Hexham Wind Farm

Chapter 16

Air quality and greenhouse gas

WIND PROSPECT

16.1 Overview

This chapter provides an overview of the topography, local climate and meteorology, and existing air quality environment and greenhouse gas (GHG) emissions relevant to the investigation area, and an assessment of potential air quality and GHG emission impacts associated with the construction, operation and eventual decommissioning of the project. The assessment of air quality impacts is based on the ***Air Quality Impact Assessment*** (refer to Appendix L1) and the assessment of GHG impacts is based on the ***Greenhouse Gas Impact Assessment*** (refer to Appendix L2). Both reports were prepared by Jacobs Group (Australia) Pty Ltd.

The ***Air Quality Impact Assessment*** was conducted in accordance with relevant Environment Protection Authority Victoria (EPA Victoria) guidelines. The project would be classed as low risk and would require a Level 1 assessment (qualitative or semiquantitative assessment used to describe risks for activities) in accordance with EPA Publication 1961: Guideline for Assessing and Minimising Air Pollution in Victoria. This approach was confirmed with EPA Victoria. The ***Greenhouse Gas Impact Assessment*** sought to predict energy use and GHG emissions associated with the project construction, operation and decommissioning, and was undertaken in accordance with EPA Victoria Publication 824: Protocol for Environmental Management: Greenhouse gas emissions and energy efficiency in industry (PEM).

Air quality across the project region is expected to be good in comparison to that of urban areas. The primary air quality impact for the project is expected to be dust generation from construction activities such as materials handling, concrete batching activities, and materials extraction, treatment and transport from the proposed on-site quarry. Limited dust may be generated by maintenance activities and from vehicle movements on unsealed access tracks during project operation. Dust impacts during project decommissioning are expected to be less than what is expected during construction. Exhaust emissions from the combustion of fossil fuels in vehicles, plant and equipment during construction, operation and decommissioning may also impact local air quality. GHG emissions projected to result from the project include energy related emissions (e.g. from the use of fuels) and non-energy related emission (e.g. embedded emissions from the production of construction materials).

At the centre of the *Environment Protection Act 2017* is the general environment duty, which requires proponents to understand and minimise risks to human health and the environment from pollution and waste. The approach has been to first avoid or limit potential impacts by creating appropriate separation distances between proposed project infrastructure and sensitive receptors. To further minimise potential impacts to air quality, management measures would be implemented during the construction, operation and decommissioning of the project.

With the implementation of a site-specific Air Quality Management Plan, residual air quality impacts from dust during construction are anticipated to be moderate (i.e., very unlikely, only occurring on rare occasions). Air quality impacts from vehicle, plant and equipment emissions during all project phases, as well as dust during project operation and decommissioning, are considered unlikely. However, management controls have been proposed to avoid and minimise these impacts. A Decommissioning Plan, to be prepared in accordance with the legislative and policy requirements in-force at the time, would include a sub-plan for the management of dust during decommissioning works.

CO_2e (or Carbon Dioxide Equivalent) is a unit of measurement for the amount of carbon dioxide emissions with the same global warming potential as the equivalent amount of another GHG emissions. This allows for the global warming potential for a number of GHG to be aggregated into a single indicator.

The project is predicted to result in overall GHG emissions of 1,324,393 tonnes carbon dioxide equivalent over the two-year construction period. Embedded (non-energy related) emissions from the production of construction materials would form the majority of overall construction emissions for the project, comprising approximately 93% of overall construction emissions over the construction period. Over the 25-year life of the project, the overall GHG emissions are expected to be 1,705,821 tonnes of carbon dioxide equivalent. These emissions would predominately be associated with the battery energy storage system (i.e., energy related emissions), comprising approximately 98% of total operational emissions. Decommissioning emissions would likely be similar to construction emissions, without the embedded emissions or land clearing. While proposed, the mitigation measures may assist in reducing the emissions associated with the construction, operation and decommissioning of the project, the residual impact rating is considered moderate due to the extent of predicted emissions during operation. However, the project will have a positive GHG contribution and has minimised the risks associated with its GHG emissions so far as reasonably practicable.

16.2 EES objective and key issues

Table 16.1 outlines the evaluation objective and key issue from the EES scoping requirements that have guided the air quality and GHG assessments.

Table 16.1 EES evaluation objective and key issues

Evaluation objective	
Amenity: *To minimise and manage adverse air quality and noise and vibration effects on residents and local communities as far as practicable during construction, operation and decommissioning having regard to applicable limits, targets or standards.*	
Key issues	Potential for adverse effects to air quality at sensitive receptors and on other sensitive land uses during construction of wind turbines, associated infrastructure and potential use of an on-site quarry.

16.3 Legislation, policy and guidelines

Table 16.2 summarises the key legislation, policies and guidelines relevant to Appendix L1 - ***Air Quality Impact Assessment*** and Appendix L2 - ***Greenhouse Gas Impact Assessment*** for the project.

Table 16.2 Relevant legislation, policy and guidelines

Legislation/ policy/ guideline	**Description**	**Relevance to project**
International		
Greenhouse Gas Protocol	The Greenhouse Gas Protocol is collaboration between the World Resources Institute and the World Business Council for Sustainable Development. The Protocol provides a globally standardised framework and guideline for the calculation and reporting of carbon footprints and developing mitigation measures.	The ***Greenhouse Gas Impact Assessment*** was undertaken in line with the principles of the Greenhouse Gas Protocol.
Commonwealth		
National Environment Protection (Ambient Air Quality) Measure	The National Environment Protection (Ambient Air Quality) Measure provides a national framework for monitoring and reporting of ambient air quality. This is achieved through the establishment of air quality standards for measuring six common pollutants.	EPA Victoria is responsible for the regulation, monitoring, assessment and reporting of air pollution in Victoria. Pollutant concentrations measured at EPA Victoria's ambient air monitoring stations are compared against the National Environment Protection (Ambient Air Quality) Measure standards. Key air pollutants relevant to the project are nitrogen oxides, carbon monoxide, sulfur dioxide and fine particulates. EPA Victoria monitoring data was used to inform the air quality impact assessment for the project.

Legislation/ policy/ guideline	Description	Relevance to project
National Greenhouse and Energy Reporting Act 2007	Commonwealth Government uses the National Greenhouse and Energy Reporting legislation for the measurement, reporting and verification of Australian GHG emissions, including for international GHG reporting purposes.	The ***Greenhouse Gas Impact Assessment*** applied the methodologies identified under this act to account for GHG from specific sources relevant to the project, such as emissions from direct fuel combustion, the consumption of power from direct combustion, and the consumption of electricity from the grid.
State		
Planning and Environment Act 1987	The Moyne Shire Planning Scheme contains a Victoria Planning Provision within the Planning Policy Framework relevant to air quality and GHG.	Victoria Planning Provision 13.06-1S (Air quality management) objective is "*to assist the protection and improvement of air quality*". Clause 15 (Built environment and heritage) notes that "*Planning should promote development that is environmentally sustainable and minimise detrimental impacts on the built and natural environment*" and "*facilitate development that supports the transition to net zero greenhouse gas emissions*".
EPA Victoria Publication 824: Protocol for Environmental Management: Greenhouse gas emissions and energy efficiency in industry (PEM)	The PEM was an incorporated document of State Environment Protection Policy (Air Quality Management). It was the regulatory instrument that was used to align GHG assessment methodology and approach with the requirements under the State Environment Protection Policy (Air Quality Management). The PEM includes requirements for outlining the scope and assessment boundary, identifying emission sources and factors to be used, and the process for calculating emissions for the project.	While the PEM is no longer an incorporated document, it is used to contribute to the state of knowledge on minimising GHG emissions.
Environment Protection Act 2017 Environment Reference Standard (ERS)	The *Environment Protection Act 2017* establishes the legislative framework for protecting the environment in Victoria. The subsequent *Environment Protection Amendment Act 2018* introduced the general environmental duty. The general environmental duty requires anyone engaging in any activity that poses risks of harm to human health or the environment from pollution or waste to minimise those risks, so far as reasonably practicable. This requires such risks to either be eliminated or, if it is not reasonably practicable to eliminate such risks, to be reduced so far as reasonably practicable. The framework of the *Environment Protection Act 2017* includes the Environmental Reference Standard (ERS). The ERS identifies environmental values for Victoria, including air quality, and defines indicators and objectives to measure those values.	The ERS, combined with the EPA Victoria Publication 1961: Guideline for assessing and minimising air pollution, provides the basis for assessing air quality. The air quality objectives defined in the ERS have informed the objectives for air quality for the project. The ***Greenhouse Gas Impact Assessment*** recommended measures to reduce the project's carbon emissions, so far as reasonably practicable, consistent with the general environmental duty.

Legislation/ policy/ guideline	**Description**	**Relevance to project**
Climate Change Act 2017	This legislation contains policy objectives, guiding principles to embed climate change in government decision making.	The GHG objectives defined in the *Climate Change Act 2017* have informed the project objectives for air quality.
Victoria's Climate Change Strategy (DELWP, 2021a) Renewable Energy Action Plan (DELWP, 2017a)	• Key drivers for the project rationale relate to climate change and the need to reduce GHG emissions.	These policies inform the context surrounding the justification for the project
EPA Victoria Publication 1961: Guideline for assessing and minimising air pollution in Victoria	EPA Victoria Publication 1961 outlines air quality assessment criteria for the assessment and management of air emissions. It adopts a risk-based approach for evaluating risks from air pollution. There are three levels of assessment: • Level 1: qualitative or semiquantitative screening-level assessment used to describe risks for activities that either have: - intrinsically low risks - common and well understood risk that can be effectively controlled without the need for extensive assessment. • Level 2 and level 3: more complex and usually involve the use of dispersion modelling and/ or monitoring.	The ***Air Quality Impact Assessment*** included consideration of EPA Publication 1961. The project would be classed as low risk and therefore require a Level 1 assessment.
EPA Victoria Publication 1834.2: Civil construction, building and demolition guide	EPA Victoria Publication 1834.2 provides an overview of: • Duties under the *Environment Protection Act 2017* • Activities that may lead to erosion and the generation of sediment and dust • Potential impacts of sediment and dust • Factors to consider in understanding erosion, sediment and dust generation • Controls and/or mitigation measures that can be implemented to minimise the generation and transport of dust, and manage risk associated with dust emissions from activities associated with civil construction, building, and demolition.	Measures for the management of dust and potential impacts would be developed in accordance with controls contained in EPA Victoria Publication 1834.2.
EPA Victoria Publication 1949: Separation distance guideline	This publication replaced Publication 1518: Recommended separation distances for industrial residual air emissions – guideline. It provides a guideline of EPA Victoria's approach to separation distances for various industries. It applies to off-site odour and dust emissions from industrial uses and activities that have the potential to impact human health and wellbeing, local amenity and aesthetic enjoyment.	Recommended separation distances for key activities outlined in EPA Victoria Publication 1949 were used to assess potential nuisance dust impacts during construction (refer to Section 16.4.1 (Separation distance review) for further discussion).
EPA Victoria Publication 1943: Guidance for assessing nuisance dust	Publication 1943 provides a framework for assessing nuisance dust impacts. This framework is consistent with the overarching provisions of the GED to 'eliminate or minimise the risks posed by hazards to prevent harm'.	A qualitative assessment of potential dust impacts was undertaken using the approach detailed in EPA Victoria Publication 1943.

Legislation/ policy/ guideline	Description	Relevance to project
EPA Victoria Publication 2048: Guideline for minimising greenhouse gas emissions	Publication 2048 forms the primary documentation used by business to understand their obligations under the GED in relation to GHG emissions under the *Environment Protection Act 2017*. It outlines the steps required for the assessment of GHG emissions.	The ***Greenhouse Gas Impact Assessment*** was completed in accordance with the steps outlined in EPA Victoria Publication 2048.
Other relevant EPA Victoria publications	The following additional EPA Victoria Publications address specific activities relevant to the project: • Publication 1823.1: Mining and quarrying - guide to preventing harm to people and the environment • Publication 1806: Reducing risk in the premixed concrete industry • Publication 1730: Solid storage and handling guidelines • Publication 1894: Managing soil disturbance: guidance sheet • Publication 1895: Managing stockpiles: guidance sheet • Publication 1897: Managing truck and other vehicle movement: guidance sheet	

16.4 Investigation area

16.4.1 Air quality

The ***Air Quality Impact Assessment*** considered impacts to amenity (including nuisance air quality effects) for sensitive receptors within three kilometres of the project site, consistent with the EES scoping requirements. The investigation area is shown in Figure 16.2.

16.4.2 GHG emissions

The ***Greenhouse Gas Impact Assessment*** investigation area extends beyond the project site as GHG emissions can have global climate impacts. Many emissions associated with the project are indirect emissions, such as those embedded in construction materials and fuel, which would be produced outside the project site. The emissions associated with the project will contribute to state-wide and nation-wide GHG accounting, goals and targets.

16.5 Method

To address the EES evaluation objective, it is necessary to understand the potential impact of the project on air quality values, and state and Commonwealth GHG emissions so that impacts can be appropriately avoided or mitigated. Understanding these impacts requires an impact assessment which quantifies the potential air quality impact and GHG emissions associated with the construction, maintenance, operation and eventual decommissioning of the project.

16.5.1 Air quality

Dust could be generated at locations across the project site from activities such as wind turbine site construction earthworks, use of access tracks, materials processing at the on-site quarry and operation of concrete batching plants. These activities were classed as low risk (refer to Table 16.2), and would therefore require a Level 1 assessment methodology in accordance with the EPA Victoria Publication 1961. This assessment approach was confirmed by EPA Victoria in December 2022.

The *Air Quality Impact Assessment* included:

- a review of local meteorological and air quality conditions to identify any existing air quality issues and conditions that may influence air quality
- identification and assessment of potential air quality issues associated with the construction, operation and decommissioning of the project
- identification of measures to avoid, minimise or mitigate potential air quality impacts during the design, construction, operation and decommissioning phases.

Wind speed and direction monitoring are both collected at heights of 40 metres and 80 metres from an existing meteorological mast.

Separation distance review

Separation distances for project activities were reviewed in accordance with EPA Victoria Publication 1949. Two project activities have published recommended sensitive receptor separation distances from sensitive receptors. These distances are displayed in Table 16.3.

Table 16.3 EPA Victoria Publication 1949 recommended separation distances for activities relevant to the project

Industry type	Industry activity / definition	Scale and description	Recommended separation distance	Further guidelines, references & exceptions
Concrete plant	Production of concrete	Greater than 5,000 tonnes per year	100 metres	EPA Victoria Publication 1751: Planning guidance for concrete batching
Quarry	Quarrying, crushing, screening, stockpiling and conveying of rock	Without blasting With blasting With respirable crystalline silica	500 metres	EPA Victoria Publication 1961: Guideline for Assessing and Minimising Air Pollution in Victoria

Nuisance dust review

Nuisance dust impacts were assessed in accordance with EPA Victoria Publication 1493. This process involves a qualitative risk assessment, consisting of four steps summarised in Figure 16.1.

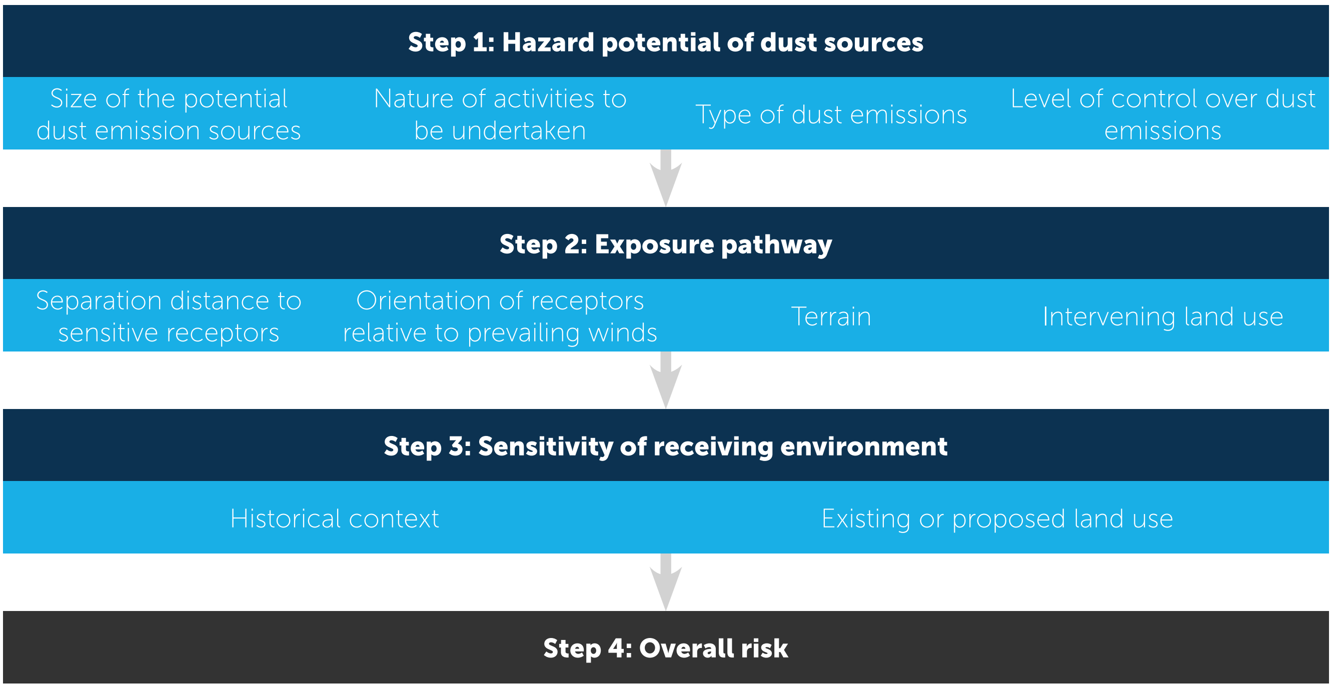


Figure 16.1 Summary of nuisance dust risk assessment process in accordance with EPA Victoria Publication 1493

Scores are assigned for each category of steps 1 through to 3 based on the criteria outlined in EPA Victoria Publication 1493. These scores, when combined, are used to determine the overall risk of dust impacts from the project (Step 4). The overall risk scores are presented in Table 16.4

Table 16.4 Overall risk of dust impact *(Source: EPA Publication 1961)*

Score	Rating	Description
32-36	Very high	Dust impact almost certain. Nuisance dust impacts will occur. Any interventions to reduce impacts in either the source, pathway or receiving environment are unlikely to be practical so effective mitigation is doubtful.
27-31	High	Dust impacts highly likely to occur. Significant nuisance dust to occur, and impacts are highly likely. There may be some interventions that can be applied to reduce the impacts, but it is likely that significant re-engineering or redesign will be required.
22-26	Medium	Dust impacts likely. Some nuisance dust impacts to occur and without careful and considered application of mitigation measures it is likely to cause impacts. The focus should be what can be done to break the source-pathway-receiving environment chain.
17-21	Moderate	Dust impacts only likely to occur on rare occasions. Although there may be some residual nuisance dust impacts, it is possible it can be practically and effectively managed.
12-16	Low	Dust impacts are not likely and any would be minimal.
-	Negligible*	Any dust impacts are extremely unlikely to occur.

** additional category added to Publication 1943 categories to account for circumstances where dust impacts would not occur*

Exhaust emissions and odours/airborne hazards

Air quality-related impacts associated with exhaust emissions and odours/airborne hazards were qualitatively assessed in accordance with EPA Victoria Publication 1961 Level 1 requirements. The impact assessment ratings used to assess these impacts are summarised in Table 16.5.

Table 16.5 Impact assessment ratings for exhaust emissions and/or odours/airborne hazards

Impact rating	Comment
Very high	Exhaust emissions and/or odours/airborne hazards and/or non-construction dust impacts almost certain. Interventions to reduce impacts in either the source, pathway or receiving environment are unlikely to be practical so effective mitigation is doubtful.
High	Exhaust emissions and/or odours/airborne hazards and/or non-construction dust impacts highly likely to occur. Significant impacts to occur, and impacts are highly likely. There may be some interventions that can be applied to reduce the impacts, but it is likely that significant re-engineering or redesign will be required.
Medium	Exhaust emissions and/or odours/airborne hazards and/or non-construction dust impacts likely. Some impacts to occur and without careful and considered application of mitigation measures it is likely to cause impacts. The focus should be what can be done to break the source-pathway-receiving environment chain.
Moderate	Exhaust emissions and/or odours/airborne hazards and/or non-construction dust impacts only likely to occur on rare occasions. Although there may be some residual impacts, it is possible it can be practically and effectively managed.
Low	Exhaust emissions and/or odours/airborne hazards and/or non-construction dust impacts are not likely and are expected to be minimal.
Negligible	Exhaust emissions and/or odours/airborne hazards and/or non-construction dust impacts are extremely unlikely to occur.

16.5.2 GHG emissions

Potential GHG impacts associated with the project were assessed by:

- characterising the existing conditions
- undertaking engagement with relevant stakeholders
- reviewing the potential for impacts and recommending control and monitoring measures.

Existing conditions

Victorian and Australian level GHG emissions from the last ten years of reporting (2012-2022), provided in Australia's National Greenhouse Accounts, were reviewed to determine current emissions and emissions trends. As emissions inventories for 2023 and 2024 were not available at the time of the assessment, GHG emission inventory data for the most recent available year (2022) was adopted as the benchmark to determine the contribution of emissions from the construction and operation of the project to Victorian and Australian emissions.

Australia's National Greenhouse Accounts is a series of reports published by the Commonwealth Department of Industry, Science, Energy and Resources that detail annual reported GHG emissions, track progress towards Australia's emission reduction commitments, inform future emission reduction commitments, and support the creation of domestic reduction policies.

Stakeholder engagement

EPA Victoria and Department of Transport and Planning Impact Assessment Unit were consulted to support the preparation of the assessments discussed in this chapter and to understand potential impacts resulting from the project. Refer to the ***Air Quality Impact Assessment*** (Appendix L1) and ***Greenhouse Gas Impact Assessment*** (Appendix L2) for further detail on consultation activities.

Impact assessment

The ***Greenhouse Gas Impact Assessment*** was undertaken in accordance with the PEM (EPA Publication 824: Protocol for Environmental Management: Greenhouse gas emissions and energy efficiency in industry). This involved:

- estimating annual energy consumption by energy type and associated GHG emissions
- estimating direct (non-energy related) GHG emissions (e.g. business travel or use of products)
- identifying and evaluating opportunities to reduce GHG emissions.

This process is also generally consistent with the processes outlined in EPA Victoria Publication 2048.

Steps taken as part of this assessment process included:

- determining the sources of GHG emissions and assessing their likely significance.
- determining the assessment boundary.
- identifying emission factors, derived from the National Greenhouse Accounts Factors published by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW), to determine GHG emissions from processes or activities
- determining grid electricity emission factors based on DCCEEW's Australia's emissions Projections 2023 (for the years 2025 to 2050, a linear reduction in emissions factors associated with the grid was assumed)
- comparing the total project GHG emissions against annual state and Commonwealth GHG emissions to identify the significance of project emissions
- consideration of cumulative GHG impacts
- identifying relevant mitigation measures to address key emission sources
- assessing the significance of residual GHG impacts following the implementation of mitigation measures based on the amount of carbon dioxide equivalent emitted, with the impact significance criteria presented in Table 16.4
- given expected changes in technologies and policy at the time of project decommissioning, a qualitative assessment of the GHG emissions during this phase was adopted and considered GHG emitting activities associated with typical decommissioning works.

Table 16.6 GHG impact significance criteria

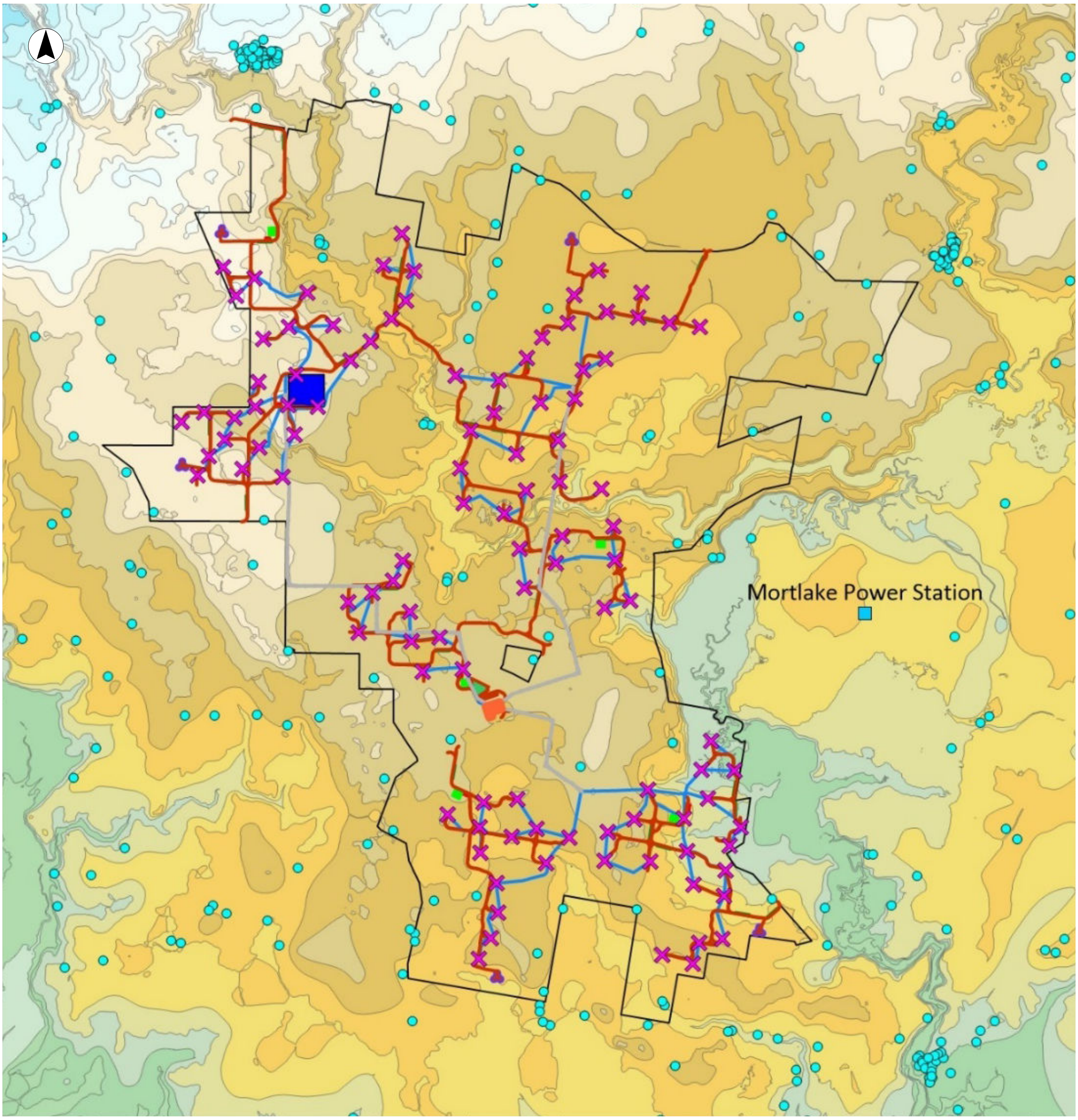
Rating	GHG impact significance criteria
Very High	Construction or operational Scope 1 and Scope 2 GHG emissions represent a non-negligible proportion of Victoria's total GHG emissions (greater than 1%).
High	Construction or operational Scope 1 and Scope 2 GHG emissions trigger referral for individual potential environmental effects under the *Environmental Effects Act 1978* (greater than 200,000 tonnes CO_2e per annum).
Moderate	Construction or operational Scope 1 and Scope 2 GHG emissions trigger the NGER Scheme reporting threshold (25,000 tonnes CO_2e per annum).
Low	Construction or operational Scope 1 and Scope 2 GHG emissions are below the NGER Scheme reporting threshold (25,000 tonnes CO_2e per annum).
Negligible	Construction Scope 1 and Scope 2 GHG emissions are insignificant, that is emissions are less than 5,000 tonnes CO_2e per annum. Operational Scope 1 and Scope 2 GHG emissions are insignificant, i.e., the project is near to or on par with the 'no project' scenario.

16.6 Existing conditions

16.6.1 Topography

Topography can affect meteorology at a local scale and therefore influence how air emissions disperse and affect surrounding sensitive receptors.

The project site and surrounding areas are relatively flat, with elevations across the project site varying between approximately 100 and 150 metres above sea level. The topography of the project site is shown in Figure 16.2.

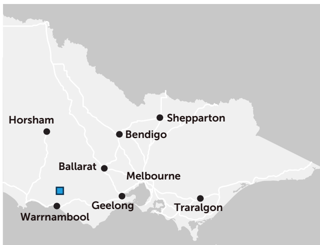


LEGEND

- Sensitive receptor
- Wind turbine
- Quarry
- Temporary concrete batching plant
- Site apcess roads
- Construction support compounds
- BESS
- Terminal station
- Construction staging areas
- Main compound and site offices
- A Meteorological mast
- Transmission line
- Underground cabling
- Mortlake Power Station

Elev. (m)

190	150	110
185	145	105
180	140	100
175	135	95
170	130	90
165	125	85
160	120	
155	115	



Data: State of Victoria (DECCA/Land Use Victoria), Commonwealth of Australia, Wind Prospect, and specialist studies/reports. Data is indicative only; accuracy and completeness are not guaranteed.

Figure 16.2 Project site topography, dust sources and sensitive receptor locations

16.6.2 Sensitive receptors

The location of sensitive receptors in relation to the project site are shown in Figure 16.2.

The separation distance between sensitive receptors and potential dust-generating project activities are listed in Table 16.7.

Sensitive receptor or **sensitive land use** (in the context of odour and dust emissions) is any land use that requires a focus on protecting human health and wellbeing, local amenity and aesthetic enjoyment.

(Source: New draft separation distance guideline EPA Publication 1949)

Table 16.7 Approximate separation distances between project activity and nearest sensitive receptor

Potential dust-generating project activity	Estimated separation distance (metres) between the activity and nearest sensitive receptor
Concrete batch plant	1,100
Wind turbine hardstand	800
Underground cable	400
Access track	140
On-site quarry	2,300

16.6.3 Local climate and meteorology

Meteorological conditions are important for determining the direction and rate at which air emissions disperse from a source. The closest weather station to the project site is the Mortlake Racecourse Bureau of Meteorology (BoM) station, located around 12 kilometres east of the project site. Meteorological measurements at this station were obtained near ground-level. Wind speed and direction monitoring data collected at a meteorological mast installed within the project site (at a height of 40 metres above ground level and location shown in Figure 16.2) was also reviewed to determine the existing meteorological conditions.

Temperature, rainfall and humidity

Monthly means for daily minimum and maximum temperatures for the Mortlake Racecourse BoM station from 1991 to 2023 are shown in Figure 16.3. The recorded Mortlake Racecourse temperatures are expected to be representative of that at the project site. Mean and median monthly rainfall measured at Mortlake Racecourse BoM station from 1991 to 2023 are shown in Figure 16.4.

The local occurrence of dry summer months combined with elevated summer temperatures indicate the risk of dust impacts are expected to be highest during summer. Morning and afternoon monthly average relative humidity levels, measured between 1991 and 2010 at Mortlake Racecourse are displayed in Figure 16.5. Humidity reduces air circulation which can trap pollutants in air.

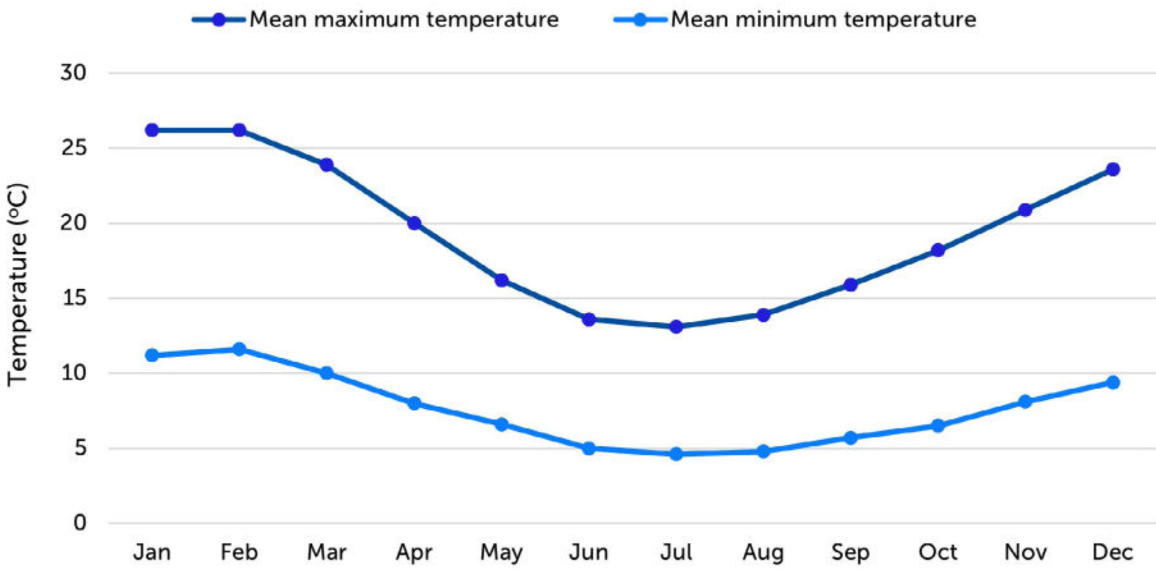


Figure 16.3 Mean minimum and maximum temperatures Mortlake Racecourse station (1991 to 2023)
(Source: BoM, 2024)

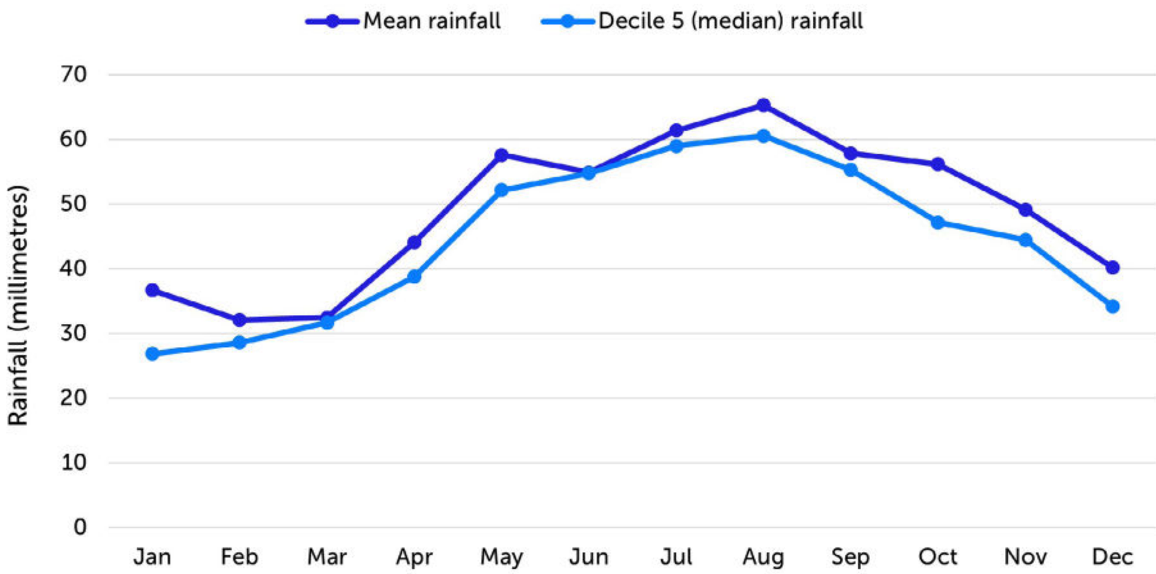


Figure 16.4 Mean and median monthly rainfall – Mortlake Racecourse (1994 to 2023)
(Source: BoM, 2024)

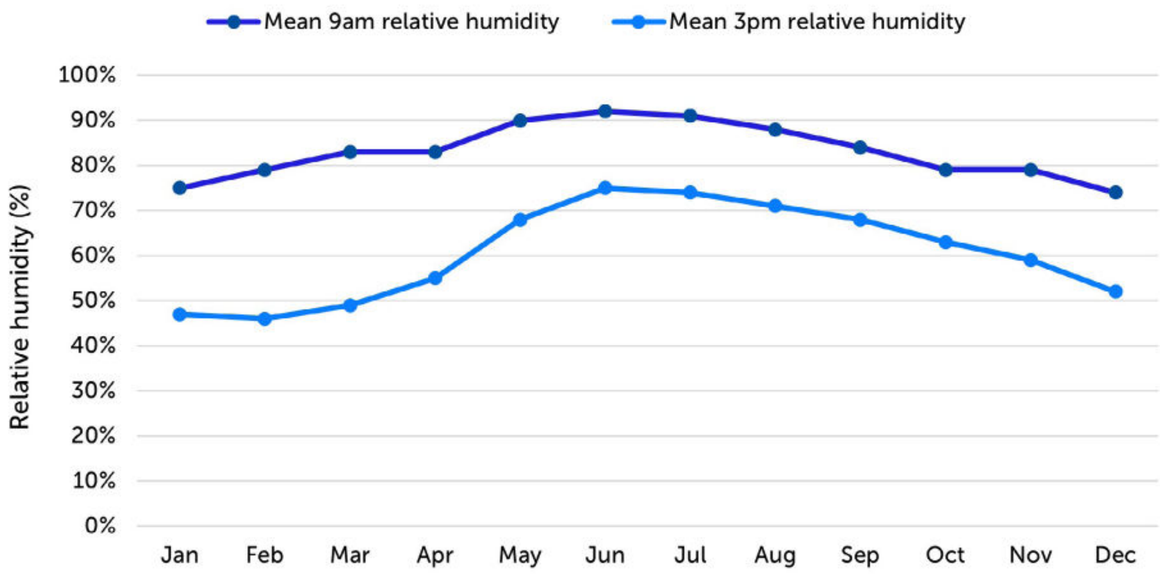


Figure 16.5 Mean 9am and 3pm relative humidity – Mortlake Racecourse (1991 to 2010)
(Source: BoM, 2024)

Wind

The annual average wind speed at the Mortlake Racecourse station (from 2003 to 2023) was 3.9 metres per second (see Figure 16.6). Figure 16.7 shows a seasonal wind rose for Mortlake Racecourse station in 2022, which indicates that northerly winds are dominant in winter, and milder southerlies dominate in summer. Easterly winds are less common all year round and autumn and spring do not show strong wind patterns.

Meteorological data from the on-site meteorological mast (collected at 40 metres above ground level for wind speed and 39 metres above ground level for wind direction) was compared with the Mortlake Racecourse BoM station data (collected near ground level) and is also shown in Figure 16.7. Due to the differences in sensor heights between the meteorological mast and Mortlake Racecourse BoM station, the data is not expected to closely align, with the on-site measurements at 40 metres showing higher wind speeds, as expected. Additionally, the on-site measurements do not show the strong northerly winds in winter, as observed at Mortlake Racecourse.

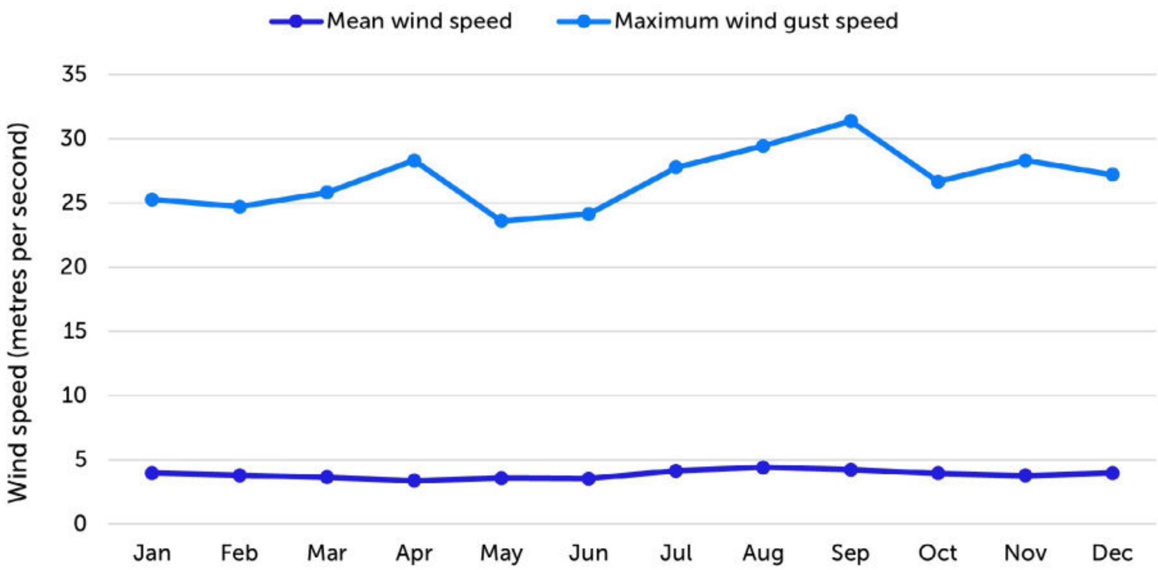


Figure 16.6 Mean wind speed and maximum wind gusts – Mortlake Racecourse (2003 to 2023)

(Source: BoM, 2024)

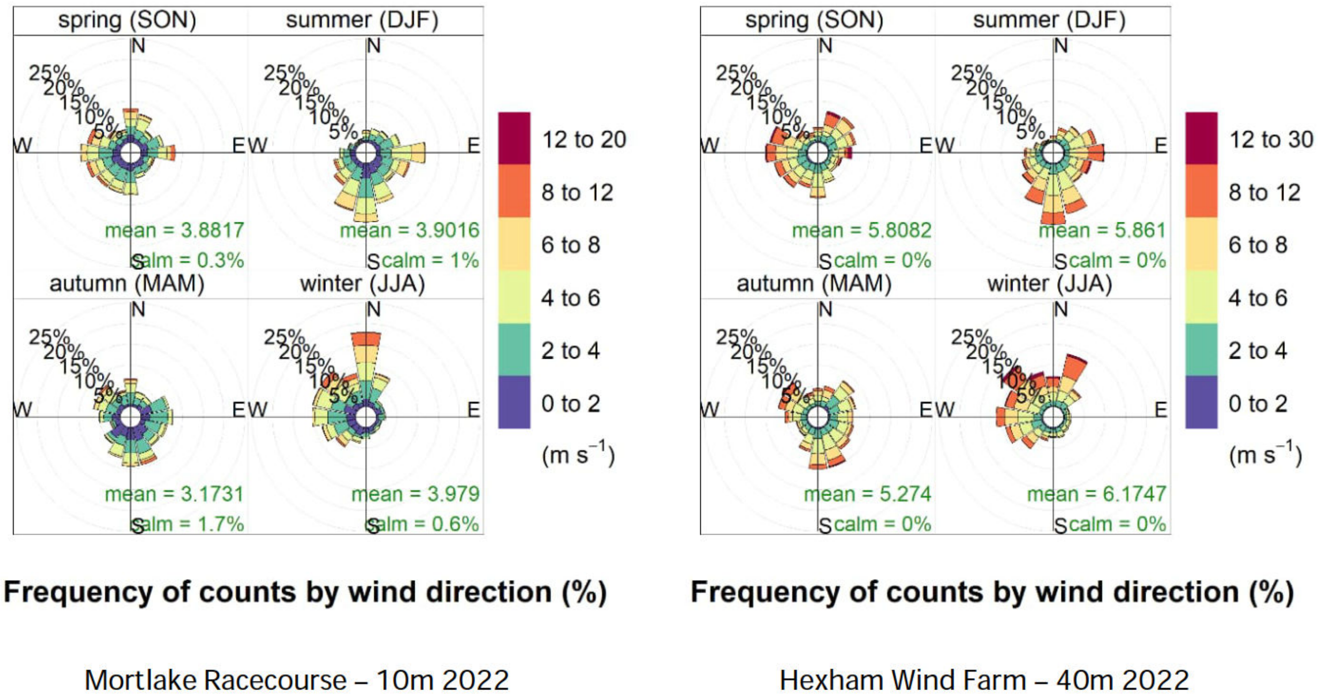


Figure 16.7 Seasonal wind rose (2022) – Mortlake Racecourse (left) and the project site (right)

16.6.4 Existing air quality

Air quality across the project region is expected to be good in comparison to that of urban areas and the Melbourne-Geelong Airshed, which is the geographical area where the spread of pollutants is limited by local weather and topography. Air quality in these areas is subject to elevated concentrations of gaseous and particulate pollutants from thousands of road vehicles using the nearby road network.

Airborne particulate matter

There is no air quality monitoring data available for the project site. Of the EPA Victoria monitoring stations across the Port Phillip and Latrobe Valley regions with continuous data, the monitoring station in Alphington (a suburb of Melbourne) was considered most representative of the air environment expected at the project site. While Alphington's air quality is influenced by urban road traffic, in general the particulate matter levels are not as affected by local sources as strongly as other air quality monitoring stations at Footscray and Geelong. The particulate matter levels measured in the Latrobe Valley (Traralgon) would be associated with brown coal-fuelled electricity production and not appropriate for this assessment.

Figure 16.8 shows the long-term trends for PM_{10} and $PM_{2.5}$ for the Alphington monitoring station (EPA Victoria, 2016; EPA Victoria, 2021), noting that:

- major bushfires events in eastern Victoria in 2019-2020 contributed to the elevated $PM_{2.5}$ and PM_{10} levels in 2019 and 2020
- elevated $PM_{2.5}$ and PM_{10} levels in 2018 were influenced by urban sources such as domestic wood heating on cold, still nights, land burns and wind-blown dust (EPA Publication 1730: Solid storage and handling guidelines).

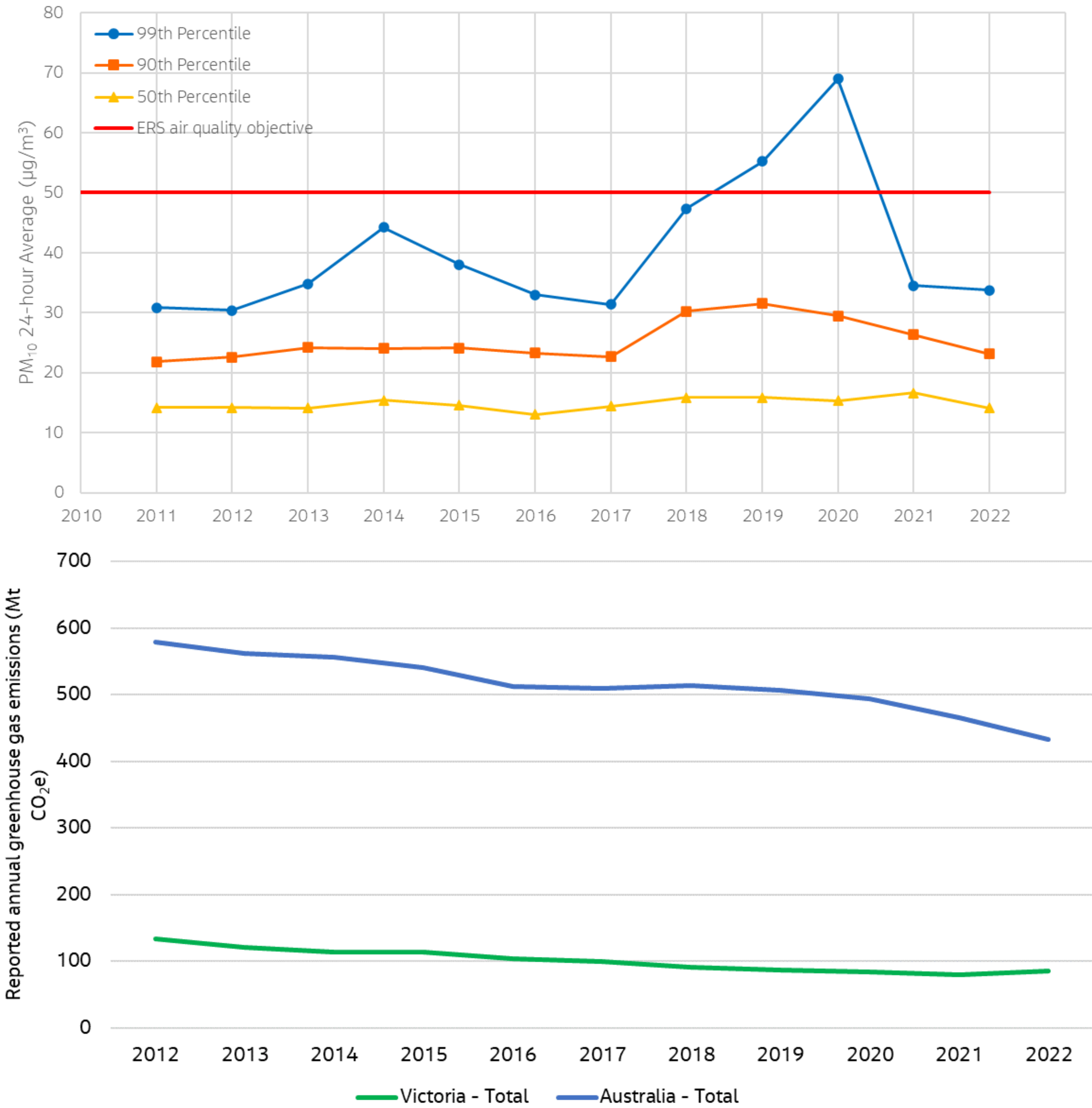


Figure 16.8 24-hour average PM_{10} (top) and $PM_{2.5}$ (bottom) Alphington monitoring station (2011 to 2020)
(Source: EPA, 2016 and EPA, 2021)

Other air pollutants

Relatively low levels of gaseous pollutants such as nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and carbon monoxide (CO) would be expected in the project region as a result of various local and distant sources such as vehicle emissions, domestic wood heaters, other combustion processes and long-range transport from population centres.

The only major emission source reporting to the National Pollutant Inventory (NPI) database that is relevant to the investigation area is the Mortlake Power Station, located three kilometres east of the project site (Figure 16.2). For the most recent published (2023/24) NPI reporting period, Mortlake Power Station reported emissions for particulates, and a range of gaseous pollutants, with CO and nitric oxide (NO_x) being most relevant to the project. Due to the separation distance between this emission source and the project site, existing concentrations of these pollutants within the project site would be negligible.

Respirable crystalline silica (RCS) is created during the cutting, grinding, and drilling of materials such as stone, rock, concrete and mortar. There are no known activities in the investigation area which would generate RCS dust, as such it is expected that concentrations of RCS are negligible for the project site.

16.6.5 GHG emissions

Australia's National Greenhouse Accounts (DCCEEW, 2024b) provide a detailed database of State and Commonwealth GHG emissions data. These inventories are used to track and monitor GHG emissions both at a State and Commonwealth level. The Victorian and Australian GHG emissions from 2012 to 2022 have been compiled and are detailed in Table 16.8.

Table 16.8 Victorian and Australian GHG emissions, 2012-2022
(Source: DCCEEW, 2024b)

Source of Emissions	Reported GHG emissions (Megatonnes CO_2e)										
	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Victoria	133	120	113	113	104	100	91	87	83	80	85
Australia	579	561	556	541	512	510	514	506	494	465	433

As shown in Figure 16.9, State and Commonwealth GHG emissions between 2012 and 2022 trended downwards.

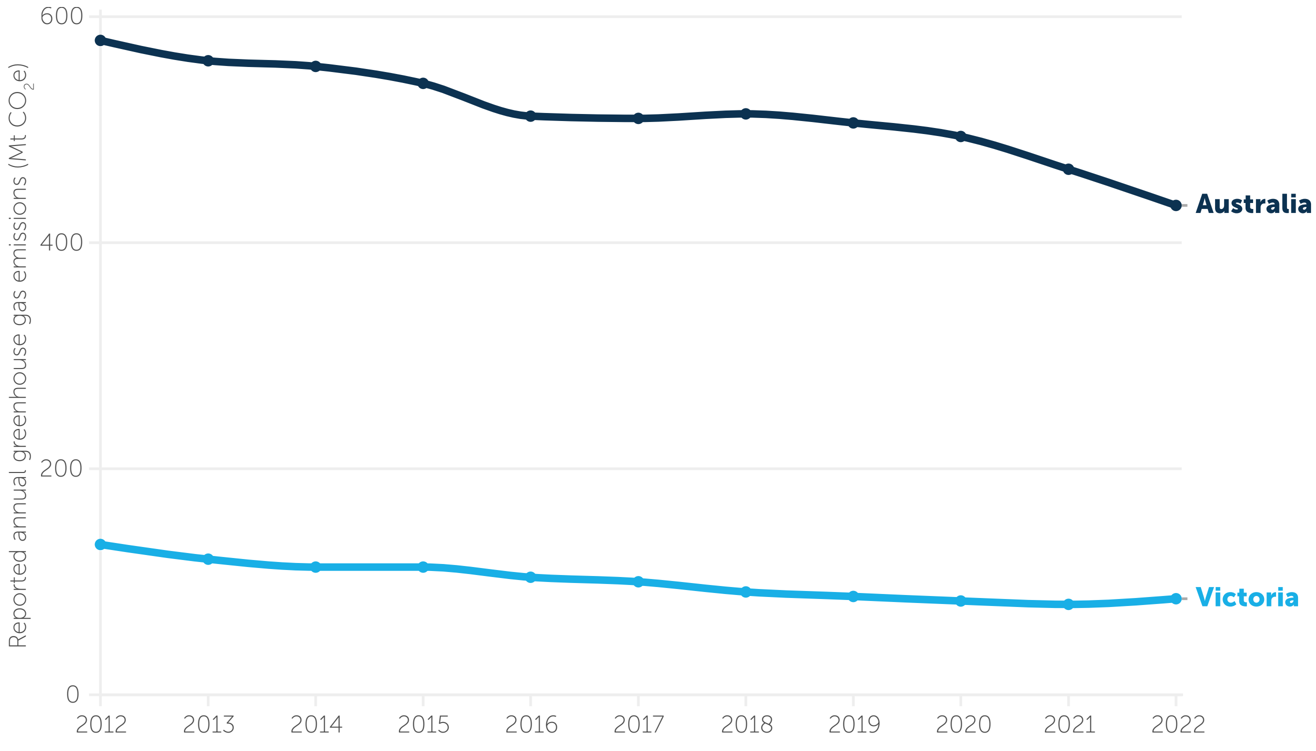


Figure 16.9 Trends in Victorian and Australian greenhouse gas emissions, 2012 - 2022

16.7 Impact assessment

16.7.1 Impact pathways

Air Quality

Air quality impacts can occur when air pollutant emissions from an industry or activity cause a deterioration in ambient (i.e., outdoor) air quality. These impacts are expected to occur from:

- generation of dust
- exhaust emissions from the combustion of fossil fuels in vehicles, plant and equipment.

The primary air quality impacts for the project are expected to be during construction.

Dust during construction

Activities with the highest potential to generate dust during construction include:

- excavation, loading and unloading, haulage, storage, placement and compaction of materials during the construction of temporary and permanent project infrastructure
- concrete batching activities at the seven temporary concrete batch plants
- extraction, treatment (i.e., sorting, crushing and screening), and transport of materials from the on-site quarry
- storage of stockpiled materials and temporary disturbed and exposed surfaces, including unsealed roads that are susceptible to wind erosion.

Potential key nuisance dust sources associated with the project construction are provided in Table 16.9.

Table 16.9 Summary of nuisance dust sources and separation distances

Activity	Approx. separation distance to nearest sensitive receptor (m)	Comment
Construction of internal access tracks	140	Around 134.6 km of new access tracks.
Construction of 26 laydown / staging areas	200	2,700 m^3 or aggregate per laydown / staging area, 300 m x 15 m in size.
Establishment and use of seven temporary concrete batch plants	600	Would be used for the duration of construction to facilitate project construction.
Construction of temporary construction compounds	1,100	
Establishment and use of on-site quarry	2,300	Blasting, extraction, treatment (i.e., sorting, crushing and screening), and transport of materials from the on-site quarry.
Construction up to 106 wind turbine hardstand areas and footings	800	Approximately 2,350 m^3 aggregate per wind turbine site.
Installation of electrical reticulation (i.e., underground cables and overhead transmission lines)	400	Comprising approximately 85 km of trenches and 49 km of overhead transmission lines.
Construction of an on-site terminal station, including battery energy storage system	1,050	On-site terminal station, battery energy storage system and permanent / temporary site facilities are located adjacent to each other.
Construction of main compound and site office including office facilities, amenities, car parking and the operations and maintenance facility	1,200	

Based on an assessment of the hazard potential of nuisance dust sources, the effectiveness of the exposure pathway and sensitivity of the receiving environment against the criteria outlined in EPA Victoria Publication 1943, there is a 'high' risk of dust-related impacts during construction if emissions to air are not mitigated or otherwise effectively managed. The outcomes of this assessment are presented in Table 16.10.

Table 16.10 Project dust risk assessment against Publication 1943 criteria

Criteria		Score	Basis
Step 1: Hazard potential of the sources	Size of dust emitting source	3	At least 2,300,000 t materials to be disturbed, handled, transported, placed and/or stored during the project
	Activities being undertaken	3	Project involves various activities with a high potential to generate dust (i.e., concrete batching, quarrying, use of unsealed access tracks, temporary laydown area and compound activities, blasting and earthworks)
	Type of dust emission	2	Variety of materials to be used during the project each with varying dispersivity
	Level of control	2	Partial control or containment possible for some activities (e.g., concrete batching, some quarrying activities), although other sources (e.g., broader quarry and unsealed internal access roads and disturbed areas would not be able to be contained and would rely on active management controls)
Step 2: Effectiveness of exposure pathway	Distance	1	Receptors are hundreds of metres or kilometres from source, or separation distance has been met easily.
	Prevailing wind direction	3	High frequency (>20%) of winds from source to receptor or source is upwind, winds are of high speed
	Terrain	2	Source is on same altitude as receiving environment, generally flat land.
	Intervening land use	3	Open land and cleared of obstacles. Isolated dwellings or structures in pathway.
Step 3: Sensitivity of receiving environment	Land use	6	High general expectation of amenity: e.g. rural living zones.
	Historical context	2	No previous history, no incidents or non-compliance. Only single isolated reports. Generally, the public is unconcerned.
Overall score (unmitigated)		27	High risk of dust impacts occurring if not properly managed

Note: The overall risk score is considered conservative as it assumes that one or more sensitive receptors would always be downwind of the project, irrespective of the wind direction.

Dust during operation and decommissioning

Limited dust may be generated by maintenance activities and from vehicle movements on unsealed access tracks during project operation. Impacts to sensitive receptors from dust generated during project operation are not expected.

Project decommissioning would include removing all above ground equipment, restoration of all areas associated with the project (unless otherwise useful to the ongoing management of the land), and post-decommissioning revegetation with pasture or crop (in consultation with and agreed with the landowner). These activities have the potential to generate dust emissions, and exhaust emissions may result from the combustion of fossil fuels in plant and equipment used during decommissioning.

Dust impacts during project decommissioning are expected to be less than what is expected during construction. Impacts would need to be reviewed and managed in the context of the legislative and policy requirements in-force at the time of decommissioning.

Vehicle emissions during construction, operation and decommissioning

Trucks, vehicles, plant and mobile generators (where required) used during the construction, operation and decommissioning of the project may emit fuel combustion products into the air, including NO_x, CO, SO_2 and fine particulates (PM_{10} and $PM_{2.5}$). Emissions from construction vehicles can also produce odours, if not well maintained. However, due to the relatively minor exhaust emissions from these sources and the separation distances to sensitive receivers, impacts to sensitive receivers from vehicle emissions are not expected.

GHG Emissions

The GHG associated with the project include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (NO_x). The GHG projected to result from the project are categorised by:

- energy related emissions (e.g. emissions from the use of fuels or consumption of electricity); and
- non-energy related emission, which include embedded emissions (e.g. emissions associated with the production of materials used in construction, emissions from chemical reactions or direct releases of GHG from activities such as land clearing).

Emission scopes (Greenhouse Gas Protocol)

GHG emissions sources are categorised into three different scopes in the Greenhouse Gas Protocol. These are:

- **Scope 1:** Direct emissions from sources that are owned or operated by a reporting organisation (examples – combustion of fuel used in on-site power generation equipment)
- **Scope 2:** Indirect emissions associated with the import of energy from another source (examples – purchases of electricity)
- **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 (examples include embedded emissions in raw materials, business travel by air/rail and product usage).

The predicted sources of emissions for construction and operation of the project are provided in Table 16.11. Some emissions sources are split into more than one scope as they have direct emissions (e.g., combustion of fuel in a vehicle operated as part of the project) and indirect emissions (extraction and processing of the fuel before it is used).

It is difficult to accurately predict the emissions associated with decommissioning activities due to anticipated changes in technologies and policy in the future, which would have a significant impact on GHG emissions by the time of decommissioning. As such, the emissions resulting from this phase were qualitatively assessed to determine the GHG risk.

Table 16.11 Greenhouse gas emission sources (construction and operation)

Emission Source	Scope 1	Scope 2	Scope 3
Construction Phase			
Energy related			
Fuel use – diesel consumption in plant and equipment during construction	•		•
Fuel use – transport of construction materials			•
Fuel use – transport of spoil and other earth			•
Fuel use – transport of construction waste			•
Electricity use – electricity consumed in Project offices		•	•
Non-energy related			
Construction materials			•
Blasting – quarrying activities	•		
Loss of carbon sink – land clearing and soil disturbance	•		
Operation Phase			
Energy related			
Grid electricity usage in site infrastructure		•	•
Electricity lost in battery charge and discharge		•	•
Fuel use – transport of maintenance materials			•
Fuel use – transport of maintenance waste			•
Fuel use – diesel consumption in plant and equipment during maintenance	•		•
Non-Energy related			
Maintenance materials			•
Sulphur hexafluoride losses	•		

GHG emissions during construction

The project is predicted to result in overall GHG emissions of 1,324,393 tonnes of CO_2e over the construction period (662,197 t CO_2e annually), with emissions from the project almost entirely comprised of Scope 3 emissions (Figure 16.10). As the annual unmitigated Scope 1 and Scope 2 emissions from the construction of the project would be greater than 5,000 t CO_2e but less than 25,000 t CO_2e (totally around 19,369 t CO_2e per year), the impact significance would be considered minor (see Table 16.6). The annual, unmitigated emission contributions of the project construction towards the total annual emissions of Victoria and Australia would constitute less than 1% of both Victoria and Australia's overall GHG emissions.

Embedded emissions (non-energy related) in project construction materials would form the majority of overall construction emissions for the project (comprising approximately 93% of overall construction emissions). Energy related emissions associated with the construction of the project include those from the consumption of fuel used on site (comprising approximately 4% of overall construction emissions), as well as from the combustion of diesel during haulage of construction materials to site, removal of excavated soil (cut and spoil) and waste from site and transfer of materials from the on-site quarry (less than 3% of overall construction emissions). Grid energy consumption to power site offices would contribute to less than 0.01% of overall construction emissions.

The percentage of predicted total GHG emissions for each emission source over the construction period is shown in Figure 16.10.

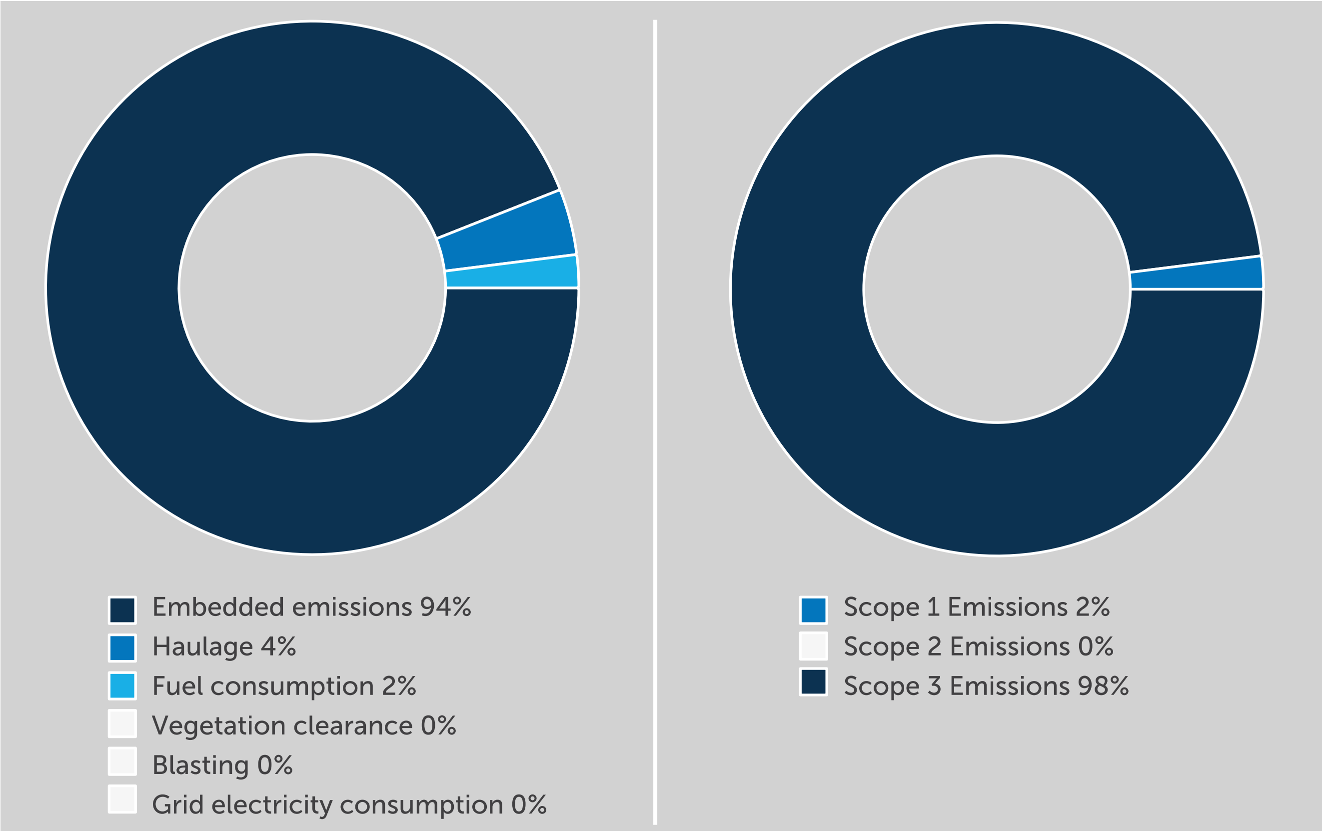


Figure 16.10 **Percentage of predicted total GHG emissions for each emission source (left) and proportion of emission scopes (right) over the construction period (assumed to be 2 years)**

GHG emissions during operation

The operation of the project is predicted to have annual GHG emissions of 82,620 to 307.48 tonnes of CO_2e from 2027 to 2050. As the annual, unmitigated Scope 1 and Scope 2 emissions from the operation of the project would initially be greater than 25,000 tonnes of CO_2e, the impact significance would be considered **moderate** (see Table 16.6). As grid decarbonisation continues, this would reduce the significance rating to **negligible**.

Energy-related emissions associated with the operation of the project include those from the battery energy storage system (comprising approximately 98% of total operational emissions, Figure 16.11), which would be powered by the grid and not the wind farm. During periods of low demand, the battery energy storage system would charge with grid energy then discharge that energy back into the grid during peak periods. However, some electricity would be lost in the charge/discharge process, which accounts for the emissions associated with the battery energy storage system operation.

Energy-related emissions during project operation would also include consumption of fuel during inspection and maintenance activities (approximately 2% of total operational emissions), and electricity usage by site infrastructure (including the operations and maintenance facility, which will consume electricity to perform standard operations) (approximately 0.02% of total operational emissions).

Non-energy related emissions associated with the materials contained in replacement equipment and components used for typical minor maintenance activities are estimated to constitute less than 0.02% of total operational emissions. Fluorinated gas and SF_6 (Sulphur hexafluoride) leakage from the project is considered negligible.

At the year of opening, emissions associated with electricity usage (Scope 2 and Scope 3 emissions), have been projected to be the greatest form of emissions from project operation. As the grid continues to decarbonise to achieve the target of net zero emissions by 2050, emissions from the use of grid electricity will progressively reduce and fuel combustion from plant and equipment during maintenance (Scope 1 emissions) will become the larger source of emissions. Over the expected 25-year life of the project, emissions from wind farm operations requiring electricity should reduce to zero.

The operation of the project would constitute between 0.1% to less than 0.001% of Victoria's overall GHG emissions, and between 0.02% to less than 0.001% of Australia's overall GHG emissions.

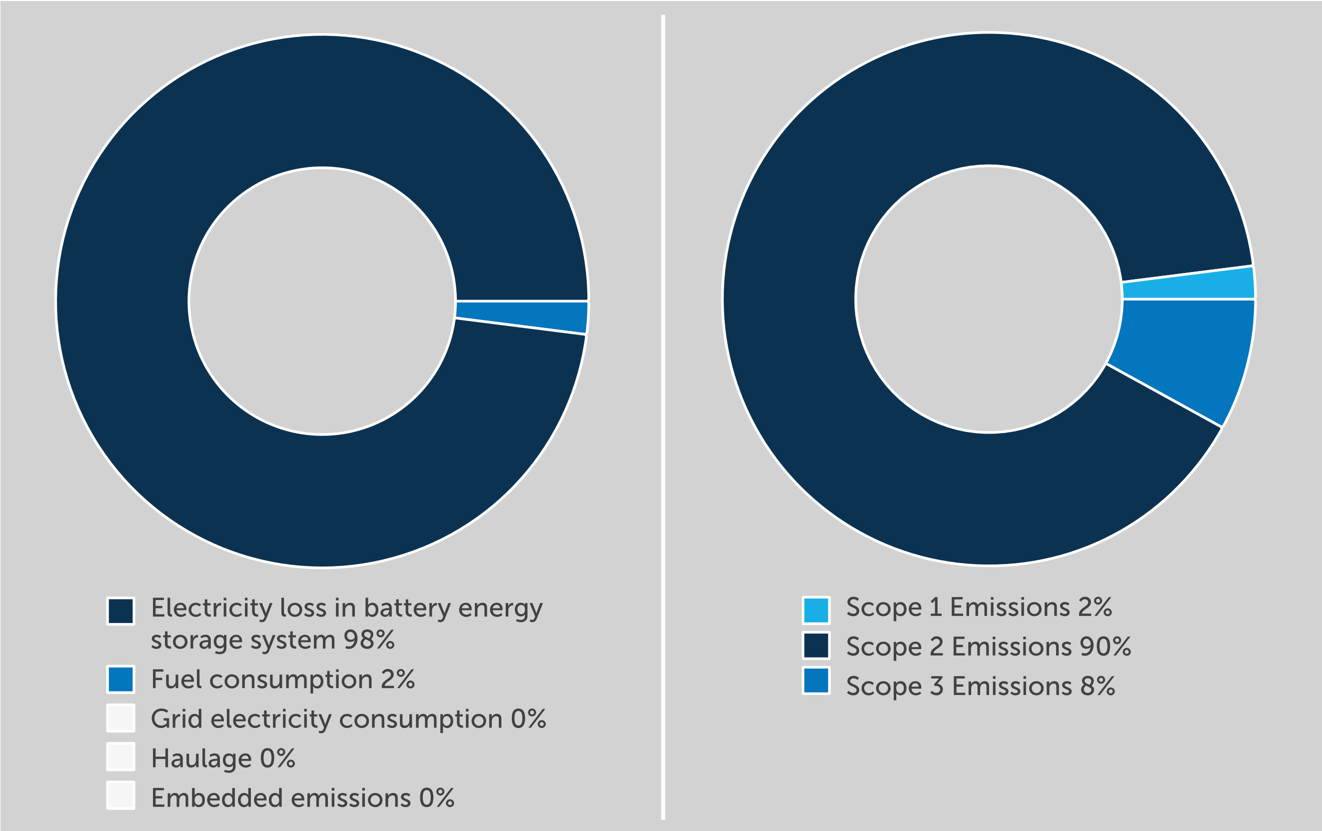


Figure 16.11 Percentage of predicted total GHG emissions for each emission source (left) and proportion of emission scopes (right) over the operation period (assumed to be 25 years)

GHG emissions during decommissioning

Emissions during decommissioning would most likely result from energy consumption by plant and equipment, vehicles (including haulage) and site offices. Activities would be similar to those undertaken during construction, however without the emissions associated with clearing vegetation, blasting and embedded emissions.

Due to the predominant materials used in the project being steel and concrete, a large portion of project materials could be recycled and reused. This would have a positive GHG impact by supplanting some of the demand for these materials which otherwise could have been filled by newly produced (and more emissions intensive) materials.

16.7.2 Design mitigation

Sensitive areas

During the development of the project, a range of environmental, social and infrastructure constraints were considered as part of the planning and design process and in many cases, buffers were applied to known or modelled sensitive areas (including townships and dwellings) (refer to Chapter 5 – ***Project alternatives and design*** development). The purpose of incorporating these constraints and buffers into the planning process was to ensure that potential impacts could either be avoided or minimised. This approach aligns with the general environmental duty requirements, where the primary focus is to eliminate or avoid the risk where practicable.

The project has been designed to maintain a separation distance of at least 140 metres from the nearest sensitive receptor to construction activities.

Quarry

The temporary on-site quarry has been proposed in a part of the project site away from occupied dwellings. The closest occupied dwelling is around 2,300 metres from the quarry boundary. This distance is greater than the minimum separation distance of 500 metres for quarries specified in EPA Victoria Publication 1949: Separation distance guideline. Alternative locations were also considered but found to be less suitable for reasons unrelated to their proximity to dwellings, including their less suitable geology and proximity to environmental values. Owing to the low density of dwellings within and surrounding the project site, siting the quarry at a reasonable distance from occupied dwellings was not difficult.

Other project activities

The seven temporary concrete batch plants have been located to provide convenient access to all wind turbines. The distance between concrete batch plants and sensitive receptors was an important consideration to minimise off-site impacts resulting from unintended, project-generated dust emissions. The closest sensitive receptor to any of the concrete batch plants is approximately 600 metres. This distance is significantly greater than the minimum separation distance of 100 metres for concrete plants specified in EPA Victoria Publication 1949: Separation distance guideline.

16.7.3 Environmental management measures

Imperative to the effective management of dust impacts will be the implementation of a Air Quality Management Plan (AQMP) which will be a subset of the Construction Environmental Management Plan (CEMP). This plan will specifically address air quality emissions and mitigations. Under the general environmental duty, persons engaging in activities that involve air emissions are required to eliminate risks of harm to human health and the environment from those emissions, so far as reasonably practicable. Where this cannot be achieved, risks must be reduced (so far as reasonably practicable) and existing or proposed controls documented as to how they meet the requirement to minimise risks.

To address its general environmental duty relating to air quality, the project has included design measures (where feasible) to avoid potential air impacts for nearby sensitive receptors (see Section 16.7.2). To further minimise potential impacts to air quality, management measures would be implemented during the construction, operation and decommissioning of the project. Committed management measures are outlined in Table 16.2.

Table 16.12 Air quality and GHG management measures

Air quality and greenhouse gas impacts	Project phase	Management measures	Number
Air Quality			
Dust from concrete batching plants impacts air quality	Construction	**Concrete Batching Plant - Air quality management** 1. Design and operate all project concrete batching plants to adequately control dust emissions, as per guidelines set out in EPA Victoria Publication 1806: Reducing risk in the premixed concrete industry.	AQ01
Dust from quarry site (blasting) impacts air quality	Construction	**Quarry Work Plan** 1. Prior to the development of an on-site quarry, the draft Quarry Work Plan (provided in Attachment II) will be finalised and submitted to Resources Victoria (Department of Energy, Environment and Climate Action) for approval. 2. The Quarry Work Plan will include measures to: - a. manage and monitor surface water impacts b. manage noise emissions, in accordance with a Quarry Noise Management Plan (NV02) c. control emissions of dust or other particulates d. manage the carriage and deposition of dust, silt and clay by vehicles existing the work authority area e. manage erosion from topsoil and overburden stockpiles f. manage site rehabilitation. 3. Prior to blasting, the affected areas will be pre-wet to minimise dust emissions. Blasting would occur when winds are blowing away from the nearest sensitive receptors (i.e. from the north, south or west) and are consistent enough to encourage movement of dust away from the nearest receptors, but light enough to minimise emission generation and transport of dust off-site.	EMM07

Air quality and greenhouse gas impacts	Project phase	Management measures	Number
Dust from other project activities impacts air quality	Construction	**Air Quality Management Plan** 1. Prior to the commencement of construction, develop and implement a site-specific Air Quality Management Plan as a sub-plan of the Construction Environmental Management Plan (EMM01) to identify potential and existing dust sources and outline best practice design controls and management practices to minimise dust. 2. These measures would include, but not be limited to: a. watering of unsealed roads to reduce wheel generated dust b. use of wheel wash facility to minimise transfer of dust from the project site c. use of water sprays to reduce wind erosion from material stockpiles and exposed areas d. minimising the number of stockpiles and the time they are exposed e. locating stockpiles where they will be least susceptible to wind erosion f. constructing stockpiles slopes no greater than 2:1 (horizontal to vertical) g. finishing and contouring stockpiles located on a floodplain to minimise loss of material in a flood or rainfall event h. use of water sprays as required for material transfer operations and quarry activities (e.g., drilling rock, crushing and screening) i. restricting vehicle speeds to 20 km/h near sensitive areas such as dwellings j. site-specific dust control measures for dust producing activities k. monitoring of forecast and real time local wind parameters (e.g., wind speed, wind direction) and adjustment of dust generating activities, as required, to reduce impact to sensitive receptors l. ensure the area of cleared land is minimised during the drier months of the year, when potential for dust generation is at its greatest m. ensuring that smooth surfaces are deep ripped and left rough and cloddy to reduce the wind velocity at the soil surface n. constructing wind fences wherever appropriate, e.g., installing shade cloth as a wind break o. stabilising stockpiles and batters that will remain bare for more than 28 days by covering with mulch or anchored fabrics or seeding with sterile grass p. rehabilitation and revegetation of inactive stockpiles and disturbed areas to reduce wind erosion q. selection of equipment, e.g., concrete batching plants, which have integrated best practice dust control features r. regular visual monitoring of dust, with results recorded in a dust management database s. regular monitoring of the effectiveness of dust control measures. If dust controls are found to be ineffective, these would be reviewed (internally and/or by an external dust specialist, if required) and amended as necessary t. contingency measures where dust plumes are identified during visual monitoring and/ or the project receives dust related complaints u. dust management training would be undertaken for construction workforce as part of the site-specific induction, outlining controls to be implemented during construction to manage potential air quality impacts v. procedures for monitoring of weather (e.g., wind speed, wind direction) and triggers to adjust dust generating activities w. complaint investigation and response plan x. procedures for reporting the project's performance against regulatory limits.	AQ02

Air quality and greenhouse gas impacts	Project phase	Management measures	Number
	Operation	**Operations Environmental Management Plan - Air quality management** 1. Prior to the commencement of operation, develop and implement measures to avoid and minimise operational dust impacts in accordance with the general environmental duty. These will include but not be limited to: a. limiting the extent of cleared areas of vegetation, to the extent practicable, to reduce the potential for dust arising from wind erosion effects b. inspecting and maintaining unsealed access tracks c. reviewing meteorological and ambient air quality conditions and planning activities accordingly. 2. These measures will be documented in the Operational Environmental Management Plan (EMM09).	AQ03
	Decommissioning	**Decommissioning Plan** 1. Prior to commencement of decommissioning, develop and implement a Decommissioning Plan to minimise the risk of harm from decommissioning activities, so far as reasonably practicable. This plan would outline mitigation measures for managing potential environmental impacts associated with decommissioning works, and would include relevant sub-plans such as a: a. Traffic Management Plan that specifies measures to manage traffic impacts associated with removing the turbine(s) and associated infrastructure from the site b. Noise and Vibration Management Plan for decommissioning related works c. Dust Management Plan. 2. Development of the Decommissioning Plan and engagement with statutory authorities will be undertaken and be guided by the relevant legislation of the day.	EMM10
Vehicle emissions impact air quality	Construction Operation Decommissioning	**Vehicle emissions and equipment maintenance** 1. Maintain and service vehicles, plant and equipment in accordance with manufacturer specifications to ensure they operate in a proper and efficient manner. Where possible, vehicles, plant and equipment will be switched off when not in-use.	AQ04
Cumulative impacts (spatial and/or temporal) from other nearby projects	Construction Operation Decommissioning	**Cumulative impact management** 1. Prior to the commencement of construction, plan and co-ordinate project works with Mt Fyans Wind Farm, Mortlake Turn-In Project and Mortlake Energy Hub, as well as any other relevant projects so that cumulative impacts at sensitive receptors are avoided to the extent possible.	AQ05

Air quality and greenhouse gas impacts	Project phase	Management measures	Number
GHG emissions			
Construction and operations GHG emissions	Construction Operation	**Sustainability Management Plan** 1. Prior to the commencement of construction and operation, develop and implement sustainability targets and specify ratings to reduce construction and operations greenhouse gas emissions from a 'business as usual' benchmark. 2. To aid in achieving the targets, ensure contractors develop and implement a Sustainability Management Plan that contains measures to meet the sustainability targets and specified ratings, and includes the requirement to monitor and report on the progress of achieving the sustainability targets and implementation of the Sustainability Management Plan. 3. The operational Sustainability Management Plan will include measures to track and manage SF_6 utilisation and also include a leak detection and repair (LDAR) strategy to effectively detect and rapidly manage any SF_6 spills.	GHG1
GHG emission impacts of materials and energy consumption	Construction Operation	**Sustainable design practices** 1. Prior to the commencement of construction, consider the selection of materials in detailed design, and monitor and report energy and carbon use during construction, to reduce greenhouse gas emission impacts of materials and energy consumption as far as practicable. 2. During the design and procurement process, review and where feasible adopt innovative technologies and the use of sustainable design practices and renewable energy sources during construction. 3. Ensure vendors review, and where reasonable and feasible implement alternatives which avoid or otherwise minimise SF_6 utilisation. 4. Investigate, document and implement opportunities to use renewable energy sources during construction 5. Integrate sustainable design practices into the design process to minimise, to the extent practicable, greenhouse gas emissions arising from construction, operations and maintenance of the project in line with the ratings and targets developed as part of the Sustainability Management Plan.	GHG2
	Operation	**Battery Energy Storage System operation** 1. Review battery energy storage system operations to ensure the most efficient (and low carbon) usage of energy and adopt recommendations where practicable.	GHG3
	Decommissioning	**Materials recycling** 1. Prior to the commencement of decommissioning, explore opportunities to recycle steel, concrete and other materials as an alternative to sending the material to landfill, and implement where practicable.	GHG4

16.7.4 Residual impacts

Air quality

Dust during construction

With the implementation of a site-specific Air Quality Management Plan (a sub-plan of the Construction Environmental Management Plan) (EMM AQ03), it is expected that residual impacts of dust during construction would be reduced to moderate, with air quality impacts anticipated to be very unlikely and only occurring on rare occasions, such as during inclement weather (see Table 16.4). Dust concentrations at surrounding receptors are expected to remain within the range of values already likely experienced during natural fluctuations and variations in existing background conditions (i.e., imperceptible from existing conditions).

Dust during operation and decommissioning

Measures outlined in EMM AQ04 would be implemented to avoid and mitigate dust impacts during operation. With the implementation of these measures, residual impacts during operation are expected to be negligible.

A Decommissioning Plan would apply to the decommissioning phase of the project. This plan would be developed by the operator and would include a sub-plan for the management of dust during decommissioning works (EMM AQ05). With the implementation of these measures, residual impacts during decommissioning are expected to be low.

Vehicle emissions during construction, operation and decommissioning

In accordance with EMM AQ06, routine servicing and maintenance of vehicles, plant and equipment would be completed to ensure they operate in a proper and efficient manner. Given the relatively minor nature of potential exhaust emissions from these sources and the separation distances to sensitive receivers, impacts from these emissions are not expected. With the implementation of recommended management measures, residual impacts associated with vehicle, plant and equipment emissions during construction, operation and decommissioning are expected to be negligible.

GHG emissions

GHG emissions during construction

Mitigation measures will assist in reducing the overall emissions during construction. However, due to the extent of construction related emissions, the majority of emissions will remain, and the residual rating is considered moderate. The operation of the project will take approximately six months to pay back the construction related emissions. The residual impact is considered minor.

GHG emissions during operation

Mitigation measures will assist in reducing the overall emissions during operation. However, due to the nature of operation related emissions, the majority of emissions will remain although these will decrease as the grid continues to undergo decarbonisation. The residual rating is considered moderate to negligible.

GHG emissions during decommissioning

Decommissioning emissions would likely be similar to construction emissions, without the embedded emissions or land clearing.

Mitigation measures will assist in reducing the overall emissions during decommissioning. However, due to the extent of decommissioning related emissions, the majority of emissions are expected to remain, and the residual rating is considered minor.

16.7.5 Cumulative impacts

A cumulative impact assessment considers the impacts of a project together with the impacts of other relevant projects that may interact spatially and temporally to change the level of impact.

Air quality

Cumulative air quality impacts may arise from the interaction of construction, operational and decommissioning project activities and other current and proposed developments, activities, land uses and projects in the area. When considered in isolation, specific project impacts may be considered minor. However, impacts may be more substantial when potential impacts of multiple projects on the same receptors are considered.

Cumulative impacts associated with the proposed Mt Fyans Wind Farm and approved Woolsthorpe Wind Farm were considered possible during construction; however impacts are not likely given the distance of these projects to the Hexham Wind Farm project site (around five kilometres and 15 kilometres away from the project site, respectively).

The Mortlake Turn-In Project (expected to be completed in 2025) would involve the connection of a second 500-kilovolt line to the Mortlake Terminal Station at Mortlake Power Station. Given the temporal and spatial relationship to the Hexham Wind Farm project, there is potential for cumulative nuisance dust impacts during construction.

Mortlake Energy Hub, a large-scale battery energy storage system and solar project adjacent to Mortlake Power Station and the Mortlake Turn-In Project, is expected to be commissioned late in 2026. There may be a temporal and spatial relationship between the Mortlake Energy Hub Project and the Hexham Wind Farm project. As such, there is potential for cumulative nuisance dust impacts during construction.

Cumulative residual air quality impacts at surrounding sensitive receptors would depend on the timings and sequencing of the Hexham Wind Farm project and these nearby projects. Coordination with the Mortlake Turn-In Project and Mortlake Energy Hub Project is recommended to avoid circumstances where the same sensitive receptors are jointly affected (EMM AQ07). With this planning and coordination, it is expected that residual cumulative impacts would be low.

GHG cumulative emissions

The project will result in a cumulative impact in the context of Victorian, Australian and global GHG emissions by adding additional GHG emissions (mostly related to construction). However, the project is also contributing to the reduction in GHG emissions by providing a renewable source of energy. The project will assist in achieving the targets of the Victorian *Climate Change Act 2017* and Australia's 2030 Emissions Reduction Target.

16.7.6 Impact assessment summary

A summary of the air quality and GHG impact assessments is provided in Table 16.13 below.

Table 16.13 Air quality and GHG impact assessment summary

Impact pathway	Project phase	Mitigation and management	Likely effect (magnitude, extent and duration)	Significance rating and justification
Air quality				
Dust from concrete batching plants	Construction	Controls through design and operation [EMM AQ01]	Dust impacts are considered very unlikely and may only occur on rare occasions such as when background conditions are elevated and/or during inclement weather.	**Moderate** With the implementation of recommended management measures, residual impacts of dust from project activities during construction would be reduced to the extent reasonably practicable.
Dust from quarry site (blasting)	Construction	Quarry Management Plan [EMM07]		
Dust from other project activities	Construction	Construction Environmental Management Plan, including an air quality management sub-plan [EMM AQ02]		
Dust from other project activities	Operation, decommissioning	Measures to avoid and minimise dust impacts during operation, as per the Operations Environmental Management Plan [EMM AQ03] Decommissioning Plan, including a sub-plan for the management of dust during decommissioning works [EMM10]	Limited dust may arise during operations and decommissioning.	**Low** With the implementation of mitigation and management measures, impacts during operations and decommissioning are not expected.
Vehicle emissions	Construction, operation, decommissioning	Vehicle and equipment maintenance and efficient operation [EMM AQ04]	Vehicles may discharge products of fuel combustion into the air including nitrogen oxides, carbon monoxide, sulfur dioxide, and fine particulates. Products of combustion from construction vehicles can also give rise to odour, if not well maintained.	**Low** Given the relatively minor nature of potential exhaust emissions from these sources and the separation distances to sensitive receivers, impacts from these emissions are not expected.
Cumulative impacts (spatial and/or temporal) from other nearby projects	Construction, operation, decommissioning	Planning and co-ordination to avoid impacting the same sensitive receptors [EMM AQ05]	The potential for cumulative air quality related impacts were considered for Mt Fyans Wind Farm, Mortlake Turn-In Project and Mortlake Energy Hub. It is expected that residual cumulative impacts are not likely.	**Low** Cumulative impacts are unlikely and may only occur on very rare occasions during exceptional circumstances.

Impact pathway	Project phase	Mitigation and management	Likely effect (magnitude, extent and duration)	Significance rating and justification
Greenhouse gas				
Direct emissions (scope 1) and indirect emissions (scope 2) from project activities	Construction, operation and decommissioning	Sustainability Management Plan (GHG1) Sustainable design practices (GHG2)	Mitigation measures will assist in reducing the overall emissions during construction, operation and decommissioning. However, due to the extent of project emissions, the majority of emissions will remain. The operation of the project will take approximately half a year to pay back the construction related emissions.	Moderate While the mitigation measures may assist in reducing the overall construction, operation and decommissioning emissions, due to the amount of predicted emissions, mitigation is highly unlikely to reduce emissions to below the 25,000 t CO_2e annual emissions threshold required to drop the impact to low. Decommissioning emissions would likely be similar to construction emissions, without the embedded emissions or land clearing.
Other indirect emissions (scope 3) associated with embedded emissions	Construction, operation and decommissioning	Sustainability Management Plan (GHG1) Sustainable design practices (GHG2)		

16.8 Conclusion

The ***Air Quality Impact Assessment*** and ***Greenhouse Gas Impact Assessment*** were undertaken to support the EES for the project.

A site-specific air quality management plan will identify potential and existing dust sources and outline best practice design controls and management practices to minimise dust. The final Quarry Work Plan would contain measures for the control of emissions of dust or other particulates from the quarry work authority area during construction and operation of the quarry. With the implementation of recommended management measures, it is expected that residual impacts of dust during construction would be moderate (i.e., air quality impacts very unlikely and only occurring on rare occasions)

Impacts to sensitive receptors from dust during operation and exhaust emissions during construction, operation and decommissioning are not expected. Dust impacts during project decommissioning are expected to be less than what is expected during construction. Impacts would need to be reviewed and managed in the context of the legislative and policy requirements in-force at the time of decommissioning. With the implementation of recommended management measures, the potential impact to air quality for nearby sensitive receptors due to dust during operation and decommissioning, and exhaust emissions during all project phases, is considered to be low.

A Sustainability Management Plan, containing measures to meet the sustainability targets and specified ratings, would be developed and implemented to manage construction and operation GHG emissions. The management measures also include the requirement to consider the selection of materials in the detailed design and monitor and report energy and carbon use during construction to reduce GHG emission impacts associated with materials and energy consumption, as far as practicable. While proposed the mitigation measures may assist in reducing the overall construction, operation and decommissioning emissions, the residual rating is considered moderate due to the extent of operation related emissions. However, the project will have a positive GHG contribution and has minimised the risks associated with its GHG emissions so far as reasonably practicable.