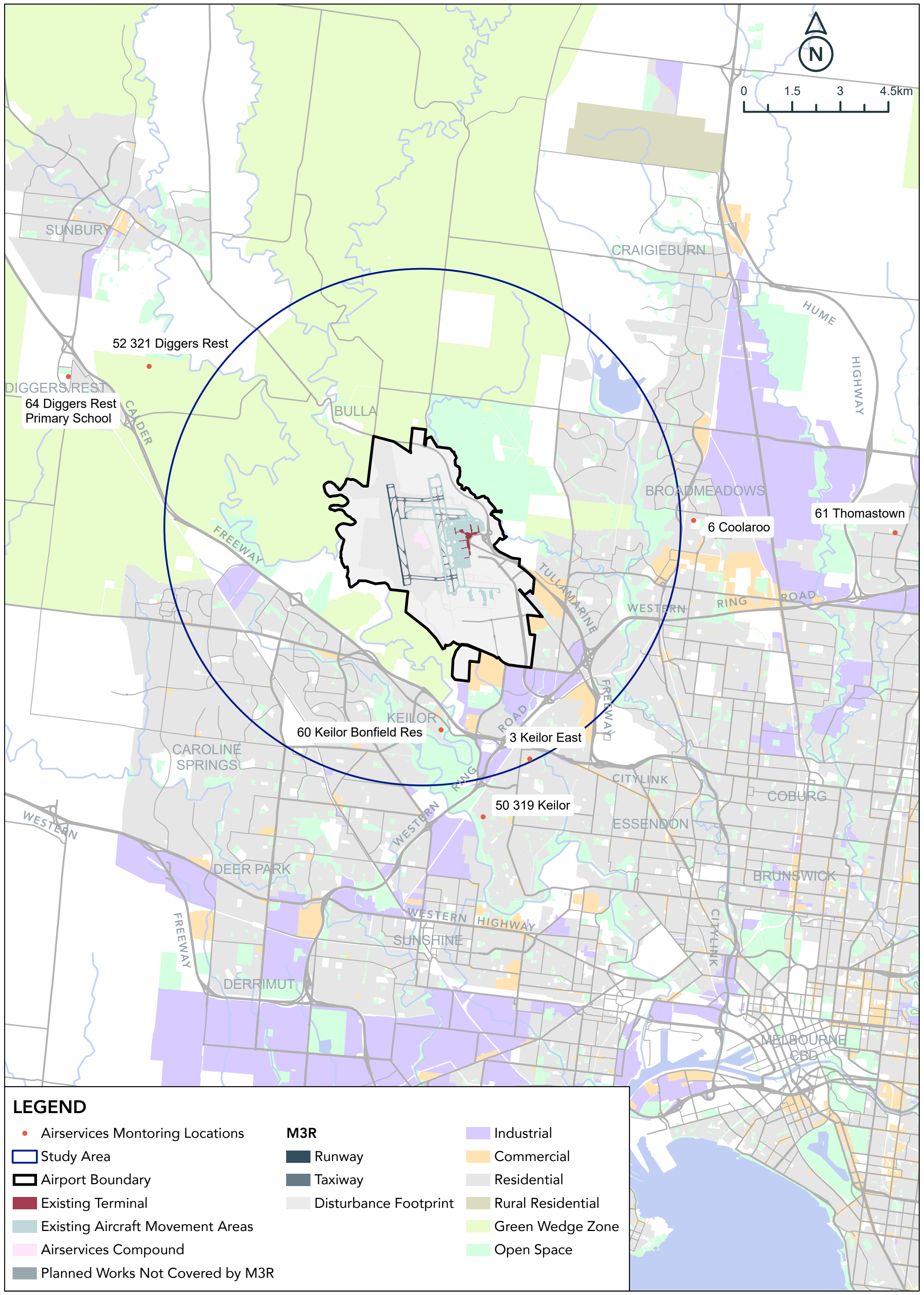


Table B9.6
Ambient noise monitoring locations

Location	Address	Description of noise environment
1	Woodlands Historic Park car park	Road traffic, airport operations
2	Sunbury Road, adjacent to emergency access gate 4	Road traffic, bird song, distant aircraft activity
3	Bulla, Coghill Street (bottom of)	Road traffic from Sunbury Road, neighbourhood noise (dog barking), bird song
4	295 Loemans Road (entrance)	Local road traffic, airport operations
5	Kings Road (Keilor Gold Course)	Local road traffic, airport operations, bird song
6	51 Overnewton Road	Local road traffic and road traffic from Calder Freeway, distant airport operations, bird song
7	95 McNabs Road (on road side)	Local road traffic, airport operations, bird song
8	True Value Solar Stadium (car park)	Local road traffic and road traffic from Calder Freeway, airport operations, bird song

Table B9.7
Summary of ambient noise data

Location	L_{A90}/dB			L_{Aeq}/dB		
	0700-1800	1800-2200	Post-2200	0700-1800	1800-2200	Post-2200
1	43	40	39	59	51	45
2	48	45	41	62	59	47
3	49	46	39	60	58	46
4	42	41	37	58	53	49
5	48	45	38	59	54	50
6	48	44	39	57	55	51
7	42	39	36	55	48	46
8	48	47	40	63	54	53
Average	**46**	**43**	**38**	**59**	**54**	**48**

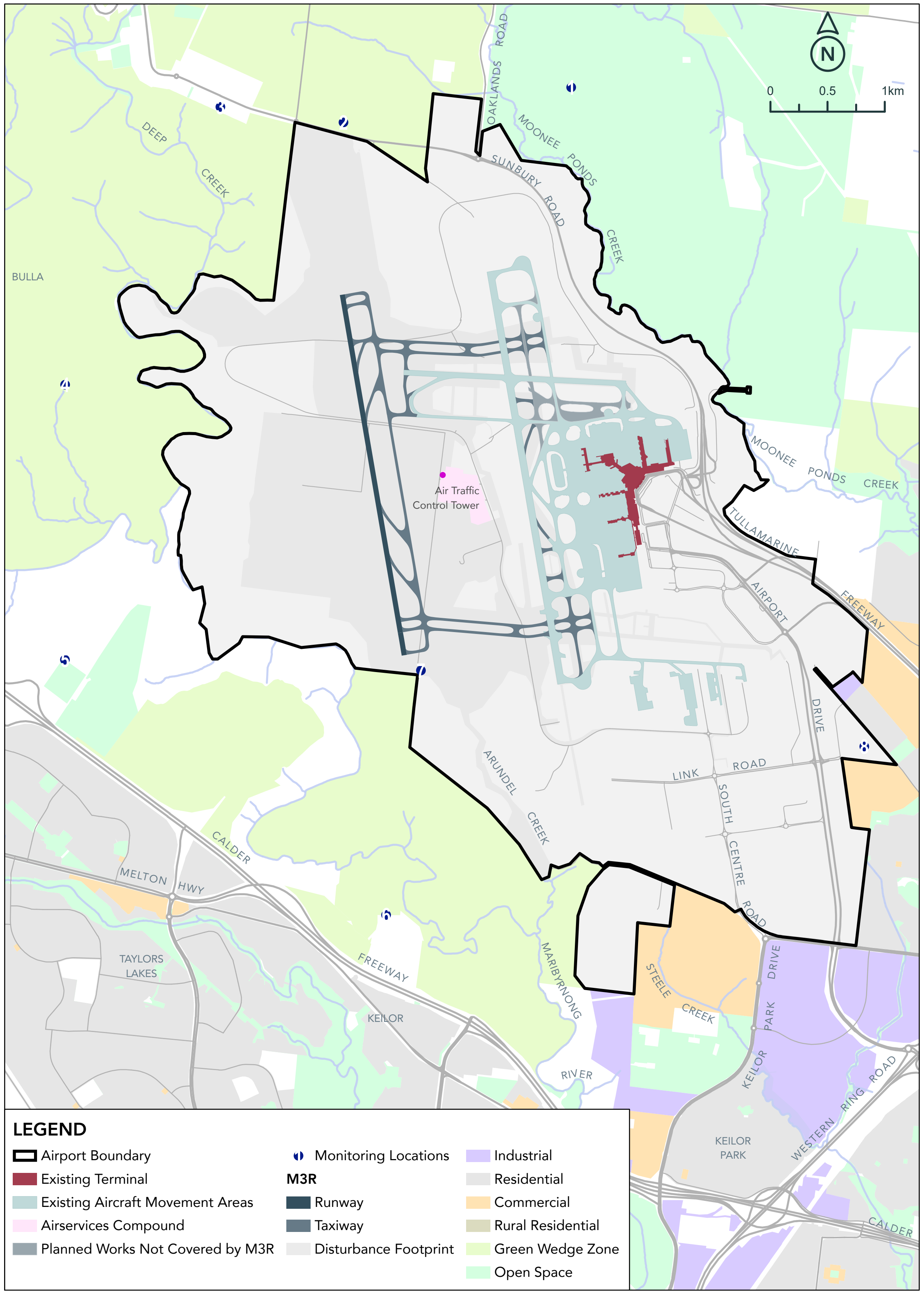
The data above shows a variance in the noise levels during the day, evening and night when measured at each location.

Having regard to the noise levels presented in Table B9.7, and based on a conservative assessment, the following background noise levels have been used to represent the three time periods:

- Day (0700-1800h) – $L_{A90,t}$ 45 dB(A)
- Evening (1800-2200h) – $L_{A90,t}$ 40 dB(A)
- Night (2200-0700h) – $L_{A90,t}$ 38 dB(A).

During periods without arrivals or departures, general airport noise is audible at some locations as described above. However, the presence of local road-traffic noise and noise from the main freeways comparatively generates higher levels of environmental noise, such that airport noise is masked for most of the time.

Figure B9.4
Temporary noise monitoring locations



B9.4.3
Existing operational noise

Existing operational ground noise contours have been established as part of this assessment. They are described as follows and shown in Figure B9.5 to Figure B9.8. The contours have been derived from 2019 baseline movement data and reflect the typical-busy-hour L_{Aeq} for the day (0800-0900) and night (2300-0000) periods respectively.

A single scenario representing all operating modes (i.e. runways being used for arrivals and departures) has been used for each time period, noting that taxiway operations are largely reciprocal - carrying outbound traffic in one mode and inbound in another. Terminal-related sources are independent of the operating mode.

Wind speed and direction will affect the propagation of noise from the source to the receiver. As stated in Section B9.7.1, the ISO 9613 algorithm used in the noise modelling includes a downwind component. Attenuation of noise due to foliage has not been included in the ground noise modelling. Research regarding the potential for noise attenuation due to scattering and signal interference from foliage indicates that it may reduce noise impacts. A conservative approach, not including any attenuation of noise due to foliage in the modelling, has been taken.

These noise contours (which reflect the four runway directions) show that aircraft ground noise is apparent along the length of each taxiway. Noise from aircraft at stand is also apparent from:

- Running of Auxiliary Power Units (APUs) for those aircraft not connected to power on the stand using Fixed Electrical Ground Power (FEGP)
- Starting of engines after push back (i.e. once the aircraft has left the stand but is not yet under power)
- When parking at stand under power.

Noise at stand is not a large component of aircraft ground noise during the day. However, at night, when movements are fewer, noise from aircraft at stand can be audible at locations around the airport due to generally lower background and ambient noise levels.

Figure B9.5 and Figure B9.6 present the modelled ground noise contours for busy day- and night-time hours respectively. These calculations include noise generated by aircraft at the stand (APUs) but exclude taxiing and other mobile aircraft sources.

Figure B9.7 and Figure B9.8 present the same busy-hour scenarios including taxiing.

The noise contours accord with the receiver noise levels presented in Table B9.4 and also the ambient noise measurements discussed in Section B9.4.2 (in particular Table B9.7).

Figure B9.5
Typical busy hour daytime operations 2019 ground noise contours (excluding taxiing)

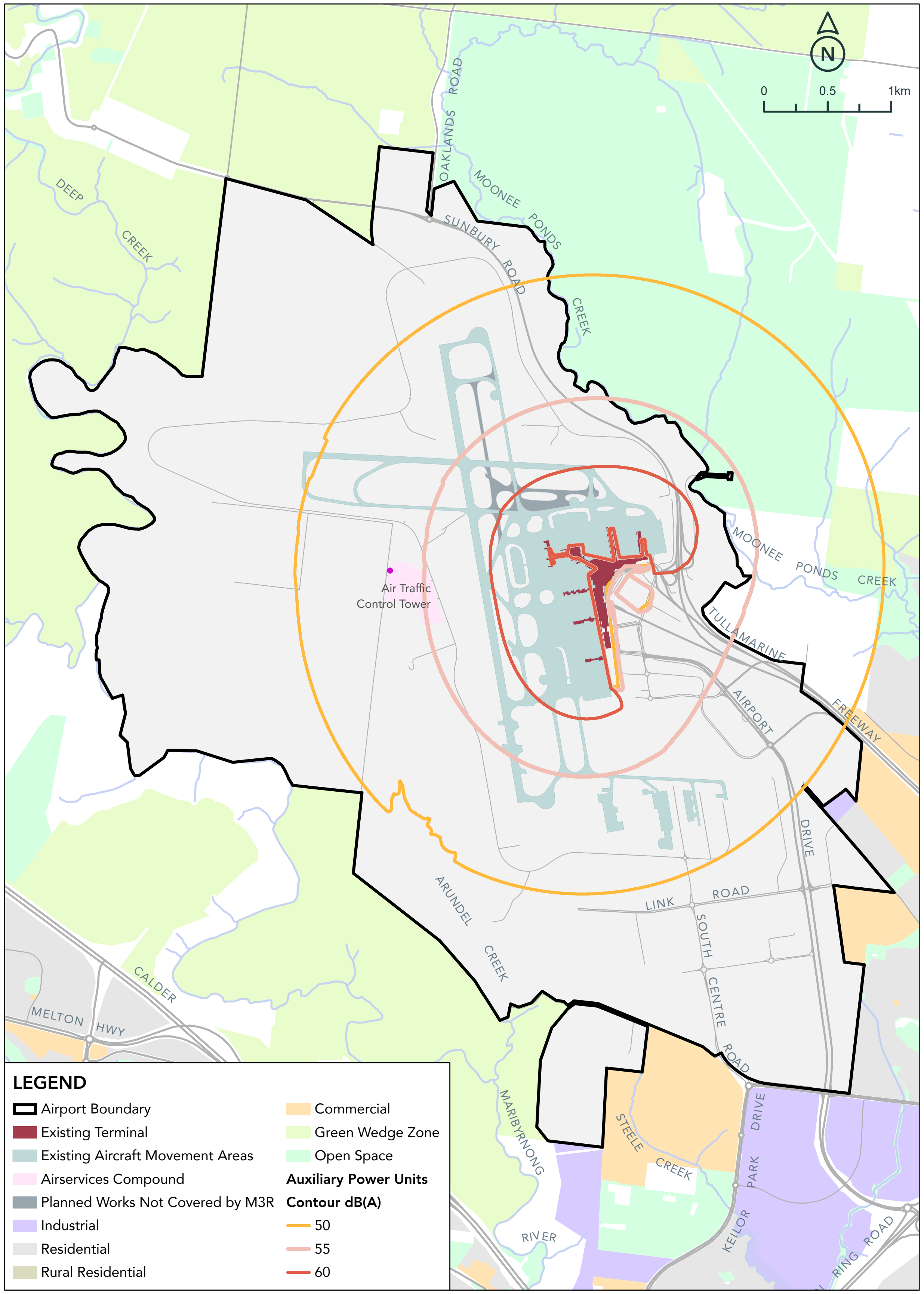


Figure B9.6
Typical busy hour night-time operations 2019 ground noise contours (excluding taxiing)

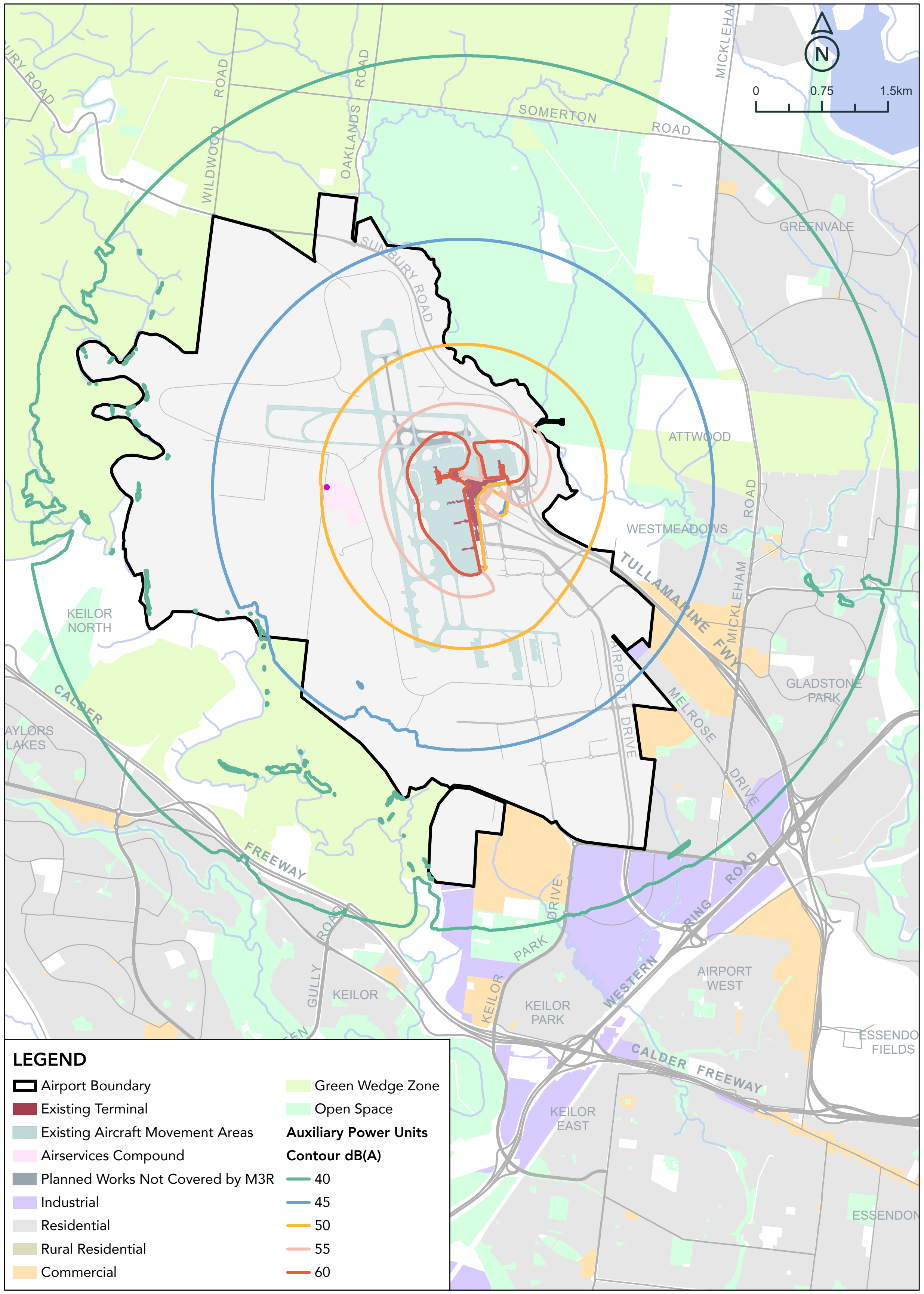


Figure B9.7
Typical busy hour daytime operations 2019 ground noise contours (including taxiing)

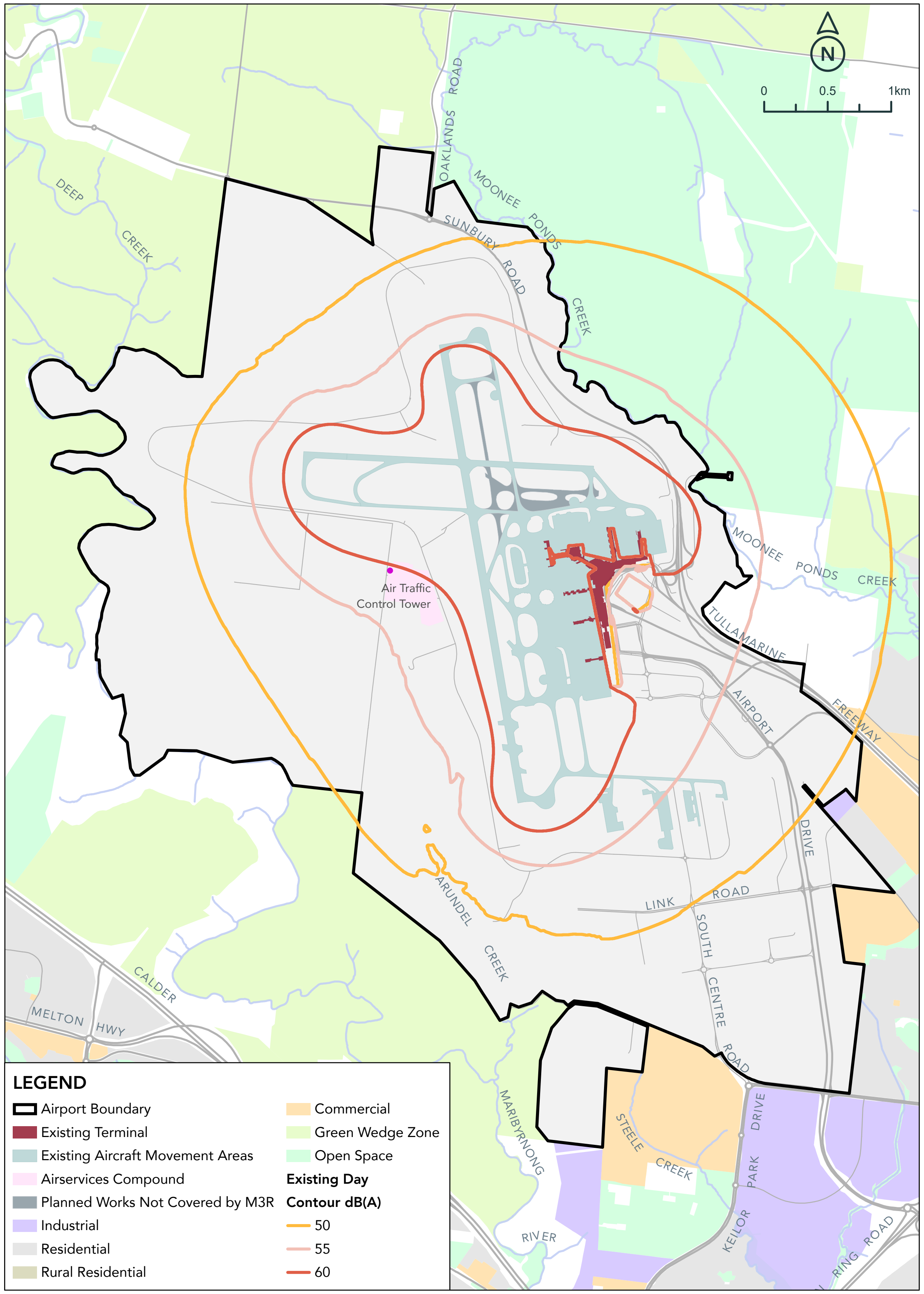
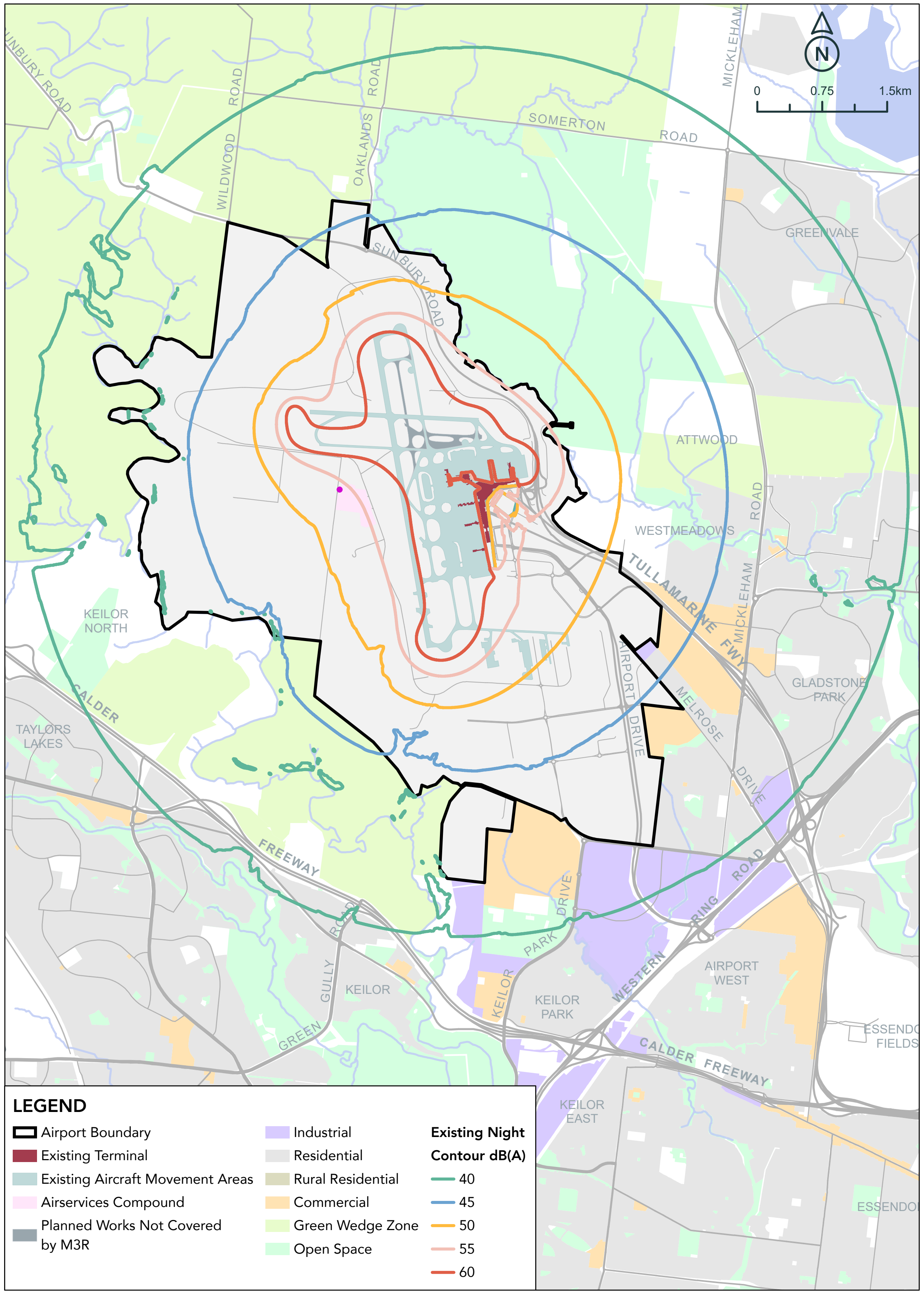


Figure B9.8
Typical busy hour night-time operations 2019 ground noise contours (including taxiing)



B9.5 DESCRIPTION OF SIGNIFICANCE CRITERIA

This section establishes the relevant construction and operational noise and vibration criteria that will be used to assess the impacts of M3R. In addition, a rating of significance has been developed by reference to these criteria and from experience of similar airport-development projects.

B9.5.1 Construction controls

The AEP Regulations provide a target level of 75 dB(A) at the site of a sensitive receptor. This represents a noise level likely to cause significant annoyance if sustained for long periods. Given the anticipated duration of construction activities, it is therefore appropriate to consider further noise objectives to control construction noise.

The EPA *Civil construction, building and demolition guide*, Publication 1834 (EPA, 2020) provides guideline noise levels for construction noise, including long-term construction noise. These guidelines are detailed in Table B9.8 below.

The AEP Regulations reference $L_{A10(15\ min)}$ whereas EPA guidelines reference $L_{Aeq(15\ min)}$. In practice, the two noise descriptors are very similar for construction noise, although small differences may be observed (up to three dB(A)). For simplicity, the EPA's L_{Aeq} descriptor has been adopted in this assessment.

EPA 1834 does not provide guidance on suitable daytime construction guideline noise levels. Therefore, in preparing this MDP, Melbourne Airport has reviewed the impact of daytime construction taking into consideration the approach most often adopted in similar situations (i.e. to reduce the target noise level by five to 10 dB(A)) and has adopted it as the M3R daytime construction noise goal. Accordingly, to provide a pragmatic approach to assessing long-term construction activities, the construction noise objective during the day (0700-1800h) has been set at 65 dB(A) $L_{Aeq(15min)}$, to be achieved at residential dwellings and other noise-sensitive receptors (excluding parks and other open spaces).

Table B9.8
EPA 1834 guideline noise levels

Time period	Applicable hours	Guideline noise levels, $L_{Aeq(15\ min)}$ Up to 18 months after project commencement	Guideline noise levels, $L_{Aeq(15\ min)}$ 18 months or more after project commencement
Normal working hours	0700-1800h Monday to Friday 0700-1300h Saturday	No specific guideline noise levels measures apply	
Weekend/evening work	1800-2200h Monday to Friday 1300-2200h Saturday 0700-2200h Sunday and public holidays	Noise level at any residential premises not to exceed background noise (L_{A90}) by 10 dB(A) or more	Noise level at any residential premises not to exceed background noise (L_{A90}) by 5 dB(A) or more
Night	2200-0700h Monday to Sunday	Noise is to be inaudible within a habitable room of any residential premises	

Table B9.9
Construction noise objectives

Time period	Applicable hours	Construction noise objectives $L_{Aeq(15\ min)}$	Comment
Normal working hours	0700-1800h Monday to Friday 0700-1300h Saturday	65	Reduction of 75 dB L_{A10} by 10 dB(A) to achieve a project-defined noise goal
Weekend/evening work	1800-2200h Monday to Friday	50	Based on 45 dB L_{A90} – note 1
	1300-2200h Saturday	50	Based on 45 dB L_{A90} – note 2
	0700-2200h Sunday and public holidays	45	Based on 40 dB L_{A90} – note 3
Night	2200-0700h Monday to Sunday	40	Based on sleep disturbance effects

1. Derived from measured weekday data 1800-2200h
2. Derived from Airservices data – typical long-term average level on Saturdays (see section B9.5.2)
3. Derived from Airservices data – typical long-term average level on Sundays (excludes public holidays as it is unlikely that works would take place during these periods) (see section B9.5.2)

For all other time periods, EPA 1834 establishes construction noise objectives based on indicative background noise levels. Background noise data has been recorded within the eight-kilometre study area and the data has been used to determine airport-wide construction noise criteria for M3R. Table B9.9 details M3R's construction noise criteria and objectives. With respect to the night-time objective, EPA 1834's noise guideline promulgates noise to be inaudible within habitable rooms.

(Inaudibility is a subjective descriptor of noise and will vary according to the prevailing background noise environment and the sound reduction performance of a building.)

The fundamental aim of controlling noise at night is to prevent sleep-disturbance effects. The WHO considers adverse effects on sleep occur with outdoor L_{Aeq} values of 40 dB(A) (WHO, 1999). Taking into account the sound reduction of an open window, this will result in internal noise levels of 30 dB(A) within bedrooms (based upon a 10 dB reduction for a partially open window). This design level accords with AS NZS 2107:2016 for sleeping areas at night in suburban areas influenced by transportation noise.

Table B9.10 provides guideline values for perception of vibration.

For the assessment of human comfort from vibration, industry best practice is to use Vibration Dose Value (VDV). It considers vibration level, frequency and duration; and is complex in its prediction and measurement. NSW DEC "Assessing Vibration: A technical guideline" presents recommended vibration limits for continuous vibration in different units, including PPV. Higher vibration levels are likely to be acceptable for transient vibration.

Suitable vibration and airblast criteria (derived from BS 5228-2:2009, AS 2187-2:2006 and DIN 4150-3:2016-12) for human comfort are provided in Table B9.11. Construction impacts will be managed to comply with the criteria stipulated in these standards. If either measured or predicted vibration and airblast levels exceed the criteria, a suitably qualified expert will assess and manage construction vibration and airblast to comply with the criteria as far as practicable.

In Australia, British Standard BS 7385 Part 2-1993 "Evaluation and measurement for vibration in buildings" and the German Standard DIN 4150-3: 1999 "Structural vibration Part 3: Effects of vibration on structures" are most often used to assess the potential for building damage due to vibration. DIN 4150-3 provides more stringent levels and is adopted herein. Guideline values are frequency dependent but, in the absence of knowledge about the dominant frequency of vibration, the lowest and most conservative values are normally adopted. These are shown in Table B9.12.

During blasting, vibration is generated in the ground. This vibration may propagate to the surrounding area and cause effects upon buildings and building occupants. Ground vibration has the potential to shake buildings and cause disturbance to occupants and, at higher levels, has the potential to damage buildings.

Table B9.10
Vibration guide values for perception

Vibration level (component PPV)	Effect
0.14 mm/s	Vibration might be just perceptible in the most sensitive situations for vibration frequencies associated with construction and maintenance. At lower frequencies people are less sensitive to vibration.
0.3 mm/s	Vibration might be just perceptible in residential environments.
1.0 mm/s	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
10 mm/s	Vibration is likely to be intolerable for any more than a very brief exposure to this level.

Table B9.11
Vibration (continuous) criteria for human comfort

Receiver	Time	Preferred	Maximum
Critical working areas (e.g. hospital operating theatres, precision laboratories)	Day- or night-time	0.14 mm/s PPV	0.28 mm/s PPV
Residences	Night-time 2200-0700h	0.2 mm/s PPV	0.4 mm/s PPV
	Daytime 0700-2200h	0.28 mm/s PPV	0.56 mm/s PPV
Offices	Day- or night-time	0.56 mm/s PPV	1.1 mm/s PPV
Workshops	Day- or night-time	1.1 mm/s PPV	2.2 mm/s PPV

Table B9.12
Vibration Damage Guideline Values (DIN 4150-3)

Construction equipment	Guideline Value, PCPV (mm/s)
Buildings used for commercial purposes, industrial buildings, and buildings of similar design	20
Dwellings and buildings of similar design	5
Vibration-sensitive buildings including heritage structures	3

Airblast is the air pressure wave (sometimes called overpressure) which is generated as the energy of a blast is released into the atmosphere. Airblast can propagate through the air to the surrounding area and can cause effects at nearby buildings. The pressure wave may shake the building and cause disturbance to occupants. At higher levels, it can cause damage to the building, including breaking windows at very high levels.

The Australian and New Zealand Environment and Conservation Council (ANZECC) guideline, Technical basis for guidelines to minimise annoyance due to blasting overpressure and ground vibration (ANZECC, 1990) (R13), recommends residential criteria for the assessment of vibration and airblast from blasting. Table B9.13 summarises the criteria recommended by the ANZECC guidelines. It should be noted that the vibration criteria are higher than those for other construction vibrations because of the very short duration of blast vibration.

These criteria accord with the Department of Jobs, Precincts and Regions "Guidelines for Ground Vibration and Airblast Limits for Blasting in Mines and Quarries", although these guidelines are not strictly applicable to the project.

Table B9.13
ANZECC Recommended Vibration & Airblast Criteria

Issue	Units	Criterion for 95% of Blasts	Criterion for 100% of Blasts
Vibration	mm/s PPV	5 mm/s	10 mm/s
Airblast	dBL	115 dBL	120 dBL

B9.5.2
Operational controls

The AEP Regulations provide noise criteria for ground-based operational noise at Melbourne Airport (this excludes aircraft take-off, landing and taxiing operations). The Victoria EPAL Noise Protocol also provides guidance when developing noise objectives for non-aircraft noise sources.

For Melbourne Airport, which is on Commonwealth land not controlled by the Victorian planning scheme, noise objectives have been established for M3R. These objectives acknowledge that most of the receiving environment is within the Green Wedge Zone. The objectives are summarised in Table B9.14.

The AEP Regulations require that operational noise not exceed the background noise level at noise-sensitive receptors by more than five dB(A) or three dB(A) respectively during the day (0700-2200h) and night (2200-0700h). It is recognised that noise during the evening period is often a concern for communities and, therefore, in line with EPA guidance, the 24-hour period has been divided into three time periods; day, evening and night.

Background and ambient noise around the airport vary depending upon proximity to the airport and local roads. However, a generic set of noise objectives has been developed based upon the representative background noise data as reported in Section B9.4.2. The derived objectives are expected to be appropriate for most of the surrounding receiving environment.

In summary, measured background noise levels vary from around low-30 dB L_{A90} at night to mid-50 dB L_{A90} during the day and around 40-45 dB during the evening period (Table B9.7). Operational noise limits established using the Noise Protocol, without modification to account for land zoning, would be within 1-2 dB of those listed in Table B9.14.

Table B9.14
Operational noise objectives

Period	Noise objectives / $L_{Aeq,t}$ dB	Comments
Day (0700-1800h)	50	Based on representative daytime background noise levels of 45 dB – note 1
Evening (1800-2200h)	45	Based on representative evening background noise levels of 40 dB – note 2
Night (2200-0700h)	40	Based on sleep disturbance effects criteria – note 3

1. *Derived from measured data 0700-1800h and analysis of Airservices data see* Section B9.5.2.
2. *Derived from measured data for period 1800-2200h and analysis of Airservices data.*
3. *Identical outdoor level as used for construction criteria: the aim is to protect against sleep disturbance based on a bedroom window being open. This objective accords approximately with the AEP Regulation level of background plus three dB(A) at night.*

In addition to the above, a noise-change assessment has been undertaken to compare the noise levels between the period shortly preceding construction of the M3R, and upon opening of the new infrastructure. This scenario represents the change in noise that receivers would experience, in a relatively short period of time.

Notwithstanding any audible characteristics a noise source may have, a three dB(A) change in the overall noise level is just perceptible. A 10 dB(A) increase is considered a subjective doubling of the loudness of the sound. Anywhere between three and five dB(A) would be considered a minor change and between five and 10 dB(A) a moderate change. Greater than 10 dB(A) would be considered a major change. For the purposes of this assessment, these noise changes have only been used to compare the modelled operational scenarios and not for comparing with measured levels of noise derived from the baseline surveys.

With respect to vibration, as stated in Section B9.7, there are no significant sources of operational vibration. Therefore, the assessment of vibration impacts only considers ground-borne vibration from construction activities.

B9.5.3
Significance rating

The severity of the construction and operational impacts will be assessed in accordance with the *Actions on, or impacting upon, Commonwealth land, and actions by Commonwealth agencies, Significant impact guidelines 1.2 (Department of Sustainability, Environment, Water, Population and Communities, 2013).*

The scale, intensity and duration of the potential impacts will be assessed according to the severity criteria described in Table B9.15. If absolute levels of noise exceed the relevant construction or operational noise criteria, then the impact would be at least minor. The subsequent scaling of the impact will also depend upon the degree of exceedance. The duration of the noise exposure can also affect the rating of the noise. Community response surveys typically show that short-term noise effects will occur following a change in noise. These effects will generally reduce once communities habituate to the change. For the M3R, the duration of both the construction program and future operation has been considered when developing the severity criteria.

For vibration, the absolute limits have been used. For exceedances of preferred human comfort levels but below maximum levels, the magnitude would be negligible to minor, depending on the duration. For exceedances of building damage criteria, the impacts would be negligible to moderate; potentially requiring additional, more detailed assessment and monitoring, or possibly, in the most extreme circumstances, rectification works to structures.

B9.6
CONSTRUCTION NOISE AND VIBRATION

This section of the chapter details the assessment of noise and vibration from construction. The scenarios and prediction methodology are outlined first, followed by an assessment of impacts using the noise and vibration criteria and objectives detailed in Section B9.5.

B9.6.1
Construction noise

B9.6.1.1
Construction noise predictions

<u>Construction duration and timing</u>

The approach to construction of M3R is described in Chapter A5: Project Construction. Construction noise and vibration impacts will occur during the significant earthwork phases and subsequent phases of infrastructure construction. Due to operational constraints, some of these works will occur at night to minimise disruption to the operation of the existing runways. To enable a worst-case approach, all phases of the development have been considered to potentially occur at any time of day. This will ensure that all available combinations of daytime/night-time activities have been considered and that a worst-case assessment has been undertaken.

The proposed construction equipment and activities were assessed on a risk management basis: any activities or noise sources that are expected to generate high levels of noise, approximately greater than 70 dB(A) at

Table B9.15
Severity criteria

Impact severity	Absolute rating	Noise change rating	Comment
Major	Exceedance of construction/operational noise criteria by more than 15 dB(A)	Significantly greater than 10 dB(A) increase in noise level due to the introduction of the development at identified noise-sensitive receivers	Applies to permanent noise from airport operations – i.e. long-term effects which will negatively affect health and wellbeing.
High	Exceedance of construction/operational noise criteria by no more than 10 dB(A)	Approximate 10 dB(A) increase in noise levels such that noise affected receivers have to alter their living/working conditions, such as closing windows, etc.	Potential for health effects to occur such as sleep disturbance from construction and operational noise sources.
Moderate	Exceedance of construction/operational noise criteria by no more than 8 dB(A)	Noise change of between 5-8 dB(A) is predicted to occur at residential receivers which may lead to short term disturbance	A noticeable increase in noise – likely to trigger additional mitigation.
Minor	Exceedance of construction/operational noise criteria by no more than 5 dB(A)	Noise change of between 3-5 dB(A), i.e. a perceptible change in noise level but not considered sufficient to warrant further mitigation	Typically occurs from small changes in the noise environment, e.g. intensification of road traffic. May be considered where mitigation will occur.
Negligible	Construction/operational noise levels below relevant criteria	Minimal change to the existing noise environment, e.g. overall noise change would result in no perceptible change in the noise environment	Would typically also occur from natural growth in road traffic flows and the consequent effects of noise.

a distance of 10 metres (and/or perceptible levels of vibration off-site >1 mm/s), have been assessed against the relevant construction criteria. Where appropriate, construction-noise-management measures are proposed to offset any adverse effects.

It is estimated that delivery of M3R will take four to five years. During this time, different techniques would be used to construct the new airport facilities (runway, runway extensions, taxiways and supporting infrastructure).

Source data

Construction noise will be generated by construction plant and machinery. Haulage noise will also be generated due to heavy vehicles delivering construction materials to the site and during the removal/ redistribution of excess construction waste (spoil). It is generally not possible to assess construction noise quantitatively until a project is relatively close to the construction phase, when more certainty about construction methodology and equipment is available and a contractor has been appointed.

However, for environmental assessments, an indicative noise assessment can be conducted based upon assumptions regarding the duration of works, their location, times of occurrence and the activities to be undertaken.

Typical plant likely to be used during construction includes (but will not be limited to):

- Tipper trucks and trailers
- Long-arm excavators
- Piling rigs
- Compaction plant (to be used for ground improvements within the site)
- Bulldozers
- Loaders and forklifts
- Mobile ('crawler') cranes
- Dump trucks
- Paving equipment.

Table B9.16 provides details of the major items of construction plant likely to be used, including the sound level of the plant (expressed as a sound pressure level at a specified distance) and the likely operating duty of the plant during a typical construction day. The presented data is likely to be a reasonable estimate of the source sound-level data of the various items, and will enable the main effects of the proposed construction activities to be assessed.

Construction noise calculations

Construction noise calculations generally consider the characteristics of the noise source (i.e. sound level, frequency content and number of plant, the time of day that the plant is being used and the operating duration of the plant, location, and whether the plant is stationary or moving). Sound propagation effects will also influence the received noise level because of atmospheric and ground absorption, and the shielding effects of natural and man-made features.

The site and surrounds have been modelled using SoundPLAN software considering the following factors:

- Equipment source noise levels
- Distance to receivers
- Topography/buildings
- Atmospheric absorption
- Ground effects.

Calculations utilised ISO 9613 Acoustics – Attenuation of sound during propagation outdoors parts 1 and 2 which is implemented within the SoundPLAN noise modelling software. The ISO 9613 algorithm includes a downwind propagation component and thereby represents a scenario with adverse propagation from the source to the receiver.

B9.6.1.2
Construction noise assessment

Construction noise levels have been calculated for the receivers listed in Table B9.3 and the results are detailed below in Table B9.17. A range of noise levels is presented, to reflect construction operations with northern and southern work zones.

A comparison with the project's construction-noise objectives has been conducted and a 'comply/fail' assessment has been made.

It is noted that the highest noise levels from equipment will occur during stage 2 and 3 earthworks. Therefore compliance with noise management levels during these stages will mean compliance at all other stages.

The closest receivers (R1-R11) have been highlighted, as the construction noise guidelines are relevant to residential receivers. Lower noise levels can be expected at locations farther from the airport than those presented.

A review of the results indicates that compliance is predicted for all surrounding receivers for all construction stages, except for the closest receiver (R1: 95-105 McNabs Road).

There is a minor to moderate non-compliance predicted at the closest receiver (R1: 95-105 McNabs Road) when works are toward the southern end of the site (i.e. the upper level of the presented range). When works are more distant, compliance is predicted.

Table B9.16
Construction equipment (indicative)

Construction equipment	Description	Quantity	L_{Aeq} (dB at 10m)	Expected duty (%)
Stage 1 – site compound				
Truck (delivering materials)	Idle	6	80	75
Mobile crane	Operating	2	70	75
Excavator – tracked	30t	2	80	90
Wheeled loader	Loading/moving	2	84	75
Dozer	20t	2	86	75
Vibrator roller	12t	2	82	80
Roller	22t	2	79	80
Stage 2 – earthworks (prep)				
Truck & trailers	Idle	10	80	75
Mobile crane	Operating	2	70	50
Excavator – tracked	32t	4	80	90
Wheeled loader	Loading/moving	3	84	90
Dozer	20t	2	86	75
Dumper	9t	2	84	70
Roller	22t	2	79	80
Stage 3 – earthworks (bulk)				
Truck & trailer	Idle	4	80	75
Excavator – tracked	32t	4	80	90
Wheeled loader	Loading/moving	2	84	90
Dozer	20t	2	86	75
Dumper	9t	1	84	75
Roller	22t	2	79	80
Stage 4 – paving				
Truck (delivering materials)	Idle	4	80	75
Asphalt plant	Permanent	1	86	100
Lighting rig + genset	Night works	4	60	75
Dozer	20t	2	86	75
Vibrator roller	12t	2	82	75
Asphalt paver (+ tipper)	18t	2	81	100
Roller	22t	4	79	75
Stage 5 – buildings				
Truck (delivering materials)	Idle	4	75	75
Hand tools	Misc. work	4	75	90
Mobile crane	Operating	1	70	50
Generators	Operating	2	67	90

Table B9.17
Predicted construction noise levels

Task	Receiver	Predicted noise level (L_{Aeq}/dB)	Comparison with criteria					
			Weekday 0700-1800	Weekday 1800-2200	Saturday 0700-1300	Sunday 1300-2200	Sunday & public holidays 0700-2200	Night 2200-0700
Stage 2-earthworks (prep)	R1	28-48[1]	Complies	Complies	Complies	Complies	Minor non-compliance	Moderate non-compliance
	R2	27-33	Complies	Complies	Complies	Complies	Complies	Complies
	R3	24-34	Complies	Complies	Complies	Complies	Complies	Complies
	R4	20-28	Complies	Complies	Complies	Complies	Complies	Complies
	R5	11-24	Complies	Complies	Complies	Complies	Complies	Complies
	R6	15-23	Complies	Complies	Complies	Complies	Complies	Complies
	R7	23-34	Complies	Complies	Complies	Complies	Complies	Complies
	R8	17-22	Complies	Complies	Complies	Complies	Complies	Complies
	R9	19-20	Complies	Complies	Complies	Complies	Complies	Complies
	R10	23-23	Complies	Complies	Complies	Complies	Complies	Complies
	R11	20-24	Complies	Complies	Complies	Complies	Complies	Complies
	R12	19-23	Complies	Complies	Complies	Complies	Complies	Complies
	R13	26-38	Complies	Complies	Complies	Complies	Complies	Complies
	R14	24-33	Complies	Complies	Complies	Complies	Complies	Complies
	R15	24-30	Complies	Complies	Complies	Complies	Complies	Complies
	R16	30-33	Complies	Complies	Complies	Complies	Complies	Complies
	R17	21-28	Complies	Complies	Complies	Complies	Complies	Complies
Stage 3 – earthworks bulk	R1	29-47	Complies	Complies	Complies	Complies	Minor non-compliance	Moderate non-compliance
	R2	28-34	Complies	Complies	Complies	Complies	Complies	Complies
	R3	25-35	Complies	Complies	Complies	Complies	Complies	Complies
	R4	21-29	Complies	Complies	Complies	Complies	Complies	Complies
	R5	12-25	Complies	Complies	Complies	Complies	Complies	Complies
	R6	16-24	Complies	Complies	Complies	Complies	Complies	Complies
	R7	24-35	Complies	Complies	Complies	Complies	Complies	Complies
	R8	18-23	Complies	Complies	Complies	Complies	Complies	Complies
	R9	20-21	Complies	Complies	Complies	Complies	Complies	Complies
	R10	24-24	Complies	Complies	Complies	Complies	Complies	Complies
	R11	21-25	Complies	Complies	Complies	Complies	Complies	Complies
	R12	20-24	Complies	Complies	Complies	Complies	Complies	Complies
	R13	27-39	Complies	Complies	Complies	Complies	Complies	Complies
	R14	25-34	Complies	Complies	Complies	Complies	Complies	Complies
	R15	25-31	Complies	Complies	Complies	Complies	Complies	Complies
	R16	31-34	Complies	Complies	Complies	Complies	Complies	Complies
	R17	22-29	Complies	Complies	Complies	Complies	Complies	Complies

1. The property boundary of 95-105 McNabs Road is close to the construction extents. Whilst large earthmoving equipment operate near the property boundary, elevated noise levels can be expected (up to approximately 80 dB(A)) at the adjoining property boundary. This is likely to occur intermittently, for limited durations, at particular stages of the construction. The presented range is representative of noise at the main dwelling, from typical construction activity, which will occur across the site extending several kilometres of runway and taxiways.

The noise level from construction is predicted to be lower than the existing operational noise from the airport for the respective time periods (Table B9.4). The impacts from construction are therefore expected to be negligible.

Noise from construction is expected to be significantly less than the noise from aircraft operations such as take-off, landing and overflight.

Notwithstanding that compliance with the project construction noise objectives is generally predicted, best-practice construction-noise mitigation measures will be implemented to control adverse noise effects arising from construction activity at all locations. Further detail is provided in **Section B9.8**.

B9.6.2
Construction vibration assessment

Vibration levels from construction have been predicted using empirical methods and compared against industry-standard vibration assessment criteria. AS 2670.2-1990 and BS 5228-2:2009 have been used to assess human annoyance response to vibration in buildings. Building damage from construction sites has been assessed using a combination of accepted industry standards BS 5228.2-2009 and German DIN 4150.3:2016-12 (standards and guidance used in the assessment are also listed in **Section B9.4**).

Vibration from construction activities will typically occur from high-energy works which will generate a combination of ground-borne vibration and airborne noise which can, in some cases, generate vibration effects within buildings by vibrationally exciting the building structure.

Vibration assessment has been carried out for piling, dynamic compaction and blasting. Other sources will not generate significant magnitudes of ground-borne vibration due to the distance between the work sites and vibration-sensitive properties/structures.

Table B9.18 shows the variability in vibration levels as measured at 10 metres for a range of typical construction plant. The variability arises from make and model of the plant, the ground conditions (type of soil on which they are working), and how the plant is operated. The data emphasises the wide variation in vibration levels. Accordingly, estimates of vibration have been calculated based on broad assumptions (plant type and ground conditions) using conservative data.

Table B9.19 sets out the typical ground vibration levels at various distances for safe working distances as advised by the Transport for NSW Construction Noise and Vibration Strategy, a useful guide for assessment of vibration impact. This document provides a useful reference for assessment of potential vibration impact.

A review of sensitive receivers indicates the nearest residences are at least 450 metres from the construction site. In addition, the Airservices building is 200 metres from the construction site. These distances, when reviewed with respect to the safe working distances of **Table B9.19**, indicate that vibration from construction activities is predicted to comply with vibration criteria.

The criteria for vibration or airblast are only likely to be exceeded in the following cases:

- Piling/dynamic compaction: high energy impact and vibratory piling may cause exceedances if works are conducted within 68 metres of a vibration sensitive building or structure. In this situation, more detailed assessment would be undertaken prior to any such work
- Blasting: vibration criteria may be exceeded if charge weights approaching 100 kilograms are used, and any vibration sensitive buildings or structures are within 200-300 metres from the blast site.

As there are no known vibration-sensitive buildings or structures within the above distances, the severity of vibration impacts is considered negligible. There are no other vibration-sensitive activities (e.g. airfield navigational aids/equipment) in the area that would be affected. In accordance with best practice, there will be specific measures implemented (including communication and engagement with affected parties) if blasting is to occur on-site during operations.

Table B9.18
Vibration levels for typical construction plant

Construction equipment	Description	PPV at 10 metres (mm/s)
Dozer	Operating	3-12
Excavator – tracked	30t	2-6
Grader	Loading and moving	1-3
Roller	20t	0.5-7
Vibratory roller	12t	2-13
Dynamic compaction	15t tamping weight	12-20
Percussive breaker on tracked excavator	Rock breaking	5-12

Table B9.19
Recommended safe working distances for vibration intensive plant

Item	Description	Safe working distance: Cosmetic damage (DIN 4150)	Safe working distance: Human response
Vibratory Roller	< 50 Kn (Typically 1-2 Tonnes)	14m	15 to 20m
	< 100 Kn (Typically 2-4 Tonnes)	16m	20m
	< 200 Kn (Typically 4-6 Tonnes)	33m	40m
	< 300 Kn (Typically 7-13 Tonnes)	41m	100m
	< 300 Kn (Typically 13-18 Tonnes)	54m	100m
	< 300 Kn (Typically > 18 Tonnes)	68m	100m
Small Hydraulic Hammer	(300kg – 5 to 12t Excavator)	5m	7m
Medium Hydraulic Hammer	(900kg – 12 to 18t Excavator)	19m	23m
Large Hydraulic Hammer	(1600kg – 18 to 34t Excavator)	60m	73m
Vibratory Pile Driver	Sheet piles	50m	20m
Pile Boring	≤ 800mm	5m	7m
Jackhammer	Handheld	2m	3m

Source: Construction Noise & Vibration Strategy (V4.1), 2019, TfNSW.

B9.6.3
Construction traffic noise assessment

Construction of M3R will require substantial earthworks and it is estimated that over the life of the project, up to 125,000 truck trips carrying fill and 80,000 truck trips carrying pavement materials, may be required (with the same number of empty trips away from the site). A proportion of the fill materials will be sourced from the general site during the earthworks phases of the development. However, there will be a need to import both fill and pavement materials. This means there may be up to 38 two-way trips per hour, with approximately 25 per cent arriving from the south and the remainder from the north.

Heavy construction vehicles (trucks) will use designated traffic routes to facilitate efficient access to the project worksite. Haul trucks on the site have been assessed in **Section B9.6.1.2**, along with other mobile plant. This section addresses noise from construction traffic on public roads.

Once construction vehicles depart from the haul road and use local roads (Sunbury Road, etc), the noise from construction traffic will combine with the noise generated by existing traffic using these roads. A perceptible (three dB(A)) increase in noise would occur if construction traffic were to double existing traffic flows (neglecting the additional noise contribution of heavy vehicles) on the proposed haul roads.

Sunbury Road currently carries around 32,000 vehicles per day with around 9 to 12 per cent heavy vehicles. The overall increase in road traffic noise would be less than one dB(A) even if all construction vehicles were to use this route. This is a negligible increase.

In comparison, there are approximately 1,500 existing vehicle movements using the McNabs Road/Arundel Road route per day (see **Chapter B8: Surface Transport**). The addition of 120 construction trucks would result in a noise increase of approximately two dB(A). This would be considered a minor change in noise.

Driver behaviour can influence the noise associated with truck movements. Heavy acceleration and deceleration, especially using engine braking, can increase noise levels. In addition, driving over poorly maintained road surfaces can induce additional noise from shaking and rattling of truck and trailer bodies. As part of the traffic management plan for the project, road surfaces will be well maintained with no adverse irregularities to negate the generation of additional vehicle noise and, in some cases, vibration where receivers are in close proximity to the carriageway (typically closer than 15 metres). At most, the impact of construction traffic will be minor.

B9.7
OPERATIONAL NOISE

Ground noise from airport operations comes from a variety of sources. These are typically landside road traffic (surface access); and airside activities, principally from static and manoeuvring aircraft. Operational noise levels have therefore been predicted for both landside and airside sources.

Unlike construction activities, there are no airport-operational sources that will generate significant levels of vibration.

Ground-running aircraft undertaking routine engine checks post-maintenance have the potential to produce high magnitudes of noise, including some low frequency noise at the source. Accordingly, low frequency has been considered for Engine Ground Running (EGR).

B9.7.1
Operational noise modelling

Aircraft-movement data for Melbourne Airport for the baseline year of 2019 has been reviewed. It includes the following information:

- Time of occurrence, broken down into day (0700-2200) and night (2200-0700)
- Runway direction
- Operation type (arrival/departure)
- Aircraft category.

The above day and night-time periods have been selected to align with the assessment periods in both the AEP Regulations and the *Environment Protection Regulations 2021*.

Assessment of runway and airport operation has been conducted based on busy-hour operations of the airport for the day and night periods respectively. (Forecasts of the busy hours were determined from airspace noise modelling, which included forecasts of operations by aircraft type and runway.)

Noise modelling of aircraft on taxiways considered the forecasts applying to groups of taxiways (i.e. the apron area and taxiway from the terminal to the northern and southern ends of the airfield; and the proposed taxiways that connect to the new runway at the northern and southern ends of the airfield).

Table B9.20 presents the operations scenarios modelled for the existing airfield compared with the proposed new infrastructure in 2026 and 2046.

Noise modelling was conducted based on the following typical sound-power levels:

- Aircraft Taxing 131 dB(A)
- APU 118 dB(A)

These are typical of current jet aircraft using the airport, and have been measured at other Australian airports.

An even breakdown of aircraft per terminal was applied to each stand. APUs were assumed for a proportion of these aircraft on stand. Fixed Electrical Ground Power (FEGP) is available and its use is likely to increase. FEGP has a negligible noise contribution.

Table B9.20
Taxiway hourly aircraft operations

Operating scenario	Taxi direction (to/from runway)	Taxiway Operations (# of aircraft movements per typical hour)	
Current (actual)		**West of existing runway 16/34 (to/from east-west runway)**	**East of existing runway 16/34 (to/from terminal)**
Existing Day	North	-	8
	South	-	14
	East	-	17
	West	7	-
Existing Night	North	-	5
	South	-	8
	East	-	3
	West	2	-
Reference years (modelled)		**West of existing runway 16/34 (to/from new runway)**	**East of existing runway 16/34 (to/from terminal)**
2026 Day	North	16	36
	South	16	36
2026 Night	North	9	19
	South	9	19
2046 Day	North	27	53
	South	27	53
2046 Night	North	15	26
	South	15	26

Taxiing aircraft were assumed to travel at an average speed of 20 kilometres per hour (km/h). SoundPLAN software was used to model the aircraft ground noise. This took into account the sound power of aircraft; operating times; the geographical distribution of those sources in relation to receiver locations; and the attenuation of sound with distance from each source to each receiver location (Figure B9.2).

Noise-contour maps and spot-receiver noise levels were calculated. Aircraft ground noise has been predicted using the sound-level propagation procedures of ISO 9613, which is implemented in the SoundPLAN noise modelling software.

Based on the movement forecasts, 17 APUs were assumed to be operational at any one time in a busy daytime hour and nine in the busy night period. These were distributed in the model around each of the terminals, representing several actual stand locations. These APU assumptions remained for future operating scenarios with the anticipation that there will be a greater proportion of FEGP use in the future.

Directivity patterns of ground-running aircraft are available from Boeing and Airbus. They represent the noise footprint at typically 10-degree increments around each aircraft measured, with constant operating conditions throughout each measurement. Conservatively, reductions in noise emissions due to directivity of mobile aircraft operations (i.e. whilst taxiing) have been ignored. Quoted source noise levels are for the loudest direction (i.e. an equivalent sound-power level producing the measured sound pressure level in the loudest direction).

It is likely that future aircraft types will have reduced noise emissions compared to current-generation aircraft. In this regard, the assumptions in this assessment are considered conservative.

B9.7.2 Operational noise assessment

Operational noise levels for the airport are reported in Table B9.21 and Table B9.22. The change in noise levels from operations (excluding aircraft taxiing operations) is expected be negligible with M3R. These predictions are therefore not repeated across the various future operating scenarios.

Operational noise levels (including aircraft taxiing) are included for reference. Note that the noise objectives do not apply to taxiing noise. However, it is useful to consider overall noise emissions (excluding take-off and landing noise).

Ground-based operational noise (excluding taxiing) associated with the airport is predicted to comply with the noise objectives at all surrounding receivers during the daytime.

During night, noise levels at the nearest receivers are predicted to exceed the project noise objectives. However, these predictions represent existing operations and the resultant noise levels are consistent with measured noise levels presented in Section B9.4.2.

Ground-based operational noise levels (which excludes aircraft taxiing, take-off and landing) are not predicted to change appreciably with M3R. On this basis, impacts associated with these sources are considered minor.

With the inclusion of taxiing noise (excluded by AEP regulations from being subject to noise criteria) noise emissions from the airport are predicted to be similar to the noise objectives. The results demonstrate that an increase of up to three dB(A) is expected for many of the nearest receivers due to the reconfigured geometry of the taxiway network and increased taxi times as a result of M3R.

Regardless of the future scenario, at all but the nearest residential receiver (R1: 95-105 McNabs Road) noise levels across the busy-hour assessment period (assessed externally) are below the WHO daytime guidance criteria of 50-55 dB(A) to prevent moderate to high annoyance.

The overall significance of these noise levels is negligible.

Figure B9.9 to Figure B9.12 display the modelled noise contours for the airport in 2026 and 2046, with M3R, for both the day and night-time periods. They include taxiing noise. The results demonstrate that airport ground noise is localised around the airport.

In summary:

- The change in terminal-related sources due to M3R is expected to be negligible
- Ground-based noise is predicted to comply with the noise objectives for the daytime period
- Existing ground-based noise levels during the night are expected to exceed noise objectives; however, minimal changes are expected as a result of M3R. Hence impacts are considered minor
- Although aircraft taxiing noise is exempt from AEP Regulations it has been considered because the change in the airfield's infrastructure and capacity will affect taxiway flows and resulting noise emissions
- Increases in noise emissions from all ground-based sources (including taxiing) are predicted to range from negligible (one dB(A)) to moderate (five dB(A)) at surrounding receivers. Increases of up to three dB(A) are typically predicted
- There is a trend of increasing noise to the west of the airport for sensitive noise receptors. This is associated with the change in operations to the new runway (16R/34L).For non-residential receivers (such as public open spaces, schools and community resources) the predicted levels of noise are within the recommended limits for those locations. For public open spaces used as recreational areas, the WHO recommendation (WHO 1999) that noise levels will not increase the 'signal to noise ratio' will be achieved. This would mean that existing ambient levels (the 'noise') will not noticeably increase by the introduction of the new noise (the 'signal'). (In the context of this assessment, a noticeable increase would equate to a three dB(A) increase in ambient noise levels.)

Table B9.21
Busy Day Hour L_{Aeq} Ground Operation noise levels at Receivers – dBA

Receiver	Address	Excluding taxiing	Including taxiing		
			Existing	2026 M3R	2046 M3R
R1	McNabs Road	49	50	57	59
R2	Oakbank Road	45	43	46	47
R3	Arundel Road	48	47	50	51
R4	Annandale Road	47	45	48	49
R5	Old Calder Highway	44	39	44	45
R6	Loemans Road	41	45	46	47
R7	Sunbury Road	47	48	50	51
R8	Providence Road	48	45	48	49
R9	Trinity Blvd	49	47	50	50
R10	Bamford Avenue	50	48	50	50
R11	Melrose Street	49	47	50	51
R12	True value Solar Centre (Stadium)	48	48	50	49
R13	Melbourne Airport Golf Club (green)	51	49	58	60
R14	Melbourne Airport Golf Club (club house)	49	46	52	53
R15	Keilor Golf Course (green)	44	47	44	45
R16	Keilor Golf Course (Club House)	45	48	46	46
R17	Woodlands Historic Park - main building	47	47	48	49

Table B9.22
Busy Night Hour L_{Aeq} Ground Operation noise levels at Receivers – dBA

Receiver	Address	Excluding taxiing	Including taxiing		
			Existing	2026 M3R	2046 M3R
R1	McNabs Road	46	47	55	56
R2	Oakbank Road	41	42	43	43
R3	Arundel Road	44	45	47	48
R4	Annandale Road	44	44	45	45
R5	Old Calder Highway	40	40	41	41
R6	Loemans Road	38	42	43	40
R7	Sunbury Road	43	45	47	48
R8	Providence Road	44	45	45	45
R9	Trinity Blvd	46	46	46	47
R10	Bamford Avenue	47	47	47	48
R11	Melrose Street	45	46	46	47
R12	True value Solar Centre (Stadium)	45	45	46	46
R13	Melbourne Airport Golf Club (green)	48	52	56	57
R14	Melbourne Airport Golf Club (club house)	46	47	48	49
R15	Keilor Golf Course (green)	40	40	41	42
R16	Keilor Golf Course (Club House)	41	42	43	43
R17	Woodlands Historic Park - main building	43	44	45	45

Figure B9.9
2026 Build day (0700-2200) typical busy hour ground noise contours (including taxiing)

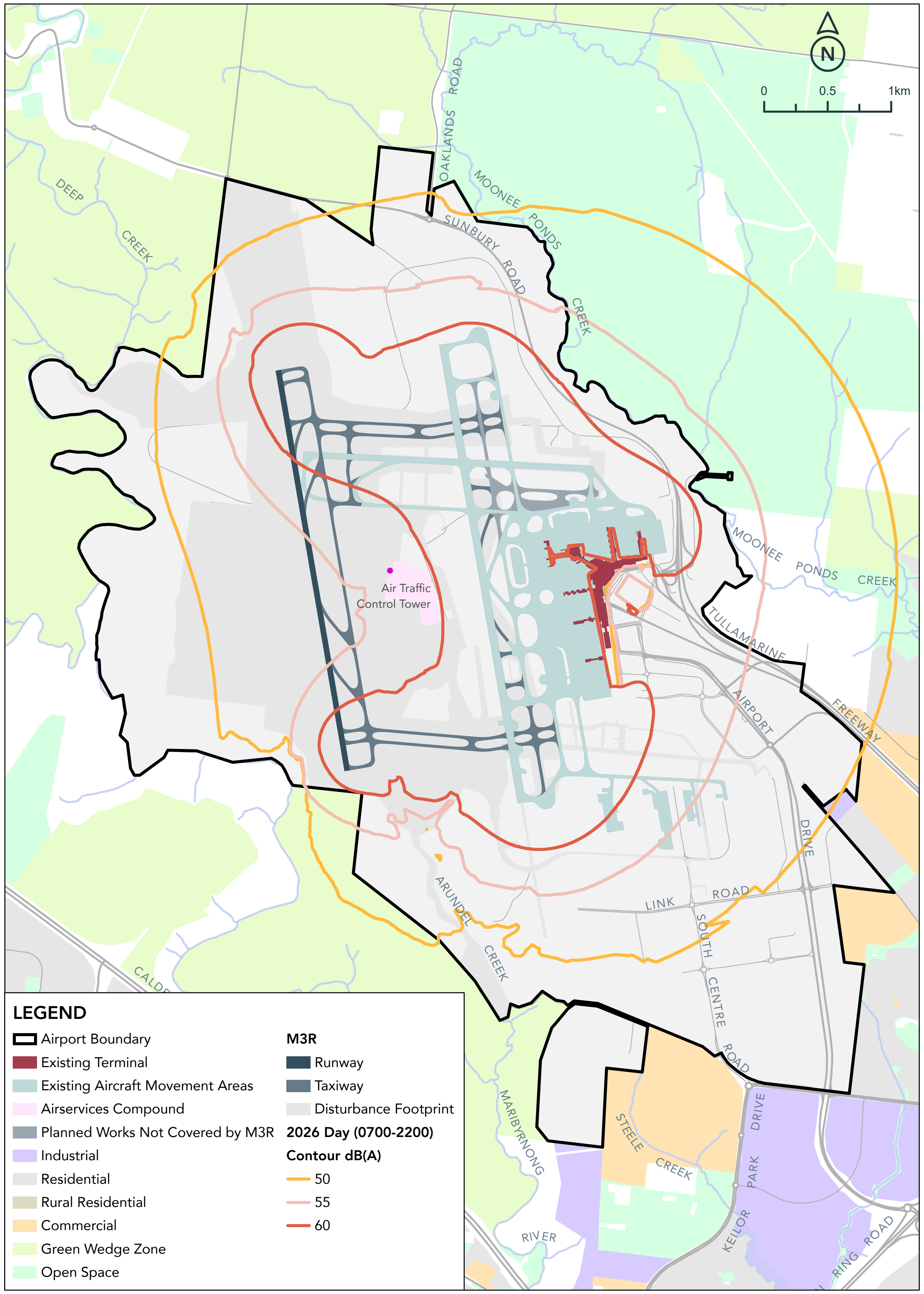


Figure B9.10
2046 Build day (0700-2200) typical busy hour ground noise contours (including taxiing)

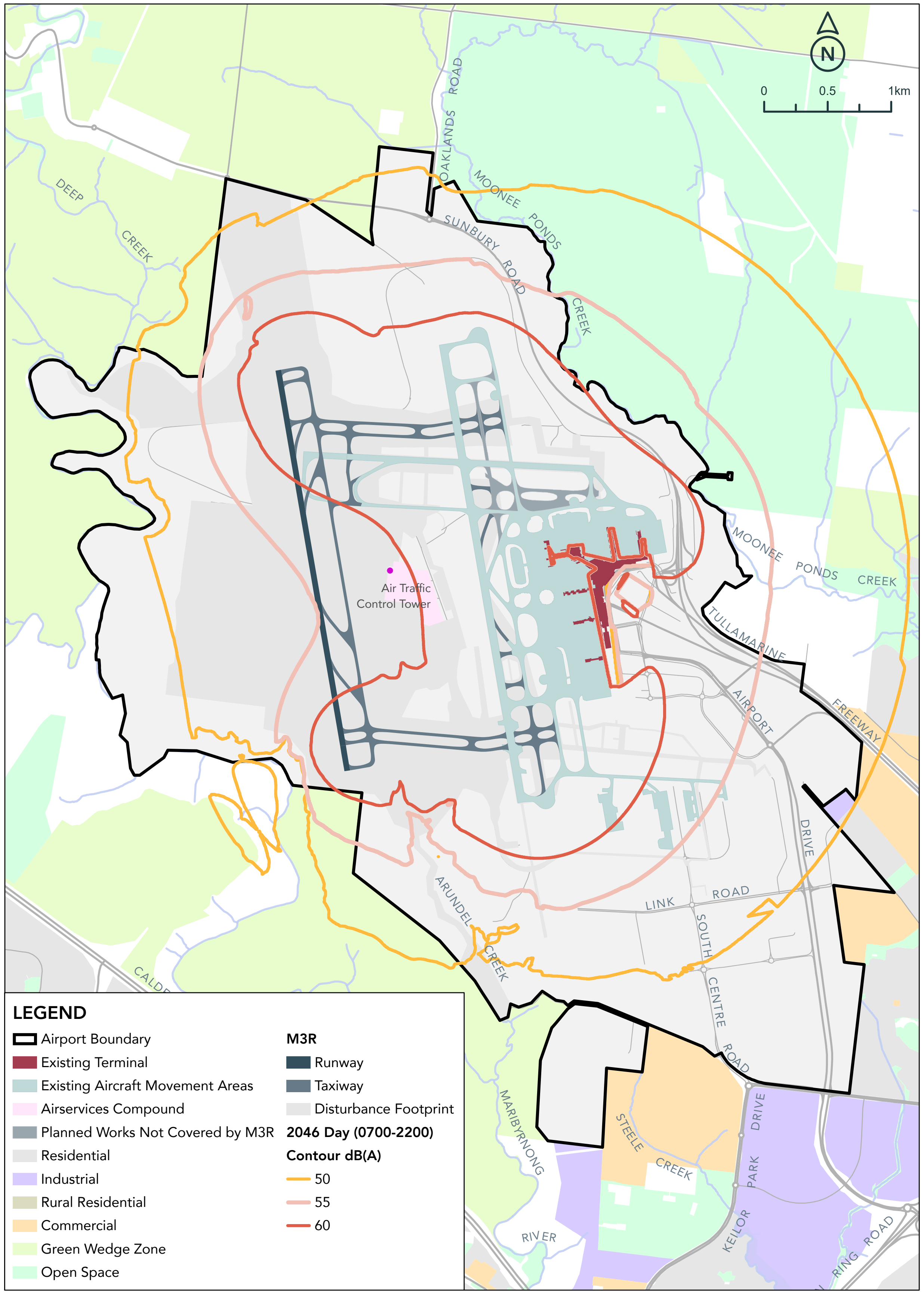


Figure B9.11
2026 Build night (2200-0700) typical busy hour ground noise contours (including taxiing)

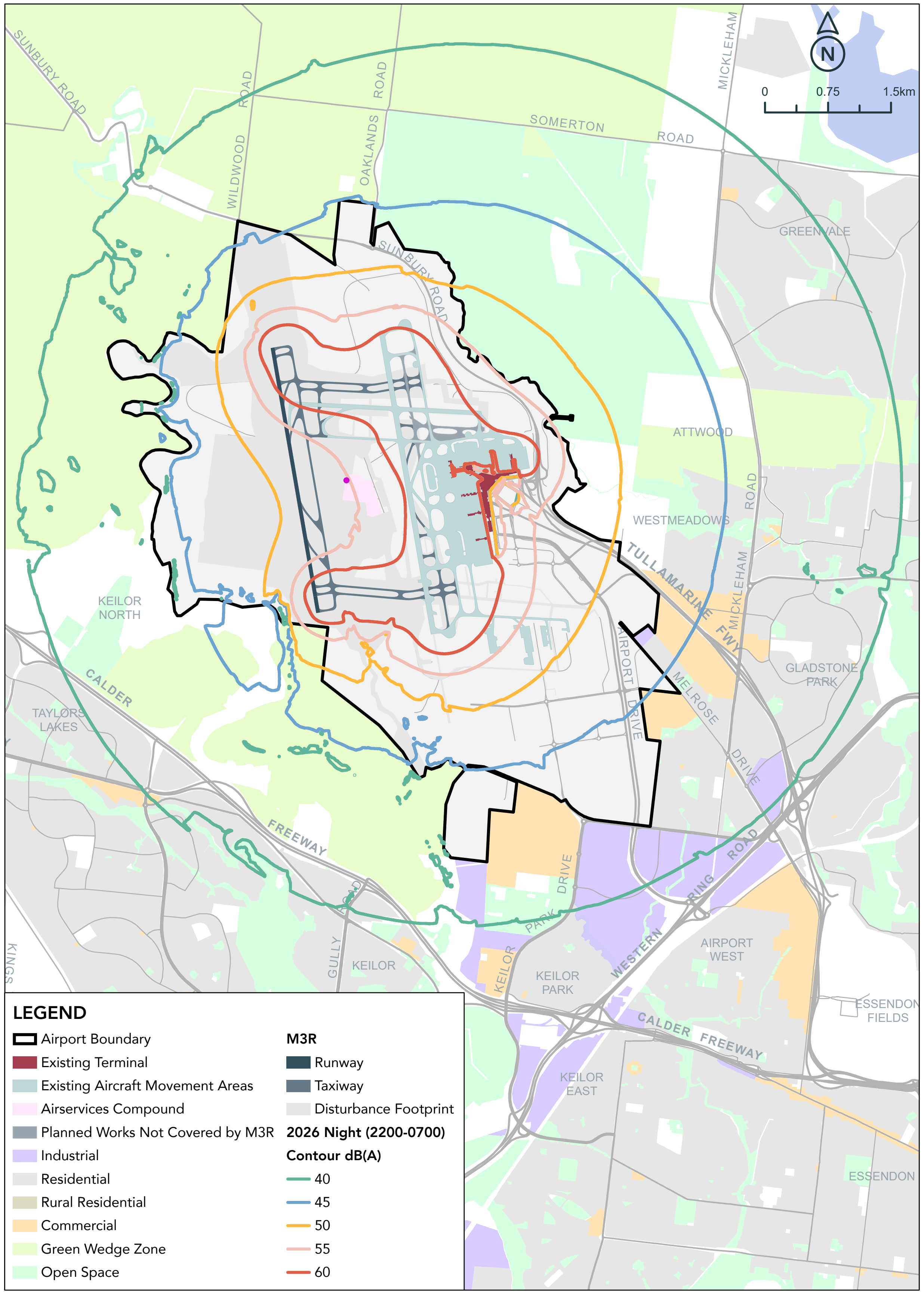
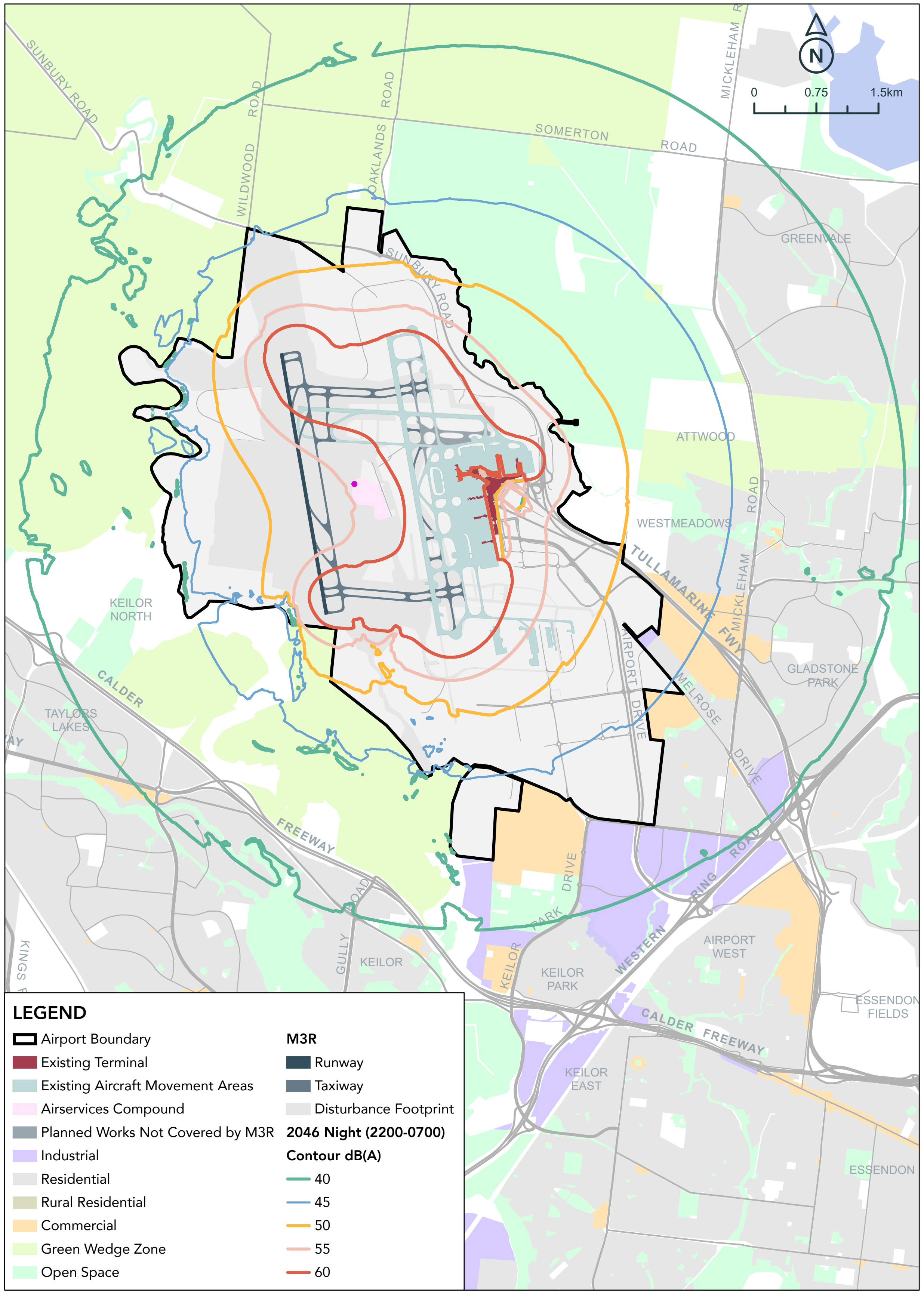


Figure B9.12
2046 Build night (2200-0700) typical busy hour ground noise contours (including taxiing)



B9.7.3
Engine ground running (EGR)

Aircraft maintenance operations are carried out at Melbourne Airport by several operators, who contract their work directly with the airlines. Post-maintenance engine ground running (EGR) is often required to ensure aircraft reliability and safe aircraft operations. EGR will typically occur during planned routine maintenance and scheduled during aircraft layover between operational days. Typically, downtime for essential aircraft maintenance occurs at night for domestic flights. Non-routine maintenance sometimes requires an EGR due to unforeseen circumstances (such as a blade change following a bird strike). These types of events can occur at any time. A typical EGR will involve running all engines at idle with intermittent use of high power on one engine at a time. The duration of an EGR will vary depending upon the maintenance requirement. However, on average a run-up will be between 10 and 25 minutes, with combined use of high power for just five minutes in total. Routine engine washing of aircraft will, in comparison, last a few minutes.

EGR of jet engines is sensitive to wind direction so aircraft will generally be faced into the oncoming wind direction. This also applies to EGR of turbo-prop aircraft (although these are not as sensitive to wind direction). EGR in the open requires an area large enough to position the aircraft facing the wind, and where it does not interfere with other aerodrome operations or navigation aids.

Melbourne Airport has an Operational Safety Policy (Melbourne Airport, 2015) for EGR. The policy is replicated in part within Melbourne Airport's aerodrome specific Aeronautical Information Publication (AIP). The Policy requires details of all EGRs to be recorded.

Four sites (see **Figure B9.13**) are available for ground running activities:

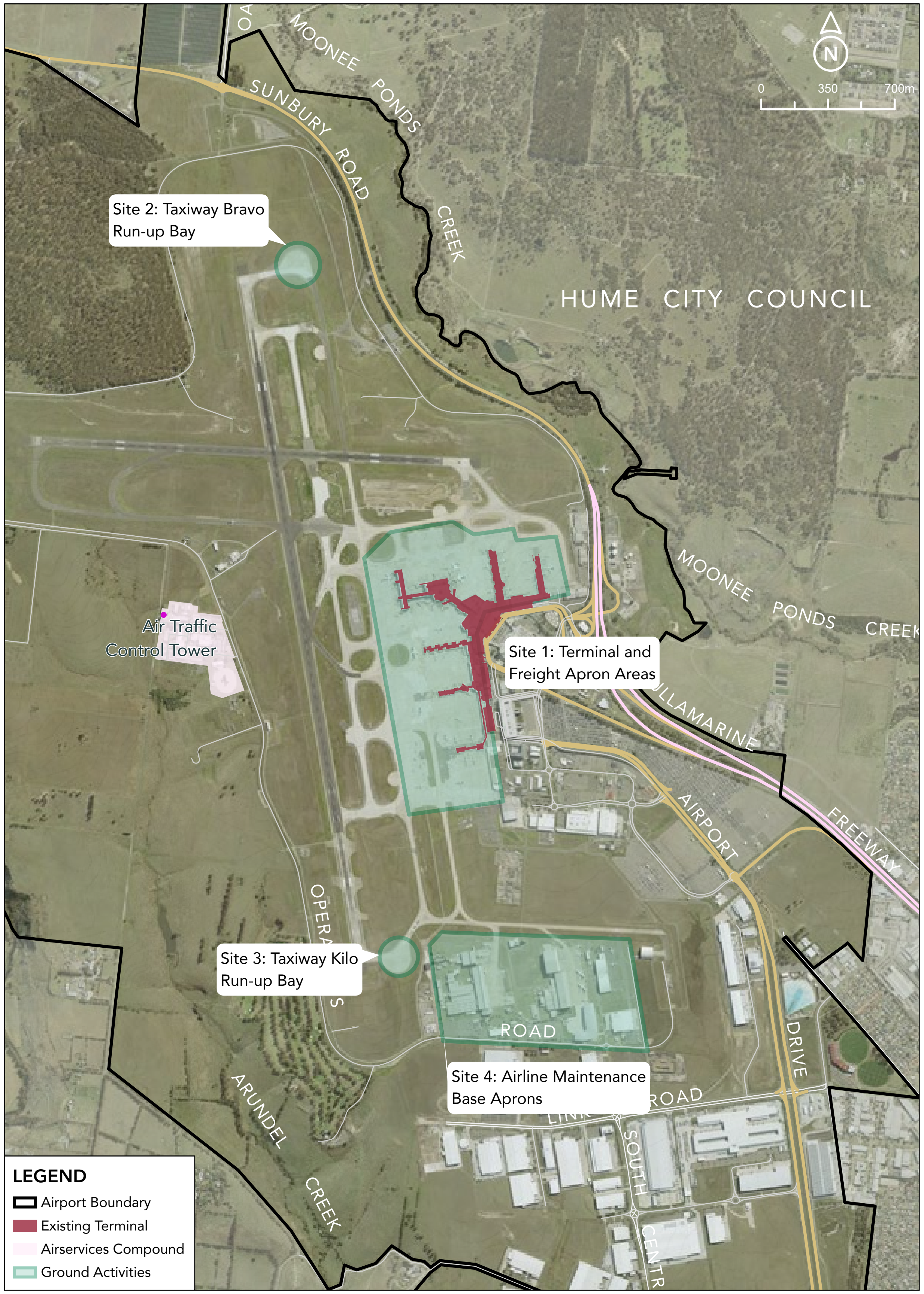
- Site 1: Terminal and Freight Apron Areas – power settings not to exceed ground idle, no more than two engines are to run at a time, duration not to exceed 30 minutes for any one event, and prior approval will have been sought.
- Site 2: Taxiway Bravo Run-up Bay – all runs at the discretion of Air Traffic Control (ATC). If facing north, aircraft is to be positioned as far north as possible; likewise if facing south then aircraft to be as far south as possible. Prior approval must be sought.
- Site 3: Taxiway Kilo Run-up Bay – all runs at the discretion of ATC, aircraft can only be positioned north or south and as far north/south as possible. (If east or west required, Bravo Run-up Bay must be used.) Restricted to between 2300 and 0500h, duration to not exceed 20 minutes and power not to exceed ground idle. Prior approval must be sought.
- Site 4: Airline Maintenance Base Aprons – power settings not to exceed ground idle, no more than one engine to be run at a time. Restricted to between 2300 and 0500h, duration to not exceed 20 minutes and prior approval must be sought.

Only site 2 can be used for high-power runs. The concrete Ground Run-up Enclosure (GRE) pad is near the threshold of runway 16, approximately 300 metres from Sunbury Road, 1.5 kilometres from Woodlands Historic Park (park buildings and car park) and over one kilometre to the nearest residential dwelling.

As part of M3R, there will be no change to Melbourne Airport's Operational Safety Policy. The run-up locations remain unchanged, although there will be a consequential increase in routine maintenance operations due to the increased aircraft fleet numbers. Currently a typical busy week will have approximately 25 engine runs. The number of future EGRs has been estimated on a pro-rata basis in comparison to the number of current EGRs versus the total number of 2019 air transport movements. It has been estimated that in 2046 there would be an additional 10 engine runs per week for the No Build scenario and 23 EGRs with M3R, which would equate to a total of four to six and six to seven engine runs per day respectively for the No Build and Build scenarios.

High-power EGRs can generate high levels of low frequency sound, which can lead to vibration within buildings. At site 2, sound levels in the region of 55-65 dB(A) would be experienced at the closest residential locations. At these decibel levels, high levels of low frequency sound are not sufficient to cause any adverse vibration. Accordingly, the impact of vibration from operational sources is negligible.

Figure B9.13
Current ground running activity locations at the airport



B9.7.4
Road traffic noise

Road traffic projections for major roads near the airport have been provided by traffic planners for the years 2026 and 2046; both with and without M3R (Build and No Build scenarios).

Noise levels at typical receiver setback distances from these roads have been calculated using the Calculation of Road Traffic Noise (CoRTN) procedure, based on projected traffic flows as detailed in Table B9.23 and Table B9.24.

Results of relative increases are detailed in Table B9.25.

With the project, the expected noise-level increase is less than two dB(A) compared to the No Build scenario for the majority of roads (with the exceptions of Airport Drive north of Sharps Road and Melrose Drive north of Mickleham Road). These increases are predicted to be 2.9 and 2.1 dB(A) in 2046. Noise levels in 2026 are not predicted to increase by more than 1.1 dB(A). Accordingly, it is unlikely that the increase in traffic noise associated with the project would be perceptible. This outcome reflects the relative small proportion of airport-induced traffic as a component of the total regional traffic forecast to use these roads.

Table B9.23
18 hr Traffic volumes

Road	Direction	No Build 2026	Build 2026	No Build 2046	Build 2046
Airport Drive north of Sharps Road	SB	7725	9642	11196	19578
	NB	7075	8584	9886	18685
Calder Freeway west of Keilor Park Drive	NWB	40679	41117	53009	55087
	SEB	43793	44427	57792	59744
Keilor Park Drive south of Tullamarine Park Road	SB	10578	11179	13940	16105
	NB	10628	11198	14371	16722
Melrose Drive north of Mickleham Road (on-airport)	NB	4932	5578	7280	11439
	SB	4744	5876	6665	9454
Melrose Drive south of Mickleham Road	NB	4565	4605	6157	6698
	SB	4794	4925	6578	7398
Mickleham Road north of Broadmeadows Road	NB	10628	10624	13325	13349
	SB	10726	10855	13172	13449
Mickleham Road 'south'	NB	9074	9137	13254	14993
	SB	8323	8491	13189	13376
Sharps Road west of Melrose Drive	EB	7076	7580	9822	10971
	WB	6046	6376	7340	8458
Sunbury Road north of Airport (2025 data & estimates)	NB	16698	16777	35753	38285
	SB	15745	15607	34321	36577
Tullamarine Freeway north of Mickleham Road	NB	52426	53994	82011	99460
	SB	50144	50697	77489	94696

Table B9.24
18 hr Percentage heavy vehicles

Road	Direction	No Build 2026	Build 2026	No Build 2046	Build 2046
Airport Drive north of Sharps Road	SB	2.7	3.2	2.4	4
	NB	0.8	0.9	1.2	1.8
Calder Freeway west of Keilor Park Drive	NWB	8.9	9	10.5	10.9
	SEB	11	11.2	12	12.3
Keilor Park Drive south of Tullamarine Park Road	SB	11.5	12.2	12.9	14.8
	NB	11.4	12.1	13.2	15.7
Melrose Drive north of Mickleham Road (on-airport)	NB	0.8	0.9	1.2	1.8
	SB	2.7	3.2	2.4	4
Melrose Drive south of Mickleham Road	NB	3.8	3.7	5	4.6
	SB	8.6	8.6	8.6	9.4
Mickleham Road north of Broadmeadows Road	NB	3.4	3.4	3.5	3.6
	SB	1.1	1.1	1.4	1.4
Mickleham Road 'south'	NB	3.8	3.7	5	4.6
	SB	8.6	8.6	8.6	9.4
Sharps Road west of Melrose Drive	EB	10.8	11.6	15.2	17.4
	WB	6.8	7.5	8	10.1
Sunbury Road north of Airport (2025 data & estimates)	NB	12.1	12.3	8.2	10.1
	SB	9.6	9.6	7.2	8.7
Tullamarine Freeway north of Mickleham Road	NB	3.3	3.5	3.1	4.4
	SB	2.6	2.6	2.7	3.8

Table B9.25
Traffic noise relative increases – build / no build

Road	2026	2046
Airport Drive north of Sharps Road	1.1	2.9
Calder Freeway west of Keilor Park Drive	0.1	0.2
Keilor Park Drive south of Tullamarine Park Road	0.3	1.0
Melrose Drive north of Mickleham Road (on-airport)	0.9	2.1
Melrose Drive south of Mickleham Road	0.7	0.5
Mickleham Road north of Broadmeadows Road	0.0	0.1
Mickleham Road 'south'	0.0	0.3
Sharps Road west of Melrose Drive	0.3	0.9
Sunbury Road north of Airport (2025 data & estimates)	0.0	0.7
Tullamarine Freeway north of Mickleham Road	0.1	1.0

B9.8 AVOIDANCE, MANAGEMENT AND MITIGATION MEASURES

B9.8.1 Incorporated mitigation

The following sections include a brief description of the incorporated mitigation measures that have been adopted as part of the construction and operational ground noise and vibration assessments.

M3R will include mitigation measures inherent in design and management. These incorporated mitigation measures do not include mitigation required to offset any adverse effects that have not been predicted, were not envisaged prior to undertaking this assessment, or which are unforeseen and arise during M3R construction or subsequent operation.

B9.8.1.1 Construction management

As part of best practice, M3R construction activities will be managed in accordance with the requirements of EPA's Civil construction, building and demolition guide (EPA 1834) which requires the appointed contractor to develop and implement a construction noise and vibration management plan.

Construction management details are available in EPA's Environmental Guidelines for major construction sites. These set out best-practice measures to eliminate health risks and nuisance to residents near major construction sites.

The EPA recommendations adopted for M3R and the range of measures will include:

- A principal contact person will be established for all community queries
- Informing potentially noise-affected neighbours about the nature of construction stages and noise reduction measures
- Notice will be given as early as possible for periods of noisier works such as blasting. The notice will include a description of the activities and their expected duration. Affected neighbours will be regularly informed of progress via social media, emails and one-to-one meetings, if required
- 24-hour contact details will be provided through letters and site signage. Any complaints received by members of the community/stakeholders will be recorded in a central database and a complaint-response procedure will be actioned suitable to the scale of works
- Within normal working hours (typically 0730-1800h) where it is reasonable to do so:
  - Noisy activities will be scheduled during the least sensitive times (for example, delaying a rock-breaking task to the later morning or afternoon)
  - Provide periods of respite from noisier works as often as practicable
  - The weekend/evening work hours in the schedule (including Saturday afternoon or Sunday) are more sensitive times and so have noise requirements consistent with quieter work. Respite periods will be provided during these days.

In addition to the above general measures, the following specific requirements will also be incorporated:

- Where work is conducted near a residential area or other noise-sensitive location, the lowest-noise work practices and equipment will be selected where possible
- Site buildings, access roads and plant will be positioned such that the minimum disturbance occurs to the locality
- The site will be planned to minimise the need for reversing of vehicles, especially when delivering materials
- All mechanical plant will be silenced by the best practical means using current technology, if safe to do so
- Mechanical plant, including noise-suppression devices, will be maintained to the manufacturer's specifications
- Internal combustion engines will be fitted with a suitable muffler in good repair
- All pneumatic tools operated near a residential area will be fitted with an effective silencer
- Vehicles speeds of large trucks will be restricted in sensitive areas
- Less noisy movement/reversing warning systems for equipment and vehicles that will operate for extended periods, during sensitive times or in close proximity to sensitive sites. Occupational health and safety requirements for use of warning systems will be followed. Use of broadband (white noise) alarms will be considered
- Drivers will be instructed to drive considerately (e.g. no aggressive braking or accelerating)
- All vehicular movements to and from the site will occur in accordance with the approved Traffic Management Plan
- Noise and vibration from the site will seek to comply with the requirements of Table B9.14 and Table B9.16 (showing construction noise and vibration criteria/thresholds).

Melbourne Airport has an established track record of delivering infrastructure works to the runways and terminal facilities. It also has an established annual maintenance program which includes works to the airfield pavements (some of which includes periods of night working). Melbourne Airport has a policy of adopting best practice when planning and undertaking construction works and these measures will be adopted through all the stages of M3R. As part of this best practice, Melbourne Airport will be consistent with the guidance of the EPA's 'Environmental guidelines for major construction sites'.

B9.8.1.2 Operational noise management

The Air Navigation (Aircraft Engine Emissions) Regulations 1998 conform with the Air Navigation Act 1920. They stipulate that an aircraft (excluding state aircraft or foreign aircraft) is not to fly in Australian airspace unless it complies with Annex 16 to the Chicago Convention. Annex 16 contains specific standards and recommended practices regarding aircraft noise and aircraft engine emissions. While Annex 16 is intended to limit noise when aircraft are in flight, it also has the ability to control engine ground noise at an airport. Other than this requirement, there is limited scope for Melbourne Airport to control the noise from aircraft operations except when aircraft are undertaking engine testing or using FEGP rather than APUs when on stand.

It is noted that the design of M3R has been developed through an iterative process, and noise minimisation has been prioritised wherever possible, including noise associated with ground operations

B9.8.2 Additional mitigation

B9.8.2.1 Construction management

The scale of M3R will require additional construction noise and vibration management above and beyond the comprehensive measures which Melbourne Airport already adopts when managing both construction and day-to-day operations.

It will be the responsibility of the contractor to minimise the potential noise and vibration disturbance from construction activities. The goal will be to implement best practice at all stages of M3R and to recognise that works at night will have the potential to generate adverse effects. An important control measure will be to ensure that there is appropriate communication with affected parties such that they are made aware of future works ahead of their occurrence and that the correct information is provided in a timely manner.

A Construction Noise Management Plan (CNMP) will be prepared prior commencing the construction works and will be regularly updated following any amendment to the project that may result in a change in noise and vibration levels. For high-risk work, such as blasting or prolonged night-time works, specific noise and vibration schedules will be developed to address specific periods of M3R. The aim of the schedules will be to minimise the resulting impacts and provide a notification list of potentially affected properties to assist with community engagement.

B9.8.2.2 Operational noise management

Regarding operational noise from aircraft, established procedures are successfully being adhered to and will be maintained once M3R is operational e.g. the engine ground-running (EGR) procedure.

While the assessments outlined in this chapter have shown that additional or enhanced mitigation is not required, additional procedures will be developed, which will assist in going above and beyond "good practice" at the airport, including:

- Airport collaborative decision-making – operating efficiency of the airport will be maintained by ensuring that any delays which may result in aircraft being held on the ground are minimised as far as is practicable, which will help to reduce noise and other emissions from ground operations. An example would be to hold aircraft at stand rather than at a taxiway intersection or runway hold point
- Several specific restrictions are imposed on taxiing and APU operation (i.e. use of FEGP in preference to APU running) and on EGR maintenance procedures, all of which limit the amount of ground noise which might otherwise occur, particularly at night.

B9.9 CONCLUSION

This chapter has identified likely construction and operational activities that may result in adverse ground-based noise and vibration effects associated with M3R at Melbourne Airport. A summary of the assessment against the significance assessment framework is contained in Table B9.26.

Many activities during construction and operation will produce noise of similar levels to existing airport noise during operational hours.

Construction vibration has been assessed as negligible even if blasting were to occur.

The construction contractor will be required to prepare a Construction Noise Management Plan.

Airport ground noise is localised around the airport. The distribution of noise around the airport depends upon runway usage and the corresponding number of aircraft movements and fleet-mix assumptions.

Operational ground noise is not expected to increase substantially with the operation of M3R. During the daytime, ground noise levels are predicted to remain within the noise objectives. Existing ground-based noise levels during the night-time are expected to exceed noise objectives, however, minimal changes are expected as a result of M3R. Hence impacts are considered minor.

Table B9.26
Impact assessment summary

Environment aspect & baseline condition	Assessment of original impact: Original Impact	Mitigation inherent in design/practice	Significance: Duration	Severity	Likelihood	Impact	Mitigation and/or management measures	Assessment of residual impact: Residual Impact	Significance: Duration	Severity	Likelihood	Impact
Construction							**Construction (cont.)**					
Noise Existing noise environment made up of existing airport noise and noise from road traffic	On-site noise from construction activities affecting off-site noise sensitive receivers	Implementation of a project-wide construction noise management plan which includes measures for noise management – including where necessary use of barriers and enclosures for noisy works at night	Short-Term	Minor to moderate impact (night)	Likely	Medium	Enhanced noise management especially at night and during other noise sensitive time periods, increased communication and engagement with noise-affected individuals	Potential for occasional audible noise at night	Short-Term	Minor	Possible	Low
Vibration Negligible vibration from existing sources	On-site vibration from dynamic compaction and potential blasting affecting off-site noise sensitive receivers. Potential to be felt, and in extreme cases, cause cosmetic damage of buildings	Implementation of a project-wide construction noise management plan which includes measures for management of vibration affects off-site – spatial separation is such that risk of damage/ nuisance is unlikely	Short-Term	Negligible	Possible	Negligible	None required	-				
Construction traffic Existing noise environment made up of existing airport noise and noise from road traffic	Heavy construction trucks on-site and off-site may cause increased noise	Implementation of a project-wide construction noise management plan which includes measures for management of construction traffic – e.g. timing, routes, road surfaces, etc.	Short-Term	Minor	Likely	Negligible	None required in addition to inherent practice	Increased noise from traffic on low usage local roads	Short-Term	Minor	Possible	Negligible
Operation							**Operation (cont.)**					
Aircraft movements Existing noise environment made up of existing airport noise and noise from road traffic	Increased airport ground noise from taxiing and engine ground running aircraft once M3R operational	Continuation of standard operating procedures including Operational Safety Policy for ground running of aircraft	Permanent	Minor	Almost certain	Medium	None required in addition to inherent practice	Noise from airport ground activity	Permanent	Minor	Almost certain	Medium
Road traffic Existing noise environment made up of existing airport noise and noise from road traffic – at greater distances from the airport and away from flight paths – road traffic will be the primary source of noise	Increased noise from surface access transport using the airport as a result of the M3R	Use of primary routes to and from the airport	Permanent	Negligible	Almost certain	Low	None required	Increased noise from surface access transport using the airport as a result of the M3R	Permanent	Negligible	Almost certain	Low

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Chapter B10
Air Quality

Summary of key findings:

- Air quality impacts were assessed for the construction and operational phases of Melbourne Airport's Third Runway (M3R). This chapter also identifies the specific measures available to avoid, manage, mitigate and/or monitor air quality impacts where required
- Potential impacts due to dust emissions from construction activities will be mitigated to satisfactory levels by applying dust suppression techniques. Project standards for deposited dust (TSP/nuisance dust), PM_{10} and $PM_{2.5}$ are therefore expected to be met outside the airport.
- The primary contributors to air emissions from airport operations were aircraft movements (Landing and Take-Offs, LTOs), Auxiliary Power Units (APUs) and road vehicle movements.
- Comparisons of model results for the No Build and Build scenarios indicated that overall Build leads to slightly worse air quality impacts. This is to be expected, given aircraft movements and road traffic movements will increase under the Build scenarios. The worst-case scenario was Build 2046 in which aircraft operations increased by 91 per cent and road traffic increased by an average of 95 per cent compared to 2019 (the base scenario).

CHAPTER B10 CONTENTS

CHAPTER B10 CONTENTS (cont.)

CHAPTER B10 FIGURES

CHAPTER B10 FIGURES (cont.)

CHAPTER B10 TABLES

B10.1 INTRODUCTION

This chapter describes the existing air quality at Melbourne Airport and compares it to two future scenarios:

- The No Build scenario: Melbourne Airport's Third Runway (M3R) is not constructed
- The Build scenario: M3R is constructed.

It also identifies specific measures to avoid, manage, mitigate, and/or monitor air quality impacts where required. The chapter is structured as follows:

- Discussion of statutory and policy requirements in **Section B10.2** including a summary of air quality standards
- The significance criteria framework for interpreting assessment results relative to the above requirements, in **Section B10.3**
- **Section B10.4** describes the technical process for air quality modelling
- **Section B10.5** describes the existing meteorological and air quality conditions
- **Section B10.6** and **Section B10.7** present the modelled air quality conditions for the M3R construction and operation impact assessments (relative to air quality standards)
- **Section B10.8** describes impact avoidance, management and mitigation measures
- Final conclusions are then presented in **Section B10.9**, including an impact assessment summary.

B10.2 STATUTORY AND POLICY REQUIREMENTS

Melbourne Airport is located on Commonwealth land. The *Airports Act 1996* (Cth) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) are therefore the key pieces of legislation setting the regulatory framework for M3R and this assessment. Consideration has also been given to relevant Victorian and local legislation (including environmental planning instruments, policies and guidelines).

B10.2.1 Commonwealth legislative requirements

The applicable Commonwealth legislation and guidelines are:

- *Airports (Environment Protection) Regulations 1997 (AEP Regulations)*
- *National Environment Protection (National Pollutant Inventory) Measure 1998 (NPI NEPM)*
- *National Environment Protection (Ambient Air Quality) Measure 2016 (AAQ NEPM)*
- *National Environment Protection (Air Toxics) Measure 2011.*

B10.2.1.1 Airports (Environment Protection) Regulations 1997

The AEP Regulations aim to promote the improvement of environmental management practices for airport activities. They apply to the assessment of air emissions within an airport's boundaries but not to pollution generated by aircraft. Hence, because monitoring and modelling measure total air quality effects, the AEP Regulations' requirements have not been applied for this assessment. The assessment focused on sensitive receptors outside the airport's boundary and therefore used the relevant Victorian regulations. Ambient air quality objectives from the AEP Regulations are provided for comparison in Table B10.1.

B10.2.1.2 National Environment Protection Measures

The National Environment Protection Council (NEPC) set out the National Environment Protection Measures (NEPM). These are national objectives designed to assist in protecting and/or managing particular aspects of the environment.

The National Environment Protection (Ambient Air Quality) Measure (known as the AAQ NEPM) (NEPC, 2003) was published to assist the protection of ambient air quality. It is used Australia-wide to monitor and assess air quality by setting out the standards for six 'criteria' i.e. primary air pollutants. They are carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), sulphur dioxide (SO_2), lead, and particles such as PM_{10}. The AAQ NEPM are adopted in Victorian Government ambient air quality standards and described in Section B10.2.2.

In 2015 the NEPC strengthened the AAQ NEPM air quality reporting standards for particles such as PM_{10}. It also amended the previous 'advisory reporting standard' for $PM_{2.5}$ to a 'performance standard' (i.e. requiring the same level of reporting as other primary pollutants). The revision also includes new objectives for $PM_{2.5}$ by 2026.

New standards for the AAQ NEPM were proposed for sulphur dioxide, nitrogen dioxide and ozone in a May 2019 NEPC impact statement. These were subsequently agreed to by the NEPC and took effect from 18 May 2021.

The National Environment Protection Measure (Air Toxics) 2011 (NEPC, 2011) facilitates a consistent approach to the monitoring and reporting of five key hydrocarbons that impact human health. They are benzene, toluene, formaldehyde, xylenes and Poly-Aromatic Hydrocarbons (PAHs).

National standards are used to assess air quality concentrations determined by Victoria's air quality monitoring programs. They are relevant to M3R because they are adopted in the Victorian Government's ambient air quality monitoring standards, described in Section B10.2.2.

B10.2.2 Victorian legislation

State legislation and guidelines are:

- *Environment Protection Act 2017*
- *Environmental Protection Amendment Act* 2018
- *State Environment Protection Policy (Ambient Air Quality)* 1999 (SEPP (AAQ))
- *State Environment Protection Policy (Air Quality Management)* 1999 (SEPP (AQM))
- *Policy Impact Assessment: Variation to State Environment Protection Policy (Air Quality Management) and State Environment Protection Policy* (Ambient Air Quality) (2002)
- *Protocol for Environmental Management: Mining and Extractive Industries 2007* (Mining PEM).

B10.2.2.1 Environment Protection Act 1970 and amendments

The EP Act 1970 was the primary legislative instrument governing the protection of the environment in Victoria, including protecting beneficial uses of the air quality environment. It sets objectives for air quality and regulates emissions through two State Environment Protection Policies (SEPP).

Amendments to the EP Act 1970 were made in the Environment Protection Act 2017 (EP Act 2017). The Environment Protection Authority Victoria (EPA Victoria) has enacted new laws aimed at preventing harm to public health and the environment in the 2017 Act, effective from July 2021.

The EP Act 2017 creates the Environment Reference Standard (ERS). This is designed to identify important environmental values and assess them in locations across Victoria. Regarding air quality, the ERS is based on the SEPP (AAQ), against which the assessment of M3R impacts should also be made.

(NB because ERS is not a compliance standard, it neither creates obligations on duty holders nor defines fixed environmental standards for enforcement.)

In 2018, Victoria passed the Environmental Protection Amendment Act, which focuses on waste management, industrial waste and contaminated environments; and also has implications for air quality.

This Act replaces permissions granted for high-risk activities with a three-tiered permissions framework of registrations, permits and licences. Licences are required for complex activities requiring the highest level of regulatory control to manage their significant risks, and will be subject to regular reviews.

B10.2.2.2
State Environment Protection Policies

The SEPP (AQM) establishes a framework for managing emissions into the air environment from all sources of air pollutants.

The management framework, and the attainment program for protection of the air environment, addresses ambient ('regional') air quality and the management of specific air pollutant sources (such as industry, motor vehicles and open burning); and local air quality impacts (including air toxics, odorous pollutants, greenhouse gases and ozone depleting substances).

The SEPP (AAQ) adopted the original (1998) objectives and goals of NEPC (2003). The new standards for PM_{10} and $PM_{2.5}$ set out in the amended NEPC (2016) were then adopted by the Victorian Government in its 2016 variation.

In this report, SEPP (AAQ) includes the 2016 updates to the particle standards. The SEPP (AAQ) air quality monitoring standards relevant to this assessment are set out in Table B10.1 alongside the corresponding NEPM standards, demonstrating their near equivalence.

Schedule A of the SEPP (AQM) prescribes the Class 1, 2 and 3 indicators (i.e. air pollutants) and their design criteria.

These design criteria represent an extensive set of ambient air quality standards to be used for air dispersion modelling assessments in Victoria. The design criteria have a separate function from the air quality standards provided in the Ambient Air Quality NEPM and the SEPP (AAQ) which are used for the assessment of ambient air quality using monitoring techniques.

Essentially, the SEPP (AQM) design criteria are a set of air quality standards to be used with air dispersion models, their goal being to prevent exceedances (determined by monitoring) of the air quality standards set out in the SEPP (AAQ) at nearby sensitive receptors.

The design criteria are used in the assessment of the design of new or expanded sources of emissions such as industrial premises. They are also used with the modelling procedures outlined in Schedule C of the SEPP (AQM). Part C of the SEPP (AQM) states that model-predicted exceedances of the design criteria may trigger a health risk assessment in order to demonstrate there will be no adverse impacts from the proposal. The substances and design criteria used in the modelling assessment are set out in Table B10.1.

The SEPP (AQM) specifies that the authority (EPA Victoria) will develop protocols for the environmental management for large line sources, including transport routes. In the absence of any protocol to date, the Mining PEM (see below) and the NEPM (AAQ) Standards were also used to assess PM_{10} and $PM_{2.5}$.

The air quality impact assessment for M3R was carried out in accordance with the procedures set out in SEPP (AQM)'s Schedule C. These procedures were consistent with the use of AERMOD and AEDT (the latter used internationally for airport air quality impact assessments). EPA Victoria was consulted, and agreed to the use of AEDT to model aircraft emissions in conjunction with AERMOD for the assessment of M3R.

B10.2.2.3
Protocol for Environmental Management: Mining

The Mining PEM is an incorporated document of the SEPP (AQM). It provides guidance on assessing the potential impacts of emissions arising from extractive industries, including construction dust deposition, and is therefore relevant to this assessment in addition to SEPP (AAQ) criteria.

The Mining PEM is the 'relevant industry PEM' referenced in the SEPP (AQM) as the relevant criteria for area-based sources and roads (which includes construction dust sources). It specifies dust deposition should not exceed $2 g/m^2$/month above background levels and $4 g/m^2$/month total, and a monthly average.

B10.2.2.4
Guideline for assessing and minimising air pollution in Victoria

EPA Victoria has produced a new air quality guidance called Guideline for assessing and minimising air pollution in Victoria (EPA Publication 1961). This is out for consultation and due to be finalised by the end of 2021.

This guideline is part of Victoria's environmental protection framework that establishes the knowledge needed to protect the environmental values of the ambient air environment. Emitters of air pollution have a responsibility to implement proportionate controls that eliminate or minimise risks to human health or the environment. Being proportionate and preventative requires duty holders to:

- Understand their risks
- Actively seek out ways to eliminate or minimise these risks, so far as reasonably practicable
- Ensure any risks remaining after the implementation of all controls are within acceptable limits.

The purpose of the guideline is to provide a framework to assess and control risks associated with air pollution. The guideline outlines a risk management approach that involves a recurring four-step cycle. The steps and how they have been addressed in this assessment are detailed below:

1. Identifying hazards

This involves identifying, and if necessary, quantifying emission sources. It also involves characterising the receiving environment including local topography, meteorology, background air quality and nearby sensitive land uses. Section B10.4 and Section B10.5 of this MDP chapter address hazard identification.

2. Assessing risks

A three-tiered approach to the assessment of risks from air pollution is outlined:

- Level 1 assessment: qualitative or semiquantitative assessment – used to assess risks from activities that either have intrinsically low risks, or have common, well-understood risks that can be controlled without extensive assessment.
- Level 2 assessment: dispersion modelling or monitoring – predicted concentrations benchmarked against Air Quailty Assessment Criteria (AQAC).
- Level 3 assessment: detailed risk assessment – used when a simple comparison of a pollutant's concentration to an AQAC cannot adequately assess risks.

An assessment in line with level 2 was undertaken and the results are presented in Section B10.6 and Section B10.7.

3. Implementing controls

Emitters should demonstrate how existing or proposed risk controls minimise risks, as far as reasonably practicable. This is addressed in Section B10.8.

4. Checking controls

To evaluate performance, emitters should have clearly documented environmental performance objectives that can be monitored and reported on. This is addressed in Section B10.8.

B10.2.3
Summary of air quality standards

The NEPC (2003) and NEPC (2016) air quality monitoring standards used in this assessment and proposed revisions (NEPC, 2019) are given in Table B10.1.
The NEPC (2011) monitoring investigation levels for primary hydrocarbons are set out in Table B10.2.

Ambient air quality standards will be assessed beyond the boundary of the airport. The SEPP (AQM) is the main standard applicable to new and expanded sources of emissions. This includes industrial premises, transport sources including road corridors, and other mobile sources including roads. All ambient air quality criteria are applied at sensitive receptors (Section B10.4.2.2).

The Workplace Exposure Standards for Airborne Contaminants (based on the Work Health and Safety (WHS) Act and WHS Regulation) were considered, although they are not directly applicable to air pollutants inside the boundary of Melbourne Airport. They provide a set of eight-hour Time Weighted Averages (TWAs) and Short-Term Exposure Limits (STEL) applicable to workers who are exposed to airborne contaminants.

The TWA criteria apply to the same air pollutants listed below, and in all cases are higher than the ambient air quality standard. For example, NO_2 has an 8-hour TWA of 5.6 mg/m^3 and a STEL of 9.4 mg/m^3, compared to a 1-hour average of 169 ug/m^3. Carbon monoxide has a TWA of 30 ppm compared with 9 ppm for the ambient air quality objectives. Particulate matter is not listed among pollutants in the WHS Regulations.

Exposure to staff at the airport is expected to be insignificant given staff movements within a typical shift. Compliance with ambient air quality standards is also used to indicate compliance with the WHS Regulations.

Table B10.1
Ambient air quality objectives and goals – criteria air pollutants

Environmental indicator (air pollutant)	Averaging period	Ambient air quality NEPM & SEPP (AAQ)		NEPM targets ('16) and proposed targets (NEPC, '19)	Airport (Environment Protection) Regulations 1997*
		Objective	Maximum allowable exceedances		
CO (max. conc.)	8 hours[a]	9.0 ppm	1 day/year	-	9.0 ppm
	1-hour	120 ppb	1 day/year	-	160 ppb
	1 year	30 ppb	None	-	-
O_3 (max. conc.)	1-hour	100 ppb	1 day/year	Recommended for removal	100 ppb
	4 hours[b]	80 ppb	1 day/year	Recommended for removal	80 ppb
	8 hours	-	-	65 ppb from '19, with no allowable exceedances	
NO_2	1-hour	120 ppb (226 μg/m³ at 25°C)	1 day a year	90 ppb (169 μg/m³ at 25°C) from '19, with no allowable exceedances. 80 ppb from '25 (150 μg/m³ at 25°C)	
	Annual	30 ppb (56 μg/m³ at 25°C)	None	19 ppb from '19 (36 μg/m³ at 25°C)	
SO_2 (max. conc.)	10 minutes	-	-	-	250 ppb
	1-hour	200 ppb (523 μg/m³ at 25°C)	1 day/year	100 ppb (261 μg/m³ at 25°C) from '19, with no allowable exceedances. 75 ppb (196 μg/m³ at 25°C) from '25 with no allowable exceedances	200 ppb
	1 day	80 ppb	1 day/year	20 ppb from '19	-
	1 year	20 ppb	None	-	20 ppb
Particles as PM_{10}	1 day	50 μg/m³	None	-	-
	1 year	20 μg/m³	None	-	
Particles as $PM_{2.5}$	1 day	25 μg/m³	None	20 μg/m³ by '25	-
	1 year	8 μg/m³	None	7 μg/m³ by '25	-

Notes: a Rolling eight-hour average based on one-hour averages. b Rolling four-hour average based on one-hour averages.
**The Airport (Environment Protection) Regulations 1997 does not make any allowance for exceedances.*

Table B10.2
Air toxics NEPM (2011) monitoring investigation levels and goals

Pollutant	Averaging period	Monitoring investigation level (MIL)
Benzene	Annual average	3 ppb (9.6 μg/m³)
Benzo(a)pyrene as a marker for polycyclic aromatic hydrocarbons	Annual average	0.3 ng/m³
Formaldehyde	24-hours	40 ppb (49 μg/m³)
Toluene	24-hours	1000 ppb (3767 μg/m³)
	Annual average	100 ppb (377 μg/m³)
Xylenes (as total of ortho, meta and para isomers)	24-hours	250 ppb (1085 μg/m³)
	Annual average	200 ppb (868 μg/m³)

Notes: The 8-year goal of the Air Toxics NEPM (2011) was to gather sufficient data nationally to facilitate development of a standard. The annual average concentrations are arithmetic mean concentrations of 24-hour monitoring results. Monitoring over 24-hour periods is conducted from midnight to midnight. For toluene and xylenes, the annual average and 24-hour MILs were derived independently for different (chronic and acute) health endpoints. The 24-hour MILs were derived from health-based guidelines of shorter averaging periods: 0.08 parts per million (ppm) for a one-hour averaging period (formaldehyde); 4 ppm for a six-hour averaging period (toluene); and 1 ppm for a 30-minute averaging period (xylene).

B10.2.4
Project modelling air quality standards

A summary of the air quality standards (the 'project standards') used for the assessment of modelled GLCs is provided in **Table B10.3**.

Pollutants are assessed against the SEPP (AQM) standards, except particulate matter (PM_{10} and $PM_{2.5}$). Compliance with SEPP (AAQ) criteria is also assessed outside the boundary of the airport, noting that compliance with SEPP (AQM) criteria results in compliance with SEPP (AAQ) criteria for pollutants NO_2, PM_{10}, and SO_2. VOCs were modelled as a whole, and then assessed for fractions of benzene and formaldehyde to align with the emission rates output from both AEDT and COPERT.

Table B10.3
Project modelling air quality standards

Pollutant	Class, reason for classification (SEPP (AQM))	Relevant standard	Avg. period	Criteria
Construction phase impacts				
Particles as PM_{10}	Class 1, Toxicity (VG, 2001)	Mining PEM SEPP (AAQ) / NEPM (AAQ)	24-hours	60 μg/m³ 50 μg/m³
Particles as $PM_{2.5}$	Class 2, Toxicity (VG, 2001)	Mining PEM NEPM (AAQ)	24-hours	36 μg/m³ 25 μg/m³
Deposited dust (TSP)	Amenity / nuisance	Mining PEM	Month	4 g/m² total 2 g/m² above background
Operational phase impacts				
Nitrogen dioxide (NO_2)	Class 1, Toxicity	SEPP (AQM) SEPP (AAQ)	1-hour	100 ppb (190 μg/m³ at 25°C) 120 ppb (226 μg/m³ at 25°C) 80 ppb (150 μg/m³ at 25°C) from 2025
		SEPP (AAQ)	Annual	30 ppb (56 μg/m³ at 25°C)
Particles as PM_{10}	Class 1, Toxicity (VG, 2001) Annual	SEPP (AAQ) / NEPM (AAQ)	24-hours	50 μg/m³
			Annual	20 μg/m³
Particles as $PM_{2.5}$	Class 2, Toxicity (VG, 2001)	SEPP (AAQ) / NEPM (AAQ)	24-hours	25 μg/m³
			Annual	8 μg/m³
Carbon monoxide CO	Class 1, Toxicity	SEPP (AQM)	1 hour	29 mg/m³
Sulfur Dioxide SO_2	Class 1, Toxicity	SEPP (AQM)	1 hour	450 μg/m³
Formaldehyde	Class 2 (toxicity based), International Agency for Research on Cancer (IARC) Group 2 carcinogen	SEPP (AQM)	3 minutes	33 ppb (40 μg/m3 at 25°C)
Benzene	Class 3, IARC Group 1 carcinogen	SEPP (AQM)	3 minutes	17 ppb (53 μg/m³ at 25°C)

B10.3 DESCRIPTION OF SIGNIFICANCE CRITERIA

To ensure a consistent approach across each impact assessment presented in the MDP, **Chapter A8: Assessment and Approvals Process** describes the framework for assessing the significance of impact assessment results that is used in this chapter.

The significance of air quality impact assessment results is largely dictated by the magnitude of the predicted impacts. Criteria for gauging significance are described in **Table B10.4**. These criteria have been used for the interpretation of the assessment results presented in **Section B10.4.3** and **B10.4.4**.

Table B10.4
Significance criteria

Impact significance	Description	Rationale/comments
Major	Major air quality impact on a regional scale determined by assessment parameter 'x' being well in excess of 100% of project standard for discrete (sensitive) receptors.	• Airport activity leads to large modelled predicted exceedances of project standards off-airport. • Risk assessment includes consideration of air quality monitoring results. • Emissions controls expected to be insignificant in reducing these exceedances. • Monitor and report key air pollutant GLCs to assist with air quality management and support air quality research programs. • Annual air quality modelling studies to increase understanding of major adverse air quality effects.
High	Air quality impacts at local scale determined by assessment parameter 'x' approximately greater than or equal to 100 per cent of project standard for discrete (sensitive) receptors.	• Airport activity leads to predicted exceedances of project standards off-airport. • Risk assessment includes consideration of air quality monitoring results. • Emissions controls not expected to have a significant effect reducing these exceedances. • Monitor and report key air pollutant GLCs to assist with air quality management and support air quality research programs. • Occasional air quality modelling studies to increase understanding of high adverse air quality effects.
Moderate	Air quality impacts at local scale determined by assessment parameter 'x' approximately 20 per cent to 99 per cent of project standard for discrete (sensitive) receptors.	• Airport activity has a detrimental effect on air quality, without causing exceedances of project standards at sensitive receptors. • Risk assessment includes consideration of air quality monitoring results. • Emissions controls may assist to reduce exceedances. • Monitor and report key air pollutant GLCs to demonstrate moderate adverse air quality impacts and support air quality research programs. • Occasional air quality modelling studies to increase understanding of high adverse air quality effects.
Minor	Minor air quality impacts at local scale determined by assessment parameter 'x' approximately 1 per cent to 20 per cent of project standard for discrete (sensitive) receptors.	• Airport activity has a slightly detrimental effect on air quality, without causing exceedances of project standards. • Risk assessment includes consideration of air quality monitoring results. • The 20% level is based on the EPA's guidance for using AERMOD. This level recognises increased risk of air quality impact by triggering dispersion modelling with five years of meteorological data. • Emissions controls will assist to improve air quality, especially on-airport. • Monitor and report key air pollutant GLCs to demonstrate minor adverse air quality effects; consider supporting air quality research programs; occasional air quality modelling studies to increase understanding of high adverse air quality effects.
Negligible	Negligible air quality impacts at local scale determined by assessment parameter 'x' approximately less than or equal to 1 per cent of project standard for discrete (sensitive) receptors.	• Changes to baseline air quality only just detected by monitoring or modelling. Emissions controls will still assist to improve air quality on-airport, especially near terminals. • Monitor and report key air pollutant GLCs to demonstrate negligible air quality effects, e.g., it is possible the airport's emissions of • NO_x, HCs, CO and other air pollutants could reduce O_3 levels in the vicinity of the airport to below the O_3 levels observed in other parts of the Melbourne airshed. This may become more important as the airport's emissions increase in future. • Occasional air quality modelling studies to increase understanding of negligible air quality effects and communicate results; consider supporting air quality research programs.
Beneficial	Airport activity causes a decrease in the baseline levels of a pollutant at discrete (sensitive) receptor locations.	• Changes to baseline air quality only just detected by monitoring or modelling. • Emissions controls will still assist to improve air quality on-airport, especially near terminals. • Monitor and report key air pollutant GLCs to demonstrate negligible air quality effects, e.g., it is possible the airport's emissions of • NO_x, HCs, CO and other air pollutants could reduce O_3 levels in the vicinity of the airport to below the O_3 levels observed in other parts of the Melbourne airshed. This may become more important as the airport's emissions increase in future. • Occasional air quality modelling studies to increase understanding of negligible air quality effects and communicate results; consider supporting air quality research programs.

Assessment against these criteria has been undertaken for each pollutant using a two-step process comparing the results for the worst-case emissions scenario (Build 2046) against a baseline scenario (No Build 2046).

The first step focused on modelled results at discrete receptors. For each pollutant, an assessment parameter (parameter x) was defined as the difference between Build and No Build scenarios divided by the air quality standard for that pollutant (see **Table B10.3**). In this way, assessment results were normalised for all pollutants.

The second step was a semiquantitative analysis of the results for all receptors of the AERMOD modelling grid (to ensure complete coverage) by inspecting spatial differences between the contour plots for the Build and No Build cases.

B10.4 ASSESSMENT METHODOLOGY AND ASSUMPTIONS

B10.4.1 Overview

The air quality impacts of the proposed M3R were assessed for two key stages of the project, construction and operational:

- Construction dust emissions: emissions of airborne particulate matter (PM) as PM_{10} and $PM_{2.5}$ due to activities and equipment associated with construction earthworks
- Operational emissions: particulate and gaseous emissions (e.g. PM_{10}, $PM_{2.5}$, oxides of nitrogen and hydrocarbons) from jet aircraft engine exhausts, airport Ground Support Equipment (GSE) during operations, and aircraft Auxiliary Power Units (APUs); as well as from road vehicles on the airport, surrounding roadways, and car parks.

These impacts were assessed by comparing modelled air quality impacts under the following scenarios:

- Current airport operations: the baseline operating scenario, representing the existing runway configuration based on the five most recent complete years of meteorological data (2015-19 inclusive) and most recent year of activity data (2019)
- Build: existing runway configuration with the proposed north-south additional runway plus extensions to the existing road network around the runway:
  - Representing opening year (2026) when new parallel north-south runway operations are expected to commence
  - Representing 20 years from opening in 2046
- No Build: existing runway configuration with modelled aircraft movements for reference years 2026 and 2046.

Modelling of air impacts was completed in a three-stage approach:

- Preparation of annual emissions inventories for the construction and airport operations scenarios involving:
  - Identifying key sources of air pollutants
  - Applying forecasts of future activity at and around the airport under each scenario listed above
  - Applying relevant emissions factors for each source or source group.
- Dispersion modelling and processing of results incorporating existing conditions (air quality and meteorology) at the airport
- Presentation of results and reporting.

The air quality models used in this assessment were selected based on the recommendations of the US Environmental Protection Agency (US EPA) and US Federal Aviation Administration. Model selection was also endorsed by EPA Victoria in February 2020. Note: the methodology used in this assessment has been peer reviewed by environmental consultants GHD.

The air quality impact assessment cumulatively assessed model-predicted ground level concentrations for pollutants. This included background concentrations and the effects of all major sources of air pollutants.

Existing air quality at Melbourne Airport was assessed using monitoring data from two Air Quality Monitoring Stations (AQMSs) maintained by APAM: Melbourne Airport south (MAS) and Melbourne Airport east (MAE). Data was compared to that gathered by EPA Victoria in Footscray, Campbellfield and Alphington.

The potential air quality impacts from construction of M3R were predicted by estimating dust emissions from construction activities based on material handling quantities, the construction equipment inventory, and site layout. These activities were input into the regulatory air dispersion model AERMOD (see **Section B10.4.3**).

The potential air quality impacts from the operation of M3R were predicted for existing and future scenarios using a two-step process.

First, the emissions inventory and source characterisation were developed using the internationally recognised Aviation Environmental Design Tool (AEDT) version 3c (build 140.0.11574.1 released March 2020). Second, AERMOD was used to assess emissions dispersion. AERMOD's predictions were compared with state and national air quality standards to assess the effects that airport activities may have on the local air quality environment (**Section B10.4.4**).

The assessment was completed in accordance with Guidance notes for using the regulatory air pollution model AERMOD in Victoria (EPA Victoria, 2013). During the planning phase of this assessment, the EPA's senior air quality specialists were consulted about the proposed models to use, the methods to model impacts, and other requirements.

Although Melbourne Airport is located on Commonwealth land, the air quality impact assessment supporting M3R was undertaken in accordance with procedures and standards set out in the Victorian State Environment Protection Policy (SEPP) (Air Quality Management) (AQM) for the assessment of air quality outside airport boundaries, which is within the jurisdiction of the Victorian Government (**Section B10.2.2**).

B10.4.2
Air quality at Melbourne Airport

B10.4.2.1
Current air quality monitoring program

Melbourne Airport has an Air Quality Monitoring Program (AQMP) (July 2019) that defines two regimes, to assess:

- 'Criteria' air pollutants: considered by regulators to be important for monitoring and reporting, both internationally and Australia-wide (Department of Agriculture, Water and the Environment, 2020). The criteria air pollutants measured at Melbourne Airport are nitrogen oxides (for NO_2), sulphur dioxide (SO_2), ozone (O_3), carbon monoxide (CO) and particles as PM_{10} and $PM_{2.5}$.
- 'Air toxics': in this context, are hydrocarbons identified by the Commonwealth Government (2020) as the most important hydrocarbons to monitor and report. The hydrocarbons measured at Melbourne Airport are benzene, toluene, ethylbenzene, xylene and formaldehyde.

Melbourne Airport has two ambient air quality monitoring stations (AQMS) for monitoring criteria pollutants:

- Melbourne Airport south (MAS) in a cattle grazing paddock at the southern end of the existing north-south runway (16L/34R) within the airport's boundary. It commenced monitoring on 4 December 2013 and continuously monitors all criteria pollutants and meteorological parameters.
- Melbourne Airport east (MAE) east of the airport boundary in Westmeadows, which commenced monitoring on 1 May 2017. MAE monitors NO_X (including NO_2) and $PM_{2.5}$ for Melbourne Airport.

These locations are able to assess ongoing air quality impacts from airport operations because prevailing winds are predominantly from the north. MAS measures worst-case conditions from airport operations; MAE compares ambient concentrations against those measured at MAS. They are considered suitable for the future monitoring of air quality under all scenarios.

Melbourne Airport also specifies a periodic monitoring program in its AQMP (2019) to assess compliance with air quality standards for Volatile Organic Compounds (VOCs). The most recent round of monitoring (December 2014 to July 2017) focused on the key VOCs including benzene, toluene, xylenes, and formaldehyde.

The AQMP has been reviewed periodically by independent experts (Jacobs in 2017 and Point Advisory in 2019). As a result, Melbourne Airport updated its risk register and the AQMP in July 2019.

Melbourne Airport has temporarily suspended monitoring at MAE due to the COVID-19 pandemic that has significantly reduced aircraft traffic by more than 95 per cent, making the risk of adverse air impacts low. However, monitoring at MAS is ongoing, enabling Melbourne Airport to detect any events resulting from operations at Melbourne Airport. MAE will resume when the risk of air quality impacts returns to comparable levels before the pandemic (based on the return of aircraft movements to similar levels prior to the pandemic).

B10.4.2.2
Sensitive receptors

Figure B10.1 shows Melbourne Airport's boundary and runways; **Figure B10.2** shows the proposed runway and development footprint; **Table B10.5** summarises the sensitive receptors modelled.

Melbourne Airport is predominantly surrounded by non-urban or green wedge land, particularly to the north and west. Urban areas are located to the east and south of the airport, and are a mix of industrial and residential development.

The SEPP (AQM) discusses the protection of sensitive land uses and provides examples of 'sensitive locations': hospitals, schools and residences. Fourteen discrete receptors representing the closest points to sensitive urban areas surrounding the airport were modelled (**Figure B10.1**, **Figure B10.2**). This includes households in the suburbs of Bulla, Greenvale, Attwood, Westmeadows, Tullamarine, Airport West, Keilor Park, and Keilor. All sensitive receptors are ground-based receptors and impacted by both ground and air-based sources (refer to **Section B10.4.3** and **B10.4.4**).

In addition, the AQMS at MAS and MAE and the two diffusive sampler monitoring locations (at Living Legends and Keilor Village) were included in the model as discrete receptors, to enable model results to be compared to historical results for model validation.

Table B10.5
Discrete receptors modelled, and associated use

Discrete receptor	Receptor type	Land use type
1. Bulla	Sensitive receptor	Residence
2. Living Legends	Sensitive receptor	Residence
3. Providence Rd	Sensitive receptor	Residence
4. Montrose Ct	Sensitive receptor	Residence
5. Threadneedle St	Sensitive receptor	Residence
6. Westmeadows North	Sensitive receptor	Residence
7. Westmeadows South	Sensitive receptor	Residence
8. Melrose Dve	Sensitive receptor	Residence
9. Janus St	Sensitive receptor	Residence
10. Fisher Gve	Sensitive receptor	Residence
11. Fosters Rd	Sensitive receptor	Residence
12. Arundel Rd	Sensitive receptor	Residence
13. Overnewton Rd	Sensitive receptor	Residence
14. Keilor Village	Sensitive receptor	Retirement Village (residences)
15. Highland Rd	Sensitive receptor	Residence
16. Loemans Rd	Sensitive receptor	Residence
17. MAE	Other receptor: location of AQMS	Public park
18. MAS	Other receptor: location of AQMS	Within airport boundary

Figure B10.1
Map of Melbourne Airport showing sensitive receptors and air quality monitoring stations

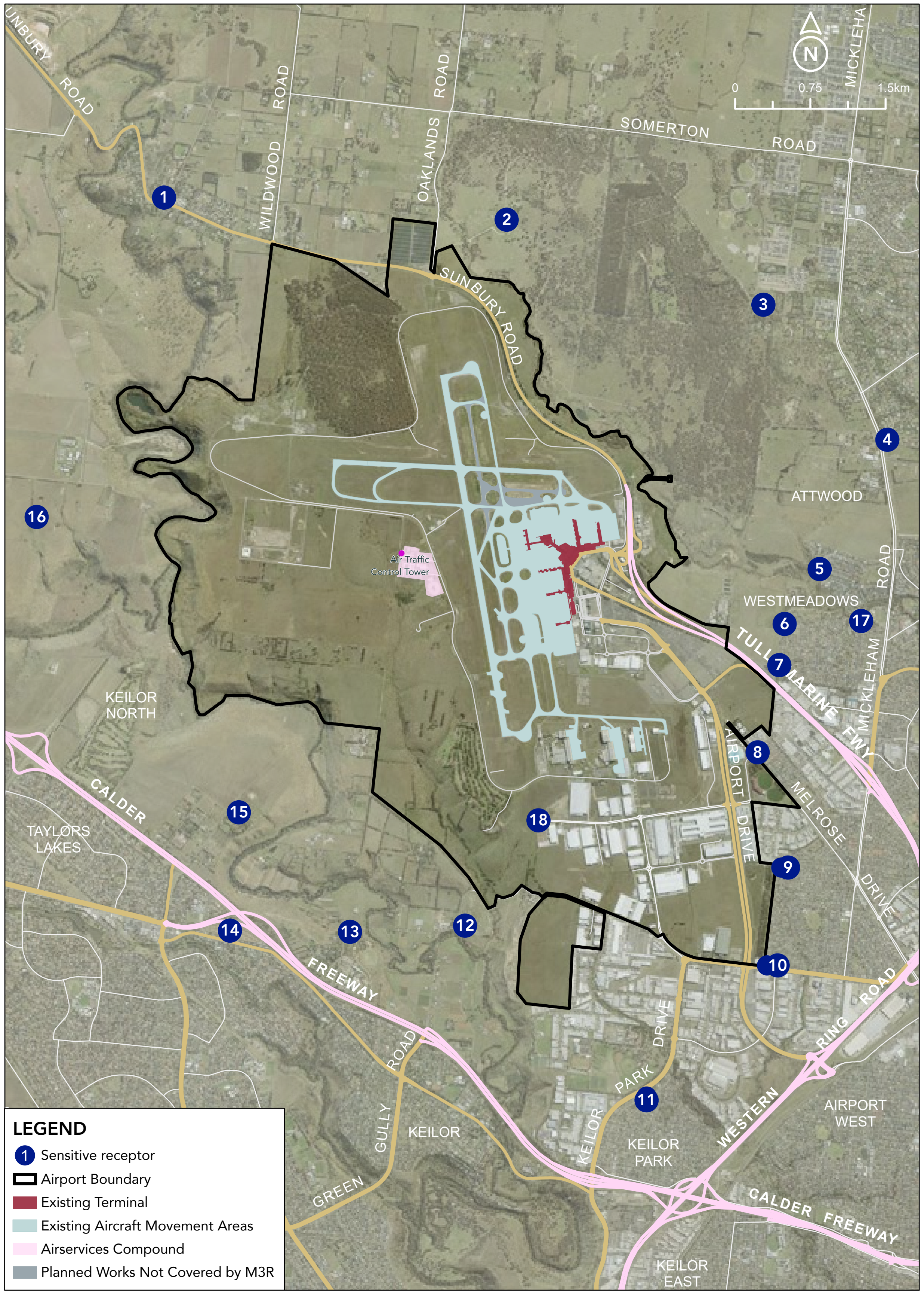
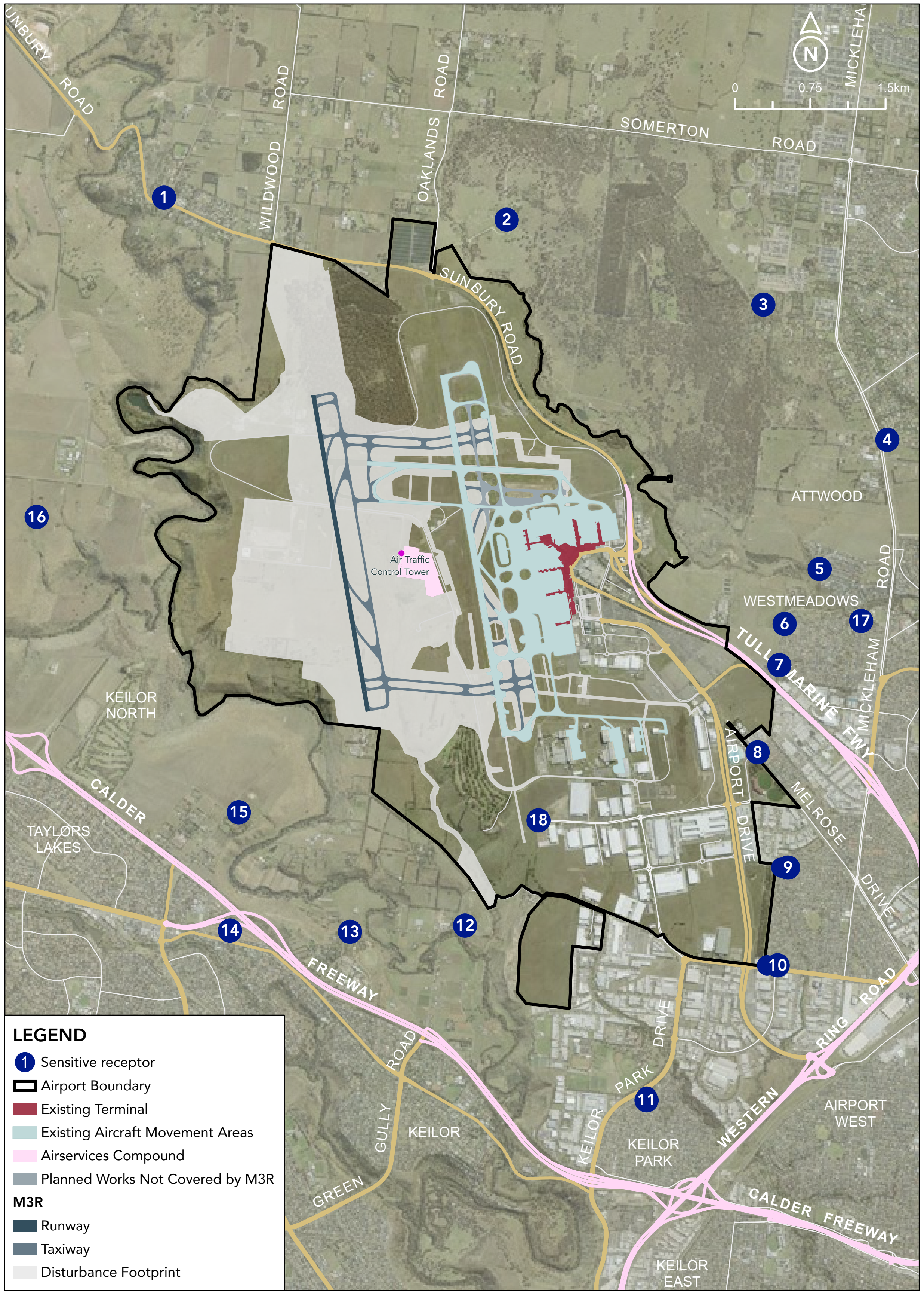


Figure B10.2
Air quality assessment base map showing M3R Build



B10.4.3 Construction dust emissions

The complete construction phase of M3R is expected to occur over a period of four to five years. During this period, dust emissions from bulk earthwork activities are expected to affect ambient air quality. The air quality modelling considered the worst-case scenario regarding dust emissions within a three-year timeframe. The worst-case conditions are based on the following factors:

- Minimum separation distance from key emissions sources to sensitive receptors
- Maximum material handling
- Maximum haul road length
- Maximum area of exposed, non-rehabilitated land.

This confluence of factors is most likely to occur during the earthworks phase of construction, when topsoil stripping and material haulage occur concurrently. Note that annual averages were not assessed because worst-case impacts are likely to occur over only three months during earthworks.

B10.4.3.1 Emissions inventory for construction dust

Construction activities that will contribute to dust emissions include:

- Clearing of land and topsoil scraping
- Excavation of residual soils (subsoil) using conventional earthworks equipment
- Haulage of materials (e.g. imported fill, stone aggregate, sand and cement) to the site, some of the haulage occurring on unpaved roads
- Materials handling by construction equipment such as excavators, bulldozers, and front-end loaders
- Grading and compaction
- Wind erosion from exposed areas and active stockpiles.

Dust emissions from other construction activities can be strictly controlled. They are likely to be insignificant in comparison with those listed above.

Construction environmental management for M3R will be of a high standard, including the provision of dust controls targeting the above activities.

Melbourne Airport has access to sufficient water for dust control by water carts, water sprays and wheel washes. Double handling of material will be minimised where possible by maximising direct material transportation and minimising stockpiling. These dust controls will be enforced through an approved Construction Environmental Management Plan (CEMP).

The focus of the air quality assessment of M3R's construction activities has been on small dust particles that may impact human health (PM_{10} and $PM_{2.5}$) and nuisance dust (Total Suspended Particles, TSP) deposited at ground level. These pollutants were estimated using industry accepted techniques, air dispersion modelling using the EPA's regulatory model AERMOD, and comparing model-predicted Ground Level Concentrations (GLCs) to Victorian Government ambient air quality standards for PM_{10}, $PM_{2.5}$ and deposited dust. The air quality standards and relevant policies are detailed in **Section B10.2**.

Nuisance dust has the potential to contaminate drinking water tanks. However, this is a concern only for heavy metal emissions in dust at contaminated land and mining sites (DEC (WA), 2011) close to sensitive receptors (residences) that are reliant on tank water as their main water supply. Therefore, heavy metal contamination from construction activities is not of concern for residences around Melbourne Airport.

Dust emission quantities from construction activities were estimated from material handling quantities, the construction equipment inventory and the site layout. This information was used to generate model input data including the locations and intensities of the dust generating activities.

The quantitative estimates for construction activities were based on two key standards:

- *NPI Emission Estimation Technique Manual for Mining Version 3.1* (Australian Government, 2012)
- *The AP-42 Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources* (USEPA, 1995 and updates).

Emission factors used to estimate dust emissions for the construction activities are provided in **Table B10.6**. The $PM_{2.5}$ emissions estimates were calculated using an estimate for the $PM_{2.5}$-to-PM_{10} ratio of 15 per cent based on studies of dust emissions from mining activities by the NSW State Pollution Control Commission (1986) and US EPA (2005).

Estimates of dust deposition are based on emission rates of TSP for an approximated particle size distribution. To give a representative pattern of dust deposition from the site, a particle size distribution for TSP based on US EPA AP-42 Industrial Wind Erosion was applied. TSP was modelled up to a size of 50 µm due to larger particles typically falling out close to the source and therefore unlikely to cause an impact beyond the site boundary.

To quantify emissions for dust dispersion modelling, assumptions were necessary to best represent the expected activities, their locations and timing. The modelled construction scenario and dust emissions estimates were designed to represent the most active construction year: the year of highest anticipated dust emissions over the four-year construction phase.

A summary of TSP, PM_{10} and $PM_{2.5}$ emissions estimates for modelling is provided in **Table B10.7**. A total imported fill throughput of 2,054,000 cubic metres and excavated fill throughput of 3,946,000 cubic metres (total 6,000,000 cubic metres) was used to estimate the number of vehicle movements divided equally over three years.

Table B10.6
Emissions factors for construction activities

Activity	TSP emission factor	PM_{10} emission factor	Notes
Import fill			
Grader	0.19 kg/VKT	0.085 kg/VKT	Assumes an average speed of 5 km/h per NPI EET Manual for Mining; all worked hours
Tipper truck (8 m³) – haulage	4.23 kg/VKT	1.25 kg / VKT	Approximately 171,167 vehicle movements will occur over the three-year earthworks program
Tipper truck (8 m³) – unload fill	0.012 kg/t	0.0043 kg/t	Approximately 2,054,000 m³ of fill is expected to be imported over three years It was assumed that 50% of the imported material will be stockpiled and the remaining 50% transported to the fill location
Bulldozer (CAT D7)	17 kg/h	4.1 kg / h	Assuming the bulldozers will operate 12 hrs/day
Excavate fill			
Grader	0.19 kg/VKT	0.085 kg/VKT	Assumes an average speed of 5 km/h per NPI EET Manual for Mining for all worked hours
Scraper (CAT 631/651)	0.029 kg/t	0.0073 kg/t	Approximately 27,600 tonnes of soil will be stripped over a 60-day period
Excavator (30 T)	0.025 kg/t	0.012 kg/t	Approximately 3,946,000 m³ of material is expected to be excavated over three years
Dump truck (Moxy VAT 730) – haulage	4.23 kg/VKT	1.25 kg / VKT	The excavated throughput equates to around 20 vehicle movements per hour, travelling on a haul route approximately 7.5 km long (both ways) It was assumed that 50% of the excavated material will be stockpiled and the remaining 50% will be transported to the fill location
Dump truck (Moxy VAT 730) – unload fill	0.012 kg/t	0.0043 kg/t	It was assumed that 50% of the excavated material will be transported to a stockpile and the remaining 50% will be transported to the fill location
Bulldozer (CAT D7)	17 kg/h	4.1 kg / h	Assuming the bulldozers will operate 12 hrs/day
Transferring stockpiles			
Front End Loader – haulage	0.025 kg/t	0.012 kg/t	Three movements (3 x 28 tonnes) will be transported per hour
Dump truck (Moxy VAT 730) – haulage	4.23 kg/VKT	1.25 kg / VKT	
Unload fill	0.012 kg/t	0.0043 kg/t	
Exposed areas			
Topsoil stockpiles	0.4 kg/ha	0.2 kg/ha	The total topsoil stockpile areas were calculated to be 29.5 ha
Imported material stockpiles	0.4 kg/ha	0.2 kg/ha	The total imported material stockpile areas were calculated to be 20.4 ha
Exposed areas	0.4 kg/ha	0.2 kg/ha	The total exposed area during the worst-case scenarios was calculated to be 94.6 ha

Table B10.7
Emission rates and control methods for construction activities at Melbourne Airport

Activity	Control method	Total TSP emission rate (g/s)	Total PM_{10} emission rate (g/s)	Total $PM_{2.5}$ emission rate (g/s)	Modelled conditions
Import fill					
Grader	-	0.5	0.2	0.04	5 am to 6 pm
Tipper truck (8 m³) – haulage	Level 2 watering	North route (stockpile): 14.0 North route (fill): 15.8 South route: 4.2	North route (stockpile): 4.1 North route (fill): 4.7 South route: 1.3	North route (stockpile): 0.62 North route (fill): 0.70 South route: 0.19	
Tipper truck (8 m³) – unload fill	Water sprays (50%)	0.3	0.1	0.01	
Bulldozer (CAT D7)	-	9.4	2.3	0.34	
Excavate fill					
Grader	-	1.1	0.5	0.07	5 am to 6 pm
Scraper (CAT 631/651)	Topsoil naturally/ artificially moist	0.2	0.04	0.01	
Excavator (30 T)	-	4.4	2.1	0.32	
Dump truck (Moxy VAT 730) – haulage	Level 2 watering	24.9	7.4	1.11	
Dump truck (Moxy VAT 730) – unload fill	Water sprays (50%)	0.5	0.2	0.03	
Bulldozer (CAT D7)	-	18.9	4.6	0.68	
Transferring stockpiles					
Front End Loader – haulage	-	0.6	0.3	0.04	5 am to 6 pm
Dump truck (Moxy VAT 730) – haulage	Level 2 watering	3.0	0.9	0.13	
Unload fill	Water sprays (50%)	0.1	0.1	0.01	
Exposed areas					
Topsoil stockpiles	Primary rehabilitation	2.3	1.1	0.17	Only modelled when wind speed greater than 5.2 m/s
Imported material stockpiles	Water sprays (50%)	1.1	0.6	0.08	
Exposed areas	-	10.5	5.3	0.79	

These estimated dust emissions show that haul roads are the most significant source in terms of the mass of emissions (due to wheel-generated dust from tipper trucks/dump trucks). Other key sources include material haulage on unpaved roads, bulldozer activities, and wind erosion from stockpiles and open areas.

The following activities were not included in the modelling for the M3R construction scenario due to their minimal scale:

- Particulates from on-site diesel generators and vehicles are expected to be minor in comparison with those from bulk earthworks activities; and insignificant in comparison with the background PM_{10} and $PM_{2.5}$ levels used in the assessment.
- Gaseous emissions from the combustion of diesel and petrol will result in emissions of NO_2, CO, particulate matter, VOCs and small amounts of SO_2. These emissions during construction were assessed as unlikely to exceed air quality criteria either off-site or at identified receptors. This is because of the comparatively low emission rates (regarding dust impact during construction, and gaseous emissions from aircraft and roadways on and around the airport); the distances between sources; and the short-term nature of their use.

In addition, particulates from asphalt and concrete batch plants in the region were not modelled because emissions from these sources are captured in the background concentrations used in the assessment. Any increase in production due to airport construction activities, and the related increase in emissions, is expected to be insignificant relative to dust emissions from earthworks.

B10.4.3.2
Dispersion model selection for construction dust emissions

The M3R construction phase activities were represented in AERMOD by a series of volume sources representing the location of activities.

Figure B10.3 shows the spatial distribution of modelled sources. Notable emissions sources include the runway footprint; major haul routes extending north and south (I2.1-2.3) centrally located stockpiles (W1-2); and the large, exposed area towards the north of the site (W3). Emissions from the dust-generating activities listed in Table B10.7 were modelled as arising from one or more of these source locations, where appropriate.

Dispersion modelling was carried out using the latest version of AERMOD (v.9.9.0). The assessment was undertaken in accordance with procedures set out in SEPP (AQM) with consideration given to the EPA guidelines for using AERMOD (EPA Victoria, 2014).

Site-specific meteorology data was sourced from the Melbourne Airport Automatic Weather Station (AWS) operated by the Bureau of Meteorology (BoM) and converted into surface and profile meteorological files to run in AERMOD using AERMET. Full details on the creation of the meteorological files used in modelling are provided in Section B10.5.1. The years 2015 to 2019 inclusive were selected for modelling.

Site topography and three-dimensional terrain has been used in the model, with 30-metre resolution.

B10.4.4
Operational emissions

The operational emissions assessment focused on air pollutants released from:

- Airport operations: including aircraft movements (landing, take-off cycle) and related equipment
- Transportation attributed to the airport: private transport and freight to and from the airport, and car parking.

Pollutants released from these two source groups are predominantly released from the combustion of fossil fuels (avgas, diesel and petrol) in private, freight or aviation vehicles. This process emits nitrogen oxides, carbon monoxide, ozone, dust particles (PM_{10} and $PM_{2.5}$) and VOCs to air.

Emissions from the two of the key source groups identified above were assessed differently:

- Aircraft operational emissions were modelled using the Aviation Environmental Design Tool (AEDT) (Version 3c). AEDT utilises the US EPA's dispersion model AERMOD to model the dispersion of such emissions in the atmosphere
- Emissions from road vehicle traffic and car parks in the vicinity of Melbourne Airport were modelled separately, also in AERMOD.

The results of these two approaches were then combined in post-processing using AERMOD.

The following subsections describe the characterisation of emissions from airport operations and surrounding roadways and car parks, followed by a more detailed discussion on dispersion model selection and configuration.

B10.4.4.1
Emissions from airport operations

Airport operations include:

- Aircraft operations on-airport during the Landing and Take-Off (LTO) cycle
- Ground Support Equipment (GSE) and Auxiliary Power Units (APUs)
- All other equipment consuming fuel at the airport (e.g. back-up generators, fuel storage tanks) and other industry on site.

Emissions to air from these operations have been characterised based on two key datasets: aircraft schedules and emission factors. The treatment and use of each are discussed below.

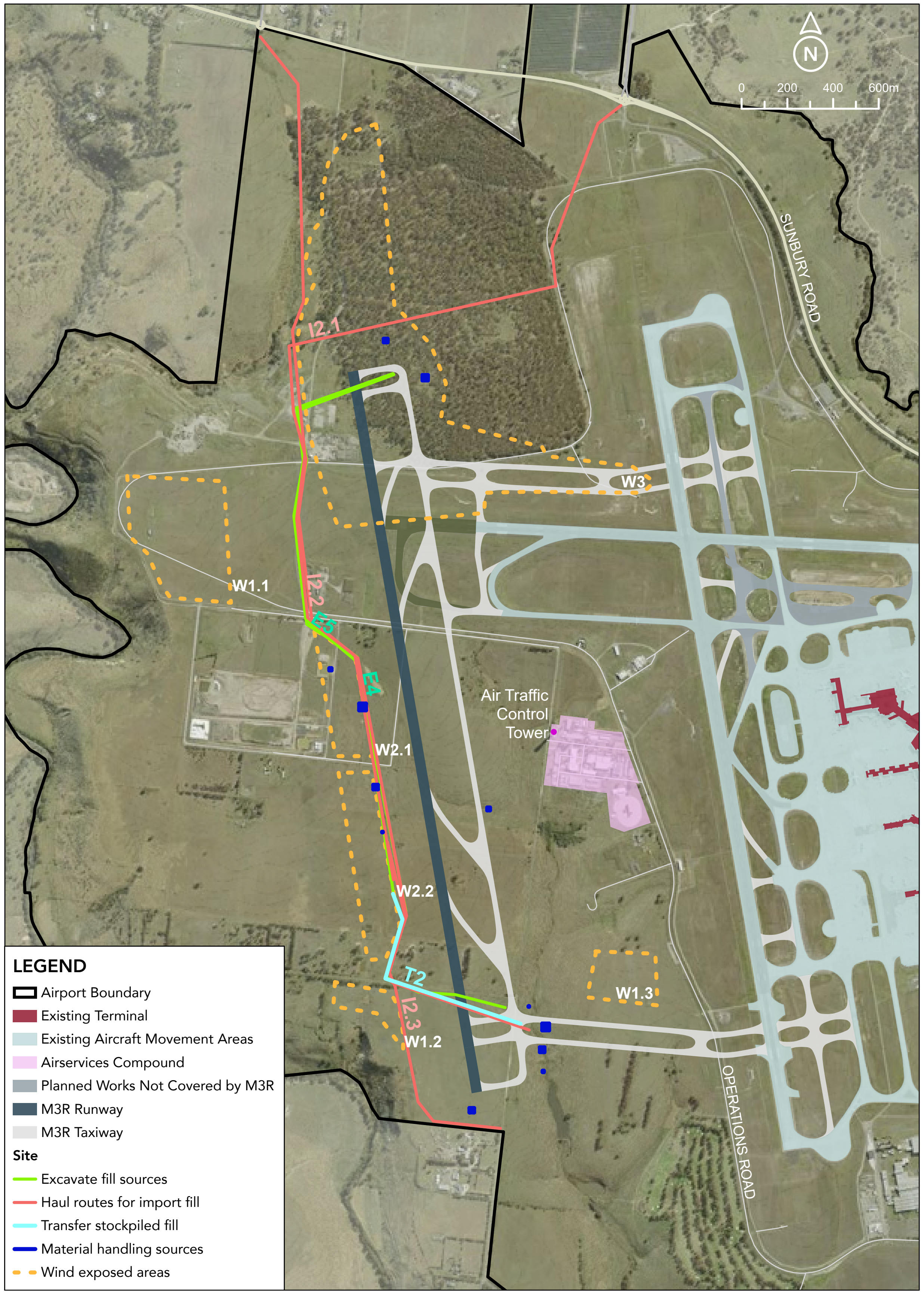
B10.4.4.2
Melbourne Airport aircraft schedules

Aircraft schedule data representing operational movements at the airport in 2019 were used to model that year's airport operations. The 2019 database comprised 254,280 records, each representing a landing or take-off.

A schedule for aircraft operational movement was developed for the No Build and Build operating scenarios. The movements are modelled using the output of Concept of Operations data developed by Melbourne Airport and Airservices Australia for M3R. The schedule was used to develop predictions for annual Air Traffic Movements (ATM) and aircraft types for a standard operating week taking the following into consideration:

- Changes in the time distribution of aircraft movements: to account for diurnal and daily changes in aircraft movements
- The destination airport for departure flights: to account for different fuel loads (and therefore fuel burn rates) based on the stage length of the flight
- The probable arrivals/departures gate: to account for the spatial distribution of aircraft and taxi movements around the airport.

Figure B10.3
Location of modelled sources for construction dust assessment (I = haul routes for import fill; E = excavate fill sources; W = wind-exposed areas, T = transfer stockpiled fill)



Operating conditions assumed that 100 per cent of flights arrived from the south and departed to the north (runway 34). This was to represent the worst-case operating conditions for all scenarios and is therefore considered conservative.

Normal airport operations typically comprise a mixture of departures and arrivals from both ends of the 16/34 runway. This modelling assumption therefore increases total emissions to the southern runway end and results in higher modelled GLCs (while GLCs to the north would remain low).

The number of ATM for each operating scenario are listed in **Table B10.8**. The 2019 base case was input to AEDT based on the ATMs. For other years, emissions were scaled directly based on the percentage increase in movements. For example, the 2026 emissions inventory, and therefore the aircraft emission rate, was increased by 18 per cent.

For the Build scenarios, all additional aircraft movements beyond 2019 were assumed to occur on the M3R runway. For example, 18 per cent of the existing runway movements were assumed to occur on the new runway in 2026, resulting in an increase of 18 per cent of aircraft movements in total. Note that 50 per cent of aircraft movements were taken to be arrivals, and 50 per cent departures.

B10.4.4.3
Emissions factors: airport operations

The air emissions inventory for current and possible future operations at the airport was developed by AEDT (this has replaced the Emissions and Dispersion Modelling System (EDMS) model as the industry best practice air quality modelling tool for airports).

AEDT is a combined emissions and dispersion model developed in the US for assessing air quality at airports (FAA 2015). It is linked to data from the aircraft performance model BADA which is owned and managed by EUROCONTROL. AEDT models aircraft performance in space and time to estimate noise, fuel consumption, emissions, and air quality consequences. Aircraft types are represented in detail (including a comprehensive list of emission factors for specific aircraft engines).

Aircraft engine data is sourced from the BADA model, which contains a database with emission factors for over 300 aircraft types and specifications for supporting equipment.

AEDT and BADA were used to compile emissions inventories for criteria pollutants NO_x, PM_{10} and $PM_{2.5}$, VOCs, CO and SO_2 based on the aircraft movements specified above. AEDT alone was used to generate an emissions file compatible with AERMOD to enable dispersion modelling using that software.

Note that airborne lead was not assessed in modelling. It is not an issue for Melbourne Airport because the use of Avgas in piston engines by small aircraft is insignificant, and lead in Jet A1 fuel is also insignificant (Jet A1 is the jet fuel used for most aircraft types including jet engine and turbo-propeller powered aircraft).

BADA's detailed aircraft schedule databases, formatted for input to AEDT, comprised several hundreds of thousands of records representing each aircraft movement in a scenario year. They included the following main fields:

- Aircraft code specifying the aircraft type (e.g. B737-8W)
- Aircraft engine code specific to the aircraft type (e.g. 4CM040)
- A date and time string
- An indicator for the type of movement (arrival or departure)
- The terminal used by the aircraft (T1 to T4 for Melbourne Airport)
- A runway indicator (e.g. 09L for Runway 09-Left, 09R for Runway 09-Right).

Table B10.8
Numbers of ATM for each operating scenario

Year	Actual data (APAM)	Forecast ATM No Build	Forecast ATM Build	Ratio (Build/No Build)
Existing (2019)	254,280	n/a	n/a	n/a
2026 (opening year)	n/a	299,832	299,832	1.00
2046 (+20 years)	n/a	329,732	483,340	1.47

The hourly emissions estimates calculated in AEDT depended on many factors. These included aircraft engine type, aircraft location and mode (e.g. taxiing) and its period of operation. Aircraft emissions vary depending on the operating modes for each scenario (taxiing versus take-off); GSE and APU emissions data were dependent on the default settings for each aircraft type.

Detailed emissions datasets were created by AEDT for AERMOD. Annual emissions estimates (for NO_X, PM_{10}, $PM_{2.5}$, VOCs) for each scenario (e.g. Build 2026) broken down by source type (e.g. aircraft, GSE) are shown in the following tables (**Table B10.9** to **Table B10.12**) for operations up to 3,000 feet (~914 metres). Note that emissions in 2026 and 2046 were scaled from the 2019 inventory based on aircraft movements in those years.

The assessment does not take into account the increasing energy efficiency of aircraft because the actual mix of next-generation aircraft in future years is uncertain. The AEDT model sensitivity to aircraft efficiency was assessed in a separate sensitivity test: it found that next generation aircraft have the potential to decrease aircraft emissions by about 10 per cent.

It is noted that the No Build cases will likely result in increased aircraft congestion at ground level compared with the Build cases (e.g. by aircraft being delayed on the taxiways) which can cause increases in emissions. Melbourne Airport expects these differences in delay times to be substantial as described in **Chapter A2: Need for the Project**. These differences were not factored into modelling, which adds a degree of conservatism to this comparative assessment (i.e. it potentially underestimates the No Build impacts).

Table B10.9
AEDT estimates of NO_X emissions, by source type and scenario (kg/year)

Source type	2019 (% total)	No Build 2026	Build 2026	No Build 2046	Build 2046
Aircraft	1,421,062 (78%)	1,676,853	1,676,853	1,847,380	2,714,227
Taxi in/out	95,956 (5%)	113,228	113,228	124,742	183,275
GSE	37,158 (2%)	43,846	43,846	48,305	70,971
APUs	55,430 (3%)	65,408	65,408	72,059	105,872
Parking facilities	2,986 (0.2%)	3,622	4,245	5,179	8,213
Roadways	215,545 (12%)	244,175	252,329	264,798	317,297
Total	1,828,136	2,147,130	2,155,908	2,362,464	3,399,855

Table B10.10
AEDT estimates of PM_{10} emissions, by source type and scenario (kg/year)

Source type	2019 (% total)	No Build 2026	Build 2026	No Build 2046	Build 2046
Aircraft	8,965 (35%)	10,579	10,579	11,655	17,123
Taxi in/out	1,798 (7%)	2,121	2,121	2,337	3,434
GSE	1,987 (8%)	2,344	2,344	2,583	3,795
APUs	6,118 (24%)	7,219	7,219	7,953	11,685
Parking facilities	627 (2%)	760	891	1,087	1,724
Roadways	5,949 (23%)	6,737	6,966	5,949	8,762
Total	25,443	29,761	30,120	31,564	46,523

Table B10.11
AEDT estimates of $PM_{2.5}$ emissions, by source type and scenario (kg/year)

Source type	2019 (% total)	No Build 2026	Build 2026	No Build 2046	Build 2046
Aircraft	8,965 (39%)	10,579	10,579	11,655	17,123
Taxi in/out	1,798 (8%)	2,121	2,121	2,337	3,434
GSE	1,878 (8%)	2,216	2,216	2,442	3,588
APUs	6,118 (26%)	7,219	7,219	7,953	11,685
Parking facilities	426 (2%)	517	606	739	1,172
Roadways	4,045 (17%)	4,581	4,737	4,045	5,958
Total	23,230	27,234	27,478	29,171	42,960

Table B10.12
AEDT estimates of VOCs emissions, by source type and scenario (kg/year)

Source type	2019 (% total)	No Build 2026	Build 2026	No Build 2046	Build 2046
Aircraft	50,527 (26%)	59,622	59,622	65,686	96,508
Taxi in/out	66,068 (35%)	77,960	77,960	85,888	126,190
GSE	11,864 (6%)	14,000	14,000	15,424	22,661
APUs	3,107 (2%)	3,667	3,667	4,040	5,935
Parking facilities	5,017 (3%)	6,084	7,132	8,701	13,796
Roadways	54,783 (29%)	62,003	64,217	67,316	80,979
Total	191,367	223,337	226,598	247,054	346,069

B10.4.4.4
Emissions from road traffic

Two source groups were included in the inventory for transportation emissions caused by induced demand from airport operations:

- Road vehicles on all major roadways leading to the airport, and all major roadways immediately surrounding the airport
- The largest car parks at the airport.

Emissions to air from these sources have been characterised based on two key datasets: road traffic modelling and emission factors. The treatment and use of each are discussed below.

B10.4.4.5
Melbourne Airport roadways traffic modelling

This assessment included the busiest roadways surrounding, and within, the airport. These are shown in Table B10.13 for current airport operations and No Build scenarios, and in Table B10.14 for current airport operations and Build scenarios (as defined in Chapter B8: Surface Transport).

The roadways and traffic modelled in this assessment are considered to represent the majority of vehicle movements in the vicinity of the airport (the remainder are considered to contribute to background air pollutant levels).

Annual road vehicle movements for 2019 were taken from measured data. Traffic modelling was conducted using the Victorian Integrated Transport Model. VITM provided traffic data for the years 2019, 2026 and 2046, for Build and No Build scenarios, with and without an airport rail link.

B10.4.4.6
Melbourne Airport car parks

Thousands of cars are parked at Melbourne Airport each day, and its large car parks are a significant source of air pollutants.

Car parks were modelled in AERMOD based on their annual capacities. Estimates for the annual throughputs of car parks were provided by Melbourne Airport and are listed in Table B10.15 (currently, and for No Build scenarios) and Table B10.16 (currently, and for Build scenarios).

The estimates for forecast future operating scenarios were scaled using increases in the roadway traffic data for the same years i.e. 2026 and 2046.

Table B10.13
Main roadways and annual road vehicle movements - current airport and M3R No Build scenario

Roadway traffic (both directions) – no M3R	Current airport (2019) vehicles p.a.	M3R No Build 2026 vehicles p.a.	M3R No Build 2046 vehicles p.a.
Airport Drive north of Sharps Road	3,896,830	4,494,017	6,598,673
Calder Freeway west of Keilor Park Drive	24,610,099	24,992,195	31,602,969
Keilor Park Drive south of Tullamarine Park Road	6,225,150	6,741,317	8,972,253
Melrose Drive north of Mickleham Road (on-airport)	2,004,364	2,311,617	3,657,662
Melrose Drive south of Mickleham Road	3,155,015	3,169,013	4,003,517
Mickleham Road north of Broadmeadows Road	7,147,955	7,252,582	8,421,470
Mickleham Road 'south' (assumed equal to Mickleham Road plus Broadmeadows Road)	5,504,243	5,569,142	8,059,873
Sharps Road west of Melrose Drive	4,281,605	4,618,014	5,775,526
Sunbury Road north of Airport (2025 data & estimates)	8,838,073	9,405,154	22,620,107
Tullamarine Freeway north of Mickleham Road	27,079,885	32,285,226	51,007,570
T4 Express Link	10,323,885	12,722,182	17,695,428

Table B10.14
Main roadways and annual road vehicle movements - current airport and M3R Build scenarios

Roadway traffic (both directions) – with M3R	Current airport (2019) vehicles p.a.	M3R Build 2026 vehicles p.a.	M3R Build 2046 vehicles p.a.
Airport Drive north of Sharps Road	3,896,830	5,856,009	11,993,459
Calder Freeway west of Keilor Park Drive	24,610,099	25,427,788	33,199,029
Keilor Park Drive south of Tullamarine Park Road	6,225,150	7,183,860	10,274,506
Melrose Drive north of Mickleham Road (on-airport)	2,004,364	3,101,376	5,514,679
Melrose Drive south of Mickleham Road	3,155,015	3,208,663	4,261,286
Mickleham Road north of Broadmeadows Road	7,147,955	7,315,044	8,623,333
Mickleham Road 'south' (assumed equal to Mickleham Road plus Broadmeadows Road)	5,504,243	5,633,126	8,771,274
Sharps Road west of Melrose Drive	4,281,605	4,996,840	6,526,220
Sunbury Road north of Airport (2025 data & estimates)	8,838,073	9,463,055	24,122,055
Tullamarine Freeway north of Mickleham Road	27,079,885	33,462,773	61,508,728
T4 Express link	10,323,885	13,614,242	22,610,599

Table B10.15
Estimates for car park annual throughput – current airport and No build scenarios

Car park [No. levels]	Current airport (2019) vehicles p.a.	M3R No Build 2026 vehicles p.a.	M3R No Build 2046 vehicles p.a.
Short-term: T1, T2, T3 [6]	7,429,159	9,009,897	12,885,146
Long-term, west [1]	1,616,719	1,960,716	2,804,040
Long-term, east [1]	570	691	988
VLS [1]	86,355	104,729	149,774
Staff Car Park [1]	2,194,063	2,660,904	3,805,387
NBCP [1]	37,979	46,060	65,871
T4 [7]	1,301,258	1,578,133	2,256,904

Table B10.16
Estimates for car park annual throughput – current airport and M3R build scenarios

Car park [No. levels]	Current airport (2019) vehicles p.a.	M3R Build 2026 vehicles p.a.	M3R Build 2046 vehicles p.a.
Short-term: T1, T2, T3 [6]	7,429,159	10,561,636	20,431,063
Long-term, west [1]	1,616,719	2,298,403	4,446,168
Long-term, east [1]	570	810	1,566
VLS [1]	86,355	122,766	237,486
Staff Car Park [1]	2,194,063	3,119,181	6,033,932
NBCP [1]	37,979	53,993	104,447
T4 [7]	1,301,258	1,849,929	3,578,613

B10.4.4.7 Emission factors: road vehicles

Emissions factors for road vehicles were derived from COPERT Australia based on a review of studies of emissions from Australian road vehicles (Smit R. , Australian Motor Vehicle Emission Inventory for the National Pollutant Inventory (NPI), 2014) (Smit, et al., 2015).

Their current validity was confirmed with EPA Victoria in April 2020, noting that these factors are conservative given the 2010 base year. They can be updated for recent years given the changing nature of vehicle sales, vehicle growth and scrappage rates, and age-mileage relationships.

COPERT Australia includes emissions factors for 226 different classes of petrol and diesel vehicles, for NO_X, PM, CO and VOCs. They were extracted for each vehicle class at operating speeds of 60kph, 80kph and 100kph; emissions factors for 50kph, 70kph and 90kph operating speeds were then derived by interpolation and extrapolation. All roads were assumed to be at-grade with zero gradient. This information was combined with estimated mean traffic velocities, and the traffic modelling described in **Section B10.4.4.5**, to create hourly incremented diurnal emission rate information for each road link. The resulting data was input to AERMOD.

B10.4.4.8 Determination of NO_2 from modelled NO_X

The combustion of fossil fuels results in the emission to air of oxides of nitrogen (NO_X), which consist of nitric oxide (NO) and nitrogen dioxide (NO_2). The ratio of NO_2 to NO_X differs, depending on the emissions source (and atmospheric residence time). NO_2 is of interest to this assessment.

Sheffield University (for the UK Government's Project for Sustainable Development of Heathrow) developed mode-specific primary NO_2 fractions for jet engine aircraft. These ranged from 25 per cent to 50 per cent for idling engines; and from 1 per cent to 20 per cent for take-off, climb out and approach (Garcia-Naranjo & Wilson, 2005).

For road vehicles, a conversion ratio from NO_X to NO_2 of 10 per cent is often used (PIARC (2012). This ratio is dependent on fleet fuel mix, and current and future vehicle technology.

Given the variability, a NO_X ratio of 15 per cent was used for all NO_2. This was validated by comparing modelled results for current airport operation to background monitored levels of NO_2 at Melbourne Airport. Monitored data was used to calibrate NO_2 emission rates in the assessment.

B10.4.4.9 Determination of $PM_{2.5}$ and PM_{10} from modelled PM

Combustion of fossil fuels also results in the emission to air of particulate matter (PM_{10} and $PM_{2.5}$). It was assumed 100 per cent of PM from road traffic was PM_{10} (from COPERT). A ratio of 68 per cent $PM_{2.5}$ to PM_{10} was applied to estimate the fraction of $PM_{2.5}$ based on the 2010 Australian Motor Vehicle Emissions Inventory analysis (Smit R. , 2014).

For aircraft emissions, it was assumed that the amounts of PM_{10} and $PM_{2.5}$ were the same based on the fuel combustion output from the AEDT model.

B10.4.4.10 Assessment of volatile organic compounds

Melbourne Airport maintains a risk register of environmental impacts that includes air quality. It investigated concentrations of volatile organic compounds (VOCs) at the airport from 2014 to 2017 and did qualitative investigations of VOCs in 2018-19.

As a result of this, Melbourne Airport focuses on benzene and formaldehyde as the VOCs representing the highest risk from sources at the airport (specifically from jet engine emissions). Previous assessments found the other VOCs to present a lower risk at the airport. Given this, an assessment can focus on a small number of higher risk air pollutants rather than producing an assessment of many tens – or even hundreds – of compounds.

The AEDT-AERMOD results were output as VOC ground level concentrations. These were then factored by the weighted averages of the benzene and formaldehyde emissions factors that had been derived from the aircraft and road vehicle emissions.

B10.4.4.11 Dispersion model selection for airport operations and road traffic

Consideration was given to the EPA guidelines for air dispersion modelling using AERMOD (EPA Victoria, 2013). The EPA's senior air quality specialists were consulted from the start of the impact assessment regarding the methodology used to conduct the air quality assessment with regards to model selection, use of background pollutant concentrations, and air quality criteria.

As discussed in **Section B10.4.4.1**, the AEDT model was used to model emissions from airport operations. And, as discussed in **Section B10.4.4.7**, COPERT characterised emissions from road traffic. Output from these was input to AERMOD (the regulatory dispersion model used by Victoria) to model atmospheric dispersion.

The latest version of AERMOD (Version 9.9.0) was used for predictions of air pollutant concentrations. These were compared with the Victorian and national air quality standards to assess the effects that these activities may have on the local air quality environment. The input data required by AERMOD comprised emission source locations and characteristics; emission rates of pollutants; locations of receptors (point locations for the model-predicted GLCs); and hourly meteorological data. Annual meteorological datasets were synthesised from data recorded by the Bureau of Meteorology (**Section B10.5.1**).

In AERMOD, mobile sources (i.e. vehicle traffic on roads) are represented by a series of volume sources. These factor in location, base elevation, release height, and initial lateral and vertical dimensions. The pollutant emission rate is calculated from the vehicle volumes along each road section. Modelling using AERMOD assumed an initial lateral dimension (plume width) equal to the road width plus three metres either side. Note that AERMOD does not calculate concentrations within this area.

Emissions modelling used hourly varying background concentrations based on measurements at MAS and MAE in accordance with guidance from EPA Victoria. Qualitative judgment was required to determine the number of off-site emissions sources (e.g. roads) to include in the modelling to limit double-counting of emissions sources if those sources were also modelled as additional sources to background. Background concentrations of pollutants are assessed further in **Section B10.5**.

B10.5 EXISTING CONDITIONS

B10.5.1 Local meteorology

Meteorological conditions are important in determining the direction and rate at which emissions from a source will disperse. The key factors in air dispersion models are wind speed, wind direction, temperature, atmospheric stability class, and mixing layer height.

EPA Victoria requires five years of meteorological data for modelling. This increases the likelihood that worst-case meteorological conditions are captured, and that inter-annual variability is considered in the assessment.

The data used for this assessment were collected by the Bureau of Meteorology (BoM) from Melbourne Airport monitoring station number 086282 (located on the airport).

The years 2015 to 2019 inclusive were selected for modelling. One-minute surface data and 30-minute cloud data were obtained from Bureau of Meteorology. These datasets were averaged to create hourly data for the following parameters:

- Wind speed (metres per second, scalar averaged)
- Wind direction (degrees true north, vector averaged)
- Temperature (degrees Celsius)
- Relative humidity (per cent)
- Station level pressure (millibar, hectopascal)
- Cloud amount (tenths).

Surface roughness values were input for the modelling grid (covering emissions sources and sensitive receptors) within a one-kilometre radius of Melbourne Airport. Three sectors were defined in AERMET as having different surface roughness values (commercial/industrial/transport land use selected).

Albedo and the Bowen Ratio were determined for the area within a five-kilometre radius of the site (10 km by 10 km domain). Note that albedo and the Bowen Ratio have seasonal dependencies where average moisture conditions were used.

Meteorological processor AERMET was used to construct the AERMOD meteorological input files based on the input data described above that accounts for the proposed M3R project; and in accordance with EPA Victoria's guideline Construction of input meteorological data files for EPA Victoria's regulatory air pollution model (AERMOD).

Profile data up to 5,000 feet was considered in order to align with the US FAA's guidance on assessing emissions in the take off and approach phases of the landing and take-off cycle up to 3,000 feet (FAA, 2000). Upper-air radiosondes from the BoM monitoring station were therefore included in the upper-air file and input to AERMET.

B10.5.2 Air quality at Melbourne Airport

The SEPP (AQM) requires that air quality impact assessments are cumulative; that is, predicted air quality impacts due to a certain facility are added to existing background air pollutant levels).

Hourly varying background concentrations of key air quality pollutants were used in the modelling to give a cumulative impact assessment (as recommended by EPA Victoria in the initial consultation on air quality methodology).

Air quality monitoring data acquired from the airport's MAS AQMS in 2019 was used as the time-varying background concentration. Measured concentrations in 2019 were compared to the previous year (2018) and cross-checked with EPA air quality monitoring data and reports from 2019 to confirm that the background estimates used in the modelling were sound.

The background concentration analysis for all criteria pollutants identified two key pollutants as having an elevated risk of non-compliance due to expansion of activities at and around Melbourne Airport: PM_{10} and NO_2.

Although downward trends in the Melbourne airshed have been observed for some air pollutants (**section Section B10.5.3**), for the purpose of this assessment it was assumed the background air quality situation would be unchanged for future scenarios. Therefore, the same hourly-varying background values were used for each scenario. This was the case for all substances except NO_2, for which the background values were inherent in the empirical equation used to determine the NO_2 GLCs from the predicted NO_X GLCs (**Section B10.4.4.8**).

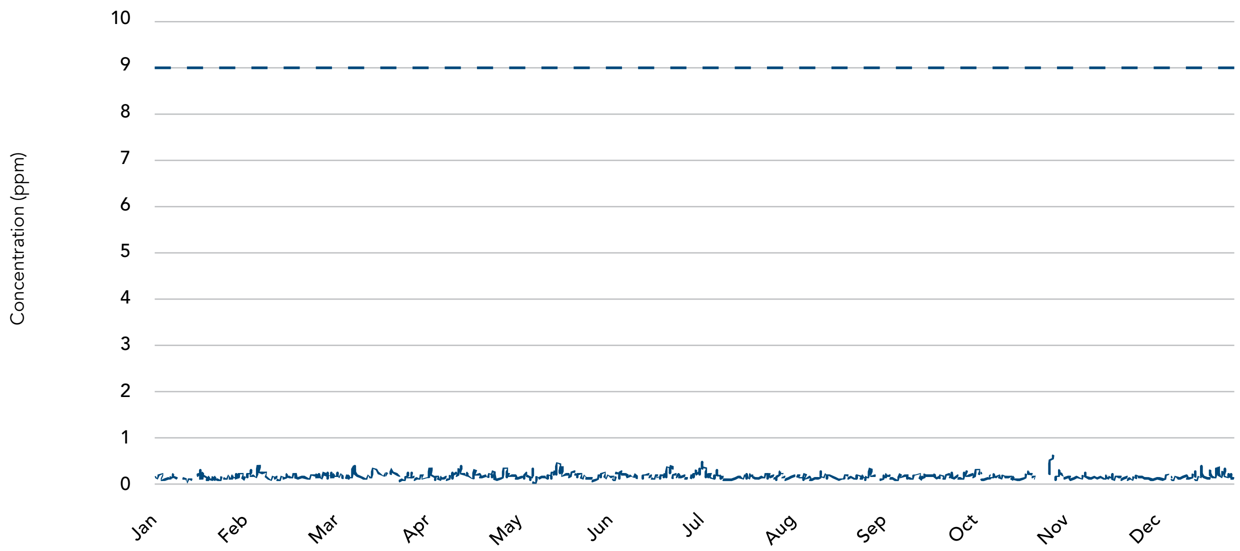
Estimates for background benzene and formaldehyde were determined by inspecting Melbourne Airport's VOCs monitoring results and making allowance for the short (three-minute) averaging period of the design criteria.

The following sections provide the airport's results from the MAS monitoring station in 2019. Results were compared to the SEPP (AAQ) criterion that follows the AAQM NEPM (as discussed in **Section B10.2**). The proposed NEPC 2019 objectives for O_3, NO_2 and SO_2 are also shown, where applicable.

B10.5.2.1
Melbourne Airport South 2019 monitoring results: CO

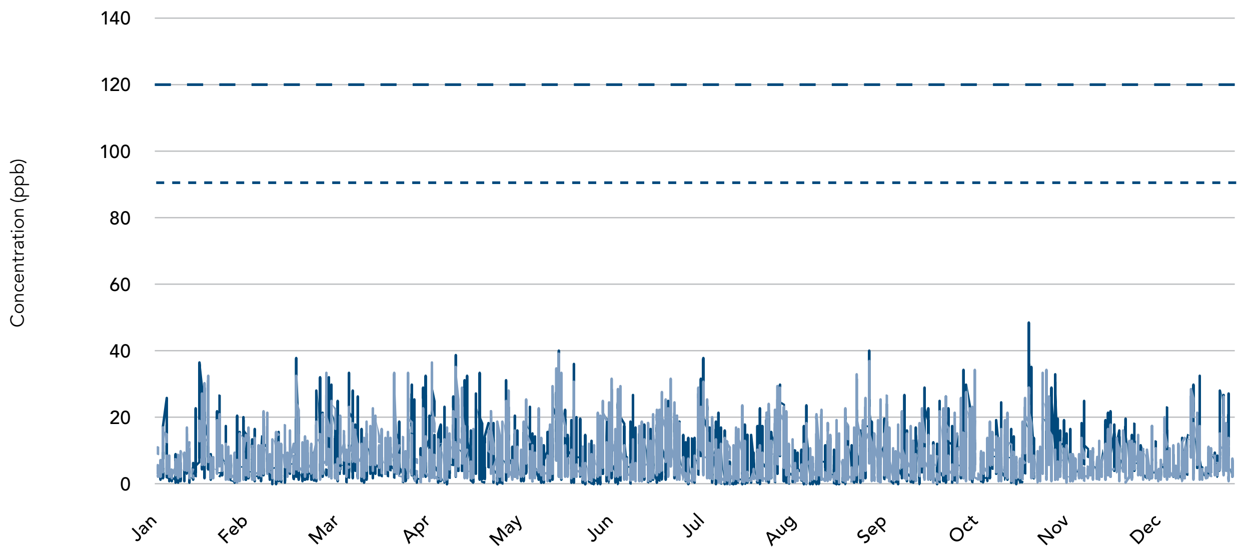
The MAS AQMS results for the eight-hour rolling average CO concentration (ppm) for 2019 are shown in **Figure B10.4**. The maximum CO eight-hour concentration in 2019 was 0.63 ppm, which is 7 per cent of the criterion (nine ppm). CO concentrations remained consistently low, with no recorded exceedances of the ambient air quality (NEPM) objective. These results are comparable to typical concentrations observed for the Melbourne region as a whole (**Table B10.17**).

Figure B10.4
MAS results for rolling eight-hour average CO and SEPP (AAQ) criteria



Source: APAM

Figure B10.5
MAS and MAE results for hourly average NO_2 and SEPP (AAQ) criteria: 2019



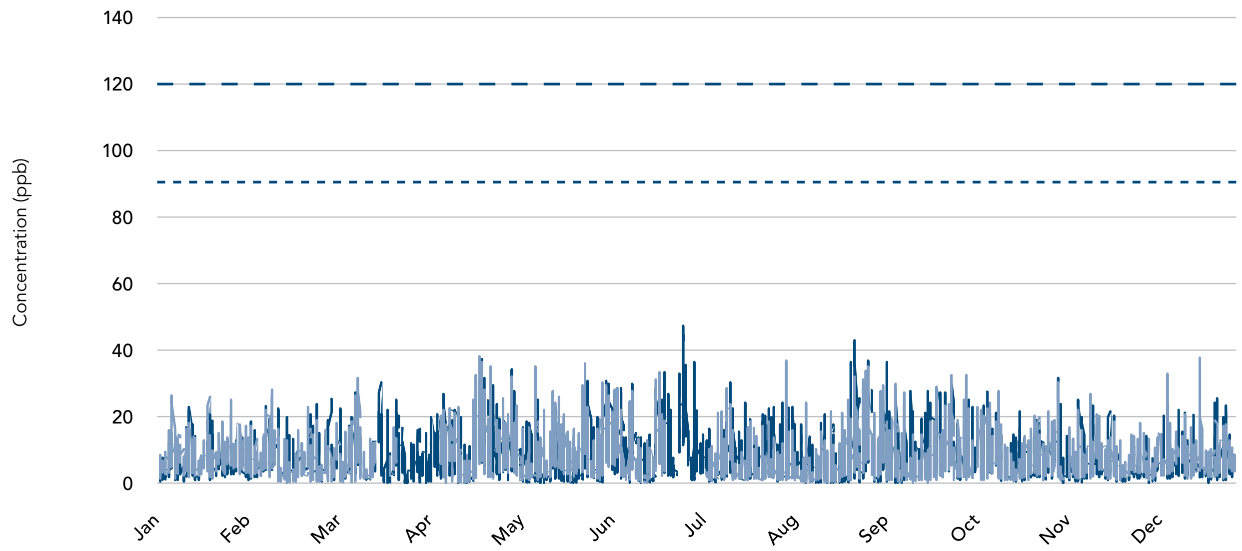
Source: APAM

B10.5.2.2
Melbourne Airport South and East 2018 and 2019 results: NO_2

The 2019 results for hourly average NO_2 concentrations (ppb) for MAS and MAE monitoring stations are shown in **Figure B10.5**. NO_2 concentrations were consistently low at both stations, with no recorded exceedances of the NEMP (pre-2019) or NEPC (2019) ambient air quality objectives.

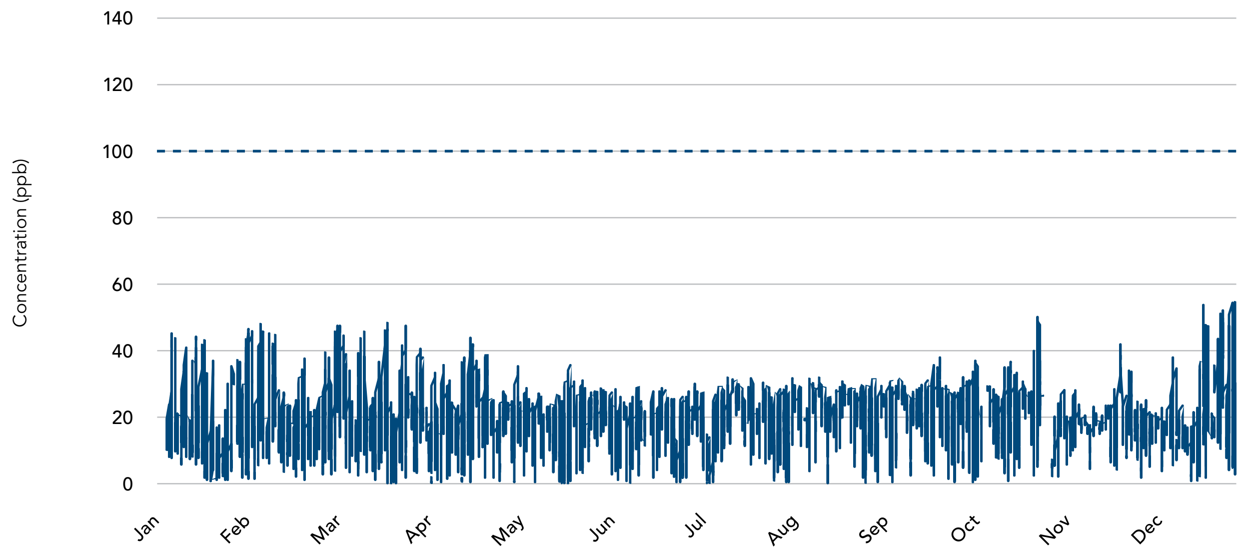
The average NO_2 concentration was 7.0 ppb at MAS and 6.9 ppb at MAE in 2019. The results for 2018 are also shown for comparison in **Figure B10.6**. These results are comparable to typical concentrations observed for the Melbourne region as a whole (**Table B10.17**) and demonstrate that year-to-year variability in NO_2 background concentrations is low.

Figure B10.6
MAS and MAE results for hourly average NO_2 and SEPP (AAQ) criteria: 2018



Source: APAM

Figure B10.7
MAS results for hourly average O_3 compared to the SEPP (AAQ) criteria



Source: APAM

B10.5.2.3
Melbourne Airport South 2019 results: O_3

The MAS results for hourly average O_3 concentrations are shown in **Figure B10.7**. O_3 concentrations remained consistently low, with no recorded exceedances of the ambient air quality (SEPP (AAQ)) criteria.

An increase in O_3 concentrations is observed from October to March, peaking around 45 ppb, while concentrations from May to September are typically around 30 ppb. These results are comparable to typical concentrations observed for the Melbourne region as a whole (**Table B10.17**).

B10.5.2.4
Melbourne Airport South 2019 results: SO_2

The MAS results for hourly average SO_2 concentrations for 2019 are shown in **Figure B10.8**. The concentrations of SO_2 remained consistently low, with no recorded exceedances of either the SEPP (AAQ) criteria or the NEPC proposed ambient air quality objective from 2019.

The average hourly SO_2 concentration for 2019 was 1.2 ppb; the maximum recorded value was 20.2 ppb. These are comparable to typical concentrations observed for the Melbourne region as a whole (**Table B10.17**).

B10.5.2.5
Melbourne Airport South 2019 results: PM_{10}

Daily average PM_{10} concentrations for MAS and two EPA monitoring stations at Alphington and Footscray for 2019 are shown in **Figure B10.9**.

PM_{10} concentrations at MAS followed similar intra-annual patterns to those at Alphington and Footscray, indicating that major sources of PM_{10} were not localised to the vicinity of Melbourne Airport.

Thirteen exceedances of the SEPP (AAQ) 24-hour ambient air quality objective were recorded at MAS. Of these, 12 were also above the objective at Alphington and/or Footscray, and attributable to airshed-wide pollutant events of natural or external origin (e.g. bushfire, windblown dust). These results have therefore been excluded from the analysis: resulting in one exceedance at MAS which may be due to local sources such as the airport. No exceedances were observed from May to September.

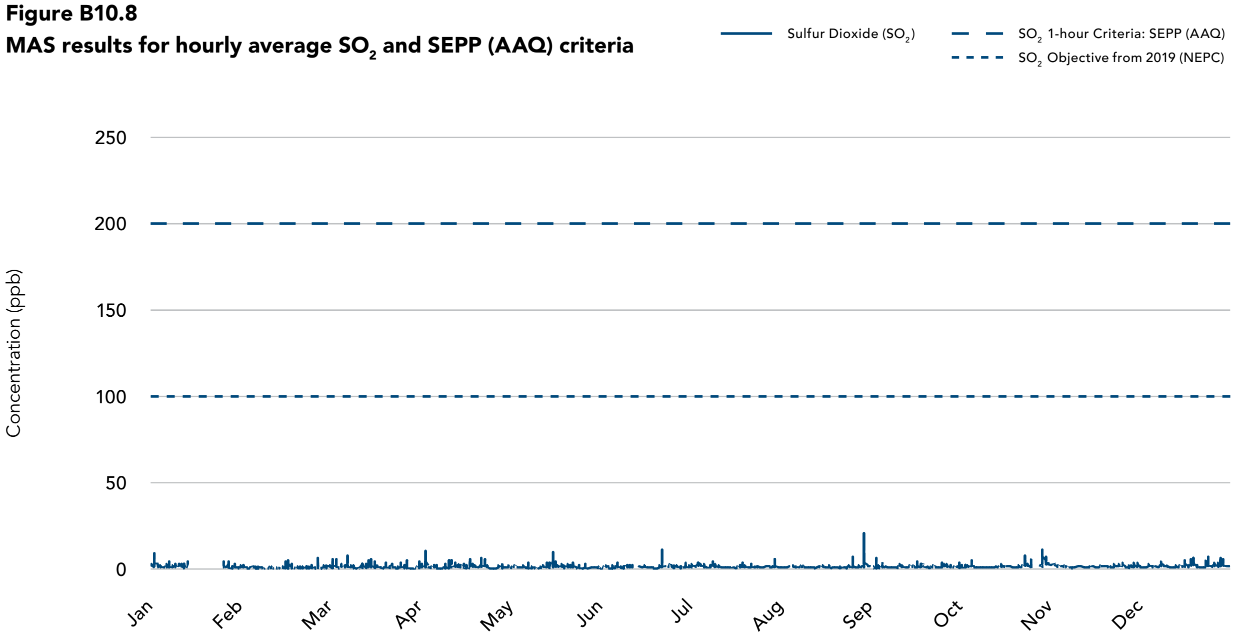
B10.5.2.6
Melbourne Airport South and East 2019 results: $PM_{2.5}$

Daily average $PM_{2.5}$ concentrations for MAS, MAE and EPA monitoring stations at Alphington and Footscray for 2019 are shown in **Figure B10.10**.

$PM_{2.5}$ concentrations at MAS and MAE followed similar intra-annual patterns to those at Alphington and Footscray, indicating that major sources of $PM_{2.5}$ were not localised to the vicinity of Melbourne Airport.

Five exceedances of the AAQ NEPM 24-hour ambient air quality objective were recorded at MAS. Of these exceedances, three were attributable to airshed-wide pollutant events of natural or external origin (e.g. bushfire, windblown dust). These results have therefore been excluded from the analysis, resulting in two exceedances at MAS.

Figure B10.8
MAS results for hourly average SO_2 and SEPP (AAQ) criteria



Source: APAM

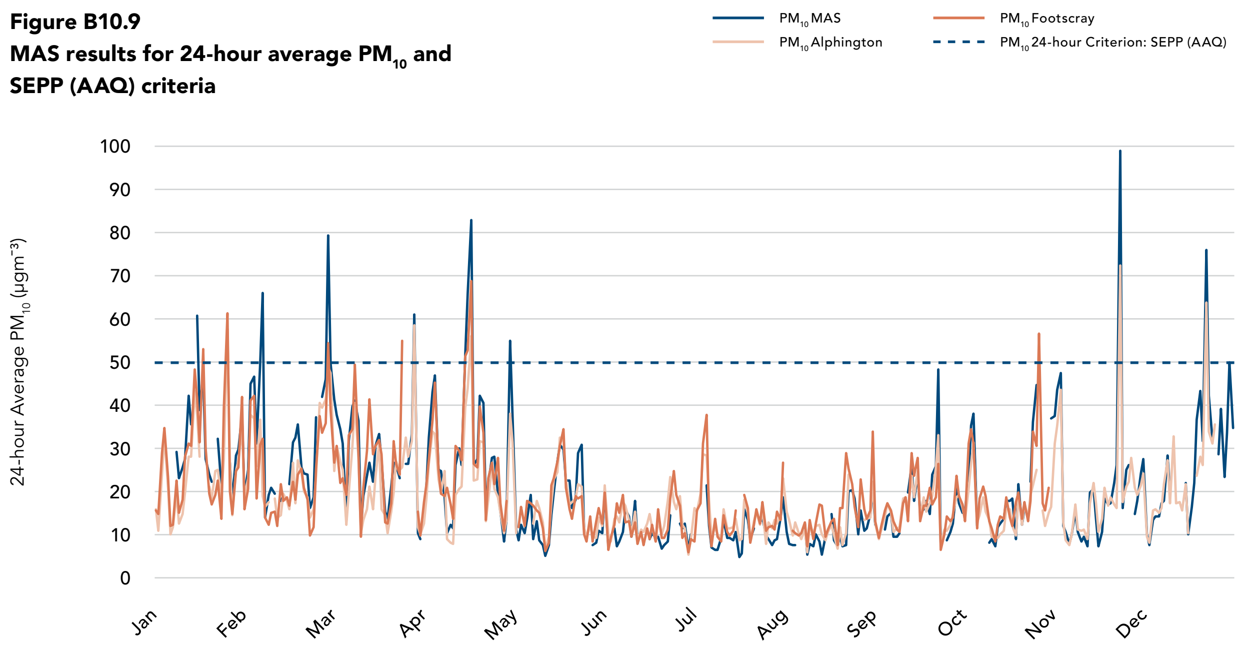
B10.5.2.7
Melbourne Airport South 2019 results: VOCs

This section draws upon diffusive sampler (VOCs) monitoring results for Melbourne Airport in the monitoring period December 2014 to July 2017 inclusive for the two higher risk VOCs selected for assessment: benzene and formaldehyde. The results were compared with air toxics NEPM Monitoring Investigation Levels (MILs).

All the measured benzene concentrations were low, and all with results of less than two μg/m³ (24-hour averages and longer-term averages). There were no exceedances of the air toxics NEPM MIL for benzene (annual average three ppb: or 9.6 μg/m³ at 25°C).

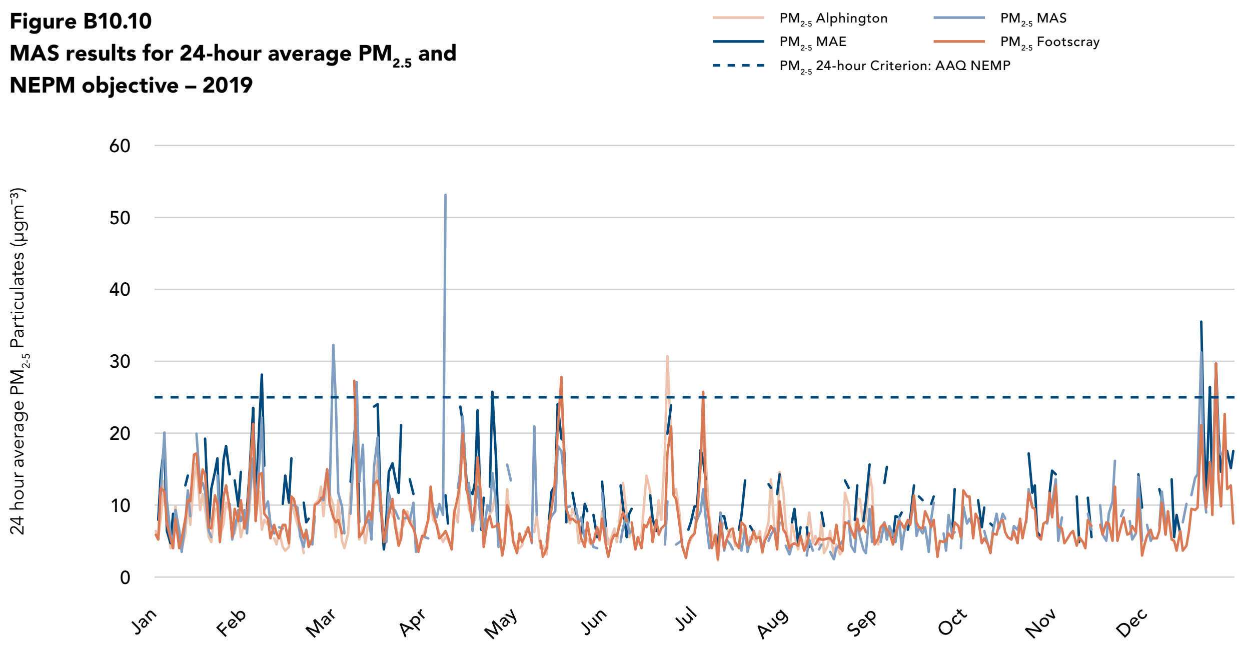
A conservative method was used to estimate the absolute maximum 24-hour average formaldehyde concentrations that could be obtained from weekly and two-week samples. The resulting formaldehyde concentrations were low, with results typically around 20 per cent of the air toxics NEPM MIL (49 μg/m³: 24-hour average). The highest measurement was approximately 50 per cent of the NEPM MIL.

Figure B10.9
MAS results for 24-hour average PM_{10} and SEPP (AAQ) criteria



Source: APAM

Figure B10.10
MAS results for 24-hour average $PM_{2.5}$ and NEPM objective – 2019



Source: APAM

B10.5.3
Air quality in the Melbourne airshed

EPA air quality monitoring data acquired across the entire Melbourne airshed were reviewed for comparison to the existing levels of air pollutant concentrations used in this assessment.

The EPA operates several air quality monitoring stations in the Melbourne airshed and provides annual reports including summaries for each pollutant. Estimates for typical air pollutant concentrations in the Melbourne airshed from 2002-15 were determined by inspecting of the trends graphed in EPA 2016 and summarised in Table B10.17. For example, 'trending downwards' means that the concentrations in previous years are typically higher than more recent data.

B10.6
ASSESSMENT OF CONSTRUCTION PHASE IMPACTS

This section presents the results of atmospheric dispersion modelling for comparison to project air quality standards (Section B10.2.3 and B10.2.4) for the construction phase for PM_{10} and $PM_{2.5}$ emissions and deposited dust generated, corresponding to the construction scenario described in Section B10.4.3. Throughout this section, the contour plots show lines of equal predicted GLCs predicted by the model in accordance with the rules set out in the SEPP (AQM).

B10.6.1
Construction phase impacts: $PM_{2.5}$

B10.6.1.1
Predicted peak impact – project construction

The predicted $PM_{2.5}$ ground level concentrations arising from M3R construction operations (i.e. excluding background) are shown in Figure B10.11.

The contour presented displays the maximum 24-hour average assessment criteria (36 µg/m³ and 25 µg/m³) for $PM_{2.5}$. Model results show that maximum daily concentrations in excess of these criteria were restricted to the immediate vicinity of major haulage routes and heavily trafficked areas, and not found to extend beyond the airport boundary.

It was predicted that the $PM_{2.5}$ impact from M3R construction for all modelled years complied with the required ground level criterion at each identified sensitive receptor. The highest predicted GLC at any sensitive receptor was five µg/m³ over five years of model runs (approximately 14 and 20 per cent of the 36 µg/m³ and 25 µg/m³ assessment criteria, respectively) at R13 (Figure B10.1).

Table B10.17
Typical air pollutant concentrations for Melbourne airshed 2002-2015

Air pollutant	EPA monitoring stations	Air toxics NEPM standard/ MIL	Typical value (50th percentile)	Typical high value (99th percentile)
CO	Alphington, Geelong South & Richmond	Max. 8-hour average, 9.0 ppm (10 mg/m³ @ 25°C)	2002-2015: < 0.5 ppm (< 0.6 mg/m³ @ 25°C)	Trending downwards; 2015: < 1.5 ppm (1.7-2.3 mg/m³ @ 25°C)
NO2	Alphington, Brighton, Footscray, Geelong South & Point Cook	Max. 1-hour average, 120 ppb (226 µg/m³ @ 25°C)	2002-2015: 15-20 ppb (28-38 µg/m³ @ 25°C)	Trending downwards; 2010-2015: 35-40 ppb (66-75 µg/m³ @ 25°C)
O_3	Alphington, Brighton, Dandenong, Footscray, Geelong South, Melton, Mooroolbark & Point Cook	Max. 1-hour average, 100 ppb (196 µg/m3 @ 25oC)	2002-2015: 25-30 ppb (49-59 µg/m³ @ 25°C)	No trend; 2002-2015: 60-70 ppb (118-137 µg/m3 @ 25°C)
SO2	Altona North only (worst case)	Max. 1-hour average, 200 ppb (524 µg/m3 @ 25oC)	2002-2015: 5 ppb (13 µg/m³ @ 25°C)	No trend; 2002-2015: 20-40 ppb (52-105 µg/m3 @ 25°C)
PM10	Alphington, Brighton, Dandenong, Footscray, Geelong South, Mooroolbark & Richmond	Max. 24-hour average, 50 µg/m3	2010-2015: 15 µg/m³	Trending downwards, but affected by bushfire smoke: 2010-2015: 40-50 µg/m3
PM2.5	Alphington and Footscray	Max. 24-hour average, 25 µg/m3	2010-2015: 6 µg/m³	Trending downwards, but affected by bushfire smoke: 2010-2015: 17-30 µg/m3
Benzene	Tullamarine landfill	MIL annual average, 3 ppb (9.6 µg/m³)	< 10 µg/m³	Highest 24-hour average 2280 µg/m³ (road traffic)
Formaldehyde	Tullamarine landfill	MIL 24-hour average, 40 ppb (49 µg/m³)	< 5 µg/m³	Highest 24-hour average 10 µg/m³

B10.6.1.2
Predicted peak impact – including background concentrations

The $PM_{2.5}$ 24-hour average varying background file was added to the maximum 24-hour predicted GLC at each of the 16 identified receptors to determine the cumulative impact of M3R construction works and the existing background air quality for each modelled day. It is found that where an exceedance of the 25 µg/m³ criterion has occurred, in all cases it is because of an elevated background level on that day.

Based on this analysis, it was determined that no exceedances of the $PM_{2.5}$ criteria would occur due to M3R construction activities when background is included. The risk of the cumulative GLCs (i.e. from M3R construction activities plus background) exceeding the assessment criteria is therefore considered low.

B10.6.2
Construction phase impacts: PM_{10}

B10.6.2.1
Predicted peak impact: project construction

The predicted PM_{10} GLCs arising from M3R construction operations (i.e. excluding background) are shown in Figure B10.12.

The contour presented displays the maximum 24-hour average assessment criteria (60 µg/m³ and 50 µg/m³) for PM_{10}. Modelling shows that maximum daily concentrations were contained mostly within the airport boundary, around stockpiles and major haul routes.

Concentrations above the 24-hour average assessment criteria were predicted for properties near the north and south site boundaries. However, this is considered to be a low probability occurrence as the results reflect worst-case conditions modelled over a period of five years, whereas the earthworks phase of construction will only be a portion of the overall project development duration.

For the identified sensitive receptors (Figure B10.1) it was predicted that the PM_{10} impact from the M3R construction phase for all modelled years complied with the required ground level criterion. The highest predicted GLC of 33 µg/m³ over five years of model runs (approximately 55 per cent and 66 per cent of the 60 µg/m³ and 50 µg/m³ assessment criteria respectively) occurred at R13.

B10.6.2.2
Predicted peak impact including background concentrations

The PM_{10} 24-hour average varying background file was added to the maximum 24-hour predicted GLC at each of the 16 identified receptors to determine the cumulative impact of the project construction operations and the existing background air quality for each modelled day.

It is found that where an exceedance of the 50 µg/m³ criterion is predicted, in almost all cases it is the result of an elevated background level occurring on that day. Where there is a cumulative exceedance, it was found that that the background concentration contributed greater than 50 per cent of the criterion for all exceedances with the exception of R13.

Based on this analysis, only one exceedance of the 50 µg/m³ criterion (and zero exceedances of the 60 µg/m³ criterion) is predicted to occur at the identified sensitive receptors as a result of M3R construction activities when background is included. The risk of the cumulative GLCs (from M3R construction activities plus background) exceeding the assessment criteria is therefore considered low.

B10.6.3
Construction phase impacts: deposited dust (TSP)

B10.6.3.1
Predicted peak impact: project construction

The predicted ground level dust deposition values arising from M3R construction (i.e. excluding background) are shown in Figure B10.13.

The contour presented displays the monthly criterion level (two g/m²/month) for deposited dust. Dust deposition above this criterion is generally restricted to the vicinity of the constriction area, with a southward bias due to prevailing northerly winds. No existing airport infrastructure to the east of runway 16L/34R was found to be impacted.

It was found that the deposited dust predicted impact from M3R constriction activities for all modelled years complied with the required ground level criterion at each nominated sensitive receptor.

The highest predicted ground level deposition of over two g/m²/month occurred at residences to the north of the airport, near receptor R1 (Bulla) and to the south of the airport. The highest predicted ground level deposition at the nominated receptors was 1.8 g/m²/month over five years of model runs (approximately 90 per cent of the criterion) occurring at R13.

Figure B10.11
M3R construction: maximum 24h $PM_{2.5}$ GLC excluding background (μg/m³)

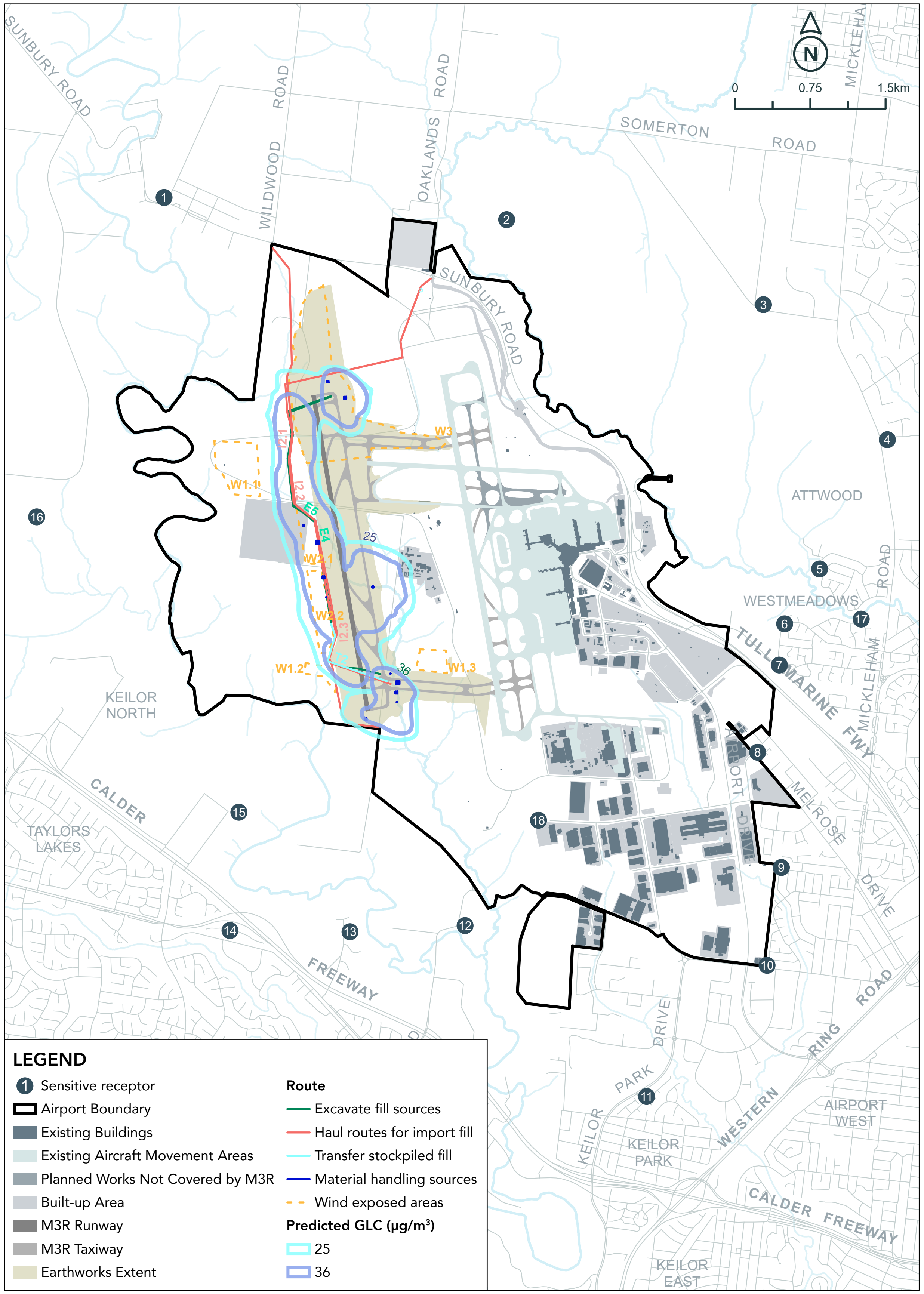


Figure B10.12
M3R construction: maximum 24h PM_{10} GLC excluding background (μg/m³)

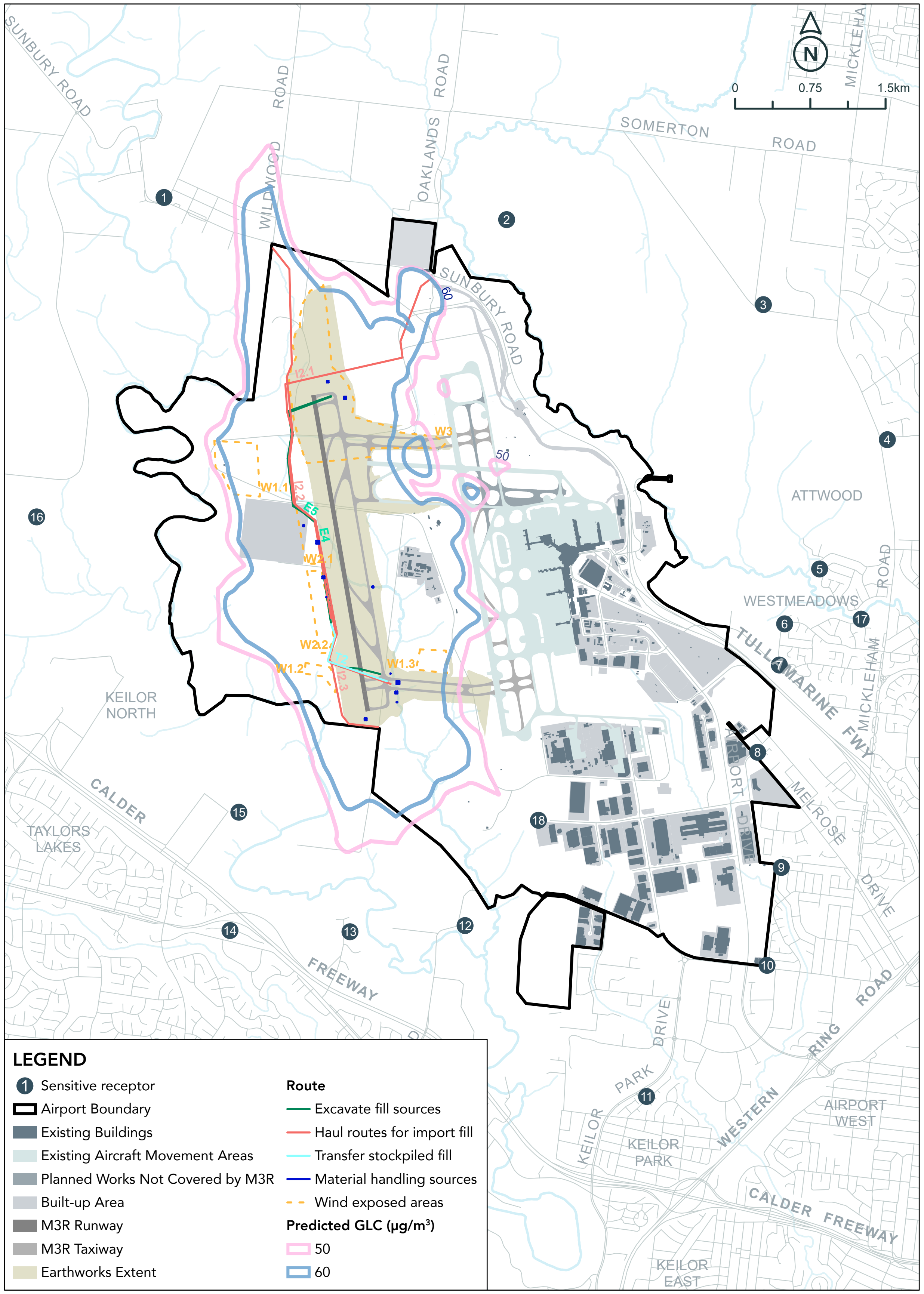
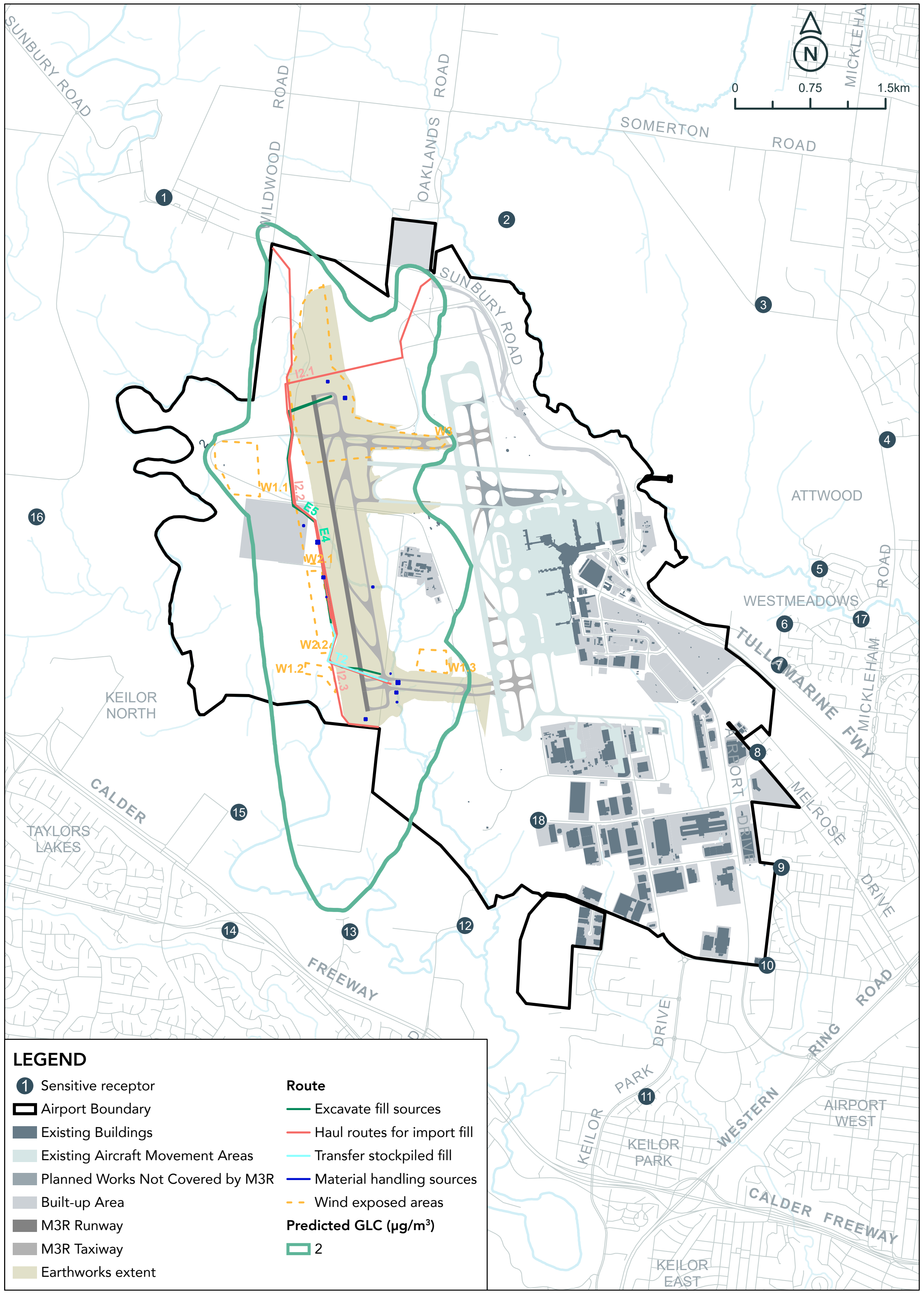


Figure B10.13
M3R construction: maximum predicted deposited dust excluding background. 2 g/m²/month contour indicated



B10.6.3.2
Predicted peak impact: including background concentrations

As dust deposition is not currently measured at the project site, a measured background value cannot be added to the deposited dust predicted model result. However, it is noted the Mining PEM says regarding deposited dust:

> *'Results of monitoring should not exceed 4 g/m²/month (no more than 2 g/m²/month above background) as a monthly average'.*

Therefore, if background levels are well below two g/m²/month then residences in the area with concentrations above two g/m²/month would fall within the assessment criteria levels of the Mining PEM guidance of four g/m²/month.

B10.6.4
Ground level concentration contour plots

The AERMOD results for $PM_{2.5}$ and PM_{10} GLCs and dust deposition rate are provided as the following contour plots, in accordance with the procedures set out in SEPP (AQM):

- Maximum 24h $PM_{2.5}$ GLC excluding background (µg/m³)
- Maximum 24h PM_{10} GLC excluding background (µg/m³)
- Maximum predicted deposited dust excluding background (g/m²/month).

The assessment methodology is detailed in **Section B10.4**. The AERMOD results for GLCs are provided as contour plots in units of µg/m³, with air quality standards colour-coded in each case.

B10.7
OPERATIONAL PHASE IMPACTS

This section presents the results of atmospheric dispersion modelling for comparison against project air quality standards (**Section B10.2.3** and **B10.2.4**) in the operational phase for NO_2 and PM_{10}. The method used to assess operational emissions is described in **Section B10.4.4**.

Throughout this section, contour plots show the lines of GLCs predicted by the model in accordance with the rules in the SEPP (AQM). Contours overlaid on a base map illustrate the locations of impacts to air quality. Results at nominated sensitive receptors are presented in **Section B10.7.6**.

Background concentrations of NO_2 and PM_{10} are not included in the figures in this section. Figures therefore show the maximum impacts of airport operations rather than the maximum cumulative impact on sensitive receptors when background concentrations are added to airport operations.

Other criteria air pollutants were assessed only for the worst case scenario, and the results shown in **Section B10.7.6**. Model inputs and results were peer reviewed by environmental consultant GHD.

B10.7.1
Current impacts (2019)

The following subsection presents the baseline modelling results for aircraft operations and road traffic for 2019. They correspond to the operations scenario described in **Section B10.4.4**.

B10.7.1.1
Current impacts: NO_2

The AERMOD results for NO_2 are shown in **Figure B10.14** for the one-hour average. The SEPP (AAQ) criterion for NO_2 (226 µg/m³) and SEPP (AQM) criterion (190 µg/m³) were the standards used for the assessment.

As evident in **Figure B10.14**, the highest GLCs of NO_2 are observed to the south end of the runway, predominantly from emissions from aircraft movements. Although aircraft parking and taxiways have a lower impact they still contribute to GLCs.

No exceedances of the SEPP (AQM) criteria are observed outside the airport boundary.

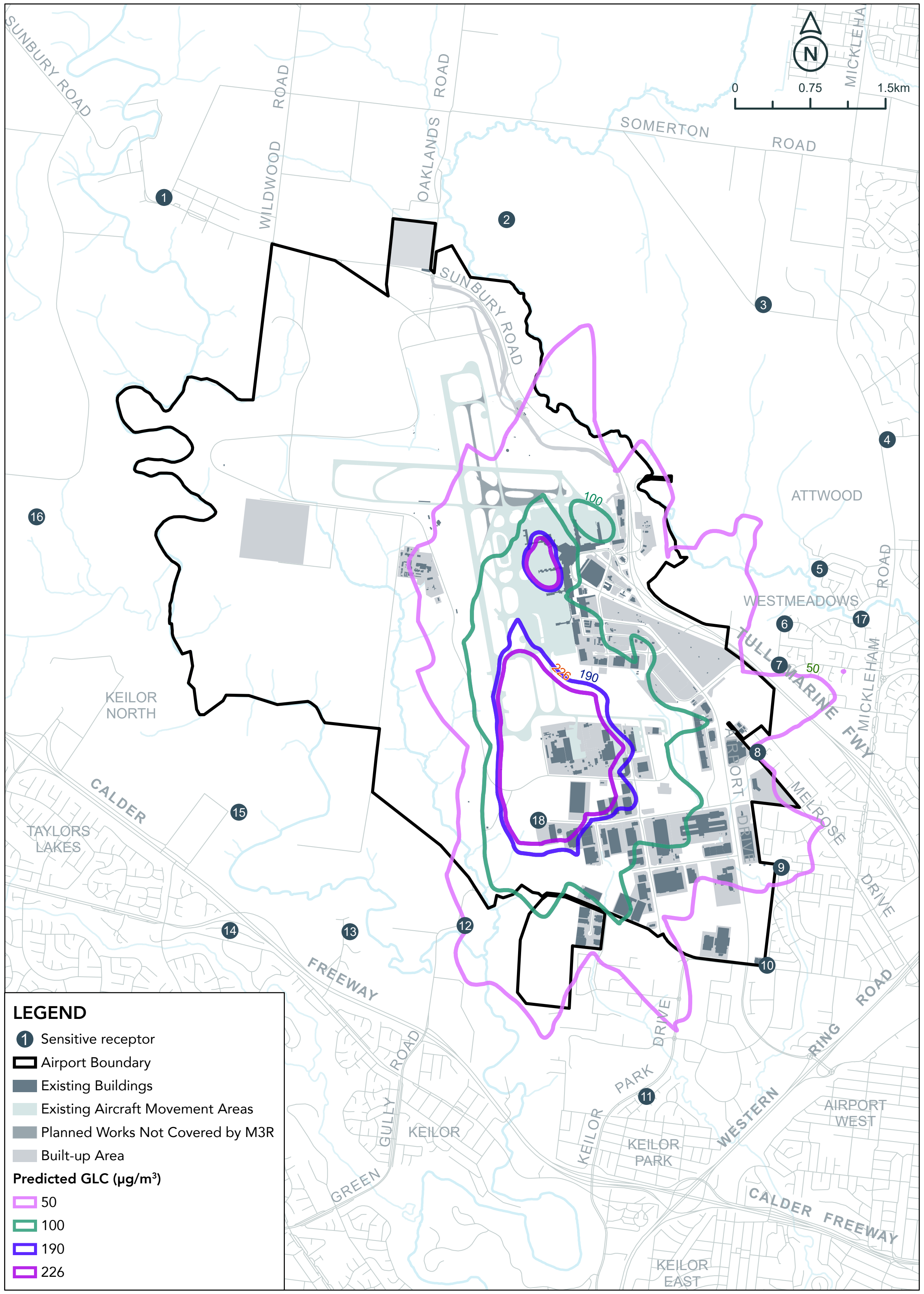
The highest concentrations are observed to the south of the 16L/34R runway. The MAS monitoring station is situated in this area, indicating that the monitoring station is measuring impacts from the both the operation of the airport and the ambient background pollutant levels. Therefore, model results that use data from MAS as representing background concentrations (presented in **Section B10.7.6**) are likely to have some double counting of aircraft emissions (as recorded in the MAS data, plus the modelled impact).

Note that the model run represents worst case conditions; a comparison of modelled results against data recorded at MAS demonstrates that actual emissions are lower and unlikely to result in any exceedances of air quality criteria. The ninth highest concentration (i.e. the 99.9th percentile) of NO_2 measured at MAS in 2019 was 71.7 µg/m³ (38.15 ppb). This is just 20 per cent of the ninth-highest modelled concentration for 2019 at MAS. By comparison, the highest 99.9th percentile prediction for a sensitive receptor was observed at receptor R9 (Janus St) at 54.6 µg/m³ (25 per cent of the SEPP (AQM) criteria).

Figure B10.15 shows AERMOD results for the NO_2 annual average. Predicted maximum concentrations, occurring to the south of the existing 16/34 runway, are less than 20 per cent of the SEPP (AQM) design criterion for NO_2 (56 µg/m³).

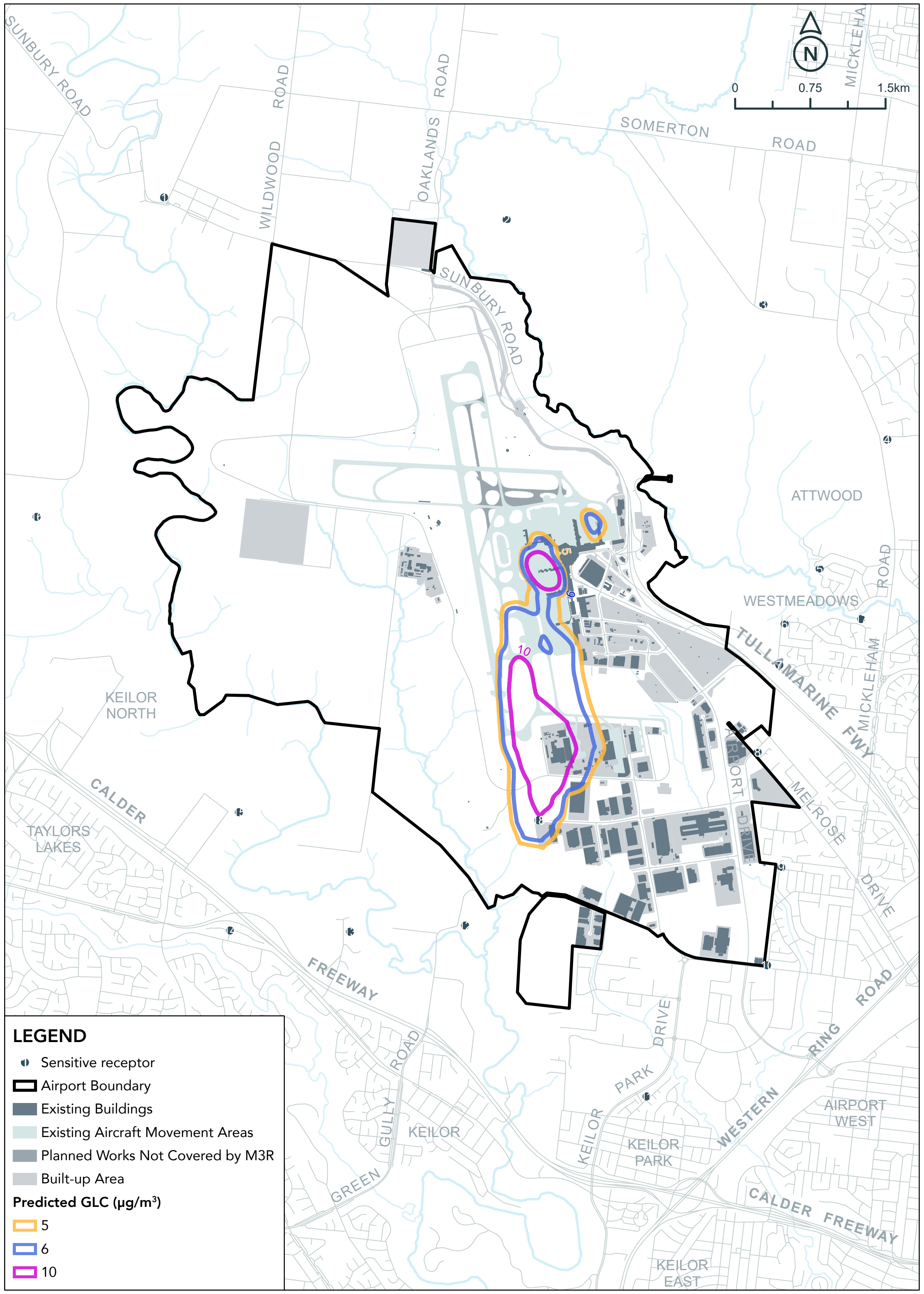
In addition, GLCs for NO_2 were assessed against the 2019 one-hour NEPC goal of 169 µg/m³ (maximum) and 150 µg/m³ from 2025. Model results demonstrated that all receptors achieved the 2019 goal; and all but two receptors (R11 and R12) achieve the 2025 goal. Note that this goal applies to the maximum concentration, not the 99.9th percentile concentration shown in the figures below. Also note these targets are not compliance related.

Figure B10.14
AERMOD results for current (2019) airport operations: µg/m³ NO_2 (99.9th percentile, one-hour average, no background)



Note: The SEPP (AAQ) criterion for NO_2 (226 µg/m³) is represented by the red contour, and the SEPP (AQM) criterion (190 µg/m³) is represented by the orange contour.

Figure B10.15
AERMOD results for current (2019) airport operations: NO_2 (annual average, no background)



Note: SEPP (AQM) design criterion for NO_2 (56 µg/m³) and the NEPC 2019 target (36 µg/m³) is not shown, as modelled results are below these concentrations.

B10.7.1.2
Current impacts: PM_{10}

The AERMOD results for PM_{10} are shown in **Figure B10.16** (24-hour impacts) and **Figure B10.17** (annual impacts).

The SEPP (AAQ) 24-hour criterion for PM_{10} (50 µg/m³) was the standard used for the assessment. Note that the figure does not include background concentrations. The results are presented this way because the impact of emissions from the airport is minimal compared to background concentrations, and would otherwise be indistinguishable in this figure.

As evident from **Figure B10.16**, the highest GLCs of PM_{10} are observed around the aircraft parking, extending towards the car parks at Melbourne Airport. Taxiways and aircraft are shown to have a minimal impact on PM_{10} concentrations. No exceedances of the criteria are observed outside the airport boundary. Similarly, annual PM_{10} concentrations are shown to be well below the annual criterion in all locations (20 µg/m³).

B10.7.1.3
Variability of model results

Five years of meteorological data were used to determine a worst-case meteorological dataset, based on AERMOD model results for predicted NO_2 GLCs (one-hour average, 99.9th percentile).

Concentrations at the sensitive receptors are shown in **Table B10.18**. As evident in the table, concentrations at each receptor varied but were of a similar order of magnitude. At all sensitive receptors, GLCs were well below the SEPP (AQM) criteria. Receptor R12 (Arundel Road) was predicted to have the highest concentration NO_2 of 94.5 µg/m³ (42 per cent of the criteria). Comparisons with the measurements at MAS in 2019 confirmed these AERMOD results were conservative (high).

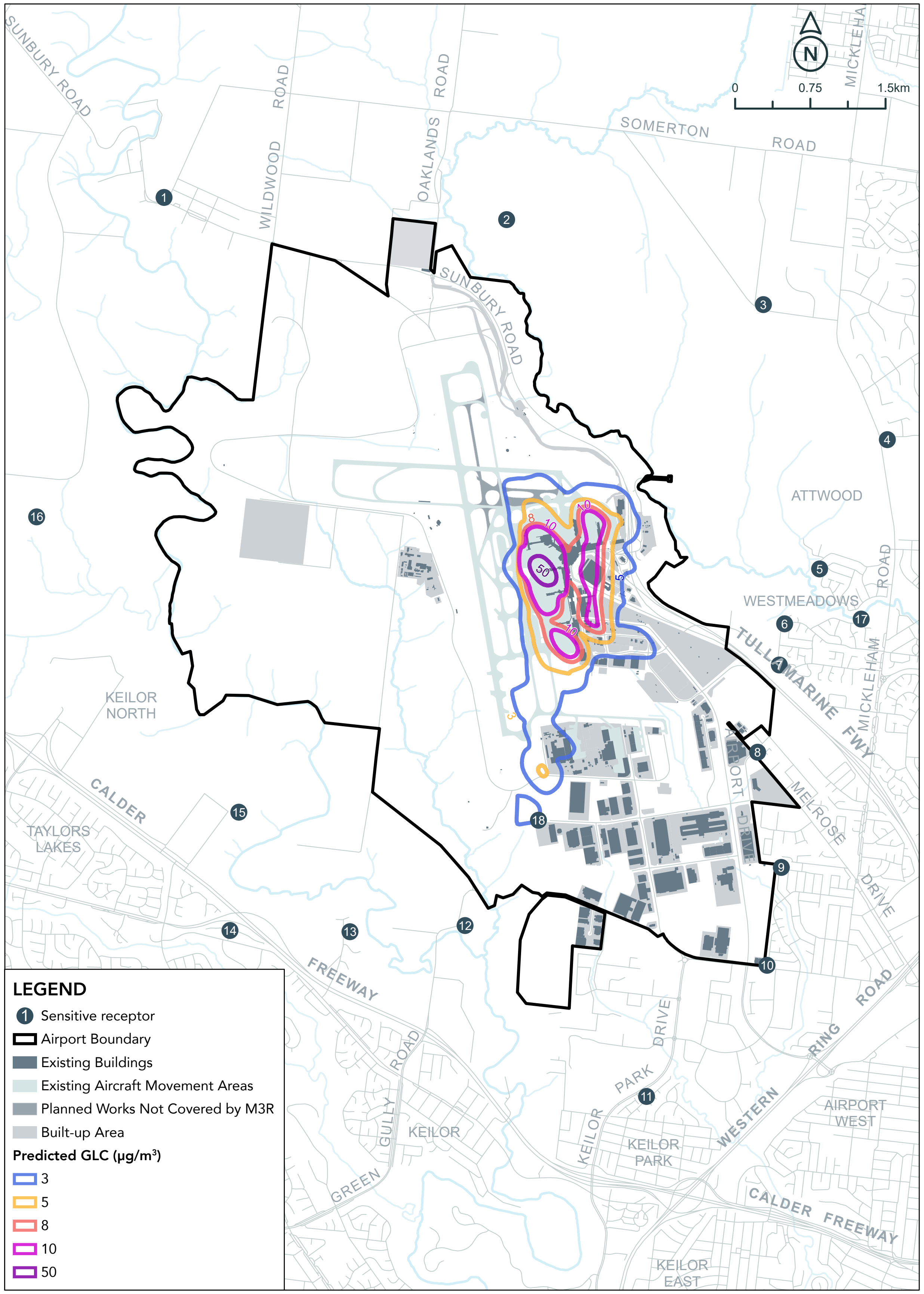
The meteorological data from 2017 typically produced worst-case results with the AEDT-AERMOD modelling combination. However, modelling results from the 2019 dataset produced results that were closest to the measured concentrations at the MAS monitoring station, and this dataset was therefore used for the assessment.

The AERMOD results for NO_2 GLCs (one-hour average, 99.9th percentile) are shown in **Figure B10.18**. Predicted GLCs above the SEPP (AQM) criteria of 226 µg/m³ for each year are centred around the south end of the existing 16/34 runway and cover a similar area. GLCs were predicted to be above the criteria outside the airport boundary for one year (2015) although no sensitive receptors are located in the impact area.

Table B10.18
Current airport: AERMOD results for 99.9 percentile one-hour average NO_2 GLCs (µg/m³) (no background)

Discrete receptor	2015	2016	2017	2018	2019
1. Bulla	8.4	8.9	5.3	8.4	8.7
2. Living Legends	24.7	30.0	30.4	26.2	22.6
3. Providence Rd	16.5	13.4	14.9	19.1	19.8
4. Montrose Ct	19.1	19.7	18.6	20.9	20.3
5. Threadneedle St	43.2	29.4	28.5	33.8	33.9
6. Westmeadows North	48.9	46.3	43.5	48.4	42.4
7. Westmeadows South	53.0	43.0	58.2	49.0	42.1
8. Melrose Dve	66.4	77.0	74.5	51.3	48.7
9. Janus St	40.3	28.9	50.1	40.3	54.6
10. Fisher Gve	34.9	31.9	35.7	49.7	30.8
11. Fosters Rd	66.8	35.4	81.2	34.9	24.2
12. Arundel Rd	91.1	46.2	94.5	58.3	48.1
13. Overnewton Rd	22.5	25.3	46.8	30.6	19.7
14. Keilor Village	15.0	17.2	26.5	20.2	11.8
15. Highland Rd	14.2	25.1	21.4	14.8	7.8
16. Loemans Rd	4.9	4.0	4.3	3.5	4.5
17. MAE	35.5	24.5	36.2	28.7	25.0
18. MAS	842.6	403.7	649.8	430.5	365.8

Figure B10.16
AERMOD results for current (2019) airport operations: PM_{10} maximum 24-hour average (no background)



SEPP (AAQ) criterion for PM_{10} 24-hour average (50 µg/m³) is shown by the purple contour.

Figure B10.17
AERMOD results for current (2019) airport operations: PM_{10} yearly average (no background)

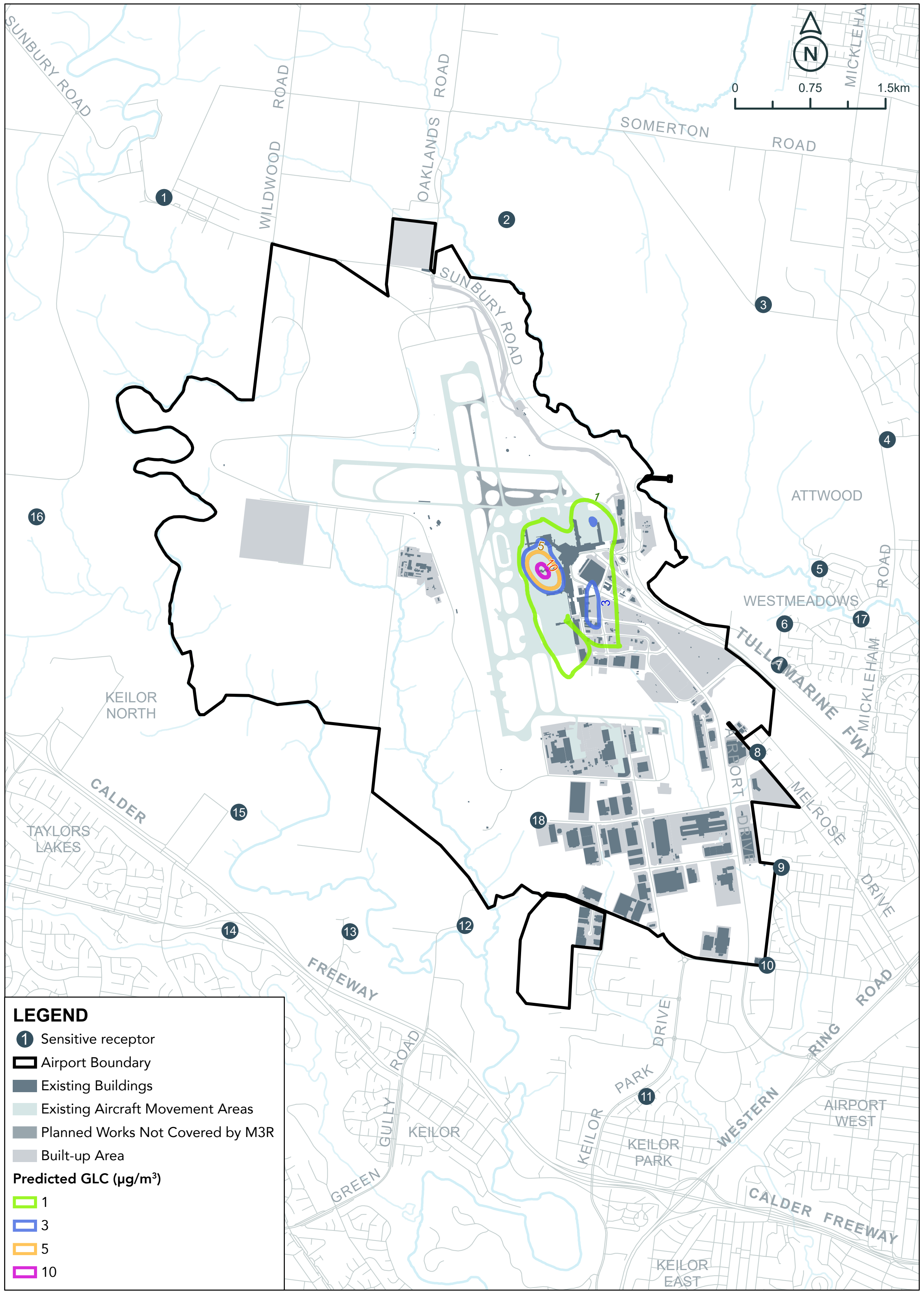
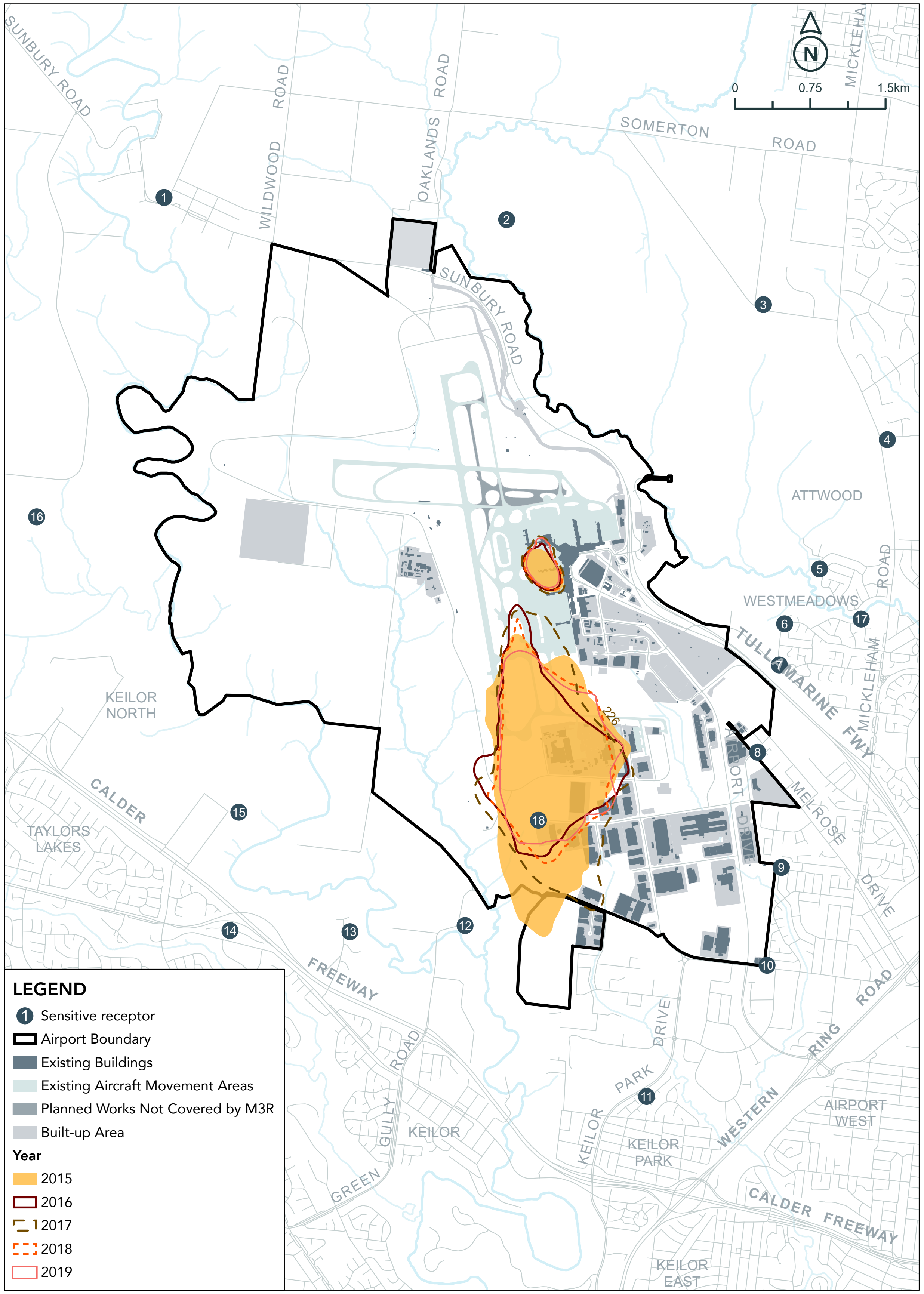
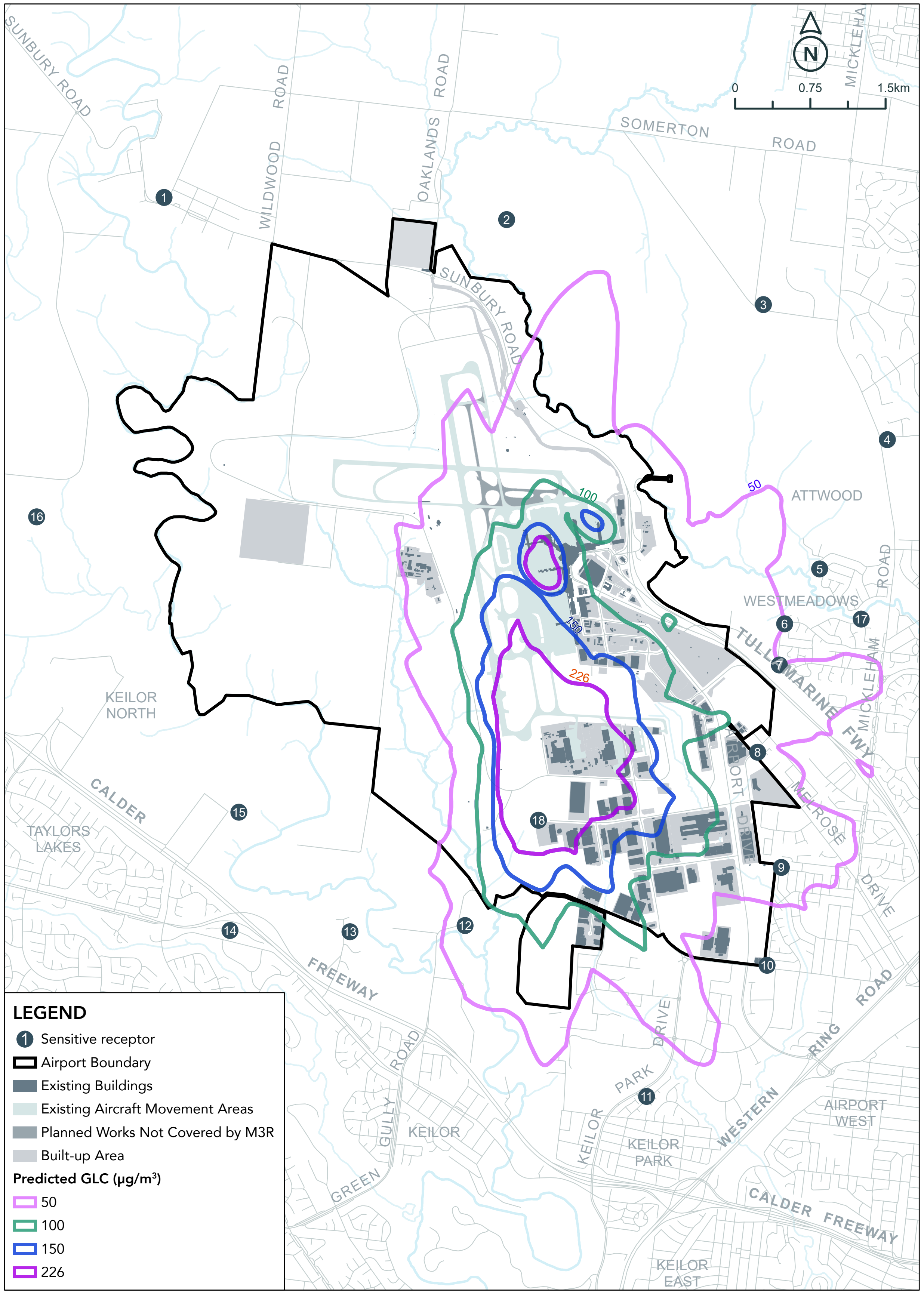


Figure B10.18
Results comparing 1-hour NO_2 average concentration of 226 µg/m³ (99.9 percentile) GLC variability among five years of meteorological files in model runs (no background)



Note: SEPP (AQM) design criterion for PM_{10} yearly average (20 µg/m³) is not shown, as modelled results are below this concentration.

Figure B10.19
M3R No Build 2026: AERMOD results for 99.9 percentile hourly NO_2 GLC (µg/m³) (no background)



Note: The SEPP (AAQ) criterion for NO_2 (226 µg/m³) is represented by the red contour.

B10.7.2
Predicted impacts for No Build 2026

This section presents the NO_2 and PM_{10} atmospheric dispersion modelling results for airport operations in 2026 if M3R is not built.

All concentrations exclude background levels in order to show maximum impacts from airport operations. Concentrations at sensitive receptors are provided in **Section B10.7.6**.

B10.7.2.1
No Build 2026: NO_2

The AERMOD results for NO_2 are shown in **Figure B10.19** for the one-hour average, with reference to the SEPP (AAQ) criterion for NO_2 (226 µg/m³), and SEPP (AQM) criterion (190 µg/m³) and NEPC proposed target from 2025 (150 µg/m³).

As evident from **Figure B10.19**, no exceedances of the SEPP (AQM) criteria are observed outside the airport boundary. GLCs above the design criteria cover an area slightly larger than in 2019 due to increased aircraft movements, extending a further 40 to 100 metres than in 2019.

Figure B10.20 shows AERMOD results for the NO_2 annual average. As with the 2019 modelling, there are no exceedances of the GLC and impacts are similar to those predicted in 2019.

B10.7.2.2
No Build 2026: PM_{10}

The AERMOD results for PM_{10} are shown in **Figure B10.21** for the 24-hour average, with reference to the SEPP (AAQ) design criterion for PM_{10} (50 µg/m³).

As evident from **Figure B10.21**, no exceedances of the SEPP (AQM) criteria are observed outside of the airport boundary. GLCs above the design criteria cover an area slightly larger than the 2026 No Build scenario, with a further increase in aircraft movements.

Figure B10.22 shows AERMOD results for the PM_{10} annual average. As with the 2019 modelling there are no exceedances of the GLC, and impacts are similar to those predicted in 2019.

B10.7.3
Predicted impacts for Build 2026

This section presents the NO_2, PM_{10}, and $PM_{2.5}$ atmospheric dispersion modelling results for airport operations in 2026 if M3R is built. All concentrations exclude background levels in order to show maximum impacts from airport operations. Concentrations at sensitive receptors are shown in **Section B10.7.6**.

As evident from the results below, predicted concentrations are very similar to the No Build scenario since operations include the same number of aircraft movements (an 18 per cent increase in movements from 2019). Therefore, the major difference in this scenario is some additional spatial dispersion of pollutants due to a larger area in which sources operate as a result of the new runway.

B10.7.3.1
Build 2026: NO_2

The AERMOD results for NO_2 are shown in **Figure B10.25** for the one-hour average, with reference to the SEPP (AAQ) criterion (226 µg/m³) and SEPP (AQM) design criterion (190 µg/m³) for NO_2.

As evident from **Figure B10.25**, no exceedances of the SEPP (AQM) criteria are observed outside of the airport boundary. GLCs above the design criteria cover an area slightly larger than in 2019, due to increased aircraft movements, extending a further 40 to 100 metres than in 2019.

Figure B10.24 shows AERMOD results for the NO_2 annual average. As with the 2019 modelling, there are no exceedances of the GLC, and impacts are similar to those predicted in 2019.

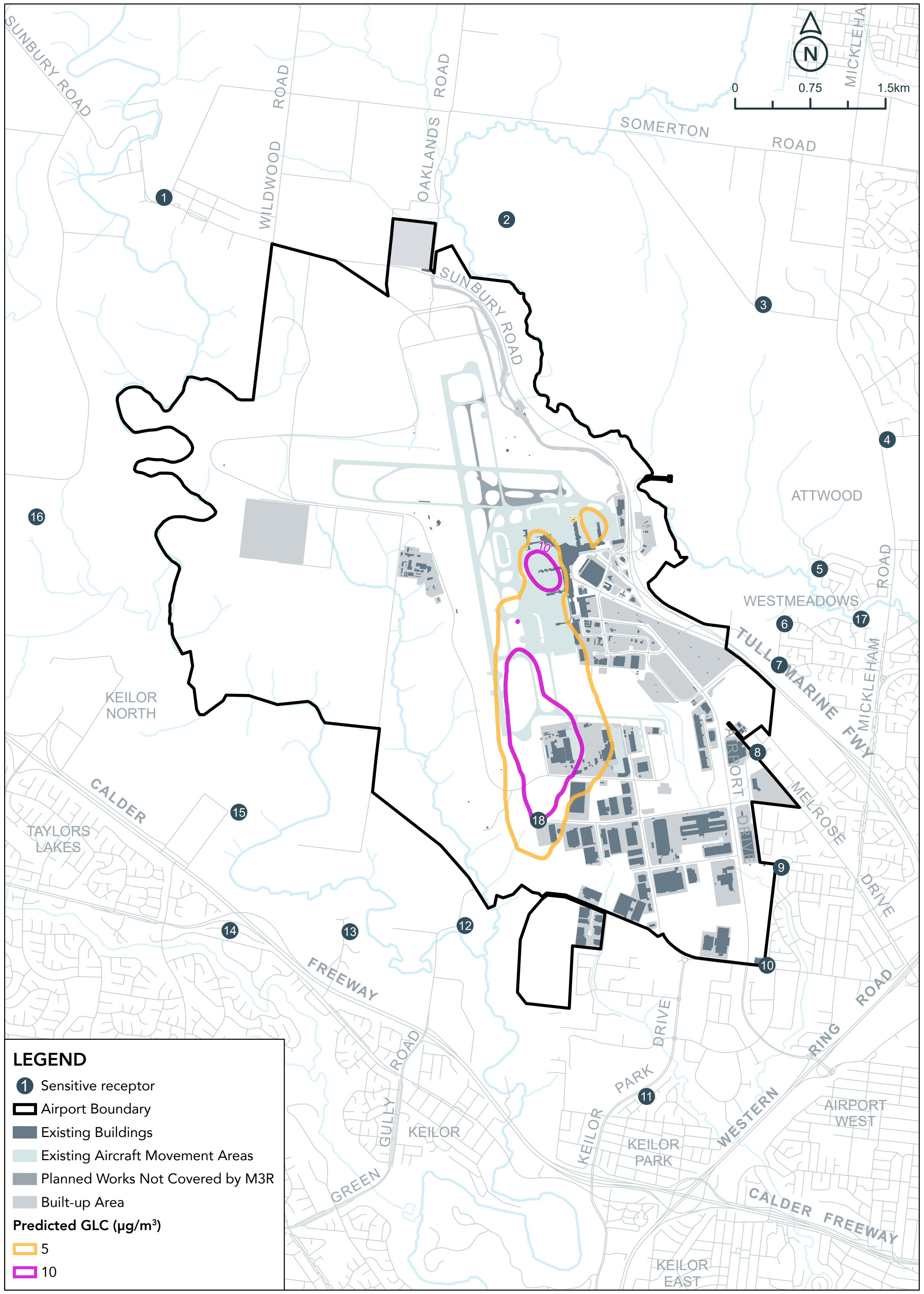
B10.7.3.2
Build 2026: PM_{10}

The AERMOD results for PM_{10} are shown in **Figure B10.25** for the 24-hour average, with reference to the SEPP (AAQ) design criterion for PM_{10} (50 µg/m³).

As evident from **Figure B10.25**, no exceedances of the SEPP (AQM) criteria are observed outside the airport boundary.

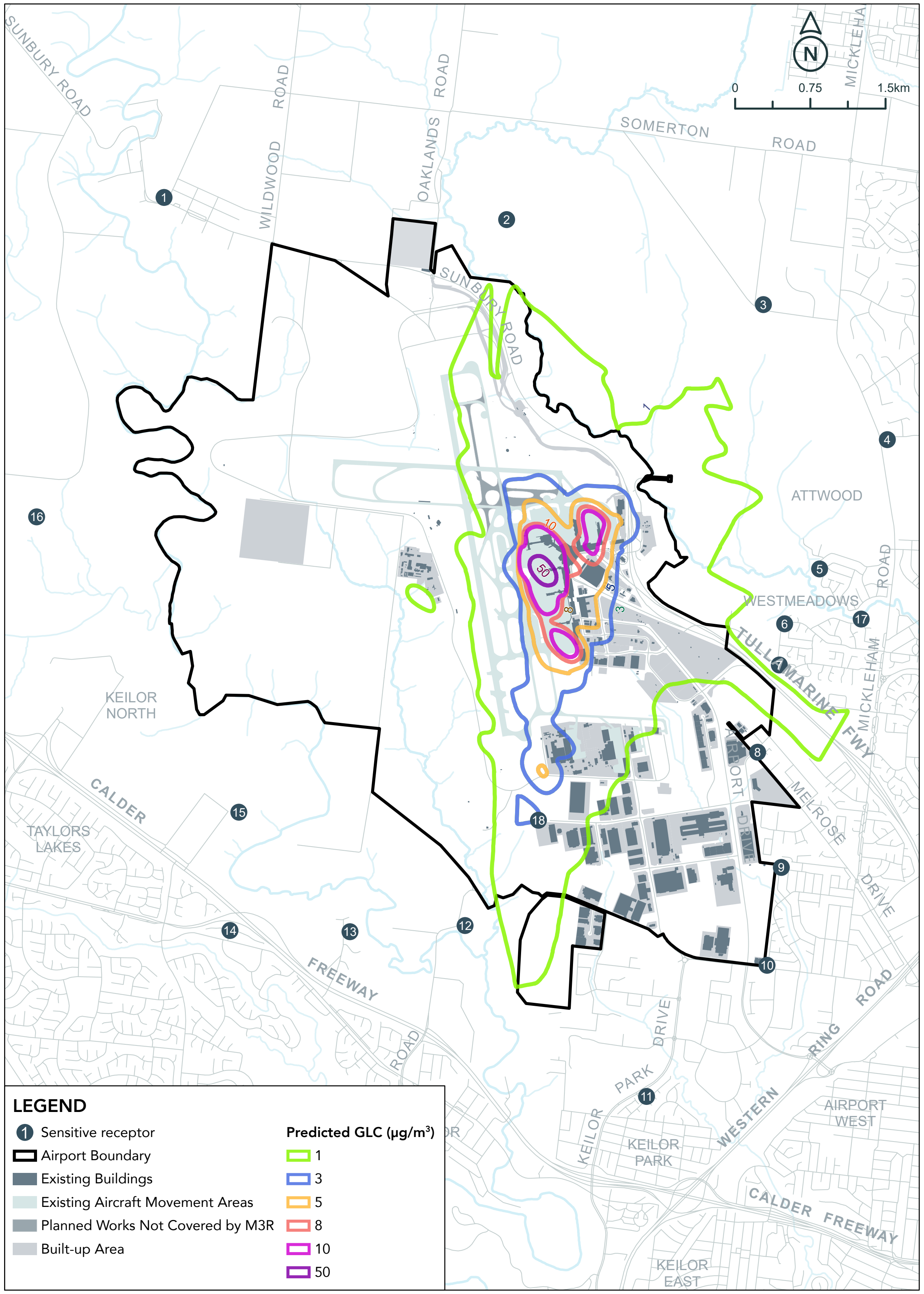
Figure B10.26 shows AERMOD results for the PM_{10} annual average. As with the 2019 modelling there are no exceedances of the GLC, and impacts are similar to those predicted in 2019.

Figure B10.20
M3R No Build (2026): AERMOD results for annual NO_2 GLC (ug/m³) – no background



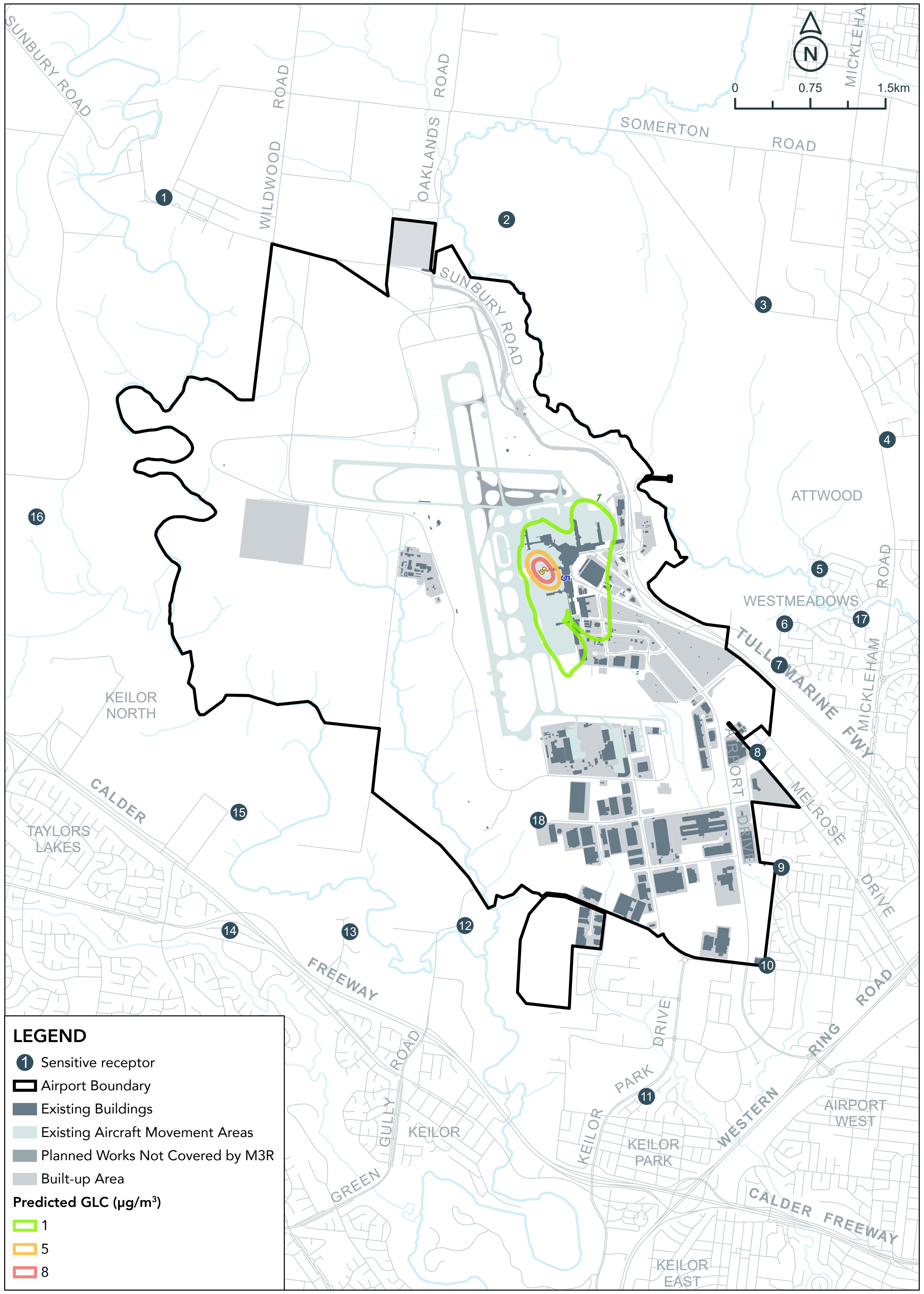
Note: SEPP (AQM) design criterion for NO_2 (56 μg/m³) and the NEPC 2019 target (36 μg/m³) is not shown, as modelled results are below these concentrations.

Figure B10.21
M3R No Build 2026: AERMOD results for maximum 24-hour PM_{10} GLC (μg/m³)



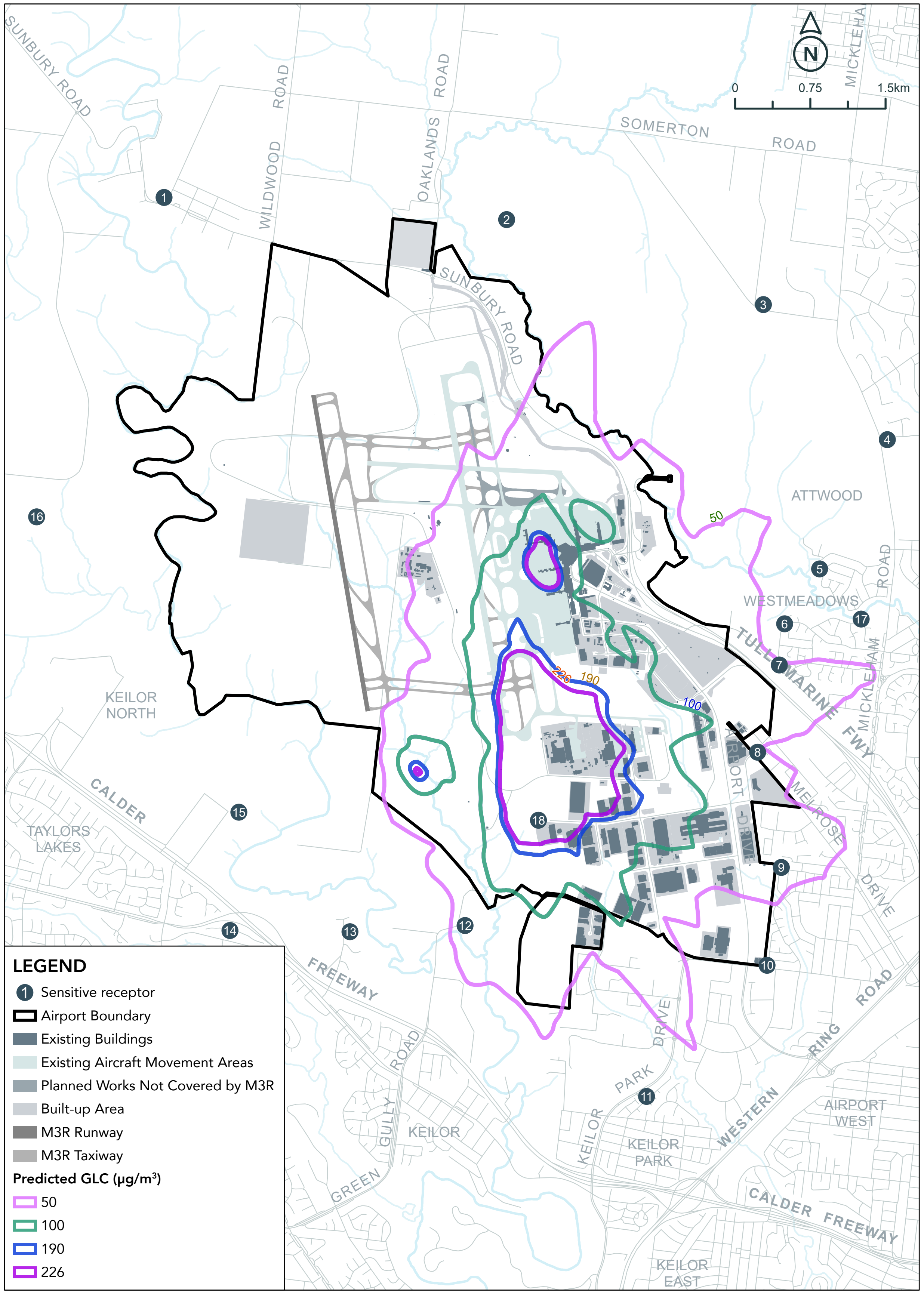
Note: SEPP (AAQ) standard for PM_{10} (50 μg/m³) is represented by the purple contour.

Figure B10.22
M3R No Build 2026: AERMOD results for annual average PM_{10} GLC (μg/m³)



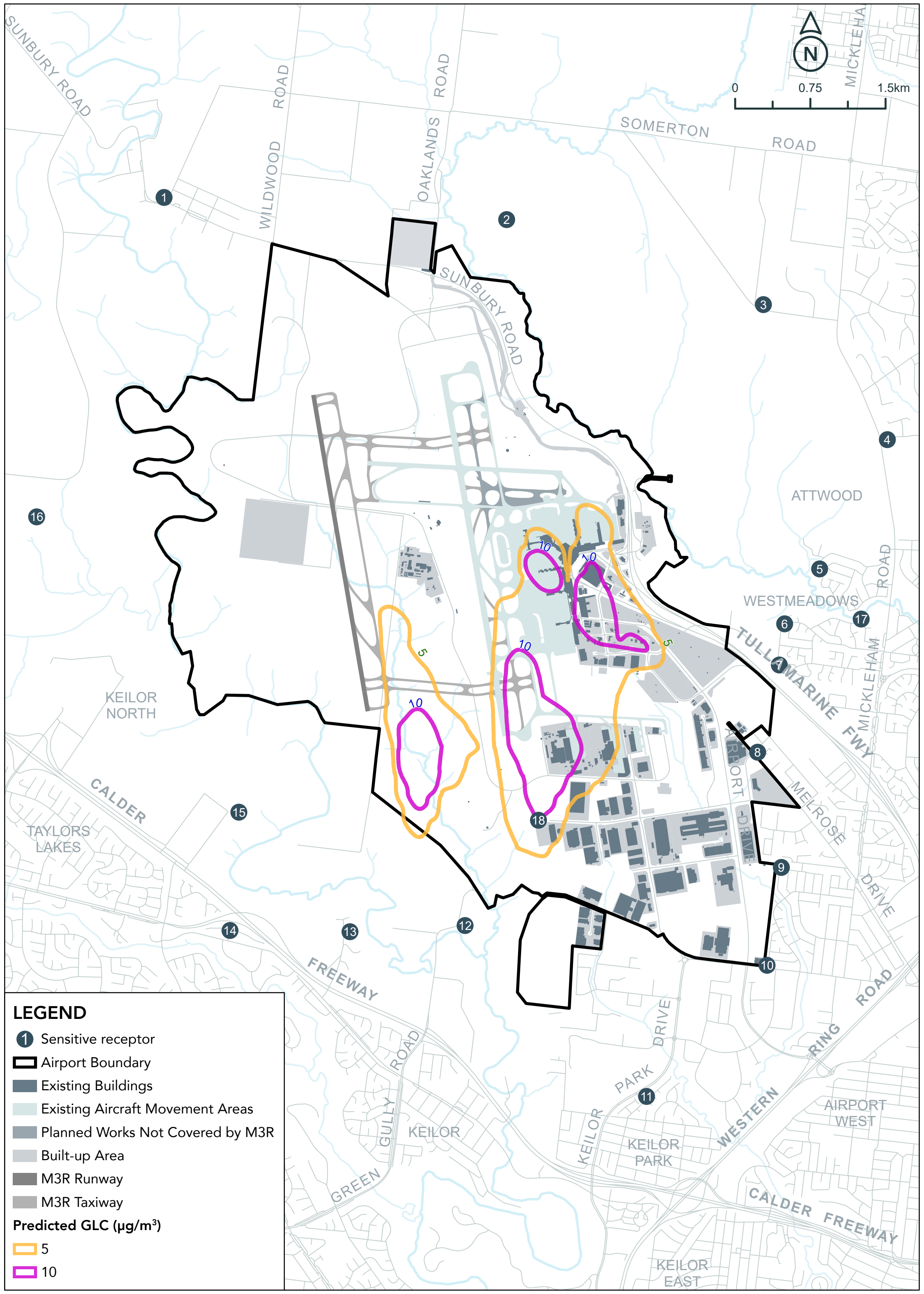
Note: SEPP (AAQ) criterion for PM_{10} yearly average (20 μg/m³) is not shown, as modelled results are below this concentration.

Figure B10.23
M3R Build 2026: AERMOD results for 99.9 percentile hourly NO_2 GLC (μg/m³) – no background



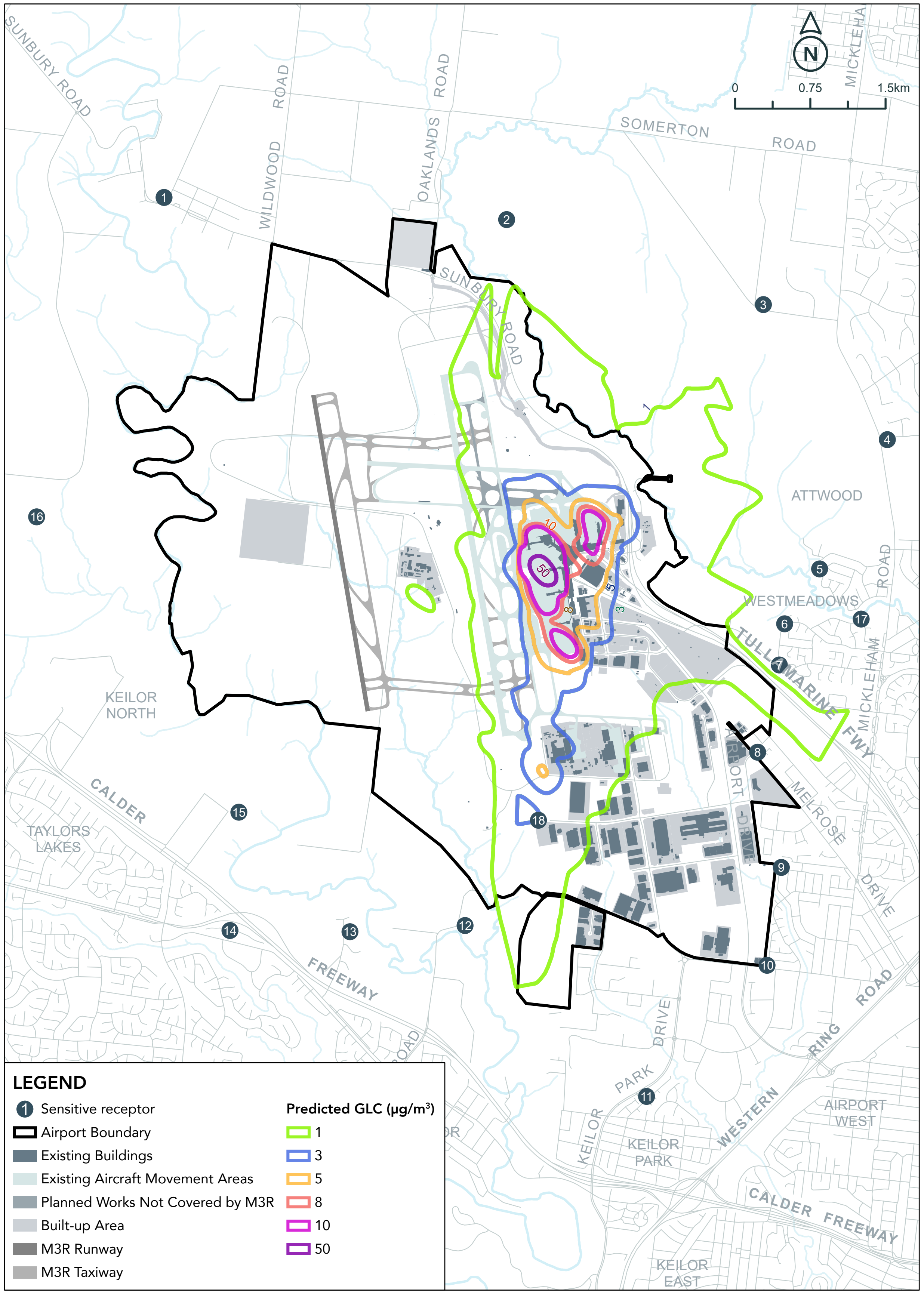
The SEPP (AAQ) criterion for NO_2 (226 μg/m³) is represented by the red contour, and the SEPP (AQM) criterion (190 μg/m³) is represented by the orange contour.

Figure B10.24
M3R Build 2026: AERMOD results for annual NO_2 GLC (µg/m³) – no background



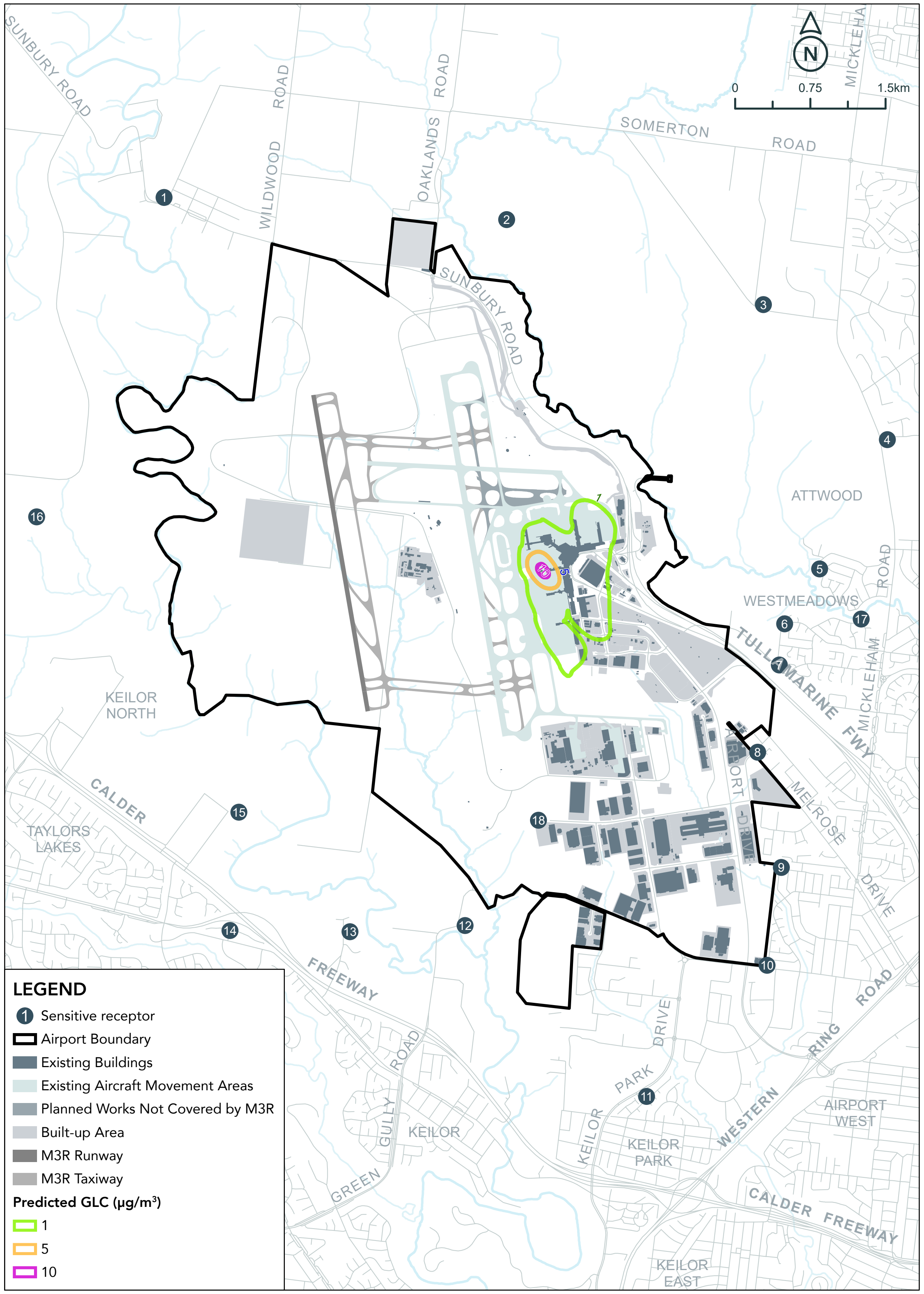
Note: SEPP (AQM) design criterion for NO_2 (56 µg/m³) and the NEPC 2019 target (36 µg/m³) is not shown, as modelled results are below these concentrations.

Figure B10.25
M3R Build 2026: AERMOD results for maximum 24-hour PM_{10} GLC (µg/m³)



Note: SEPP (AAQ) standard for PM_{10} (50 µg/m³) is represented by the red contour.

Figure B10.26
M3R Build 2026: AERMOD results for annual average PM_{10} GLC (µg/m³)



Note: SEPP (AAQ) standard for annual average PM_{10} (20 µg/m³) is not shown, as modelled results are below this concentration.

B10.7.4
Predicted impacts for No Build 2046

This section presents the NO_2 and PM_{10} atmospheric dispersion modelling results for airport operations in 2046 if M3R is not built . All concentrations exclude background levels. Concentrations at sensitive receptors are provided in **Section B10.7.6**.

As evident from the results below, predicted concentrations are slightly higher than in 2026 (for the No Build scenario), due to an increase in aircraft operations to 30 per cent higher than 2019 (compared with 18 per cent in 2026). This is deemed the maximum number of aircraft movements at Melbourne Airport under a No Build scenario.

B10.7.4.1
No Build 2046: NO_2

The AERMOD results for NO_2 are shown in **Figure B10.27** for the one-hour average, with reference to the SEPP (AAQ) criterion for NO_2 (226 µg/m³), SEPP (AQM) criterion (190 µg/m³) and NEPC proposed target from 2025 (150 µg/m³).

As evident from **Figure B10.27**, no exceedances of the SEPP (AQM) criteria are observed outside of the airport boundary. GLCs above the design criteria cover an area slightly larger than the 2026 no build scenario, with a further increase in aircraft movements.

Figure B10.28 shows AERMOD results for the NO_2 annual average. As with the 2019 modelling, there are no exceedances of the GLC, and impacts are similar to those predicted in 2019.

B10.7.4.2
No Build 2046: PM_{10}

The AERMOD results for PM_{10} are shown in **Figure B10.29** for the 24-hour average, with reference to the SEPP (AQM) design criterion for PM_{10} (50 µg/m³).

As evident from **Figure B10.29**, no exceedances of the SEPP (AQM) criteria are observed outside of the airport boundary. GLCs above the design criteria cover an area slightly larger than the 2026 no build scenario, with a further increase in aircraft movements.

Figure B10.30 shows AERMOD results for the PM_{10} annual average. As with the 2019 modelling, there are no exceedances of the GLC, and impacts are similar to those predicted in 2019.

B10.7.5
Predicted impacts for Build 2046

This section presents the results of atmospheric dispersion modelling for the airport operations in 2046 if M3R is built for NO_2 and PM_{10}. All concentrations exclude background levels to show maximum impacts from airport operations. Concentrations at sensitive receptors are provided in **Section B10.7.6**.

As evident from the results below, predicted concentrations are higher than the No Build 2046 scenario because operations include 91 per cent more aircraft movements than in 2019 compared with 30 per cent more under a No Build scenario. Therefore, two impact zones are evident at the southern ends of both runways. While an increase in aircraft movements shifts concentrations above the criteria for NO_2 outside the airport boundary, GLCs at all sensitive receptors still comply with the criterion.

B10.7.5.1
Build 2046: NO_2

The AERMOD results for NO_2 are shown in **Figure B10.31** for the 1-hour average in 2046, with reference to the SEPP (AAQ) criterion for NO_2 (226 µg/m³) and SEPP (AQM) criterion (190 µg/m³).

As evident from **Figure B10.31** no exceedances of the SEPP (AQM) criteria are observed at sensitive receptors. GLCs are shown to be highest to the south of the airport, with concentrations above the criteria extending up to 700 metres outside the airport boundary to the southwest, into vacant green wedge land. This coincides with the location where the new runway is closest to the existing site boundary and therefore has limited separation distance.

Figure B10.32 shows AERMOD results for the NO_2 annual average. As with the 2019 modelling there are no exceedances of the GLC, and impacts are similar to those predicted in 2019.

B10.7.5.2
Build 2046: PM_{10}

The AERMOD results for PM_{10} are shown in **Figure B10.33** for the 24-hour average, with reference to the SEPP (AQM) design criterion for PM_{10} (50 µg/m³).

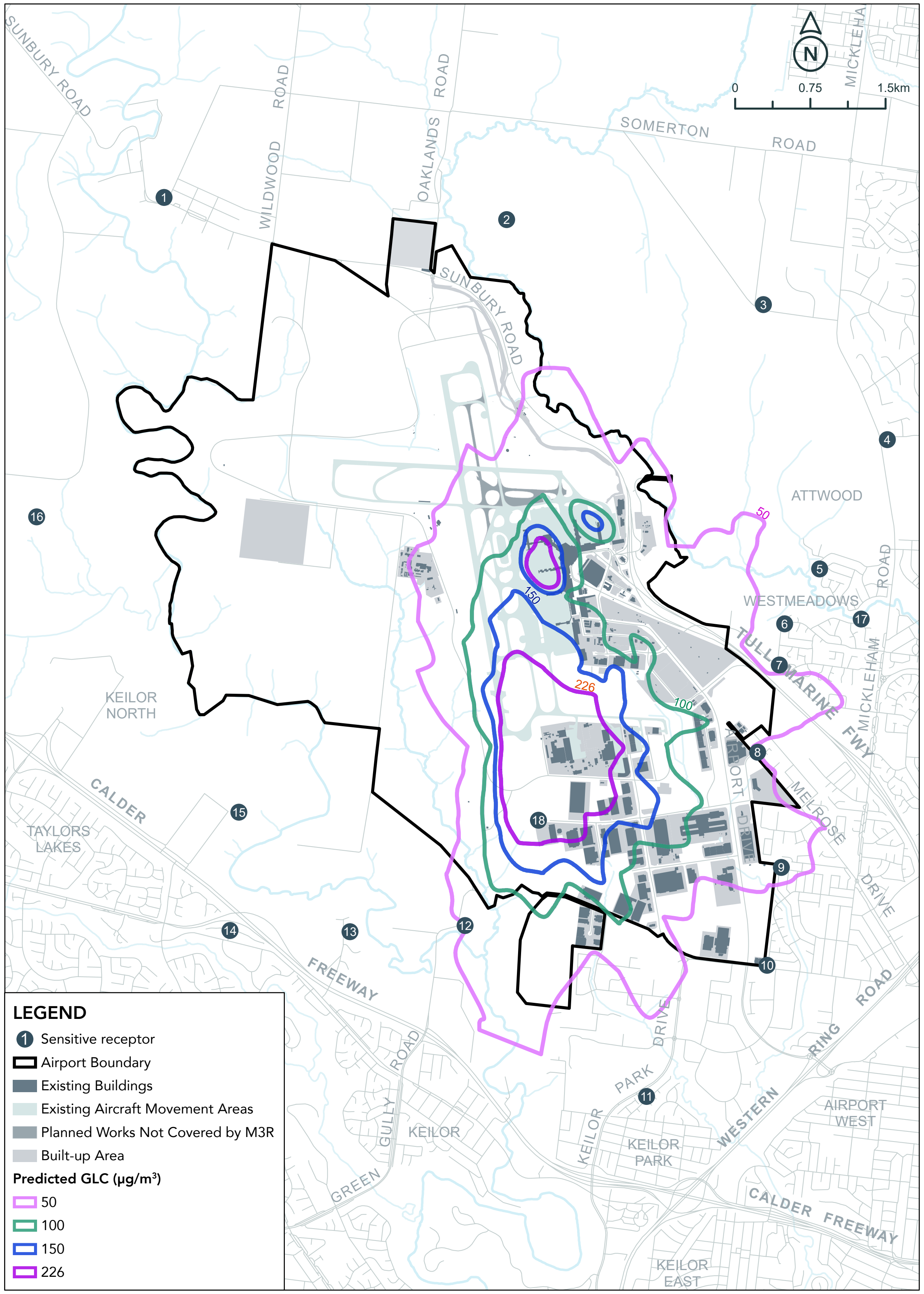
As evident from **Figure B10.33**, no exceedances of the SEPP (AQM) criterion are observed outside of the airport boundary. GLCs above the criteria are observed around the gates, where no sensitive receptors are located.

Figure B10.34 shows AERMOD results for the PM_{10} annual average. As with the 2019 modelling there are no exceedances of the GLC and impacts are similar to those predicted in 2019.

B10.7.6
Summary of modelling results

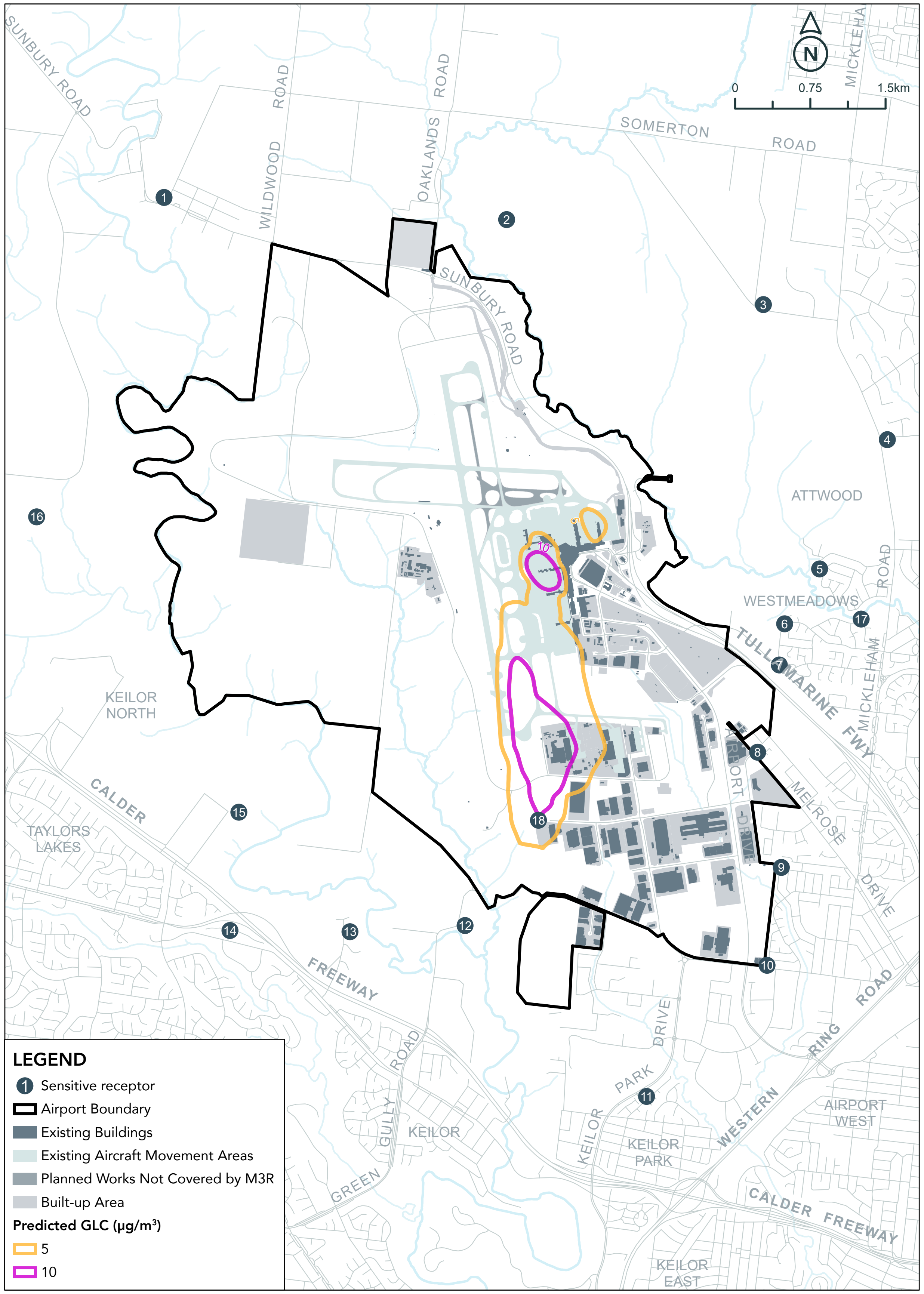
The following subsections summarise AERMOD predicted concentrations at the sensitive receptors identified in **Section B10.4.2** compared to the requirements of the SEPP (AQM).

Figure B10.27
M3R No Build 2046: AERMOD results for 99.9 percentile hourly NO_2 GLC (µg/m³) (no background)



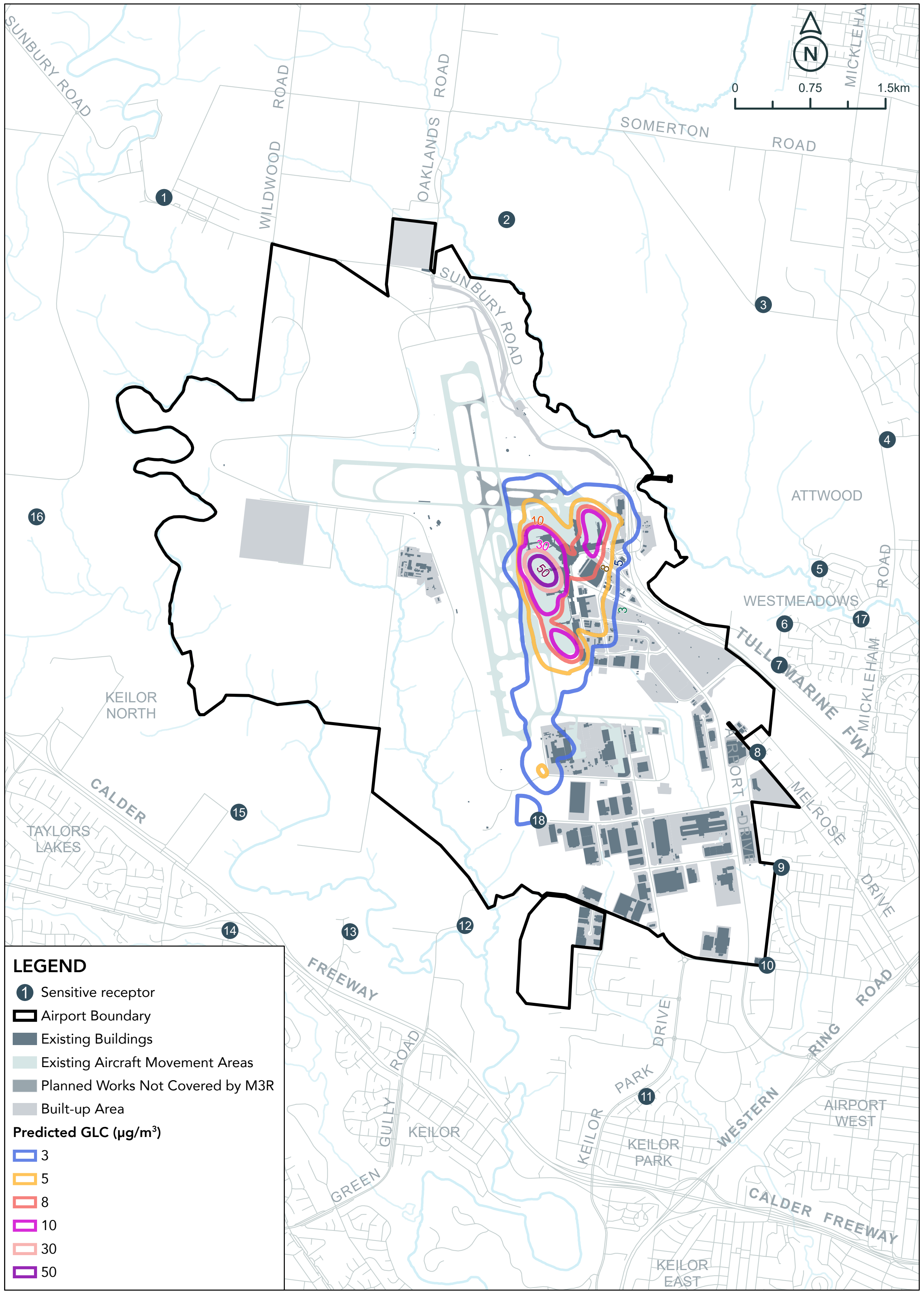
Note: The SEPP (AAQ) criterion for NO_2 (226 µg/m³) is represented by the red contour.

Figure B10.28
M3R No Build 2046: AERMOD results for annual NO_2 GLC (µg/m³) (no background)



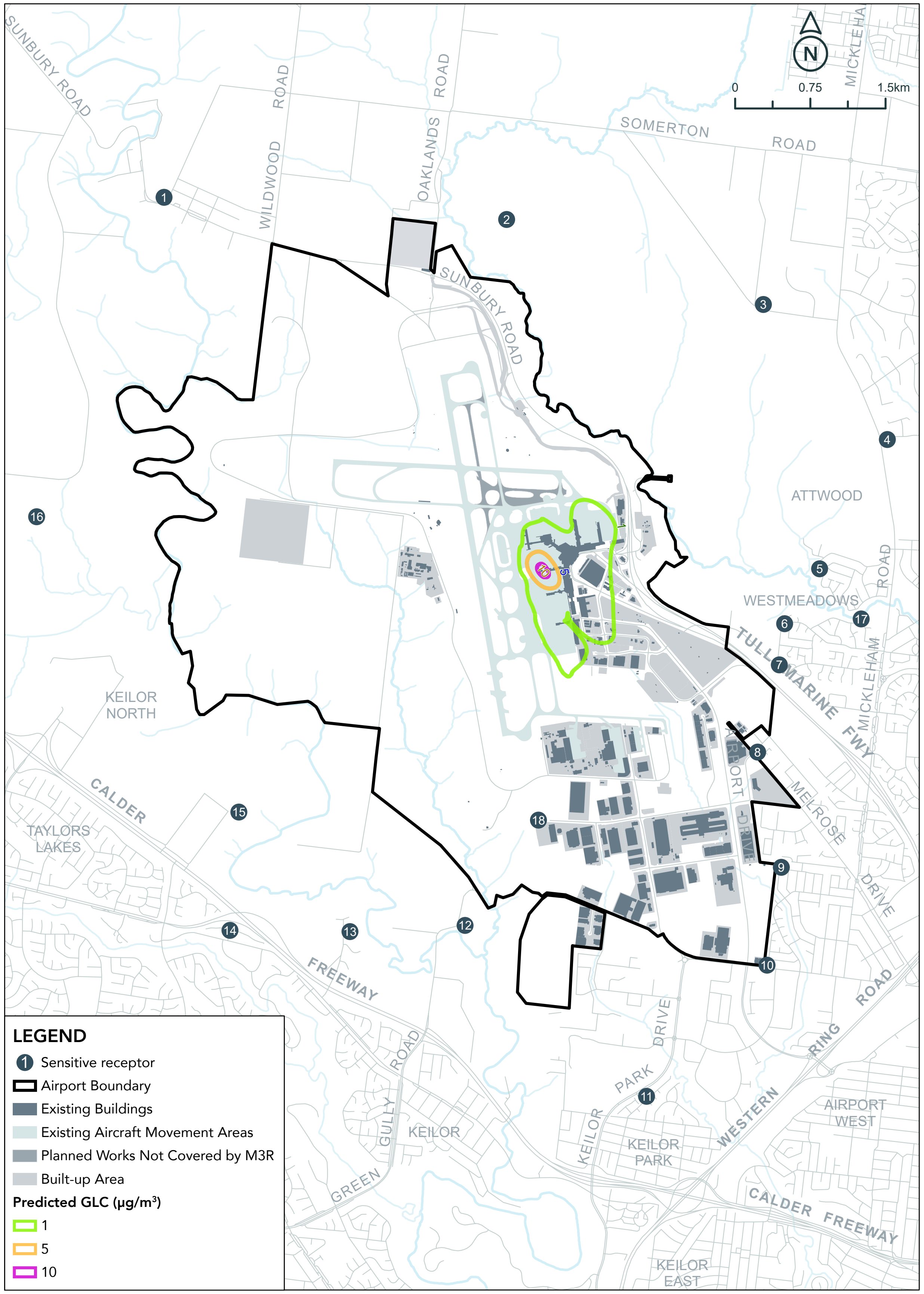
Note: SEPP (AQM) design criterion for NO_2 (56 µg/m³) and the NEPC 2019 target (36 µg/m³) is not shown, as modelled results are below these concentrations.

Figure B10.29
M3R No Build 2046: AERMOD results for 24-hour average PM_{10} GLC (μg/m³)



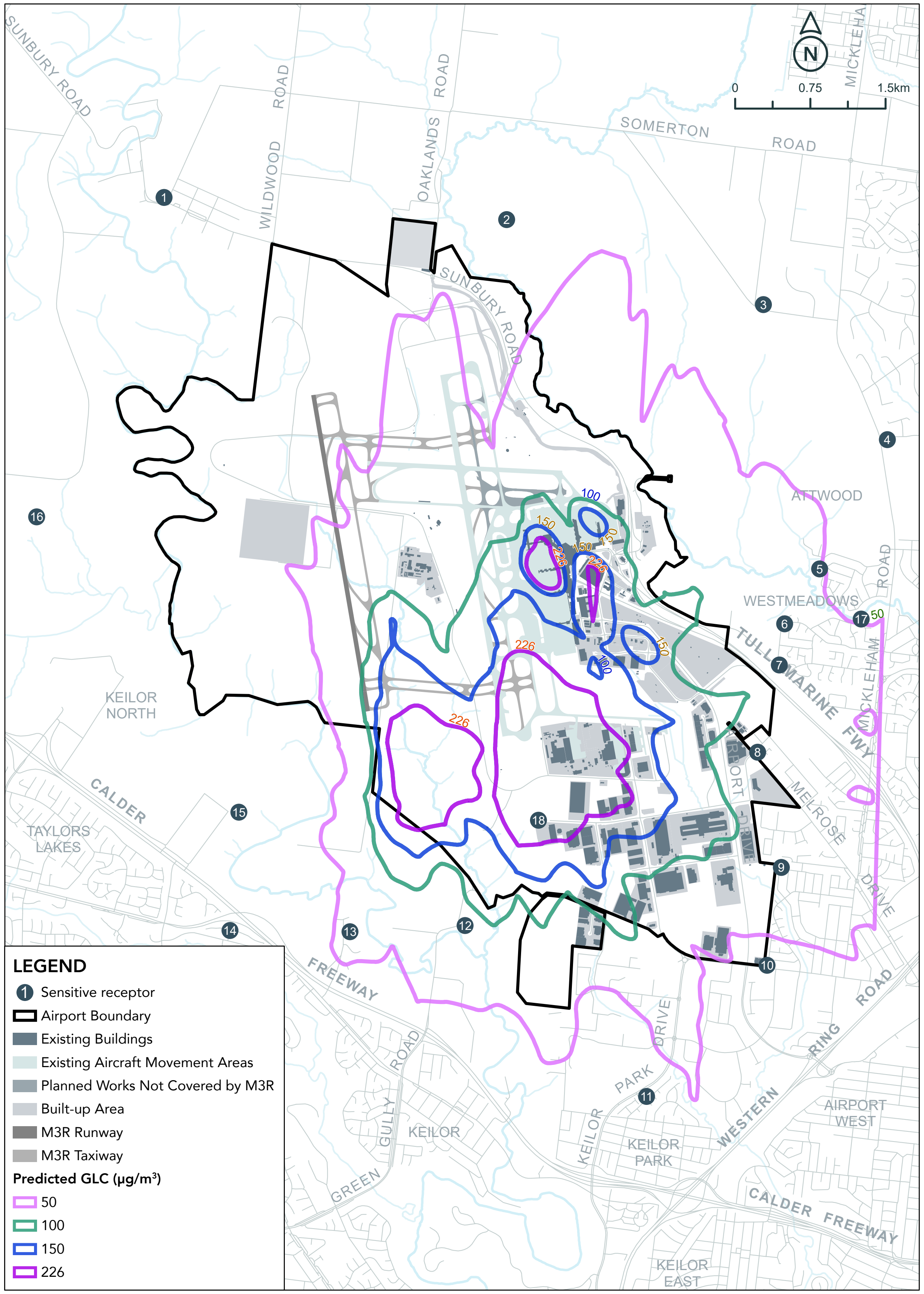
Note: SEPP (AAQ) standard for PM_{10} (50 μg/m³) is represented by the purple contour.

Figure B10.30
M3R No Build 2046: AERMOD results for annual PM_{10} GLC (μg/m³)



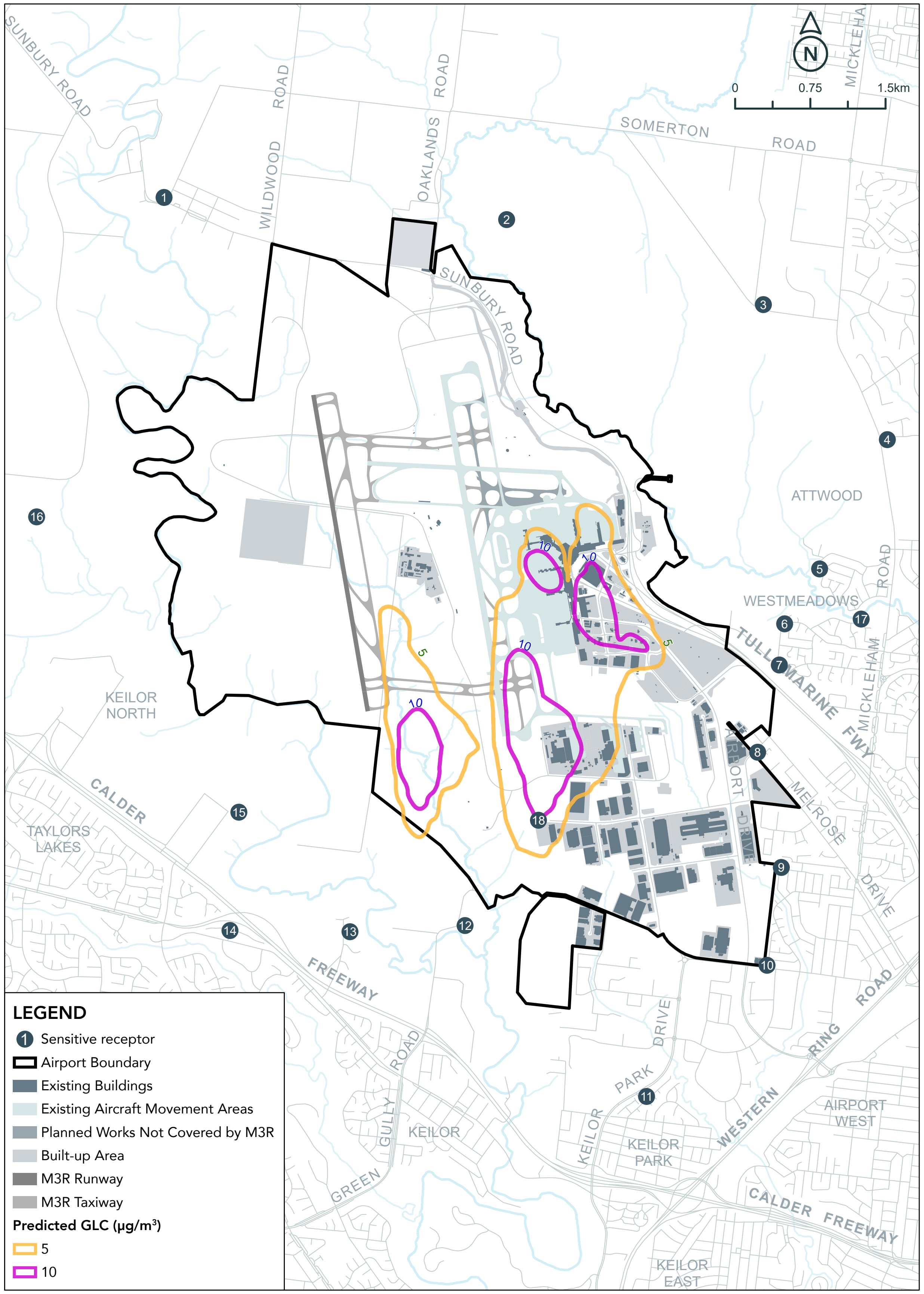
Note: SEPP (AAQ) standard for PM_{10} (20 μg/m³) is not shown, as modelled results are below this concentration.

Figure B10.31
M3R Build 2046: AERMOD results for 99.9 percentile hourly NO_2 GLC (ug/m³) (no background)



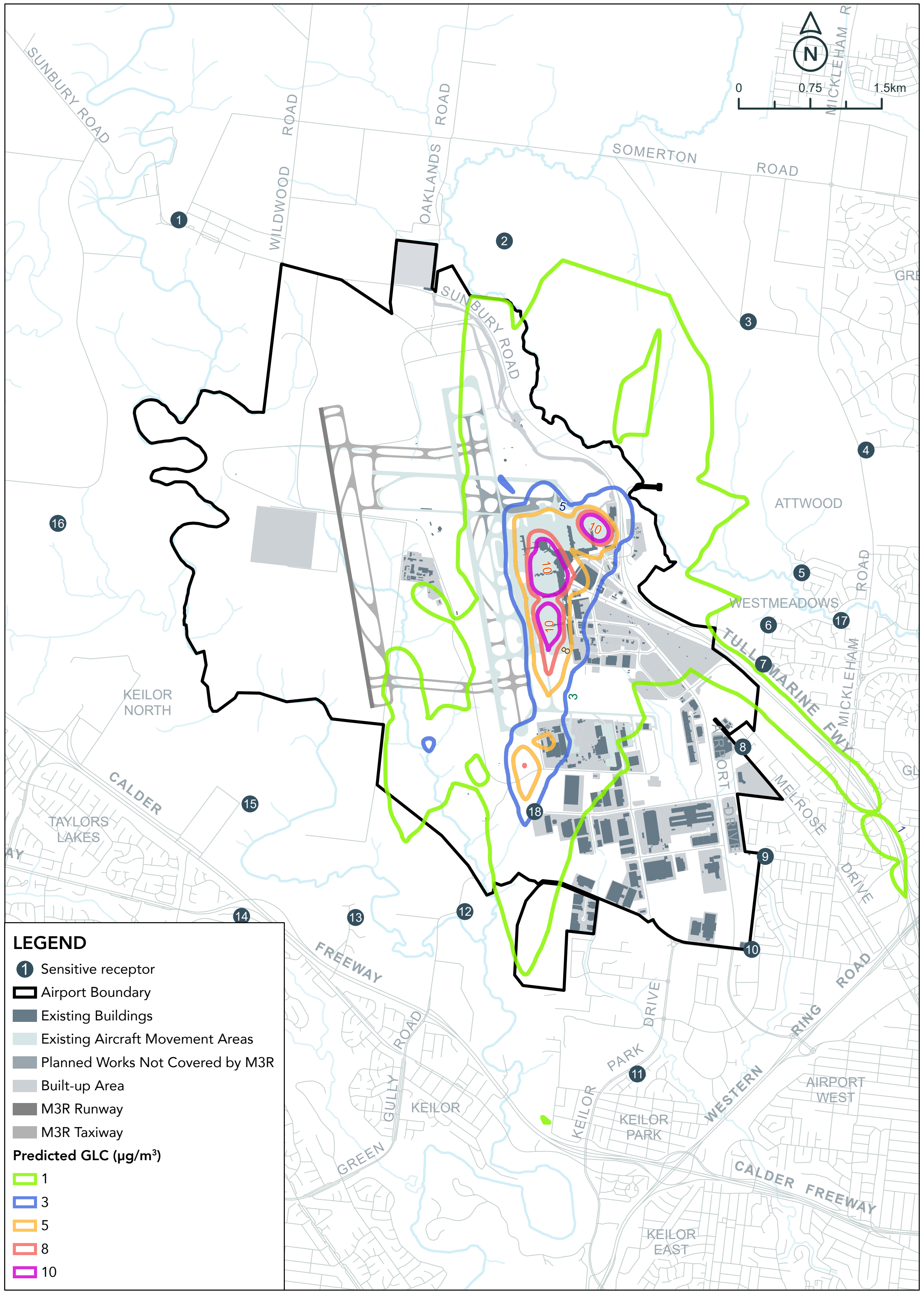
Note: The SEPP (AAQ) criterion for NO_2 (226 µg/m³) is represented by the red contour.

Figure B10.32
M3R Build 2046: AERMOD results for annual NO_2 GLC (ug/m³) (no background)



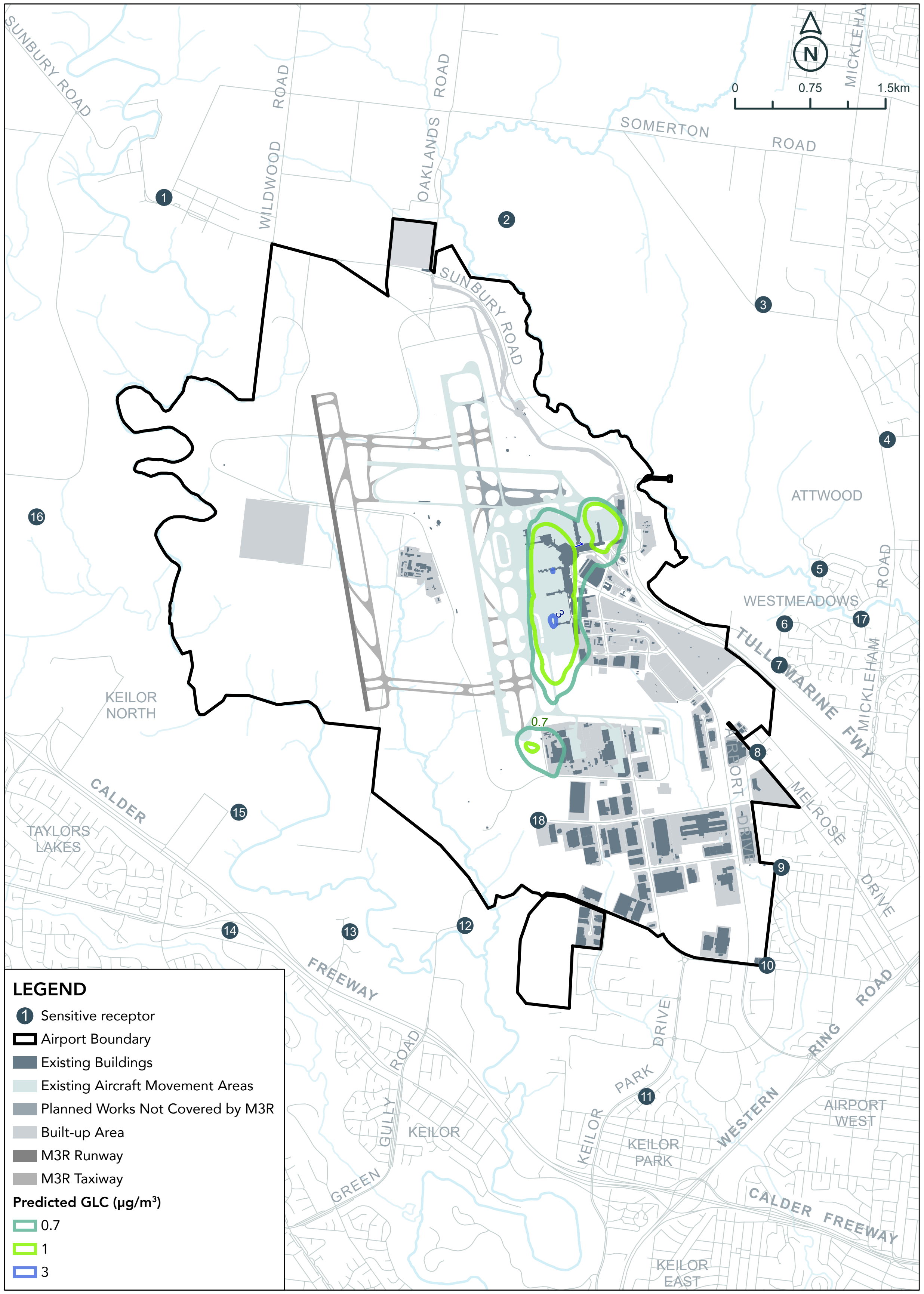
Note: SEPP (AQM) design criterion for NO_2 56 µg/m³ and the NEPM goal 36 µg/m³ are not shown, as modelled results are below these concentrations.

Figure B10.33
M3R Build 2046: AERMOD results for maximum 24-hour PM_{10} GLC (μg/m³)



Note: SEPP (AAQ) criterion for PM_{10} (50 μg/m³) is represented by the red contour.

Figure B10.34
M3R Build 2046: AERMOD results for annual average PM_{10} GLC (μg/m³)



Note: SEPP (AAQ) criterion for PM_{10} yearly average (20 μg/m³) is not shown, as modelled results are below these concentrations.

B10.7.6.1
NO_2

The modelling results for NO_2 GLCs showed that predicted GLCs at all sensitive receptors were below SEPP (AQM) design criterion (190 µg/m^3) for all scenarios in future years. Results are shown in **Table B10.19**.

Concentrations at sensitive receptors for the Build scenario in 2026 decrease by an average of 1 per cent compared to the No Build scenario. This is a result of the same number of air traffic movements; however, these movements are spread out further in the Build scenario with M3R.

The Build scenario increases average NO_2 concentrations by an average of 12 per cent compared with the No Build scenario in 2046. This is predominantly due to the large increase in aircraft movements.

Annual average concentrations of NO_2 were also assessed against the SEPP (AQM) design criterion of 30 ppb (56 µg/m^3 at 25 degrees). Results are shown in **Table B10.20**. As evident from the table, no exceedances were recorded at any receptor.

Table B10.19
M3R summary of results at sensitive receptors for 1-hr NO_2 (µg/m^3) (with background)

Discrete receptor	2019	2026			2046		
		No build	Build	% increase	No build	Build	% increase
NEPM / SEPP (AQM) criteria	226	226	226	-	226	226	-
1. Bulla	67.9	68.9	67.9	-2%	67.9	71.6	6%
2. Living Legends	71.3	71.8	70.5	-2%	70.1	71.8	2%
3. Providence Rd	69.0	69.0	69.0	0%	69.0	71.6	4%
4. Montrose Ct	69.0	69.0	69.0	0%	69.0	71.6	4%
5. Threadneedle St	69.0	71.6	70.8	-1%	69.0	78.1	13%
6. Westmeadows North	76.4	78.3	76.4	-2%	76.4	84.4	10%
7. Westmeadows South	76.2	81.1	81.8	1%	76.2	104.8	37%
8. Melrose Drive	80.5	87.8	84.4	-4%	79.4	97.7	23%
9. Janus St	76.7	77.1	77.2	0%	76.7	86.2	12%
10. Fisher Grove	73.8	72.0	72.5	1%	71.9	80.2	12%
11. Fosters Rd	72.2	72.1	72.1	0%	72.0	74.0	3%
12. Arundel Rd	100.8	115.0	102.0	-11%	100.7	114.3	13%
13. Overnewton Rd	67.9	70.3	69.1	-2%	67.9	95.5	41%
14. Keilor Village	67.9	67.9	67.9	0%	67.9	68.9	2%
15. Highland Rd	67.9	68.9	70.4	2%	67.9	72.3	7%
16. Loemans Rd	66.3	66.3	66.3	0%	66.3	67.9	2%
Model validation							
17. MAE (modelled)	71.6	71.6	71.6	0%	71.6	76.4	7%
18. MAS (modelled)	395.1	460.7	395.1	-14%	395.2	395.3	0%
MAE – measured	65.1	-	-	-	-	-	-
MAS - measured	71.7	-	-	-	-	-	-

B10.7.6.2
PM_{10}

The modelling results for PM_{10} GLCs showed that predicted GLCs at all sensitive receptors were below the SEPP (AAQ) criterion (50 µg/m^3) when background levels were not included. The Build scenario increases average PM_{10} concentrations by an average of 10 per cent compared with the No Build scenario in 2046. Results are shown in **Table B10.21**.

To assess cumulative impacts (airport sources plus background levels) at and around the airport, the 2019 variable background concentration on PM_{10} was added to the peak modelled 24-hour impacts.

Results with background levels included are shown in **Table B10.22**. Background concentrations increase significantly for receptors R11 and R14 in the Build 2046 scenario due to a higher background concentration when peak impacts from airport operations occurred. Likewise for receptor R10, the time of peak concentration occurred during a lower background concentration resulting in a significant overall decrease in GLC. Overall, airport operations (with or without M3R) were found to increase GLCs above background concentrations by 2 to 4 per cent, and by a maximum of 10 per cent.

Where background concentrations were not available, the 70^{th} percentile average for 2019 (24.3 µg/m^3) was applied as background. As evident from the table, the additional of background concentrations of PM_{10} do not result in an exceedance of the criteria (50 µg/m^3) for the maximum 24-hour averages at the airport. The expansion of activities at the airport is therefore shown to have a relatively small impact (generally less than 5 per cent) on PM_{10} concentrations.

Table B10.20
M3R summary of results at sensitive receptors for annual NO_2 (µg/m^3) (with background)

Discrete receptor	2019	2026			2046		
Applicable criteria		No build	Build	% increase	No build	Build	% increase
NEPM / SEPP (AQM) 99.9 percentile	56	56	56	56	56	56	56
1. Bulla	12.8	12.8	12.8	0%	12.8	12.9	1%
2. Living Legends	13.1	13.2	13.2	0%	13.2	13.4	2%
3. Providence Rd	13.0	13.0	13.0	0%	13.0	13.2	2%
4. Montrose Ct	13.1	13.1	13.1	0%	13.1	13.3	2%
5. Threadneedle St	13.4	13.5	13.5	0%	13.4	13.8	3%
6. Westmeadows North	13.7	13.8	13.8	0%	13.8	14.2	3%
7. Westmeadows South	14.1	14.2	14.2	0%	14.2	14.7	4%
8. Melrose Dve	14.0	14.2	14.2	0%	14.2	14.5	2%
9. Janus St	13.3	13.4	13.4	0%	13.3	13.6	2%
10. Fisher Gve	13.2	13.3	13.3	0%	13.5	13.4	-1%
11. Fosters Rd	13.4	13.4	13.4	0%	13.3	13.5	2%
12. Arundel Rd	13.4	13.6	13.6	1%	13.4	14.1	5%
13. Overnewton Rd	12.8	12.9	13.0	0%	12.8	13.5	5%
14. Keilor Village	12.8	12.8	12.8	0%	12.8	12.9	1%
15. Highland Rd	12.8	12.8	12.8	0%	12.8	12.9	1%
16. Loemans Rd	12.7	12.7	12.7		12.7	12.8	1%
Model validation							
17. MAE (modelled)	13.4	13.4	13.4	-6%	13.4	13.7	2%
18. MAS (modelled)	22.2	23.9	22.4	0%	22.2	23.0	4%
MAE – measured	6.9	-	-	-	-	-	-
MAS - measured	7.0	-	-	-	-	-	-

Table B10.21
M3R summary of results at sensitive receptors for PM10 24-hour average (µg/m³) (2019 – no background)

Discrete receptor	2019	2026			2046		
Applicable criteria		No build	Build	% increase	No build	Build	% increase
NEPM / SEPP (AQM) criteria	50	50	50		50	50	
1. Bulla	0.12	0.11	0.11	0%	0.12	0.12	0%
2. Living Legends	0.61	0.60	0.60	0%	0.62	0.63	2%
3. Providence Rd	0.47	0.47	0.47	0%	0.47	0.53	13%
4. Montrose Ct	0.54	0.53	0.53	0%	0.54	0.55	2%
5. Threadneedle St	0.59	0.55	0.55	0%	0.58	0.58	0%
6. Westmeadows North	0.75	0.69	0.69	0%	0.74	0.66	-11%
7. Westmeadows South	0.75	0.77	0.77	0%	0.81	0.79	-2%
8. Melrose Drive	0.62	0.63	0.63	0%	0.67	0.61	-9%
9. Janus St	0.37	0.35	0.35	0%	0.36	0.36	0%
10. Fisher Grove	0.40	0.41	0.41	0%	0.41	0.40	-2%
11. Fosters Rd	0.35	0.35	0.35	0%	0.35	0.35	0%
12. Arundel Rd	0.53	0.53	0.53	0%	0.53	0.54	2%
13. Overnewton Rd	0.20	0.19	0.19	0%	0.20	0.32	60%
14. Keilor Village	0.11	0.10	0.10	0%	0.11	0.15	36%
15. Highland Rd	0.11	0.10	0.10	0%	0.11	0.19	73%
16. Loemans Rd	0.11	0.11	0.11	0%	0.11	0.11	0%

B10.7.6.3
$PM_{2.5}$

Predicted impacts of $PM_{2.5}$ emissions at the airport will closely follow predicted impacts for PM_{10} since 100 per cent of PM_{10} is $PM_{2.5}$ from airport sources.

While $PM_{2.5}$ has a stricter criterion (25 µg/m³ compared to 50 µg/m³ for PM_{10}), model results demonstrate this criterion is met for all scenarios in all modelled years outside the airport boundary. The maximum impacts from $PM_{2.5}$ are observed in the 2046 Build scenario, when GLCs are observed to be around three to five µg/m³ at the airport boundary near the terminals.

In addition, $PM_{2.5}$ background concentrations are much lower than PM_{10} concentrations, with no exceedances of SEPP (AAQ) criteria observed in the background concentrations (refer to **Section B10.5.2**). For this reason, the addition of emissions of $PM_{2.5}$ from the airport is predicted to be a minor impact.

B10.7.6.4
Benzene

Results from the worst-case model run (2046 Build scenario) for benzene GLCs are shown in **Figure B10.35**.

The model results for benzene showed that predicted GLCs were well below the SEPP (AQM) criteria of 53 µg/m³ (3-minute average) at all locations except for a small area around gate 2. At the airport boundary, concentrations were around 10 µg/m³ and lower concentrations were observed at sensitive receptors.

Hourly background concentrations of benzene were not available to use in the assessment, however previous campaign monitoring on benzene at Melbourne Airport estimated annual average concentrations of 0.2 to 1.2 µg/m³. Therefore, the addition of background levels of benzene to modelled concentrations would result in maximum concentrations around 20 per cent of the SEPP (AQM) criterion at the airport boundary. Actual maximum concentrations are likely to be much lower as background levels are likely to include airport sources (resulting in double-counting of emissions), in addition to the conservative model parameters used including all air traffic movements to the south end of runway 16/34.

In addition, the NEPM (Air Toxics) monitoring investigation level for benzene (MIL) (9.6 µg/m³ annual average) was also evaluated (not shown in figures). Modelled results show annual concentrations of 0.3 µg/m³ around the airport gates and terminals area, due mostly to operation of the GSE and APUs. Therefore the annual average for benzene was well below the MIL.

Table B10.22
M3R summary of results at sensitive receptors for PM_{10} (µg/m³) (Build – with background)

Discrete receptor	2019	2026			2046		
		No build	Build	% increase	No build	Build	% increase
SEPP (AAQ) criteria	50	50	50		50	50	
1. Bulla	11.16	11.2	11.2	0%	11.2	11.2	0%
2. Living Legends	8.70	8.7	8.7	0%	8.7	8.7	0%
3. Providence Rd	12.94	12.9	12.9	0%	13.0	13.0	0%
4. Montrose Ct	13.01	13.0	13.0	0%	13.0	13.0	0%
5. Threadneedle St	30.41	30.4	30.4	0%	30.4	30.4	0%
6. Westmeadows North	n/a	25.0	25.0	0%	25.0	30.5	22%
7. Westmeadows South	30.57	30.6	30.6	0%	30.6	30.6	0%
8. Melrose Drive	7.22	7.2	7.2	0%	7.3	8.7	20%
9. Janus St	8.46	8.4	8.4	0%	8.50	8.5	0%
10. Fisher Grove	27.44	27.4	27.4	0%	27.44	9.8	-64%
11. Fosters Rd	6.95	6.9	6.9	0%	6.9	27.0	289%
12. Arundel Rd	n/a	24.8	24.8	0%	24.8	24.8	0%
13. Overnewton Rd	n/a	24.5	24.5	0%	24.5	24.6	0%
14. Keilor Village	6.70	18.3	18.3	0%	6.7	18.3	173%
15. Highland Rd	23.07	24.4	24.4	0%	24.4	24.5	0%
16. Loemans Rd	47.00	47.0	47.0	0%	47.0	47.0	0%

B10.7.6.5
Formaldehyde

The model results from the worst-case model run for formaldehyde showed that predicted GLCs at all sensitive receptors were below the SEPP (AQM) criteria of 40 µg/m³ (**Figure B10.36**).

Concentrations above the criterion are observed at and just beyond the eastern boundary of the airport, where aircraft parking is close to the airport boundary. No sensitive receptors are located in this area.

Hourly background concentrations of formaldehyde were not available to use in the assessment. However, previous campaign monitoring on formaldehyde at Melbourne Airport estimated average 24-hour concentrations of eight to ten µg/m³ as discussed in **Section B10.5.2.7**. Therefore, the addition of background levels of formaldehyde to modelled concentrations may increase GLCs by less than 20 per cent, thereby increasing the distance beyond the boundary where GLCs are above the 3-minute criterion.

In addition, the NEPM (Air Toxics) MIL for formaldehyde (49 µg/m³ 24-hour average) was also evaluated (not shown in figures). Modelled results show maximum 24-hour average concentrations of 10 µg/m³ around the airport gates and terminals area, due mostly to operation of the GSE and APUs. Hence the maximum 24-hour average for formaldehyde was well below the MIL, at around 20 per cent of the MIL.

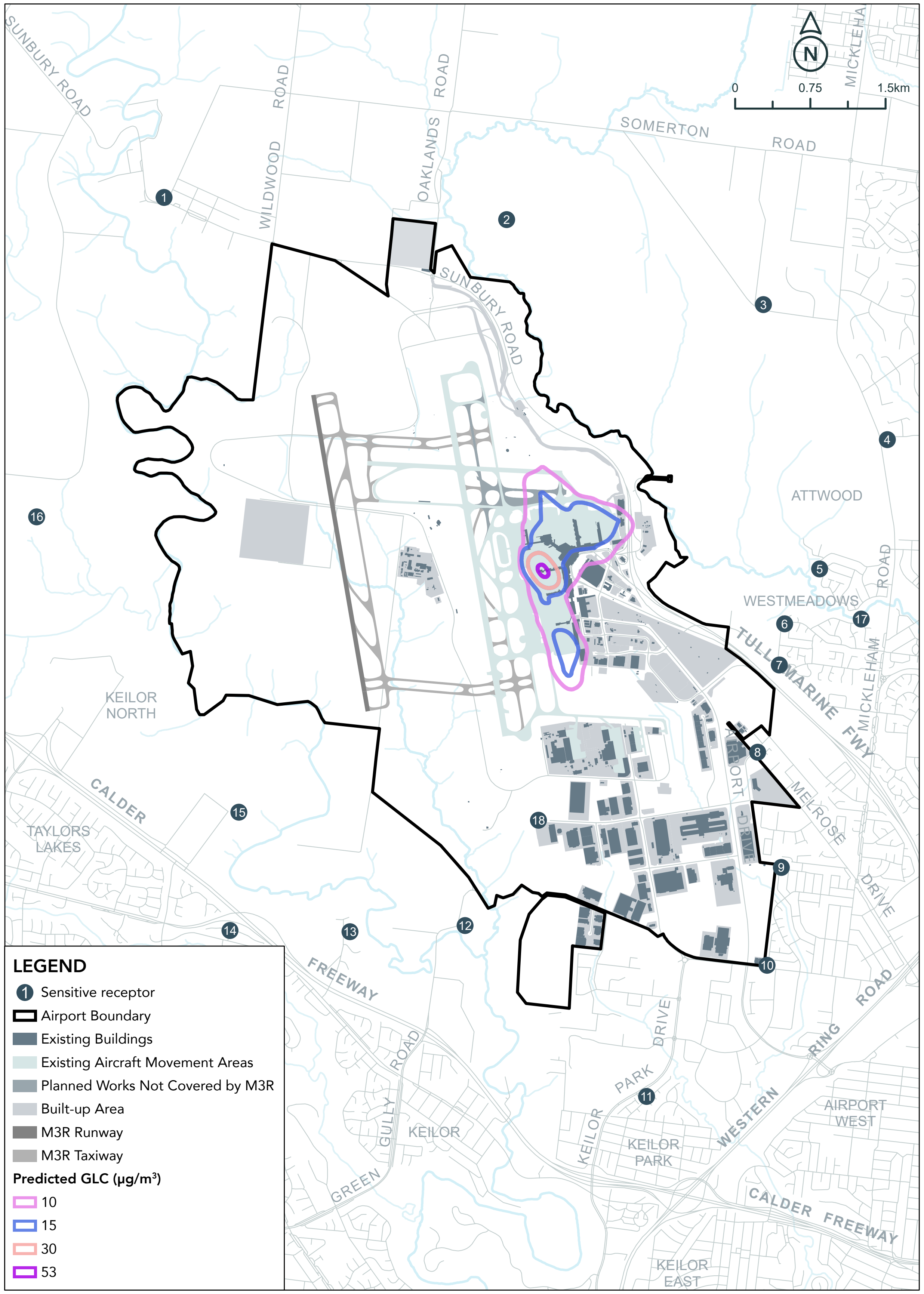
B10.7.6.6
CO

Results from the worst-case model run for CO GLCs are shown in **Figure B10.37**. The modelling results for CO showed that predicted GLCs at all sensitive receptors were well below the SEPP (AQM) 1-hour objective (29,000 µg/m³), at around 500 µg/m³. Background concentrations of carbon monoxide are not shown, to show the signal of the airport sources.

As discussed in **Section B10.5.2**, background concentrations of CO peaked at 7 per cent (720 µg/m³) of the SEPP (AAQ) objective. The addition of background CO levels thus results in a maximum CO concentration of around 10 per cent of the SEPP (AAQ) Objective.

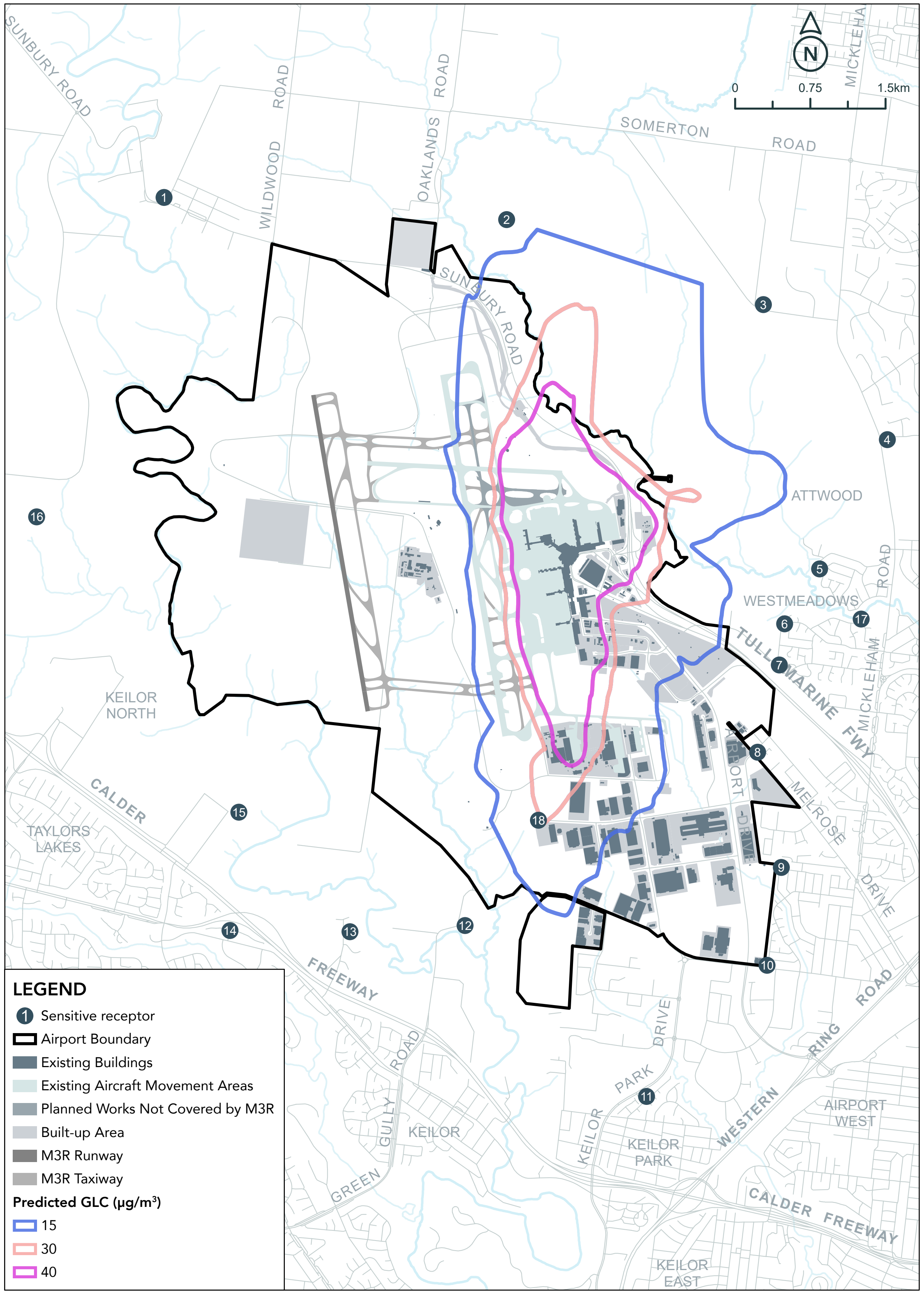
GLCs are shown to be highest around aircraft parking areas and along the taxiway to the south end of the 16/34 runway, with concentrations around 500 µg/m³. At the boundary, concentrations also reach a maximum of around 500 µg/m³.

Figure B10.35
M3R Build 2046: AERMOD results for 99.9 percentile, 3 minute average benzene (ug/m³) – no background



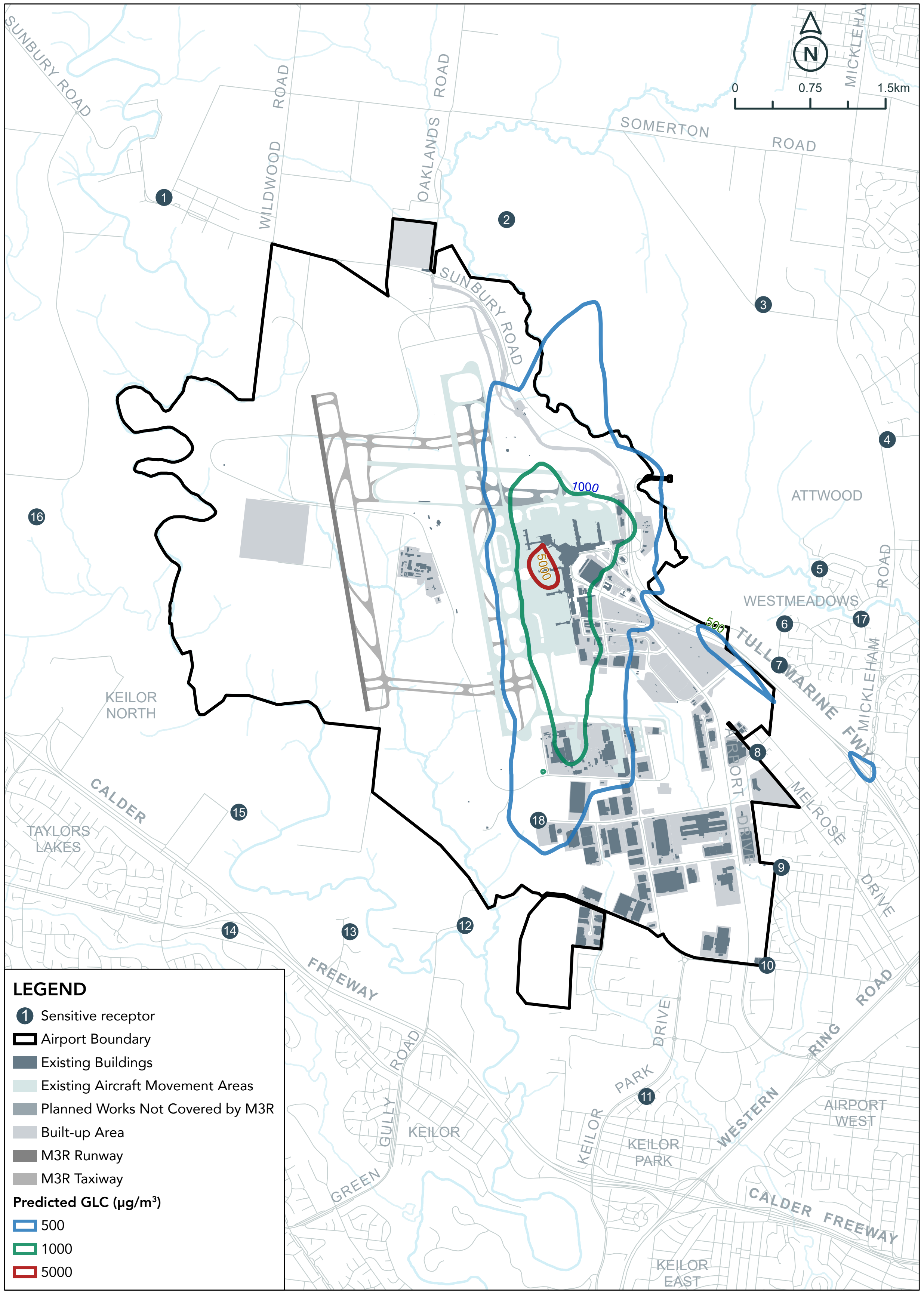
Note: The SEPP (AQM) criteria for benzene (53 µg/m³) is shown by the red contour.

Figure B10.36
M3R Build 2046: AERMOD results for 99.9 percentile, 3-minute average formaldehyde (ug/m³) – no background



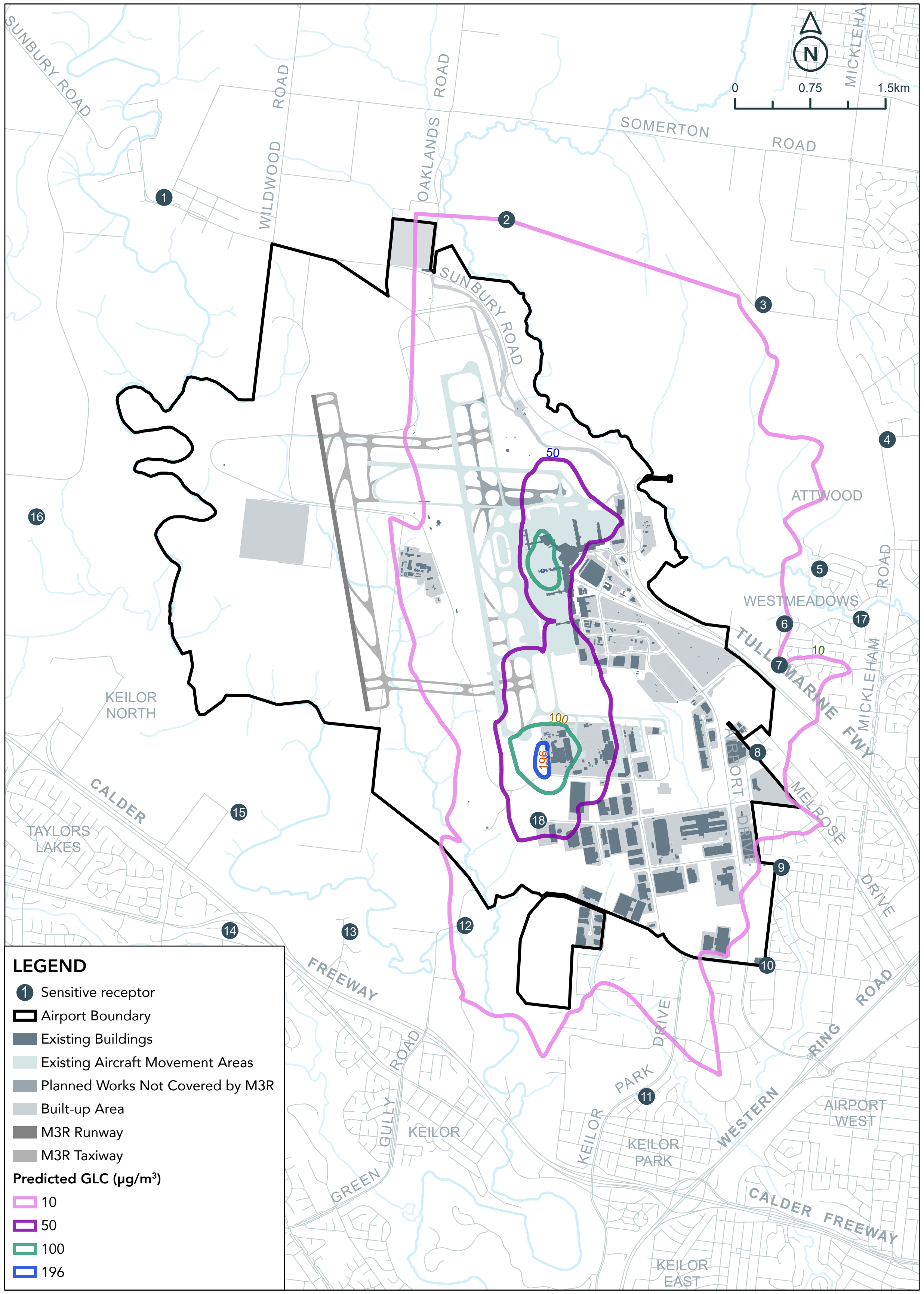
Note: The SEPP (AQM) criterion of 40 µg/m³ is shown as the orange contour.

Figure B10.37
M3R Build 2046: AERMOD results for 99.9 percentile hourly CO (ug/m³) – no background



Note: The SEPP (AQM) 1-hour objective for CO (29,000 µg/m³) is not shown, as modelled results are well below this concentration.

Figure B10.38
M3R Build 2046: AERMOD results for 99.9 percentile hourly SO_2 (ug/m³) – no background



Note: The SEPP (AAQ) objective for SO_2 (523 µg/m³) is not shown, as modelled results are well below this concentration.

B10.7.6.7 SO_2

Results from the worst-case model run for SO_2 GLCs are shown in Figure B10.38. The results for SO_2 show that predicted GLCs at all sensitive receptors were well below the SEPP (AAQ) objectives (523 µg/m³ one-hour average) at around 50 µg/m³.

As discussed in Section B10.5.2, background concentrations of SO_2 averaged less than 1 per cent (3.1 µg/m³) of the SEPP (AAQ) objective. The addition of background SO_2 levels results in a maximum SO_2 concentration of 10 per cent of the SEPP (AAQ) objective.

B10.7.7 Airspace impacts

Although the focus of this chapter is on ground level impacts, aircraft operations may also impact air quality within the airspace and are considered in this section.

B10.7.7.1 Normal aircraft operations above 3000 feet AGL

The high release height of aircraft emissions during flight – higher than 3,000 feet above ground level (AGL) (ICAO, 2011) – will increase the dispersion of air pollutants including oxides of nitrogen, particulate matter and hydrocarbons. This height reduces the ground level concentrations of those pollutants due to:

- The substantial physical separation from sensitive receptors on the ground by at least approximately 915 metres
- Wind speeds being higher than at ground level with greater mixing and dispersive properties
- Emissions of air pollutants are well dispersed by fast moving jet aircraft compared to aircraft emissions at and near ground level (and other ground operations at the airport)
- The hot jet exhaust emissions are buoyant, which increases their dispersion. At higher altitudes, the colder air temperature further increases a plume's buoyancy.

However, sometimes there could be a mixing of air emissions from above 3,000 feet towards ground level.

The daytime atmospheric 'boundary layer' or 'mixing layer' is characterised by turbulence and mixing of air. The height of this layer can be estimated by measurements of boundary-layer cloud heights (Pickett et al 1996).

Inspection of the BoM ceilometer measurements of the lowest cloud base over Melbourne Airport for 2015 indicates the mixing layer varies between approximately 500 metres (approximately 1,640 feet) and more than 2,000 metres (more than 6,560 feet) in height AGL. Therefore, when aircraft are flying low enough to be in the mixing layer but still above 3,000 feet AGL there is the potential for emissions to be brought to ground level due to large-scale circulations and air mixing in the boundary layer. However even in these cases, the aircraft emissions will be very well-dispersed horizontally and vertically before they reach ground level.

Therefore, the expectation is that aircraft emissions released above a height of 3,000 feet AGL would have a negligible impact on air quality at ground level; and would likely contribute only a small amount of emissions to total emissions in the Melbourne airshed (i.e. the total emissions released within the area below the boundary layer).

B10.7.7.2 Depletion of stratospheric ozone

A layer of ozone exists in the atmospheric layer above the troposphere (the lower stratosphere) at an altitude of between approximately 15 and 30 kilometres. This is above the highest cruise heights of subsonic jet airliners which are the aircraft that have the highest flight altitude and use Melbourne Airport. Ozone protects life on earth by absorbing ultraviolet radiation from the sun (Department of Environment and Energy, 2017).

This stratospheric ozone is decreased by the presence of ozone-depleting substances, primarily chlorofluorocarbons (CFCs) ('the hole in the ozone layer'). CFCs were used as refrigerants, aerosol propellants and foam-blowing agents. In the stratosphere, CFCs release reactive molecules that destroy ozone (CSIRO 2016).

Emissions of CFCs and other ozone-depleting substances have been controlled for many years, including by Victoria (VG, 2001a; VG, 2001b). However, the depletion of ozone in the stratosphere remains an environmental issue of concern (CSIRO 2016).

An Intergovernmental Panel on Climate Change (IPCC) Special Report on Aviation and the Global Atmosphere (IPCC 1999) presented an early, comprehensive assessment of the potential effects of aviation on stratospheric ozone depletion and global climate change. IPCC (1999) reported that aircraft NO_X emissions from subsonic aircraft flying in the upper troposphere and lower stratosphere (at altitudes from approximately nine to 13 kilometres) react with atmospheric ozone. Ozone at these heights was expected to increase in response to the increases in aircraft NO_X.

To summarise, IPCC (1999) concluded that the effect of subsonic (top of troposphere) aircraft emissions was to create a slight increase of approximately 1 per cent in stratospheric ozone, but the subject required further evaluation. The overall environmental assessment of ozone is complicated, as ozone is also a greenhouse gas.

At present, ICAO's main concerns about aircraft engine emissions are related to the potential for aircraft emissions to contribute to climate change (ICAO 2017c).

From the findings of ICAO (1999) and the aviation industry's current focus (ICAO 2017c), the issue of depletion of stratospheric ozone due to aircraft emissions is inconclusive. The issue is less important than the potential for aircraft emissions to impact on air quality at ground level and contribute to climate change.

The depletion of stratospheric ozone by aircraft emissions, if it occurs, is expected to have a negligible effect on air quality at ground level.

B10.7.7.3 Secondary air pollutant formation

Some air pollutants are formed by physical or chemical processes in the atmosphere e.g. NO_2 (nitrogen dioxide); and others by photochemical processes e.g. O_3 (ozone). They are known as secondary air pollutants (Jacobsen 2002).

Secondary atmospheric particulate matter (PM) sources include chemical reactions between SO_2, NO_X, and ammonia that form solid sulphate and nitrate aerosols; as well as the oxidation of non-methane volatile organic compounds, to form organic aerosols. These interactions may take minutes or days, and their effects can be seen at great distances from the point of release.

There is non-water secondary particulate formation from jet engine exhausts, primarily from sulphur and hydrocarbons. This will increase the background PM or regional PM levels, although quantities will be negligible with respect to other sources of PM at ground level.

B10.7.7.4 Condensation trails

Jet airliners flying at high cruise altitudes (typically between 30,000 and 40,000 feet) sometimes produce visible condensation trails (contrails).

Essentially, contrails are clouds composed of ice particles that form when water vapour and other gases in the jet engine exhaust provide the condensation nuclei needed for ice crystals to form. Most of the water forming these ice crystals is provided by water vapour in the ambient atmosphere, not from engine exhaust components. In conditions of low humidity the contrails either do not form or quickly evaporate.

Shorter-lived, shorter-length condensation trails are sometimes visible streaming behind parts of aircraft wings and engine propellers, often in the more humid conditions at lower levels. These contrails are comprised of atmospheric water only that has condensed into small water droplets in low pressure areas generated behind the aircraft (USEPA 2000). These contrails are shorter-lived because the small water droplets evaporate quickly after returning to the ambient air with its higher air pressure.

While contrails have an effect on climate by altering the fluxes of sunlight and terrestrial infrared radiation, the effect on ambient air quality at ground level is insignificant (USEPA, 2000). The jet engine exhaust components of contrails, released at very high cruise altitudes, will be very well dispersed before reaching ground level. When these components eventually reach ground level, their concentrations would be so small as to be undetectable.

B10.7.7.5 Fuel dumping

Fuel jettison or fuel dumping from aircraft in flight is undertaken only rarely, and in emergencies when an aircraft's weight must be reduced quickly to its maximum landing weight.

In Australia, fuel dumping from aircraft in flight will not occur unless permission is given by Air Traffic Control or according to a direction issued by the Civil Aviation Safety Authority (CASA); or in an emergency (where fuel may be released over areas where it does not create a hazard) (Commonwealth Government, 2004).

The Airservices Australia Aeronautical Information Package (18 August 2016) states that:

> *'When fuel dumping is required, the pilot in command should request authority from ATC before commencing a fuel dump, and must:*
>
> - *Notify ATC immediately after an emergency fuel dump*
> - *Take reasonable precautions to ensure the safety of persons or property in the air and on the ground*
> - *Where possible, conduct a controlled dump in clear air above 6,000 feet and in an area nominated by ATC.'*

In the vicinity of Melbourne, initially the liquid fuel dumped by a fast-moving jet aircraft at the Airservices Australia (2016) minimum height of 6,000 feet AGL would shatter into small droplets on contact with the atmosphere. It is expected the resulting droplets would disperse and evaporate before reaching the ground. Upon reaching ground level, the concentrations of vapours and any remaining droplets would be very small and undetectable. Therefore, normal fuel dumping operations at heights greater than 6,000 feet Above Ground Level (AGL) by aircraft using Melbourne Airport are expected to have a negligible air quality impact at ground level in the Melbourne airshed and beyond.

B10.7.7.6 Radiative Forcing

Radiative Forcing (RF) is a measure of the imbalance in the Earth's radiation budget caused by additional gases and aerosols in the atmosphere, or by changes in cloudiness (ICAO, 2013).

RF is an important consideration for aviation Greenhouse Gas (GHG) inventories, because in addition to the emissions of standard GHGs from aviation fuel combustion, other aviation activities and emissions in the upper atmosphere have the potential to increase radiative forcing, and therefore contribute to global warming. These include emissions of water vapour leading to formation of contrails, emissions of soot, emissions of hydrocarbons and modification of cloud formation and dispersal patterns.

While these interactions and potential effects are relatively well understood, the ability to quantify the effect on a global scale or rationalise it to a single GHG emissions factor per flight is less understood. This is because there are much greater differences in residence time for each of the emissions studied, and the geographical location (and the prevailing climate) has a much greater effect on the potential to contribute to global warming.

B10.8 AVOIDANCE, MANAGEMENT AND MITIGATION MEASURES

This section sets out avoidance, management, and mitigation measures for non-GHG air pollutants such as NO_X, hydrocarbons (e.g., benzene and formaldehyde) and airborne particulate matter.

The results of a residual significance assessment of severity (Section B10.3) and likelihood were used to estimate impact risk levels using a risk matrix. This allows the calibrated risk results of this air quality assessment to be be used with the results from other parts of the Major Development Plan (MDP).

B10.8.1 During construction

Emissions of PM_{10} and $PM_{2.5}$ will be managed with the implementation of a dust management plan as part of a CEMP. The CEMP will include the dust controls applied in the modelling such as the use of water carts and sprays on stockpiles. Further details about the dust controls will be set out in the CEMP.

The modelling demonstrates that further dust mitigation measures are appropriate to be set out in the CEMP (i.e. in addition to the dust suppression applied in the modelling). Such measures may include real-time, continuous dust monitoring data and video data feeding back to dust controls and management systems. Other mitigation options that will be considered in the CEMP include the use of the southern access road as an alternate to the northern access road during southerly wind conditions (for the protection of sensitive receptors north of the site) and restricting the use of obvious sources of visible dust in poor meteorological conditions.

More specific guidelines for dust mitigation measures during the M3R construction phase are described in Chapter E2: Environmental Management Framework.

B10.8.2 During operation

B10.8.2.1 Avoidance

In light of the above and particularly having regard to Melbourne Airport's operations and growth, it is not possible to avoid impacts on air quality (for example by relocating infrastructure associated with M3R).

B10.8.2.2 Engineering design options

M3R engineering design options have not wholly mitigated the air quality impacts associated with M3R. Primarily, the predicted air quality impacts are due to the forecast, high, air and road traffic numbers. These cannot be 'designed out' of M3R; rather, these numbers flow from Melbourne Airport's – and Melbourne's – inherent continued growth, and are proposed to be mitigated and managed in the manner set out in this chapter.

However, the air dispersion modelling for the M3R was based on current (COPERT) emissions factors for road vehicles. In future, road vehicle emissions technology will continue to improve and increased use of hybrid and electric vehicles is anticipated. An airport rail link may reduce some congestion on the roads. More details about road traffic mitigation measures are explained in Chapter B8: Surface Transport.

B10.8.2.3 Mitigation measures

The AERMOD results for air pollutant GLCs for M3R make it evident that mitigation measures are important for Melbourne Airport now, and will be increasingly important in the future. For the immediate term, monitoring and other mitigation measures are implemented through the Environment Strategy within the 2018 Master Plan and the existing AQMP. This includes a review of existing modelling, data and on and off-monitoring, and recommendations for improvement.

The following paragraphs discuss aspects of Melbourne Airport's objective to apply best practice emissions management.

Some of the key pollutants with high levels of predicted concentrations are mainly emitted by aircraft at ground-level and road traffic. The hydrocarbon emissions, e.g., benzene and formaldehyde, tend to be highest when aircraft are in the terminal areas. These emissions can be mitigated to some extent through the improved efficiency of ground operations primarily by reducing aircraft taxi delays – directly associated with increased capacity of the M3R.

Broadly, the mitigation measures for (non-greenhouse gas) air emissions that can be applied to aircraft operations at ground level and their ground support equipment (GSE) and aircraft operating at heights less than 3,000 feet, are:

- Advances in aircraft engine technology and air emissions standards and controls (ICAO, 2017b)
- Aircraft and support equipment operational measures (ICAO, 2017d).

Examples of potential mitigation measures under consideration by Melbourne Airport are:

- Continue to install fixed electrical ground power and pre-conditioned air with appropriate agreement from airlines for reducing the use of their aircraft APUs on stands/ terminals
- Discourage certain high emitting types of aircraft by a landing emission charge with appropriate agreement from airlines, (i.e. engine-related charging) Civil Aviation Authority (2013), ICAO (2017b)
- Encourage single or reduced engine taxiing
- Encourage the use of alternative aircraft taxiing operations (e.g. main engine starts nearer the runway rather than at the terminal or stand)
- Encourage ground handlers to use electric vehicles/ equipment where feasible (electric charging infrastructure is required). Alternatively, a replacement program ensuring that only low emissions equipment is introduced to the airport
- Provide park-and-ride services to reduce the need for road traffic access – where parking is situated in an area that not considered at risk in terms of air quality and potentially limited to low emission vehicles.
- Melbourne Airport can support such measures with additional infrastructure (e.g. electrical connections) and efficient scheduling of runway use (however several of these actions are dependent on terminal (aircraft) operators). Therefore, Melbourne Airport will continue to engage with these operators and support the use of low-emissions GSE, APUs and aircraft. Implementation of these measures will be tracked based on continued application of the AQMP, as well as annual reporting of fuel use and fuel intensity for aircraft movements.

B10.8.2.4 Monitoring, research and reporting

Monitoring, further research and reporting is needed to understand and quantify risks for air quality impacts that cannot be mitigated to a significant degree by lowering emissions. To this end, the airport's air quality monitoring program has already delivered highly valuable data to the airport and M3R over its relatively short lifetime and will continue to do so.

Current efforts by the US National Aeronautics and Space Administration (NASA) could lead to airlines cutting fuel use in half, pollution by 75 per cent, and noise to nearly one-eighth of today's levels (NASA, 2016a; NASA, 2016b). Technology demonstrations completed by NASA researchers included embedded nozzles to reduce aircraft weight and drag, and new composite materials methods to reduce weight (NASA, 2016a). There are various programs to improve the efficiency and emissions from jet engines, e.g. NASA (2017).

B10.8.2.5 Summary of environmental management

This section provides a summary of the airport's current environmental management, drawing on the Environment Strategy – Air Quality chapter that forms part of the 2018 Master Plan. Many aspects have already been discussed in some depth in this chapter.

Building on the airport's earlier environmental strategies and air quality studies, the Melbourne Airport Master Plan 2013 committed to a five-year review of ambient air quality, to provide information on long-term air quality trends in the vicinity of Melbourne Airport and also to support the airport's third runway. Air quality monitoring station MAS was located on the airport and began operating in December 2013. MAS continuously monitors a suite of key air pollutants such as nitrogen dioxide and particulate matter, and meteorological parameters such as temperature, wind speed and wind direction. The MAS monitoring data represent highly valuable information about current air quality as experienced at locations within a radius of approximately 1.5 kilometres from the airport's busy terminals areas.

A second air quality monitoring station, MAE, located outside the airport's boundaries, commenced operating in 2017. Also, a regular program of monitoring for hydrocarbons including benzene and formaldehyde commenced at two locations: Living Legends and Keilor Village outside Melbourne Airport's boundaries in December 2014, using diffusive samplers.

In 2016 to 2017, a new air-quality impact assessment was undertaken to investigate the effects of ground-based activities on the surrounding environment and compliance with relevant legislation, primarily to support the previous third runway project's assessment (i.e. RDP - the assessment from which this chapter has been updated). The M3R modelling results have become an important input to the Environment Strategy – Air Quality which formed part of the 2018 Master Plan.

In addition to monitoring and assessment, the control of emissions on a smaller scale will be important. Air quality management procedures are included in the CEMP, Operational Environmental Management Plans and Permit to Commence Work conditions to minimise emissions of dust, odour and other air pollutants.

The airport's environmental management relating to air quality was developed further in 2019 through an update to the Air Quality Monitoring Program, in support of the Environment Strategy published in the 2018 Master Plan. The 2022 Airport Environment Strategy has been drafted as part of the 2022 Master Planning process.

B10.9 CONCLUSION

The objectives of this assessment were to identify the potential environmental impacts due to air emissions associated with M3R construction and future Melbourne Airport operations including an operational M3R; and to quantify and investigate the predicted air quality impacts.

AEDT and AERMOD were used to model predicted concentrations of air pollutants associated with existing and future airport operations for the Build and No Build scenarios. The assessment then focused on the compliance of each scenario with the legislated criteria, and differences between these scenarios.

Extensive and detailed air emissions inventories were developed for the current and potential future airport operating scenarios to cover the widest range of air quality effects predicted to be associated with the airport. The scenarios assessed are listed in the following points:

- Current airport (2019) representing the current operational situation
- M3R opening year (2026) representing M3R opening (Build and No Build)
- M3R 20 years (2046) representing 20 years after M3R opening at 'ultimate capacity' (Build and No Build).

The cumulative impact assessment included estimates for background air pollutant levels for the individual pollutants studied. This was a conservative measure in the assessment, since background levels of air pollutants are likely impacted by airport operations resulting in some unavoidable double counting (i.e. airport sources are added on top of background levels).

Emissions sources included all aircraft movements on the airport (including all parts of the aircraft LTO cycle); vehicles on all main roadways on and surrounding the airport; all AEDT default selections for GSE on the airport associated with each aircraft type; and all AEDT default selections for APUs for each aircraft type.

The AERMOD results for the current and future Melbourne Airport operations indicated that the highest risk air quality indicators were NO_2 (99.9 percentile hourly average) due to high emissions from airport sources, and PM_{10} due to high background concentrations around the airport. Other pollutants including $PM_{2.5}$ (annual average), benzene (99.9 percentile three- minute average) and formaldehyde (99.9 percentile three- minute average) were also considered.

Primary contributors to air emissions from operations were the large amounts of aircraft and road vehicle movements, with forecast traffic increases from M3R representative opening year scenario (2026) to the 20-year scenario (2046). While mitigation measures and emissions controls are limited in their application to aircraft and road traffic movements, the airport considers them to be important and will continue to put them in place and minimise air quality impacts as far as practicable.

Significant conservative measures used in the assessment were:

- The use of the 34 runway for all aircraft movements (landing and take-off) thereby concentrating movements around the southern runway end
- The use of current aircraft for all future years thereby discounting future reductions in aircraft efficiency
- No improvements to road vehicle emissions factors for the future scenarios or any assumed reductions in future background concentrations.

These measures were validated as conservative based on the comparison to monitored concentrations of NO_2 at the MAS monitoring station, which had significantly lower concentrations than those predicted in the model in 2019.

Comparisons of model results for the No Build and Build scenarios indicated that Build leads to slightly worse air quality impacts overall – which is to be expected given the substantial increases in air and road traffic allowed by Build. In all scenarios however, compliance with SEPP (AQM) criteria was achieved, except where background levels were already high (in the case of PM_{10}).

The assessed risk levels for the operational case Build 2046 for all pollutants all ranged between negligible and medium.

A summary of the air quality impact assessment for M3R construction (existing air quality as baseline) and the worst- case operational scenario Build 2046 (No Build 2046 as baseline), is provided in **Section B10.7.5**.

The initial risk level for the M3R construction was assessed as high, but consideration of additional mitigation measures decreased this risk level to medium (**Section B10.6**). The potential for air quality impacts due to dust emissions from construction activities is anticipated to be mitigated to satisfactory levels through the application of dust suppression techniques implemented through the CEMP. This means the project standards for deposited dust (TSP/nuisance dust), PM_{10} and $PM_{2.5}$ are expected to be met outside the airport boundaries.

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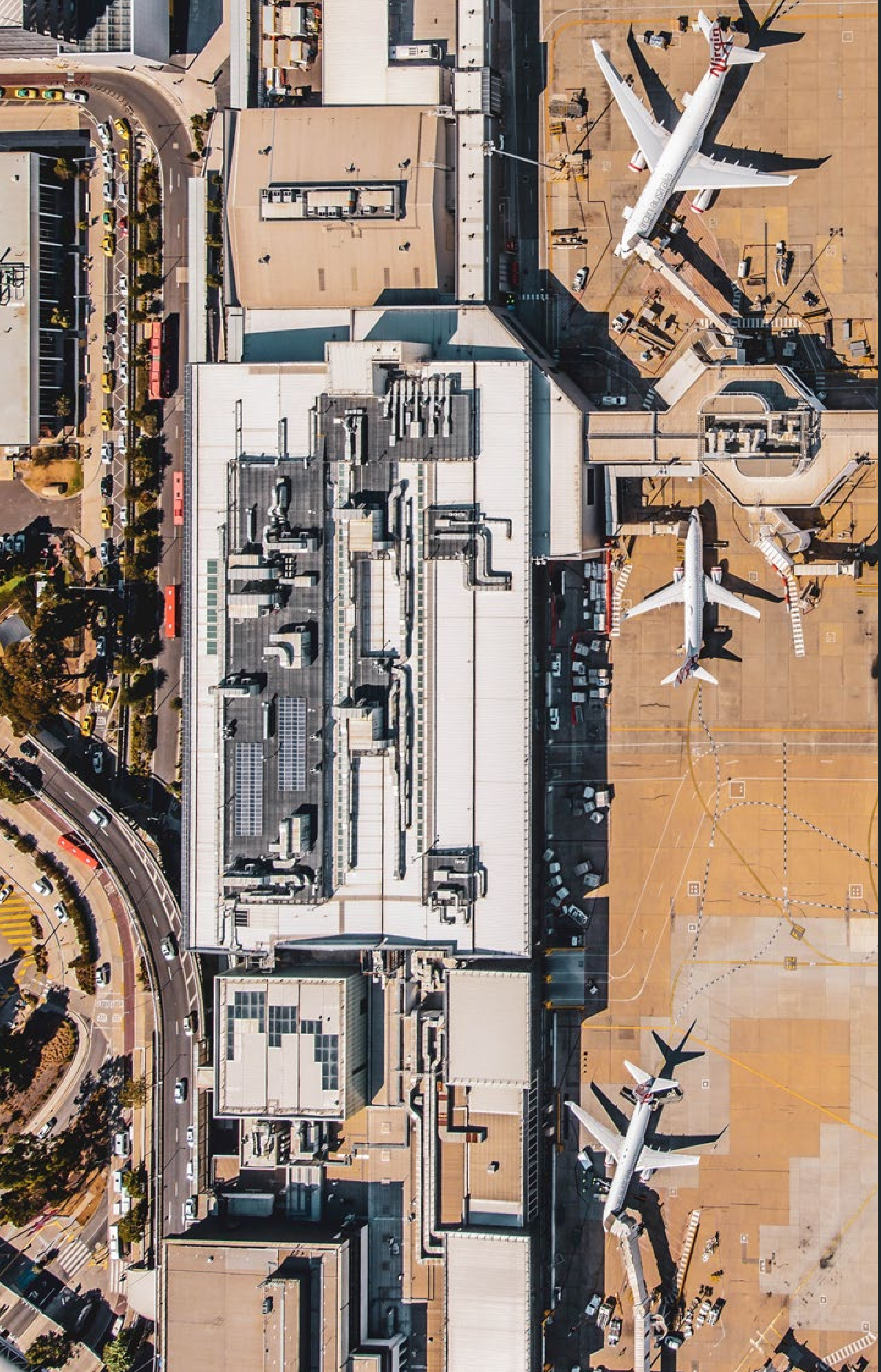
Table B10.23
Impact assessment summary

Aspect of the environment	Baseline condition	Description and characterisation of impact: Impact	Mitigation inherent in design/ practice	Temporal	Significance assessment: Severity	Likelihood	Impact risk	Mitigation or management measures	Description of residual impact: Impact	Temporal	Significance assessment: Severity	Likelihood	Impact risk
Air quality – construction								**Air quality – construction (cont.)**					
Construction, 24h PM_{10}	Current ambient air quality; $PM_{2.5}$ and PM_{10} GLCs	Air quality impacts at discrete sensitive receptors north of airport boundaries.	Construction dust mitigation measures (as modelled).	Short-term (M3R construction project lifetime).	High	Likely	High	Additional construction dust mitigation measures that could include use of real-time monitoring to trigger additional dust mitigation measures (such as slowing or halting activities observed to be causing dust emissions). Note: dust mitigation measures have the added benefit of aiding aviation operations by improving runway visibility and minimising ingestion of small particles by jet engines.	Air quality impacts confined to within airport boundaries.	Short term (M3R construction project lifetime).	Moderate	Likely	Medium
Construction, annual average PM_{10}		Some increased air quality impacts due to construction, but no exceedances expected outside site boundaries.			Minor	Likely	Medium				Minor	Likely	Medium
Construction, 24h $PM_{2.5}$		Some increased air quality impacts due to construction, but no exceedances expected outside site boundaries.			Minor	Likely	Medium				Minor	Likely	Medium
Construction, annual average $PM_{2.5}$		Modelling indicates air quality impacts for discrete sensitive receptors, primarily due to existing high background $PM_{2.5}$ levels, i.e. not the project.			Moderate	Likely	Medium		Air quality impacts confined to within airport boundaries.		Moderate	Likely	Medium
Dust deposition (TSP) (Construction)		Air quality impacts at discrete sensitive receptors north of airport boundaries.	Construction dust mitigation measures (as modelled).	Short-term (M3R construction project lifetime).	High	Likely	High				Moderate	Likely	Medium
Air quality – operations								**Air quality – operations (cont.)**					
Operations, 1h NO_2	Baseline is model predicted air quality situation for No Build 2046 scenario.	Some air quality impacts for discrete sensitive receptor to east and south; negligible impacts at other points outside and neighbouring the airport boundaries.	Adoption of modern engine technology including emissions controls by the aviation industry.	Long-term (airport lifetime)	Minor	Likely	Medium	Potentially some improvements to local air quality from improvements in engine emissions technology and efficiency of airport operations. Note: assessment results dominated by airport activity.	Air quality impact for discrete receptor to north; some air quality impacts at other points outside and neighbouring the airport boundaries.	Long-term (airport lifetime)	Moderate	Likely	Medium
Operations, 24h PM_{10}		No discernible air quality impacts outside the airport boundaries due to the project.			Minor	Likely	Medium		No discernible air quality impacts outside the airport boundaries due to the project.		Minor	Likely	Medium
Operations, annual average PM_{10}		No discernible air quality impacts outside the airport boundaries due to the project.			Negligible	Likely	Negligible		No discernible air quality impacts outside the airport boundaries due to the project.		Negligible	Likely	Negligible
Operations, 24h $PM_{2.5}$		No discernible air quality impacts outside the airport boundaries due to the project.			Minor	Likely	Medium		No discernible air quality impacts outside the airport boundaries due to the project.		Minor	Likely	Medium
Operations, annual average $PM_{2.5}$		Air quality impacts for discrete sensitive receptors, however primarily due to high background $PM_{2.5}$ levels.			Negligible	Likely	Negligible		Air quality impacts for discrete sensitive receptors, however primarily due to high background $PM_{2.5}$ levels.		Moderate	Likely	Medium

Aspect of the environment (cont.)	Baseline condition (cont.)	Description and characterisation of impact (cont.): Impact	Mitigation inherent in design/ practice	Temporal	Significance assessment: Severity	Likelihood	Impact risk	Mitigation or management measures (cont.)	Description of residual impact (cont.): Impact	Temporal	Significance assessment: Severity	Likelihood	Impact risk
Air quality – operations (cont.)								**Air quality – operations (cont.)**					
Operations, 3-minute benzene	Baseline is model predicted air quality situation for No Build 2046 scenario. (cont.)	Air quality impact for discrete sensitive receptor to north.			Minor	Likely	Medium		Air quality impact for discrete receptor to north.		Minor	Likely	Medium
Operations, 3-minute formaldehyde		Air quality impacts for discrete sensitive receptors, and areas adjacent to airport boundaries.			Minor	Likely	Medium		Air quality impacts for discrete sensitive receptors, and areas adjacent to airport boundaries.		Minor	Likely	Medium
Operations, 1h CO		Air quality impacts for discrete sensitive receptors			Minor	Likely	Medium		No discernible air quality impacts outside the airport boundaries due to the project.		Minor	Likely	Medium
Operations, 1h SO_2		Air quality impacts for discrete sensitive receptors			Minor	Likely	Medium		No discernible air quality impacts outside the airport boundaries due to the project.		Minor	Likely	Medium



Chapter B11
Greenhouse Gas Emissions

Summary of key findings:

- A detailed greenhouse gas emissions inventory has been prepared for the construction and operation of Melbourne Airport's Third Runway (M3R).
- This assessment identified a difference in predicted greenhouse gas emissions between the Build and No Build scenarios of 348 kilotonnes CO_2-e annually by 2046.
- The biggest source of emissions is from aircraft during the Land and Take-Off cycle (LTO).
- Melbourne Airport has a limited ability to implement measures to reduce these LTO-related emissions but will continue working with airlines to reduce greenhouse gas emissions wherever possible.

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B11.1
INTRODUCTION

This chapter describes the existing Greenhouse Gas Emissions (GHG) of the study area, applicable legislation and policy requirements, the potential impacts of Melbourne Airport's Third Runway (M3R) and associated assessment methodology. Where required, this chapter also identifies the specific measures that can be taken to avoid, manage, mitigate and/ or monitor these impacts.

The purpose of this chapter is to:

- Describe the relevant international, Commonwealth and Victorian legislative framework and policy, as well as Melbourne Airport's GHG strategy, that form the context for the GHG assessment
- Set out the methodology, assumptions and technical limitations for the impact assessment, including establishment of the GHG assessment boundary
- Define the existing (i.e. baseline) direct and indirect GHG emissions associated with the operation of Melbourne Airport
- Calculate the likely GHG emissions from both building and not building M3R
- Assess the risks and impacts associated with these predicted GHG emissions
- Identify measures to avoid and mitigate these impacts.

B11.2
STATUTORY AND POLICY REQUIREMENTS

Melbourne Airport is located on Commonwealth land. The Commonwealth *Airports Act 1996* and *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999* are the key pieces of legislation setting the regulatory framework for M3R and this assessment. Consideration has also been given to relevant Victorian and local legislation including environmental planning instruments, policies and guidelines.

This section outlines the relevant international, Commonwealth and Victorian statutory and policy requirements for GHGs given that the purpose of this GHG assessment is to address these.

B11.2.1
International framework

The following describes the aviation-specific international greenhouse gas agreements and protocols that are relevant to M3R. International agreements ratified by Australia that inform domestic GHG policy are noted as well as the global accounting protocol. International aviation-specific agreements flowing from Australia's council membership of the United Nations International Civil Aviation Organisation (UN ICAO) are also described, in addition to aviation-specific guidance and working groups.

B11.2.1.1
Global greenhouse gas emissions

Paris Agreement

The United Nations Framework Convention on Climate Change (UNFCCC) conference issued the Paris Agreement in December 2015. Its main aim is to 'strengthen the global response to the threat of climate change by keeping a global temperature rise this century below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius'. The objective is to stabilise the concentration of GHGs in the atmosphere at a level that would 'prevent dangerous anthropogenic interference with the climate system' (Savaresi 2016). Australia ratified the Paris agreement in 2016, committing the country to five-yearly targets for cutting emissions. This will shape Australia's policy on climate change to achieve the targeted reductions.

Kyoto Protocol

The Kyoto Protocol is an international treaty linked to the UNFCCC adopted in Japan on 11 December 1997 that came into force on 16 February 2005. The Commonwealth Government ratified the Kyoto Protocol on 3 December 2007.

Australia has met its target of limiting emissions to 108 per cent of 1990 levels on average over the protocol's initial 2008-12 timeframe. Over these reporting years, Australia's net emissions averaged 104 per cent of the base-year level (Australian Government Climate Change Authority 2014). Australia has committed to meeting its long-term Kyoto Protocol target by setting a target to reduce emissions by 60 per cent on 2000 levels by 2050. It is understood this remains current despite recent ratification of the Paris Agreement's 2030 target.

GHG emissions from fuel consumption associated with international aviation were excluded from the first period (2008-12) of the Kyoto Protocol (although emissions from domestic travel, and energy use by airports, formed part of the national reduction target). Global targets for international aviation were expected at the 2009 UN Climate Change Conference in Copenhagen but did not materialise. However, in October 2016 the UN ICAO released a program for reducing GHG emissions associated with international aviation (described in Section B11.2.1.2).

Greenhouse Gas Protocol

The international Greenhouse Gas Protocol is a collaboration between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). Globally accepted, it provides guidance on the calculation and reporting of carbon footprints and is the basis for determining GHG emissions associated with M3R.

B11.2.1.2
Aviation greenhouse gas emissions

UN ICAO agreement 2016

As noted above, in 2016 the UN ICAO agreed on a scheme to reduce GHG emissions from international aviation activities. The strategy, known as the *Carbon Offsetting and Reduction Scheme for International Aviation* (CORSIA) involves 'technical and operational improvements and advances in the production and use of sustainable alternative fuels for aviation' (UN ICAO 2016b).

CORSIA involves voluntary pilot and initial phases from 2021-23 and 2024-26 respectively; followed by a mandatory phase for all participants from 2027-35. Australia is intending to participate in CORSIA from the outset of the pilot phases.

The main aim of CORSIA is to work towards the global aspirational goal of carbon neutral growth of international aviation emissions from 2020 onwards. This agreement is relevant to M3R although it is noted that domestic aviation emissions are not subject to CORSIA.

Airports Council International Guidance Manual: Airport Greenhouse Gas Emissions Management

Airports Council International (ACI) is a non-profit association whose prime purpose is the advancement of airport interests and promoting professional excellence in airport management and operations. Its *Guidance Manual: Airport Greenhouse Gas Emissions Management* (ACI 2009) presents a method for defining, quantifying, regulating, reducing, offsetting, reviewing and reporting GHG emissions associated with airport activities and aviation operations. This guidance is relevant because it defines who has primary responsibility for emissions in the aviation sector.

B11.2.2
Commonwealth

B11.2.2.1
Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) is the* Commonwealth Government's central piece of environmental legislation, which commenced on 16 July 2000. Under the EPBC Act, 'environment' includes consideration of:

- Ecosystems and their constituent parts including people and communities
- Natural and physical resources
- Qualities and characteristics of locations, place and areas
- Heritage values of places
- Social, economic and cultural components of the environment.

The EPBC Act currently has no provisions for GHG emission assessments and Melbourne Airport therefore has no compliance obligations to consider under the Act.

B11.2.2.2
National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting Act 2007* (Cth) (NGER Act) provides for the reporting and dissemination of information related to GHG emissions, GHG projects, energy production and energy consumption. Under the NGER Act, corporations in Australia which exceed thresholds for GHG emissions or energy production or consumption are required to measure and report data to the Clean Energy Regulator on an annual basis (the NGER Scheme).

The *National Greenhouse and Energy Reporting (Measurement) Determination 2008* identifies a number of methodologies to account for GHGs from specific sources which are relevant to Melbourne Airport and M3R. This includes emissions of GHGs from direct fuel combustion (e.g. fuel for transport energy purposes); emissions associated with consumption of power from direct combustion of fuel (e.g. diesel generators used during construction); and from purchased electricity.

Melbourne Airport meets the facility threshold for a controlling corporation to report under the NGER Act. It therefore annually reports GHG emissions from its operations to the Commonwealth Government. GHG emissions associated with the operation of M3R would be included in this ongoing reporting under the NGER Scheme.

B11.2.2.3
Commonwealth renewable energy target

The Commonwealth Renewable Energy Target (RET) commits Australia to generating 41,000 gigawatt hours of additional renewable electricity generation by 2020 (large-scale RET) in order to achieve a 20 per cent share of renewable energy in Australia's electricity supply by 2020. This demonstrates a substantial increase in Commonwealth Government support for renewable energy initiatives.

The Clean Energy Regulator oversees the operation of the RET; the Department of Industry, Science, Energy and Resources (DISER) provides policy advice and implementation support for the scheme.

The RET is designed to encourage investment in new large-scale renewable power stations and the installation of new small-scale systems such as solar photovoltaic (PV) and hot water systems in households. It has two core components: the large-scale renewable energy target (LRET) and the small-scale renewable energy scheme (SRES). Together, they give a financial incentive for investment in renewable energy.

M3R will have the potential to include in its scope the installation of renewable energy generation equipment, and to benefit from financial incentives (and reduction in GHGs that on-site generation will deliver). Potential options for renewable energy generation are explored in Section B11.7.

B11.2.3
Victorian Government legislation

The Victorian legislation below is not binding given that the airport is located on Commonwealth land, and is within the Commonwealth's jurisdiction and assessed under Commonwealth requirements. However, Victorian requirements do provide useful guidance to inform the assessment approach and methodology of this assessment.

B11.2.3.1
Climate Change Act 2017

On 23 February 2017, the *Climate Change Bill 2016* (Vic) was passed by the Victorian Parliament to create a new Climate Change Act that repealed the 2010 Act. The *Climate Change Act 2017* (Vic) sets out a clear policy framework and a pathway to 2050 consistent with the Paris Agreement's aim to keep global temperature rise well below 2 degrees Celsius above pre-industrial levels. It provides a platform for subsequent action by the Victorian Government, community and business; and the long-term perspective and policy stability to drive innovation and investment.

The *Climate Change Act 2017* (Vic) includes a long-term carbon reduction target of net zero emissions by 2050; a requirement to set five-yearly targets and strategies; frequent reporting; and mitigation measures that support climate change adaptation.

This MDP addresses the requirements of the *Climate Change Act 2017* (Vic) by providing the GHG impact assessment and placing it in a regional and national context (see Section B11.6).

B11.2.3.2
TAKE2 pledge

TAKE2 is Victoria's collective climate change action initiative to help Victoria reach net zero GHG emissions by 2050. Its name refers to the agreement reached at the UN Conference on Climate Change in Paris whereby 195 countries agreed to keep global temperature rises under 2 degrees.

The TAKE2 pledge encourages organisations, through regular updates and advice, to find ways to reduce their emissions and therefore their potential impact on global warming. Melbourne Airport has taken this pledge.

B11.2.3.3
Environment Protection Act 1970

State Environment Protection Policy (Air Quality Management) 2001

Protocol for Environmental Management: Greenhouse Gas Emissions and Energy Efficiency in Industry 2002

The *Environment Protection Act 1970* (Vic) (EP Act) provides a legal framework to protect the environment in Victoria. It applies to noise emissions and the state's air, water and land.

The State Environment Protection Policy (Air Quality Management) 2001 (SEPP (AQM)) is subordinate legislation under the EP Act giving more detailed requirements for the Act's application. Its clauses relevant to GHG emissions are:

- Clause 18: general requirements including a definition of the management of emissions, generators of emissions, and requirements to comply with the policy
- Clause 19: requirements for the management of new sources of emissions
- Clause 33: power of the EPA to apply the Protocol for Environmental Management (PEM) for GHGs to generators of emissions.

The *Protocol for Environmental Management: Greenhouse gas emissions and energy efficiency in industry (2002)* (PEM) is an incorporated document to the SEPP AQM.

The PEM specifies the steps taken by businesses to demonstrate compliance with the policy principles and provisions of SEPP (AQM) that are related to energy efficiency and GHG emissions. It is the regulatory instrument used to align the GHG assessment methodology and approach with the requirements of the EP Act and SEPP AQM.

This chapter provides an assessment of emissions of GHGs from energy-related and non-energy related sources in line with PEM requirements.

In July 2021, the *Environment Protection Amendment Act 2018* came into effect. Its General Environmental Duty (GED) is a centrepiece of the new laws and is applicable to all Victorians. It is now mandatory to understand the risks associated with conducting activities that pose a risk to human health and the environment. Organisations must also take reasonably practicable steps to eliminate or minimise them. In an Australian first, the GED is criminally enforceable.

B11.2.4
Melbourne Airport commitments

Although Melbourne Airport requires a significant amount of energy to operate its facilities, a number of energy audits have identified both energy intensive activities and energy efficiency opportunities. Since 2008-09, Melbourne Airport has reduced its per passenger GHG emissions by 7 per cent.

Melbourne Airport's energy strategy focuses on use of 'common energy'. This is energy (electricity and natural gas) over which APAM has direct operational control to service the operation of the airport (aviation processing, lighting, thermal plant, etc) and supporting infrastructure (such as car parks, airfield lighting, data centres and roads).

The strategy's aim is achieved by:

- An eight-megawatt tri-generation power facility, built in 2014, that provides one-third of Melbourne Airport's power requirements. As well as providing redundancy to essential airport facilities, by reducing energy consumption and energy costs it will deliver an estimated saving of some 920,000 tonnes of carbon dioxide over a 15-year life span.
- Optimising energy use through energy efficiency measures and smart monitoring and control systems
- Transitioning to renewable energy
- Targeting smart procurement options
- Rolling out a solar adoption program with a confirmed 12 megawatts of solar PV generation installed. In addition, Melbourne Airport has developed a solar-powered water treatment plant and installed a 1.8MW solar system on a new business park site.

Melbourne Airport has achieved Level 2 status under the Airport Carbon Accreditation Scheme of Airports Council International. This recognises Melbourne Airport's commitment to reducing its impacts on the environment, and to managing and reducing carbon emissions. The scheme recognises improved performance by airports in carbon and energy management; and encourages the development of management practices that support the principles of carbon neutrality.

Melbourne Airport has also committed to the Victorian Government's TAKE2 climate change pledge. The TAKE2 initiative aims to reach zero net GHG emissions by 2050. Regarding M3R, this ongoing commitment will require the airfield energy consumption (and associated GHG emissions) modelled in this report to be reduced, generated from renewable sources, and/or offset.

B11.3
DESCRIPTION OF SIGNIFICANCE CRITERIA

To ensure a consistent approach across each impact assessment presented in the MDP, the framework used throughout the document for assessing the significance of impact assessment results is the one detailed in Chapter A8: Assessment and Approvals Process.

Project-specific criteria have been also been developed for the assessment of GHG emissions as described in Table B11.1.

The contribution of GHG emissions to climate change is a global issue, not just a national, state, or local one. The severity assessment of GHG emissions resulting from M3R is therefore assessed in this context. Reporting thresholds have been used to differentiate between the severities of the impacts because they usefully illustrate the importance of emissions levels on a local to global scale.

Table B11.1
Severity criteria

Impact severity	Description		Rationale/comments
	Construction	Operation	
Major	A significant level of GHG emissions associated with construction of the project as defined by scope 1, scope 2 and scope 3 emissions representing >0.1 % of Australia's total annual GHG emissions, or > 5 % of Victoria's total GHG emissions, excluding LULUCF#. A significant estimated financial liability (e.g. offsetting of scope 1 and scope 2 emissions).	A significant increase in annual operational GHG emissions^ compared to the No Build operational scenario and a significant and irrecoverable estimated financial liability. The increase in GHG emissions represent > 0.1 % of Australia's total annual GHG emissions, or >5 % of Victoria's total annual GHG emissions, excluding LULUCF#.	Financial liability could include capital costs due to implementation of GHG abatement technologies and/or offsetting under a decarbonisation strategy (stakeholder or future Melbourne Airport policy requirement and/or commitment); or financial liability due to future emissions trading scheme and/or carbon tax (measured as $/t$CO_2$-e scope 1 and scope 2 emissions). Comparison with latest publicly available GHG emissions inventories. Greater than these levels assume negative reputation and media attention globally, with follow-on effects including political implications (affects the Commonwealth Government's ability to comply with agreements at the Paris 2015 UNFCCC¥ Conference of the Parties); project is significantly delayed and/or cancelled.
High	A high level of GHG emissions associated with scope 1, scope 2 and scope 3 emissions representing a non-negligible proportion of Australia's total emissions (> 0.01 % but < 0.1 %), or a non-negligible proportion of Victoria's total GHG emissions (> 1 % but < 5 %), excluding LULUCF#. The estimated financial liability is high (e.g. offsetting of scope 1 and scope 2 emissions).	An increase in annual operational GHG emissions^ compared to the No Build operational scenario and a major estimated financial liability. The increase (or decrease) in GHG emissions represent a non-negligible proportion of Australia's total annual emissions (> 0.01 % but <0.1 %), or a non-negligible proportion of Victoria's total annual GHG emissions (> 1 % but < 5 %), excluding LULUCF#.	Financial liability could include offsetting, GHG abatement technologies. Comparison with latest publicly available GHG emissions inventories. Greater than these levels assume negative reputation and media attention nationally, with follow- on effects including political and stakeholder relations implications. Beneficial outcomes include consideration of indirect (scope 3) emissions such as improved holding (aircraft emissions) due to the unconstrained schedule (Build scenario).
Moderate	Annual scope 1 and scope 2 GHG emissions for the construction of the project are greater than the threshold required to report as a separate facility in NGER scheme (25,000 tCO_2-e p.a.). The potential for some additional financial liability (new or additional costs associated with reporting by the contractor are experienced) and requirement to monitor and report emissions.	An increase in annual operational GHG emissions^ compared to the No Build operational scenario, with scope 1 and 2 operational emissions for the project greater than the threshold required to report as a separate facility in NGER scheme (25,000 tCO_2-e p.a.). The potential for material financial liability (greater than 10% increase in reporting workload) and requirement to monitor and report emissions under NGER scheme.	Assumes emission reduction technologies implemented on M3R may not be eligible for, or Melbourne Airport chooses not to participate in, offsets credited through the Climate Solutions Fund (CSF), i.e. assumes 'material financial liability'. Beneficial outcomes include consideration of indirect (scope 3) emissions such as improved holding (aircraft emissions) due to the unconstrained schedule (Build scenario).
Minor	Annual scope 1 and scope 2 GHG emissions for the construction of the project are below the threshold required to report as a separate facility in NGER scheme (25,000 tCO_2-e p.a.) but above 5,000 tCO_2-e p.a. No change in reporting obligations and no increased financial liability for GHG emissions (costs associated with reporting by the contractor are absorbed in current reporting activities).	An increase in annual operational GHG emissions^ compared to the No Build operational scenario, with scope 1 and scope 2 operational emissions below the threshold required to report as a separate facility in NGER scheme (25,000 tCO_2-e p.a.) but above 5,000 tCO_2-e p.a. Some additional financial liability (compared to existing reporting requirements for Melbourne Airport) for reporting of operational scope 1 and scope 2 emissions.	Emission reduction technologies implemented on M3R could be eligible for offsets credited through the CSF, i.e. assumes some financial liability. 'Additional financial liability' means more resources required to monitor/report due to complexity and/or scale of the additional emissions. Beneficial outcomes include consideration of indirect (scope 3) emissions such as improved holding (aircraft emissions) due to the unconstrained schedule (Build scenario).
Negligible	Annual scope 1 and scope 2 GHG emissions for the construction of the project are below 5,000 tCO2-e p.a. No obligation to monitor and report emissions and no financial liability for GHG emissions.	No change in annual operational GHG emissions^ compared to the No Build operational scenario. No additional financial liability (compared to existing reporting requirements for Melbourne Airport) for reporting of operational scope 1 and scope 2 emissions.	Assumes Melbourne Airport may still trigger reporting requirements under NGERS for actual scope 1 and 2 emissions, as per 'normal' obligations.

Table Notes: # Land use, land use change and forestry ^ Including scope 3 emissions e.g. wider transport effects ¥ United Nations Framework Convention on Climate Change

B11.4 METHODOLOGY AND ASSUMPTIONS

This section details the approach and methodology used in developing the GHG inventory.

B11.4.1 Overview

The GHG emissions associated with Melbourne Airport and its surrounds are explained in this chapter. They include GHGs associated with ground-based activities up to and including the Landing and Take-Off (LTO) cycle; and M3R construction and operational emissions.

Although GHG emissions associated with the airspace are largely out of Melbourne Airport's control they are discussed in this chapter for context. They include aircraft emissions when they have completed climb-out and are cruising to their destination after take-off; and also those associated with being delayed in a holding pattern while waiting to land, these are likely to be experienced under the constrained (i.e. No Build) scenarios.

A GHG inventory is an assessment of the GHG emissions associated with a product, service or event. GHGs such as methane and nitrous oxide are aggregated with carbon dioxide and reported as a single number of 'carbon dioxide equivalents'.

Rising concentrations of GHGs in the atmosphere contribute to climate change. M3R will be a source of GHGs both from ground-based sources and the aircraft using it. Therefore, being able to reduce these emissions across the infrastructure lifecycle would limit any potential adverse impact of M3R on climate change.

GHG emissions can be attributed to a number of sources, both direct and indirect, Melbourne Airport has responsibility and control over some of these sources, but not all. Examples of direct sources from M3R during construction include emissions associated with the combustion of fuel by on-site plant and equipment. Indirect sources may include those attributed to the generation of electricity used on site. Also considered an indirect source, is the manufacture and transport of construction materials to site.

During operation, the key GHG direct emissions sources for M3R would be the increased aircraft emissions in the LTO cycle associated with the new north-south runway (16R/34L); fuel used to power Ground Support Equipment (GSE); and Auxiliary Power Units (APUs). Indirect emissions include those attributed to the generation of electricity used to operate installed assets associated with M3R e.g. new runway lighting and electrical, and ventilation for the potential new tunnel/underpass structure.

B11.4.2 Approach

The GHG inventory in this chapter is calculated according to the principles of the Greenhouse Gas Protocol (GHG Protocol) (WBCSD 2013). This is recognised as the international standard for calculating GHG inventories. The GHG emissions in the inventory can be divided into three categories known as 'scopes'.

Scopes 1, 2 and 3 defined by the GHG Protocol can be summarised as follows:

- Scope 1: direct emissions from sources owned or operated by a reporting organisation (e.g. combustion of diesel in company-owned vehicles or used in on-site generators)
- Scope 2: indirect emissions associated with acquiring energy from another source (e.g. offsite generation of electricity)
- Scope 3: indirect emissions (other than Scope 2 energy imports) that are a direct result of the operations of the organisation but from sources neither owned nor operated by them (e.g. business travel by air).

Airports Council International (ACI) (ACI 2009) provides additional guidance for airports making a GHG inventory based on the GHG Protocol. It clarifies which scopes should be allocated to specific emissions when completing an airport GHG inventory and divides Scope 3 into two elements:

- Scope 3a: emissions which an airport operator *can* influence (even though it does not control the sources)
- Scope 3b: emissions which an airport operator *cannot* influence to any reasonable extent.

The ACI approach has been followed in this assessment because it is the most relevant for airports and is consistent with the recognised international standard (i.e. the GHG Protocol).

It should be noted that some emissions sources can have more than one scope. For example, electricity *consumption* emissions are classified as Scope 2 but also have a Scope 3 element (relating to emissions associated with transmission losses in the electricity network). Similarly, electricity *generation* emissions (if generated as part of the project) are classified as Scope 1 but have a Scope 3 element (relating to emissions upstream of a power plant regarding extraction, refinement and supply of fuel).

B11.4.3
Scope

The purpose of this assessment is to ascertain the GHG emissions associated with the construction and operation of M3R.

The construction assessment includes all material sources of GHGs for the construction phases (the construction program's duration is four to five years). The operational assessment determines the difference in emissions between Build and No Build scenarios at year of opening (2026), five years after opening (2031) and 20 years after opening (2046).

The operational assessment includes emissions associated with aircraft activity (the LTO cycle), airfield operation, and airside support vehicles and equipment. This is to provide a full picture of M3R's likely impacts regarding GHG emissions; it does not assess emissions associated with terminal or landside activities as these are outside the scope of the MDP. The change in passenger access to the airport (by road) is included for all future scenarios. The boundary of this study area is described in the next section.

B11.4.4
Assessment study boundary

The study boundary determines which sources of emissions are included in the scope of assessment and which are excluded, for both construction and operation of M3R.

The construction assessment includes the sources outlined in Table B11.2. Construction materials which will be material have been considered in this assessment (e.g. concrete, aggregate, steel, PVC conduit and electrical cable). Minor construction materials used in small quantities have been excluded from the inventory. This is because the quantity of emissions from minor construction materials is likely to be below the materiality threshold for foot printing. For this study, the materiality threshold is 1 per cent for individual sources of emissions and 5 per cent when aggregated.

The operational assessment includes the sources outlined in Table B11.3.

Table B11.2
Greenhouse gas – construction assessment boundary

Source	Description	Scope	Notes
Fuel combustion – diesel (transport)	Emissions associated with diesel used in mobile construction equipment.	Scope 1 and 3b	Scope 1 assesses direct emissions from combustion on site and scope 3b assesses emissions associated with the fuel supply chain.
Fuel combustion – diesel (stationary)	Emissions associated with diesel used in stationary construction equipment.	Scope 1 and 3b	Scope 1 assesses direct emissions from combustion on site and scope 3b assesses emissions associated with the fuel supply chain.
Vegetation clearance	Emissions associated with the loss of carbon sink through clearing vegetation during construction.	Scope 1	
Purchased electricity	Emissions associated with electricity purchased and used to power site offices and lighting during construction.	Scope 2 and 3b	Scope 2 assesses direct emissions from the power generation process and scope 3b assesses emissions associated with the power supply chain and transmission and distribution losses.
Construction material purchase	Embedded emissions associated with the manufacture of construction materials.	Scope 3a	
Construction material transport	Emissions associated with transport of construction materials to site from manufacturing location	Scope 3a	
Waste disposal	Emissions associated with disposal of construction waste off-site.	Scope 3a	

Table B11.3
Greenhouse gas – operational assessment boundary

Source	Description	Scope	Notes
Passenger access	Emissions associated with the road network relevant to passengers accessing Melbourne Airport.	Scope 3b	Emissions are modelled based on the Victorian Integrated Transport Model (VITM) outputs within a 10-kilometre radius of the airport (refer to **Chapter B8: Surface Transport**).
Purchased electricity	Emissions associated with the generation of electricity imported to Melbourne Airport.	Scope 2 and 3b	Emissions associated with electricity usage in the airfield only (lighting and aircraft navigational systems).
Fuel combustion – diesel (transport)	Emissions associated with combustion of diesel in transport equipment used airside. This includes ground support equipment (GSE) such as tractors, mobile stairs and baggage trolleys.	Scope 1 or 3a and 3b	The scope of these emissions depends on whether the GSE is owned by Melbourne Airport, or by the airlines/other tenants
Fuel combustion – diesel (stationary)	Emissions associated with combustion of diesel in airside stationary equipment (generators).	Scope 1 & 3b	Generators are used to provide electrical energy to airfield systems in the event of a loss of power.
Aircraft – landing take-off cycle	Emissions from aircraft in the LTO cycle at Melbourne Airport (i.e. including taxiing, take-off, climb out, approach).	Scope 3a (taxi) and 3b (take off, climb out and approach)	Derived from Air Quality modelling undertaken in AEDT software (see **Chapter B10: Air Quality**).
Aircraft – auxiliary power units (APUs)	Emissions from aircraft APUs whilst on stand.	Scope 3a	It is assumed that only APUs are used, no ground power units (GPU). The fleet mix is unknown and this assumption represents a worst-case.

The study assesses emissions from the operation of two runways under a No Build scenario and three runways under a Build scenario. Results are presented as totals for both scenarios; the difference between the two represents the likely GHG emissions due to M3R.

The following have been excluded from the assessment of operational emissions:

- Full-flight emissions from aircraft after the LTO cycle
- Energy consumption associated with the operation of landside infrastructure (including all terminal infrastructure)
- Solid waste disposal associated with the operation of landside infrastructure (including all terminal infrastructure)
- Any sources of emissions below the materiality threshold (either in absolute terms or in terms of the incremental change between Build and No Build scenarios). There are various sources of emissions likely to be below the materiality threshold for foot-printing. For this study, the materiality threshold is 1 per cent for individual sources of emissions, and 5 per cent for all these emissions in aggregate.

B11.4.5
Units and metrics

The results for this study will be scaled to appropriate metrics to provide a meaningful comparator for the emissions. This comparator is often defined as the 'functional unit' in carbon accounting. For this study, the following units will be presented:

- Emissions per Air Traffic Movement (ATM) (both arriving and departing)
- Emissions per passenger (both arriving and departing)
- Total emissions: all relevant/significant airport sources
- Total emissions: airside emissions which will be used in the impact assessment for M3R only (i.e. the subset of emissions relating to aircraft arrivals and airside activities which will compare the boundary used in the impact assessment).

B11.4.6 Methodology

This section details the methodology used to determine the GHG emissions projected to occur due to M3R in both the construction and operation phases.

B11.4.6.1 Construction

To determine likely GHG emissions from construction of M3R, data on emissions, energy use and fuel use from construction activities were sourced in units that allow for calculation of GHG emissions. These activity data sources are described in Table B11.4.

Table B11.4
Data sources for construction GHG assessment

Emission Source	Data Sources
Fuel combustion – diesel (transport)	Construction plant and equipment lists were developed as part of the concept design. These include lists of particular plant and equipment per phase of construction, with an indication on the usage hours per day, and total days construction for each.
Fuel combustion – diesel (stationary)	Two items of stationary equipment were included in the assessment; an asphalt batching plant and a concrete batching plant. Usage data were determined as part of the concept design, and fuel efficiency derived from manufacturer websites.
Vegetation clearance	Data on vegetation clearance type and quantity were sourced from ecological studies completed for the MDP (refer to Chapter B5: Ecology).
Purchased electricity	Electrical energy used to power offices (including lighting) was derived from floor areas for the proposed (temporary) construction building and standard office building electrical energy consumption figures according to the Building Code of Australia.
Construction material purchase	Construction material quantities were determined as part of the concept design process.
Construction material transport	Construction material transport distances were determined by researching an appropriate supplier of each material in close proximity to the airport. Suppliers for each material are not yet confirmed; use of this approach was considered to provide an appropriate estimate of the likely emissions.
Waste disposal	Waste values were informed by Chapter B3: Soils, Groundwater and Waste, with additional assumption made regarding waste types/ classifications where required.

Using these data sources, the GHG inventory was then calculated by applying the following methodology:

- Construction fuel: mobile equipment – vehicle usage data for the different phases of construction was multiplied by indicative fuel consumption figures from the Carbon Emissions Reporting Tool (CERT) version 1.1 developed by Transport for NSW (TfNSW, 2015). This determined the total indicative fuel consumption which was in turn multiplied by the relevant emissions factor to determine GHG emissions
- Construction fuel: stationary equipment – asphalt and concrete batching plant fuel consumption per unit of output was taken from manufacturer websites; and multiplied by expected throughput to determine the total, which was in turn multiplied by the relevant emissions factor to determine GHG emissions. If the emissions associated with batching plants were also covered by emissions factors for construction materials, double counting was avoided (see list of assumptions below)
- Construction fuel: passenger vehicles – assumptions made on the total numbers of passenger vehicles were multiplied by expected time in usage and vehicle fuel efficiency figures from the Australian Bureau of Statistics. Total projected fuel consumption was then multiplied by the relevant emissions factor to determine GHG emissions
- Vegetation clearance: data on vegetation clearance types and areas was fed into the vegetation removal section of the carbon gauge GHG calculator for road projects (version 01.130612 developed by VicRoads 2013). This provided an indicative, regionally tailored, projection of carbon emissions from the loss of vegetation as a carbon sink
- Purchased electricity: consumption projections were based on indicative site office floor area; benchmarks for energy consumption were derived from the Building Code of Australia. The resulting total electrical energy consumption was multiplied by the relevant emissions factor to determine GHG emissions
- Construction materials: embedded emissions – quantities from the concept design were input to the Infrastructure Sustainability Council of Australia (ISCA) materials calculator version 2.0.04 (ISCA, 2019). This provided the emissions of GHGs associated with the manufacture of each material. The exception being electrical cable, for which CERT (TfNSW, 2015) was used to determine GHG emissions. (There were some instances where double counting of emissions would occur by using default ISCA calculations and separately calculating emissions for on-site production steps such as the operation of batching plants. Where this was the case, steps were taken to ensure that emissions were only counted once)
- Construction material transport: calculated using the ISCA materials calculator version 2.0.04 (ISCA, 2019). Total projected fuel consumption was based on articulated or rigid truck delivery, and transport distance was entered based on an identified local supplier. The ISCA materials calculator then provided an output in terms of total GHG for transport
- Waste disposal: quantities of projected green waste, general construction waste, office waste and rubber (tyres) were multiplied by the appropriate emissions factor to determine GHG emissions.

The following assumptions were applied to the assessment:

- All construction plant and equipment will be fuelled by diesel
- The majority of construction passenger vehicles will be fuelled by diesel
- Data on expected usage of plant and equipment included indicative operating hours and days of operation (assuming continuous operation during this time – a likely overestimate)
- Assumptions around plant operating efficiency used worst-case (i.e. maximum) GHG emissions when a range was given
- Although the contractors' site office area is as yet undefined, an allocation of temporary compound space of 10,000 metres squared was assumed and (conservatively) estimated that 50 per cent would be office space.
- Assumptions for concrete mixes:
  - For all mixes, it was assumed that no Supplementary Cementitious Material (SCM) was used
  - Portland Cement Concrete (PCC) aircraft pavements
  - Cement content in the range 360 kilogram to 420 kilogram per cubic metre was indicated
  - The higher value was used as a conservative assumption. Default mixes within the ISCA calculator for remaining materials was assumed
  - For lean (low strength) concrete (five megapascals) no emissions factors were available. The 20 megapascals emissions factor was used as a conservative assumption
  - For high strength (40 megapascals) concrete – standard mixes in the ISCA calculator were used.
- The ISCA calculator provides an emissions factor for concrete production at a batch plant, which is automatically added to the output. As concrete batching plant emissions were separately calculated from the ISCA calculator, these were removed from the ISCA outputs to avoid double counting.
- Assumption for asphalt mix:
  - The ISCA calculator was used to determine emissions associated with supply of asphalt
  - The value selected was for 'asphalt, standard mix 5.5 per cent virgin bitumen' which represents the highest value (in terms of emissions per unit output). As the emissions factor for this material included emissions associated with the batch plant, the (separately calculated) batch plant emissions were subtracted from the total value calculated to avoid double counting.
- Waste disposal
  - A 100 per cent recycling rate has been applied to green waste because all native trees and vegetation will be mulched and re-used on site.
  - An 80 per cent recycling rate has been applied to demolition waste
  - An average recycle rate of 69 per cent (Sustainability Victoria, 2020) has been applied to paper waste.

A summary of activity data used in the construction assessment is provided in Table B11.5.

Table B11.5
Construction GHG assessment – summary of activity data

Activity	Sub-activity	Value	Units
Fuel usage	Construction plant and equipment – diesel	34,911	kl
	Passenger vehicles – diesel	300	kl
	Stationary plant (asphalt and concrete batching) – diesel	1,848	kl
Land clearing	Riparian woodland	1.26	Ha
	Plains grassland	225.97	Ha
	Plains grassy woodland	0.25	Ha
	Plains woodland	130.35	Ha
	Creekline grassy woodland	1.33	Ha
	Escarpment shrubland	0.75	Ha
	Hills herb-rich woodland	43.45	Ha
	Aquatic herbland	0.01	Ha
	Tall marsh	0.49	Ha
Electricity use	Electricity use – offices	3,942,000	kWh
Materials	Asphalt	200,800	t
	Concrete, ready mix (airfield PCC)	189,633	m^3
	Concrete, ready mix, lean	56,286	m^3
	Concrete, 40 MPa structural concrete	53,580	m^3
	Concrete, precast	128,592	t
	Aggregate	990,497	m^3
	Steel	13,429	t
	PVC conduit	420	t
	Electrical cabling – 6mm, 70mm and 240mm	392	km
Waste	Green waste	0	t
	Construction and demolition waste	120,000	t
	Office waste (paper, etc.)	28	t
	Rubber (tyres)	150	t

Table B11.6
Emissions factors – National Greenhouse Accounts Factors 2019 – construction

Source	Reference unit	Emissions ($kgCO_2$e per reference unit) CO_2	CH_4	N_2O	Total (CO_2e)	Additional upstream emissions (scope 3) $kgCO_2$e
Diesel oil (transport energy)	kL	2,698.14	3.86	19.3	2,721.30	138.96
Diesel oil (stationary energy)	kL	2,698.14	3.86	7.72	2,709.72	138.96
Paper and cardboard	t	-	-	-	2.9	-
Garden and green waste	t				1.4	
Rubber and leather	t				2.9	
Construction & demolition waste	t				0.2	

The emissions factors used in the assessment of construction GHG emissions are presented in **Table B11.6** and **Table B11.7**.

Table B11.6 presents carbon dioxide equivalent (CO_2-e) emissions factors for carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) developed and published by the Commonwealth Government in its annual National Greenhouse Accounts Factors 2019 (DoEE, 2019).

Table B11.7 presents emissions factors used in the assessment, embedded in the ISCA materials calculator (ISCA 2019).

Table B11.7
Emissions factors – ISCA materials calculator (ISCA 2019)

Source	Emission factor (tCO_2e / t)
Asphalt	0.06363
Cement	0.984022
Fine aggregates	0.004303
Coarse aggregates	0.010899
Mains water	0.000743
Additives	4.39
Manufactured sand	0.007601
Crushed rock	0.0109
Steel reinforcing bar	1.5
PVC	2.7340

B11.4.6.2 Operations

To determine the GHG emissions associated with operation of M3R, data on emissions, energy use and fuel use from operational activities was sourced in units that allowed for the calculation of GHG emissions. The activity data sources used for the operational assessment are identified in **Table B11.8**.

Table B11.8
Data sources for operational GHG assessment

Emission source	Data sources
Passenger access	Data regarding passenger road access (volumes of traffic on different access routes to Melbourne Airport) were sourced from transport studies carried out as part of this assessment (refer to **Chapter B8: Surface Transport**). This data gave total volume of traffic based on the Victorian Integrated Transport Modell (VITM), covering all access roads that would see a difference associated with traffic, for baseline and future years.
Purchased electricity	Airfield electricity consumption data were primarily sourced from meter readings taken for the baseline year where available, with assumptions made to fill gaps
Fuel combustion – diesel (transport)	This emissions source refers to emissions from GSE. The emissions were projected based on standard fuel consumption figures which estimate consumption per aircraft movement for two different aircraft types. The aircraft data (movements and type) were sourced from master spreadsheets which forecast flights under both the Build and No Build scenarios.
Fuel combustion – diesel (stationary)	This emissions source refers to emissions from standby generation units for airfield lighting. By their nature, these generators are only run during testing or emergencies, so consumption is low. Data are taken from recent National Greenhouse and Energy Reporting (NGER) reports filed by Melbourne Airport.
Fuel combustion kerosene – for use as fuel in an aircraft (transport energy)	The main source of GHG emissions in this assessment is from aircraft. This includes use of APUs on stand and the LTO cycle. The main sources of data for this part of the assessment were master spreadsheets which forecast flights under both the Build and No Build scenarios. These were processed in AEDT to determine both air quality and GHG related emissions. The source spreadsheets included actual and forecast individual flights, including aircraft type, length of flight to first destination, terminal allocation and runway allocation. This information, combined with the outputs from AEDT, was used to determine emissions from this source.

The methodology for calculation of the operational GHG inventory includes:

Passenger access

This impact assessment includes the effects of GHG emissions associated with the road network used by passengers, employees and trucks accessing Melbourne Airport. It compares road-based transport emissions of the Build scenario and the No Build scenario using outputs from the VITM (see next paragraph). Comparison of GHG indicators for Build vs No Build is considered a useful approach to assess a project's longer-term operational impacts. It is often used for state projects assessed under the *Environment Effects Act 1978 (Vic)* or the *Major Transport Projects Facilitation Act 2009 (Vic)*. This approach has therefore been used to assess road network emissions associated with M3R.

VITM is Public Transport Victoria's (PTV) four-step strategic traffic model that was used in the surface transport assessment of M3R (refer to **Chapter B8: Surface Transport**).

Both VITM and its predecessor, Melbourne Integrated Transport Model (MITM), have been used extensively by PTV and VicRoads for strategic modelling in metropolitan Melbourne. The assessment boundary for this analysis has been limited to the VITM extent necessary in order to detect the transport effects of M3R, and applies to 11 key road links within approximately 10 kilometres of Melbourne Airport.

Key VITM outputs used for the GHG assessment include:

- Daily average vehicles per hour on each road link analysed
- AM peak vehicles per hour on each road link analysed
- PM peak vehicles per hour on each road link analysed.

To ensure consistency with the air quality assessment (**Chapter B10: Air Quality**) Victorian average vehicle fleet fuel efficiency figures were extracted from COPERT Australia using input data for the Victorian context. GHG emissions factors are sourced from the national greenhouse gas accounts factors 2019 (DoISER, 2020).

Purchased electricity

Electricity use on-site is documented at a high level in the NGER inventory. This data details total imports to the site, as well as electricity sold to tenants (i.e. directly purchased from suppliers by tenants). The remainder is used by Melbourne Airport. As landside electricity consumption is outside the scope of this MDP's approval, detail was provided on airside electricity consumption to determine the emissions specifically relevant to M3R. This was in the form of meter readings for substations supplying electricity to the airfield. The majority of meter readings were available but, where there were gaps, assumptions were made to ensure all electricity usage was represented.

Future electricity consumption associated with M3R was assumed to be an additional 50 per cent of baseline consumption (representing a move from two runways to three). This is in line with data available on power consumption in the concept design report, which indicates load increase for the airfield from 8 megavolt amperes to 12 megavolt amperes for M3R.

Future electricity grid emissions intensity was determined from analysis undertaken by Jacobs for the Commonwealth Government to determine Victorian emissions projections to 2034-35 (Jacobs, 2016).

Fuel combustion: liquid fuels and oils

Fuel combustion in the airfield included stationary sources (two backup generators for airfield and terminal buildings) and mobile sources (GSE). The approaches to calculating emissions from these sources included:

- GSE: ICAO default data (ICAO 2011) provides default carbon dioxide emissions factors for all GSE per aircraft movement (inbound or outbound) based on operations at Zurich Airport. These are 18-kilogram CO_2/movement for narrow body aircraft and 58-kilogram CO_2/movement for wide body aircraft. These factors were applied to each aircraft movement in Build and No Build schedule files to determine total contribution. These emissions were converted to GHG (CO_2-e) using standard emissions factors. As Melbourne Airport do not own or control the GSE, 100 per cent of emissions was allocated to the airlines/tenants.
- Backup generation: emissions from the baseline year were increased proportionally (according to changes in number of aircraft movements for each scenario modelling the likely increase associated with the M3R).

Aircraft: Landing take-off cycle

Emissions associated with the LTO cycle were determined through the Aviation Environmental Design Tool (AEDT) model, which was based for each of the future Build and No Build scenarios on full forecast flight schedules (see **Chapter B10: Air Quality**). AEDT determined emissions for each aircraft type in the following LTO components:

- Descend below mixing height: includes the following components:
  - Approach/descent from 10,000 feet (~3000m) (including reverse thrust)
  - Landing ground roll
  - Taxiing (in) and idle
- Climb below mixing height:
  - Taxiing (out) and idle
  - Engine start-up
  - Takeoff ground roll
  - Climb out to 10,000 feet (~3000m)

Output files from AEDT were post-processed to allocate emissions from the above movements to each ATM in the schedule. The outputs from AEDT were presented in direct CO_2 emissions only (as AEDT does not output values for CH_4 and N_2O emissions associated with aviation fuel combustion). These values, as well as Scope 3 (upstream) emissions were determined from the appropriate emissions factors for aviation fuel combustion. Note that emissions for future years are scaled based on the number of aircraft movements. Emissions estimates for the Build scenarios do not include additional taxi-in and taxi-out time as a result of the third runway (however, this is a relatively small component of overall emissions). In addition, estimates do not factor in improvements in aircraft efficiency, nor efficiency of GSE, APUs and taxiing. A sensitivity analysis of next-generation aircraft shows emissions per aircraft movement could fall by around 10 per cent should the aircraft fleet be entirely upgraded by 2046.

Aircraft: auxiliary power units

ICAO (ICAO, 2011) provides an approach to calculating auxiliary power units (APU) emissions for either short-haul or long-haul flights (with specific definition of the aircraft types that this refers to).

This approach gives a standard duration of APU operation and associated fuel burn calculation for each air traffic movement (80 kilograms of fuel for short-haul flight ATMs and 300 kilograms of fuel for long-haul flight ATMs). These values were applied to each movement in the Build and No Build schedules to determine total emissions associated with APU use for each year assessed.

The following assumptions were used in determining the operational GHG emissions.

Passenger access:

- It was assumed that vehicles travelling on the modelled roadways were representative of the Victorian fleet average
- By 2046, 30 per cent of Victoria's vehicle fleet will be electric (the central scenario from CSIRO 2020); in 2026, the percentage is assumed to negligible (in-line with the central scenario)
- Improvements in the fuel efficiency of Victoria's fossil fuel vehicle fleet are assumed to be negligible (a conservative assumption).

Electricity:

- Emissions associated with airfield operation only were included (excluding the control tower or activities on the apron). Electricity usage included mid-markers, radar, Doppler, glide paths, stores, runway lighting and localiser
- Energy usage for one of the airfield lighting equipment rooms was unavailable and assumed to be the same as one for which data were available. The same approach was applied to a mid-marker
- Emissions intensity of grid electricity in Victoria was derived for future years from modelling undertaken by Jacobs (Jacobs, 2016). See Table B11.12.

Ground support equipment:

- It was assumed for the purposes of allocating the emissions to the correct scope, that 100 per cent of GSE is owned and operated by airlines and other tenants (Scope 3a).

Aircraft – LTO cycle:

- AEDT provides outputs as total CO_2 for each stage of the LTO cycle, summed by aircraft type.

A summary of the activity data used in determining operational GHG emissions for the future Build and No Build scenarios is presented in Table B11.9.

The information presented is headline (i.e. totals only). There is a wide array of data that sits underneath these totals (such as breakdown by vehicle type and time of day for Vehicle Kilometres Travelled (VKTs)). However, it would not be feasible to present all of these inputs. Note that ATMs for 2021 are the same for both Build and No Build scenarios. Under the Build scenario, Melbourne Airport would be operating these flights over three runways; under No Build only two runways would be operating.

The emissions factors used in the assessment of operational GHG emissions are presented in Table B11.10 to Table B11.12.

Table B11.10 presents emissions factors developed and published by the Commonwealth Government in its annual National Greenhouse Accounts Factors 2020 (DoISER), 2019).

Table B11.11 presents emissions factors derived from ICAO (ICAO 2011).

The emissions factors in Table B11.12 represent the Scope 2 emissions factors used for future electricity consumption in Victoria. Scope 3 emissions associated with electricity generation were unavailable for future years and conservatively assumed to stay at present-day levels.

Table B11.9
Operational GHG assessment – summary of annual activity data

Activity	Data	Scenario	Value	Units
Passenger access	Total VKT for all vehicles on access network per year (with Airport Rail)	2026 No Build	454,227,715	VKT
		2026 Build	465,318,012	VKT
		2031 No Build	513,949,730	VKT
		2031 Build	548,900,982	VKT
		2046 No Build	693,115,774	VKT
		2046 Build	799,649,891	VKT
Purchased electricity	Electricity consumption in the airfield.	2026 No Build	1,310,167	kWh
		2026 Build	1,965,251	kWh
		2031 No Build	1,310,167	kWh
		2031 Build	1,965,251	kWh
		2046 No Build	1,310,167	kWh
		2046 Build	1,965,251	kWh
Fuel Combustion – Diesel (transport)	Fuel (diesel) consumption by GSE. Activity available in CO_2 only (due to emissions factors used)	2026 No Build	9,919	tCO_2
		2026 Build	9,917	tCO_2
		2031 No Build	10,767	tCO_2
		2031 Build	11,438	tCO_2
		2046 No Build	10,908	tCO_2
		2046 Build	15,990	tCO_2
Fuel combustion – diesel (stationary)	Fuel (diesel) consumption by standby generators.	2026 No Build	7.97	kL
		2026 Build	7.97	kL
		2031 No Build	8.65	kL
		2031 Build	9.19	kL
		2046 No Build	8.78	kL
		2046 Build	12.90	kL
Fuel combustion kerosene - for use as fuel in an aircraft (transport fuel) – landing and take-off cycle and APU usage	Aircraft movements (total) projected, and part of the input into AEDT	2026 No Build	299,832	ATMs (number)
		2026 Build	299,780	ATMs (number)
		2031 No Build	325,468	ATMs (number)
		2031 Build	345,748	ATMs (number)
		2046 No Build	329,732	ATMs (number)
		2046 Build	483,340	ATMs (number)

Table B11.10
Emissions factors – National Greenhouse Accounts Factors 2019 – operational

Source	Reference unit	Emissions (kgCO_2e per reference unit)				Scope 3 kgCO_2e
		CO_2	CH_4	N_2O	Total (CO_2e)	
Kerosene – for use as fuel in an aircraft (transport energy)	kL	2,572.32	0.37	22.08	2,594.77	132.48
Kerosene – for use as fuel in an aircraft (stationary energy (APU usage))	kL	2,561.28	0.74	7.36	2,569.38	132.48
Gasoline (other than for use as fuel in an aircraft) (transport energy)	kL	2,305.08	17.1	61.56	2,383.74	123.12
Diesel oil (transport energy)	kL	2,698.14	3.86	19.3	2,721.30	138.96
Diesel oil (stationary energy)	kL	2,698.14	3.86	7.72	2,709.72	138.96
Electricity (Vic.)	kWh	–	–	–	0.98	0.11

Source: NGER, 2019

Table B11.11
Emissions factors from ICAO

Source	Reference unit	Emissions (kgCO_2-e per reference unit)			
		CO_2	CH_4	N_2O	Total (CO_2-e)+++
Ground support equipment – narrow bodied aircraft	ATM	18	0.03 +	0.13 +	18.16
Ground support equipment – wide bodied aircraft	ATM	58	0.08 +	0.41 +	58.49
Auxiliary power units – narrow bodied aircraft ++	ATM	256.13	0.04	2.21	258.38
Auxiliary power units – wide bodied aircraft ++	ATM	960.48	0.14	8.28	968.90

Source: ICAO, 2011
Table Notes: + Emissions for CH_4 and N_2O in the above table are derived from NGA factors, as only CO_2 is reported from the source. ++ Data are presented in the source in fuel consumption and are converted here into emissions based on the emissions presented in Table B11.10 for kerosene for use as fuel in an aircraft (transport energy). Original data are 80 kilograms fuel and 300 kilograms fuel per ATM for narrow body and wide body aircraft respectively. +++Where figures have been rounded discrepancies may occur between totals and the sums of component items.

Table B11.12
Future electricity greenhouse gas emissions intensity

Year	Emissions intensity – scope 2 (kgCO_2-e/kWh)
2026	0.98
2031	0.92
2046	0.53

Source: Jacobs, 2016
Table Notes: The emission factors are derived from Jacobs (2016) by developing a scaling factor from their modelling and applying it to the M3R scenarios for 2026, 2031 and 2046.

B11.5 EXISTING CONDITIONS

For the GHG assessment, only operational emissions are detailed in the baseline assessment as the construction emissions are not relevant.

B11.5.1 Baseline results

The baseline results are presented in **Table B11.13** and **Figure B11.1** and **Figure B11.2**. The emissions have been presented in the scope classifications as recommended by Airports Council International (ACI, 2009).

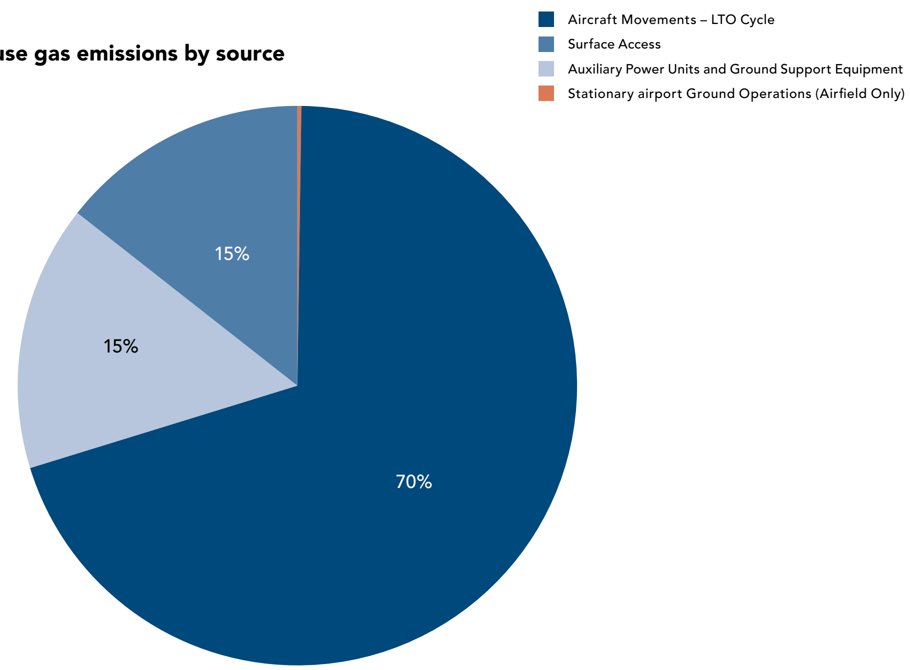
Table B11.13
Baseline operational GHG emissions

Source	Emission Factor	Activity data	Activity data unit	Scope 1 greenhouse gases (tCO_2-e)	Scope 2 greenhouse gases (tCO_2-e)	Scope 3a greenhouse gases (tCO_2-e)	Scope 3b greenhouse gases (tCO_2-e)	Total greenhouse gases (tCO_s-e)
Stationary airport Ground Operations (Airfield Only)								
Electricity – airfield	Electricity	1,310,167	kWh		1,284		144	1,467
Diesel – standby generators	Diesel oil (stationary energy)	6,754	L	18			1	19
Sub-total				18	1,284		145	1,486
Aircraft movements – LTO cycle								
Aircraft – descent	Kerosene – for use as fuel in an aircraft (transport energy)	N/A	AEDT				102,203	102,203
Aircraft – taxiing and idle	Kerosene – for use as fuel in an aircraft (transport energy)	N/A	AEDT			68,721		68,721
Aircraft – take off	Kerosene – for use as fuel in an aircraft (transport energy)	N/A	AEDT				48,937	48,937
Aircraft – climb out	Kerosene – for use as fuel in an aircraft (transport energy)	N/A	AEDT				225,295	225,295
Sub-total				–	–	68,721	376,435	445,155
Auxiliary power units and ground support equipment								
Auxiliary power units	Kerosene – for use as fuel in an aircraft (transport energy)					84,816	4,370	89,186
Ground support equipment	Diesel oil (transport energy)					8,412		8,412
Sub-total						93,228	4,370	97,598
Surface access								
Road	Multiple			-	-	-	91,612	91,612
Sub-total				-	-	-	91,612	91,612
TOTAL				18	1,284	161,948	472,562	635,812

The largest source of baseline operational GHG emissions comes from the aircraft movements (70 per cent) as shown in **Figure B11.1**. The next largest component is the use of APUs and GSE for aircraft while on the ground, closely followed by surface access. Ground-based stationary energy (diesel for generators and airfield electricity consumption) is relatively insignificant.

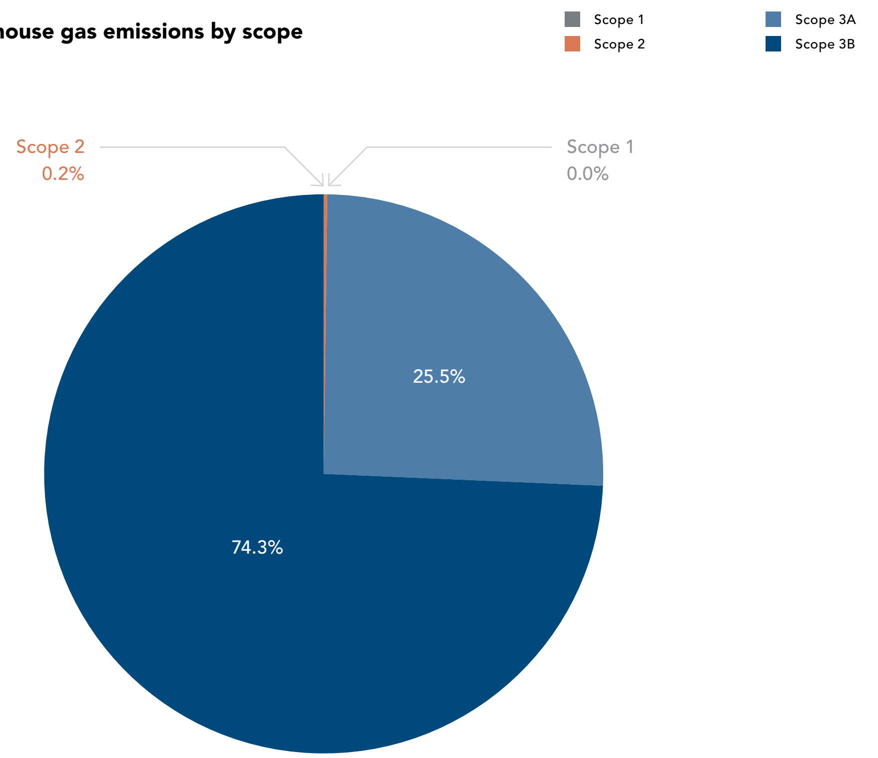
Figure B11.2 shows that the vast majority of emissions fall into a Scope 3 category. This means Melbourne Airport can influence, but does not have direct control over, these emissions sources. These emissions are mostly the responsibility of the airlines, the LTO cycle of aircraft and operation of APUs/ GSE which they do not own or control. The Melbourne Airport Scope 1 and Scope 2 emissions sources are much smaller.

Figure B11.1
Baseline operational greenhouse gas emissions by source



Source: APAM

Figure B11.2
Baseline operational greenhouse gas emissions by scope



Source: APAM

B11.5.2
Baseline emissions

Table B11.14 provides a summary of the results for the baseline, with detail on the units and metrics assessed – i.e. the total emissions, the total emissions per passenger, and the total emissions per ATM. Emissions associated with the LTO cycle are included.

Table B11.14
Baseline GHG emissions results – units and metrics

Parameter	Baseline
Passengers (no.)	37,395,992
Air traffic movements (no.)	254,280
Total emissions (Scope 1, 2 & 3 tCO_2-e/year)	635,812
Emissions per passenger (Scope 1, 2 & 3 tCO_2-e/passenger)	0.017
Emissions per ATM (Scope 1, 2 & 3 tCO_2-e/ATM)	2.50

Table Notes: Passenger numbers have been taken from the 2018/19 NGER Report Total emissions differ those presented in the 2018/19 NGER Report due to different emissions inventory boundaries and emissions scopes included.

B11.6
ASSESSMENT OF POTENTIAL IMPACTS

The assessment of potential impacts for GHG emissions is presented as a construction assessment and an operational assessment, before the results are combined.

B11.6.1
Construction

The results of the construction GHG assessment are presented in **Table B11.15**, **Figure B11.3** and **Figure B11.4**.

Table B11.15
Results – construction GHG assessment

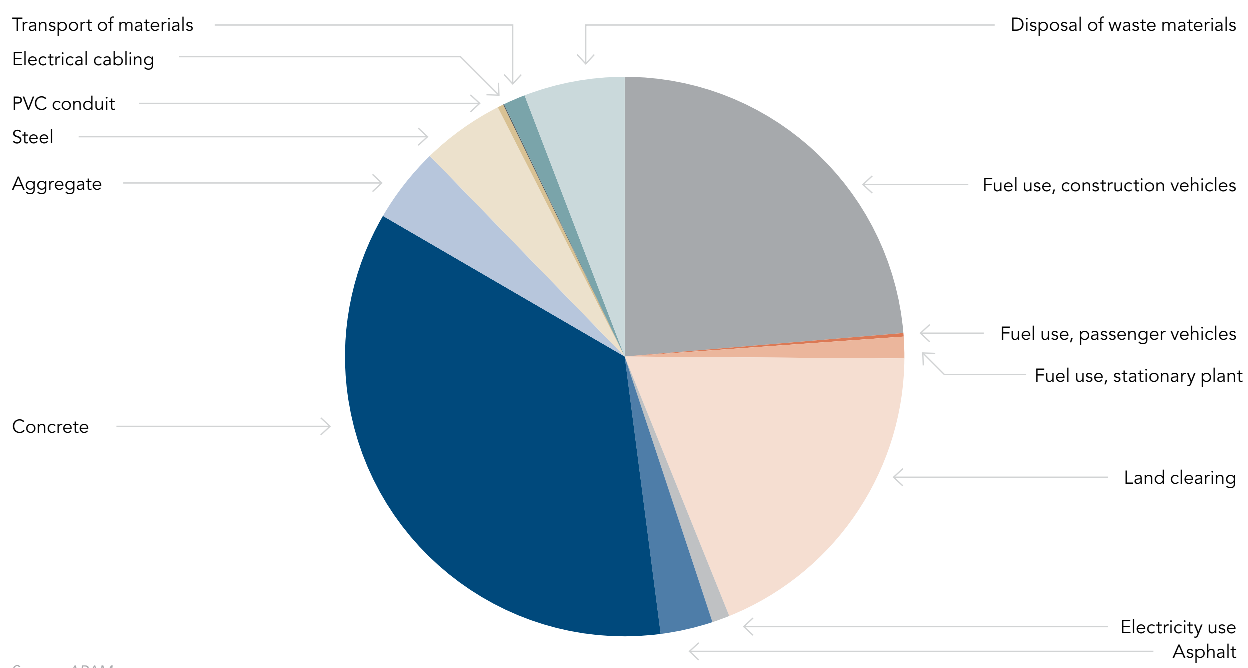
Source	Emissions (tCO_2e)			
	Scope 1	Scope 2	Scope 3	Total
Fuel use, construction vehicles	95,018		4,851	99,869
Fuel use, passenger vehicles	816		42	858
Fuel use, stationary plant	5,008		257	5,265
Land clearing	79,315			79,315
Electricity use		3,836	434	4,297
Asphalt			12,777	12,777
Concrete			149,571	149,571
Aggregate			18,352	18,352
Steel			20,144	20,144
PVC conduit			1,453	1,453
Electrical cabling			224	224
Transport of materials			5,366	5,366
Disposal of waste materials			24,603	24,603
Total	180,157	3,836	238,074	422,094

Table Notes: Where figures have been rounded discrepancies may occur between totals and the sums of component items.

The results in **Figure B11.3** and **Figure B11.4** show that the emissions are dominated by Scope 1 and 3 sources. This is largely due to fuel use by construction vehicles, land clearing (both Scope 1) and embedded emissions in the concrete used during construction (Scope 3).

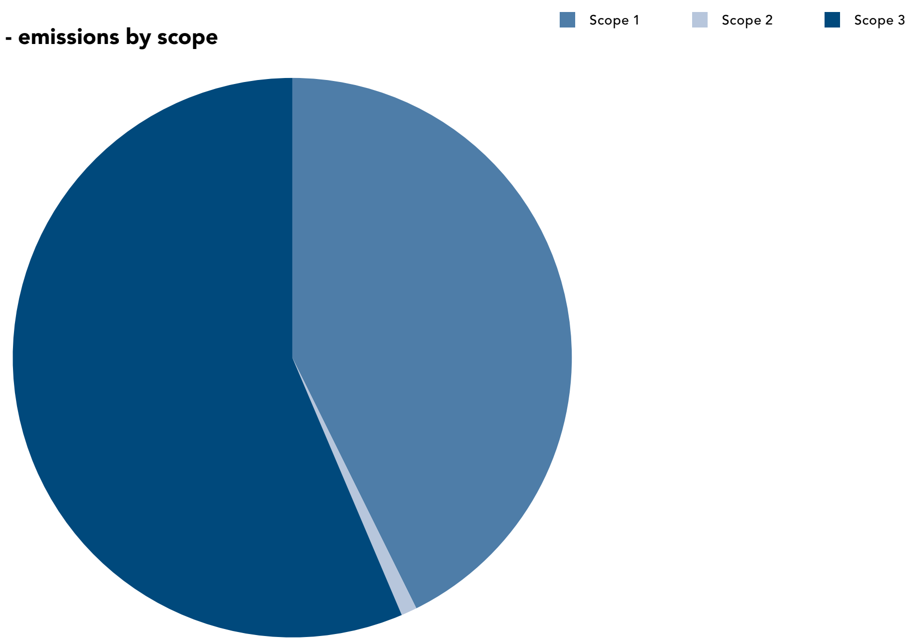
The duration of the construction program is four to five years. Four years (48 months) has been conservatively applied for following calculations. Assuming emissions were generated linearly across this period, this would result in annual average emissions of 46,005 tonnes CO_2-e/year (for Scope 1 and 2 sources) and 105,524 tonnes CO_2-e/year (for all scopes). Emissions from potential NGER reportable emissions sources (scopes 1 and 2 minus land clearing emissions) would be approximately 26,176 tonnes CO_2-e/year.
This would represent an approximate 47 per cent increase on 2019/20 NGER emissions for Melbourne Airport for the four years of construction (however note that assumptions regarding fuel and electricity consumption for construction are conservative, and this number would be expected to be at the upper limit of the expected range).

Figure B11.3
Construction GHG assessment – emissions by source



Source: APAM

Figure B11.4
Construction GHG assessment - emissions by scope



Source: APAM

The severity of construction related emissions has been categorised as minor adverse where they relate to those sources forming a significant contribution to the identified impact (i.e. from fuel combustion or material use). This is because the projected emissions, based on worst-case assumptions, sit on the borderline of the annual NGER threshold of 25,000 tonnes CO_2.e/year. It is expected the actual amount would be low enough to warrant a minor adverse rating.

B11.6.2
Operation

The results of the operational GHG assessment are presented in **Table B11.16** and **Figure B11.5** and **Figure B11.6**.

The results show that emissions substantially increase in the period 2026 to 2046 between the No Build and Build scenarios (approximately 0.27 megatonnes CO_2-e/year). This is the expected result given the additional air traffic that will use M3R.

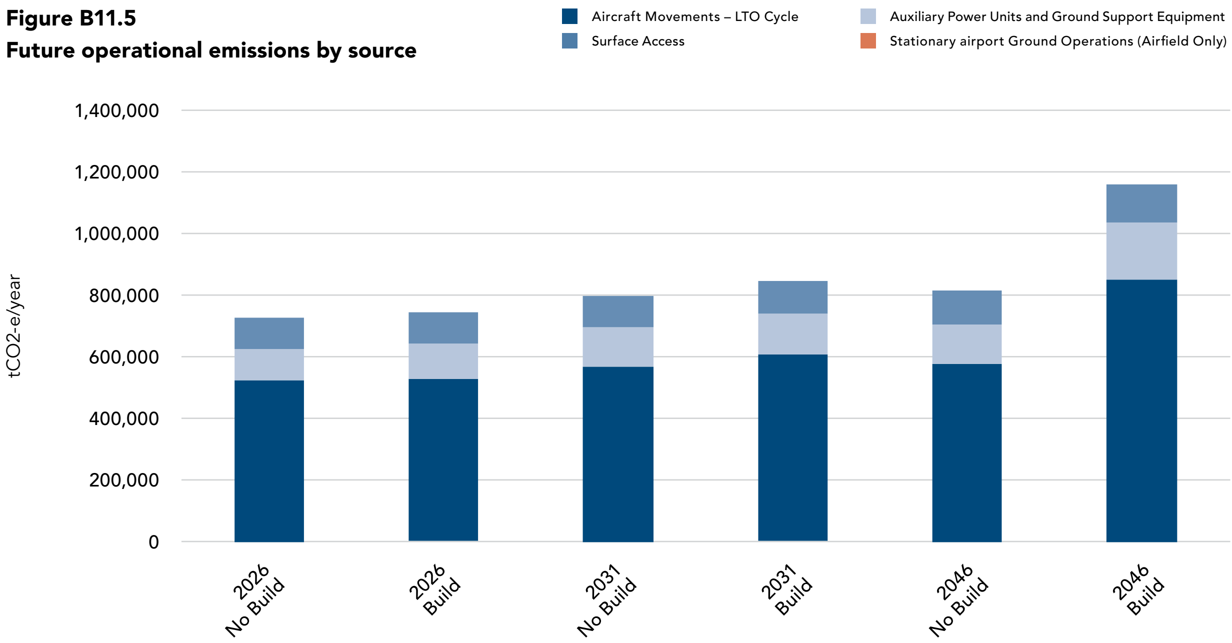
Decreases in emissions associated with electricity consumption on-site over time are related to the future reduction in the electricity grid's emissions intensity.

Table B11.16
Results – operational GHG assessment

Source	Emission Factor	Annual GHG emissions (tCO_2-e)					
		2026 No Build	2026 Build	2031 No Build	2031 Build	2046 No Build	2046 Build
Electricity – airfield	Electricity	1,428	2,142	1,355	2,032	841	1,262
Diesel – standby generators	Diesel oil (stationary energy)	23	23	24	26	25	37
Sub-total		1,451	2,165	1,379	2,058	866	1,299
Aircraft – descent	Kerosene – for use as fuel in an aircraft (transport energy)	120,600	120,600	130,820	138,997	132,864	195,208
Aircraft – taxi	Kerosene – for use as fuel in an aircraft (transport energy)	81,090	81,090	87,962	93,460	89,337	131,256
Aircraft – take off	Kerosene – for use as fuel in an aircraft (transport energy)	57,745	57,745	62,639	66,554	63,618	93,469
Aircraft – climb out	Kerosene – for use as fuel in an aircraft (transport energy)	265,848	265,848	288,378	306,401	292,884	430,314
Sub-total		525,284	525,284	569,799	605,412	578,702	850,247
Auxiliary power units	Kerosene – for use as fuel in an aircraft (transport energy)	89,186	105,145	114,154	121,267	115,650	169,526
Ground support equipment	Diesel oil (transport energy)	9,919	9,917	10,767	11,438	10,908	15,990
Sub-total		99,105	115,062	124,921	132,705	126,558	185,516
Surface Access - Road	Multiple	101,530	104,199	103,261	109,602	108,454	125,812
Sub-total		101,530	104,199	103,261	109,602	108,454	125,812
TOTAL		727,370	746,710	799,361	849,777	814,580	1,162,874

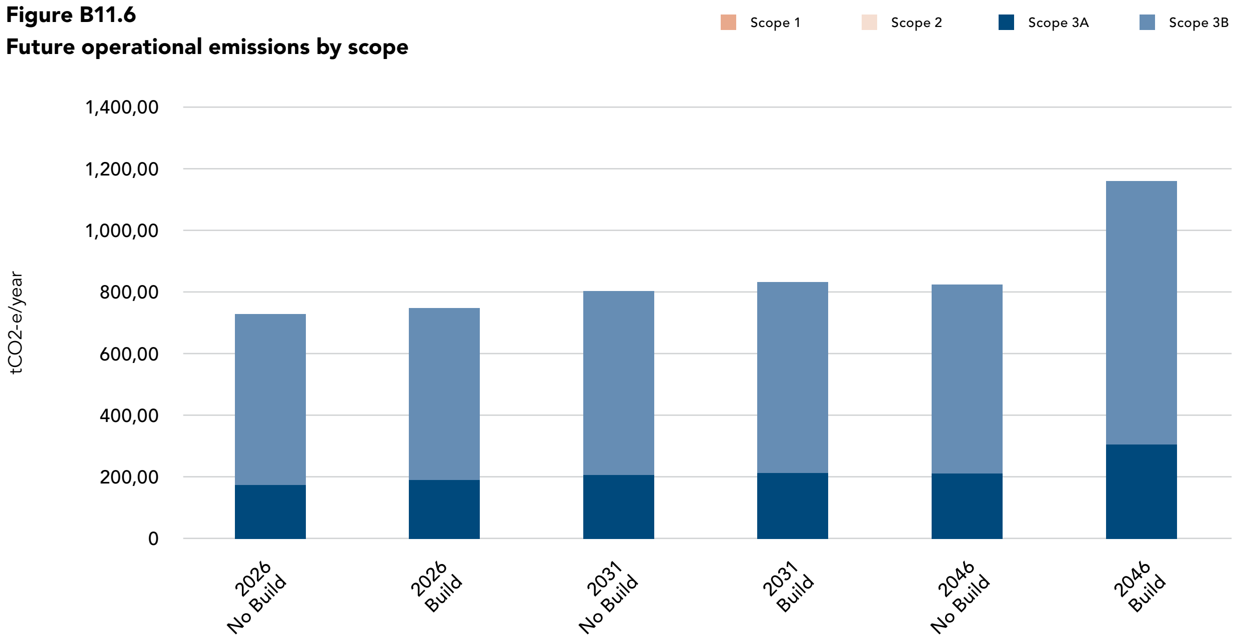
Table Notes: Where figures have been rounded discrepancies may occur between totals and the sums of component items.

Figure B11.5
Future operational emissions by source



Source: APAM

Figure B11.6
Future operational emissions by scope



Source: APAM

Figure B11.7 shows a cumulative emissions profile for M3R. This focuses on the construction emissions, and the difference between the Build and No Build scenarios only. C1-C4 represent the four years of construction. The difference between Build and No Build emissions for 2026 and 2046 is inserted, and linearly interpolated for the years in between. The figures show that over the construction period, and for 21 years of operation, M3R will contribute approximately 4.3 megatonnes CO_2-e above forecast emissions for the No Build scenario.

B11.6.3
Summary and review relative to functional units

Table B11.17 compares the results for each of the scenarios modelled according to the functional units (i.e. the total emissions, the total emissions per passenger and the total emissions per ATM). These results include emissions for two operational runways in the No Build scenarios, and three runways in the Build scenarios.

For emissions per ATMs, the No Build scenarios slightly increase between 2026 and 2046 while there is a slight decrease in emissions per ATMs under the Build scenario.

Figure B11.7
Cumulative emissions profile – construction and operation

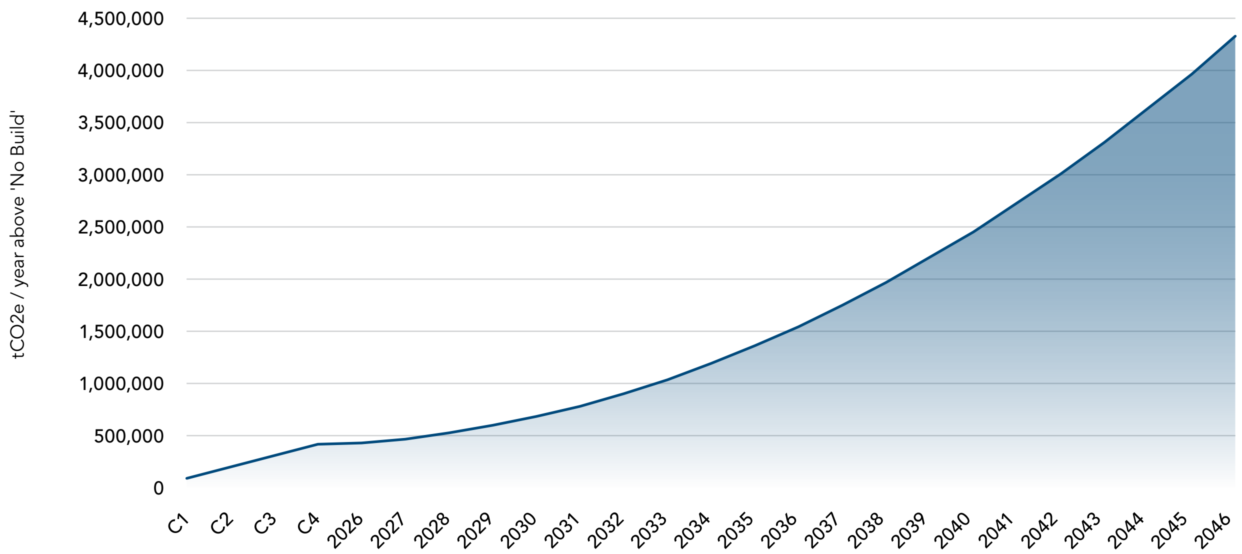


Table B11.17
GHG emissions results – functional unit comparison

Parameter	Annual GHG emissions (tCO_2-e)					
	2026 No Build	2026 Build	2031 No Build	2031 Build	2046 No Build	2046 Build
Passengers (no.)	47,300,000	47,300,000	54,400,000	56,900,000	60,000,000	83,800,00
ATM (no.)	299,832	299,780	325,468	345,748	329,732	483,340
Total emissions (all scopes) (tCO_2-e/year)	727,370	746,710	799,361	849,777	814,580	1,162,874
Emissions per passenger (all scopes) (tCO_2-e/passenger)	0.015	0.016	0.015	0.015	0.014	0.014
Emissions per ATM (all scopes) (tCO_2-e/ATM)	2.43	2.49	2.46	2.46	2.47	2.41

Latest data available for Australian and Victorian annual GHG emissions is 2018 data (AGEIS, 2020). This shows emissions inventories of:

- 537,446 kilotonnes CO_2-e per year – for Australia
- 102,189 kilotonnes CO_2-e per year – for Victoria.

The additional impact of M3R above the No Build scenario would be:

- 2026 – 19 kilotonnes CO_2-e per year (0.004 per cent of national emissions/0.02 per cent of Victorian emissions)
- 2031 – 50 kilotonnes CO_2-e per year (0.009 per cent of national emissions/0.05 per cent of Victorian emissions)
- 2046 – 348 kilotonnes CO_2-e per year (0.06 per cent of national emissions/0.34 per cent of Victorian emissions).

Based on Table B11.1's severity ratings, Scope 1 and 2 emissions impacts associated with operational energy consumption (airfield electricity consumption and generator fuel use) have been rated as negligible. Impacts associated with aircraft fuel consumption have been rated as high adverse, based on the relative contribution they make to current national and Victorian emissions inventories.

B11.7
AVOIDANCE, MANAGEMENT AND MITIGATION MEASURES

This section gives an overview of the carbon-emission abatement initiatives being reviewed as part of M3R, focusing on measures under the control of Melbourne Airport.

Section B11.7.2 presents the results of the residual significance assessment after taking these measures into account.

B11.7.1
Abatement options

M3R still requires its final detailed design, airline negotiations and construction feasibility. It is therefore not possible at present to identify all the initiatives to reduce the projected construction and operational GHG emissions under Melbourne Airport's control.

However, Melbourne Airport is committed to abate emissions by reducing M3R's:

- Construction GHG emissions where possible
- Operational GHG emissions under the control of Melbourne Airport (Scope 1 and 2) where possible.

To inform the selection of GHG mitigation measures in the detailed design the following options have been identified.

B11.7.1.1
Construction

Measures to reduce emissions production during construction of the new north-south runway (16R/34L) include:

- Minimising the construction footprint and vegetation removal
- Greater substitution of cementitious materials for Portland cement during concrete works, and greater use of recycled steel
- Local sourcing strategies (i.e. selection of construction materials from local suppliers)
- The potential to use alternative forms of concrete reinforcements, where feasible, to reduce steel consumption (including polymer, fibre and steel fibre reinforcement)
- The potential to specify warm-mix asphalt over hot-mix asphalt to reduce the embodied energy of this essential construction material
- Focusing on an overall reduction in the total construction material requirement where feasible
- Managing site works (and broader construction opportunities) to achieve as closely as possible a neutral cut-and-fill balance (that is, to reuse excavated materials on-site where feasible)
- Managing any contaminated land in situ where feasible to avoid the bulk export and import of materials to and from site (subject to legislative and regulatory requirements)
- The use of energy efficient vehicles and biofuels in the construction process
- Re-use of green waste on site e.g. compost.

B11.7.1.2
Operation

Measures to reduce emissions production during operations of the new north-south runway (16R/34L) include:

- Sustainable energy generation, including solar
- Low emission options for on-site transport given airports require a significant variety of on-site transport such as shuttle buses and luggage handling vehicles. Electrification, high efficiency and E10 (unleaded petrol blended with 9 to 10 per cent ethanol) are potential options for to be further explored
- Efficient taxiing of aircraft (thereby reducing the time from taxi to runway) is explained in the mitigation measures section of **Chapter B10: Air Quality**
- The use of high energy efficiency plant and equipment (such as tunnel lighting and ventilation) where appropriate
- Operational commitments associated with Melbourne Airport's TAKE2 pledge.

B11.7.2
Significance assessment

The assessment of severity (based on the descriptions in **Table B11.1**) has taken a broad approach whereby:

- The non-mitigated severity of construction related emissions has been categorised as minor adverse where they relate to sources forming a significant contribution to the identified impact (i.e. from fuel combustion or material use). This is because the projected emissions are, using worst-case assumptions, on the borderline of the annual NGER threshold of 25,000 tonnes CO_2-e/year. It is expected the actual amount would be low enough to warrant a minor adverse rating.
- The severity of operational emissions has been categorised based on the emissions of the nominated source (rather than the total emissions of operation).

The full summary assessment is contained in **Table B11.19**, with a summary of the residual significance assessment provided in **Table B11.18**. This assessment considers the application of the above mitigation measures.

Attaining Victorian, national and international commitments for carbon neutral growth, and achievement of carbon neutrality, would make a significant change to the identified severity ratings. However, these are outside the scope of the MDP and are instead considered by the Master Plan and Environment Strategy for the airport.

Table B11.18
Results of residual significance assessment – GHG impact

Impact	Severity	Likelihood	Impact risk
Construction			
Construction materials – embodied carbon – indirect (scope 3) impact associated with the manufacture of construction materials used (material manufacture).	Minor adverse	Likely	Medium
Construction materials – embodied carbon – indirect (scope 3) impact associated with the transport of construction materials used (material transport).	Minor adverse	Likely	Medium
Earthworks – GHG emissions – direct (scope 1) impacts associated with fuel use in construction vehicles on-site and indirect (scope 3) impacts associated with off-site haulage – reducing haulage emissions.	Minor adverse	Likely	Medium
Earthworks – GHG emissions – direct (scope 1) impacts associated with fuel use in construction vehicles on-site and indirect (scope 2 and scope 3) impacts associated with material treatment in off-site facilities (management of contaminated land).	Minor adverse	Likely	Medium
Earthworks – GHG emissions – direct (scope 1) impacts associated with fuel use in construction vehicles, plant and equipment on site; direct (scope 1) emissions relating to loss of carbon sink.	Minor adverse	Likely	Medium
Construction fuel and energy use – GHG emissions – direct (scope 1) impacts associated with fuel use in construction vehicles on-site and indirect (scope 3) emissions associated with fuel supply chain.	Minor adverse	Likely	Medium
Operation			
Purchased electricity for lighting (airfield) – GHG emissions – indirect (scope 2) impacts associated with imported electricity use (incremental electricity consumption compared to the No Build scenario). Note: airfield lighting makes up approximately half of the overall electrical load of M3R.	Negligible	Likely	Negligible
Purchased electricity for ventilation/lighting (tunnel) – GHG emissions – indirect impact (scope 2 emissions): jet fans required for longitudinal ventilation and smoke control within tunnel; in-tunnel lighting.	Negligible	Likely	Negligible
Fuel consumption from aircraft movements – GHG emissions – indirect (scope 3) impacts associated with aircraft fuel use during LTO cycle up to 10,000 feet AGL, and whilst on stand.	High adverse	Likely	High

B11.8
CONCLUSION

The greenhouse gas assessment has determined the expected emissions of GHGs associated with the construction and operation of M3R compared to the No Build scenarios. It identified that the construction of M3R would result in emissions of 422 kilotonnes CO_2-e over the four years of construction (Scopes 1, 2 and 3).

Operation of M3R would result in the following emissions:

- 2026 – 19 kilotonnes CO_2-e per year (0.003 per cent of national emissions/0.02 per cent of Victorian emissions)
- 2031 – 50 kilotonnes CO_2-e per year (0.009 per cent of national emissions/0.05 per cent of Victorian emissions)
- 2046 – 348 kilotonnes CO_2-e per year (0.06 per cent of national emissions/0.34 per cent of Victorian emissions).

The vast majority of these emissions are related to aircraft in the LTO cycle and auxiliary power units. These are both Scope 3 sources, i.e. emissions associated with M3R but from sources not owned or operated by Melbourne Airport. Emissions associated with surface access (employees and passengers accessing the airport using the current road network) are also a material contributor to forecast emissions; however, Scope 1 and 2 emissions (direct emissions from sources owned and operated by Melbourne Airport, as well as emissions associated with electricity consumption) are minimal given the magnitude of other sources.

While these emissions are relatively low, Melbourne Airport understands the importance of taking action and is committing to abate emissions by reducing M3R's:

- Construction GHG emissions where possible
- Operational GHG emissions under the control of Melbourne Airport (Scope 1 and 2) where possible.

Melbourne Airport is committed to the TAKE2 pledge, part of a strategy to achieve carbon neutrality in Victoria by 2050. Melbourne Airport will need to consider a range of GHG mitigation and offset options as its contribution to this pledge. In addition, there is a range of national commitments to support sustainable aviation including:

- Improvement in aircraft energy efficiency
- Improvement in aircraft routing and handling
- Increased use of low energy technology for aircraft at stand
- Research for sustainable aviation biofuels
- Establishment of forums for the exchange of best practice ideas.

Melbourne Airport has now achieved Level 2 carbon accreditation under the Airport Carbon Accreditation (ACA) framework. The framework will also capture its revised carbon reduction target and associated carbon management plan recently developed.

Internationally, ICAO has reached a commitment to achieve carbon neutral growth in international aviation emissions from 2020. Australia committed to participating in this scheme from the outset. This involves baselining international aviation emissions in 2019 and 2020 and offsetting any emissions from 2021 onwards that are in excess of this baseline. **Table B11.19** below provides a summary of the GHG impact assessment.

Table B11.19
GHG impact assessment summary

Environmental aspect & baseline condition	Description and characterisation of impact: Original Impact	Mitigation inherent in design/ practice	Temporal	Significance assessment: Severity	Likelihood	Impact risk	Mitigation or management measures	Description of residual impact: Impact	Temporal	Significance assessment: Severity	Likelihood	Impact risk
Construction							**Construction (cont.)**					
Construction materials – embodied carbon (material manufacture) N/A	Without mitigation management measures and controls, indirect (scope 3) impact associated with the manufacture of construction materials used	Roads: potential for alternate and reuse of material to reduce embodied impact and carbon profile	Permanent	Minor adverse	Likely	Medium	Melbourne Airport commitment to reduce M3R construction greenhouse gas emissions by up to 10 per cent below a business as usual approach	Reduction in construction greenhouse gas emissions by up to 10 per cent	Permanent	Minor adverse	Likely	Medium
Construction materials – embodied carbon (material transport) N/A	Without mitigation management measures and controls, indirect (scope 3) impact associated with the transport of construction materials used	Roads: potential for alternate and reuse of material to reduce embodied impact and carbon profile	Permanent	Minor adverse	Likely	Medium	Melbourne Airport commitment to reduce M3R construction greenhouse gas emissions by 10 per cent below a business as usual approach	Reduction in construction greenhouse gas emissions by 10 per cent	Permanent	Minor adverse	Likely	Medium
Earthworks – GHG emissions – reducing haulage emissions N/A	Without mitigation management measures and controls, direct (scope 1) impacts associated with fuel use in construction vehicles on-site and indirect (scope 3) impacts associated with off-site haulage	Earthworks: minimise cut and fill to reduce material impacts and carbon profile, potential for conservation of on-site resources. Minimise any off-site disposal. Unsuitable material will be used in landscaping. All topsoil will be reused on-site.	Permanent	Minor adverse	Likely	Medium	Melbourne Airport commitment to reduce M3R construction greenhouse gas emissions by 10 per cent below a business as usual approach	Reduction in construction greenhouse gas emissions by 10 per cent	Permanent	Minor adverse	Likely	Medium
Earthworks – GHG emissions – management of contaminated land N/A	Without mitigation management measures and controls, direct (scope 1) impacts associated with fuel use in construction vehicles on-site and indirect (scope 2 and scope 3) impacts associated with material treatment in off- site facilities.	Earthworks: minimise cut and fill to reduce material impacts and carbon profile, potential for conservation of on-site resources.	Permanent	Minor adverse	Likely	Medium	Melbourne Airport commitment to reduce M3R construction greenhouse gas emissions by 10 per cent below a business as usual approach	Reduction in construction greenhouse gas emissions by 10 per cent	Permanent	Minor adverse	Likely	Medium
Earthworks – GHG emissions – vegetation clearance N/A	Without mitigation management measures and controls, direct (scope 1) impacts associated with fuel use in construction vehicles, plant and equipment on site; direct (scope 1) emissions relating to loss of carbon sink.	Airfield pavements, including landscaping: potential for alternate and reuse of material to reduce embodied impact and carbon profile, use of native vegetation for landscaping and urban design considerations	Permanent	Minor adverse	Likely	Medium	Melbourne Airport commitment to reduce M3R construction greenhouse gas emissions by 10 per cent below a business as usual approach	Reduction in construction greenhouse gas emissions by 10 per cent	Permanent	Minor adverse	Likely	Medium
Construction fuel and energy use – GHG emissions N/A	Without mitigation management measures and controls, direct (scope 1) impacts associated with fuel use in construction vehicles on-site and indirect (scope 3) emissions associated with fuel supply chain.	Optimising sourcing of fill for M3R on-site to minimise haulage transport consumption.	Permanent	Minor adverse	Likely	Medium	Melbourne Airport commitment to reduce M3R construction greenhouse gas emissions by 10 per cent below a business as usual approach	Reduction in construction greenhouse gas emissions by 10 per cent	Permanent	Minor adverse	Likely	Medium

Environmental aspect & baseline condition (cont.)	Description and characterisation of impact (cont.)						Mitigation or management measures (cont.)	Description of residual impact (cont.)				
	Original Impact	Mitigation inherent in design/ practice	Temporal	Significance assessment				Impact	Temporal	Significance assessment		
				Severity	Likelihood	Impact risk				Severity	Likelihood	Impact risk
Operation							**Operation (cont.)**					
Purchased electricity for lighting (airfield) – GHG emissions Note: total M3R demand approximately 4MW, compared to Melbourne Airport 30MW peak demand.	Without mitigation management measures and controls, indirect (scope 2) impacts associated with imported electricity use (incremental electricity consumption compared to the No Build scenario). Note: airfield lighting makes up approximately half of the overall electrical load of the M3R.	Airfield ground lighting: reduction in energy profile through low energy lighting/reward prevention of light spill. The lighting design for operation complies with AS4282 'control of the obtrusive effects of outdoor lighting' and AS1158 'road lighting'.	Permanent	Negligible	Likely	Negligible	Melbourne Airport commitment to reduce M3R operational greenhouse gas emissions, under the control of Melbourne Airport (scope 1 and 2), by 10 per cent below a business as usual approach	Reduction in operational greenhouse gas emissions by 10 per cent	Permanent	Negligible	Likely	Negligible
Purchased electricity for ventilation/ lighting (tunnel) – GHG emissions Note: total M3R demand approximately 4MW, compared to Melbourne Airport 30MW peak demand.	Without mitigation management measures and controls, indirect impact (scope 2 emissions): jet fans required for longitudinal ventilation and smoke control within tunnel; in-tunnel lighting.	Tunnel and structures: reduce energy consumption associated with mechanical tunnel ventilation and tunnel lighting	Permanent	Negligible	Likely	Negligible	Melbourne Airport commitment to reduce M3R operational greenhouse gas emissions, under the control of Melbourne Airport (scope 1 and 2), by 10 per cent below a business as usual approach	Reduction in operational greenhouse gas emissions by 10 per cent	Permanent	Negligible	Likely	Negligible
Fuel consumption from aircraft movements – GHG emissions N/A	Without mitigation management measures and controls, indirect (scope 3) impacts associated with aircraft fuel use during LTO cycle up to 10,000 feet AGL, and whilst on stand.	Airfield planning: airfield layout to minimise impact on ground based environmental and heritage aspects and to seek opportunities for enhancement. Airline carbon offset mitigation programs.	Permanent	High adverse	Likely	High	Support ongoing state, national and international commitments to reduce and offset aviation emissions	These emissions are outside the scope of Melbourne Airport to directly control and therefore the residual impact remains	Permanent	High adverse	Likely	High

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Chapter B12 Landscape and Visual

Summary of key findings:

- Melbourne Airport has been operating since the early 1970s, so is well established within the landscape. The proposed development of Melbourne Airport's Third Runway (M3R) is generally consistent with the airport planning framework contemplated by the Commonwealth Government's 1990 Environmental Impact Statement. The community has been informed of proposed developments and impacts through subsequent statutory Master Plans that have been approved since 1997.
- Construction of M3R has the potential to impact the site's landscape values due to the removal of vegetation, and earthworks that will alter the landform. The visual impacts caused by earthworks and the removal of part of the Grey Box Woodland would be permanent; however, the visual impacts caused by other construction activity will be short term. These impacts will be seen in the context of the existing airport and are unlikely to be significant.
- When M3R becomes operational, there will be a moderate impact on views from rural landscapes due to vistas being opened to M3R and existing areas of the airport.

CHAPTER B12 CONTENTS

CHAPTER B12 CONTENTS (cont.)

CHAPTER B12 FIGURES

CHAPTER B12 FIGURES (cont.)

CHAPTER B12 TABLES

B12.1 INTRODUCTION

This chapter describes the study area's existing landscape and visual conditions and the applicable legislation and policy requirements. It then identifies the potential impact of Melbourne Airport's Third Runway (M3R) on the area's existing landscape and views in the daytime and night-time. Where practicable, this assessment identifies the specific measures that can be used to avoid, manage, mitigate and/or monitor impacts.

This work was undertaken for Melbourne Airport by specialist consultants IRIS Visual Planning and Design.

For the purposes of this chapter, 'study area' refers to the M3R project area and the surrounding landscape that may be impacted by the project. The 'project area' refers only to that area defined by the maximum extent of disturbance associated with the M3R construction process (as shown in **Chapter A4: Project Description**, **Figure A4.1: M3R Overview**).

B12.2 METHODOLOGY AND ASSUMPTIONS

This landscape and visual impact assessment was undertaken in the following stages:

- Identification of the existing landscape and visual conditions
- Identification of M3R's proposed components and character
- Assessment of M3R's landscape impact
- Assessment of M3R's daytime visual impact
- Assessment of M3R's night-time visual impact
- Identification of the opportunities to mitigate M3R's impact
- Developing an impact assessment that takes into account the proposed mitigation measures.

B12.2.1 Guidance for landscape and visual assessment

There is a range of guidance available for landscape and visual assessment. The methodology for this assessment is based on two nationally and internationally accepted guidance documents: the *Guidance Note for Landscape and Visual Assessment*, (Australian Institute of Landscape Architects, 2018) and *Guidance for Landscape and Visual Impact Assessment* (GLVIA) Third Edition (Landscape Institute and Institute of Environmental Management & Assessment UK, 2013). Regard has also been given to the methodology suggested by the *Landscape Assessment Guidelines* (Heritage Victoria, 2009) that advises on the assessment of impacts on Victoria's culturally significant landscapes.

The assessment of night-time visual impacts draws on the terminology of *AS4282 Control of the Obtrusive Effects of Outdoor Lighting* (Council of Standards Australia, 2019).

The landscape and visual impact significance criteria have been based on the guidance in the above documents as well as the parameters of the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (EPBC Act), *Significant impact guidelines 1.2 – actions on, or impacting upon, Commonwealth land and actions by Commonwealth agencies* (DSEWPC, 2013).

However, these documents do not prescribe a method for landscape and visual impact assessments. The following method has therefore been developed for the project. It is based on the above documents and is applicable to the type and scale of M3R.

B12.2.2 Relevance to previous regulatory frameworks

This assessment takes into account the 1990 Environmental Impact Statement (EIS) approved by the Commonwealth Government and reinforced by community engagement and Ministerial approval of master plans since 1997. Based on the regular community consultation and public notice required for these statutory processes, it is reasonable to assume the community is aware of the scale and intent of the airport's development (including the proposed M3R development covered by this framework).

B12.2.3 Existing visual conditions

An inspection of the study area was carried out in September and October 2016, and additional photographs were provided by the project team in 2018 and 2020. These site inspections (plus additional desktop analysis) were used to evaluate the area's existing landscape character, with the photographs representing a variety of views.

B12.2.4 M3R components

The components of M3R have been described in terms of the proposed infrastructure; and the activities visible during its construction, operation and maintenance in both daytime and night-time. They are described in terms of their form, shape, mass and scale, material, movement and lighting (where known).

B12.2.5 Landscape impact assessment

The landscape impact assessment was based on identifying the sensitivity of the landscape and the level of modification caused by M3R. These were then used to assign a level of likely landscape impact.

B12.2.5.1 Landscape sensitivity

Landscape sensitivity refers to the value placed on a landscape element or character area, and the level of service it provides to the community. 'Sensitivity' may reflect the frequency and volume of users in a location; it may also refer to the value of characteristics such as tranquillity, visual relief, and contribution to microclimate.

The value of landscapes is often described in council planning schemes, Victorian Government master plans and planning policy documents. This shows the importance of landscape resources to local, regional and state-wide communities.

The sensitivity of landscape features is therefore considered in the broadest context of possible landscapes: from those of national importance through to those considered to have a local or neighbourhood landscape importance (Table B12.1).

In this table, the terms 'state' and 'regional' landscape sensitivity describe the value placed on the landscape by the community. (Landscape features afforded legislative protection are specifically identified in the policy context section of this assessment.)

Table B12.1 Landscape sensitivity levels

Landscape sensitivity level	Description
National	Landscape feature protected with national or international legislation. A landscape feature or place that attracts international visitors and is iconic to the nation (e.g. the public realm of the World Heritage listed Sydney Opera House, Lake Burley Griffin, and the beaches of the Twelve Apostles Marine National Park).
State	Landscape feature or urban place that is heavily used and is iconic to the state (e.g. Federation Square, Birrarung Marr and the Royal Botanic Gardens Melbourne).
Regional	Landscape feature that is moderately used or valued by residents of a major portion of a city or a non-metropolitan region (e.g. Organ Pipes National Park and Woodlands Historic Park).
Local	Landscape feature valued and experienced by concentrations of residents and/or local recreational users. Provides a service to the local community. For example, it provides a place for gathering, recreation, sport or trail walking.
Neighbourhood	Landscape feature valued and appreciated primarily by a small number of residents, workers or visitors (e.g. trees lining a rural road, or scattered across a field or a vineyard). For example, it provides an opportunity for passive recreation and/or some shade and shelter to a road.

B12.2.5.2
Landscape modification

Landscape modification refers to the change in the landscape caused by a project. It includes direct impacts (such as the removal of trees or parkland, and changes to topography and landform) and indirect impacts (the functional change of an area of open space due to altered land use and accessibility).

Landscape modification can result in either adverse or beneficial effects. Table B12.2 lists the terminology used to describe the levels of landscape modification.

B12.2.6
Visual impact assessment

The assessment of visual impact is based on identifying the sensitivity of the viewer ('visual sensitivity') and the level of visual modification created by M3R. When combined, they determine the level of likely visual impact. (This approach is explained more fully in the following sections.)

In order to assess impacts on the visual conditions of the project area, representative viewpoints have been selected to illustrate the range of views to M3R. These viewpoints represent publicly accessible views from a variety of locations and viewing situations. Particular attention was paid to views near residential properties; and places where viewers might congregate such as parks and reserves, approach roads and elevated lookouts.

B12.2.6.1
Visual sensitivity

Visual sensitivity (as distinct from landscape sensitivity above) refers to the nature and duration of views. Locations with a higher number of potential viewers – where visual amenity is important to viewers, and where a view may be seen for longer – can be regarded as having a higher visual sensitivity. Views that are recognised in local, Victorian or Commonwealth planning documents will have a higher sensitivity level.

To ensure a reasonable assessment of impact, a viewpoint's sensitivity is considered in the broadest context of possible views: from those of 'national' visual importance down to those considered to be of 'neighbourhood' visual importance. The terminology in Table B12.3 is used to describe the five levels of visual sensitivity.

B12.2.6.2
Visual modification

Visual modification describes the extent of change resulting from M3R and the compatibility of its new elements with the surrounding landscape. General principles determining the level of visual modification include elements relating to the view itself such as distance, landform, backdrop and contrast. In addition, there are the characteristics of the development, namely scale, form and alignment.

Visual modification can result in either an improvement or a reduction in visual amenity.

A high degree of visual modification occurs when a development contrasts strongly with the existing landscape.

A low degree of visual modification occurs if there is minimal visual contrast, and a high level of integration (of form, line, shape, pattern, colour or texture values), between the development and its environment in which it is viewed. In this situation, the development may be noticeable, but does not markedly contrast with the existing modified landscape.

Table B12.4 lists the terminology used to describe the level of visual modification.

Table B12.2
Landscape modification levels

Landscape modification level	Description
Considerable reduction in landscape quality	The quality of the landscape (character and function) will be substantially reduced. This may include substantial changes to the amount, location and distribution of landscape features of the site, including waterways, vegetation, changes to landform etc, that detract from the values of the landscape.
Noticeable reduction in landscape quality	The quality of the landscape (character and function) will be somewhat reduced. This may include changes to the amount, location and distribution of landscape features of the site, including waterways, vegetation, changes to landform etc., that detract from the values of the landscape.
No perceived reduction or improvement in landscape quality	Either the quality of the landscape (character/function) will be unchanged or, if changed, it is largely consistent with the quality (character/function) of the remaining landscape areas and/or mitigated by proposed improvements.
Noticeable improvement in landscape quality	The quality of the landscape (character and landscape function) will be somewhat improved. This may include changes to the amount, location and distribution of landscape features of the site, including waterways, vegetation, changes to landform etc., that enhance the values of the landscape.
Considerable improvement in landscape quality	The quality of the landscape (character and landscape function) will be substantially improved. This may include changes to the amount, location and distribution of landscape features of the site, including waterways, vegetation, changes to landform etc., that enhance the values of the landscape.

Table B12.3
Visual sensitivity levels

Visual sensitivity level	Description
National	Heavily experienced view to a national icon, e.g. view to the Twelve Apostles from the Loch Ard Gorge or visitor centre viewing area, Sydney Opera House from Lady Macquarie's Chair and a view to Parliament House along Anzac Parade, Canberra.
State	Heavily experienced view to a feature or landscape that is iconic to the state, e.g. views from the summit of Mt Buller in the Australian Alps National Park, view from Craig's Hut on Mt Stirling or a view to the Melbourne central business district skyline across the Yarra from the Main Yarra Trail, Alexandra Gardens.
Regional	Heavily experienced view to a feature or landscape that is iconic to a major portion of a city or a non-metropolitan region, or an important view from an area of regional open space, e.g. views from Guilfoyle's Volcano in the Royal Botanic Gardens Melbourne, a view from along the Esplanade to the entry of Luna Park, St Kilda, or a view to the basalt columns at the Organ Pipes National Park.
Local	View of high quality or experienced by concentrations of residents and/or local recreational users, and/or large numbers of road or rail users, e.g. view from Woodlands Historic Park or view from the Melbourne Airport aircraft viewing area on Sunbury Road.
Neighbourhood	Views where visual amenity is important at a neighbourhood scale, such as views seen from local roads, briefly glimpsed views to landscape features and views from scattered and groups of residences.

Table B12.4
Visual modification levels – day time

Visual modification level	Description
Considerable reduction in visual amenity	Changes the amenity of the view fundamentally, a substantial part of the view is altered and/or the change is not visually compatible with the character of the view.
Noticeable reduction in visual amenity	Changes the amenity of the view somewhat, the alteration to the view is clearly visible and/or the change is somewhat visually compatible with the character of the view.
No perceived reduction or improvement in visual amenity	Either the view is unchanged or, if it is changed, the change in the view is generally unlikely to be perceived by viewers and/or it is absorbed into the character of the view.
Noticeable improvement in visual amenity	Changes the amenity of the view somewhat, the alteration to the view is clearly visible and/or the change somewhat enhances the view.
Considerable improvement in visual amenity	Changes the amenity of the view fundamentally, a substantial part of the view is altered and/or the change transforms and enhances the character of the existing view.

B12.2.7
Assessment of night-time visual impact

An assessment of the potential visual impacts of M3R at night has been undertaken for each viewpoint.

The assessment of night-time impact has been carried out using a similar methodology to the daytime assessment. However, the night-time assessment also draws upon guidance in *AS4282 Control of the obtrusive effects of outdoor lighting* (Standards Australia, 2019).

AS4282 identifies four main potential effects of lighting: on residents, transport system users, transport signalling systems and astronomical observations. Of relevance to this assessment is the effects of lighting on the visual amenity of residents and transport system users.

AS4282 identifies environmental zones (shown in Table B12.5) which are useful for categorising night-time landscape settings. The following assessment will use these environmental zones to describe the existing night-time visual condition and assign a sensitivity to these settings.

B12.2.7.1
Night-time visual sensitivity

The environmental zone (defined in AS4282 and shown in Table B12.5) which best describes the existing night-time visual condition of the site has been selected. These zones are typical night-time settings and reflect the predominant light level of the site and visual study area. Each environmental zone is assigned a level of sensitivity, as described in the table.

Table B12.5
Environmental zone sensitivity – night-time

Environmental Zones (from AS4282:2019)		
Sensitivity level	**Zone Description**	**Examples**
Very high	A0: Intrinsically dark	UNESCO Starlight Reserve IDA Dark Sky Parks Major optical observatories No road lighting – unless specifically required by the road controlling authority Relatively uninhabited rural areas
High	A1: Dark	Relatively uninhabited rural areas No road lighting – unless specifically required by the road controlling authority
Moderate	A2: Low district brightness	Sparsely inhabited rural and semi-rural areas
Low	A3: Medium district brightness	Suburban areas in towns and cities
Negligible	A4: High district brightness areas	Town and city centres and other commercial areas Residential areas abutting commercial areas

Table B12.6
Visual modification levels – night-time

Modification	Description
Very high	• Substantial change to the level of skyglow, glare or light spill would be expected. • The lighting of the proposal would transform the character of the surrounding setting at night. • The effect of lighting would be extensive, dominating, and permanent.
High	• Considerable change to the level of skyglow, glare or light spill would be expected and/or • The lighting of the proposal would noticeably contrast with the surrounding landscape at night and/or • The effect of lighting would be experienced across a considerable portion of the landscape and/or • Be experienced for a long duration.
Moderate	• Alteration to the level of skyglow, glare or light spill would be expected and/or • The lighting of the proposal would contrast somewhat with the surrounding landscape at night and/or • The effect of lighting would be experienced across a moderate portion of the landscape and/or • Be experienced for a moderate duration.
Low	• Alteration to the level of skyglow, glare or light spill would be expected and/or • The lighting of the proposal would not contrast substantially with the surrounding landscape at night and/or • The effect of lighting would be experienced across a small portion of the landscape and/or • The effect of lighting would be experienced for a short duration.
Negligible	• Either the level of skyglow, glare and light spill is unchanged or • The change is generally unlikely to be perceived by viewers or compatible with the existing or intended future use of the area and/or • The effect of lighting would be experienced for a short duration and/or temporarily.

B12.2.7.2
Night-time visual modification

Following the sensitivity assessment, the degree of visual modification expected in the visual study area at night is then identified. These changes are described, as relevant, in terms of:

- Sky glow: the brightening of the night sky
- Glare: a condition of vision in which there is discomfort or a reduction in the ability to see
- Light spill: the light emitted by a lighting installation that falls outside the design area.

Table B12.6 describes each night-time visual modification level.

B12.2.8
Impact assessment

Impact has been assigned by combining the sensitivity and modification levels. This approach is described further in Section B12.4. In addition to the assigning of impact, the significance assessment incorporates the severity, duration and likelihood of the impacts.

B12.2.9
Mitigation measures

Opportunities for mitigation have been identified to avoid, reduce and/or manage the severity and/or likelihood of the impact where possible during construction and operation phases of M3R.

The impacts identified for M3R are then reassessed, and the residual effects and associated impacts of M3R identified.

B12.2.10
Impact significance, risk assessment, and residual effects

To conclude this assessment, a summary table has been completed. This includes the description and characterisation of impacts, mitigation or management measures, and an assessment of the residual impact based on these measures.

For each assessment, the characterisation of the impacts considers the temporal nature of the impact, and an assessment of significance, incorporating an identification of severity, likelihood and the resulting impact.

B12.2.11
Assumptions and limitations

The following assumptions and technical limitations have informed this study:

- The night-time conditions of the project area have been assumed from the daytime field work.
- There is an element of judgment used in the rendering of photomontages. The photomontages produced for this assessment were based on information available at the time and reviewed by the design team for consistency with the design intent.
- As both a two-dimensional and static medium, photographs and photomontages cannot capture the complexity of the visual experience. The views assessed and represented by photographs in this assessment therefore give only an approximate impression of the scene as it would be experienced by a person; a true understanding of impact will only be achieved by visiting the location from which a photograph was taken.
- The assessment of landscape and visual impact requires a level of considered judgment that may be subjective. Every effort has been made to reduce the subjectivity of this assessment and peer reviews undertaken to achieve consistency in the assignment of impacts.
- Simulations from four viewpoints were used to develop photomontages that demonstrate the scale and features of M3R from varying angles and distances. Although photomontages were not created for every viewpoint, four photomontages and a three-dimensional model were used to estimate what would be seen from the other viewpoints.
- Several site visits were undertaken between 2016 and 2018. Due to COVID-19 restrictions, additional photographs were taken in 2020 by a member of the project team guided by landscape and visual assessment specialists.

B12.2.12
Photography and photomontages

The approach to photography and photomontages was adapted from the Landscape Institute (UK) *Technical guidance note 06/19, Visual representation of development proposals (2019).*

The photographs used in this assessment were taken with a 35-millimetre single-lens reflex digital camera adjusted to achieve a 50-millimetre equivalent focal length, to most closely represent what the human eye sees.

The photomontages prepared for M3R are intended to act as artist's impressions: showing the general location, layout, scale and relationship of key elements of M3R to the surrounding landscape. They were created by using a photograph, computer modelling and photo-editing techniques as follows:

- Photography: a one-frame shot selected to replicate what will be seen by a person in any one view
- Data interpretation: a 3D model developed based on a digital-terrain model with one-metre data and 3D-design information provided by M3R engineers
- Photograph alignment: the model was positioned over the existing photograph using the Global Positioning System (GPS) coordinates of the location, and with a minimum of three existing elements within the photograph as reference points.
- Rendering: editing photographs using Adobe® Photoshop® software to render the finishes of the M3R elements (including the addition of colour, texture and shadow).

B12.3
STATUTORY AND POLICY REQUIREMENTS

Melbourne Airport is located on Commonwealth land leased by APAM (Australia Pacific Airports (Melbourne)). The Commonwealth *Airports Act 1996* (Airports Act) and the Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) are the key pieces of legislation that set the regulatory framework for M3R and this assessment. However, consideration has also been given to relevant Victorian and local legislation (including environmental planning instruments, policies, and guidelines) as part of a holistic approach to environmental management.

There are Commonwealth, state and local government legislation, planning instruments, guidelines and reference documents which are relevant to the visual and landscape character values of the study area. These include the following Commonwealth, Victorian government and local authority statutory and policy requirements.

- *Environment Protection and Biodiversity Conservation Act 1999* (Cth)
- *National Parks Act 1975* (Vic)
- *Organ Pipes National Park Management Plan* (Parks Victoria, 1998)
- *Airports Act 1996 and Airports (Environmental Protection) Regulations 1997* (Cth)
- *Melbourne Airport Master Plan 2018* (Australia Pacific Airports Melbourne, 2018)
- *Metropolitan Planning Strategy 2017-2050: Plan Melbourne* (DELWP, 2017)
- *Maribyrnong River Valley Design Guidelines* (Department of Planning and Community Development Victoria, 2010)
- *Keilor Market Gardens Cultural Landscape* (Victorian Heritage, 1999)
- *Hume Planning Scheme* (Hume City Council)
- *Brimbank Planning Scheme* (Brimbank City Council)
- *Brimbank Green Wedge Management Plan* (Brimbank City Council, 2010).

The following content summarises the relevant clauses contained in these documents.

B12.3.1
Commonwealth statutory and policy requirements

B12.3.1.1
Environment Protection and Biodiversity Conservation Act 1999 (Cth)

The EPBC Act protects those places and components of the environment that are unique, rare, or considered to have special value at a national level.

As the airport is on Commonwealth-owned land, the Act's significant impact guidelines require consideration *(Actions on, or impacting upon Commonwealth land and actions by Commonwealth agencies, Significant impact guidelines 1.2, (DSEWPC, 2013, page 14))*. Subsequently referred to as EPBC Act (Significant impact guidelines 1.2).

Among other environmental factors relevant to this chapter, the Significant impact guidelines 1.2 state that in relation to impacts on landscapes and soils a significant impact includes one that has 'a real chance or possibility that the action will … substantially alter natural landscape features'.

This consideration has been incorporated into the significance criteria for this assessment, so that any impact that substantially alters the natural landscape features will therefore be deemed to constitute a high landscape and visual amenity risk for M3R.

The EBPC Act does not define 'landscape feature'. This assessment therefore uses the definition in the South West Victoria Landscape Assessment Study (Department of Planning and Community Development Victoria and Planisphere, 2013):

> *'A landscape feature is a topographic feature or prominent landmark such as a headland, mountain range or volcanic cone that is visually dramatic and provides the landscape with its 'wow' factor. The prevalence or concentration of a particular landscape element or vegetation type e.g. River Red Gums, rocky outcrops, dry stone walls, etc, may also be classified as a landscape feature.' (page 30).*

Appendix A of the Significant impact guidelines 1.2 includes a list of questions to assist in identifying the environmental and, in this case, landscape context for M3R. Although this list is not exhaustive, it states in relation to 'Landscapes and landforms' that the following questions be answered:

- What landscape features or landforms are present?
- What landscape features or landforms are likely to be directly or indirectly impacted by the action?
- Are there any outstanding, rare, unusual, valuable or important landscape features or landforms?

These questions are answered throughout this assessment as the existing landscape condition is described, any features identified and any direct or indirect impacts identified. The sensitivity of these views and landscape features incorporates the consideration of any rare, unusual, valuable or important features.

In addition, Appendix A of the Significant impact guidelines 1.2 identifies issues that are to be considered in relation to people and communities, including: *'Will the action impact upon public amenity?'*. Public amenity includes, among other factors, visual amenity. This requirement will therefore be partially addressed through the undertaking of this assessment.

B12.3.1.2
National Parks Act 1975

Organ Pipes National Park is located approximately 2.5 kilometres west of M3R. It is reserved and managed under the provisions of the *National Parks Act 1975* (Vic) (National Parks Act). This includes 'the protection and preservation of indigenous flora and fauna and of features of scenic or archaeological, ecological, geological, historic or other scientific interest in those parks'.

B12.3.1.3
Organ Pipes National Park Management Plan 1998

The landscape objectives of this plan include preservation of 'viewscapes within and into Jacksons Creek valley' and enhancement of 'viewscapes across the Keilor Plains' (section 3.5).

The plan's relevant landscape management strategies include to 'exercise opportunities presented by planning scheme referrals to minimise the visual impacts of adjacent developments on the Park' (Parks Victoria, 1998, section 3.5). These objectives and strategies will be addressed by the identification and assessment of a view from Organ Pipes National Park.

B12.3.1.4
Airports Act 1996 and Airports (Environmental Protection) Regulations 1997

The Airports (Environment Protection) Regulations 1997 establish a framework for protecting the existing aesthetic values of local areas such as the Grey Box Woodland and other vegetation within Melbourne Airport. Specifically, *Regulation 4.04 General duty to preserve* states:

> *The operator of an undertaking at an airport must take all reasonable and practicable measures to ensure that, in the operation of the undertaking, and in the carrying out of any work in connection with the undertaking: (a) there are no adverse consequences for: … (ii) existing aesthetic, cultural, historical, social and scientific (including archaeological and anthropological) values of the local area. (R4.04 (1))*

This landscape and visual impact assessment will identify any potential adverse effects on the local area's aesthetic values.

B12.3.1.5
Melbourne Airport Master Plan 2018

As part of the planning and development process, the Airports Act requires Melbourne Airport to produce a master plan outlining its strategic vision for the project area for the next 20 years.

In the 2018 Master Plan, the airport is divided into five precincts, each with a set of planning requirements for development (2018, page 132). M3R is in the Airport Expansion precinct which largely comprises former rural lands to the south-west of the existing north-south runway (16L/34R). The role of this precinct is to 'provide for the airport's future expansion' while conserving 'environmentally significant land where such land is not required for future airport operations' (page 134).

This precinct contains nationally significant vegetation of the Victorian Volcanic Plains including a block of Grey Box Woodland (on airport land) and vegetation adjacent to Deep Creek and the Maribyrnong River. These landscapes are be considered in this assessment.

The guidelines for the Landside Main and Business precincts (eastern and southern precincts) require their use and development to provide 'a high level of visual amenity'.

The current master plan shows the third runway aligned east-west; and the long-term development concept plan shows four runways in a hashtag layout. (This ultimate layout has been shown in the Master Plan since 1990.)

Melbourne Airport is currently preparing a new Master Plan (2022) which will show the third runway being orientated north-south (see **A1: Introduction** for more detail).

B12.3.2
Victorian government statutory and policy requirements

B12.3.2.1
Metropolitan Planning Strategy 2017-2050: Plan Melbourne

This document (Plan Melbourne) is Melbourne's overarching metropolitan planning strategy. Plan Melbourne's vision for the city is guided by nine principles. Principle 2 seeks to 'develop and deliver infrastructure to support its competitive advantages in sectors such as business services, health, education, manufacturing and tourism'.

This principle is supported by outcomes and policy directions including Outcome 4 'Melbourne is a distinctive and liveable city with quality design and amenity'. This outcome is supported by Direction 4.5 'plan for Melbourne's green wedges and peri-urban areas', which provides for food production, stone supply, biodiversity, recreation, tourism and critical infrastructure including airports. (Peri-urban areas are hybrid landscapes of fragmented urban and rural characteristics.)

The direction seeks to use green wedges and peri-urban areas to protect state infrastructure and is further supported by Policy 4.5.2, which endeavours to 'protect and enhance valued attributes of distinctive areas and landscapes', including 'significant views' and 'high-value landscape features' such as open farmed landscapes, ranges, hills and ridges. A desired outcome for green wedges and peri-urban areas is to protect state significant infrastructure, including airports and flight paths.

In this strategy, Melbourne Airport is located within Melbourne's northern green wedge land at Sunbury (between three major growth areas) and identified as 'Victoria's primary gateway' (Policy 1.1.5). Green Wedge Zones (Map 19) and the urban growth boundary are legislated to manage the non-urban areas of metropolitan Melbourne. The plan also notes that 'green wedges and peri-urban areas are immensely important' and that managing these landscapes will have a range of beneficial impacts on Melbourne including its 'local amenity' (Policy 1.4.2).

The airport is adjacent to a major open space (Woodlands Historic Park) and between two watercourses (Moonee Ponds Creek and the Maribyrnong River) in one of Melbourne's main river corridors. The airport is identified as 'state-significant infrastructure' which should be protected as a 'regionally significant asset' (Policy 4.5.2). However, the airport is not identified as one of the 'high-value landscape features' or 'iconic landscapes' within Melbourne's green wedge or peri-urban area in Policy 4.5.2. (Refer to **Chapter B2: Land Use and Planning** for further information.)

B12.3.2.2
Maribyrnong River Valley Design Guidelines 2010

The Maribyrnong River Valley Design Guidelines prepared by the former Victorian Government Department of Planning and Community Development in 2010 identify the existing and preferred character of the Maribyrnong River. They also outline an action plan to preserve and enhance this preferred character. The entire length of the river, from the Organ Pipes National Park to the river mouth, is considered. Capital works, planning scheme amendments, detailed planning, improved governance and community engagement strategies are proposed.

The Brimbank section of the river (extending south-east from the Organ Pipes National Park) is within the landscape and visual study area. The existing condition here is described (in Section 2.2 of the document) as:

> *'The river flows between complex rolling slopes and rural parkland. Bounded at the valley rim by urban settlement, the Calder Freeway to the north and the railway trestle bridge to the south, there is an absence of urban settlement in the river valley.'*

The vision for the preferred character is described as follows (also in Section 2.2):

> *'The naturalistic and remote character of this length of the river is its most valued characteristic. Extensive pest control and revegetation has restored much of the natural feel of this length of the river valley … There is a need to continue to strike a balance between recreation and conservation/revegetation outcomes. There is also a need to control urban intrusions in order to maintain the uninhabited and remote feel of this length.'*

This vision for a naturalistic landscape around the Maribyrnong River (and limiting urban intrusions that may alter the landscape's remote qualities) is considered through the viewpoint assessment – particularly views from the Organ Pipes National Park (Viewpoint 15). M3R is located in the 'General study area' for the masterplan, not in the 'Main study area'. As such, M3R is not subject to the design and development guidelines contained in this document (Map 4, page 37).

B12.3.2.3
Victorian Heritage Database, Keilor Market Gardens Cultural Landscape 1999

The Keilor Market Gardens cultural landscape (located on Arundel and Milburn Roads, Keilor) has a local heritage listing. The statement of significance which was last updated in 1999 states (page 1):

> *'The market gardens of Keilor are of regional historical significance as they are associated with the beginnings of irrigated horticulture in Victoria and have been continuously cultivated since the mid-nineteenth century.'*
>
> *'The landscape is of regional significance as an expression of the early and long-lived farming practices adapted to the richer soils of the river terraces. The farms themselves also have long links with local families, such as the Milburns and Senserricks, and the pattern of houses and farm buildings reflect the original population distribution.'*

This landscape includes a number of other heritage items that contribute to its character. They include Arundel Farm and several heritage-listed farmhouses from the late 19th and early 20th centuries, weir, and trestle bridges.

This steeply sloping landscape was terraced with sloping ground between, and utilises the Maribyrnong River for irrigation. The landscape is visually bounded by the top of the escarpment on the opposite side of the river to the north and east, the Calder Freeway to the south, and the Overnewton College grounds to the west.

M3R would not have a direct landscape impact on this cultural landscape. The potential for a visual impact will be addressed in the viewpoint assessment, including the visibility analysis shown on the zone of visual influence mapping (Figure B12.26) and assessment of Viewpoint 8 (a nearby rural location).

B12.3.3
Local statutory and policy requirements

B12.3.3.1
Hume Planning Scheme

M3R is located within Commonwealth land and therefore not controlled by the Hume Planning Scheme. However, the planning scheme does include the Melbourne Airport Environs Overlay (MAEO, clause 45.08) that relates to areas surrounding the airport. This overlay does not include any objectives relating to landscape or visual amenity.

The Hume Planning Scheme refers to Victoria's Landscapes policy (clause 12.05-2S) to 'protect and enhance significant landscapes and open spaces that contribute to character, identity and sustainable environments' (such as waterway corridors and forests).

To the west and south of M3R, the valleys of Deep Creek and the Maribyrnong River are subject to the Environmental Significance Overlay (ESO). The planning scheme refers to the following Victorian policy objective to protect the landscape character of these rural waterways, which is:

> *'To ensure that the scenic qualities and visual character of waterway corridors, creek valleys and their surrounding environs are not compromised by the inappropriate siting of buildings, the placement of fill, the removal of soil, or lack of screening vegetation' (Schedule 1, clause 42.01 Environmental Significance Overlay).*

The decision guidelines relating to the Environmental Significance Overlay (clause 42.01) also consider the 'the effect of the height, bulk and general appearance of any proposed buildings and works on the environmental values and visual character of the waterway' (schedule 1 to clause 42.01 Environmental Significance Overlay).

The rural landscape is a recognised as a 'key characteristic of Hume's image and identity' including 'wide expanses of flat open woodland and grassland, cleared grazing land and natural features such as largely undeveloped hills and ridges, and very steep creek valleys' (clause 21.04-3 Landscape Character). These features are 'highly valued by the community and are often highly visible, providing an important backdrop to urban areas within the Hume Corridor and the Sunbury township' (clause 21.04-3 Landscape Character).

Relevant objectives of the landscape character policy include:

- 'To ensure development protects significant and unique landscape values which contribute to Hume's character and identity
- To protect significant views and vistas of hilltops, escarpments, ridgelines, and creek valleys and waterways
- To protect significant vistas and long range views towards the Melbourne CBD and surrounding mountain ranges from Hume's hilltops, escarpments and ridgelines
- To protect and encourage significant roadside vegetation that contributes to Hume's landscape character' (clause 21.04-3).

The rural area to the north, east and west of M3R is located within the Green Wedge Zone. The Hume City planning scheme refers to the State zoning for the management of the Green Wedge Zone, which aims to 'protect, conserve and enhance the cultural heritage significance and the character of open rural and scenic non- urban landscape' (clause 35.04).

Hume supports a 'rich natural heritage which contributes to the municipality's character', including remnant vegetation such as scattered trees, woodlands, grasslands, scrub-lands and riparian vegetation (clause 21.08-1). A key objective of the Natural Heritage clause for Hume is to 'protect, conserve and enhance natural heritage for biodiversity, amenity and landscape character purposes' (clause 21.08-1, objective 1).

Other notable landscapes within the study area include Organ Pipes National Park and Woodlands Historic Park. Woodlands Historic Park is located north-east of M3R. It is zoned Public Conservation and Resource and includes the homestead (state heritage listed; item 25 within the Heritage Overlay) and gardens set within 820 hectares of rural parkland established in the mid-19th century. A key objective of the Public Conservation and Resource Zone is 'to protect and conserve the natural environment and natural processes for their historic, scientific, landscape, habitat or cultural values' (clause 36.03).

Other relevant heritage items near the project area include the local heritage-listed Arundel Farm (including homestead, gardens and agistment) and state heritage-listed Glenara (including the homestead and gardens).

Further details on the planning requirements relating to heritage and ecology are contained in chapters B5: Ecology, B6: Indigenous Cultural Heritage and B7: European Heritage.

B12.3.3.2
Brimbank Planning Scheme

M3R is located within Commonwealth land and therefore not controlled by this planning scheme. However, the planning scheme includes the Melbourne Airport Environs Overlay (MAEO, clause 45.08) that relates to areas surrounding the airport. This overlay does not include any objectives relating to landscape or visual amenity.

To the south and south-west of the airport, the planning scheme identifies an Environmental Significance Overlay (ESO) along the Maribyrnong River. The ESO extends from Organ Pipes National Park, past Sydenham Park, through Keilor towards the Yarra River valley. The character of this waterway is described as 'a natural river with a remote and natural non urban character' (Section 1.0, Schedule 5 to the ESO5). The planning scheme includes the following objectives for this area regarding 'Vegetation, Landscape Character and Views':

- Ensure planting and revegetation reinforces the preferred character of the river (Objective 7, Schedule 5 to the ESO5)
- Maintain and protect views along the river corridor, including escarpments and other highly visible areas from visually intrusive development (Objective 8, Schedule 5 to the ESO5)
- Minimise the visual impact of buildings and works on the river corridor (Objective 10, Schedule 5 to the ESO5).

Protection and enhancement of the Maribyrnong River valley is also a priority in the Rural Conservation and Public Conservation and Resource zone provisions. These aim to:

- 'Protect and enhance the natural environment and natural processes for their historic, archaeological and scientific interest, landscape, faunal habitat and cultural values' (Rural Conservation Zone, clause 35.06)
- 'Protect and conserve the natural environment and natural processes for their historic, scientific, landscape, habitat or cultural values' (Public Conservation and Resource Zone, clause 36.03).

There are no areas identified on the Significant Landscape Overlay (clause 42.03) within the study area.

Further details on the planning requirements relating to heritage and ecology is contained in chapters B5: Ecology, B6: Indigenous Cultural Heritage and B7: European Heritage.

B12.3.3.3
Brimbank Green Wedge Management Plan 2010

Brimbank Council has prepared a Green Wedge Management Plan (Brimbank Council, 2010) that covers the Brimbank section of the Sunbury Green Wedge south of Melbourne Airport. This plan identifies a vision, objectives and actions for the sustainable use and development of this green wedge.

This green wedge includes volcanic plains and low plateaus dissected by deeply-cut stream channels, particularly those of the Maribyrnong River and its tributaries. It contains the large township of Sunbury, the smaller town of Bulla, and areas of Melbourne Airport.

It identifies the key features and values of the Sunbury Green Wedge, including:

- High-quality agricultural land
- Areas of significant landscape value
- Melbourne Airport and related flight paths
- Parklands
- Rural lifestyle opportunities.

This management plan identifies key parklands (including Woodlands Historic Park and Organ Pipes National Park) and describes them as important regional assets. The steeply-incised valleys of the Maribyrnong River and its tributaries Jacksons Creek and Deep Creek are identified as having significant landscape values including 'scenic views across the valley and a sense of seclusion along the valley floor'. It also identifies the low hills in the north as providing 'contrasting landscape elements' (pages 5 to 6).

The management plan is divided into themes, one of which is Landscape. The objective of Theme D (Landscape) is 'Protection and enhancement of the Maribyrnong Valley's rural atmosphere and scenic landscape' (page 15). It adds, 'The area's scenic views and rural atmosphere are highly valued by the community. Opportunity exists to protect these landscape qualities by ensuring new development integrates within the landscape and does not compromise view corridors to key features such as the city skyline' (page 25).

Within this landscape theme, it identifies several features having visual value. These include:

- Views of grassy plains, rocky outcrops and lava flows from Organ Pipes National Park
- Views across the Maribyrnong Valley to the distant mountain ranges from Sydenham Park
- Views from the Calder Freeway across the grassy plains to the airport and city skyline
- The Maribyrnong Valley's natural qualities and dramatic landscape
- The patchwork landscape of the Keilor Market Gardens
- The unspoilt qualities of the Maribyrnong River and the seclusion from urban development experienced from the valley floor (page 25).

These views and features were reviewed on-site and helped select representative viewpoints. The values of these views will be considered to have an increased landscape value due to their identification in this management plan.

B12.4
DESCRIPTION OF SIGNIFICANCE CRITERIA

The assessment of significance has applied the framework described in **Chapter A8: Assessment and Approvals Process**. For severity, project specific criteria have been developed for the assessment of impacts on landscape and visual values. These are described in **Table B12.7**, **Table B12.8** and **Table B12.9**.

These are based on a combination of landscape and visual sensitivity (**Table B12.1**, **Table B12.3** and **Table B12.5**) and the magnitude of change (**Table B12.2**, **Table B12.4** and **Table B12.6**).

The assessment of significance has applied the standard framework described in **Chapter A8: Assessment and Approvals Process**.

Table B12.7
Impact severity criteria – landscape

Impact severity	Description
Major	Considerable reduction in quality of a landscape of national sensitivity Noticeable reduction in the quality of a landscape of national sensitivity or Considerable reduction in the quality of a landscape of state sensitivity
High	Noticeable reduction in the quality of a landscape of state sensitivity or Considerable reduction in the quality of a landscape of regional sensitivity
Moderate	Noticeable reduction in the quality of a landscape of regional sensitivity or Considerable reduction in the quality of a landscape of local sensitivity
Minor	Noticeable reduction in the quality of a landscape of local sensitivity or Considerable reduction in the quality of a landscape of neighbourhood sensitivity
Negligible	Noticeable reduction in the quality of a landscape of neighbourhood sensitivity or No alteration to a landscape
Beneficial	Noticeable improvement to the quality of a landscape of any sensitivity

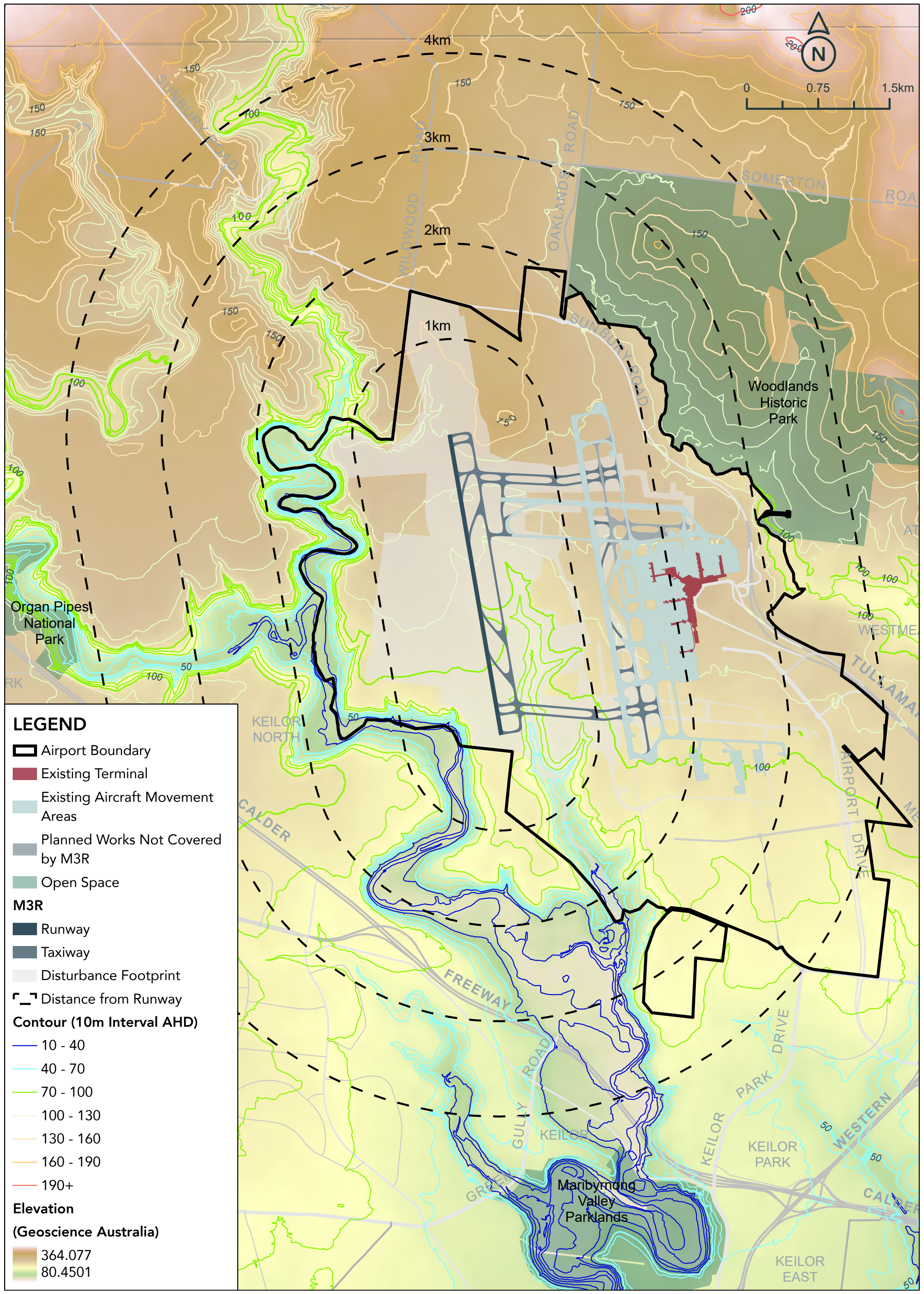
Table B12.8
Impact severity criteria – visual

Impact severity	Description
Major	Considerable reduction in the amenity of a view of national sensitivity Noticeable reduction in the amenity of a view of national sensitivity or Considerable reduction in the amenity of a view of state sensitivity
High	Noticeable reduction in the amenity of a view of state sensitivity or Considerable reduction in the amenity of a view of regional sensitivity
Moderate	Noticeable reduction in the amenity of a view of regional sensitivity or Considerable reduction in the amenity of a view of local sensitivity
Minor	Noticeable reduction in the amenity of a view of local sensitivity or Considerable reduction in the amenity of a view of neighbourhood sensitivity
Negligible	Noticeable reduction in the amenity of a view of neighbourhood sensitivity or No perceived change in the amenity of a view of any sensitivity
Beneficial	Noticeable improvement to the amenity of a view of any sensitivity

Table B12.9
Impact severity criteria – visual (night time)

Impact severity	Description
Major	Considerable reduction in the amenity of an A0: Dark landscape or A1: Intrinsically dark landscape
High	Noticeable reduction in the amenity of an A0: Dark landscape or A1: Intrinsically dark landscape Considerable reduction in the amenity of an area of A2: Low district brightness
Moderate	Noticeable reduction in the amenity of an area of A2: Low district brightness Considerable reduction in the amenity of an A3: Medium district darkness
Minor	Noticeable reduction in the amenity of an area of A3: Medium district brightness Considerable reduction in the amenity of an area of A4: High district brightness
Negligible	Noticeable reduction in the amenity of an area of A4: High district brightness No perceived change in the amenity of a view of any sensitivity
Beneficial	Noticeable improvement to the amenity of a view of any sensitivity at night

Figure B12.1
Topographic Plan



B12.5 EXISTING CONDITIONS

B12.5.1 Landform

Melbourne Airport and the M3R project area are located on a relatively flat plateau. There is some steep undulation associated with Deep Creek and Arundel Creek to the west of the existing north-south runway (Figure B12.1).

To the south and west of M3R, Jacksons Creek, Deep Creek and the Maribyrnong River dissect this plateau landscape; with steep banks descending approximately 70 metres below the plateau in parts. To the south of the airport, the southern banks of the Maribyrnong River have been modified through historic agricultural land uses and a widened river valley created.

To the north-west of M3R, the landform becomes more steeply undulating and is divided by the upper reaches of the Maribyrnong River. In the north-east, the landform rises to a number of peaks, including Woodland and Gellibrand hills, rising up to a height of up to 200 metres.

B12.5.2 Existing landscape conditions and views

B12.5.2.1 The Airport

Melbourne Airport is located approximately 22 kilometres north-west of Melbourne's central business district. It comprises a north-south runway (16/34) and an east-west runway (09/27); and is supported by taxiways, aprons, freight handling facilities and a terminal complex.

Two air traffic control towers rise above the landscape to the south-west of the intersection of the existing runways. These structures create a local visual landmark that identifies the airport in views from surrounding areas. (Figure B12.3)

Melbourne Airport is located within an area of the Western Basalt Plains landscape (Parks Victoria, 1998, section 3.5, page 23) characterised by flat open grasslands and the deeply incised Deep Creek, which forms the western boundary of the airport property. The existing runways and airside areas of the airport are enclosed by chain wire or welded mesh fencing allowing views across the airfield.

Figure B12.2
View east from Operations Road aircraft viewing area

Figure B12.3
View south from Sunbury Road to air traffic control towers

Figure B12.4
Grey Box Woodland

Figure B12.5
Concrete crushing (recycling) plant

To the south-west of the airport, and within the M3R project area, an aircraft viewing area is located on Operations Road that enables viewing of the existing runways and an area for parking (Figure B12.8).

To the north-west of the existing runways is the Grey Box Woodland. This is a eucalypt forest of mature specimens combined with recent plantings (Figure B12.4). A mature avenue of eucalypts lines a track from Sunbury Road along the eastern side of the woodland. The woodland screens views to the airport and provides amenity to views from Sunbury Road and residential areas to the north.

This woodland is set within a working rural landscape. There are therefore light industrial uses including quarry operations and a concrete crushing (i.e. recycling) plant (Figure B12.5), farm sheds and equipment spotted around the landscape to the west of the woodland.

B12.5.2.2
Rural landscapes to the west and north-west of the airport

To the airport's north and north-west there is a rural landscape of open, grassy plains and elevated plateaus divided by deeply incised creeks. This flat and sparsely treed landscape enables open views across wide expanses of cleared grazing land, and across the existing 09/27 runway and to the air traffic control towers and terminals beyond.

Several roads traverse this landscape. They include Loemans Road, which runs generally north to south and parallel to the airport, offering views across this landscape and to the airport (Figure B12.6). There is a mixture of land use in this landscape including rural residential blocks and small pastoral properties. There are several large and visually prominent residences located atop the plateaus (Figure B12.7) with expansive, elevated views over the river valleys and airport, viewed against the backdrop of Gellibrand and Woodlands hills and Melbourne's central business district skyline to the south-east.

Figure B12.6
View south along Loemans Road

Figure B12.7
Homestead on Deep Creek, Loemans Road

Figure B12.8
Aircraft seen from viewing area

Figure B12.9
Solar farm on Oaklands Road

B12.5.2.3
Township of Bulla and rural landscapes to the north

Directly north of M3R, Sunbury Road is a moderately trafficked two-lane roadway lined with street trees in some areas. An aircraft viewing area (including car park, sloped lawn and often a hot food van) is located at the corner of Sunbury and Oaklands roads. This popular viewing location offers views to the existing north-south runway (16L/34R) and arriving and departing aircraft which fly directly overhead (Figure B12.8). A 12 MW solar farm is located north of this viewing area, west of Oaklands Road (Figure B12.9).

To the north-west of M3R, a state heritage listed homestead and garden, Glenara, is located on the banks of Deep Creek in the outskirts of Bulla (Figure B12.10). This property provides a 'contrast between the open plains and the oasis of the garden' and its 'dramatic setting on a gorge of Deep Creek' (Heritage Victoria, 1997). The house is oriented away from the airport and enclosed largely by a mature framework of trees in its gardens and the surrounding grounds.

To the west on Sunbury Road, the township of Bulla is centred on the banks of Deep Creek (Figure B12.11). There are some heritage properties in its centre, and the landform rises steeply from the creek to a small hill on Green Street. Properties on the outskirts and east of Bulla have views across the surrounding cleared grazing land to the vegetated banks of Deep Creek and woodland areas. Where vegetation and landform allow, there are views across this landscape to runway 09/27 and the air traffic control towers.

B12.5.2.4
Woodlands Historic Park

Woodlands Historic Park is located to the north-east of the airport (Figure B12.12 and Figure B12.13). It includes a historic 1840s homestead; trails for walking, cycling and horse riding; lookouts and picnic facilities. The property includes areas of natural bushland with distinctive granite boulders, as well as paddocks where retired champion racehorses are rested. Woodlands Historic Park is referred to in the Green Wedge Management Plan, which states that, 'in the context of an area where substantial native vegetation remnants are rare, the habitat values of these parks and other smaller reserves are particularly important' (Brimbank City Council, 2010, pages 5-6).

Figure B12.10
Glenara set within the vegetated banks of Deep Creek

Figure B12.11
View to Sunbury Road and Bulla from the air

Figure B12.12
Open woodland on Gellibrand Hill

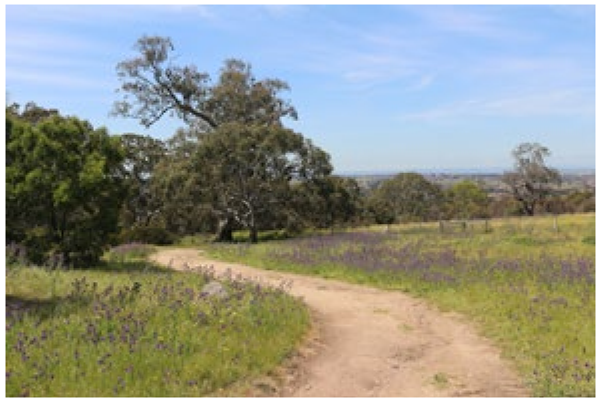


Figure B12.13
Woodlands Historic Park homestead

The park rises to two elevated vantage points: Gellibrand Hill and Woodlands Hill. Gellibrand Hill offers a 360-degree view including Melbourne's central business district (CBD), Port Phillip Bay, the Great Dividing Range and across Melbourne Airport. There are also glimpsed views through trees from the Moonee Ponds Creek trail to the existing High Intensity Approach Lighting (HIAL) structures located on airport land east of Sunbury Road.

B12.5.2.5
Rural landscapes, golf courses and residential areas to the south and south-west

To the south, the landscape consists of a largely rural landscape of open, grassy plains and hills divided by the steep banks of the Maribyrnong River. This undulating landscape is a patchwork, with trees lining fields and McNabs Road and Arundel Road. These allow for framed and filtered views across the surrounding cleared grazing and farmland to runway 09/27, air traffic control towers and airport terminals.

Residential properties are a mixture of heritage and contemporary buildings set within a landscape of rural land uses. The farming activities across this landscape include traditional market gardening on rich alluvial flats, equine agistment, broad-acre grazing, and vineyards. Arundel Farm Estate is a locally heritage-listed property in this landscape and includes a bluestone homestead, winery, agistment and café (**Figure B12.14**).

The Keilor Market Gardens Cultural Landscape is bounded by the Maribyrnong River in the north, Calder Freeway in the south, and Overnewton College grounds in the west.

This area has local heritage listing as a significant cultural landscape. It includes numerous heritage features including several farm houses, a weir and trestle bridge (**Figure B12.15**) on the Maribyrnong River. The landscape is visually enclosed by the top of the escarpment of the opposite side of the river, which rises distinctly above the southern bank of the river to create a distinctive valley. Although the airport is not visible from this landscape, regularly approaching and departing aircraft are a consistent feature seen above this landscape.

North-west of the Keilor Market Garden Cultural Landscape, Overnewton College and Overnewton Castle are in a locally elevated location (**Figure B12.16**). The airport may be visible in windows from the upper levels of the castle; however, due to intervening landform and vegetation it is unlikely to be seen from the grounds.

Figure B12.14
Winery at the Arundel Farm Estate

Figure B12.15
Heritage listed trestle bridge on the Maribyrnong River

Figure B12.16
Views near Overnewton Castle and College

Figure B12.17
Keilor Public Golf Course

This area also includes the Keilor and Melbourne Airport golf courses to the south and south-west of the airport (**Figure B12.17**). The manicured lawns of these golf courses are largely visually enclosed by mature perimeter vegetation planting and mature remnant trees. Melbourne Airport Golf Course, in particular, uses its proximity to the airport and views to the existing runways and airport operations as a marketing tool: 'the feature hole is the 17th, with a green location that places players less than 60 metres below the flight paths of aircraft, including the daily flights of A-380s' (Melbourne Airport Golf Club, 2020).

B12.5.2.6
Organ Pipes National Park to the south-west

Organ Pipes National Park is located approximately 2.5 kilometres west of M3R. The park protects the basalt columns known as the Organ Pipes (also of state geological significance) and the adjacent volcanic plains grassland and shrubland. The park covers 121 hectares of gorge country along Jacksons Creek in the Maribyrnong Valley.

Its landscape provides a dramatic and sudden drop in landform, enclosing views and evoking a sense of remoteness: a strong contrast to the surrounding exposed flat land. The valleys and gorges are 'highly valued by the community and are often highly visible, providing an important backdrop to urban areas within the Hume Corridor and the Sunbury township.' (clause 21.04-3, Hume Planning Scheme).

The park includes trails to the valley floor as well, as a viewing platform near the visitor centre that offers elevated views to the Organ Pipes and surrounding urban and rural landscape (**Figure B12.20** and **Figure B12.21**). Due to distance and intervening vegetation, the airport is not a dominant feature in these views (aircraft can however be seen flying overhead).

B12.6
ASSESSMENT OF POTENTIAL IMPACTS

B12.6.1
Visual character of M3R

M3R has several processes and elements with the potential to change the landscape character of the project area, and the amenity of views from the wider study area. (Details of M3R are described in **Chapter A4: Project Description**.)

Figure B12.18
Elevated residential areas of Keilor

Figure B12.19
View north from the Calder Freeway

Figure B12.20
Organ Pipes National Park visitor centre

Figure B12.21
View north-east along the Jackson Creek valley

B12.6.1.1
Construction phase

The impact of M3R's construction phase is estimated to span three to five years. The main likely activities contributing to visual impact during construction will be:

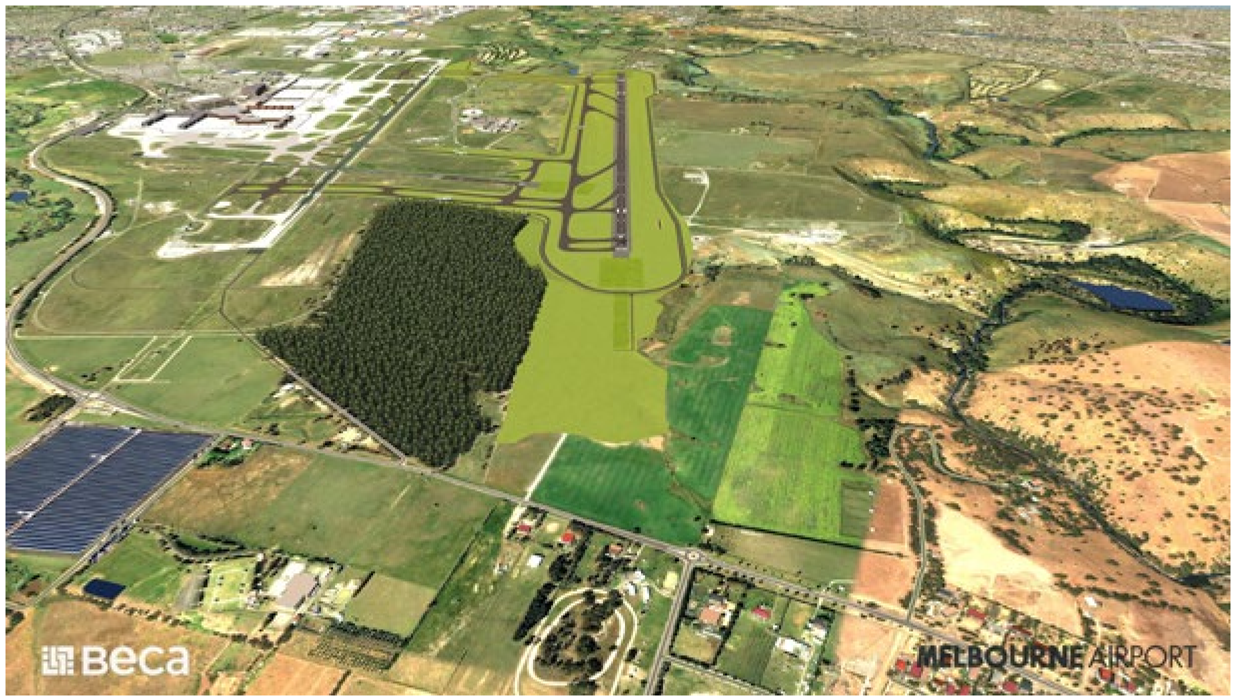
- A construction compound including site offices and amenities, storage containers, vehicle parking, concrete batching plant, asbestos spoil storage areas, stockpiles of material deliveries and fencing (refer to **Chapter A5 Project Construction** for indicative construction plans)
- Site clearing works such as removal of some vegetation (including the western part of the Grey Box Woodland south of Sunbury Road), fences and gates, access roads and telegraph poles
- Localised stockpiling of cleared material, and installation of sedimentation fencing
- Services removal and relocation including high voltage cable, water mains, sewer mains, airfield ground lighting cable duct, and communications
- Diversion of existing Operations Road to facilitate the new cross-field taxiways, including provision of a new underpass tunnel structure
- Removal of existing McNabs Road and Barbiston Road (because they form part of the M3R disturbance area, in particular the site earmarked for the new north-south runway (16R/34L))
- Conversion of sections of Arundel Creek to a culvert structure as required to facilitate taxiway construction
- Bulk site earthworks, including earth moving vehicles working on much of the project area
- Temporary construction access roads (including construction access road off Sunbury Road)
- Removal of all vegetation within the disturbance area including part of the Grey Box Woodland
- Asphalt and/or concrete batching plants (each approximately 50 x 50 metres footprint x 20 metres high) to provide pavement for construction
- Machinery including B-double trucks hauling material in and out of the project area, tipper trucks, D8 excavators, excavators, graders, padfoot rollers, concrete trucks, mobile crane and light vehicles
- If required, night-time airfield construction works will include low-glare and downward-focused task lighting to avoid disruption of existing airport operations.

B12.6.1.2
Operation phase

The impact of M3R's operation phase is estimated to last at least 50 years. Its likely sources of landscape and visual impact during operations are:

- Formation of a new parallel north-south runway (16R/34L) including a full-length parallel taxiway to its immediate east, with connecting runway entrance/exit taxiways
- Modification of existing north-south runway (16L/34R) with additional taxiway infrastructure

Figure B12.22
3D Modelled image, south-facing view of the new north-south runway



- Shortening of the existing east-west runway (09/27) at the western end, including parallel taxiway and runway entry/exit taxiways
- Airside road and fencing
- Realigned section of Arundel Creek where intersected by the new entry/exit taxiways via box culverts or pipes
- The remaining project area will be either grassed or hardstand, with some temporary uses as required
- Commercial passenger aircraft utilising the new airfield infrastructure
- A High Intensity Approach Lighting (HIAL) system on steel truss towers would extend 720 metres towards Sunbury Road at the northern end of the new runway
- Airfield ground lighting including all ground based and approach lighting such as taxiway lighting, runway lighting, and potential road lighting.

Patterns of air traffic will change (refer to **Chapter C2: Airspace Architecture and Capacity**) including:

- An increase, over time, in north-south aircraft movements due to the additional north-south runway.

B12.6.2
Landscape assessment

The following section describes the assessment of landscape impact, including identification of landscape sensitivity and impacts during construction and operation.

B12.6.2.1
Landscape sensitivity levels

The airport's landscape has no specific landscape value within the local planning scheme. It does, however, have some continuity with the rural landscapes to the north, west and south of the project area. Overall, the airport's landscape is of local sensitivity.

B12.6.2.2
Assessment

Potential landscape impacts during construction

Construction of M3R will include the removal of all existing vegetation within the project area including part of the Grey Box Woodland south of Sunbury Road and vegetation along Barbiston Road. This includes windbreaks of peppercorn, cypress and sugar gum trees within the paddocks of former Barbiston Farm (a de-listed state heritage item). Further detail is in **Chapter B5: Ecology.**

The open grassland fields will be removed and the landform modified to create a flat platform for the runway. This will require excavation in the northern areas of the runway footprint and filling to the south. The earthworks would avoid the Maribyrnong River (to the west) but include modifications to Arundel Creek valley (to the east). Part of Arundel Creek will be diverted via box culverts or pipes, where intersected by the new cross-field taxiways.

Figure B12.23
3D Modelled image, south-west facing aerial perspective view M3R

The removal of part of the Grey Box Woodland and substantial changes to the local landform would alter the patterns and natural boundaries within the landscape. The project would expand the area of hardstand while reducing the area of grassland across the project area. Overall, this will create a noticeable reduction in the site's landscape values, resulting in a minor adverse landscape impact.

Potential landscape impacts during operation

During operation, the open grassland of the airport will be replaced with large areas of paved runways and taxiways. Due to the operational requirements of the runways, and the potential for birds, bats and other wildlife to interfere with airport operations, tree planting (for the purpose of aesthetics and screening) within the airport site is undesirable. There is therefore no tree planting proposed within M3R. However, trees and grasses will remain in the undisturbed areas; and temporarily disturbed areas of the project area will be reinstated with grassland.

Figure B12.24
3D Modelled image, north-facing view along the new north-south runway

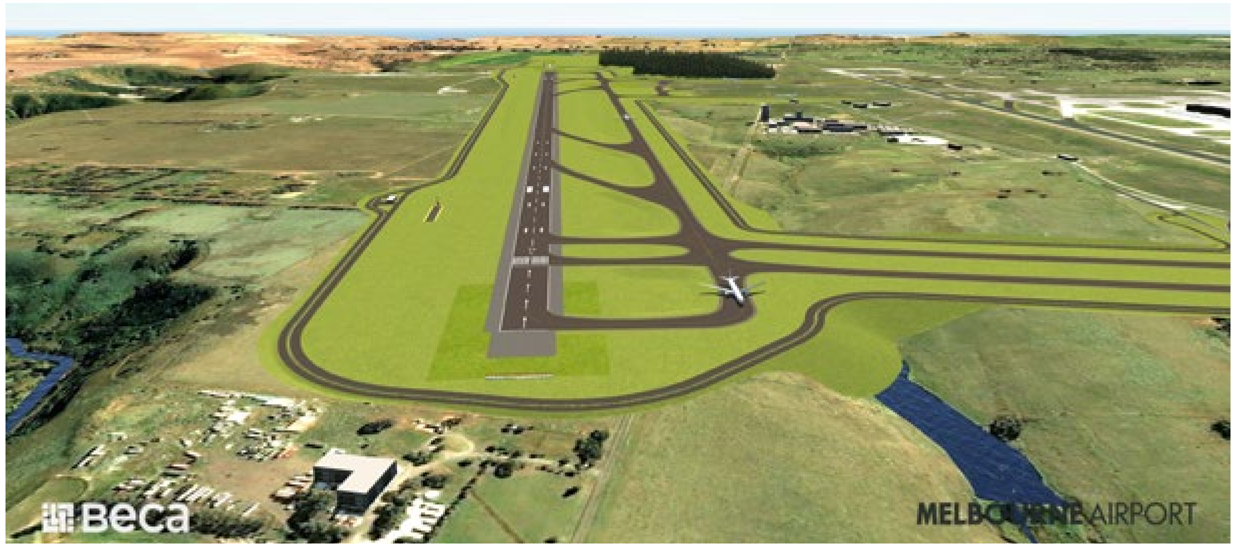


Figure B12.25
3D Modelled image, north-east facing view to the new north-south runway

Overall, this will create a noticeable reduction in the landscape values of the site which are of local sensitivity, resulting in a minor adverse landscape impact.

B12.6.3
Visual assessment

The following section describes the assessment of visual impact in daytime and night-time conditions. It includes identification of visual sensitivity and impacts during M3R construction and operation.

B12.6.3.1
Visual influence of M3R

A Zone of Visual Influence (ZVI) diagram has been used to establish the theoretical area from which M3R will be visible (**Figure B12.26**). This map uses a digital terrain model to identify areas from which views to the project area may be possible (based on a grid of points across the proposed and existing runways at the height of a typical aircraft fuselage). It does not incorporate the screening effect of vegetation however; the landform within the disturbance area and vegetation can limit visibility in this analysis. This mapping therefore shows a worst-case scenario.

The ZVI shows M3R's potential visual influence extending west across Deep Creek and across the rural landscape to residential properties on the outskirts of Bulla, across Sunbury Road in the north to the elevated areas of the Woodlands Historic Park, to rural areas in the south across the Calder Freeway, and to residential areas in the south and west (and potentially to the Organ Pipes National Park in the west). This area was the basis of field investigations identifying views to M3R.

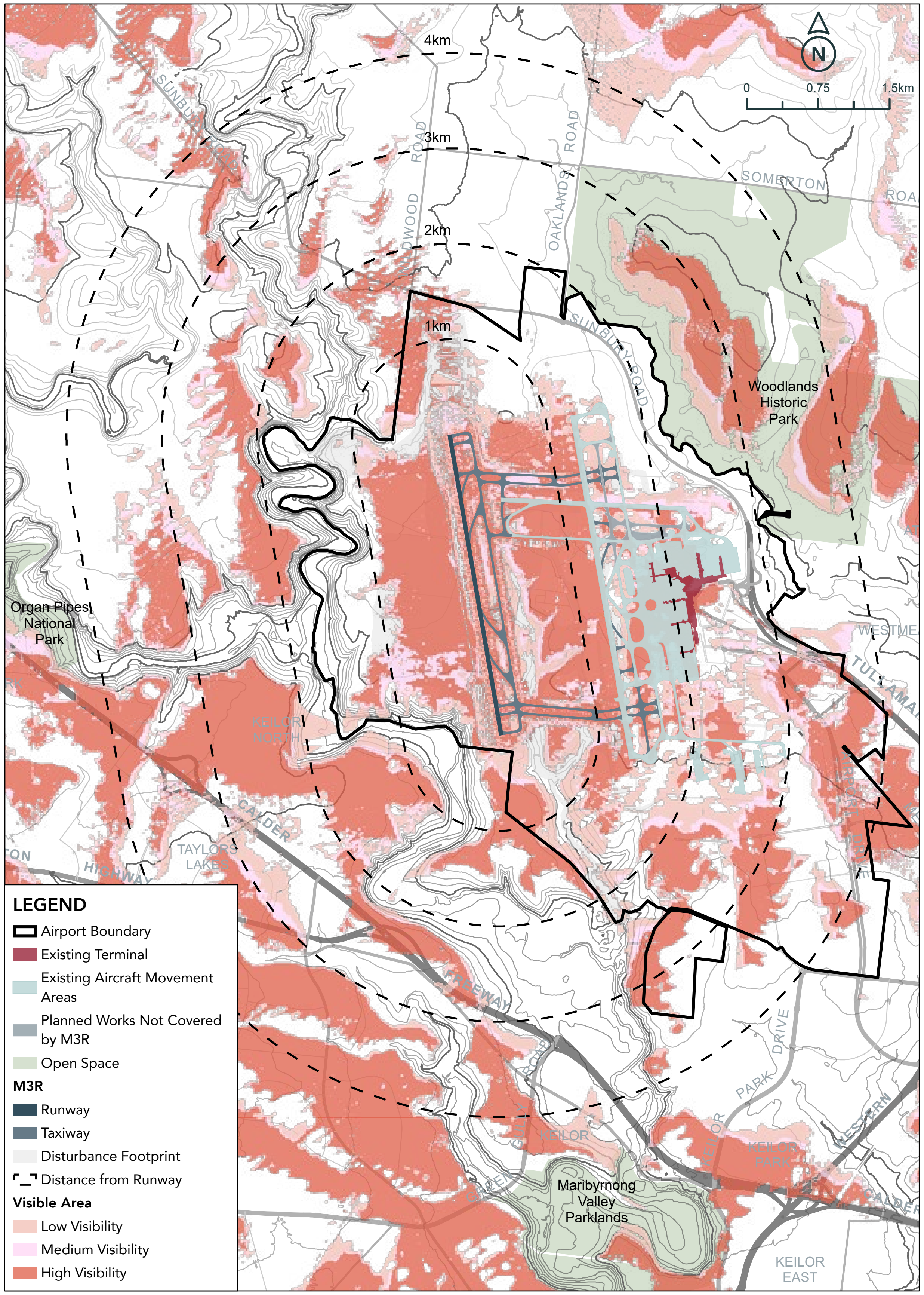
B12.6.3.2
Daytime visual sensitivity levels

The following sensitivity levels will be used in the assessment of daytime visual impact (**Table B12.10**).

Table B12.10
Daytime visual sensitivity levels

Location	Values	Visual sensitivity level
Rural properties and farmsteads	• These properties are used mainly by residents and their visitors • Provisions to protect scenic views and rural character in the Green Wedge Management Plan, Hume and Brimbank planning schemes.	Neighbourhood
Woodlands Historic Park	• Woodlands Historic Park is a part of the Parks Victoria estate, and is managed in accordance with the Parks Victoria Act 1998 • This environmental and recreational asset attracts residents and visitors from across the region to use the walking, cycling and horse riding trails, lookouts and picnic facilities • The recreational nature of these views means that there is an increased value placed on the amenity of views within this area • Woodlands Historic Park is open to vehicles daily from 9am to 4.30pm. Pedestrian access is 24 hours.	Regional
Urban residential areas	• These properties are used mainly by residents and their visitors.	Neighbourhood
Melbourne Airport Golf Course Keilor Public Golf Course	• Used by locals and visitors to the area • The recreational nature of these views means that there is an increased value placed on the amenity of views within this area • Provisions to protect scenic views and rural character in the Green Wedge Management Plan.	Local
Organ Pipes National Park	• Organ Pipes National Park is a part of the state-wide network of environmental and recreational assets, and is protected by the National Parks Act (Vic) • The recreational nature of these views means that there is an increased value placed on the amenity of views within this area • This park attracts residents and visitors from across the region. The park is opened to vehicles daily from 8.30am to 4.30pm.	Regional
Calder Freeway	• The Calder Freeway is a key arterial route between Melbourne and Bendigo, passing in this section through Keilor • This route provides views to locals and visitors from across the region • Vehicles on this route are moving at a speed of approximately 80km/h, and experience both urban and rural views.	Local
Sunbury Road	• Sunbury Road is a key arterial route north of Melbourne Airport, connecting the Tullamarine Freeway with Bulla • This route provides views to locals and visitors from across the region • Vehicles on this route are moving at a speed of approximately 80km/h, and experience mainly rural views north of the airport.	Local

Figure B12.26
Zone of visual influence



B12.6.4
Viewpoint assessment

A range of viewpoints have been selected to represent the visibility of M3R. These viewpoints have been grouped by their location and are as follows:

Views from rural landscapes to the west

- Viewpoint 1 – view south-east from Loemans Road (Table B12.11)
- Viewpoint 2 – view south-east from Loemans Road (north) (Table B12.12).

Views from Bulla and rural landscapes to the north

- Viewpoint 3 – view south-east from Glenara Road (Table B12.13)
- Viewpoint 4 – view south from Sunbury Road (Table B12.14).

Views from Woodlands Historic Park

- Viewpoint 5 – view south from the Woodlands Historic Park Homestead (Table B12.15)
- Viewpoint 6 – view west from Gellibrand Hill, Woodlands Historic Park (Table B12.16)

Views from residential, rural properties and golf courses to the south and west

- Viewpoint 7 – view north from the Melbourne Airport Golf Course (Table B12.17)
- Viewpoint 8 – view north from the Arundel Farm Estate (Table B12.18)
- Viewpoint 9 – view north from McNabs Road (Table B12.19)
- Viewpoint 10 – view north from Skyline Drive, Keilor (Table B12.20)
- Viewpoint 11 – view north-east from Kiuna Road, Keilor North (Table B12.21)
- Viewpoint 12 – view north-east from Keilor Public Golf Course (Table B12.22).

Views north-east from the Calder Freeway

- Viewpoint 13 – view north-east across the Kings Road overbridge (Table B12.23)
- Viewpoint 14 – view north-east from the Calder Freeway (Table B12.24)

Views from Organ Pipes National Park to the south-west

- Viewpoint 15 – view east from Organ Pipes National Park (Table B12.25).

The location of these representative viewpoints is shown in Figure B12.27.

B12.6.5
Summary of daytime visual impact

Key observations from the viewpoint assessment of daytime visual impact are described in the following paragraphs.

B12.6.5.1
Views from rural landscapes to the west

From Loemans Road (viewpoints 1 and 2) and residences within properties to the east of this road (shown on Figure B12.28), views towards the airport are panoramic, extending across a plateau and the deeply incised Deep Creek with limited tree cover. This landform results in clear views to the existing Runway 09/27, airport terminals and air traffic control towers. These views also include the distant skyline of the Melbourne Central Business District (CBD).

During construction, there will be a change in character as activities such as vegetation clearing, major earthworks, stockpiling, pavement and civil works occur over a large area. These elements will be in the middle ground of these views, and closer to the viewer than the existing airport. While the removal of the western part of the Grey Box Woodland would reduce the amenity of these views during construction, the remaining woodland would continue to screen the view to the northern areas of the existing airport. This will result in a considerable reduction in the amenity of views from the rural landscapes to the west (which are of neighbourhood sensitivity) resulting in a minor adverse visual impact during construction.

During operation, the new north-south runway would be visible across views, particularly on Loemans Road. The character of M3R will be generally consistent with the existing elements of the airport seen within the existing views. The new parallel north-south runway will increase the footprint of the airport and bring the runway and associated air traffic closer to viewers in the rural landscapes west of the airport. The new runway will be prominent in these views and will approximately double the area of airfield and tarmac visible. This will create a larger-scale airfield and bring elements closer to viewers.

While M3R's built elements will not obstruct views to the CBD skyline (visible to the south-east and in the background) increased air traffic movements will be seen across the view as aircraft take off and land across the two runways. These elements will all be seen unobstructed due to the open farmland landscape setting. While there will be removal of some vegetation within the Grey Box Woodland, part of it would remain, providing amenity and a backdrop to the northern part of these views. There will also be a visual compatibility between the rural landscape and the similarly flat and open landscape of the airfield.

Overall, M3R will result in a considerable to noticeable reduction in the amenity of views from the rural landscapes to the west (depending on the distance and visibility of M3R). These views are of neighbourhood sensitivity, resulting in a minor adverse to negligible visual impact during operations (Figure B12.29, Figure B12.30 and Figure B12.31).

Figure B12.27
Viewpoint location plan

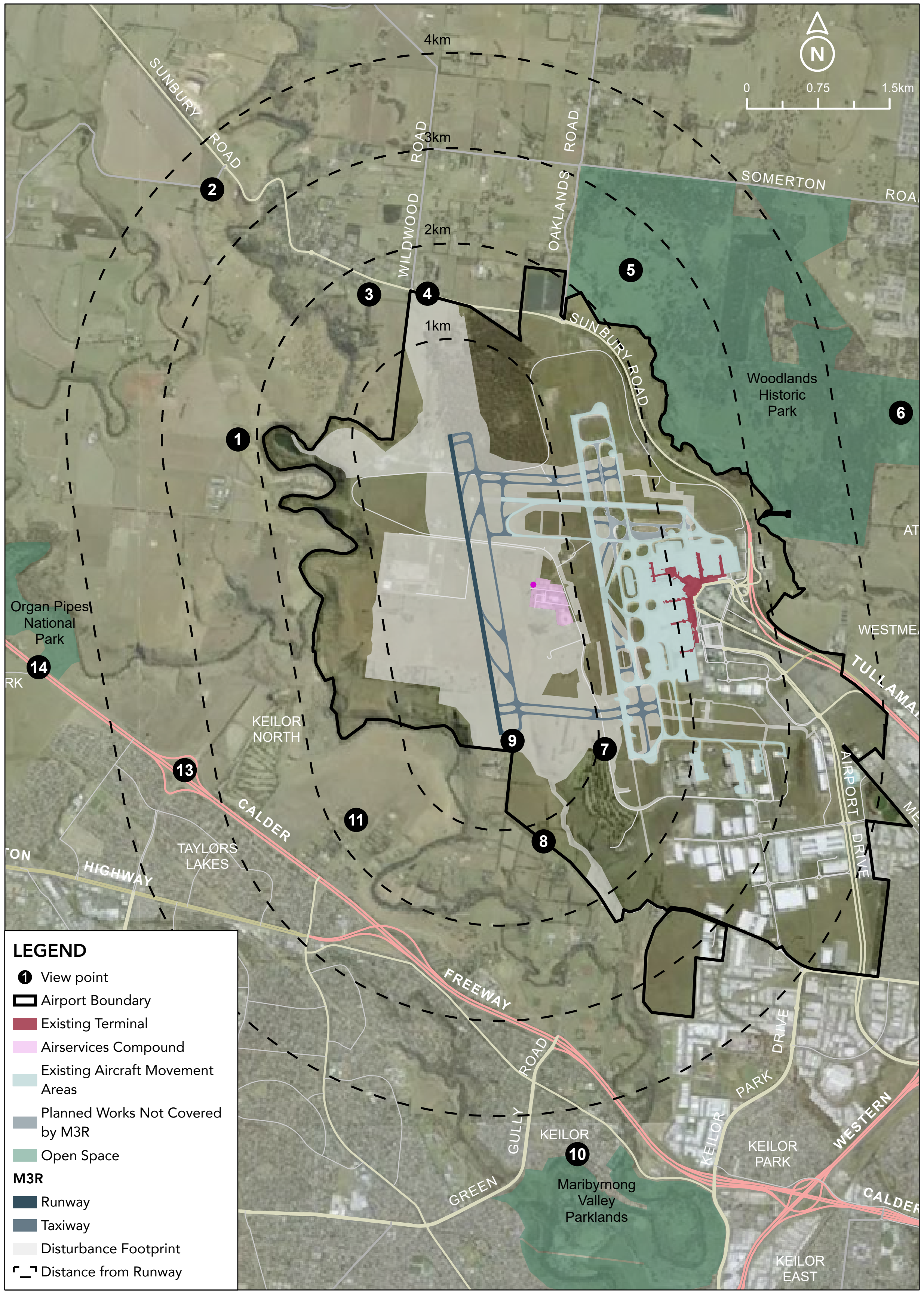


Figure B12.28
Views from rural landscapes to the west

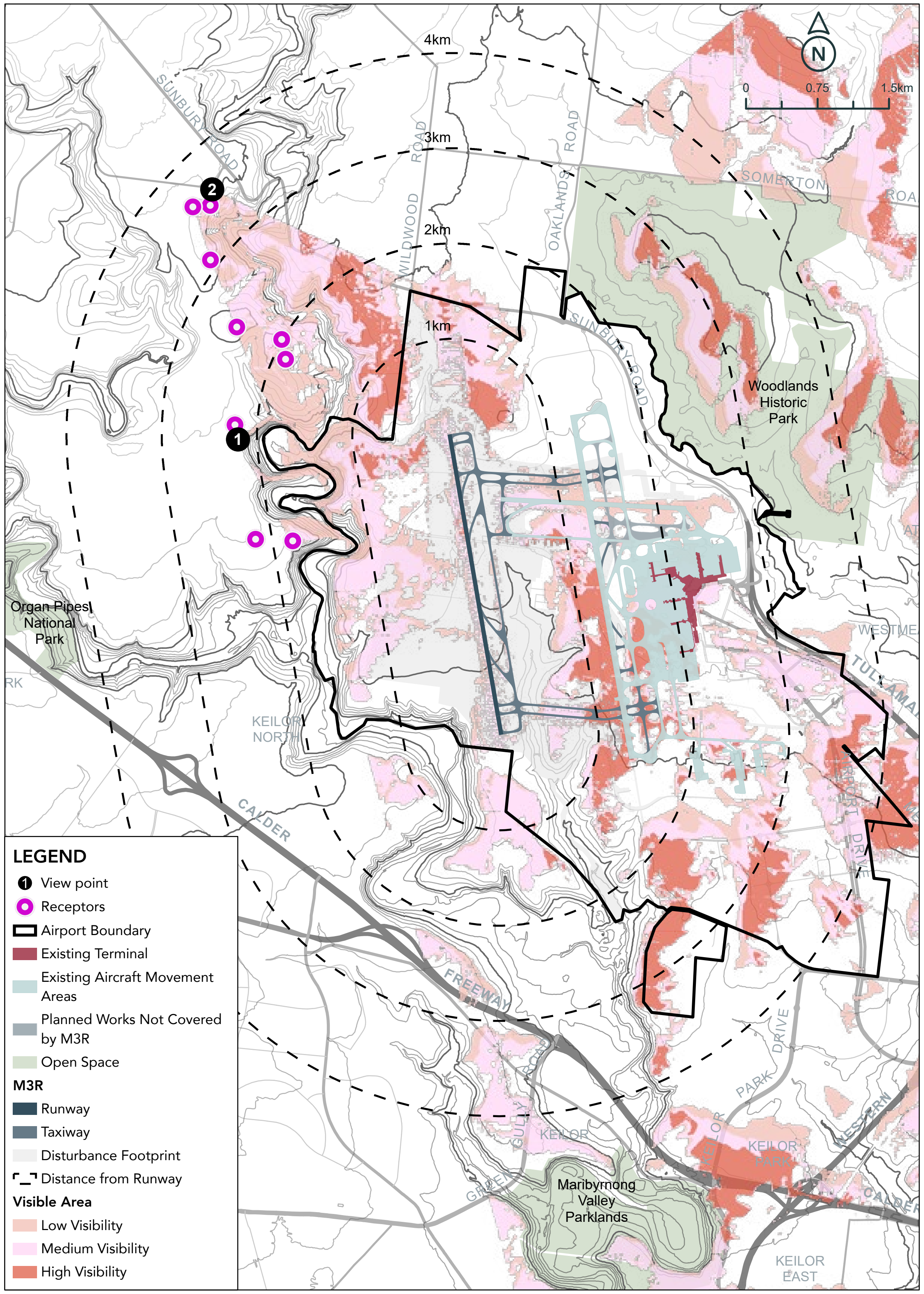


Figure B12.29
Viewpoint 1 – view east from Loemans Road

Figure B12.30
Viewpoint 1 – view east from Loemans Road – artist's impression, M3R opening year

Table B12.11
Viewpoint 1 – view south-east from Loemans Road

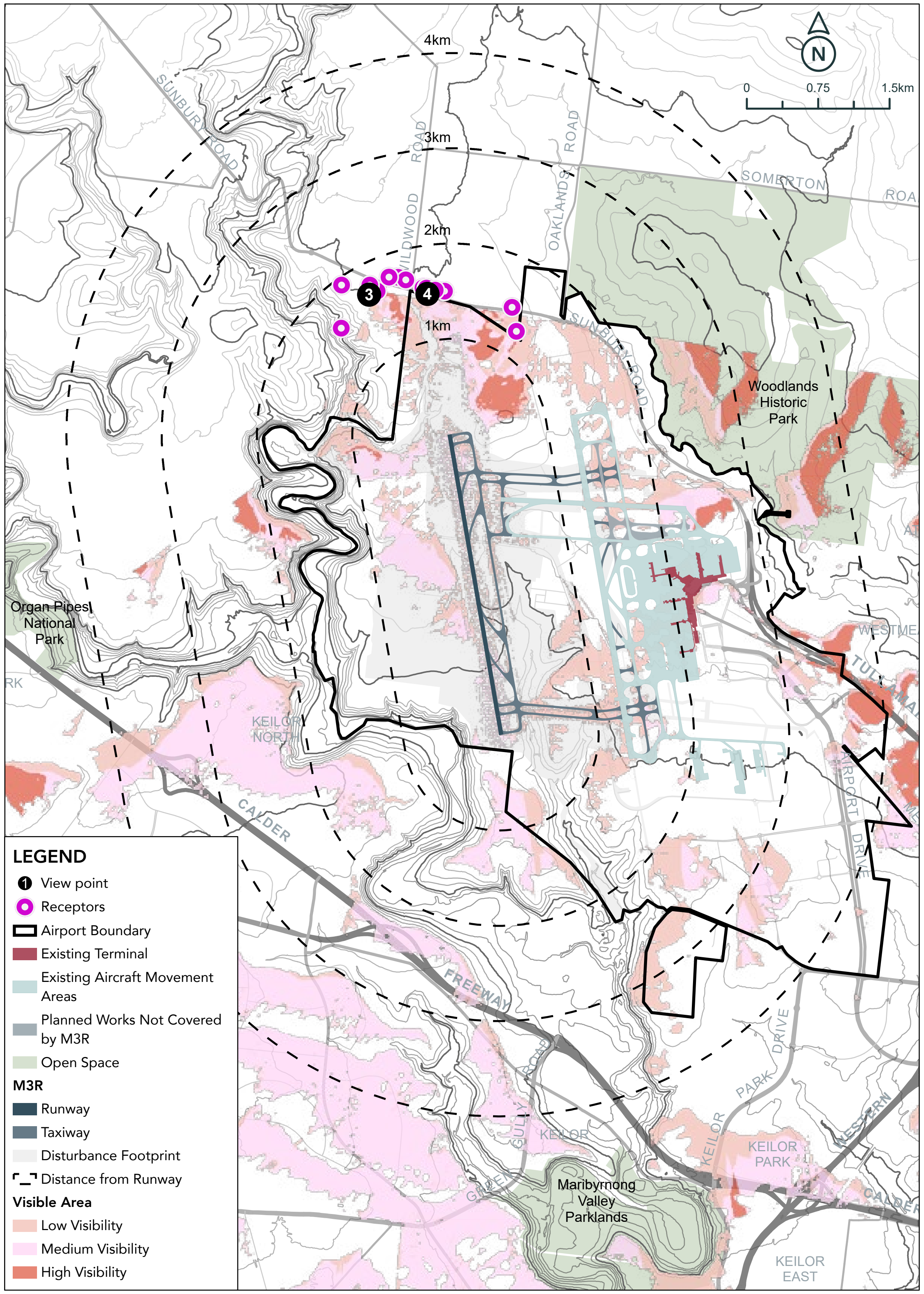
Visual assessment		
Existing view (distance to M3R >1km): • Panoramic view across the steep valley of Deep Creek to the airport • Quarry visible on banks of Deep Creek in foreground • Air traffic control towers, runways, and terminal buildings visible in middle ground (right of view) • Vegetation along Barbiston Road visible in middle ground (right of view) • Terminal precinct and northern part of the existing north-south runway is screened by the Grey Box Woodland (left of view) • Aircraft seen on the existing runways, taxiways, and at the terminal • Aircraft arriving and departing the existing 16L/34R across the view and intermittent aircraft seen travelling directly overhead on the 09/27.		
Visual sensitivity: neighbourhood		
View during construction: • Vegetation removal on Barbiston Road and removal of western part of the Grey Box Woodland • Establishment of a construction support site • Major earthworks for the new north-south runway and taxiways, spoil stockpiling, asphalt / concrete batching plant • Sedimentation control fencing along Deep Creek • Movement of construction vehicles and presence of machinery.		
Visual modification: considerable reduction	**Visual impact:** minor	**Duration:** short-term
View during operation, opening year: • New north-south runway aligned across this view, including HIAL, taxiways, airside access road and security fencing • Aircraft visible on both runways, air traffic with aircraft arriving and departing overhead • View to airport terminal will remain.		
Visual modification: considerable reduction	**Visual impact:** minor	**Duration:** short-term
View during operation, year five: • Additional air traffic travelling overhead and across the view, closer to the viewer.		
Visual modification: considerable reduction	**Visual impact:** minor	**Duration:** medium-term
View during operation, year 20: • Additional air traffic travelling overhead and across the view, closer to the viewer.		
Visual modification: considerable reduction	**Visual impact:** minor	**Duration:** long-term
Visual sensitivity at night: A2: Low district brightness		
Construction, night: • If required, night works will be seen extending across much of this view and towards the viewer and be seen in the middle ground.		
Visual modification: noticeable reduction	**Visual impact:** moderate	**Duration:** short-term
Operation, night: • Light associated with M3R including aircraft intermittently will be seen in the middle ground • Less vegetation would increase the visibility of the airport at night, including the new runway and HIAL • This lighting will be seen against the existing brightly lit airport terminal and largely absorbed into the existing night scene.		
Visual modification: noticeable reduction	**Visual impact:** moderate	**Duration:** long term

Figure B12.31
Viewpoint 2 – view south-east from Loemans Road (north)

Table B12.12
Viewpoint 2 – view south-east from Loemans Road (north)

Visual assessment		
Existing view (distance to M3R 2.5km): • Rural properties on the outskirts of Bulla visible to the north (left of view) in the middle ground • View across undulating landscape valley with scattered farmhouses and trees • Air traffic control towers, terminal buildings and east-west runway visible in the background • Terminal precinct and northern part of the existing north-south runway is screened by the intervening vegetation • Melbourne central business district skyline in the distance • Intermittent aircraft seen travelling across the view and overhead from the existing runways.		
Visual sensitivity: neighbourhood		
View during construction: • Construction activity within the project area, including earthworks, pavement and civil works for the new north-south runway in the background • Establishment and use of a construction support site and stockpiling of spoil may be visible • Movement of construction vehicles and presence of machinery.		
Visual modification: noticeable reduction	**Visual impact:** negligible	**Duration:** short-term
View during operation, opening year: • New north-south runway aligned across this view, including HIAL, taxiways and airside access roads • Increased north-south air traffic with aircraft seen arriving and departing the new runway across the view and closer to the viewer. • Aircraft visible on both runways, air traffic with aircraft arriving and departing overhead • View to airport terminal and central business district will remain.		
Visual modification: noticeable reduction	**Visual impact:** negligible	**Duration:** short-term
View during operation, year five: • Additional air traffic travelling across the view and overhead.		
Visual modification: noticeable reduction	**Visual impact:** negligible	**Duration:** medium-term
View during operation, year 20: • Additional air traffic travelling across the view and overhead.		
Visual modification: noticeable reduction	**Visual impact:** negligible	**Duration:** long-term
Visual sensitivity at night: A2: Low district brightness		
Construction, night: • Night works will be seen in the background of the view, between intervening elements (including landform and vegetation in foreground of view) and would generally be absorbed into the night scene.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** short-term
Operation, night: • New lighting associated with the new and existing runways will be seen in the background • Additional lighting would be seen against existing brightly lit airport terminals.		
Visual modification: noticeable reduction	**Visual impact:** moderate	**Duration:** long-term

Figure B12.32
Views from Bulla and rural landscapes to the north



B12.6.5.2
Views from Bulla and rural landscapes to the north

From Sunbury Road and residential properties on the outskirts of Bulla (Viewpoint 3 and 4) views towards the airport are restricted to slot views framed by vegetation along Deep Creek, within fields and the Grey Box Woodland. This vegetation screens views to the existing runways 16L/34R and 09/27, terminals and air traffic control towers so that only partial views to the airport are typically seen from this area. The state heritage listed Glenara Homestead is located on the banks of Deep Creek, surrounded by extensive gardens and a mature framework of trees. Views from this property are expected to be contained by this landform and vegetation and not extend to the existing airport.

During construction, there will be a change in character because activities including vegetation removal, major earthworks, stockpiling, pavement and civil works will be visible in the middle and background of these views. This will result in a considerable reduction in the amenity of views from the outskirts of Bulla and rural landscapes to the north (of neighbourhood and local sensitivity) resulting in a minor and moderate adverse visual impact during construction.

During operation, the new north-south runways will be visible from Sunbury Road and properties on the south-eastern outskirts of Bulla. The removal of vegetation (including the western part of the Grey Box Woodland) will reduce the amenity of these views. It will also increase the area of the airport (including the runways, taxiways, terminal) and associated air traffic seen within these views. The landform may partly screen the runway as it will be in cutting at its northern end, however, parts of the parallel runway and air traffic overhead will be seen in the middle ground of these views. Views from Glenara will include M3R and there will be an increase in air traffic seen overhead from this property.

Overall, M3R will result in a considerable reduction in the amenity of views from the rural landscapes and residential properties to the north. However, these views are of neighbourhood and local sensitivity, resulting in a minor to moderate adverse visual impact during operations.

Figure B12.33
Viewpoint 3 – view south east from Glenara Road

Table B12.13
Viewpoint 3 – view south east from Glenara Drive

Visual assessment		
Existing view (distance to M3R 10m): • View across adjacent rural property and to the Grey Box Woodland trees and woodland • Existing vegetation screens views to airport terminal buildings, and existing 16L/34R • Air traffic can be seen including intermittent aircraft travelling across the view and overhead from the existing runways.		
Visual sensitivity: neighbourhood		
View during construction: • Removal of western part of the Grey Box Woodland will be seen in middle ground • Works to construct the new 16R/34L will be prominent, in front of the Grey Box Woodland, including major earthworks (excavation and fill), stockpiling of spoil, equipment storage, vegetation clearing, pavement and civil works • Establishment of a construction support site, including concrete/asphalt batching plant will be seen in background • Presence of large-scale machinery and movement of construction vehicles within the site will be seen in the middle and background.		
Visual modification: considerable reduction	**Visual impact:** minor	**Duration:** short-term
View during operation, opening year: • The eastern part of the Grey Box Woodland would remain and will continue to provide a backdrop to this view • The HIAL structures and northern end of new runway, taxiways and terminal will be seen in the background • M3R will bring the airport closer to this view, replacing the woodland and parts of the adjacent rural field with fenced airport land • Aircraft visible at the airport and an increase in air traffic will be seen across the view and overhead.		
Visual modification: considerable reduction	**Visual impact:** minor	**Duration:** short-term
View during operation, year five: • Additional air traffic travelling across the view and overhead.		
Visual modification: considerable reduction	**Visual impact:** minor	**Duration:** medium-term
View during operation, year 20: • Additional air traffic travelling across the view and overhead.		
Visual modification: considerable reduction	**Visual impact:** minor	**Duration:** long-term
Visual sensitivity at night: A2: Low district brightness		
Construction, night: • Lighting on the new runway will be seen in the middle to background of this view.		
Visual modification: noticeable reduction	**Visual impact:** minor	**Duration:** short-term
Operation, night: • Light associated with M3R will extend across large part of the middle ground of this view and will be seen against the eastern portion of the Grey Box Woodland • The back of the HIAL structures would be seen extending north towards Sunbury Road, north of the new runway, but the lights will not be seen.		
Visual modification: noticeable reduction	**Visual impact:** moderate	**Duration:** long-term

Figure B12.34
Viewpoint 4 – view south from Sunbury Road

Figure B12.35
Viewpoint 4 – view south from Sunbury Road – artist's impression, M3R opening year

Table B12.14
Viewpoint 4 – view south from Sunbury Road

Visual assessment		
Existing view (distance to M3R 10m): • View across Sunbury Road to gently undulating landscape with trees and woodland • Grey Box Woodland screens views to the airport terminal buildings, air traffic control towers and existing 16L/34R • Western end of existing 09/27 visible in the centre of this view • Foreground consisting of fields with cattle grazing create a rural character • Concrete crushing (recycling) plant visible in the middle ground • Air traffic can be seen including intermittent aircraft travelling across the view and overhead from the existing runways.		
Visual sensitivity: local		
View during construction: • Removal of the western part of the Grey Box Woodland will be prominent in foreground, opening up the view to part of the existing airport in the background • Works to construct 16R/34L will be prominent, including major earthworks (excavation and fill), stockpiling of spoil, equipment storage, vegetation clearing, pavement and civil works • Establishment of a construction support site, including concrete/asphalt batching plant will be seen in background • Presence of large-scale machinery and movement of construction vehicles along Sunbury Road and site access road seen in close proximity.		
Visual modification: considerable reduction	**Visual impact:** moderate	**Duration:** short-term
View during operation, opening year: • The new and existing runways, HIAL structure at northern end of new runway, taxiways and terminal in the background • M3R will bring the airport closer to this view, replacing the rural fields with fenced airport land • Aircraft visible at the airport and an increase in air traffic will be seen across the view and overhead.		
Visual modification: considerable reduction	**Visual impact:** moderate	**Duration:** short-term
View during operation, year five: • Additional air traffic travelling across the view and overhead.		
Visual modification: considerable reduction	**Visual impact:** moderate	**Duration:** medium-term
View during operation, year 20: • Additional air traffic travelling across the view and overhead.		
Visual modification: considerable reduction	**Visual impact:** moderate	**Duration:** long-term
Visual sensitivity at night: A2: Low district brightness		
Construction, night: • Removal of the western part of the Grey Box Woodland will reveal some of the existing lighting at the airport • Lighting on the new runway will be seen in the middle to background of this view.		
Visual modification: noticeable reduction	**Visual impact:** moderate	**Duration:** short-term
Operation, night: • Light associated with M3R will extend across large part of the middle ground of this view and will be seen against the brightly lit airport terminal • The back of the HIAL structures would be seen extending north towards Sunbury Road, north of the new runway, but the lights will not be seen.		
Visual modification: noticeable reduction	**Visual impact:** moderate	**Duration:** long-term

B12.6.5.3
Views from Woodlands Historic Park

From Woodlands Historic Park (viewpoints 5 and 6) there are views from its homestead and Gellibrand Hill. From the homestead, views to the airport are restricted by existing vegetation including the Grey Box Woodland. There are, however, views to the existing 16L/34R, part of the terminal and air traffic control towers. These include air traffic travelling across the view and overhead. From Gellibrand Hill, there are elevated, open views across the entire airport. The airport is a feature in the panoramic views from Gellibrand Hill, as is the CBD which can also be seen from this local highpoint.

During construction, works would be seen in the background of the view from Woodlands Historic Park. While the existing Grey Box Woodland will screen the northern end of the new runway and HIAL lighting, activities such as major earthworks, stockpiling, pavement and civil works, and the presence of large-scale plant and equipment will be visible.

These elements will be seen in the context of the existing airport. Construction traffic along Sunbury Road and vehicles accessing the site would be seen from the homestead. Overall, this will result in a noticeable reduction in the amenity of views from Woodlands Historic Park, which are of regional sensitivity, resulting in a moderate adverse visual impact during construction.

During operation, the character of M3R will be generally consistent with the existing airport elements seen within the middle and background of these views. M3R will not be prominent in this view as it will be viewed over the existing airfield and partly screened by the Grey Box Woodland. There will be an increase in air traffic visible overhead and travelling across the view. Overall, the M3R will result in no perceived change in the amenity of views from the Woodlands Historic Park Homestead and adjacent areas. These views are of regional sensitivity, resulting in a negligible visual impact during operations (**Figure B12.36**, **Figure B12.38** and **Figure B12.39**).

Figure B12.36
Viewpoint 5 – view south from the Woodlands Historic Park Homestead

Figure B12.37
Views from Woodlands Historic Park

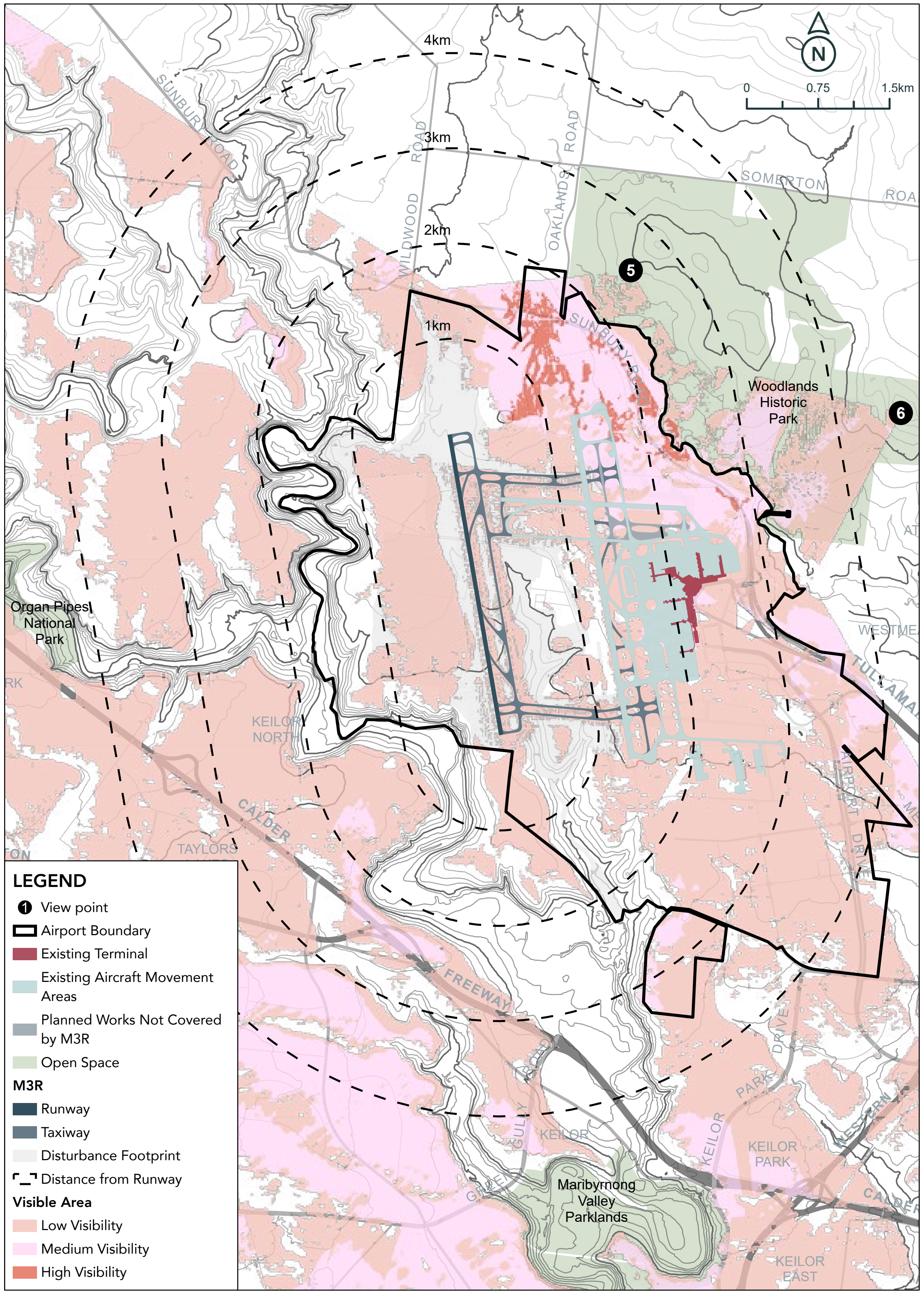


Table B12.15
Viewpoint 5 – view south from the Woodlands Historic Park Homestead

Visual assessment		
Existing view (distance to M3R 1km): • Slightly elevated vantage point • Rural landscape visible in the foreground, Sunbury Road in the middle ground • Grey Box Woodland screens views to western part of east-west runway • Air traffic control towers are visible rising above the horizon • Aircraft travelling overhead		
Visual sensitivity: regional		
View during construction: • Establishment and operation of a construction compound including concrete/asphalt batching plant • Construction of new parallel runway and taxiways would be visible to the south of the Grey Box Woodland and in the background of the view • Construction of additional taxiways around the existing 09/27 in middle ground • Presence of large-scale machinery within the project area and movement of construction vehicles on Sunbury Road.		
Visual modification: noticeable reduction	**Visual impact:** moderate	**Duration:** short-term
View during operation, opening year: • Aircraft visible on the northern end of the existing 16L/4R and new 16R/34L and taxiways south of the Grey Box Woodland • The entire existing 09/27 will be visible in the centre of view • Increase in air traffic seen across this view with aircraft seen using both north-south runways.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** short-term
View during operation, year five: • Additional air traffic travelling across the view.		
Visual modification: noticeable reduction	**Visual impact:** moderate	**Duration:** medium-term
View during operation, year 20: • Additional air traffic travelling across the view.		
Visual modification: noticeable reduction	**Visual impact:** moderate	**Duration:** long-term
Visual sensitivity at night: A2: Low district brightness		
Construction, night: (view not accessible at night) • Any night works will be seen in the middle ground of this view and seen in the context of the existing brightly lit terminal and traffic lights on Sunbury Road.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** short-term
Operation, night: (view not accessible at night) • The lighting associated with the east-west runway, central and southern parts of the new runway will be seen in the background of this view, seen in the context of an existing brightly lit airport.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** long-term

Figure B12.38
Viewpoint 6 – view west from Gellibrand Hill, Woodlands Historic Park

Figure B12.39
Viewpoint 6 – view west from Gellibrand Hill, Woodlands Historic Park – artist's impression, M3R opening year

Table B12.16
Viewpoint 6 – view west from Gellibrand Hill, Woodlands Historic Park

Visual assessment		
Existing view (distance to M3R: 2km): • Elevated, panoramic view over the airport from Woodlands Historic Park • Control towers, existing 16L/34R and 09/27 runways, terminal precinct, apron and adjacent open grassy plains alongside Deep Creek visible in the background • Maribyrnong River valley visible to the south of the airport in the far background • Grey Box Woodland visible to the north (right of view) • Air traffic including intermittent aircraft travelling across the view.		
Visual sensitivity: regional		
View during construction: • Works to construct the new north-south (16R/34L) runway and taxiways including major earthworks (excavation and fill), stockpiling, pavement and civil works, and removal of Barbiston Road and McNabs Road would be seen • Some vegetation clearing, including glimpses to the western part of the Grey Box Woodland and vegetation on Barbiston Road would be visible • Establishment and operation of a construction compound • Presence of large-scale machinery within the project area and movement of construction vehicles.		
Visual modification: noticeable reduction	**Visual impact:** moderate	**Duration:** short-term
View during operation, opening year: • The central and southern areas of the new 16R/34L and taxiways will be seen across the view • The Grey Box Woodland would continue to screen • Aircraft will be visible on all runways, taxiways and at the terminals • Increase in north-south air traffic with aircraft seen across the view spread across the view, arriving and departing from the new 16R/34L and also the existing 16L/34R.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** short-term
View during operation, year five: • Additional air traffic travelling across the view.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** medium-term
View during operation, year 20: • Additional air traffic travelling across the view.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** long-term
Visual sensitivity at night: A2: Low district brightness		
Construction, night: (view not accessible at night) • Night works will be restricted to areas adjacent to the terminal and be generally absorbed into the night scene.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** short-term
Operation, night: (view not accessible at night) • Light associated with aircraft using the new north-south runway will be seen in the middle ground of this view and will be generally absorbed into the night scene.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** long-term

B12.6.5.4
Views from residential properties, rural areas and golf courses to the south and west

From residential and rural properties on McNabs Road and Kiuna Road (viewpoints 9 and 11) there are broad, open views to the existing 16L/34R, airport terminal and air traffic control towers. These views also include air traffic travelling across the view and overhead.

During construction, activities such as vegetation clearing, major earthworks, stockpiling, pavement and civil works; and the presence of plant and equipment, will be seen in the foreground, middle ground and background of these views. The realignment of Operations Road, construction of a vehicle underpass, and removal of McNabs Road and Barbiston Road, within the project area, will be seen from several residential properties within the semi-rural areas to the south and west of the site. This construction activity will screen some portions of the view to the existing airport. Overall, this will result in a considerable reduction in the amenity of views from these properties, which are of neighbourhood sensitivity, resulting in a minor adverse visual impact during construction.

From these locations during operation, the new 16R/34L runway will be seen unobstructed, west of the existing 16L/34R. Features including the southern embankments, and aircraft located on the runway and arriving and departing across the view. will be the main features seen. Due to the scale of the works, M3R will result in a considerable reduction in the amenity of these views and a minor adverse impact. (Figure B12.43, Figure B12.44, and Figure B12.46).

Views from the Melbourne Airport Golf Course, on Operations Road (Viewpoint 7) and the Keilor Public Golf Course (Viewpoint 12) also offer views to the existing runway and airport terminal facilities. Melbourne Airport is in the middle ground of these views, partly filtered by mature trees. There are also glimpses to the airport from the surrounding rural areas of the heritage listed Arundel Farm. The farm's homestead (Viewpoint 8) is located to the west of Arundel Road and intervening trees along the road, and within the surrounding fields screen views to the airport.

During construction, activities including vegetation removal, major earthworks, stockpiling, pavement and civil works; and the presence of plant and equipment will be seen in the middle to background of these views. These elements will replace views to the existing airport. Overall, this will result in a noticeable and considerable reduction in the amenity of views from these locations, which are of local sensitivity, resulting in a minor adverse and moderate visual impact during construction.

During operations, activities associated with M3R will extend closer to these locations, and rise above the surrounding landform. Aircraft will be seen in close proximity, and associated air traffic seen overhead and travelling across these views. From the Keilor Public Golf Course, the new runway and taxiways will be visible filtered through trees to the north-east; however, much of the golf course includes screening vegetation that blocks views to the airport. From the Melbourne Airport Golf Course, however, the new runway, taxiways and realignment of Operations Road will be seen in close proximity and elevated above the surrounding landform. Overall, due to the filtering effect of the intervening vegetation, and precedent of the existing airport and runways seen in these views, M3R will create a noticeable reduction in the amenity of views from these locations. These views are of local visual sensitivity, and this will result in a minor adverse visual impact during operations. (Figure B12.41, Figure B12.42, and Figure B12.47).

There are distant views to the airport from elevated areas to the south of the study area, including views from areas of Keilor (Viewpoint 10), approximately four kilometres from M3R. In these views, the airport can be seen in the background, and air traffic can be seen approaching the site from the east and west. During construction, it is unlikely construction works will be seen from this location, resulting in a negligible visual impact.

During operations, there will be additional air traffic seen flying overhead, arriving, and departing from the new runway. Views from these elevated residential areas are of neighbourhood sensitivity, resulting in a negligible visual impact during M3R operation (Figure B12.45).

Figure B12.40
Views from residential, rural properties and golf courses to the south and west

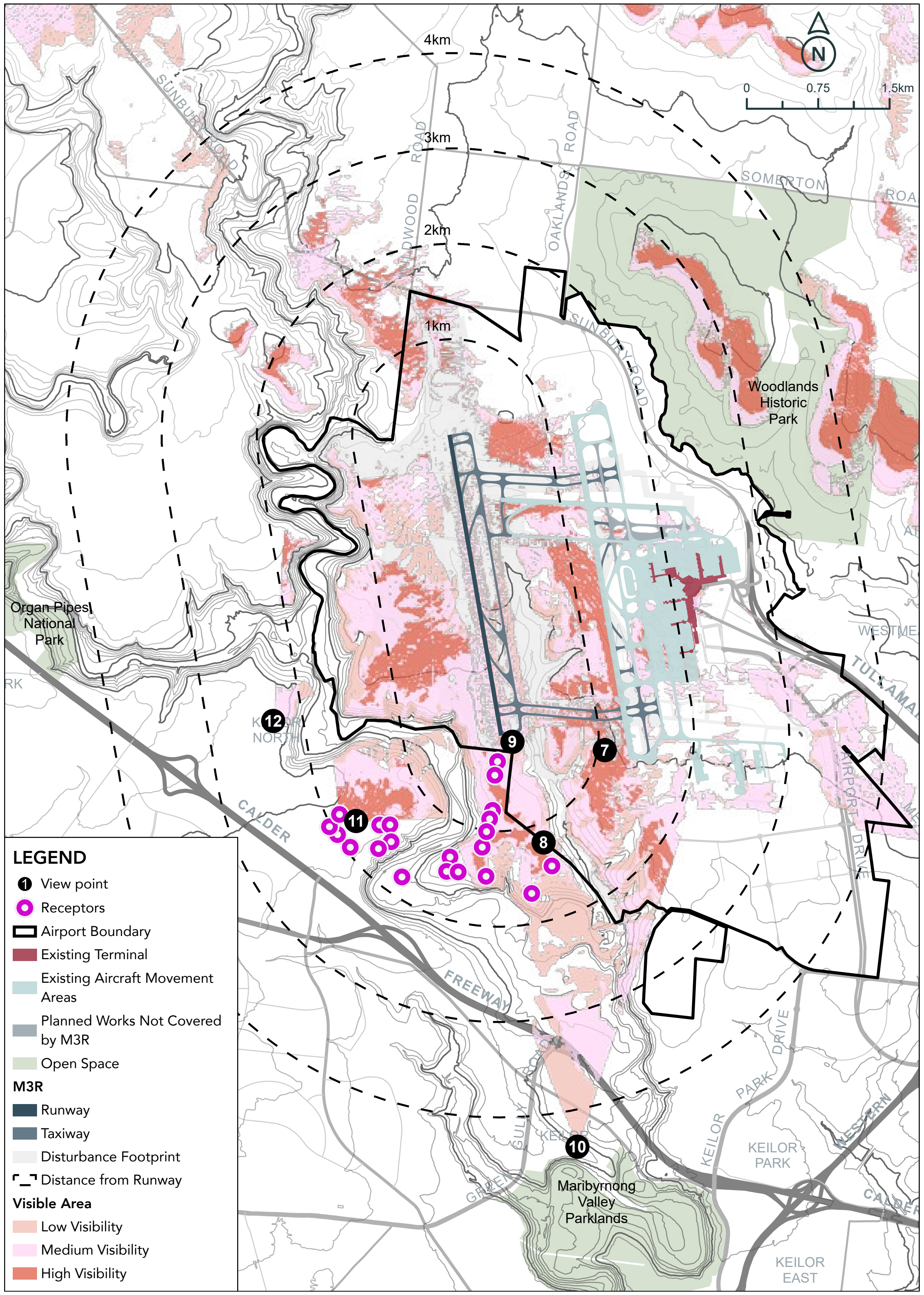


Figure B12.41
Viewpoint 7 – view north from the Melbourne Airport Golf Course

Figure B12.42
Viewpoint 8 – view north from the Arundel Farm Estate

Table B12.17
Viewpoint 7 – view north from the Melbourne Airport Golf Course

Visual assessment

Existing view (distance to M3R 50m):

- Golf course green in the foreground
- Mature vegetation within the golf course filter views to the airport
- The existing 09/27, apron and adjacent grassy plains are visible in the middle ground
- Distant views to the Great Dividing Range
- Grey Box Woodland at northern end of the airport seen in the background
- Air traffic including intermittent aircraft travelling across the view.

Visual sensitivity: local

View during construction:

- Works to form the new 16R/34L including major earthworks (excavation and fill), stockpiling, pavement and civil works
- Vegetation clearing would be seen in middle and background of view
- Diversion of Operations Road to the west and across this view in middle ground
- Construction of a new vehicle tunnel under the southern cross-field taxiways and stormwater drainage network in middle ground of view, including new pipework, swales and culverts
- Construction of the new 16R/34L, including apron, taxiways, airside access road and fencing in middle ground of this view
- Presence of large-scale machinery with the project area and movement of construction vehicles in middle ground.

Visual modification: considerable reduction | **Visual impact:** moderate | **Duration:** short-term

View during operation, opening year:

- Diverted Operations Road extending across this view in middle ground
- Aircraft visible on the new 16R/34L, glimpsed through trees within the golf course
- Increase in north-south air traffic with aircraft seen arriving and departing the runways visible overhead.

Visual modification: noticeable reduction | **Visual impact:** minor | **Duration:** short-term

View during operation, year five:

- Additional aircraft overhead, arriving and departing from the new north-south runway.

Visual modification: noticeable reduction | **Visual impact:** minor | **Duration:** medium-term

View during operation, year 20:

- Additional air traffic seen overhead, arriving and departing the new north-south runway.

Visual modification: noticeable reduction | **Visual impact:** minor | **Duration:** long-term

Visual sensitivity at night: A2: Low district brightness

Construction, night: (view not accessible at night)

- Light will be seen extending across and extending north from this view to construct the new runway, Operations Road and Arundel Creek diversions. This work will bring lighting towards this location, in the middle ground where it is not screened by trees.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** short-term

Operation, night:

- Light associated with Operations Road, and aircraft on the new north-south runway (16R/34L) will be seen in the middle ground of this view.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** long-term

Table B12.18
Viewpoint 8 – view north from the Arundel Farm Estate

Visual assessment

Existing view (distance to M3R 600m):

- Vineyard seen in the foreground is part of Arundel Farm Estate
- Small-scale rural character, with rolling landform, vineyard in the foreground, paddocks in the middle ground, defined by trees
- Northern areas of the airport including north-south runway, terminal precinct, apron and backdrop of the Great Dividing Range visible in background
- Air traffic including intermittent aircraft travelling across the view.

Visual sensitivity: local

View during construction:

- Construction of the new 16R/34L, taxiways, airside access road and fencing, including major earthworks (excavation and fill), stockpiling, vegetation clearing would be in the background and partly screened by vegetation
- Works to form and construct the new southern cross-field taxiways and stormwater drainage network would be seen in the middle to background of the view between the trees
- Diversion of Operations Road to the west will be screened by vegetation
- Views to large-scale machinery within the project area and movement of construction vehicles.

Visual modification: noticeable reduction | **Visual impact:** minor adverse | **Duration:** short-term

View during operation, opening year:

- New east-west southern cross-field taxiways and stormwater drainage network in middle ground of view, slightly elevated on embankment in the background of view, seen through trees within the rural landscape
- Aircraft visible on the new 16R/34L and increase in north-south air traffic with aircraft seen overhead.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** short-term

View during operation, year five:

- Additional aircraft seen overhead arriving and departing from the new runway.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** medium-term

View during operation, year 20:

- Additional aircraft seen overhead arriving and departing from the new runway.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** long-term

Visual sensitivity at night: A2: Low district brightness

Construction, night:

- Additional light will be seen adjacent to the existing brightly lit environment of the terminal in the background.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** short-term

Operation, night:

- Light associated with Operations Road, and aircraft on the new north-south runway (16R/34L) will be seen in the background of this view and be absorbed into the existing brightly lit terminal in the background.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** long-term

Figure B12.43
Viewpoint 9 – view north from McNabs Road

Figure B12.44
Viewpoint 9 – view north from McNabs Road – artist's impression, M3R opening year

Table B12.19
Viewpoint 9 – view north from McNabs Road

Visual assessment		
Existing view (distance to M3R 0m – located on southern boundary of M3R project area): • Undulating and partly vegetated rural landscape visible in foreground • Airport air traffic control towers, runways, terminal precinct and apron visible in middle ground • Vegetation along Barbiston Road visible in foreground and Grey Box Woodland seen in the background of view • Rural landscape in the middle ground • Distant views to the Great Dividing Range • Air traffic including intermittent aircraft travelling across the view and overhead.		
Visual sensitivity: neighbourhood		
View during construction: • Removal of vegetation along Barbiston Road and the western part of the Grey Box Woodland • Closure of McNabs Road in the foreground • Works to form the new 16R/34L including major earthworks (excavation and fill), and stockpiling in fore and middle ground of view • Construction of new 16R/34L, apron, taxiways, airside access road and fencing • Drainage relocations and upgrade works to the east of view, including installation of new pipework, swales, culverts and new vehicle tunnel under southern cross-field taxiways • Presence of large-scale machinery within the project area and movement of construction vehicles.		
Visual modification: considerable reduction	**Visual impact:** minor	**Duration:** short-term
View during operation, opening year: • New 16R/34L elevated on embankment, visible to the west (left of view) • Aircraft visible on the new 16R/34L, and cross-field taxiways • Increase in north-south air traffic with aircraft seen across the view and overhead • Obstruction of the distant views to the rural landscape including trees and woodland.		
Visual modification: considerable reduction	**Visual impact:** minor	**Duration:** short-term
View during operation, year five: • Additional aircraft travelling across the view.		
Visual modification: considerable reduction	**Visual impact:** minor	**Duration:** medium-term
View during operation, year 20: • Additional aircraft travelling across the view.		
Visual modification: considerable reduction	**Visual impact:** minor	**Duration:** long-term
Visual sensitivity at night: A2: Low district brightness		
Construction, night: • Light will be seen the middle ground and extending across this view for M3R construction, including the reconfiguration of Operations Road and works at Arundel Creek (right of view).		
Visual modification: noticeable reduction	**Visual impact:** moderate	**Duration:** short-term
Operation, night: • Light associated with aircraft on the new north-south runway (16R/34L) will be seen in the middle ground of this view, seen in the context of the existing lit airport.		
Visual modification: noticeable reduction	**Visual impact:** moderate	**Duration:** long-term

Figure B12.45
Viewpoint 10 – view north from Skyline Drive, Keilor

Figure B12.46
Viewpoint 11 – view north-east from Kiuna Road, Keilor North

Table B12.20
Viewpoint 10 – view north from Skyline Drive, Keilor

Visual assessment		
Existing view (distance to M3R 4km): • Elevated northerly view with suburban residential landscape in the fore and middle ground • Rural landscapes of the Maribyrnong River and Arundel Creek valleys, including the Keilor Market Gardens Cultural Landscape, in the middle to background • Terminal precinct and apron areas visible in background • Mature vegetation alongside roads and paddocks near Arundel Farm and within Melbourne Airport Golf Course screen views to the runways • Distant views to the Great Dividing Range • Air traffic including intermittent aircraft travelling across the view and overhead.		
Visual sensitivity: neighbourhood		
View during construction: • Intervening vegetation will screen most construction activity to the west of the project area • Some work at the south eastern end of the project area may be visible in the background, including the construction of new and cross-field taxiways.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** short-term
View during operation, opening year: • Aircraft visible overhead, arriving and departing the new north-south runway (16L/34R), in background of view • There will be an increase in north-south air traffic currently seen overhead and across the view but distributed across three runways.		
Visual modification: noticeable reduction	**Visual impact:** negligible	**Duration:** short-term
View during operation, year five: • Additional aircraft travelling overhead.		
Visual modification: noticeable reduction	**Visual impact:** negligible	**Duration:** medium-term
View during operation, year 20: • Additional aircraft travelling overhead.		
Visual modification: noticeable reduction	**Visual impact:** negligible	**Duration:** long-term
Visual sensitivity at night: A3: Medium district brightness		
Construction, night: • Light associated with night works is unlikely to be seen from this location due to the distance. • Any additional lighting will be absorbed into the existing lit view.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** short-term
Operation, night: • Light associated with aircraft on the new north-south runway and taxiways (16R/34L) will be seen in the middle ground.		
Visual modification: noticeable reduction	**Visual impact:** minor	**Duration:** long-term

Table B12.21
Viewpoint 11 – view north-east from Kiuna Road, Keilor North

Visual assessment

Existing view (distance to M3R 1.5km):

- Flat and sparsely vegetated landscape in the foreground and middle ground allow expansive views over the Maribyrnong River valley to the airport
- Airport air traffic control towers, terminal precinct, and runway visible in middle ground
- Southern part of airport screened by mature vegetation within Melbourne Airport Golf Course
- Vegetation on Barbiston Road visible in middle ground
- Grey Box Woodland visible in background of view, beyond the air traffic control towers
- Air traffic including intermittent aircraft travelling across the view.

Visual sensitivity: neighbourhood

View during construction:

- Works to prepare and construct the new 16R/34L and taxiways will be seen in middle and background, including major earthworks (excavation and fill), vehicle tunnel works (under new southern cross-field taxiways), stockpiling, stormwater drainage works, and removal of vegetation on Barbiston Road in the background
- Removal of the western part of the Grey Box Woodland will be seen in background of view
- Diversion of Operations Road and removal of Barbiston Road and McNabs Road in middle ground
- Presence of machinery within the project area and movement of construction vehicles.

Visual modification: considerable reduction | **Visual impact:** minor | **Duration:** short-term

View during operation, opening year:

- New 16R/34L elevated on embankment, new apron, taxiways, airside access road and security fencing, extending across the middle ground
- Increase in north-south air traffic visible overhead, arriving and departing the new 16R/34L and travelling along the taxiways
- Diversion of Operations Road, stormwater drainage network and new vehicle tunnel under the southern cross-field taxiways will be visible.

Visual modification: considerable reduction | **Visual impact:** minor | **Duration:** short-term

View during operation, year five:

- Additional aircraft travelling across the view, arriving and departing from the new runway.

Visual modification: considerable reduction | **Visual impact:** minor | **Duration:** medium-term

View during operation, year 20:

- Additional aircraft travelling across the view, arriving and departing from the new runway.

Visual modification: considerable reduction | **Visual impact:** minor | **Duration:** long-term

Visual sensitivity at night: A2: Low district brightness

Construction, night:

- Light will be seen extending across the middle ground of this view to construct the runway. This work will be seen in a broad view which includes the existing, brightly lit terminal

Visual modification: noticeable reduction | **Visual impact:** moderate | **Duration:** short-term

Operation, night:

- Light associated with Operations Road and aircraft on the new north-south runway (16R/34L) will be seen in the middle ground of this view, in context of existing lit airport.

Visual modification: noticeable reduction | **Visual impact:** moderate | **Duration:** long-term

Figure B12.47
Viewpoint 12 – view north-east from Keilor Public Golf Course

Table B12.22
Viewpoint 12 – view north-east from Keilor Public Golf Course

Visual assessment

Existing view (distance to M3R 1km):

- Golf course fairway in the foreground
- Mature vegetation within the golf course filter views to the airport
- Trees along Barbiston Road can be seen aligned across the view in the background
- Grey Box Woodland visible in the far background (right of view)
- Distant views to the Great Dividing Range (left of view)
- Air traffic including intermittent aircraft travelling across the view.

Visual sensitivity: local

View during construction:

- Works to construct the new 16R/34L, including major earthworks (excavation and fill), stockpiling, civil and pavement works, seen in the background (right of view)
- Vegetation clearing within the project area, including along Barbiston Road and the western part of the Grey Box Woodland
- Presence of large-scale machinery with the project area and movement of construction vehicles.

Visual modification: noticeable reduction | **Visual impact:** minor | **Duration:** short-term

View during operation, opening year:

- New 16R/34L elevated on embankment, new apron, taxi way hardstands, airside access road and security fencing would be seen in the background (right of view)
- Removal of trees including part of the woodland would open up the background of this view, allowing longer range views into the airport and towards Sunbury Road
- Aircraft visible on the new and existing runways and an increase in north-south air traffic, with aircraft seen overhead, arriving and departing the airport, glimpsed through trees within the golf course.

Visual modification: noticeable reduction | **Visual impact:** minor | **Duration:** short-term

View during operation, year five:

- Additional air traffic travelling overhead and aircraft arriving and departing the runway.

Visual modification: noticeable reduction | **Visual impact:** minor | **Duration:** medium-term

View during operation, year 20:

- Additional air traffic travelling overhead.

Visual modification: noticeable reduction | **Visual impact:** minor | **Duration:** long-term

Visual sensitivity at night: A2: Low district brightness

Construction, night: (view not accessible at night)

- Light associated with the construction works will be seen in the background, where not screened by trees within the golf course (right of view).

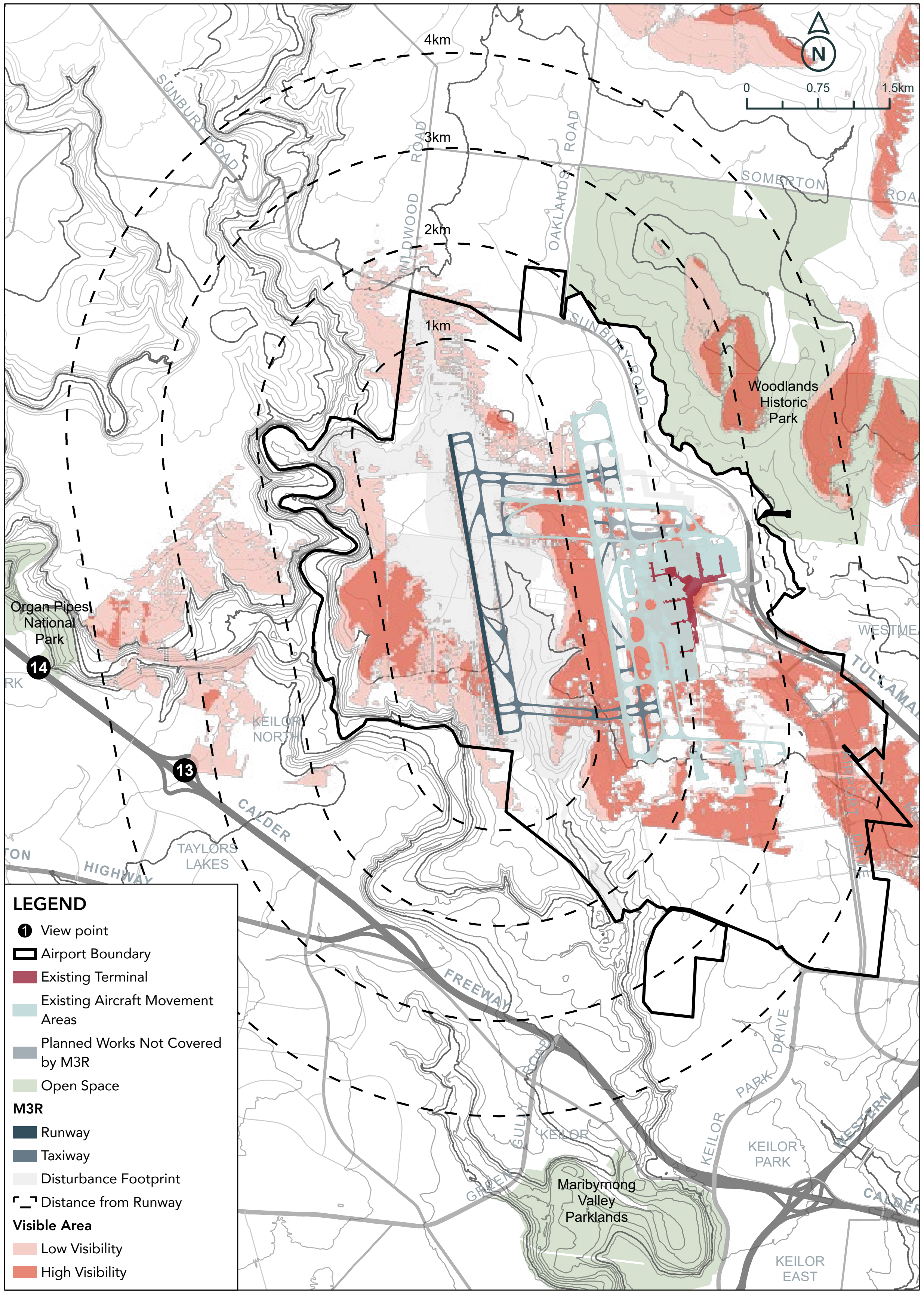
Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** short-term

Operation, night: (view not accessible at night)

- Light associated with Operations Road and aircraft on the new north-south runway (16R/34L), will be seen in the background (right of view) and seen in the context of the existing lit airport.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** long-term

Figure B12.48
Views from Calder Freeway



B12.6.5.5
Views north-east from the Calder Freeway

From the Calder Freeway and overbridges (viewpoints 13 and 14) there are broad open views across the rural landscape and towards Melbourne Airport. In these views, the terminals and air traffic control towers can be seen in the background, across the creek valleys. Existing blocks of vegetation and intervening landform screen views to the existing runways.

During construction, activities including vegetation removal, major earthworks, stockpiling, civil and pavement works and the presence of plant and equipment will be mostly screened by intervening elements. There may be glimpses to the upper portions of construction equipment over and through the intervening vegetation. The works will be seen mainly from vehicles moving at speed and viewed within the context of the airport. Overall, this will result in a noticeable reduction but no perceived change in the amenity of views from these locations, which are of local sensitivity, resulting in a minor adverse and negligible visual impact during construction.

During operation, the character of M3R will be generally consistent with the existing elements of the airport seen within these views. The realignment of Operations Road and new runway 16R/34L will be seen in front of the airport. Increased air traffic will also be seen, aligned parallel with the existing north-south air traffic currently seen overhead. Overall, due to the precedent of the existing airport in this view, M3R will not create a perceived change in the amenity of views from the Calder Freeway, resulting in a negligible visual impact (Figure B12.49 and Figure B12.50).

Figure B12.49
Viewpoint 13 – view north-east across the Kings Road overbridge

Table B12.23
Viewpoint 13 – view north-east across the Kings Road overbridge

Visual assessment

Existing view (distance to M3R 2km):

- Elevated view to undulating rural landscape in middle ground of view
- Mature vegetation along the Maribyrnong River and within Keilor Public Golf Course partially screen views to the airport
- Upper part of the terminal and control towers visible rising above the horizon in the background
- Woodlands Historic Park, in far background of view
- Distant views to the Great Dividing Range (right of view)
- Air traffic including intermittent aircraft travelling across the view.

Visual sensitivity: local

View during construction:

- Intervening vegetation will screen the majority of construction activity
- Vegetation clearing and the upper parts of tall machinery may be seen in background.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** short-term

View during operation, opening year:

- Increase in north-south air traffic with aircraft seen across the view, arriving and departing from the new runway.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** short-term

View during operation, year five:

- Additional aircraft travelling across the view.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** medium-term

View during operation, year 20:

- Additional aircraft travelling across the view.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** long-term

Visual sensitivity at night: A2: Low district brightness

Construction, night:

- The glow of night works will be seen in the background, west of the existing airport terminal above intervening vegetation in the background.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** short-term

Operation, night:

- Light associated with aircraft on the new north-south runway (16R/34L) may be seen in the background of this view.
- This additional light would be seen in the context of an existing lit airport.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** long-term

Figure B12.50
Viewpoint 14 – view north-east from the Calder Freeway

Table B12.24
Viewpoint 14 – view north-east from the Calder Freeway

Visual assessment

Existing view (distance to M3R 3.5km):

- Open and level views across the Jackson Creek valley to Melbourne Airport
- Undulating rural landscape including the deeply incised banks of Jacksons Creek
- Airport terminal and control towers visible, rising above the horizon in the background of view
- Elevated vegetation at Woodlands Historic Park seen in far background of view
- Grey Box Woodland visible at northern end of airport, in view background (left of view)
- Air traffic including intermittent aircraft travelling across the view
- The project area is visible in the background of this view, beyond the Jacksons Creek valley,

Visual sensitivity: local

View during construction:

- Construction of the new north-south runway, including major earthworks (excavation and fill), stockpiling, vegetation clearing, civil and pavement works visible in background
- Construction of new taxiways, airside access road and security fencing may be glimpsed in the background
- Presence of large-scale machinery with the project area and movement of construction vehicles.

Visual modification: noticeable reduction | **Visual impact:** minor | **Duration:** short-term

View during operation, opening year:

- New runway, taxiways, airside access road and security fencing would be glimpsed in the background
- Aircraft visible arriving and departing the new north-south runway and travelling along taxiways, increasing the amount of air traffic seen across the view in the background.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** short-term

View during operation, year five:

- Additional aircraft travelling across the view, arriving and departing from the new runway.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** medium-term

View during operation, year 20:

- Additional aircraft travelling across the view arriving and departing from the new runway.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** long-term

Visual sensitivity at night: A3: Medium district brightness

Construction, night:

- Light associated with night works is unlikely to be seen from this location due to intervening vegetation
- Any additional lighting will be absorbed into the setting of the existing lit areas at the terminal and surrounds.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** short-term

Operation, night:

- Light associated with aircraft on the new north-south runway (16R/34L) would be seen in the background of this view, in the context of an existing lit airport.

Visual modification: no perceived change | **Visual impact:** negligible | **Duration:** long-term

B12.6.5.6
Views from Organ Pipes National Park to the south-west

Views from within the Organ Pipes National Park (Viewpoint 15) are largely contained within the valley of Deep Creek. While the airport cannot be seen, air traffic can be seen flying across the view, detracting from the wilderness and remote character of these views.

During construction there will be no change in amenity of views from the Organ Pipes National Park, resulting in a negligible visual impact. During operations, there will be increased air traffic seen aligned across the view.
As there is already air traffic seen in this view, it is unlikely that there will be a perceived reduction in the amenity of this view, which is of local visual sensitivity, resulting in a negligible visual impact during operations (Figure B12.51).

Figure B12.51
Viewpoint 15 – view east from Organ Pipes National Park

Figure B12.52
Views from Organ Pipes National Park to the south-west

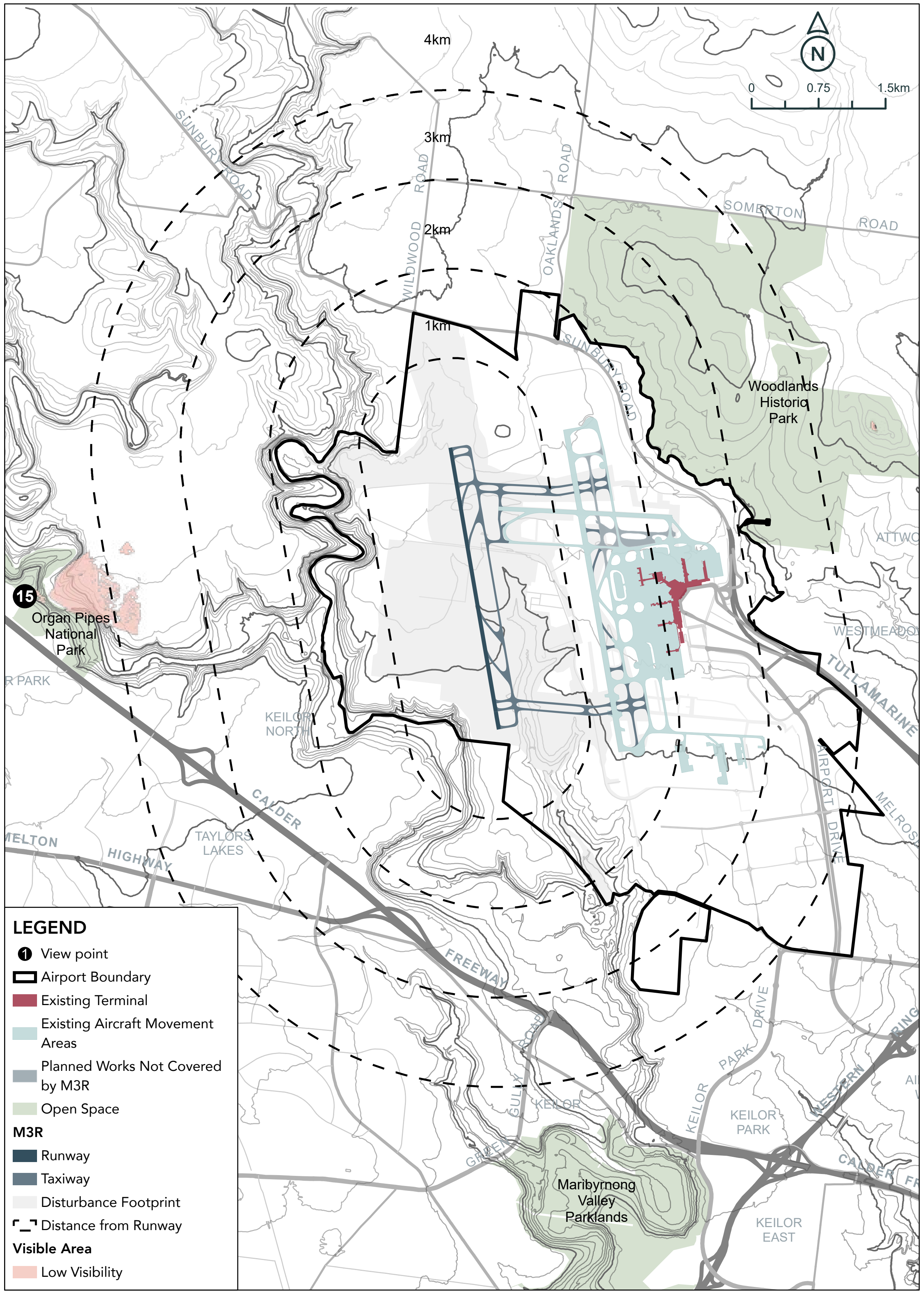


Table B12.25
Viewpoint 15 – view east from Organ Pipes National Park

Visual assessment		
Existing view (distance to M3R 3.5km): • View from the ridgeline, into the Jackson Creek valley from a trail within the National Park • Vegetation and landform in the middle ground enclose views • Landform and vegetation screen views to the airport • Air traffic, including intermittent aircraft, travelling across the view.		
Visual sensitivity: local		
View during construction: • Intervening landform will screen any view to the construction activity within the project area.		
Visual modification: noticeable reduction	**Visual impact:** minor adverse	**Duration:** short-term
View during operation, opening year: • Intervening landform and vegetation will screen construction activity. • Glimpses to aircraft arriving and departing from the new runway and additional air traffic will be seen across the view.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** short-term
View during operation, year five: • Additional aircraft seen overhead and travelling across the view.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** medium-term
View during operation, year 20: • Additional aircraft seen overhead and travelling across the view.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** long-term
Visual sensitivity at night: A2: Low district brightness		
Construction, night: (view not accessible at night) • Works undertaken at night will not be seen due to intervening landform and vegetation.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** short-term
Operation, night: • Aircraft arriving and departing from the new runway may be seen in the background of this view and travelling overhead.		
Visual modification: no perceived change	**Visual impact:** negligible	**Duration:** long-term

B12.6.6
Night-time sensitivity levels

The criteria described in Table B12.26 are used to describe night-time visual impact sensitivity.

B12.6.7
Views from rural landscapes to the west

During construction, night works will be seen unobstructed and would extend across a large area of the view from properties to the east of Loemans Road (refer to Viewpoint 1 and 2). It is not expected that there would be any light trespass onto the residences in this area due to the separation provided by Deep Creek. These night works will be seen against the existing brightly lit airport terminal, which is prominent in existing views. Overall, there will be noticeable reduction in the amenity of views at night from this area of A2: low district brightness, and a moderate adverse visual impact during construction.

During operations, the new north-south runway will be seen, with some lighting on the runway and HIAL at its northern end (directed upwards to guide aircraft). There will also be lighting associated with air traffic overhead and along the parallel runways. There will be no light trespass onto these properties due to the separation of the residences from the airport by Deep Creek, and this lighting will be viewed against the existing brightly lit airport terminal, which is prominent in the existing view. This will result in a noticeable reduction in the amenity of views at night, from this area of A2: Low district brightness, and a moderate adverse visual impact during operations.

Table B12.26
Night-time sensitivity levels

Location	Values	Visual sensitivity level
Airport terminal precinct	• Brightly lit buildings, car parking structures, streets and apron areas • High level of night-time activity.	A4: High district brightness area
Bulla, Sunbury Road, Calder Freeway, Keilor	• Concentration of lighting from residential properties and vehicles on local streets in Bulla • Urban locations such as Keilor include lighting from residences and moderately well-lit roadways • Moderate levels of activity at night • Moderately sensitive visual settings at night.	A3: Medium district brightness area
Rural areas to the south, west and north of the airport	• Includes rural areas with scattered residential properties in relatively dark locations • Limited night-time activity on courses so that views are not accessible at night • Highly sensitive visual setting at night.	A2: Low district brightness area
Golf courses	• Activity is limited (daytime opening hours 6.30am-6pm) and views are not accessible at night from the course • The clubhouse and car parking areas at the Melbourne Airport Golf Course can be hired for functions.	A2: Low district brightness area
Organ Pipes National Park, Woodlands Historic Park	• National park and state park are largely unlit at night, with some limited lighting at park entries • No night-time activity and views are not accessible at night • Very highly sensitive visual setting	A1: Intrinsically dark landscape

B12.6.8
Views from Bulla and rural landscapes to the north

During construction, views from Bulla and rural landscapes to the north will be in close proximity to the construction of the northern end of the new north-south runway (16R/34L) (refer to viewpoints 3 and 4). Views to construction activity within the remainder of the project area will also be possible in the middle and background of views. During night works, there would be lighting seen on visible areas of the site. It is not expected that there would be any light trespass onto adjacent residences as lighting would be focused on the project area and due to the nature of the rural landscapes. The night works would be seen in the context of the existing brightly-lit airport terminal and in an area where air traffic would currently be seen travelling across these views at night. This will result in a noticeable reduction in the amenity of views at night from this area of A2: Low district brightness, and a moderate adverse visual impact during construction.

During operations, aircraft arriving on the new north-south runway (16R/34L) will be seen arriving and departing across the views, parallel with but closer to this location. The new HIAL north of the new runway would be visible, but light would be directed upwards, towards air traffic. It is expected that there will be no light trespass on adjacent residences. Overall, there will be a noticeable reduction in the amenity of views at night, from this area of A2: Low district brightness, and a moderate adverse visual impact during operations.

B12.6.9
Views from Woodlands Historic Park

Views from Woodlands Historic Park will not be available at night and, for this reason, no impact will be experienced.

B12.6.10
Views from residential, rural properties and golf courses to the south and west

It is not expected that there will be access to views from the golf courses at night. For this reason, no impact will be experienced (refer to viewpoints 7 and 12). Although there may be access to the golf course clubhouses during functions there are no views to the works expected from these locations.

During construction, from residential properties within this rural landscape (such as on Kiuna and McNabs roads) there will be unobstructed views to the night works (refer to Viewpoint 8, 9, 10 and 11). Night works will include major earthworks and involve forming of the runway and taxiways, raised up above the surrounding landform and taxiways. Because works will be contained within the project area it is not expected there would be light trespass on these residences. Although these night works will be seen within the context of the existing brightly -lit airport terminal, these works would bring lighting closer to these viewers, extending across much of these views, elevated above these viewing locations, and in close proximity. It is expected that there will be a noticeable reduction in the amenity of views at night from this area of A2: Low district brightness, and a moderate adverse visual impact during construction.
In elevated residential areas to the south (such as Keilor) it is expected that any additional lighting seen during construction would be absorbed into existing lit views.

As this is an area of A3: Medium district brightness, there would be no perceived change and a negligible visual impact during construction.

During operations, lighting on the new north-south runway (16R/34L) will be located at a level above these residences and directed upwards to guide aircraft and therefore unlikely to be seen. There will, however, be some light on the wing and tail tips of aircraft arriving and departing across the view. There will not be any light trespass onto these residential properties, and the lighting will be viewed in the context of the existing brightly lit airport terminal. This will result in a noticeable reduction in the amenity of views at night, from these properties, which are in an area of A2: Low district brightness, and a moderate adverse visual impact during operations. In elevated residential areas to the south, such as Keilor, the light associated with aircraft on the new north-south runway and taxiways will be seen in the middle ground of views, resulting in a noticeable reduction in the amenity of views at night from this area of A3: Medium district brightness, and a minor adverse visual impact during operation.

B12.6.11 Views north-east from the Calder Freeway

Views from the Calder Freeway, and overpasses, include open views across the landscape and include the brightly lit airport in the background (refer to Viewpoint 13 and 14).

During construction, night works may be required and will be seen in areas around the terminal and extending to the west. These elements will be glimpsed between intervening trees and landform and be seen mainly from fast moving vehicles. This will result in no perceived change in the amenity of these views at night, from this area of A3: Medium district brightness and a negligible visual impact during construction.

During operations, where the new north-south runway (16R/34L) will be seen, the lighting levels will be consistent with the existing areas of runway, with some minimal lighting, and additional aircraft arriving and departing across the view. This will result in no perceived change in the amenity of views from this area of A2: Low district brightness, and a negligible visual impact during operations.

B12.6.12 Views from Organ Pipes National Park to the south-west

Views from Organ Pipes National Park will not be available at night and for this reason, no impact will be experienced.

B12.7 AVOIDANCE, MANAGEMENT AND MITIGATION MEASURES

The following section identifies mitigation measures that will be incorporated into M3R design and activity during construction and operation.

B12.7.1 Construction

A Construction Environmental Management Plan (CEMP) will be prepared. During construction, the following measures will be undertaken where feasible to avoid, manage and mitigate the construction impacts of M3R on the landscape and visual amenity of the project area. The following will be considered:

- Mulch, hydro mulch or soil binder to be used to minimise impacts of open excavation where appropriate
- Set construction vehicles, equipment, stockpiling, asphalt, and concrete batching plants away from sensitive receptors such as occupied properties on Loemans, Operations, McNabs and Sunbury roads.

B12.7.2 Operation

Due to the operational requirements of an airport, it is not desirable to introduce planting and trees that will attract birds and wildlife. On-site mitigation measures will therefore be restricted considering the location and treatment of airport structures and facilities.

To avoid, manage and mitigate the impact of M3R operations, the following measures will be considered:

- Investigate relocation of the airport viewing area from Operations Road
- Screen planting (in accordance with obstacle limitations) to the north of the new 16R/34L runway (where possible, adjacent to Sunbury Road) in order to screen ground level views into the airport from nearby residences at Bulla and from rural areas to the north.

All planting proposed for the mitigation of landscape and visual impact will be undertaken in accordance with the Melbourne Airport Planting Guidelines (2014).

B12.8 CONCLUSION

An impact assessment has been undertaken and is contained in **Table B12.27**. In summary, the key findings of this study are as follows.

B12.8.1 Landscape impacts

There is a likely moderate adverse landscape impact during construction and a short-term medium rating, which will reduce to a minor adverse landscape impact during operations, and a long-term medium rating. These impacts are due particularly to the removal of the western part Grey Box Woodland and landform changes.

The moderate adverse landscape impact expected during construction is acceptable as it is temporary in nature. The minor adverse landscape impact during operations, while permanent, is also acceptable as the airport land is a relatively low sensitivity landscape compared with the higher sensitivity landscapes in the vicinity, such as the Keilor Market Gardens Cultural Landscape which are unaffected by M3R.

B12.8.2 Visual impacts

In the daytime during construction, the visual impact of M3R will be a short-term minor to moderate adverse visual impact, with a short-term rating of medium. The main sources of impact will be vegetation clearing, major earthworks, plant and equipment. The nature of these impacts is mainly due to the precedent of the existing airport runways and terminals, seen in views to the site, and the restricted visibility of the site due to vegetation in areas to the north and south.

During daylight operations the visual impact of M3R will be generally minor adverse to negligible visual impact, with a long-term rating of medium to negligible. The main sources of impact will be the proximity of the new north-south runway (16R/34L) to adjacent rural, recreational and residential areas, realignment of Operations Road and increased air traffic seen overhead and travelling north-south across views.

The minor to moderate adverse visual impact expected during construction would be acceptable as these are temporary in nature. Where there are minor adverse visual impacts during operation, while permanent, these are also acceptable as they are experienced from a small number of receivers and are from the lower sensitivity viewing locations.

At night, during construction, there will be a moderate adverse visual impact with a medium rating in views from Bulla and rural landscapes to the north, rural landscapes to the west, and rural properties to the south and west. This will be due to the unobstructed nature and expanse of work that would be seen in views from Loemans Road and the proximity of views from residential properties on Kiuna, McNabs and Sunbury roads and extent of view to this work. This impact will be short-term. During operation this impact will reduce to minor adverse and negligible, with a long-term low rating due to the existing brightly lit context of the existing airport terminal and the limitations on lighting night works in the vicinity of airport operations.

At night, the moderate adverse visual impact expected in views from Bulla and rural landscapes to the north, and rural properties to the south and west during construction are acceptable. These impacts would be temporary in nature and are areas where night-time activity is either limited or at a distance from the works.

At night, and during operation, there will be a moderate adverse visual impact with a medium rating in views from rural landscapes to the west, views from Bulla and rural landscapes to the north, and views from rural properties to the south and west. This is due to lighting associated with the runways, intermittent headlights on Operations Road, and increased air traffic seen overhead and across these views. The moderate adverse visual impact at night, while permanent, is acceptable as this is an increase to already impacted viewing locations. This results from an increased intensification of the existing airport which is currently seen within these views.

At night, during construction and operation, there will be a negligible impact on views from golf course to the south and from the Calder Freeway, as the additional light would be seen in the context of an existing lit airport and the golf course fairways would not be accessed at night. This would result in a negligible rating during construction and operation.

Table B12.27
Impact assessment summary

Environment aspect & baseline condition	Assessment of original impact: Original Impact	Mitigation inherent in design/practice	Significance: Duration	Severity	Likelihood	Impact	Mitigation and/or management measures	Assessment of residual impact: Residual Impact	Significance: Duration	Severity	Likelihood	Impact
Construction												
Airport landscape	Local	N/A	Short Term	Moderate adverse	Likely	Medium	Minimise removal of vegetation within the Grey Box Woodland where possible outside of construction requirements	On-site	Short Term	Moderate adverse	Likely	Medium
Views from rural landscapes to the west	Neighbourhood sensitivity	N/A	Short Term	Minor adverse and negligible	Likely	Medium	Set construction vehicles, equipment, stockpiling, asphalt and concrete batching plants away from sensitive receptors on Loemans Road	Off-site	Short Term	Minor	Likely	Medium
Views from rural landscapes to the west (at night)	A2: Low district Brightness	N/A	Short Term	Moderate adverse and negligible	Likely	Medium	N/A	Off-site	Short Term	Moderate adverse	Likely	Medium
Views from Bulla and rural landscapes to the north	Neighbourhood / local sensitivity	N/A	Short term	Moderate and minor adverse	Likely	Medium	N/A	Off-site	Short term	Moderate adverse	Likely	Medium
Views from Bulla and rural landscapes to the north (at night)	A2: Low district brightness	N/A	Short term	Moderate and minor adverse	Likely	Medium	N/A	Off-site	Short term	Moderate adverse	Likely	Medium
Views from Woodlands Historic Park	Regional sensitivity	N/A	Short term	Moderate adverse and negligible	Likely	Medium	N/A	Off-site	Short term	Moderate adverse and negligible	Likely	Medium and negligible
Views from residential properties, rural areas and golf courses to the south and west	Neighbourhood / local sensitivity	N/A	Short term	Minor-moderate adverse and negligible	Likely	Medium and negligible	Set construction vehicles, equipment, stockpiling, asphalt and concrete batching plants away from sensitive receptors on Operations and McNabs roads	Off-site	Short term	Minor adverse and negligible	Likely	Medium and negligible

Environment aspect & baseline condition (cont.)	Assessment of original impact (cont.)						Mitigation and/or management measures (cont.)	Assessment of residual impact (cont.)				
	Original Impact	Mitigation inherent in design/practice	Significance					Residual Impact	Significance			
			Duration	Severity	Likelihood	Impact			Duration	Severity	Likelihood	Impact
Construction (cont.)												
Views from residential properties, rural areas and golf courses to the south and west (at night)	A2: Low district brightness and A3: Medium district brightness	N/A	Short term	Moderate adverse and negligible	Likely	Medium and negligible	N/A	Off-site	Short term	Moderate adverse	Likely	Medium and negligible
Views north-east from the Calder Freeway	Local sensitivity	N/A	Short term	Minor adverse and negligible	Likely	Medium	N/A	Off-site	Short term	Minor adverse	Likely	Medium
Views north-east from the Calder Freeway (at night)	A2: Low district brightness and A3: Medium district brightness	N/A	Short term	Negligible	Likely	Negligible	N/A	Off-site	Short term	Negligible	Likely	Negligible
Views from Organ Pipes National Park to the south west	Regional sensitivity	N/A	Short term	Negligible	Likely	Negligible	N/A	Off-site	Short term	Negligible	Likely	Negligible
Operation												
Airport landscape	Local sensitivity	N/A	Long term	Minor adverse	Likely	Medium	Relocation of airport viewing area	On-site	Long term	Minor adverse	Likely	Medium
Views from rural landscapes to the west	Neighbourhood sensitivity	Existing runways and terminal in view	Long term	Minor adverse-negligible	Likely	Medium-negligible	N/A	Off-site	Long term	Minor adverse-negligible	Likely	Medium-negligible
Views from rural landscapes to the west (at night)	A2: Low district brightness	Existing runways and terminal in view	Long term	Moderate adverse	Likely	Medium	N/A	Off-site	Long term	Moderate adverse	Likely	Medium

Environment aspect & baseline condition (cont.)	Assessment of original impact (cont.)						Mitigation and/or management measures (cont.)	Assessment of residual impact (cont.)				
	Original Impact	Mitigation inherent in design/practice	Significance					Residual Impact	Significance			
			Duration	Severity	Likelihood	Impact			Duration	Severity	Likelihood	Impact
Construction (cont.)												
Views from Bulla and rural landscapes to the north	Neighbourhood / local sensitivity	N/A	Long term	Minor and moderate adverse	Likely	Medium	Screen planting north of the new north-south runway, adjacent to Sunbury Road	Off-site	Long term	Minor adverse – negligible	Likely	Medium
Views from Bulla and rural landscapes to the north (at night)	A2: Low district brightness	N/A	Long term	Moderate adverse	Likely	Medium	N/A	Offsite	Long term	Moderate adverse	Likely	Medium
Views from Woodlands Historic Park	Regional sensitivity	N/A	Long term	Moderate adverse	Likely	Negligible	N/A	Offsite	Long term	Negligible	Likely	Negligible
Views from residential properties, rural areas and golf courses to the south and west	Neighbourhood / Local sensitivity	N/A	Long term	Minor adverse and negligible	Likely	Medium and negligible	N/A	Offsite	Long term	Minor adverse and negligible	Likely	Medium and negligible
Views from residential properties, rural areas and golf courses to the south and west (at night)	A2: Low district brightness and A3: Medium district brightness	N/A	Long term	Moderate and minor adverse and negligible	Likely	Medium and negligible	N/A	Offsite	Long term	Moderate adverse	Likely	Medium and negligible
Views north-east from the Calder Freeway	Local sensitivity	N/A	Long term	Negligible	Likely	Negligible	N/A	Offsite	Long term	Negligible	Likely	Negligible
Views north-east from the Calder Freeway (at night)	A2: Low district brightness and A3: Medium district brightness	N/A	Long term	Negligible	Likely	Negligible	N/A	Offsite	Long term	Negligible	Likely	Negligible
Views from Organ Pipes National Park to the south west	Regional sensitivity	N/A	Long term	Negligible	Likely	Negligible	N/A	Offsite	Long term	Negligible	Likely	Negligible

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Chapter B13
Climate Change and Natural Hazard Risk

Summary of key findings:

- Natural hazards and climate variables have the potential to affect the construction or operation of Melbourne Airport's Third Runway (M3R).
- Melbourne Airport is in a benign climatic location and does not experience extremes such as cyclone, snowstorm or coastal flooding that affect many other international airports.
- However, climate events and natural hazards do sometimes affect Melbourne Airport. The likelihood of some of these impacts occurring is expected to increase during the operational life of M3R.
- M3R has been designed to standards that will control most physical climate risks.

CHAPTER B13 CONTENTS

CHAPTER B13 CONTENTS (cont.)

CHAPTER B13 FIGURES

CHAPTER B13 TABLES

B13.1
INTRODUCTION

This chapter describes the existing natural hazards and aspects of the local climate of the study area, the potential impacts on Melbourne Airport's Third Runway (M3R) and applicable legislation and policy requirements. Where required and practicable, specific measures to avoid, manage, mitigate and/or monitor climate change and natural hazard impacts are detailed.

B13.2
METHODOLOGY AND ASSUMPTIONS

This chapter describes current climate conditions, and how climate is expected to change in and around Melbourne Airport by focusing on a medium-term (2030) and a long-term future (2070). The chapter then presents an assessment of how risks related to natural hazards and the current and future climate may affect M3R; and recommends how they can be managed over the operational lifetime of M3R. (For the purpose of this study, a natural hazard is defined as any natural phenomenon with the potential to have a negative effect on M3R.)

The assessment has focused on those risks to M3R that can be controlled. Where relevant, it has also taken into account the risks to the operation of M3R which cannot be managed within the project itself.

The risk assessment in this study has been carried out in accordance with *AS 5334-2013 Climate change adaptation for settlements and infrastructure – A risk-based approach* and *AS/NZS ISO 31000:2009 Risk management – Principles and guidelines*. The assessment followed the first five steps of the six-step risk management process identified in ISO 31000, with implementation to be undertaken through the design, construction and operation of M3R.

This chapter contains the following sections:

- Establishing the context
- Risk identification
- Risk analysis
- Risk evaluation
- Risk treatment
- Implementation of management strategies, monitoring and review.

B13.2.1
Establishing the context

The context for this study is the current situation at Melbourne Airport regarding natural hazards and climate, and how it can be expected to change over the operational lifetime of M3R.

Current climate conditions have been established using Bureau of Meteorology (BoM) records from its weather station at Melbourne Airport supplemented with additional information from sources such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the Victorian Government. These current climate conditions have been used as the baseline for considering future climate change.

The latest climate projections for the area around Melbourne Airport were reviewed to gain an understanding of how the climate is expected to change. The primary source of this information was CSIRO's Climate Change in Australia website and Climate Futures suite of tools (CSIRO, 2016). The following three Climate Futures tools were used to generate the projections presented in **Section B13.5.2**:

- Summary data explorer - provides bar plots and data files of multi-model regional average seasonal changes in eight variables. The region used for this study was the Southern Slopes cluster, which includes southern Victoria and Tasmania.
- Extremes data explorer - provides bar plots and data files of multi-model regional average seasonal changes in six extremes variables.
- Thresholds calculator - generates location-specific data for minimum and maximum temperature using eight pre-selected climate models.

Some projections are presented as a median (i.e. middle) value and a range that excludes the lower and upper 10 per cent of climate model results. Data from Climate Futures tools was supplemented with information from additional sources including:

- CSIRO's *Climate Change in Australia Projections Cluster Report – Southern Slopes* (Grose, 2015)
- Bushfire Cooperative Research Centre's *Bushfire Weather in Southeast Australia: Recent Trends and Projected Climate Change Impacts* (Lucas, 2007)
- South Eastern Australian Climate Initiative's *Projected changes in climate and runoff for south-eastern Australia under 1 °C and 2 °C of global warming* (Post, 2012).

B13.2.2
Climate change scenarios

For this study, two future timescales have been considered: a medium-term scenario of 2030 and a long-term scenario of 2070, which cover the expected lifespan of M3R. The extent of climate change over these scenarios depends in part on future trajectories of greenhouse gas emissions. To manage this uncertainty the Intergovernmental Panel on Climate Change has developed several emissions scenarios. These scenarios, called Representative Concentration Pathways (RCPs), result in different projected changes in the climate.

Projections for 2030 do not diverge greatly regardless of RCP due to a lag between the emission of greenhouse gases and their effect on the climate. For that reason, this study has considered only one emissions scenario for 2030 (RCP4.5). RCP4.5 is a medium-emissions scenario which assumes emission reductions after a peak at around 2040, leading to a carbon dioxide concentration of about 540 parts per million by 2100 compared to around 400 parts per million in 2016.

By 2070, the scale of projected changes to climate is more sensitive to the world's future emissions pathway. This study has considered two alternative emissions scenarios by 2070: RCP4.5 and RCP8.5. RCP8.5 is a high-emission, business-as-usual scenario that assumes increases in emissions leading to a carbon dioxide concentration of approximately 940 parts per million by 2100. Using the high-emission scenario to assess climate risk in 2070 reduces the inherent uncertainty in looking more than 50 years ahead. For this reason, the RCP8.5 emission scenario has been used when evaluating risks for this analysis.

In other words, RCP4.5 is broadly analogous to a future where the global average temperature reaches 2°C above pre-industrial levels by 2100 (i.e. a 2° future); RCP8.5 is broadly analogous to a 4° future.

Table B13.1 shows a sample of recent climate events that have affected operations at Melbourne Airport. Some relate to risks outside the scope of this study but they do show how natural hazards can affect the airport.

B13.2.3
Risk identification, analysis, evaluation and treatment

The relevant impacts to be assessed within this study are the potential risks posed by climate change and natural hazards on M3R construction and operational activities. This includes risks that are physical in nature as well as those that arise from society's responses to climate change (i.e. transition risks). Physical risks have been identified and assessed using the judgment of climate-change specialists, and M3R engineering and environment and sustainability teams. This work builds on previous climate risk assessments undertaken by Melbourne Airport. The update also involved the identification and assessment of transition risks through a multi-disciplinary workshop.

The process of identifying risks considered the following types of impact:

- Direct weather events such as heatwaves or heavy rainfall
- Hazards strongly influenced by weather conditions such as drought and flood
- Hazards affected by weather and climate such as wildlife distribution
- Additional non-weather-related natural hazards
- Regulatory and market responses to climate change.

This study distinguishes between direct and indirect impacts. Direct impacts are those such as damage to airport infrastructure, or weather conditions preventing the use of a runway. Indirect impacts are those which affect M3R as a result of a direct impact on an external system, such as flooding of a road leading to Melbourne Airport or a cyclone in Asia affecting inbound flights.

The sources of information used to identify, analyse, evaluate and treat these risks were:

- Melbourne Airport staff with knowledge of airport operations and development, airspace operations and air-traffic management initiatives, and the challenges of natural hazards
- Performance data and previous studies carried out by Melbourne Airport
- Published climate-change risk assessments and initiatives from other international airports
- Consultation with Melbourne Airport staff and specialists working on M3R.

Table B13.1
Recent climate and natural hazard events and their impacts on Melbourne Airport

Climate event	Impact on Melbourne Airport	Date
Bushfire smoke	Delayed flights. The airport was forced down to a single runway as heavy bushfire smoke covered the city and impacted visibility.	Jan 2020
Strong winds	Runway closed, more than 30 flights delayed, and others cancelled	Jul 2019
Dust Storm	Brief reduction in visibility	Mar 2019
Storm – 23mm in 24 hours after a wet week; low cloud	Runway closed and flights delayed.	Jul 2016
Fog – visibility down to 400m	More than 30 flights cancelled, and others delayed.	Jun 2016
Ice – temperature 0.6°C	18 flights delayed after ice formed on plane wings (de-icing truck broken).	Jul 2015
Storm – Lightning (within 8nm of airport)	Ground staff stopped working on asphalt as per airport rules. Flight delays of up to two hours.	Oct 2014
Fog	20 domestic flights cancelled.	Jul 2014
Bushfires in Kilmore area	Air traffic control tower evacuated briefly due to smoke penetration causing some flights to undergo emergency landings and half-hour delays for outbound flights.	Feb 2014
Heatwave – 4 days 40°C+	Multiple disruptive incidents including airfield fuel spills, suspension of outdoor construction and temporary closure of Departure Drive due to expansion of connection joints.	Jan 2014
Fog	Several international and domestic flights were diverted to Sydney and Adelaide airports.	Oct 2013
Storm – 90km/h wind gusts	Delayed flights.	Dec 2012
Storm – rain, hail, lightning	Flights delayed, passenger disruption, aircraft damaged requiring precautionary inspections.	Dec 2011
Storm – strong wind, lightning	Airport closed, inbound flights diverted, outbound planes grounded.	Dec 2011
Storm – 50mm rainfall in an hour	Disrupted flights for four hours. Persistent flight delays continuing into the next day. Transport to and from the airport ceased for a period.	Sep 2011
Dust storm	Delayed flights.	Sep 2009

The results of the climate risk analysis have been recorded in a risk register summarised in Appendix B13.A. Risks have been rated according to their significance, which is a product of the severity and likelihood of the impact. Impact severity has been rated using the assessment framework for this study (Table B13.2). Risk likelihood has been rated using M3R standard criteria, and overall impact level has been assigned using the M3R impact matrix as described in Chapter A8: Assessment and Approvals Process.

Risks have been rated according to the judgment of the M3R design team and staff at Melbourne Airport. The rating is qualitative, although where possible the assessment has been supported by quantitative information.

Risks have been assessed over three time periods; current, medium-term (2030) and long-term (2070). Evidence about natural and climate hazards at Melbourne Airport was taken as evidence of current risk. Medium and long-term risks were rated using the climate projections summarised in Section B13.5.

B13.2.4 Assumptions

The following assumptions were made in this study:

- Present-day climate and natural hazards at Melbourne Airport are well understood by staff and the M3R team
- Climate science provides realistic projections of the future climate at Melbourne Airport
- The study assesses risks to the construction and operation of M3R due to climate, climate change and natural hazards. It is not an assessment of how M3R will impact the environment or contribute to climate change.

B13.3 REQUIREMENTS AND EXPECTATIONS

This section details the statutory and policy environment that the airport needs to consider regarding climate risk. Non-statutory and international frameworks related to climate risk (e.g. recommendations of the Taskforce for Climate-related Financial Disclosures) are discussed in the transitional risk register (Appendix B13.A).

B13.3.1 Statutory requirements

There is currently no Commonwealth or Victorian legislation that explicitly requires Melbourne Airport to take account of climate risks as part of M3R. Neither the *Environment Protection and Biodiversity Conservation Act 1999* (Cth) (referred to as the EPBC Act) nor the *Airports Act 1996* (Cth) (referred to as the Airports Act) explicitly addresses climate change. However, it is reasonable to expect that Melbourne Airport manages climate risk as it has potential for wide-ranging impacts including potentially affecting the operations and legislative compliance of M3R.

B13.3.1.1 Melbourne Airport Master Plan 2018

The Airports Act requires Melbourne Airport to regularly produce a master plan, which includes an environment strategy. Section 16.4.2 of *Melbourne Airport's Environment Strategy* (2018) includes an action to develop a Climate Change Adaptation and Mitigation Framework in consultation with stakeholders including the Victorian Government.

B13.3.2 Victorian Climate Change Act 2017

The *Climate Change Act 2017* (Vic) (referred to as the CC Act) requires the relevant minister to produce a climate-change strategy by October 2020 and renew it every five years. The strategy will include a description of the Victorian Government's adaptation priorities as well as a summary of the latest climate science and potential impacts on the state.

The CC Act also requires the relevant minister to produce an adaptation action plan by October 2021 and renew it every five years. It will include a summary of climate risks to Victoria and actions to respond, focusing on a number of sectors including the transport system.

B13.3.3 Emergency Management Amendment (Critical Infrastructure Resilience) Act 2014 (Vic)

The *Emergency Management Amendment (Critical Infrastructure Resilience) Act 2014* (Vic) (referred to as the EMA (CIR) Act) created new arrangements for the Victorian Government, and public and private sector stakeholders, to work together to enhance Victoria's arrangements for critical infrastructure resilience. The ministerial guidelines for critical infrastructure resilience aim to help stakeholders meet their requirements under the arrangements. The guidelines set out an approach considering all types of hazards, recognising that planning for one kind of hazard or disaster event can also increase the resilience of a community facing a different kind of event. Hazards related to climate change are not explicitly identified but all types of natural hazard are included within the all-hazards approach.

B13.3.3.1 Victorian Government

All Victorian critical infrastructure is recorded by the Victorian Government in the critical infrastructure register. Melbourne Airport is listed as 'vital' – the highest category of significance, meaning disruption could adversely impact the continuity of an essential service to Victoria or the economic or social wellbeing of Victoria. At the operator of vital critical infrastructure, Melbourne Airport is required to carry out certain tasks such as the preparation of an emergency risk-management plan and execution of exercises to test this plan.

B13.3.4 Policy requirements

There are no specific policies relating to the adaptation of airport infrastructure to climate change. However, assessment and management of climate risk is consistent with the strategies and policy outlined below.

B13.3.4.1 Commonwealth strategies

National Climate Resilience and Adaptation Strategy 2015

This strategy sets out how Australia is managing climate risks. One of its guiding principles is that all decisions will take account of the current climate and future change.

Another guiding principle is that responsibility for adaptation is shared; and that governments at all levels, businesses, communities and individuals have important roles to play.

Critical Infrastructure Resilience Strategy 2015

This strategy aims for the continued operation of critical infrastructure in the face of all hazards. One of the policy objectives is that critical infrastructure owners and operators such as Melbourne Airport are effective in managing foreseeable risks to the continuity of their operations.

Council of Australian Governments, roles and responsibilities for climate change adaptation in Australia 2013

This document, issued by the Council of Australian Governments (COAG), outlines the principles for the management of climate-change risks. It identifies that governments are primarily responsible for managing risks to public goods and assets, and private parties are responsible for managing risks to private assets. The Commonwealth Government's role also includes promoting effective climate-risk management in the private sector by:

- Providing the best available information about climate change
- Setting appropriate policy, regulation and planning frameworks.

The CC Act is the basis for achieving the Victorian Government's commitment to position Victoria as a leader in climate-change mitigation by reducing emissions and adapting to the impacts of climate change. Victoria's Climate Change Framework sets out the state government's long-term approach to climate change, including how Victoria is preparing for a changing climate.

The *Victorian Climate Change Adaptation Plan 2017-2020* (Department of Environment, Land, Water and Planning, 2017) sets out the priorities for the Victorian Government to better understand and manage the current and long-term risks of climate change.

B13.3.5 Expectations

While Melbourne Airport is not subject to definitive statutory or policy obligations in relation to the management of climate-related risks and opportunities, it does recognise that stakeholder expectations have increased significantly in recent years. Similarly, investors' concerns about climate-related risks have become significantly more pronounced. These concerns have precipitated multiple legal challenges globally and led to the formation of the G20 Financial Stability Board's Taskforce for Climate-related Financial Disclosures (TCFD) which has issued a set of recommendations on the matter. In Australia, these recommendations have been reinforced by the Australian Securities and Investments Commission (ASIC) which in December 2019 launched a new surveillance program to ensure Australia's biggest companies are dealing with the risks of climate change. Similarly, the Australian Prudential Regulation Authority (APRA) continues to actively encourage the adoption of voluntary frameworks to assist entities with assessing, managing and disclosing their financial risks associated with climate change (with reference to the TCFD).

The implementation of the TCFD recommendations is progressively becoming mainstream for several reasons: namely great business value, investors seeking assurance, risk-management improvements, and demonstrating duty of care and diligence from company directors.

In light of these continuing developments, Melbourne Airport considers it possible that it will become subject to statutory and/or policy obligations in relation to climate-related risks in the future.

This chapter represents one step in an ongoing process of continuous improvement through which Melbourne Airport will:

- Continue to monitor and manage its climate-related risks, with disclosure to stakeholders
- Meet any statutory or regulatory obligations as and when they arise.

B13.4 DESCRIPTION OF SIGNIFICANCE CRITERIA

The assessment of significance has applied the framework described in **Chapter A8: Assessment and Approvals Process**. For severity, project-specific criteria have been developed for the climate change and natural hazards study, and these are described in **Table B13.2**. The identification of five categories of impact (environmental, financial, regulatory, safety and reputation) reflects the fact that climate change can affect the severity of a wide range of risks to M3R.

Table B13.2
Severity assessment framework

Assessment	Environment	Financial	Regulatory	Safety	Reputation
Catastrophic	Permanent, widespread and irreversible contamination to land, air, groundwater or surface water environment Permanent loss of species, habitat, community amenity or heritage sites Enforcement action undertaken by DOE/EPA	> 15% EBITDA	Very serious breach of legislation, regulation, agreements or contracts, that is difficult to rectify and results in one or more of: Prosecution or civil action leading to imprisonment or significant sanction Ministerial or formal intervention by regulator Licence/permit revocation Public inquiry	Event causing two or more fatalities and/ or permanent total disability of any employee, visitor or contractor	Very serious public outcry (community action or protests, including online) (3+ days) Sustained negative media coverage at state or national level (3+ days) Lasting impact to reputation (1+ year) Critical impact on relations with key stakeholders (loss of government support)
Major	Very serious contamination to land, air, groundwater or surface water environment (clean-up / recovery 1 to 4 years) Major impact on species, habitat, community amenity or heritage sites (restoration period 1 to 4 years) Enforcement action undertaken by DOE/EPA in the form of an enforceable undertaking or court prosecution	> 5% – 15% EBITDA	Serious (but isolated) breach of legislation, regulation, agreements or contracts, that requires considerable investment to rectify and results in one or more of: Prosecution or civil action with high compensation (or fine) and -ve precedent Ministerial or formal intervention by regulator (enforceable undertaking) Restrictions or conditions placed on licence/permit	Event causing single fatality and/ or total and permanent disability of any employee, visitor or contractor	Serious public outcry (community action or protests, including online) (2 to 3 days) Adverse state media coverage (2 to 3 days) Negative impact to reputation but repairable (within 1 year) Adverse impact on relations with key stakeholders (expressed displeasure by department or government)
Moderate	Serious contamination to land, air, groundwater or surface water environment (clean-up / recovery within 1 year) Moderate impact on species, habitat, community amenity or heritage sites (restoration within 1 year) Enforcement action undertaken by EPA in the form of a Penalty Infringement Notice (or similar)	> 2.5% – 5% EBITDA	Non-compliance with legislation regulation, agreements or contracts that is reportable and/or requires an immediate response to an external party. This may result in: Infringement notice (or similar) External review or audit	Event causing a serious or permanent injury or long-term illness with immediate admission to hospital of any employee, visitor or contractor	Public outcry (sustained and numerous customer complaints including online) Adverse state media coverage (1 to 2 days) Limited, repairable damage to reputation Some concern on relations with key stakeholders (explanation required)
Minor	Minor contamination to land, air, groundwater or surface water environment (clean-up / recovery of a localised event within weeks) Minor impact on species, habitat, community amenity or heritage sites (restoration within weeks) Enforcement action undertaken by DOE/ EPA in the form of a warning	> 1% – 2.5% EBITDA	Minor non-compliance with legislation, regulation, agreements or contracts that is reportable but has minimal impact to operations and no urgency for rectification	Event resulting in injury or disease that resulted in a treatment given by a medical practitioner but without permanent disability of any employee, visitor or contractor	Localised complaints that can be managed to achieve an effective outcome Limited, adverse local media attention (single instance) Negligible impact to reputation with freedom to operate unaffected
Limited	Temporary contamination (days) to land, air, groundwater or surface water environment to immediate area around asset or activity No lasting impact (days) on species, habitat, community amenity or heritage sites Self-reporting or notification to DOE/EPA	<= 1% EBITDA	Insignificant non-compliance with legislation, regulation, agreements or contracts that has no impact to operations and/or no requirement to report	Slight and recoverable injury or discomfort requiring first aid response with no follow up required of any employee, visitor or contractor	Local complaint, no media coverage Quickly forgotten with freedom to operate unaffected
Beneficial	A positive impact on the natural environment.	Saving realised compared with project or project/ airport operating budget	N/A	N/A	Positive media coverage.

B13.5 CLIMATE

B13.5.1 Current climate

Melbourne Airport is located within a temperate climate with warm to hot summers, mild springs and autumns, and cool winters. The region is showery with fairly consistent rainfall throughout the year and fairly low average annual rainfall. Frosts can occur in winter but it has never snowed at Melbourne Airport.

The region is on the boundary of hot inland areas and the cool Southern Ocean. This results in temperature differences that can cause strong cold fronts to form, which sometimes lead to severe weather conditions such as gales, thunderstorms and heavy rain. The region can also experience extreme heat in summer.

The information in section Section B13.5.1.1 shows the current climate at Melbourne Airport, based on records from the Bureau of Meteorology's weather station at the airport (station number 86282). Weather-station data is available from 1970 to 2019 (Bureau of Meteorology 2019) for most variables, when available. This current climate has been used as the baseline for considering future climate change.

B13.5.1.1 Precipitation

The highest mean rainfall occurs in November (61.7 millimetres) and the lowest in July (35.3 millimetres). In general, both median and mean values show greatest precipitation in early spring through to the end of summer (Table B13.3).

The heaviest rainfall in a 24-hour period occurs in late summer and autumn with the highest recorded falls in February (138.8 millimetres) and April (132.4 millimetres) (Table B13.4).

Rainfall events greater than one millimetre are most common in winter; those greater than 10 millimetres and 25 millimetres are most common from November to February. This indicates that rainy days are most frequent in winter while the precipitation intensity is greatest in summer (Table B13.5).

B13.5.1.2 Temperature

Mean maximum temperature data shows highest mean maximum temperatures generally occur in December, January and February (24.6°C, 26.6°C and 26.7°C respectively). The highest daily maximum temperatures have also occurred during these months (43.8°C, 46.0°C and 46.8°C respectively) (see Table B13.6). On average there are 32.7 days over 30°C, 10.2 days over 35°C and 1.5 days over 40°C each year (see Table B13.7).

Mean minimum temperature data (see Table B13.8) show that the coldest temperatures generally occur in June, July and August (6.2°C, 5.5°C and 5.9°C respectively) with temperatures historically falling below 2°C between May and October and below 0°C between June and September. On average the minimum temperature drops below 2°C 8.4 times and below 0°C 1.1 times per year respectively (see Table B13.9).

B13.5.1.3 Relative humidity

Humidity data at the Melbourne Airport weather station is collected twice daily at 9am and 3pm. At 9am, mean relative humidity is highest in June and lowest in December. For 3pm, the highest mean relative humidity is also in June, whereas the lowest occurs in January and February. The relative humidity is higher at 9am than at 3pm throughout the year (see Table B13.10).

B13.5.1.4 Solar radiation

Daily solar radiation data has been collected at Melbourne Airport since 1990. The mean daily solar radiation is greatest in January and least in June at 24.2 megajoules per square metre and 6.2 megajoules per square metre respectively. The annual average daily solar radiation is 15.0 megajoules per square metre (see Table B13.11).

Table B13.3
Mean monthly recorded precipitation (millimetres)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Mean	40.0	41.2	36.2	43.0	39.8	40.7	35.3	43.9	46.4	52.6	61.7	51.8	534.9
Lowest	1.6	1.0	4.4	4.8	8.0	10.4	7.0	15.4	8.2	5.6	18.2	1.6	310.2
Highest	101.6	200.6	142.2	141.6	155.5	126	94.4	97.1	127	143.8	158	139	820.8

Table B13.4
Highest accumulated 24-hour precipitation (millimetres)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Highest daily	50.6	138.8	98.2	132.4	52.4	75.8	44.6	37.0	50.8	70.8	80.8	76.4
Date	6/1 1995	3/2 2005	23/3 2001	8/4 1977	16/5 1974	1/6 2013	30/7 1987	7/8 1978	29/9 2011	16/10 1983	19/11 1978	27/12 1999

Table B13.5
Mean number of days per month where 24-hour rainfall exceeded 1, 10 and 25 millimetres

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
days ≥ 1 mm	5.1	4.3	5.6	6.3	7.5	8.3	8.2	9.7	9.1	8.6	7.7	6.2	86.6
days ≥ 10mm	1.3	1.1	1.0	1.1	0.8	0.8	0.5	0.8	1.0	1.4	1.8	1.6	13.3
days ≥ 25mm	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.4	2.4

Table B13.6
Mean monthly maximum and daily maximum temperatures (ºC)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	26.6	26.7	24.3	20.3	16.7	13.7	13.2	14.4	16.7	19.5	22.1	24.6	19.8
Highest daily	46.0	46.8	40.8	34.5	27	21.8	22.7	25.6	30.2	36	39.6	43.8	46.8

B13.5.1.5
Evaporation

Evaporation data has been collected at Melbourne Airport since 1998. Mean daily evaporation is greatest in January and least in June at 8.1 millimetres and 1.8 millimetres respectively. The annual mean daily evaporation is 4.7 millimetres (see Table B13.12)

B13.5.1.6
Moisture and runoff

Soil moisture and run-off data in Melbourne have been modelled with the Bureau of Meteorology's Australian Water Resources Assessment Modelling System. Data are presented as percentile values relative to the 1911-2016 mean value. Both these metrics reached all-time low levels in 2007 and peaked in 2011 (see Table B13.13 Table B13.14).

B13.5.1.7
Drought

Drought is a prolonged, abnormally dry period when the amount of available water is insufficient to meet normal use. 'Drought' is therefore not simply low rainfall but a measurement of the severity of rainfall deficiency. Over the last 10 years, Melbourne Airport experienced a serious annual rainfall deficiency in 2008 (below 10th percentile of the historic annual rainfall record) and a severe rainfall deficiency in 2009 (below 5th percentile of the historic annual rainfall record).

B13.5.1.8
Bushfire

The region in which Melbourne Airport is located is one of the most bushfire-prone in the world. The worst bushfires recorded since European settlement in Australia occurred in Victoria in 2020 and resulted in several delayed flights. The airport was reduced to a single runway as heavy bushfire smoke covered the city and impacted visibility.

Bushfire risk is measured using the Forest Fire Danger Index (FFDI) which combines observations of temperature, relative humidity, wind speed and drought factor.

The drought factor depends on both short-term and long-term rainfall. The FFDI is often converted into a fire-danger rating that reflects the fire behaviour and the difficulty of controlling a particular fire. At Melbourne Airport the average number of days each year with a fire danger rating of severe or worse is 3.1 (CSIRO, 2016d).

The land surrounding Melbourne Airport is designated a bushfire-prone area by Victoria's Department of Environment, Land, Water and Planning (DELWP) and there is a region of bushfire management overlay in the north west quadrant of the site (Figure B13.1). A bushfire-prone area is an area of land that can either support a bushfire or is likely to be subject to bushfires. A bushfire management overlay is a planning control applying to land with the highest fire risk and is likely to be particularly exposed to the impact of bushfire.

B13.5.1.9
Wind

Wind-speed data at the Melbourne Airport weather station is recorded twice daily at 9am and 3pm. Average 9am and 3pm wind speeds are highest in September at 22.1 kilometres per hour and 24.4 kilometres per hour respectively. Across all months, wind speeds are greater at 3pm than 9am (Table B13.15).

Highest recorded wind-gust speeds over all months range from 102 kilometres per hour in June to 139 kilometres per hour in November. The three highest recorded wind-gust speeds have occurred in November, January and August, showing that strong winds can potentially occur in both winter and summer (Table B13.16).

Table B13.7
Mean number of days per month above 30°C, 35°C and 40°C

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
days > 30°C	8.5	8.5	5.0	0.4	0.0	0.0	0.0	0.0	0.0	1.1	3.0	6.2	32.7
days > 35°C	3.8	2.8	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	2.0	10.2
days > 40°C	0.8	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.5

Table B13.8
Mean monthly minimum and daily minimum temperatures (°C)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean	13.9	14.2	12.8	10.2	8.3	6.2	5.5	5.9	7.1	8.5	10.4	12.1	9.6
Lowest daily	6.0	4.8	3.7	1.2	0.6	-0.9	-2.5	-2.5	-1.1	1.0	0.9	3.5	-2.5

Table B13.9
Mean number of days per month below 2°C and 0°C

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
days < 2°C	0.0	0.0	0.0	0.0	0.1	2.1	3.0	1.9	1.1	0.2	0.0	0.0	8.4
days < 0°C	0.0	0.0	0.0	0.0	0.0	0.2	0.6	0.2	0.1	0.0	0.0	0.0	1.1

Table B13.10
9am and 3pm mean relative humidity (%)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean 9am relative humidity (%)	65	69	70	72	79	83	81	77	72	66	67	64	72
Mean 3pm relative humidity (%)	44	44	47	52	60	67	65	59	56	52	49	45	53

Table B13.11
Mean daily solar exposure 1990-2019 (megajoules per square metre)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Solar radiation (MJ/m2)	24.2	21.1	16.5	11.4	7.7	6.2	7.0	10.0	13.5	17.9	21.3	23.7	15.0

Table B13.12
Mean daily evaporation 1998-2019 (millimetres)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Evaporation (mm)	8.1	7.1	5.8	3.8	2.5	1.8	2	2.7	4.1	5.2	6.0	7.4	4.7

Table B13.13
Root-zone soil moisture percentile to a 1911-2016 baseline (%)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Soil moisture (%)	0.0	2.83	0.98	50.5	93.5	67.3	23.3	6.54	7.52	32.7	47.7	20.6	11.52

Table B13.14
Run-off percentile relative to 1911-2016 baseline (%)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Run-off (%)	0.0	1.86	0.98	66.31	94.4	58.9	29.9	6.54	7.52	35.6	44.0	19.6	13.28

Figure B13.1
Proximity of Melbourne Airport to bushfire-prone areas and bushfire management overlays (VicPlan, 2020).

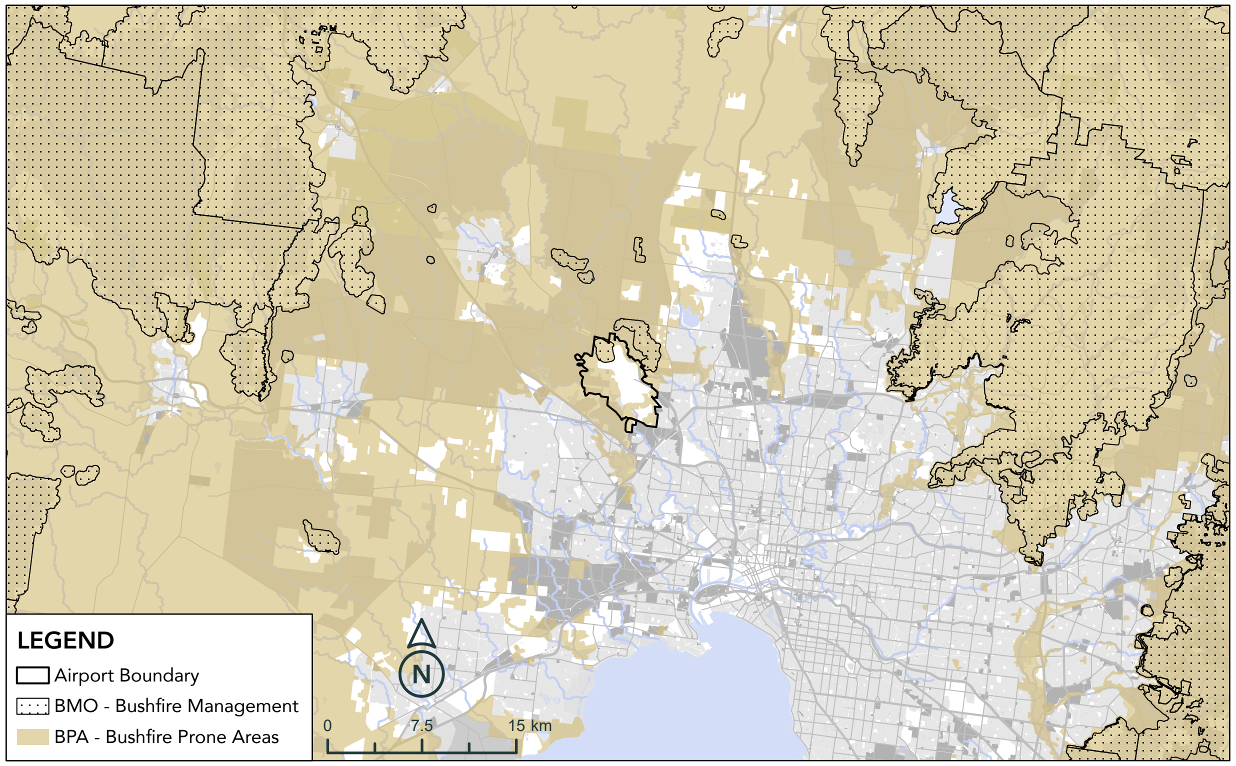

Table B13.15
9am and 3pm average wind speed (kilometres per hour)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
9am wind speed (km/h)	18.5	17.0	16.9	16.7	17.2	18.3	20.2	21.6	22.1	21.8	19.0	18.7	19
3pm wind speed (km/h)	22.3	21.2	20.6	19.9	19.7	20.8	22.7	23.9	24.4	23.5	22.4	22.7	22

Table B13.16
Maximum wind gust speed (kilometres per hour)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed (km/h)	137	122	113	107	108	102	108	124	115	122	139	113
Date	3/1 1981	28/2 2015	26/3 1984	2/4 2008	21/5 1989	28/6 1991	30/7 1993	10/8 1992	2/9 2002	3/10 1971	15/11 1982	21/12 1973

B13.5.1.10
Fog

Fog is low-lying cloud which reduces visibility to less than 1,000 metres. The annual average number of fog days experienced by Melbourne Airport is 13 a year, with most fogs occurring in late spring and early winter. May and June experience the highest number of fog days, both averaging 2.5 days each year (Bureau of Meteorology, 2016).

B13.5.1.11
Frost

The Bureau of Meteorology forecasts frost potential based on temperature thresholds across Australia. The number of potential frost days at Melbourne Airport can be equated to the number of days each year when the temperature drops below 2°C, equating to 8.6 days per year (Table B13.9).

B13.5.1.12
Fauna strike

Fauna strike is the collision between an aircraft and an animal, usually a bird and occasionally a bat. There are multiple incidents of fauna strike at Melbourne Airport every year, with the most common birds involved being magpies, starlings, ravens and pigeons. The FY19 average strike rate at Melbourne was 4.2 strikes per 10,000 aircraft movements. By comparison, the strike rate per 10,000 movements for high-capacity air transport operations across Australia as recorded by the Australian Transport Safety Bureau (ATSB) for 2004-2013 has varied from 6.67 in 2007 to a high of 8.38 in 2013. Damaging fauna strikes are rare (about 0.2 per 10,000 air traffic movements) and their long-term trend is downward (Steele, 2015).

B13.5.1.13
Riverine flooding

Riverine flooding is unlikely to affect Melbourne Airport, and flooding from rivers has never impacted airport operations. However, the Hume Planning Scheme records two local Land Subject to Inundation Overlays (LSIO) which are based on the extent of flooding resulting from a one-in-100-year storm (Figure B13.2). The LSIO to the east of Melbourne Airport relates to Moonee Ponds Creek and the flood overlay does not encroach onto airport property. The LSIO to the west relates to the Maribyrnong River, which forms part of the airport's western boundary. This section of the Maribyrnong River is in a deep ravine and is unlikely to cause flooding at Melbourne Airport.

B13.5.1.14
Dust storm

The two major dust storms affecting Melbourne in the recent past occurred in 2009 and 2019. In addition, severe dust-haze observations have been recorded through DustWatch since 2011 at Loddon Plains, the closest dust-observing station to Melbourne (two hundred kilometres north-west of the airport). Dust observations are given as hours of dust observed per year (Table B13.17).

Figure B13.2
Land subject to LSIO near Melbourne Airport (VicPlan, 2020).

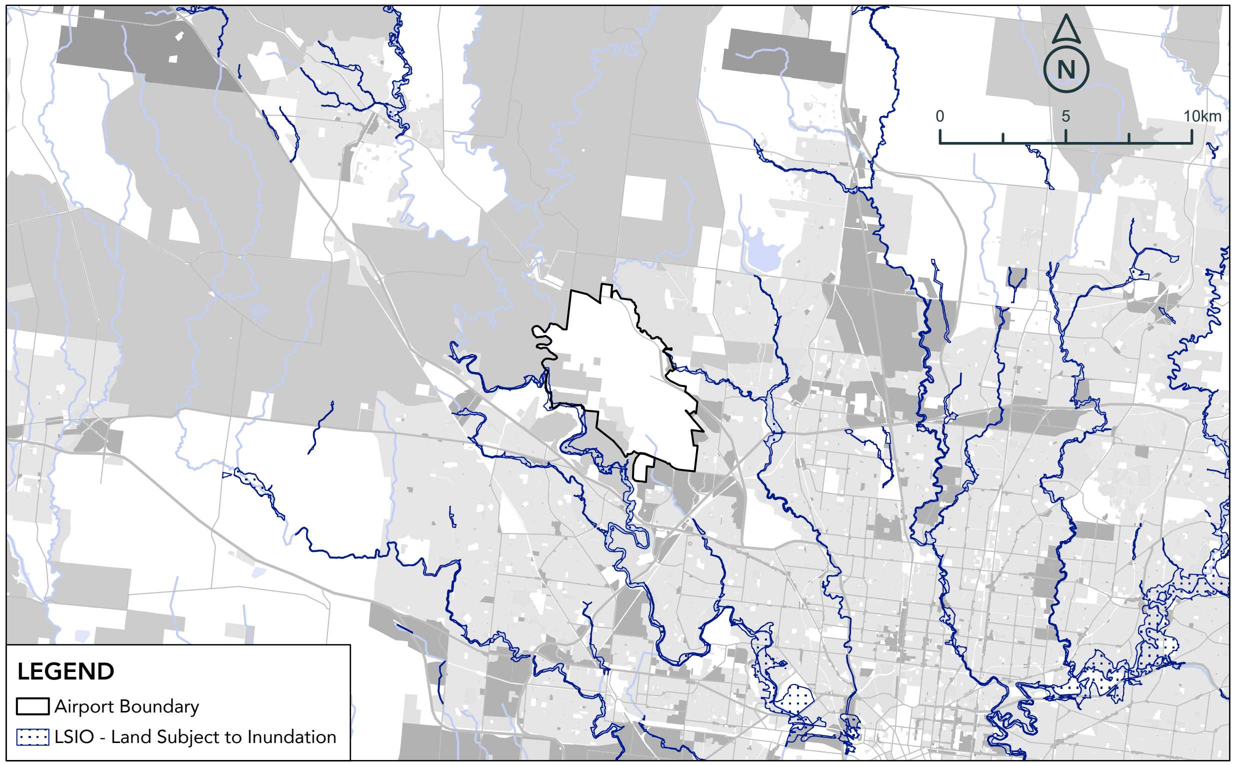

Table B13.17
Hours of dust observed yearly at Loddon Plains (DustWatch, 2019)

	2011	2012	2013	2014	2015	2016	2017	2018
Dust observed (hours)	0	1	2	6	2	9	0	0

B13.5.2
Climate projections

The climate projections contained in this section are sourced from a range of publicly available Australian references.

The climate in the region is expected to become warmer and drier, with a greater incidence of very hot days, drought, grass fires and bushfires. Extreme events such as flooding and storms are projected to increase in frequency and intensity.

Different levels of confidence are associated with projected changes in climate variables. Confidence levels are based on the strength and extent of the evidence and the degree of scientific agreement. CSIRO assigns five levels of confidence (very high, high, medium, low and very low) to climate projections.

Current projections used here refer to the future years 2030 and 2070, which are in fact 20-year periods centred on 2030 and 2070. For example, the 2030 projections encompass changes from the period 2020 to 2039. Changes are compared to a baseline period of 1986-2005. Where a range of projections is shown (for example in Table B13.13) the range relates to the 10th to 90th percentile range of climate-model results.

B13.5.2.1
Precipitation

There is a lack of consensus among climate models about the direction of change in average annual rainfall in Melbourne (Table B13.18). Overall, the projections suggest small decreases in annual rainfall although within the bounds of natural variability until at least 2030.

Lower rainfall in the coolest six months of the year is projected with high confidence and by 2070 these declines could be outside the bounds of natural variability.

The direction of change for rainfall in Victoria during the warmer months is not reliably projected by current models.

Table B13.18
Projected rainfall differences (per cent) for Greater Melbourne (Department of Environment, Land, Water and Planning, 2015)

	2030 RCP4.5	2070 RCP4.5	2070 RCP8.5
Annual	-2 (-7 to +3)	-2 (-7 to + 3)	-5 (-23 to +4)
Summer	-1 (-17 to +14)	-1 (-17 to +14)	-1 (-21 to +25)
Autumn	-3 (-15 to +15)	-3 (-15 to +15)	-7 (-20 to +14)
Winter	-3 (-14 to +7)	-3 (-14 to +7)	-7 (-17 to +5)
Spring	-7 (-21 to +4)	-7 (-21 to +4)	-14 (-39 to +4)

Extreme rainfall

An increase in the intensity of extreme rainfall events is projected with high confidence, although there is more uncertainty about the magnitude of the increase. For the RCP4.5 medium-emissions scenario, the projections for 2030 and 2070 are similar; for example, a median projection of a 7 per cent increase by 2070 (Table B13.19).

For the RCP8.5 high-emissions scenario, the projected increases in extreme rainfall are more significant. Some models project it increasing by up to 20 per cent for the wettest day in a year and over 30 per cent for the wettest day in 20 years (CSIRO 2016a).

Table B13.19
Projected percentage changes in wettest day in Victoria (CSIRO 2016a)

	2030 RCP4.5	2070 RCP4.5	2070 RCP8.5
Annual wettest day	4 (-1 to +10)	7 (-3 to +13)	13 (3 to +20)
1 in 20-year wettest day	7 (-2 to +16)	9 (2 to +17)	18 (5 to +33)

B13.5.2.2
Temperature

Annual average temperatures are projected to increase by 0.5 to 0.9°C by 2030 (RCP4.5) and by 1.0 to 3.0°C by 2070 (**Table B13.20**). This projected warming is large compared to natural variability (Grose, 2015).

Projected changes for daily maximum and minimum temperature are similar to those of the mean temperature. By 2070, there is expected to have been a substantial increase in the temperature reached on the hottest days; the frequency of hot days; and the duration of warm spells (**Table B13.21**). The temperature on the coldest winter night will increase by 0.7°C by 2030; 1.3°C by 2070 (RCP4.5) and 2.0°C by 2070 (RCP8.5). This would mean that by 2070 the temperature would rarely, if ever, reach freezing point at Melbourne Airport.

Table B13.20
Projected temperature change (°C) for Greater Melbourne, compared to 1986-2005 (Department of Environment, Land, Water and Planning, 2015)

	2030 RCP4.5	2070 RCP4.5	2070 RCP8.5
Temperature change (°C)	0.9 (0.6 to 1.3)	1.5 (1.2 to 1.9)	2.6 (2.1 to 3.1)

Table B13.21
Average annual number of days above 35°C and 40°C for Melbourne Airport (CSIRO, 2016b)

	Baseline (1981-2010)	2030 RCP4.5	2070 RCP4.5	2070 RCP8.5
Days >35°C	10	13 (12-15)	16 (15-18)	21 (16-25)
Days >40°C	1	2 (2-3)	4 (3-5)	5 (3-7)

** Data generated with thresholds calculator using Melton as proxy location due to its proximity to Melbourne Airport and similar historical record of high-temperature days. The given figures are an average of the eight models in the thresholds calculator, with the full range of model results in brackets.*

B13.5.2.3
Relative humidity

Reductions in relative humidity are expected to contribute to drier conditions this century. By 2030 these reductions will be small (less than 1 per cent). By 2070 the reductions are projected to be larger (up to 4 per cent), particularly in winter and spring under higher emissions scenarios (CSIRO, 2016c; Grose, 2015).

B13.5.2.4
Solar radiation

An increase in average annual solar radiation of less than 3 per cent is projected by 2030. By 2070 there could be slightly larger increases in winter and spring of up to 4 per cent (CSIRO, 2016c; Grose, 2015).

B13.5.2.5
Evaporation

All climate models project increases in potential evaporation in Victoria in all seasons. By 2030 this increase is unlikely to be greater than 5 per cent. By 2070 the increase is expected to be larger, 5 to 10 per cent, particularly in winter (CSIRO, 2016c; Grose, 2015).

B13.5.2.6
Moisture and run-off

The projected increases in potential evaporation combined with likely decreases in rainfall will lead to decreases in soil moisture and run-off. **Table B13.22** shows that these decreases could be quite significant, even for modest increases in mean temperature. However, there is low confidence in these estimates (Grose, 2015).

B13.5.2.7
Drought

The time spent in drought is projected with medium confidence to increase over the course of the century. There is moderate consensus that this increase will be large (more than 25 per cent) by 2070 under RCP4.5 and 8.5. The number of droughts every 20 years is projected to increase and could double by 2070 under RCP8.5 (**Table B13.23**).

Table B13.22
Projected changes to run-off (millimetres) for Maribyrnong River catchment for 1°C and 2°C increases in mean temperature (Post, 2012)

Baseline run-off (mm)	Change in run-off for 1°C mean working (%)			Change in run-off for 2°C mean working (%)		
	Worst-case	Median	Best-case	Worst-case	Median	Best-case
68	-27	-17	-7	-47	-29	-12

Table B13.23
Duration and frequency of extreme drought in Victoria (Grose, 2015)

	Baseline (1981-2010)	2030 RCP4.5	2070 RCP4.5	2070 RCP8.5
Percentage of time in drought (%)	37	42	48	47
Percentage of time in extreme drought (%)	23	26	29	26
Frequency of extreme droughts (per 20 years)	1.4	1.9	2.0	2.9

B13.5.2.8
Bushfire

Climate change resulting in a harsher fire-weather climate in the future is projected with high confidence. Bushfire risk is expected to increase through both an increase in the duration of the bushfire season as well as the level of risk during the season. However, there is low confidence in the magnitude of the change to fire weather.

The current average annual cumulative Forest Fire Danger Index (FFDI) for Melbourne Airport is 2591 (Clarke et al, 2013). Projections for Melbourne Airport indicate that the annual FFDI will increase by about 12 per cent by 2030, around 17 per cent under RCP4.5 by 2070 and 25 per cent under RCP8.5 by 2070 (CSIRO, 2016d).

The number of days with a 'severe' fire danger rating is projected to increase from 2.7 (baseline) to 3.5 by 2030 (noting that the present-day value is 3.1), about 3.8 under RCP4.5 by 2070 and 4.2 under RCP8.5 by 2070 (CSIRO, 2016d).

B13.5.2.9
Wind

Overall climate models estimate little change in average wind speed this century in comparison to natural variability (however, there is a high degree of uncertainty). By 2070, wind speeds are projected to decrease in western Victoria in winter and spring but these decreases are not expected to exceed 10 per cent under RCP8.5.

For maximum wind speeds, such as the one-in-20-year wind gust, there is projected to be little change (plus or minus 5 per cent) by 2070 (Grose, 2015).

B13.5.2.10
Fog

The formation of fog depends on several climate variables and there are no studies on the impact of climate change on the frequency of fog. However, increased temperatures may lead to a decrease in fog and this is already being observed worldwide (Klemm, 2016).

B13.5.2.11
Frost

The average annual number of potential frost days at Melbourne Airport is projected to decrease from nine days to six days by 2030, and three days by 2070 (CSIRO, 2016).

B13.5.2.12
Fauna strike

The number of birds at Melbourne Airport depends on a number of natural variables and operational activities. This makes it difficult to predict the effect of climate change on the likelihood of fauna strike.

B13.5.2.13
Dust storm

Dust storms could become more common with climate change. Although there are no specific projections available, decreased rainfall, increased evaporation and the associated drying of soil would point to a projected increase in the risk of dust storms occurring (Dineley, 2013).

B13.6
ASSESSMENT OF POTENTIAL IMPACTS

B13.6.1
Description of likely impacts on M3R

All the climate variables and natural hazards described in **Section B13.5** have, to varying degrees, the potential to impact on the operation and asset management of Melbourne Airport. However, only some of these have the potential to affect construction or operation of M3R, which is the focus of this section.

Table B13.24 provides an overview of the natural hazard and climate risks to M3R. This is a summary of the impact-assessment table in **Section B13.6.2**. The table shows a broad range of climate impacts that may affect M3R during both construction and operation.

Section B13.6.1.3 outlines the transition risks associated with the transition to a lower-carbon economy for Melbourne Airport.

Table B13.24
Summary of physical risks to M3R during construction and operations

	Extreme rainfall	Extreme heat	Drought	Lightning	High Wind	Bushfire
Construction						
Access to site	L		L			L
Condition of laydown area or construction site	M					L
Worker wellbeing/ability to work		L				L
Operation						
Longevity of runway and other asphalt areas	L	M				
Performance/ usability of runway and other asphalt areas	L	M	M			
Worker wellbeing/ability to work		M				
On-site vegetation		L	L			M
Impacts on natural environment (WQ, AQ, ecology)	M		M			

Table includes only risks which are within the scope of M3R to control. 'L' - low risk, 'M' - medium risk. The risk levels shown are the maximum level between now and 2070. 'WQ' - Water Quality. 'AQ' - Air Quality

B13.6.1.1
Construction phase

As M3R will be completed within 10 years, natural hazards but not climate change have been included in the assessment of potential impacts during the construction phase.

Access to site

During the construction phase there will need to be continuous access to the site to deliver materials, equipment and staff. This access will be provided from the north and south from public roads. The use of these roads could be affected by any of the following factors:

- Bushfire
- Heavy rain leading to surface-water flooding.

Conditions of the construction site

The natural hazards that could impact the movement of materials and staff during construction are:

- Localised surface-water flooding
- A grass fire on site, or close by Melbourne Airport (e.g. vegetation along creeks and streams).

Operating conditions during construction

The main natural hazards that could impact workers' health, comfort, wellbeing or efficient working are heatwaves and bushfire smoke. If temperatures climb above 35°C, or if air quality is too poor, outdoor construction will normally be required to cease. If this occurs for a prolonged period, it has the potential to disrupt the construction schedule.

Interaction of climate with M3R construction

During construction of M3R there may be a period when movements on the existing north-south runway (16L/34R) are restricted. At this time, the only operational runway will be the existing east-west runway (09/27). As such, Melbourne Airport will be particularly susceptible to strong winds – especially prevailing northerly winds. Landing and take-off will be suspended when crosswinds exceed safe aircraft operating conditions.

B13.6.1.2
Operational phase

Once in operation, the new airfield infrastructure is projected to face a wide range of climate and natural hazards. The significance of some of these risks is likely to change during the 50-year design life of M3R due to climate change. For this reason, the assessment of risks to operations has considered medium-term (2030) and long- term (2070) climate projections.

Climate change is unlikely to create new risks for the operation of M3R. It will, however, change the severity of some existing climate and natural-hazard risks, typically by changing their likelihood. According to current projections, the most significant changes for the Greater Melbourne region are likely to be from increases in the incidence of drought months, extreme-heat days, storms and bushfire. The effect of climate change on operational risks has been considered as part of the impact assessment (Section B13.6.2).

There are varying degrees of confidence associated with projected changes in climate variables. For some, such as temperature, there is high or very high confidence in the direction of change but lower confidence in the magnitude of change. For other variables such as fog, wind and lightning, there is low or very low confidence in both the magnitude and direction of change due to climate change.

The starting point for understanding risks to the operation of M3R is those currently experienced by Melbourne Airport. These have been assessed using the knowledge of Melbourne Airport staff, and media reports of weather-related disruption.

Operating conditions at the airport

The key climate-related impacts that can cause issues with the operation of M3R include:

- Heatwaves – sustained high temperatures will impact the health and wellbeing of staff and passengers, especially airside staff such as ground handlers, refuellers, safety officers etc, and any passengers who traverse the tarmac to/from aircraft
- Bushfire on site or near to Melbourne Airport - may mean people (staff and visitors) can't access the airport, thereby impacting operations and business activity
- Regional bushfire - leading to smoke and particulate matter in the 'airshed' (i.e. part of the atmosphere that behaves in a coherent way with respect to the dispersion of emissions). This results in poor visibility affecting flights; and could result in reduced passenger numbers, staff and public health problems (e.g. reduced staff as personnel are unable to access the airport and/or they may be protecting their homes and/or volunteering with local fire authorities).

Longevity of surfaces

A number of climate variables can affect the integrity of the runway and other airfield pavement surfaces such as taxiways and aprons. This can reduce the lifespan of the asphalt materials and affect their maintenance regime.

These impacts may not always operate in isolation but can combine in the following ways to cause degradation:

- Drought and an increase in variation of wet and dry spells, which can lead to subsidence or heave that damages structures
- Excessive hot weather (higher than 38°C) that can weaken asphalt bindings in airfield pavements and lead to cracking and deformation, especially when they are subject to the structural loading from aircraft parking and ground manoeuvres
- Regular saturation of the subgrade layers of the airfield pavement, leading to degradation over time
- The combined effects of heat, solar radiation and heavy rain, resulting in asphalt degradation and reduction in the lifecycle performance of materials and foundations.

Performance of runway and other asphalt areas

Some impacts could affect the short-term performance or maintenance of the runways, including:

- Heavy rain, particularly on soils compacted by drought, could overwhelm the drainage system and lead to inundation of the airfield creating more hazardous conditions for aircraft
- Residue can build up on airfield surfaces during a dry period. Then when it rains, the residue could cause surfaces to become slippery and more hazardous
- Hot weather can lead to an increased build-up of rubber on runway and a consequent increase in rubber-removal resources and costs.

On-site flora and fauna

Some natural hazards may cause a negative impact on the flora and fauna at Melbourne Airport from:

- Drought and hot weather, leading to die-back of habitat and vegetation, erosion and dust generation, and changes in species composition
- Waterlogging of the root zone of airfield grasses and vegetation, resulting in changes in species composition.

Impacts on natural environment

Some climate events could indirectly negatively impact the environment through:

- The release of pollutants when the airport drainage and treatment system are full (after heavy rain) into local watercourses, degrading water quality and aquatic biota
- Ponding after heavy rain attracts birds, leading to greater risk of 'fauna strike'.

Indirect and uncontrollable impacts

The assessment identified and evaluated a number of potential impacts that cannot be controlled within the scope of M3R. Melbourne Airport will consider how to mitigate them as part of its broader efforts to improve climate resilience.

B13.6.1.3
Transition Risks

The following sections provide an overview of the key categories of transition risks.

Policy and legal risks

The policy landscape is evolving in response to climate change and its impacts. The two major aims of this emerging climate policy are mitigation and adaptation. In addition, policymaking is becoming increasingly adaptive as the speed of knowledge creation and distribution increases. Examples of policy-related transition risks include carbon pricing and emissions-reporting obligations. Climate-change adaptation policies may present opportunities such as the promotion of energy and efficiency solutions, or sustainable land-use practices.

Transition to a lower-carbon economy may also result in increased legal challenges to stop carbon-intensive development. The recent decision in the United Kingdom to stop the expansion of the Heathrow Airport is an example of legal action that has already occurred.

Technology Risks

Technological innovations associated with the transition to a lower-carbon economy may present both risks and opportunities to organisations. Advances in renewable energy production; and storage, energy-efficiency and carbon-capture and storage technologies, present risks for many organisations relying on traditional fuel sources either directly or as part of their supply chain. For example, airports are directly reliant on traditional forms of jet fuel for the supply of fuel to aircraft; and on fossil fuels throughout their supply chain and for transport within and to the airport. Fossil fuels are further used throughout an airport's supply chain in the manufacture of materials and goods needed for airport operations. Further risks arise from uncertainty around the speed and nature of technological development. Conversely, falling prices and increasing demand for technology such as renewable energy sources and electrified transport present opportunities for organisations to market and invest in these developments.

Market Risks

The considerable uncertainty and complexity around how markets may be affected by climate change poses major risks to organisations. For example, changing customer preferences and costs of raw materials may result in abrupt changes in demand and a compromised ability to meet that demand.

Reputation Risks

Customer and stakeholder perceptions of an organisation will be increasingly shaped by how they see that organisation contributing to, or hindering, the transition to a lower-carbon economy. A further risk may arise from public sentiment towards the aviation sector as a whole which could affect demand, production capacity and workforce management.

B13.6.2
Risk assessment

The climate change risk assessment has been conducted using the methodology described in Section B13.2. The full risk assessment is recorded in the climate change and natural hazards physical-and-transitional risk register (Appendix B13.A).

The risk register categorises risks as follows::

- Risks to M3R construction
- Risks to the operation of M3R
- Transition risks.

The assessment has identified eight risks to construction and 22 risks to operations from natural hazards and climate. Most have been assessed as low severity. Four construction-related risks and four operational risks are of medium severity in the present day.

A further three operational risks increase in severity from low to medium by 2070, taking climate projections into account.

The assessment shows that none of the risks from climate change or natural hazards is rated as high or extreme, and that no impacts are rated as major adverse.

B13.6.2.1
Uncertainty with regard to climate projections

This assessment has considered the most likely climate projections according to current scientific evidence. However, there is some uncertainty about aspects of the projections. For temperature there is strong evidence that mean and extreme temperatures will increase, albeit with uncertainty about the magnitude of the change.

For other variables such as wind and lightning, there is either a lack of strong evidence about the direction of change or the evidence is ambiguous. For these variables, no assumptions have been made about the direction of change, meaning climate change has no effect on the risk rating. However, in designing critical airfield infrastructure such as a runway it is prudent to consider increases in such variables, and design accordingly.

B13.6.2.2
Cumulative and interactive impacts

The climate-change and natural-hazards risk register (Appendix B13.A) follows a standard approach of linking weather events to distinct adverse consequences. Although such an approach is crucial for identifying the range of risks it does not fully address the complexity of the impact of climate change.

In reality, climate risks tend to coincide, interact and have a cumulative effect. For example, individual adverse-weather events can lead to complex situations with many interacting impacts. It is extremely difficult to predict this type of impact or to evaluate the severity of the risk. However, this demonstrates that climate change is a systemic risk with significant uncertainties, and mitigation measures will therefore have to take this into account.

B13.7
AVOIDANCE, MANAGEMENT AND MITIGATION MEASURES

At a minimum, Melbourne Airport has committed to implementing mitigation measures sufficient to ensure there are no residual risks rated as either high or extreme in both current or future climate scenarios. The mitigation measures will have the potential to reduce the likelihood and/or consequence of potential impacts.

The assessment for this study (Section B13.6) has shown there are no risks related to climate change or natural hazards that are rated as high or extreme. This is partly because M3R has been designed to high standards that already control most climate risks. The absence of any high or extreme risks in this study means the level of risk to M3R from climate change and natural hazards is acceptable even without additional mitigation measures.

However, Melbourne Airport has opted to implement mitigation measures for some physical risks initially assessed as being medium. It has done this where the measures are low cost, easy to implement, or have ancillary benefits. Table B13.25 shows the mitigation measures Melbourne Airport proposes to implement for medium-level risks and the residual risk rating once the measures are in place. It has been possible to mitigate most medium to low-level risks.

B13.7.1
Climate change consideration in design

Some aspects of M3R will be designed to take into account certain climate thresholds. Examples include:

- Drainage system designed for a one-in-100-year rainfall event – in line with the Australian Rainfall and Runoff (ARR) Guidelines
- Asphalt bindings in airfield pavements and asphalt sub-layer designed to take account of ambient air temperature up to a certain threshold.

For this type of climatic threshold, M3R design team will factor in a climate change allowance. For example, for the drainage system the design team has carried out a climate change sensitivity analysis for the one-in-100-year rainfall event. This sensitivity analysis has incorporated a 19 per cent increase in rainfall intensity for the pre and post-development condition. This is in line with Melbourne Water's projections under RCP8.5 (the high-emission scenario).

Where practical, the design will be adapted so the M3R can withstand future climate changes. Another approach will be to allow flexibility in the design so additional mitigation measures can be added later if required.

B13.7.2
Mitigation measures for cumulative and interactive impacts

As explained in Section B13.6.2.2, climate risks will interact and accumulate in a way that is difficult to assess. The systemic nature of climate risk calls for mitigation measures which increase M3R's climate resilience regardless of climate scenarios. These measures include incorporating climate risk into emergency planning and implementing a system for climate risk monitoring and review.

Climate risk in emergency planning

M3R operations will occasionally be disrupted by weather-driven events. Some of these events will have multiple interacting impacts which are hard to predict. One way to prepare for them is through emergency planning and testing of emergency scenarios. Melbourne Airport will therefore take account of climate risks such as extreme weather in its airport emergency planning.

Climate risk monitoring, reporting and review

The M3R Team will periodically review the risks from climate change and natural hazards. These periodic reviews will take account of new climate science as well as the monitoring system described in Section B13.7.3.

Table B13.25
Mitigation measures for current medium-level physical risks and residual risk rating

Natural hazard/ climate variable	Risk event and consequence	Mitigation measures	Residual risk rating: Consequence	Residual risk rating: Likelihood	Residual risk rating: Risk level
Construction					
Extreme rainfall	Without mitigation and management measures and controls, localised surface water flooding leads to inundation of laydown area, construction site or access road(s) and consequent disruption to construction schedule.	In the final design phase, a Sedimentation and Erosion Control Plan will be developed as part of the CEMP detailing mitigation measures such as stabilisation of identified areas of instability. (See **Chapter B4: Surface Water and Erosion**).	Minor	Probably not	Low
	Polluted run-off affects local/ downstream water quality of local waterways. Water quality limits breached. Potential for impact on aquatic and riparian flora and fauna.	In the final design phase, a best practice IECA Sediment and Erosion Control Plan will be developed as part of the CEMP.	Moderate	Almost Certainly Not	Low
Bushfire	Without mitigation and management measures and controls, smoke impacts worker health, particularly those with asthma or other chronic respiratory condition(s).	Melbourne Airport will encourage the contractor to include specific procedures in its Occupational Health & Safety Management Plan to ensure safety in smoky conditions.	Moderate	Almost Certainly Not	Low
Winds	Strong E/W winds during the period of construction when the east-west runway is closed. After construction of the North-South runway the East-West runway will be closed whilst it is being altered, which may cause disruptions in certain wind conditions.	Wherever possible, existing runways will remain open during M3R construction. Necessary closures for works will be optimised to reduce risk of unavailability due to weather conditions.	Minor	Probable	Medium
Operation					
Bushfire	Regional bushfires or grassfires lead to smoke and particles in the airshed. This results in poor visibility affecting aircraft, and could result in reduced passenger and staff numbers as they can't access airport (or may be looking after their homes and/or volunteering)	N/A	Moderate	Probably Not	Medium
Drought	On-site vegetation dies due to period of drought and hot weather Potential degradation of protected ecological communities or habitat	Ongoing monitoring to record any changes to protected communities	Moderate	Almost Certainly Not	Low
Extreme Changes in soil conditions	An increase in variation of wet and dry spells causes subsidence or heave, damaging the runway foundations, taxiways and surfaces	The runway pavement has been designed to withstand projected variations in subgrade moisture condition	Moderate	Almost Certainly Not	Low

Natural hazard/ climate variable (cont.)	Risk event and consequence (cont.)	Mitigation measures (cont.)	Residual risk rating (cont.): Consequence	Residual risk rating (cont.): Likelihood	Residual risk rating (cont.): Risk level
Operation (cont.)					
Extreme rainfall	Spillage or release of contaminants such as fire retardant at a time when heavy rain has completely inundated the drainage and treatment network Mobilisation of contaminants in stormwater run-off affecting downstream water quality. Water quality limits breached. Potential for impact aquatic and riparian flora and fauna	Stormwater Management Plan, regular inspections of airport drainage system including outfalls, retarding basins and water sensitive urban design	Moderate	Almost Certainly Not	Low
High temperature	Sustained high temperatures impacting the health and wellbeing of outside workers (especially airside staff such as ground handlers, refuellers, flight dispatchers, etc.)	Sun protection, first aid kits, medical facilities, hydration stations and cool zones are provided for all staff, ground handlers and contractors. Airport guidelines include safety procedures for working in hot conditions	Minor	Chances about even	Low
	High temperatures leading to lower air density air Prolonged heatwaves lead to increased aviation disruptions. Noting that high temperatures lead to lower air density (which reduces aerodynamic lift and jet engine power output). This can lead to restrictions in take-off weight (meaning plane weights may need to be reduced), or service disruptions	Ensure runway lengths are fit for purpose at various climate change scenarios. This will be determined in planning based on appropriate assumptions about future temperatures and aircraft capabilities.	Moderate	Almost Certainly Not	Low
Winds	An increase in the frequency of high winds can result in damage to High Intensity Approach Lighting (HIAL) structures.	HIAL will be built to the Australian Standard for structural design actions (AS1170.2) and designed to withstand, without collapse, wind of a magnitude of up to and including that with a 100-year ARI	Moderate	Almost Certainly Not	Low
	High wind during a prolonged drought leads to dust storms generated in arid inland areas.	The airport has numerous controls in place, including tie-down procedures to follow when high wind alerts are issued. This means that all loose objects within the airfield and construction sites are tied down and/or covered	Moderate	Probably Not	Medium

B13.7.3 Monitoring and reporting

Melbourne Airport regularly monitors incidents related to climate events or natural hazards. They are recorded and managed through Melbourne Airport's existing Enterprise Risk Management system.

Melbourne Airport periodically reviews the data to determine the greatest weather-driven risks and the measures most effective in improving resilience. Ongoing monitoring of the data enables Melbourne Airport to identify any long-term increases in particular risks as the climate changes.

B13.8 CONCLUSION

B13.8.1 Physical Risks

This study has assessed the natural hazards and the aspects of the local climate that may affect the design, construction and operation of M3R. It has described the current climate, as well as the future climate in 2030 and 2070 based on climate projections.

Melbourne Airport is in a fairly benign climatic location and does not experience extremes such as cyclone, snowstorm or coastal flooding that affect many other international airports. Despite this, climate events and natural hazards do sometimes affect Melbourne Airport and the likelihood of some of these impacts occurring is expected to increase during the operational life of M3R.

This study has concluded there are no physical risks from climate change or natural hazards rated as high or extreme and no impacts are rated as major adverse. Several risks are rated as medium, which means they are within the risk tolerance of M3R.

However, this study has taken a conservative approach and has proposed mitigations for most medium-level risks so their severity is low.

Appendix B13.A describes seven physical climate change and natural-hazard risks that have the potential to result in physical impacts to M3R construction. None of these potential impacts have been found to represent significant or high risks.

However, three risks draw an inherent 2020 rating of medium during M3R construction. These relate to impacts associated with:

- Localised surface-water flooding
- Surface-water flooding leading to mobilising of contaminants from construction area affecting flora and fauna
- Bushfires resulting in smoke and diminishing air quality for workers.

All are expected to be reduced to a low rating following the application of planned controls.

B13.8.2 Transitional Risks

Appendix B13.A summarises the key transition risks and opportunities across the various categories of transition risk: political, legal, technological, market and reputation.

Two risk events were classified as medium in 2020. These were:

- Increased risk associated with climate-related regulation - a recent decision in the United Kingdom to stop the expansion of the Heathrow airport highlights the risks to future carbon-intensive development
- Abrupt/unexpected shifts in energy costs - although it is unlikely that this sort of event will occur (likelihood rated as 'probably not'), the consequences of another global jet-fuel crisis would be moderate.

The key risks foreseen to become significant in the longer term are:

- Emissions-reporting obligations – net zero/carbon neutrality targets and/or a price on carbon. The financial consequences of having to be carbon neutral could be major as the price of carbon offsets may increase significantly when demand outstrips supply across all sectors of the economy. In addition, the likelihood of mandatory net zero emissions for companies and assets will most likely increase over time
- Climate-related regulation – a recent decision in the United Kingdom to stop the expansion of the Heathrow airport highlights these risks to carbon-intensive development in the future
- Changing customer behaviour – consumers decide to travel less frequently by aircraft due to concerns about carbon emissions.

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APPENDIX B13.A
CLIMATE CHANGE AND NATURAL HAZARD PHYSICAL RISK REGISTER

Table B13.26
Climate change and natural hazard physical risk register

Risk event	Impacts	Consequence type	Thresholds or previous events	Current risk (2020)			Current controls and future mitigation measures	Target Risk			Effect of climate change on risk	Med-term risk (2030 RCP4.5)			Long-term risk (2070 RCP8.5)		
				Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level	Consequence	Likelihood	Risk level
Construction							**Construction (cont.)**										
Grassfire inside airport boundary	Fire affects construction or access to construction site, meaning construction staff can't work.	Financial Safety Environmental	N/A	Moderate	Almost Certainly Not	Low	Aircraft Rescue and Firefighting Service provides fire response and protection services within the airport boundary. Additionally, the airport ensures there is adequate fire water supply, fire break management, vegetation management (regular grass slashing and woodland thinning) and Municipal Fire Management Plan strategies are in place.	Moderate	Almost Certainly Not	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Bushfires result in smoke, diminishing air quality for workers.	Without mitigation and management measures and controls, smoke impacts worker health, particularly those with asthma or other chronic respiratory condition(s).	Safety	N/A	Major	Almost Certainly Not	Medium	Melbourne Airport will encourage the contractor to include specific procedures in its Occupational Health & Safety Management Plan to ensure safety in smoky conditions.	Moderate	Almost Certainly Not	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Drying / changing soils affect tree stability	Tree fall risk on construction roads affect access to construction site.	Environmental Regulatory	N/A	Limited	Probably Not	Very Low	Tree and vegetation removal undertaken during early works with project footprint. Trees to be retained are flagged off 'no-go areas' and regularly monitored.	Limited	Probably Not	Very Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A
High temperatures and heat waves	Without mitigation and management measures and controls, worker comfort compromised affecting wellbeing and productivity. Outdoor working temperature rules exceeded leading to inefficiencies and project delays.	Regulatory	N/A	Minor	Chances About Even	Low	Melbourne Airport will encourage the contractor to include specific procedures in its Occupational Health & Safety Management Plan to ensure comfort in high temperatures. In addition, the contract timetable will have an allowance for inclement weather which leads to delays.	Minor	Chances About Even	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Localised surface water flooding	Without mitigation and management measures and controls, localised surface water flooding leads to inundation of laydown areas, construction site or access road(s) and consequent disruption to construction schedule.	Financial Safety Environmental	100-year rainfall event	Moderate	Probably Not	Medium	In the final design phase, a best practice IECA Sediment and Erosion Control Plan will be developed as part of the CEMP.	Minor	Probably Not	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Surface water run-off mobilises contaminants from construction area	Polluted run-off affects local/ downstream water quality of local waterways. Water quality limits breached. Potential for impact on aquatic and riparian flora and fauna.	Environmental Regulatory	Two-year rainfall event	Moderate	Chances About Even	Medium	In the final design phase, a best practice IECA Sediment and Erosion Control Plan will be developed as part of the CEMP.	Moderate	Almost Certainly Not	Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sustained periods of rainfall saturate and soften the ground	Over time the structural integrity of detention basins / sediment basins is compromised leading to collapse.	Financial Safety Environmental	Temporary ponds / basins for construction are more prone to collapse	Minor	Probably Not	Low	Regular inspections of airport drainage system including sediment and detention basins. Increased inspections during times of high rainfall or when destabilisation or piping is apparent.	Minor	Almost Certainly Not	Very Low	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Strong E/W winds during the period of construction when the east-west runway is closed after M3R construction	Runway 09/27 (existing) will be temporarily closed for modification as part of M3R. When this east-west runway is closed there may be disruptions due to crosswind conditions, which favour operations on the closed runway.	Financial Safety Reputation	Weather conditions necessitating operations on runway 09/27 are rare.	Minor	Probable	Medium	Wherever possible, existing runways will remain open during M3R construction. Necessary closures for works will be optimised to reduce risk of unavailability due to weather conditions.	Minor	Probable	Medium	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Risk event (cont.)	Impacts (cont.)	Consequence type (cont.)	Thresholds or previous events (cont.)	Current risk (2020) (cont.)			Current controls and future mitigation measures (cont.)	Target Risk (cont.)			Effect of climate change on risk (cont.)	Med-term risk (2030 RCP4.5) (cont.)			Long-term risk (2070 RCP8.5) (cont.)		
				Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level	Consequence	Likelihood	Risk level
Operation							**Operation (cont.)**										
Grassfire inside airport boundary	People can't access airport, health impacts (particulate matter), airside staff can't work - this will affect plane landings and take-offs, could result in reduced passenger numbers.	Financial Safety Environmental	N/A	Moderate	Almost Certainly Not	Low	Aircraft Rescue and Firefighting Service provides fire response and protection services within the airport boundary. Additionally, the airport ensures there is adequate fire water supply, fire break management, vegetation management (regular grass slashing) and Municipal Fire Management Plan strategies are in place.	Moderate	Almost Certainly Not	Low	Increase in extreme fire danger days – up to 135% by 2050.	Moderate	Probably Not	Medium	Moderate	Probably Not	Medium
Regional bushfires outside of airport boundary	Regional bushfires or grassfires lead to smoke and particles in the airshed. This results in poor visibility affecting plane landings and take-offs, could result in reduced passenger numbers, reduced landside staff as they can't access airport and may be looking after their homes and / or volunteering.	Financial Safety	Hazy conditions reducing visibility and potentially affecting flight operations and air traffic movement flows. In February 2014, bushfires in the Kilmore area meant that the air traffic control tower was evacuated briefly due to smoke penetration, causing some flights to undergo emergency landings and half-hour delays for outbound flights. Bushfires in January 2020 also resulted in delays to flights.	Moderate	Probably not	Medium	N/A	Moderate	Probably Not	Medium	Increase in extreme fire danger days – up to 135% by 2050.	Moderate	Probably not	Medium	Moderate	Chances About Even	Medium
Changes in behaviour or distribution of wildlife, particularly the foraging/flight patterns of bird species during autumn, as well as the Grey-headed Flying Fox	Bird strike, Injury or death to wildlife (i.e. birds and bats) as a result of aircraft incidents and changes to local habitat dynamics and wildlife foraging/ roosting patterns.	Environmental Safety	N/A	Limited	Probable	Low	Daily airside monitoring and Bird Control Plan containing a range of pre-emptive and reactive measures aimed at habitat management, population control, exclusion, removal, active scarring and passive deterrents to reduce wildlife attractants on and within 13 kilometres of the airport boundary (as recommended by ICAO).	Limited	Probable	Low	Various climatic changes lead species' responses.	Limited	Probable	Low	Limited	Probable	Low
On-site vegetation cover reduced due to period of drought and hot weather	Reduction in water quality treatment performance by landscaped features. Regulatory discharge limits with respect to pollutants are exceeded.	Environmental Regulatory	Regulatory water quality requirements (Cth and State)	Minor	Chances About Even	Low	Landscaping to specify native, drought-tolerant species.	Minor	Probably not	Low	Increase in drought months – 20% by 2030; 40% by 2070.	Minor	Probably Not	Low	Minor	Chances About Even	Low
On-site vegetation dies due to period of drought and hot weather	Potential degradation of protected ecological communities or habitat	Environmental	N/A	Moderate	Probably not	Medium	Ongoing monitoring to record any changes to protected communities	Moderate	Almost Certainly Not	Low	Increase in drought months – 20% by 2030; 40% by 2070.	Moderate	Probably Not	Medium	Moderate	Chances About Even	Medium
Compacted dry soils lead to increased run-off risk when heavy rain arrives	Run-off overwhelms drainage system resulting in saturation of the subgrade layers. Regular saturation will result in the degradation of the pavement	Financial Safety	Requires volume of run- off above that can be handled	Moderate	Almost Certainly Not	Low	Drainage system designed for the 100-year event based on typical antecedent moisture conditions for grassed areas in South Eastern Australia. As per Australian Rainfall and Runoff guidelines.	Moderate	Probably Not	Low	Increase in drought months – 20% by 2030; 40% by 2070.	Moderate	Probably Not	Medium	Moderate	Probably not	Medium

Risk event (cont.)	Impacts (cont.)	Consequence type (cont.)	Thresholds or previous events (cont.)	Current risk (2020) (cont.)			Current controls and future mitigation measures (cont.)	Target Risk (cont.)			Effect of climate change on risk (cont.)	Med-term risk (2030 RCP4.5) (cont.)			Long-term risk (2070 RCP8.5) (cont.)		
				Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level	Consequence	Likelihood	Risk level
Operation (cont.)							**Operation (cont.)**										
Compacted dry soils lead to increased run-off risk when heavy rain arrives	Inundation of airfield areas and aircraft manoeuvring surfaces could cause ponding in operational areas which could result in flight delays and possible cancellations, en route diversions and loss of revenue.	Financial Safety	Requires volume of run- off above that can be handled	Minor	Probably Not	Low	Various surface water controls such as bio-retention storage will manage peak flow rates and are designed to effectively drain airfield	Minor	Almost Certainly Not	Very Low	Increase in drought months – 20% by 2030; 40% by 2070.	Minor	Almost Certainly Not	Very Low	Minor	Probably Not	Low
An increase in variation of wet and dry spells	An increase in variation of wet and dry spells causes subsidence or heave, damaging the runway foundations, taxiways and surfaces.	Financial Safety Reputation	N/A	Moderate	Probably Not	Medium	The runway pavement has been designed to take account of variations in subgrade moisture condition.	Moderate	Almost Certainly Not	Low	Increase in drought months – 20% by 2030; 40% by 2070.	Moderate	Probably Not	Medium	Moderate	Probably Not	Medium
Spillage or release of contaminants such as fire retardant at a time when heavy rain has completely inundated the drainage and treatment network.	Mobilisation of contaminants in stormwater run-off affecting downstream water quality. Water quality limits breached. Potential for impact aquatic and riparian flora and fauna.	Environmental Regulatory Reputational	Water quality treatment system will be designed for up to the two-year design storm.	Moderate	Probably Not	Medium	Stormwater Management Plan, regular inspections of airport drainage system including outfalls, retarding basins and water sensitive urban design.	Moderate	Almost Certainly Not	Low	An increase in the intensity of extreme rainfall events is projected with high confidence; the RCP4.5 medium emissions scenario predicts a 7% increase by 2070.	Moderate	Almost Certainly Not	Low	Moderate	Probably Not	Medium
Localised surface water flooding	Localised surface flooding can overwhelm drainage capacity causing delays and disruptions including on access roads and car parks. Inundation of airfield areas and aircraft manoeuvring surfaces reduces surface friction, causing hazardous conditions for landing and taxiing aircraft and related ground operations including ground support equipment and airside vehicles. This can result in flight delays and possible cancellations, and loss of revenue. Flooding may additionally damage aircraft navigation systems, buildings, and runways (which could impact take-off and landings).	Financial Safety	Run-off water depth of >3mm over more than 25% of the runway surface will be hazardous to safe landing and take-off operations leading to temporary closure of the runway. September 2011 – nearly 50 millimetres of rain in one hour led to flight disruption over two days.	Minor	Chances About Even	Low	The drainage culverts across the airport (including M3R) will be designed to handle a rainfall event with a 100- year Average Recurrence Interval (ARI). To allow for increases in rainfall intensity due to climate change the design will be sensitivity tested for rainfall with a 200-year ARI. Maintain runway in optimum condition, grooved runway surface, runway condition assessments/inspections, airport drainage system, runway end safety areas.	Minor	Probably Not	Low	An increase in the intensity of extreme rainfall events is projected with high confidence; the RCP4.5 medium emissions scenario predicts a 7% increase by 2070.	Minor	Probably Not	Low	Minor	Chances About Even	Low
Heavy rain leads to reduction in visibility	More frequent or more intense rainfall causing reduced visibility for aircraft and ground support equipment, resulting in delays.	Financial Safety	Increased separation distance between aircraft leading to delays.	Limited	Probably Not	Very Low		Limited	Probably Not	Very Low	Increased extreme rainfall events projected with high confidence; RCP4.5 medium emissions scenario predicts 7% increase by 2070.	Limited	Chances About Even	Low	Minor	Chances About Even	Low
Heatwave	Heat damage to airfield pavements (i.e. runways, taxiways, aprons and airside roads) and underground services (i.e. fuel hydrant system). Asphalt bindings in airfield pavements/asphalt sub-layers weaken when exposed to sustained periods of excessive hot weather (i.e. >38°C days) and heat absorption. This results in the asphalt oxidising, stiffening and cracking. Heavy static aircraft loads, ground taxiing and landing/take-off operations will progressively soften/deform the asphalt and in extreme circumstances trap or immobilise aircraft in ruts/runway grooves. Fuel residues from underground hydrant system leaks can bubble up to the surface through soft sub-layers. Immobilised aircraft will require towing for airworthiness inspections, creating system delays.	Financial Safety	Excessive hot weather (e.g. higher than 38°C) that can weaken asphalt bindings in airfield pavements leading to cracking and deformation, especially when subject to the structural loading from aircraft parking and ground manoeuvres	Moderate	Almost Certainly Not	Low	The airport carries out various procedures that will help mitigate this risk, involving regular airside inspections, pavement rehabilitation, rapid resurfacing and slab replacement works, etc, based on applicable design standards and best practice.	Moderate	Almost Certainly Not	Low	Increase in days >35°C from nine days to 11 days by 2030 and 20 days by 2070.	Moderate	Probably Not	Medium	Moderate	Chances About Even	Medium

Risk event (cont.)	Impacts (cont.)	Consequence type (cont.)	Thresholds or previous events (cont.)	Current risk (2020) (cont.)			Current controls and future mitigation measures (cont.)	Target Risk (cont.)			Effect of climate change on risk (cont.)	Med-term risk (2030 RCP4.5) (cont.)			Long-term risk (2070 RCP8.5) (cont.)		
				Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level	Consequence	Likelihood	Risk level
Operation (cont.)							**Operation (cont.)**										
High temperatures	Increased build-up of rubber on runway leading to an increase in contaminant build up and rubber removal resources and costs.	Financial Environmental	N/A	Minor	Probably not	Low	Maintenance of runway surface will include regular removal of waste rubber at appropriate intervals.	Minor	Almost Certainly Not	Very Low	Increase in days >35°C from nine days to 11 days by 2030 and 20 days by 2070.	Minor	Almost Certainly Not	Very Low	Minor	Probably Not	Low
Heatwave	Thermal expansion of building infrastructure, such as concrete and steel, which over time can lead to failures and reduced longevity.	Financial	N/A	Moderate	Almost Certainly Not	Low	The airport carries out various procedures that will help mitigate this risk, involving regular building structural inspections and rehabilitation.	Moderate	Almost Certainly Not	Low	Increase in days >35°C from nine days to 11 days by 2030 and 20 days by 2070.	Moderate	Probably Not	Medium	Moderate	Probably Not	Medium
High temperatures	Sustained high temperatures will impact the health and wellbeing of outside workers, especially airside staff such as ground handlers, refuellers, flight dispatchers, etc.	Safety Financial	Sustained temperatures in excess of 25°C to 30°C will require appropriate workplace precautions to be taken regarding sun protection / hydration and a possible reorganisation of shift patterns and certain outdoor activities on the airside.	Minor	Probable	Medium	Sun protection, first aid kits, medical facilities, hydration stations and cool zones are provided for all staff, ground handlers and contractors. Airport guidelines include safety procedures for working in hot conditions.	Minor	Chances About Even	Low	Increase in days >35°C from nine days to 11 days by 2030 and 20 days by 2070.	Minor	Probable	Medium	Minor	Almost Certain	Medium
High temperatures	Flashpoint of aviation Jet A-1 fuel exceeded leading to risk of fuel ignition and therefore increased fire hazard risk for apron and ramp areas.	Safety	Material Safety Data Sheet for Jet A-1 kerosene-grade fuel indicates a flashpoint minimum of 38°C.	Minor	Probably Not	Low	Emergency spill response and clean-up procedures implemented in accordance with APAM's certified ISO 14001:2015 EMS and Airport Environment Strategy.	Minor	Almost Certainly Not	Very Low	Increase in days >35°C from nine days to 11 days by 2030 and 20 days by 2070.	Minor	Almost Certainly Not	Very Low	Minor	Almost Certainly Not	Very Low
High temperatures leading to lower air density	Prolonged heatwaves lead to increased take-off disruptions. Noting that high temperatures lead to lower air density (which reduces aerodynamic lift and jet engine power output). This can lead to restrictions in take-off weight (meaning plane weights may need to be reduced), or service disruptions if runways are not long enough.	Financial Reputation Safety		Moderate	Probably Not	Medium	Ensure runway lengths are fit for purpose at various climate change scenarios. This will be determined in planning based on appropriate assumptions about future temperatures and aircraft capabilities.	Moderate	Almost Certainly Not	Low	Increase in days >35°C from nine days to 11 days by 2030 and 20 days by 2070.	Moderate	Almost Certainly Not	Low	Moderate	Probably Not	Medium
High temperatures	Overheating of aircraft during block turnarounds	Financial	During prolonged periods of hot weather with temperatures >25°C to 35°C, airlines (subject to their respective procedures and agreements) will use APUs to keep the aircraft cabin comfortable. APU use can result in unnecessary fuel burn, emissions and ground noise.	Minor	Almost Certainly Not	Very Low	Airline agreements, installation of 400Hz (90kVA) FEGP and PCA systems on some contact stands, mobile GPU use and aircraft APU running.	Minor	Almost Certainly Not	Very Low	Increase in days >35°C from nine days to 11 days by 2030 and 20 days by 2070.	Minor	Almost Certainly Not	Very Low	Minor	Almost Certainly Not	Very Low

Risk event (cont.)	Impacts (cont.)	Consequence type (cont.)	Thresholds or previous events (cont.)	Current risk (2020) (cont.)			Current controls and future mitigation measures (cont.)	Target Risk (cont.)			Effect of climate change on risk (cont.)	Med-term risk (2030 RCP4.5) (cont.)			Long-term risk (2070 RCP8.5) (cont.)		
				Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level		Consequence	Likelihood	Risk level	Consequence	Likelihood	Risk level
Operation (cont.)							**Operation (cont.)**										
High winds	An increase in the frequency of high winds can result in damage to high intensity approach lighting (HIAL) structure.	Financial Safety	HIAL structures designed for 100-year return interval for wind	Moderate	Probably Not	Medium	HIAL structures will be built to the Australian Standard for structural design actions (AS1170.2) and designed to withstand, without collapse, wind of a magnitude of up to and including that with a 100-year ARI.	Moderate	Almost Certainly Not	Low	Potential for wind speeds to increase in winter by up to 13% by 2070 (may also decrease).	Moderate	Almost Certainly Not	Low	Moderate	Probably Not	Medium
High wind during a prolonged drought leads to dust storms generated in arid inland areas.	Dust clouds driven by high winds can results in a loss of visibility, causing flight and ground disruptions and leading to delays and cancellations. In addition, dust clouds can block sensors resulting in unreliable airspeed indicators, corrode the airframe, reduce thrust and lead to engine surging/flame-outs which can cause flight issues.	Financial Safety Reputation	N/A	Moderate	Chances About Even	Medium	The airport has numerous controls in place, including tie-down procedures to follow when high wind alerts are issued. This means that all loose objects within the airfield and construction sites are tied down and/or covered. In addition, there are other external controls, such as "Notice to Airmen" (NOTAM) notifications which alert pilots to any potential safety hazards in their journey.	Moderate	Probably Not	Medium	Increase in drought months – 20% by 2030; 40% by 2070.	Moderate	Chances About Even	Medium	Moderate	Chances About Even	Medium
High winds	Damage to assets, standing aircraft, vehicles and injuries to staff.	Financial Safety	N/A	Minor	Probably not	Low	The airport has numerous controls in place, including tie-down procedures to follow when high wind alerts are issued. This means that all loose objects within the airfield and construction sites are tied down and/or covered. In addition, there are other external controls, such as "Notice to Airmen" (NOTAM) notifications which alert pilots to any potential safety hazards in their journey.	Minor	Probably not	Low	Potential for wind speeds to increase in winter by up to 13% by 2070 (may also decrease).	Minor	Probably Not	Low	Minor	Probably Not	Low
Increased incidence of tropical disease outbreaks and epidemics results in reduced travel or altered tourism patterns	Warmer temperatures have an impact on the spread of tropical diseases. Modern transportation and air travel play a part, but the potential range for many diseases expands as regions farther and farther poleward get warmer. This means there are more and more places where a disease like Zika can take root. When the Zika outbreak occurred, it was reported that travel and tourism patterns altered causing significant economic damage to areas affected by the epidemic	Financial	N/A	Limited	Almost Certainly Not	Very Low	N/A	Limited	Almost Certainly Not	Very Low	N/A	Limited	Almost Certainly Not	Very Low	Limited	Almost Certainly Not	Very Low

Table B13.27
Climate change and natural hazard transitional risk register for M3R

Transition risk type	Context	Events	Consequence type	Inherent risk rating – 2020: Consequence	Inherent risk rating – 2020: Likelihood	Inherent risk rating – 2020: Risk level	Med-term risk – Med-term: 2030: Consequence	Med-term risk – Med-term: 2030: Likelihood	Med-term risk – Med-term: 2030: Risk level	Long-term risk – Long-term: 2070: Consequence	Long-term risk – Long-term: 2070: Likelihood	Long-term risk – Long-term: 2070: Risk level
Policy / legal												
Emissions reporting obligations – net zero / carbon neutrality targets	In June 2019 ACI Europe announced a resolution for its 500 members to reach net zero carbon emissions by 2050. In November 2019, Qantas Group pledged to reach net zero carbon emissions by 2050. There are currently 50 airports across the world that have achieved carbon neutrality under the ACA program. Melbourne airport has identified an emissions reduction target that is aligned with science-based target methodologies. There is an opportunity to build on the target and align with best practice in the aviation sector. Melbourne airport has committed to achieving Level 3 ACA accreditation in the future. This could include Level3+ Neutrality which would require the airport to offset residual emissions under its control.	Early retirement of existing assets (natural gas tri-generation system) in order to meet target emission levels, leading to sunk costs. Carbon offset expenses (if net zero carbon emissions was sought), leading to increased operational costs.	Regulatory Reputation Financial	Moderate	Almost Certainly Not	Low	Moderate	Chances About Even	Medium	Major	Probable	Significant
Price on carbon	Australia already has an Australia Carbon Credit Unit market with a spot price of approximately $16.10/unit in October 2019. 29 national jurisdictions currently have an implemented carbon tax or emissions trading scheme (ETS). Australia had an ETS between 2012 – 2014 before it was revoked. CORSIA (Carbon Offsetting and Reduction Scheme for International Aviation) is a UN deal designed to help the aviation industry reach its "aspirational goal" to make all growth in international flights after 2020 "carbon neutral". Under this scheme, airlines will have to buy emissions reduction offsets from other sectors to compensate for any increase in their own emissions. Alternatively, they can use lower carbon "CORSIA eligible" fuels.	Increased ticket prices results in lower passenger demand. Ticket prices may increase as a result of: Higher operational costs throughout supply chain. Increased insurance premiums.	Financial	Moderate	Almost Certainly Not	Low	Moderate	Probably Not	Medium	Major	Probable	Significant

Transition risk type (cont.)	Context (cont.)	Events (cont.)	Consequence type (cont.)	Inherent risk rating (cont.) – 2020: Consequence	Inherent risk rating (cont.) – 2020: Likelihood	Inherent risk rating (cont.) – 2020: Risk level	Med-term risk (cont.) – Med-term: 2030: Consequence	Med-term risk (cont.) – Med-term: 2030: Likelihood	Med-term risk (cont.) – Med-term: 2030: Risk level	Long-term risk (cont.) – Long-term: 2070: Consequence	Long-term risk (cont.) – Long-term: 2070: Likelihood	Long-term risk (cont.) – Long-term: 2070: Risk level
Policy / legal (cont.)												
TCFD reporting becomes mandatory	"in the future, to achieve a carbon-neutral economy, disclosure must clearly become mandatory." - Mark Carney, Governor of the Bank of England The US has proposed The Climate Risk Disclosure Act of 2019 ASIC are investigating large companies' climate change risk management To date, the transport sector has demonstrated a high level of reporting quality, relative to the TCFD recommendations.	Additional resources (staff hours, budget, etc) required to meet new reporting obligations, will increase operating costs.	Regulatory Financial Reputational	Limited	Almost Certainly Not	Very Low	Limited	Chances About Even	Low	Limited	Chances About Even	Low
Climate-related regulation	The Heathrow airports third runway expansion was found to be illegal by the United Kingdom's Court of Appeal in February 2020. In making the judgement, the court made the ruling on the grounds that the policy to expand the airport is incompatible with commitments made by the government in the Paris climate agreement. In NSW, the Planning and Environment court affirmed the NSW government's decision to refuse approval for a new coal mine in the Gloucester Valley. Australia's obligations under the Paris Agreement, and the impact of burning coal upon the world's climate were reasons which the Court said were, on their own, sufficient to justify the government's decision not to approve the project.	Fines and judgments may result in increased costs and/or reduced demand for products and services Delay or cancellations of expansions may restrict the growth in passenger numbers, limiting revenue growth.	Regulatory Financial Reputational	Major	Probably Not	Medium	Major	Chances About Even	Significant	Major	Chances About Even	Significant

Transition risk type (cont.)	Context (cont.)	Events (cont.)	Consequence type (cont.)	Inherent risk rating (cont.) – 2020: Consequence	Inherent risk rating (cont.) – 2020: Likelihood	Inherent risk rating (cont.) – 2020: Risk level	Med-term risk (cont.) – 2030: Consequence	Med-term risk (cont.) – 2030: Likelihood	Med-term risk (cont.) – 2030: Risk level	Long-term risk (cont.) – 2070: Consequence	Long-term risk (cont.) – 2070: Likelihood	Long-term risk (cont.) – 2070: Risk level
Technology												
All-electric aircraft	In July 2019, Israeli firm Eviation launched the world's first commercial all-electric passenger aircraft.	Existing equipment becomes redundant, resulting in sunk costs Unsuccessful investment in new technologies leads to losses	Financial	Minor	Almost Certainly Not	Very Low	Minor	Almost Certainly Not	Very Low	Minor	Probably Not	Low
Renewable energy advances	Renewable energy is now most frequently the cheapest energy source and the price continues to fall	Transition to renewable energy will require investment costs Transition to electrified ground operations will require investment costs Redundancy of existing infrastructure leads to sunk costs	Financial Reputational	Beneficial	Chances About Even	Very Low	Beneficial	Probable	Very Low	Beneficial	Almost certain	Very Low
Alternative fuels i.e. hydrogen, biofuel, Sustainable Aviation Fuel (SAF)	Alternative fuels can be blended with fossil fuels for lower-emission fuelling options Bergen, Brisbane, LA, Oslo and Stockholm airports have regular biofuel distribution - only five in world. The Wayne County Airport Authority in Michigan, USA is piloting producing biofuels on-site Biofuels are expected to provide 10% of aviation fuel by 2030 and close to 20% by 2040. An indication of aviation's commitment to growing alternative fuel use is the agreement of long-term offtake agreements between airlines and biofuel producers. These now cumulatively cover around 6 billion litres of fuel. Meeting this demand will require further production facilities, and some airlines have directly invested in aviation biofuel refinery projects.	Biofuel is likely only a transitional fuel and may become redundant before it delivers an overall return on investment Unsuccessful investment in new technology, leading to sunk costs Alternative fuels are currently more expensive than standard jet fuel	Financial Reputational	Minor	Almost Certainly Not	Very Low	Minor	Probably Not	Low	Minor	Chances About Even	Low

Transition risk type (cont.)	Context (cont.)	Events (cont.)	Consequence type (cont.)	Inherent risk rating (cont.) – 2020: Consequence	Inherent risk rating (cont.) – 2020: Likelihood	Inherent risk rating (cont.) – 2020: Risk level	Med-term risk (cont.) – 2030: Consequence	Med-term risk (cont.) – 2030: Likelihood	Med-term risk (cont.) – 2030: Risk level	Long-term risk (cont.) – 2070: Consequence	Long-term risk (cont.) – 2070: Likelihood	Long-term risk (cont.) – 2070: Risk level
Markets												
Changing customer behaviour – less travel via conventional aircraft	There is a new global movement that wants to reduce the amount people fly which may affect customer behaviour and willingness to use the airport. Sustainability is a primary concern for the millennial population. Swiss bank UBS survey found that 1/5 people had cut their flights because of climate impact - There may be a shift in tourism patterns, which may impact the number of tourists coming in and out of Melbourne and timing of their travel.	Shift in consumer preferences e.g. advancements in teleconference software may result in less business travel (reduced demand for flights) Reduced demand for flights due to a shift in consumer preferences	Reputation Financial	Moderate	Almost Certainly Not	Low	Moderate	Probably Not	Medium	Major	Chances About Even	Significant
Abrupt/ unexpected shifts in energy costs	Costs of jet fuels have been rising and are projected to continue to rise. If there is a global jet fuel crisis again this would have significant impacts on ticket prices. APAC's operating costs increased 10.3% over FY17/18, with the increases attributable to costs to service the increased passenger traffic and electricity price changes.	Increased operating costs and debt Difficulty in managing budgets and controlling costs may result in budget challenges	Financial	Moderate	Probably Not	Medium	Moderate	Probably Not	Medium	Minor	Chances About Even	Low

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