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Memorandum

Project Title	Melbourne Airport Rail	**Total Pages**	18
Document Title	**MAR State Land Greenhouse Gas Emissions Impact Assessment**		
Discipline	Environment	**Date**	15 September 2021
Document ID	**MAR-AJM-PWD-PWD-MEM-XEV-NAP-0001722**	**Revision No.**	E

1. Executive Summary

Aurecon Jacobs Mott Macdonald Joint Venture (AJM-JV) has been engaged by Rail Projects Victoria (RPV) to prepare the Melbourne Airport Rail (MAR) State Land operational Greenhouse Gas Impact Assessment (the Impact Assessment). The purpose of the assessment is to inform the strategic justification needed to support planning approval under the *Planning and Environment Act 1987*; and inform a self-assessment of the relevant referral criteria under the *Environment Effects Act 1978*.

A greenhouse gas impact assessment has been carried out to project greenhouse gas emissions that would be generated by the Project during the operational phase. It was identified that greenhouse gas sources would be predominantly associated with consumption of purchased electricity to provide rail traction power and station operations.

Other operational sources would include potential leakages from refrigerants, insulation gas leakage from switchgear and diesel use by service vehicles. However, these sources would be low to negligible in comparison to the consumption of electricity, with traction power and station operations typically making up over 95% of greenhouse gas emission sources from rail projects.

Overall, operational electricity usage by the Project is estimated to produce 52,378 tonnes of CO_{2e} per year. This falls below the Ministerial Guideline criteria of 200,000 tonnes of CO_{2e} per year directly attributable to the operation of the facility.

2. Introduction

Aurecon Jacobs Mott Macdonald Joint Venture (AJM-JV) has been engaged by Rail Projects Victoria (RPV) to prepare the Melbourne Airport Rail (MAR) State Land operational greenhouse gas emissions Impact Assessment (the Impact Assessment).

2.1 Purpose

The objective of this assessment is to project the likely greenhouse gas (GHG) emissions that will result from the operation of the MAR Project. This assessment has reviewed the Corridor, Sunshine and Rail Systems Section collectively as MAR State Land. This assessment provides the Greenhouse Gas Emissions Statement to support State land approvals as follows:

- Inform the strategic justification needed to support planning approval under the *Planning and Environment Act 1987* (P&E Act); and
- Inform an assessment of the Project against the Ministerial Guidelines for Assessment of Environmental Effects under the *Environment Effects Act 1978* (the Ministerial Guidelines), referred to as an Environment Effects Act 1978 (EE Act) referral self-assessment.

The project is located within the municipalities of Hobsons Bay, Maribyrnong, Brimbank, Moonee Valley, Moreland and Hume and is subject to their local planning schemes. The respective planning schemes set out the relevant planning controls which determine whether planning approval is required for the use and/or development of land. These controls include zones, overlays, and particular and general provisions. The *Planning and Environment Act 1987* is relevant to the project as land use planning studies have shown that a variety of approvals are triggered by the proposed works. There are a variety of pathways via which planning

approval may be obtained for rail projects. The planning approval pathway for the project will be confirmed through further consultation with DELWP.

Greenhouse gas emission predictions from the operation of the Airport Station has also been included in this assessment. The Airport section falls under Commonwealth Land, but has been considered for this assessment, as the legislative boundary and guidance for greenhouse gas impacts extend beyond state requirements, and there is no physical boundary for the impacts of greenhouse gas emissions.

2.2 Report Structure

This assessment report is set out in Table 2-1

Table 2-1 Memorandum structure

Heading	Description
Section 1: Introduction	introduces the methodology and assumptions for the Impact Assessment
Section 2: Background	details the Project description, design sections and assessment scope relative to the Project
Section 3: Policy and planning setting	details the legislation, policies and guidelines applicable to the Project
Section 4: Existing environment	details the existing environment in relation to general greenhouse gas emissions and its impact on climate change
Section 5: Assessment methodology	provides a summary of the methodology used to inform the assessment
Section 6: Impact assessment	Greenhouse gas emission impact assessment - presents the estimated greenhouse gas emissions associated with the Project and assesses this against the Project objectives
Section 7: Cumulative impacts	details the cumulative impacts within the context of Victoria's and Australia's overall greenhouse gas emissions
Section 8: Environmental risk mitigation	Mitigation and environmental management measures – outlines mitigation and environmental management measures
Section 9: Conclusion	Provides a conclusion against EES referral trigger criterion for greenhouse gas emissions.

2.3 Methodology

The preparation of the Impact Assessment included the following:

- Review of the scope of works and mapping presented in the 'MAR Corridor and Sunshine Section Project Description for Environmental Specialists' (MAR-AJM-PWD-PWD-MEM-XLP-NAP-0001505, Revision C) (the Project Description).
- Identification of operational greenhouse gas emission sources and classification of these sources into Scope 1, Scope 2 and Scope 3 emissions.
- Calculation of emissions based on guidance and requirements outlined in Section 5.
- Assessment of calculated emissions against the Ministerial Guidelines, and cumulative state and national emissions.

2.4 Assumptions and Limitations

The following assumptions and limitations apply to the Impact Assessment:

- The Impact Assessment is based on the scope of works detailed in the Project Description and State Project Land derived from MAR 'Project Land' Revision A.7 (MAR-AJM-PWD-PWD-MAP-XLP-MMN-0111172).
- The Impact Assessment is based on the scope of works detailed in the Project Description for Environmental Specialists (MAR-AJM-PWD-PWD-MEM-XLP-NAP-0001505, Revision C). The Impact Assessment has considered available data (based on current reference design) at the time of forming this assessment, including the calculation and evaluation of operational greenhouse gas sources.

Where there are significant design or scope changes to the Project the impact assessment shall be reviewed and updated.

- The Impact Assessment does not consider impacts from greenhouse gas emissions during the Construction phase, and only these directly attributable to the operation of the Project. Best practice GHG avoidance, reduction and mitigation measures would be incorporated into the construction phase; managed through the Sustainability requirements under the Project Scope and Technical Requirements.

3. Background

3.1 Strategic Context

The MAR project (the Project) is a once-in-a-generation transformation of Victoria's transport network, connecting Melbourne Airport's Integrated Terminal Precinct with a rail service for the first time.

Melbourne Airport handled more than 37 million passenger movements in 2018-19[1] and by 2038, this figure is projected to almost double to more than 67 million[2], which is an average growth of 3.2% per annum. Transport connectivity from Melbourne Airport to Melbourne's Central Business District (CBD) is currently limited to the Tullamarine Freeway, and therefore, the Victorian Government is committed to delivering an efficient, competitive alternative to cater for the ongoing increase in passenger numbers at Melbourne Airport.

In 2002, the Victorian Government considered possible corridor and alignment options for a Melbourne Airport Rail Link, ultimately selecting the Sunshine route as the preferred option. At this time, land was reserved between the Albion-Jacana rail corridor and extending through to Sharps Road, Tullamarine for the construction of a rail link.

In 2018, the Victorian Government released the Melbourne Airport Rail Link Sunshine Route Strategic Appraisal, which confirmed that the Sunshine route remains the best solution for an airport rail link. The Sunshine route would provide superior connections to regional Victoria, Melbourne's growth areas in the north and west and Melbourne's south eastern suburbs and could be delivered sooner and at a significantly lower cost than other route options.

3.2 State Project Land

The State Project Land defines the land within which the Project components and construction activities are planned to be contained. It sets out the full extent of land identified as potentially required for the delivery of the Project.

The Project Land encompasses all State land areas that would be used for permanent structures and temporary construction areas. It provides the basis for and informs the Impact Assessment

Project Land relevant to State-based approvals generally includes:

- Land between Sharps Road and the Albion-Jacana rail corridor, including land crossing the M80 Freeway
- The existing Albion-Jacana rail corridor generally between Jacana and Albion Stations
- Land around Sunshine and Albion Stations, including the existing rail corridor
- Land required for the Project from Jacana Station in the north-east to Newport Station in the south-west and Middle Footscray Station in the east. This largely includes the Albion-Jacana rail corridor via Sunshine and Albion stations and land required for a new rail corridor between Sharps Road and the Albion-Jacana rail corridor.

The extent of the State Project Land is shown in Figure 3-1.

[1] https://www.bitre.gov.au/publications/ongoing/airport_traffic_data
[2] https://www.melbourneairport.com.au/Corporate/Planning-projects/Master-plan

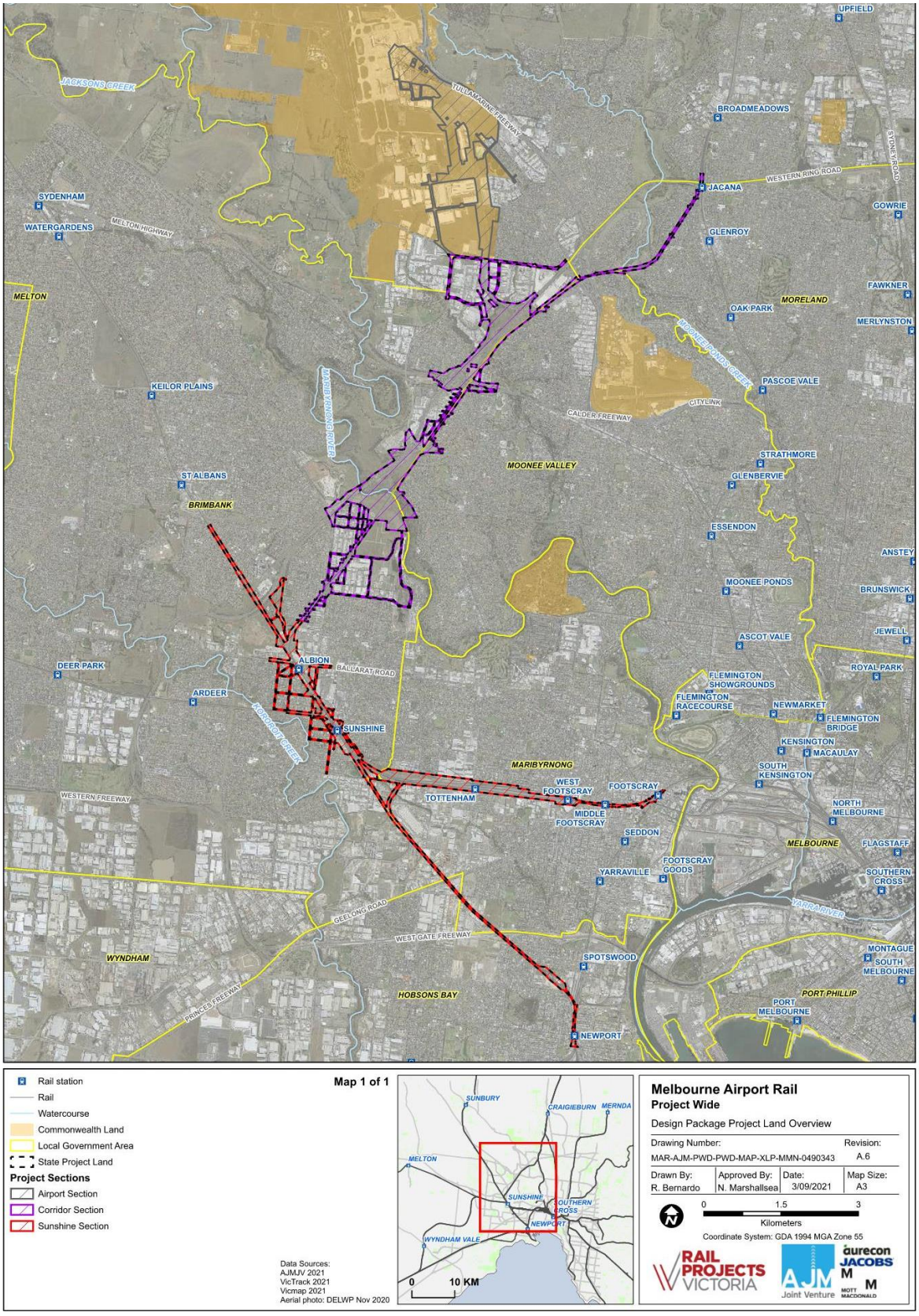

Figure 3-1 MAR State Project Land

3.3 Main Works Scope

3.3.1 Project Sections

The main works for the Project comprise of three geographically distinct sections. The sections are summarised in Table 3.1 and the location of the sections are shown in Figure 3-1.

Table 3.1 Summary of Project sections

Section	Summary
Airport section Not considered in State land approvals.	The Airport section generally includes all land relevant to the Project between Sharps Road, Tullamarine and Melbourne Airport and is located on Commonwealth owned land and is subject to a separate approvals process under the *Commonwealth Airports Act 1996*
Corridor section	The COR section generally includes the Albion-Jacana rail corridor between Jacana Station and south of Barwon Avenue, Sunshine North, as well as land between Sharps Road, Tullamarine and the Albion-Jacana rail corridor.
Sunshine section	The SUN section generally includes the existing rail corridor between Barwon Avenue, Sunshine North and Middle Footscray Station. The SUN Section also includes the Sunbury rail corridor to Ginifer Station and the Brooklyn freight corridor to Newport Station.

3.4 Corridor Section Summary

The COR section of the Project includes the following main works:

- Construction of the new MAR tracks, comprising an approximately 8 km dual track railway and associated overhead line equipment (OHLE), combined services route (CSR) and track drainage works, including:
  - A 2.3 km long elevated twin track viaduct structure between Sharps Road, Tullamarine and the Albion-Jacana rail corridor, crossing Steele Creek and the Western Ring Road including emergency and maintenance access points.
  - New at-grade MAR tracks within the existing Albion-Jacana rail corridor, located on the Western side of the existing Australian Rail Track Corporation (ARTC) tracks.
  - An elevated twin track viaduct structure across the Maribyrnong River valley, adjacent to the Western side of the existing state significant heritage bridge.
  - Slewing of ARTC tracks between Keilor Park Drive and the Calder Freeway.
- Signalling works along the Albion-Jacana rail corridor between Jacana Station and Barwon Avenue, Sunshine North and within the new MAR corridor North of the Western Ring Road.
- Construction of an intake supply substation at Terror Street or the Northeast area of Brimbank Park and two traction substations at Fullarton Road and within the McIntyre Sidings, Sunshine North.
- Construction of two new Digital Train Radio System (DTRS) facilities one North or South of Keilor Park Drive, Keilor East and a second at Airport Drive, Tullamarine.
- Diversion, relocation and replacement works associated with utilities and underground services, including the existing ARTC CSR, high voltage (HV) transmission lines and numerous miscellaneous assets
- Protection works associated with the Exxon Mobil jet fuel pipeline along the Albion-Jacana rail corridor.
- Modifications to existing structures, including structural modifications and strengthening works at Calder Freeway inbound and outbound bridges, Fullarton Road bridge, Western Ring Road on-ramp and off-ramp bridges, Keilor Park Drive and McIntyre Road bridges.
- Replacement of shared use path (SUP) connections at Calder Freeway / Fullarton Road, provision of a new SUP overpass at Cranbourne Avenue, and provision of a Strategic Cycling Corridor link between Western Ring Road and Airport Drive via Steele Creek.

- The provision of retention basins at several locations along the Albion-Jacana rail corridor
- Establishment of temporary construction laydown areas, site offices, worksites, storage, parking areas and access roads

3.5 Sunshine Section Summary

The SUN section of the Project includes the following main works:

- Construction of a new 1.8 km long MAR twin track viaduct structure, including associated OHLE and CSR between Sunshine Station and the Albion-Jacana corridor, crossing Anderson Road, Ballarat Road, the Sunbury rail corridor, St Albans Road and Stony Creek.
- Signalling works, including the installation of trackside equipment along the Sunbury line towards Ginifer Station, along the Brooklyn freight corridor towards Newport Station, and along the Western rail corridor to West Footscray Station.
- Modifications to the tracks, formation, drainage, CSR, OHLE and signalling equipment for the MAR, Sunbury and Bendigo tracks from Albion to the beginning of the Jacana freight corridor
- Modifications to the Western and Eastern Albion Station forecourts and car parks.
- Modifications to Sunshine Station, including modifications to platforms, the Sunshine Station western car park and the construction of a new concourse.
- Modifications to the existing Sunshine and Sunshine West substations
- Diversion, relocation and protection of existing utilities and underground services.
- Establishment of temporary construction laydown areas, site offices, worksites, storage, parking areas and access roads

3.6 Airport Section

The Airport Section is to be built on Commonwealth land and within the Airport Precinct.

The construction phase will be completed over a 5 to 6-year period and will be staged to minimise the impact on surrounding roads and existing assets. The scope of works on Commonwealth Land comprises the following:

- A new Airport Station at the terminal interface
- A new track starting at the new Airport Station and continuing:
  - > Through the existing long-term carpark to Airport Drive
  - > Along Airport Drive to Sharps Road and then continues into state land
- Line-wide high capacity train control and signalling, traction power and rolling stock solutions that are interoperable with those being incorporated into the Metro Tunnel.
- Airport substation to provide power supply for station and rail operational systems.
- A new Shared Use Path (SUP) from the intersection of Airport Drive and Mercer Drive to the intersection of Centre Road and Terminal Drive.

4. Policy and planning setting

4.1 International Policy

4.1.1 Paris Climate Conference COP21

Following the 2015 Paris Climate Conference, known as COP21, international agreements were made for signatories to:

- Keep global warming well below 2.0 degrees Celsius, with an aspirational goal of 1.5 degrees Celsius
- Submit revised emission reduction targets every five years (from 2018), with the first being effective from 2020, and goals set to 2050
- Define a pathway to improve transparency and disclosure of emissions
- Make provisions for financing the commitments beyond 2020.

In response to this challenge, Australia has committed to reduce emissions to 26-28 per cent on 2005 levels by 2030. Greenhouse gas emissions from new developments and projects such as this one need to be understood to better position Australia to meet these commitments.

4.2 Commonwealth Policy

4.2.1 National Greenhouse and Energy Reporting Act 2007

The Commonwealth Government uses the National Greenhouse and Energy Reporting (NGER) legislation for the measurement, reporting and verification of Australian greenhouse gas emissions. This legislation is used for a range of purposes, including being used for international greenhouse gas (GHG) reporting purposes. Corporations which meet the thresholds for reporting under NGER must register and report their greenhouse gas emissions.

Under the National Greenhouse and Energy Reporting Act 2007 (NGER Act), constitutional corporations in Australia which exceed thresholds for greenhouse gas emissions, energy production or consumption are required to measure and report data to the Clean Energy Regulator on an annual basis. The National Greenhouse and Energy Reporting (Measurement) Determination 2008 identifies several methodologies to account for greenhouse gases from specific sources relevant to the Project. This includes emissions of greenhouse gases from direct fuel combustion (fuels for transport energy purposes), emissions associated with consumption of power from direct combustion of fuel (e.g. diesel generators used during construction), and from consumption of electricity from the grid.

4.2.2 Climate Solutions Fund

The Australian Government's Direct Action Plan aims to source low cost emission reductions. The Direct Action Plan was introduced on 1 July 2014 and aims to focus on sourcing low cost emission reductions. The Direct Action Plan includes the Climate Solutions Fund, previously known as the Emissions Reduction Fund. Legislation to implement the ERF came into effect on 13 December 2014 and is considered to be the centrepiece of the Australian Government's policy suite to reduce emissions.

The implementation of a 'safeguard mechanism' came into effect on 1 July 2016 aimed at requiring Australia's largest emitters of more than 100,000 tonnes of carbon dioxide equivalence (t CO2-e) a year to keep net emissions at or below baseline emissions levels.

4.3 State Policy

4.3.1 Victoria Climate Change Act 2017

Victoria's Climate Change Act 2017 establishes a long-term target of net zero greenhouse gas emissions by 2050. The Act also requires five yearly interim emissions reduction targets, developed as part of a Climate Change Strategy.

The Act introduced a new set of policy objectives and an updated set of guiding principles to embed climate change in government decision making. From 2021, the legislation also requires the development of 'Adaptation Action Plans' for key systems that are vulnerable to the impacts of climate change, by reducing emissions from government operation and across key market sectors. The Act has also developed a system of periodic reporting, which includes the requirement for annual greenhouse gas emissions reporting and regular standalone reports from independent bodies on the science and data related to greenhouse gas emissions and climate change in Victoria.

4.3.2 Victoria's Climate Change Strategy (2021)

Victoria's Climate Change Strategy is a roadmap to net-zero emissions and a climate resilient Victoria by 2050. The Government has set ambitious, but achievable targets to reduce the state's greenhouse gas emissions from 2005 levels by 28–33% by 2025 and 45–50% by 2030.

Victoria's Climate Change Strategy includes actions to achieve these emissions reduction targets. This includes a commitment for all Victorian Government operations, including metropolitan trains, to be powered by 100% renewable energy by 2025.

4.3.3 Environment Protection Act 2017

The new Victorian environment protection legislation focuses on preventing waste and pollution impacts, rather than managing those impacts after they have occurred.

The cornerstone of the new environmental protection legislation is the general environmental duty (GED). The GED requires Victorians to understand and minimise their risks of harm to human health and the environment, from pollution and waste. Under the Act, this duty requires minimising these risks so far as reasonably practicable.

When dealing with a risk or harm, demonstrating that the person or business undertaking the activity has adopted the measures that are reasonably practicable under the GED can be achieved through assessing the level of severity of the risk, implementing measures that are suitable and available to the business to eliminate or reduce the risk, and reviewing controls to ensure they are effective.

4.3.4 Victoria's Climate Change Framework (2016)

This Framework sets out Victoria's long-term plan to achieve net zero emissions by 2050. Key actions in this framework include steps and programs to reduce greenhouse gas emissions and implementing strategy programs to assist in creating a climate resilient state by 2050.

4.3.5 Victoria's Renewable Energy Action Plan

The Renewable Energy Action Plan outlines the action that the Victorian Government is taking to encourage investment in its energy sector to ensure energy security and move away from fossil fuel energy sources.

The Action Plan invests $146 million across three focus areas, with incentives to reduce greenhouse gas producing energy sources and invest in renewable energy infrastructure.

5. Existing Environment

Greenhouse gases are gases that when released into the atmosphere effectively trap heat influencing global temperatures. The release of greenhouse gases into the atmosphere is caused by both natural processes (such as bushfires) and human activities (e.g. burning fossil fuels and land clearing).

Since the industrial revolution the concentration of greenhouse gases, in parts per million, was rapidly increasing which has led to an increase in the earth's average surface temperature and has contributed to the phenomenon of 'climate change'.

The term 'climate' refers to the typical weather conditions for a specific geographical area, usually averaged over at least 30 years. Climate variability represents the 'normal' day to day seasonal and year to year variability in the components of climate (temperature, rainfall). However, climate variability may also generate extreme conditions such as flooding, heatwaves and hail which require management.

The world's leading climate scientists presented the following key findings in the Intergovernmental Panel on Climate Change Fifth Assessment Report (AR5) (IPCC, 2014):

- Warming of the climate system is unequivocal and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and oceans have warmed, the amounts of snow and ice have diminished, and sea level has risen
- In recent decades, changes in climate have caused impacts on natural and human systems on all continents and across the oceans. Impacts are due to observed climate change, irrespective of its cause, indicating the sensitivity of natural and human systems to changing climate
- Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level will rise
- Many aspects of climate change and associated impacts will continue for centuries, even if anthropogenic emissions of greenhouse gases are stopped. The risks of abrupt or irreversible changes increase as the magnitude of the warming increases
- In urban areas, climate change is projected to increase risks for people, economies and ecosystems, including risks from heat stress, storms and extreme precipitation, inland and coastal flooding, water scarcity, sea-level rise, and storm surges
- Building adaptive capacity is crucial for effective selection and implementation of adaptation options.

6. Assessment methodology

6.1 Greenhouse gas accounting

'Greenhouse gases' is an umbrella term for a range of gases that are known for their capability to trap radiation in the upper atmosphere, where then it could have the potential to contribute to the greenhouse effect (global warming). By creating an inventory of likely greenhouse gas emissions associated with the Project, the scale of the emissions can be determined and a baseline from which to develop and deliver greenhouse gas reduction options can be formed. Prominent greenhouse gases, and their most common sources include:

- Carbon dioxide (CO2) – by far the most abundant, primarily released during fuel combustion
- Methane (CH4) – from the anaerobic decomposition of carbon-based material (including enteric fermentation and waste disposal in landfills)
- Nitrous oxide (N2O) – from industrial activity, fertiliser use and production
- Hydrofluorocarbons (HFCs) – commonly used as refrigerant gases in cooling systems
- Perfluorocarbons (PFCs) – used in a range of applications including solvents, medical treatments and insulators
- Sulphur hexafluoride (SF6) – used as a cover gas in magnesium smelting and as an insulator in heavy duty switch gear.

It is common practice to aggregate the emissions of these gases into the equivalent emission of carbon dioxide. This provides a simple, single figure for the comparison of emissions against targets. The aggregation is based on the potential of each gas to contribute to global warming relative to carbon dioxide and is known as the global warming potential. The resulting number is expressed as carbon dioxide equivalents (CO2-e).

The greenhouse gas inventory in this report is calculated in accordance with the principles of the Greenhouse Gas Protocol. The greenhouse gas emissions that form the inventory can be split into three categories known as 'Scopes' as shown in Figure 6-1. Scopes 1, 2 and 3 are defined by the Greenhouse Gas Protocol and can be summarised as follows:

- Scope 1 – Direct emissions from sources that are owned or operated by a reporting organisation (for example, combustion of diesel in company owned vehicles or on-site generators)
- Scope 2 – Indirect emissions associated with the import of energy from another source (for example, importation of electricity or heat)
- Scope 3 – Other indirect emissions (other than Scope 2 energy imports) which are a direct result of the operations of the organisation but from sources not owned or operated by them (for example, include business travel (by air or rail) and product usage).

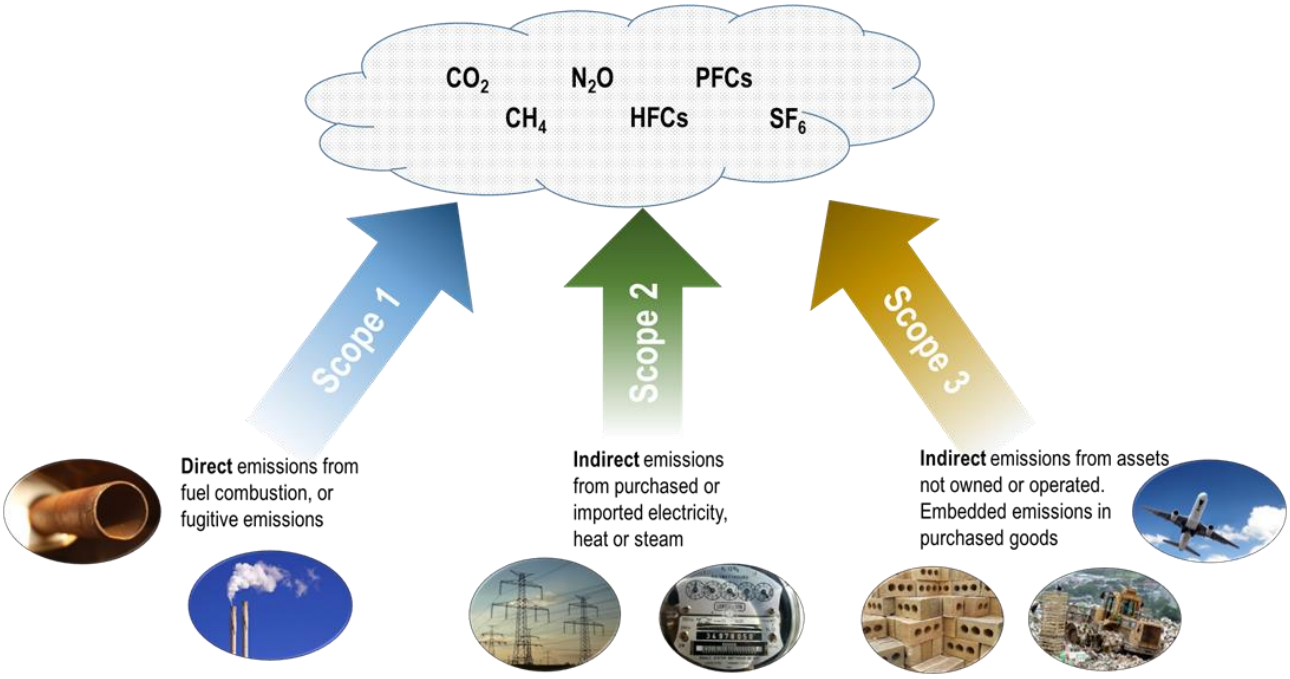

Figure 6-1 Sources of Greenhouse Gases - Adapted from World Business Council for Sustainable Development – Greenhouse Gas Protocol

The GHG Protocol (and similar reporting schemes) dictates that reporting Scope 1 and 2 sources is mandatory, while reporting Scope 3 sources is optional. Reporting substantial Scope 3 sources is recommended. This assessment considers the above-listed scope 1 and 2 only to determine the impact of the project in the context of the EES referral threshold, as presented in Section 6.2.1.

The Greenhouse Gas Protocol is collaboration between the World Resources Institute (WRI) and the World Business Council for Sustainable Development (WBCSD). The Protocol provides a globally standardised framework and guideline for the calculation and reporting of carbon. The greenhouse gas inventory in this report has been carried out in accordance with the principles of the Greenhouse Gas Protocol.

The initial action for a greenhouse gas inventory is to determine the potential sources of greenhouse gas emissions, assess their likely significance and set a provisional boundary for the assessment. Following this, data are collected to represent the activities carried out for the Project and converted to greenhouse gas emissions typically using emissions factors (a published figure for the activity representing the aggregated greenhouse gas emissions per unit of the activity).

6.2 Greenhouse gas assessment boundary

The assessment boundary defines the scope of greenhouse gas emissions and the activities to be included in the assessment. As per the scope of this assessment, only greenhouse gas emissions from operational activities have been included in the assessment boundary.

Table 6-1 summarises the emission sources and activities identified within the Project's assessment boundary for operation, according to scope.

Table 6-1 Operational greenhouse gas emissions sources

Emission Source	Scope 1	Scope 2
Traction Power		✓
Airport Station		✓
Sunshine Station (MAR scope only)		✓
Rail Corridor		✓
Substation cooling – Corridor Section (Fullarton Intake, Fullarton Substation and McIntyre Substation)		✓
Substation cooling – Airport Section (Airport Substation and Airport Drive Substation)		✓
Refrigerant leakage	✓	
Insulation gas leakage from switchgear	✓	
Diesel use by service vehicles	✓	

The key GHG emissions for the project during operation would be indirect emissions associated with the purchase of electricity used to operate trains (traction power), stations and tunnels. Electricity usage for station operations include lighting, ticket machines and screens, elevators and lifts, fire systems and ventilation systems.

Greenhouse gases directly attributable to consumption of power from the grid (Scope 2) is 99%; this is based on the Metro Trains Melbourne Pty Ltd National Greenhouse Emissions Report 2019-2020 (Clean Energy Regulator, 2019-20). Other sources in Table 6-1 (Scope 1) are likely to be negligible in comparison and would not have an impact on this assessment and have therefore not been considered for this assessment.

Greenhouse gas emissions from the Project's construction (including embodied carbon of construction materials) are outside the scope of this assessment. Section 9 details the approach to carbon mitigation across both the construction and operational phases of the Project.

6.2.1 Criteria

GHG emissions from the operation of the Project were identified, with specific reference to following criteria set out within the Ministerial Guidelines was carried out:

- Potential greenhouse gas emissions exceeding 200,000 tonnes of carbon dioxide equivalent per annum, directly attributable to the operation of the facility.

6.2.2 Greenhouse gas emission factor

The National Greenhouse Accounts (NGA) Factors August 2020 provides the latest emission factor for electricity usage in Victoria and is presented in Table 6-2.

Table 6-2 Grid electricity emission factor - Victoria

State	Scope 2 emission factor (kg CO_2e/kWh)
Victoria	0.98

7. Greenhouse gas emission impact assessment

The emission sources identified for this assessment are presented in Table 7-1. All other operational data in Table 7-1 was provided by the AJM Mechanical and Ventilation Team. It is noted at this stage of the Project, the data may be updated once an energy modelling is carried out for more accurate load profiles.

Table 7-1 Sources of electricity consumption

Emission Source	Megawatt (MW)
Traction Power	7.24
Airport Station	1.4
Sunshine Station	0.1
Rail Corridor	0.03
Substation cooling (electricity use) – Corridor Section	0.01
Substation cooling (electricity use) – Airport Section	0.01

Data is not yet available on hourly load profiles for the Airport Station, Sunshine Station and the Rail Corridor sections. Therefore, the hourly load profile for the substation ventilation load was applied to each of these to determine realistic daily consumption for these sections. The substation ventilation loads align with the expected peak times of rail operation. Figure 7-1 presents the substation load profile as provided by the Mechanical and Ventilation team. The resulting annual electrical energy consumption projections for the station and corridor sections is presented in Table 7-2. It is assumed that the hourly profile in Table 7-2 will occur 365 days a year as a conservative approach.

Figure 7-1 Substation load profile

Table 7-2 Corrected electricity load for the Airport Station, Sunshine Station and Corridor

Hour	Operating %	Airport Station (kWh/hr)	Sunshine Station (kWh/hr)	Corridor (kWh/hr)
0	20	280	20	6
1	20	280	20	6
2	20	280	20	6
3	20	280	20	6

Hour	Operating %	Airport Station (kWh/hr)	Sunshine Station (kWh/hr)	Corridor (kWh/hr)
4	20	280	20	6
5	35	490	35	10
6	50	700	50	14
7	80	1120	80	22
8	100	1400	100	28
9	100	1400	100	28
10	100	1400	100	28
11	100	1400	100	28
12	80	1120	80	22
13	40	560	40	11
14	40	560	40	11
15	40	560	40	11
16	40	560	40	11
17	70	980	70	19
18	100	1400	100	28
19	100	1400	100	28
20	72	1008	72	20
21	20	280	20	6
22	20	280	20	6
23	20	280	20	6
Total daily (MWh/day)		18.3	1.3	0.4
Total annual (MWh/yr)		**6,679**	**477**	**132**

The projected annual power load for traction power, the stations and corridor sections and substation cooling were provided by the Mechanical and Ventilation team for the MAR Project. Table 7-3 presents these power loads as well as the calculated loads for the stations from Table 7-2.

Table 7-3 Annual electricity consumption

Source	Annual electricity consumed (MWh/year)
Traction Power	46,055
Airport Station	6,679
Sunshine Station	477
Rail Corridor	132
Substation cooling – Corridor Section	61
Substation cooling – Airport Section	42
Total	**53,446**

The annual electricity loads and the resultant emissions are presented in Table 7-4. In summary, operational electricity usage by the Project is estimated to produce 52,378 tonnes of CO2-e per year. This falls below the Ministerial Guideline criteria of 200,000 tonnes of CO2e per year directly attributable to the operation of the facility.

Table 7-4 Annual emissions from electricity consumption

	Annual electricity consumed (MWh/year)	Scope 2 emission factor	Annual Scope 2 emissions (t CO_2e/year)
Traction Power	46,055	0.98	45,134
Airport Station	6,679		6,545
Sunshine Station	477		468
Rail Corridor	132		130
Substation cooling – Corridor Section	61		60
Substation cooling – Airport Section	42		41
Total	**53,446**		**52,378**

8. Cumulative impact

Cumulative greenhouse gas and climate change impacts may arise from the operation activities of the Project, with other approved or proposed projects within the greenhouse gas assessment boundary. When considered in isolation, specific Project impacts may be considered minor. These minor impacts may, however, be more substantial, when the impact at a state or national scale is considered.

The annual emission contributions of the Project towards the total annual energy-based emissions of Victoria and Australia (from the Australian Greenhouse Gas Emissions information System (Department of Industry, Science, Energy and Resources [DISER], 2020) are detailed in Table 8-1.

Table 8-1 Emission contributions of the Project in context of state and national electricity emissions

Stage of Project	Project Operation
Project emissions (Mt CO2e/year)	0.052
Total Victorian emissions (Mt CO2e/year) (2018)	102.19
Total national emissions (Mt CO2e/year) (2018)	537.45
Project contribution to Vic annual emissions	0.05%
Project contribution to national annual emissions	0.01%

9. Mitigation and Environmental Management Measures

Sustainability is being integrated into the MAR project. The feasibility of sustainability initiatives is currently being assessed, aligned to the focus areas of energy, materials, water management, liveability and legacy and climate change resilience (as specified in the RPV Sustainability Framework and shown in Figure 9-1).

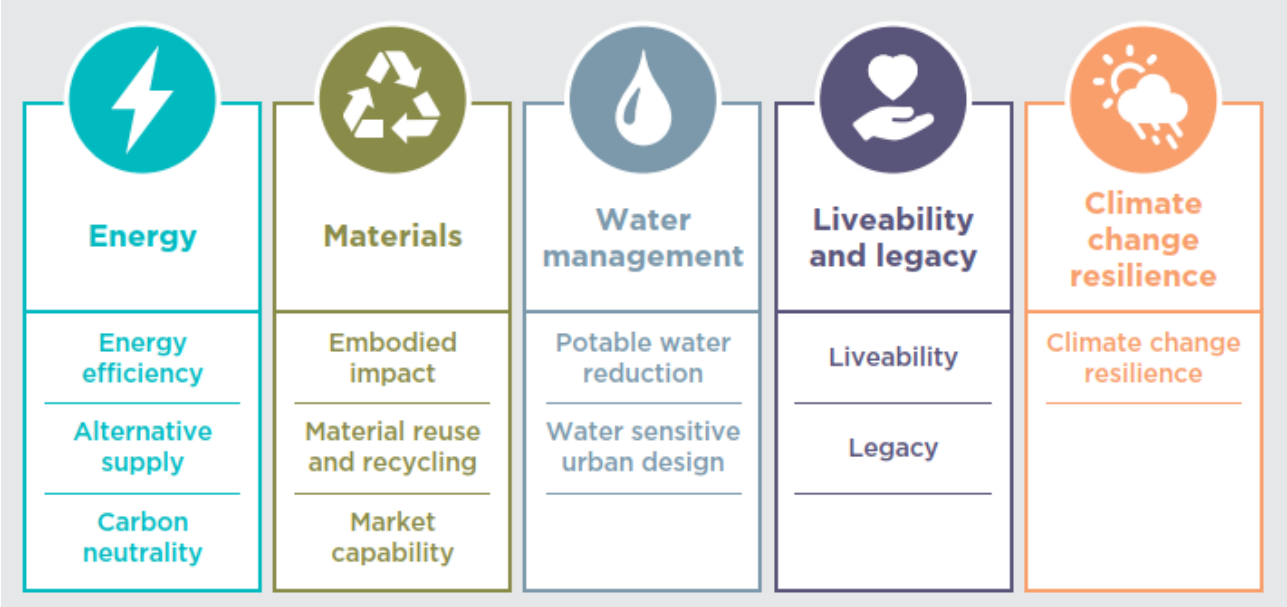

Figure 9-1 Sustainability focus areas and applications

Sustainability initiatives are identified and developed alongside the project reference design. Integration of sustainability into reference design is undertaken across all relevant design disciplines. For initiatives endorsed by RPV, requirements will be embedded in the Project Scope and Technical Requirements (PS&TR) documents for each section released to market. An overview of the process for developing project sustainability requirements is provided in Figure 9-2.

The initiatives to reduce GHG emissions of the both the construction and operational phases of the Project are aligned to the following focus areas:

Energy

The energy focus area drives the development of project requirements which either directly reduce the greenhouse gas emissions across the lifecycle of all delivered infrastructure and assets, particularly during the construction and operational phases, or indirectly reduce the greenhouse gas emissions throughout the broader State. The initiatives fall under the following categories:

- Energy efficiency
- Alternative supply
- Carbon neutrality

Materials

The materials focus area drives the development of project requirements which improve the environmental performance of materials used within projects, particularly embodied greenhouse gas emissions.

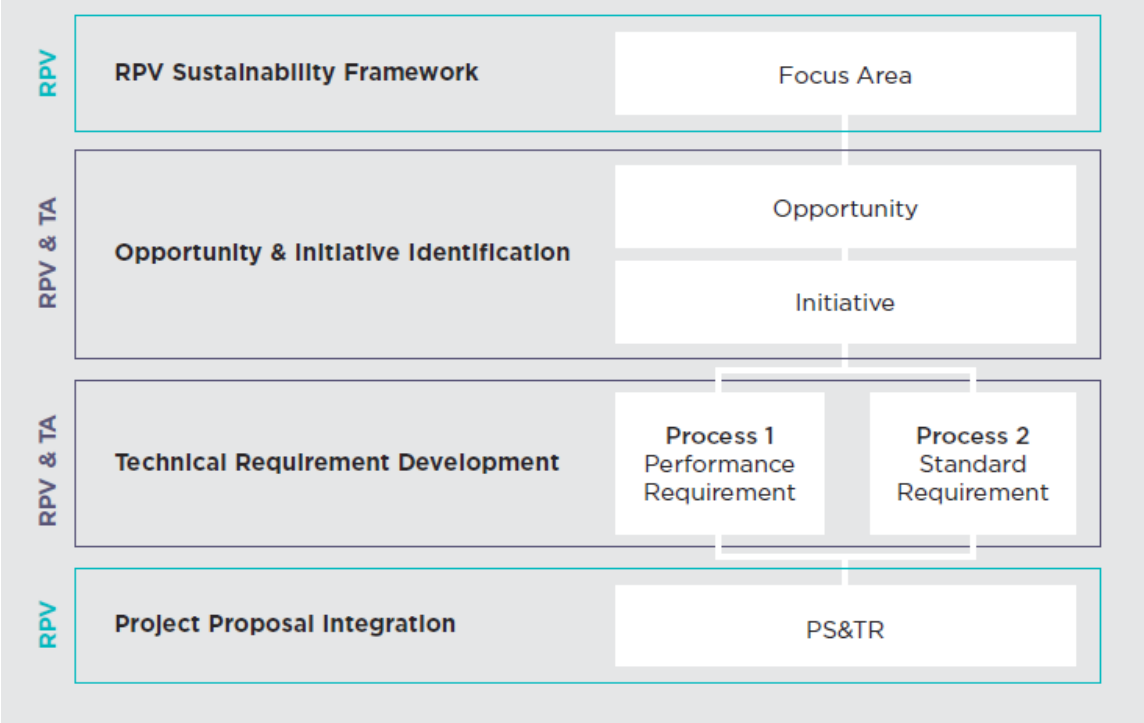

Figure 9-2 Overview of the process for developing project sustainability requirements

10. Conclusion

This report has provided the results of the assessment into greenhouse gas impacts associated with the operation of the Project. The objective achieved in this report was to quantify the potential greenhouse gas emissions associated with proposed Project operation.

The assessment identified the following Scope 2 operational greenhouse gas sources as being material to the assessment, as they account for approximately 99% of operational greenhouse gas emissions. Therefore, Scope 1 sources have not been included in this assessment as they are considered negligible.

The key outcome of the Greenhouse Gas Impact Assessment is:

- An estimated 52,378 tonnes of CO_{2e} will be emitted annually from the operation of the Project from consumption from the grid.
- The estimated operational emissions fall below the Ministerial Guideline EES referral criteria of 200,000 tonnes of CO_{2e} per year directly attributable to the operation of the facility.

11. References

Australian Department of Industry, Science, Energy and Resources, (2020) Australian Greenhouse Emissions Information System: https://ageis.climatechange.gov.au/

Clean Energy Legislation (Carbon Tax Repeal) Act 2014, Australian Government

Environment Protection Amendment Act 2018, Victorian Government

GHG Protocol - A Corporate Accounting and Reporting Standard (Revised Edition), World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI). http://www.ghgprotocol.org/sites/default/files/ghgp/standards/ghg-protocol-revised.pdf

IPCC, 2013 - IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

Melbourne Metro Greenhouse Gas Assessment, 2016. Available: https://metrotunnel.vic.gov.au/__data/assets/pdf_file/0013/51052/MMRP_Chapter-22_Greenhouse.pdf

Ministerial Guidelines for Assessment of Environmental Effects under the Environment Effects Act 1978, Victorian Government

National Greenhouse and Energy reporting Act 2007, Australian Government

NGA, 2019. National Greenhouse Accounts (NGA) Factors August 2019. Australian Government Department of the Environment and Energy

Planning and Environment Act 1987 (P&E Act), Victorian Government

Victoria Climate Change Act 2017, Vic Department of Environment, Water, Land and Planning

Victoria's Climate Change Framework 2016, Victorian Government

Victoria's Renewable Energy Action Plan 2015, Vic Department of Environment, Water, Land and Planning

Document Control Record

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Document Details						
Project Title	Melbourne Airport Rail					
Document Title	**MAR State Land Greenhouse Gas Emissions Impact Assessment**					
Document ID	**MAR-AJM-PWD-PWD-MEM-XEV-NAP-0001722**		Contract No.	CMS450111		
File Path	https://geodocs.ajmjv.com/sites/vrip/WIPLibrary/MAR-AJM-PWD-PWD-MEM-XEV-NAP-0001722.docx					
Client	Rail Projects Victoria		Client Contact	James Plant		

Rev	Date	Revision Details/Status	Prepared By	Author	Verifier	Approver
E	15 September 2021	Issued to RPV	Alok Pradhan	Alok Pradhan	James Moore	Ruth Macdonald
D	16 August 2021	Issued to RPV	Alok Pradhan	Alok Pradhan	James Moore	Ruth Macdonald
C	26 July 2021	Issued to RPV	Alok Pradhan	Alok Pradhan	James Moore	Ruth Macdonald
B	4 June 2021	Issued to RPV	Alok Pradhan	Alok Pradhan	James Moore	Ruth Macdonald
A	9 March 2021	Issued to RPV	Alok Pradhan	Alok Pradhan	James Moore	Ruth Macdonald
Current Revision	E					

Approval			
Author Signature	Signed at AJM JV internal Verification and Approval process	Approver Signature	Signed at AJM JV internal Verification and Approval process
Name	Alok Pradhan	Name	Ruth Macdonald