13 Air quality and greenhouse gas

Tables

Figures

13.1 OVERVIEW

This chapter provides an assessment of potential air quality and greenhouse gas impacts associated with the construction and operation of the Mordialloc Bypass (Freeway) (the project). It is based on the Air Quality Impact Assessment prepared by Consulting Environmental Engineers and presented in Appendix F: *Air quality impact assessment,* and on the Greenhouse Gas Impact Assessment prepared by WSP and presented in Appendix G: *Greenhouse gas impact assessment*.

Activities associated with construction and operation of the project have the potential to result in air quality impacts on nearby sensitive receptors, such as residences. To assess the likelihood of these air quality impacts emissions to air during construction and operation were modelled, as summarised below.

There is potential for air quality impacts during construction from dust caused by construction activities which is predicted to be greatest during roadway and embankment formation and laying of the pavement base. Dispersion modelling indicates that dust is expected to be contained within 60m of the project boundary on normal days and within 100m during hot, dry days with strong winds. The extent and severity of adverse effects on sensitive receptors could be minimised by implementing the management measures recommended in Section 13.9: *Environmental Performance Requirements*.

The route of the project would cross a former landfill site just south of Dingley Bypass. Construction of the project would involve laying a thick layer of coarse gravel on the site and using piles driven through the landfill into the soil below. The potential odour impact from the release of hydrogen sulphide and other odorous gases during the piling works has been qualitatively assessed with reference to gas monitoring well data to determine the appropriate risk level and mitigation. Odour is not expected to be a concern due to the low emission rate of hydrogen sulphide, low odorous gas concentrations recorded on site and the distance (over 300m) to the nearest sensitive receptors. An assessment of landfill gas is presented in Chapter 18: *Soils and contaminated land.*

Vehicle emissions modelling was undertaken to assess air quality impacts from traffic using the bypass during operation. The pollutants modelled were:

- carbon monoxide
- nitrogen dioxide
- particulate matter (PM_{10} and $PM_{2.5}$).

PARTICULATE MATTER (PM)

Particulate matter (PM): The sum of all solid and liquid particles suspended in air, many of which are hazardous. This complex mixture includes both organic and inorganic particles, such as dust, pollen, soot, smoke, and liquid droplets. Two particle sizes of interest for this project are PM_{10} and $PM_{2.5}$.

PM_{10}: 'Coarse particles' are those between 10 and 2.5 micrometres (µm) in diameter.

$PM_{2.5}$: 'Fine particles' are those with a diameter of 2.5µm ($PM_{2.5}$) or less. Particles that are smaller than 0.1µm are called ultrafine particles. Being smaller, $PM_{2.5}$ particles can be transported further and persist for longer in the atmosphere.

Carbon monoxide and PM (PM_{10} and $PM_{2.5}$) are expected to have minor to negligible air quality impacts and are predicted to be below the relevant State Environment Protection Policy (SEPP) Air Quality Management (AQM) design criteria. Nitrogen dioxide concentrations are predicted to increase above existing background levels, up to 20m from the roadway. However, beyond 20m of the roadway, NO_2 concentrations are below the SEPP (AQM) design criterion and no residential or commercial receptors would be adversely affected.

Greenhouse gases would be released during construction and operation of the project, including from construction traffic and equipment, vehicles using the new road network when operational and for maintenance, and through the manufacturing and transportation of construction materials and generation of electricity for operational lighting. Greenhouse gas emissions from project construction activities are not considered a significant project risk under the thresholds of the National Greenhouse and Energy Reporting (NGER) Scheme.

Greenhouse gas emissions during operations would be 0.96kT of CO_2-e per year, with most of these emissions attributable to electricity consumption for road lighting. This is below the NGER Scheme reporting threshold and is considered of very low significance to transport emissions in Victoria. Further, fuel efficiencies from increased traffic speeds and reduced congestion as a result of the project are expected to reduce, greenhouse gas emissions from traffic, delivering a saving of 13kT of CO_2 -e annually. Therefore the project would positively contribute to a reduction in Victoria's annual greenhouse gas emissions.

13.2 EES OBJECTIVES AND REQUIREMENTS

The draft evaluation objective for air quality and greenhouse gas emissions is defined in the *Scoping Requirements for the Mordialloc Bypass Environment Effects Statement* (scoping requirements) (DELWP 2018).

Table 13.1 summarises key issues relating to air quality and greenhouse gas emissions as identified in the scoping requirements. It should be noted that this chapter only addresses requirements related to air quality and greenhouse gas emissions. Noise and vibration impacts are addressed in Chapter 12: *Noise and vibration effects* of this EES. Effects on amenity are considered in Chapter 9: *Land use and planning* and Chapter 11: *Landscape and visual effects*.

DRAFT EVALUATION OBJECTIVE

To protect the health and wellbeing of residents and local communities, and minimise effects on air quality, noise and the social amenity of the area, having regard to relevant limits, targets or standards.

Table 13.1 EES key issues – air quality and greenhouse gas emissions

Key issues
Potential for dust emissions resulting from construction works and activities.
Potential for increased vehicle traffic to affect local air quality adversely due to exposure to vehicle emissions.
Potential for increased emissions of greenhouse gases to result from the project.

13.3 LEGISLATION AND POLICY

The relevant legislation and policy relating to assessing impacts on air quality and greenhouse gas emissions are summarised in Table 13.2.

Table 13.2 Legislation and policies – air quality and greenhouse gas

Legislation/Policy	**Description**
Commonwealth:	
National Greenhouse and Energy Reporting Act 2007 (NGER Act)	Outlines the national reporting framework for corporations and facilities required to report their energy use and greenhouse gas emissions. Under the Act, a controlling corporation is the entity that has operational control. Controlling corporations that exceed the following thresholds are required to report their energy and greenhouse gas emissions under the Act: • For facilities, consumption of more than 100 terajoules (TJ) of energy annually or emission of more than 25,000 tonnes of CO_2-e annually. • For corporations, consumption of more than 200TJ of energy annually or emissions of more than 50,000 tonnes of CO_2-e annually. A road is considered a facility for the purpose of this assessment.
National Greenhouse and Energy Reporting Regulations 2008 (NGER Regulations)	The NGER Regulations set out the details that establish compliance rules and procedures for administering the NGER Act.
Greenhouse Gas Assessment Workbook for Road Projects (February 2013)	Published by the Transport Authorities Greenhouse Group (TAGG), the TAGG workbook provides a process for estimating greenhouse gas emissions for major activities of a road project. Provides a common methodology and calculation factors for estimating greenhouse gas emissions using a whole-of-life approach. Developed by a group of Australian state road authorities (including VicRoads) and the New Zealand Transport Agency.

Legislation/Policy	Description
State:	
The Climate Change Act 2017	Sets the legislative foundation to manage climate change risks and drive Victoria's transition to net zero emissions by 2050. The Act embeds a 2050 net zero emissions target and provides for the setting of five-yearly interim greenhouse gas emissions reduction targets, climate change strategies, and adaptation action plans to ensure the 2050 target is achieved. This Act requires climate change to be considered when making specified decisions under the following Victorian legislation: • *Catchment and Land Protection Act 1994* • *Coastal Management Act 1995* • *Environment Protection Act 1970* • *Flora and Fauna Guarantee Act 1988* • *Public Health and Wellbeing Act 2008* • *Water Act 1989.* The Environment Protection Authority (EPA) is required to regulate the potential impacts of climate change and greenhouse gas emissions in relation to Victoria's long-term and interim emissions reduction targets.
Environment Protection Act 1970 (EP Act)	Authorises the EPA Victoria to issue works or other development approvals and licenses to regulate the SEPPs. Under the EP Act, greenhouse gases are defined as a waste.
State Environment Protection Policy – Air Quality Management (SEPP (AQM))	Section 40 of the SEPP (AQM) requires the air quality impacts of large line and area based sources to be assessed, including major new arterial roads. The SEPP AQM requires Victorian road authorities to assess all proposed new and upgraded road projects against a framework of air quality goals and objectives to assist with the protection of Victoria's air environment (EPA, 2001).
Transport Integration Act 2010	Part 2, Division 2, Section 10 of the Act sets out the transport objectives relating to environmental sustainability. '*The transport system should actively contribute to environmental sustainability by:* • *protecting, conserving and improving the natural environment* • *avoiding, minimising and offsetting harm to the local and global environment, including transport-related emissions and contaminant and the loss of biodiversity* • *promoting forms of transport and the use of forms of energy and transport technologies which have the least impact on the natural environment* • *improving the environmental performance of all forms of transport and the forms of energy used in transport.'*
Victoria's Climate Change Framework	Victoria's long-term plan to 2050, with the overarching goal of limiting warming to 1.5°C above pre-industrial levels while safeguarding Victoria's economic competitiveness. The framework contains a 2020 emissions reduction target of 15–20 percent below 2005 levels and achieving net zero emissions by 2050.
Protocol for Environmental Management: Greenhouse Gas Emissions and Energy Efficiency in Industry	Aims to ensure that entities subject to an EPA Victoria works approval or licence manage greenhouse gas emissions and energy associated with their activities. The Protocol stipulates a range of thresholds based on the annual predicted, or actual amounts, of gigajoules of energy used or tonnes of energy-related CO2-e. Where a works approval is required, or a licence is in place under the EP Act and Environmental Protection (Scheduled Premises and Exemption) Regulations and the thresholds are exceeded, the proponent would be required to implement greenhouse gas emissions and energy use reduction best practice and/or complete a Level 2 energy audit as outlined in the protocol.

Legislation/Policy	Description
Local:	
Kingston City Council – Energy Efficiency Strategy (August 2012)	This strategy identified a range of opportunities that will reduce emissions, energy use and energy costs for the Council without compromising on the quality of services delivered to the community. The Council follows the EPA Victoria's Carbon Management Principles tool to improve energy efficiency and avoiding and reducing greenhouse gas emissions. The strategy highlights the need for further greenhouse gas emission auditing to obtain up to date information and enable monitoring of progress.
Greater Dandenong Sustainability Strategy: Towards an environmentally sustainable city 2016-2030	Sets out the vision for Greater Dandenong to be 'one of the most sustainable cities in Australia by 2030'. The Council set out a 'whole of organisation' approach where sustainability forms the basis for the Council's operations and the strategy sets out a framework on how to achieve the vision and shape the plans for the region. Ten specific themes were identified, and goals associated with them created in the strategy. These include an Environmental Pollution theme with a goal for 'a clean and healthy city'. The corporate objectives include 'minimise sources of air pollution from Council's operations and facilities' and community objectives include 'work with the community to improve air quality across the city'.

13.4 METHODOLOGY

The aim of the assessment is to describe the existing air quality and greenhouse gas conditions and identify the potential effects of the project on local and regional air quality. The methodology for construction and operational assessments is outlined in the following sections.

The assessment objectives were to:

- identify air quality and greenhouse gas risks, including any cumulative impacts that may result from the development of the project
- obtain background air quality data and greenhouse gas data from existing sources to establish current levels
- assess the potential for change in air quality and greenhouse gas emissions during the construction and operation of the project, compared to a "without project" scenario
- recommend mitigation measures and/or EPRs to minimise, manage or avoid impacts on air quality and greenhouse gas, where required
- determine residual risk ratings following implementation of additional controls.

The air quality and greenhouse gas assessment encompassed four separate assessments:

- construction dust assessment
- landfill odour assessment
- operation vehicle emissions assessment
- greenhouse gas assessment.

13.4.1 Construction dust assessment

The assessment of potential impacts from dust emissions during construction involved:

- establishing the volume of excavation and fill for each section of the route
- establishing the construction period (two years)
- estimating the type, number and characteristics of construction equipment
- estimating dust emissions from the operation of construction equipment using published information
- modelling the transport and dispersion of dust at ground level as total suspended particles (TSP) and as PM_{10} using the Ausroads model (during construction) in accordance with the requirements of Schedule C of *State Environment Protection Policy – Air Quality Management* (SEPP (AQM))
- plotting the PM_{10} and dust (as TSP) concentrations during construction activities
- comparing the predicted levels to SEPP (AQM) design criteria (design criteria) and assessing impacts.

13.4.2 Landfill odour assessment

The former landfill site lies within the path of the project approximately 200m south of Dingley Bypass (Figure 13.1). Potential air and odorous emissions from the landfill were assessed, including carbon monoxide, methane and hydrogen sulphide.

The emissions of selected pollutants were estimated by reviewing survey data from monitoring wells on and adjacent to the site and through modelling of the methane emissions using LandGEM. A qualitative assessment of the potential odour impacts on sensitive receptors in the surrounds was completed based on the available monitoring information, the previously mentioned modelling, meteorological data for the locality and proximity of receptors.

13.4.3 Vehicle emissions assessment

The detailed impact assessment for operational vehicle emissions was based on the predicted volume of traffic using each section of the proposed project route, including on and off ramps and the predicted vehicle emissions.

Vehicle emissions were modelled using the Ausroads dispersion model. Concentrations at various distances on each side of the route were developed for the 99.9 percentile hour as required in the SEPP (AQM).

Hourly meteorological data for 2012–2017 for the dispersion model was obtained from nearby Moorabbin Airport.

Background air quality concentrations were derived from the records of monitoring stations maintained by the EPA within the project vicinity. Predictions were made for the following pollutants:

- carbon monoxide (CO)
- nitrogen dioxide (NO_2)
- PM_{10}
- $PM_{2.5}$.

The existing and predicted air quality concentrations for the pollutants listed above were assessed against design criteria, as listed in Table 13.3.

Table 13.3 SEPP (AQM) design criteria concentrations (1-hour averaging period)

Pollutant	1-hour design criteria (µg/m^3)
Carbon monoxide (CO)	29,000
Nitrogen dioxide (NO_2)	190
Particulate matter ($PM_{2.5}$)	50
Particulate matter (PM_{10})	80
Total suspended particles (TSP)	180

Figure 13.1 Location of former landfill in the northern portion of the alignment

13.4.4 Greenhouse gas assessment

The methodology for the greenhouse gas impact assessment involved:

- establishing project context, including review of the design, legislation and policy documents
- calculating the greenhouse gas impact for constructing and operating the project compared to the pre-project scenario
- developing potential requirements to control and mitigate project-related greenhouse gas emissions.

Emission sources to be included in the assessment were determined from the Reference Design.

A materiality checklist from the Carbon Gauge Calculator (TAGG, 2013) was completed to assist in determining whether an emission source should be included within the assessment boundary. From this, the greenhouse gas assessment boundaries were determined to include all Scope 1 and Scope 2 greenhouse gas emission sources, as well as select Scope 3 greenhouse gas emission sources.

EMISSION SOURCES – SCOPE 1, 2 AND 3

Scope 1 emissions: direct emissions from owned or controlled sources. A project example would be emissions from construction machinery.

Scope 2 emissions: emissions from the indirect consumption of an energy commodity. A project example would be emissions from the generation of electricity purchased to power street lights along the project.

Scope 3 emissions: all indirect emissions not included in Scope 2 that would occur as a result of the project, but from sources not owned or controlled. A project example would be emissions from the vehicles that would use the bypass once constructed.

Table 13.4 provides a summary of construction and operational greenhouse gas emissions sources assessed.

Table 13.4 Construction, operation and maintenance emission sources assessed

Emission source category	Emission source	Scope 1 – Direct emissions	Scope 2 – Indirect emissions	Scope 3 – Downstream emissions
Construction				
Fuel use	Mobile construction equipment	✓		✓
	Site vehicles	✓		✓
	Delivery of plant, equipment and construction materials			✓
	Electricity used to power construction plant (road headers, lighting towers etc.) and site offices	✓		✓
Electricity consumption	Spoil and waste removal		✓	✓
Vegetation removal	Clearance of vegetation because of the project	✓		
Materials	Embodied energy of construction materials			✓
Operation and maintenance				
Electricity consumption	Electricity used to power lighting of road		✓	✓
Fuel use	Operational road use by light and heavy vehicles			✓
	Mobile construction equipment used for maintenance activities	✓		✓
Materials	Materials used for maintenance activities			✓

Greenhouse gas emissions from the construction and operation (including maintenance) of the project were estimated using two calculation methodologies. The primary methodology was the use of the Carbon Gauge calculator, while Scope 3 emissions from operational vehicles using the bypass were estimated manually using Microsoft Excel.

The impact of the project on greenhouse gas emissions from vehicle traffic (Scope 3), was assessed using a series of impact calculations to predicted fuel consumption of vehicles for the year 2031 under the "without project" and "with project" scenarios for the following:

- Major route 1 – Thompson Rd – Boundary Road – Dingley Bypass
- Major route 2 – Thompson Road – Springvale Road -Dingley Bypass
- Victorian Integrated Transport Model (VITM) – A model of the entire Victorian transport system that can account for net impacts across the wider road network.

An environmental risk assessment (ERA) was undertaken to identify key environmental issues associated with the construction and operation of the project. The methodology for the risk assessment has been described in Chapter 4: *EES assessment framework and approach*. The results of the risk assessment process are discussed in Section 13.7 *Risk assessment.*

13.5 STUDY AREA

No specific study area has been defined for the air quality and greenhouse gas emissions impact assessment, however Section 13.6.3 provides further details on the sensitive receptors identified. The study area includes the project area defined in Chapter 6: *Project description* and surrounds.

13.6 EXISTING CONDITIONS

13.6.1 Local climate

Climate and weather influence the generation and the dispersion of dust and vehicle emissions. For example, dust generation and dispersal is highest on hot days with gusty winds. Local climate data was collected from the Bureau of Meteorology (BoM) monitoring station at Moorabbin Airport and used in the modelling and assessment of air quality impacts.

Air temperature

Mean daily maximum air temperatures are generally below 20°C (degrees centigrade) from April to October and above 20°C for the remainder of the year.

Rainfall

Figure 13.2 shows that rainfall recorded at Moorabbin Airport is reasonably evenly distributed over the year, apart from during summer (January to March) when rainfall decreases.

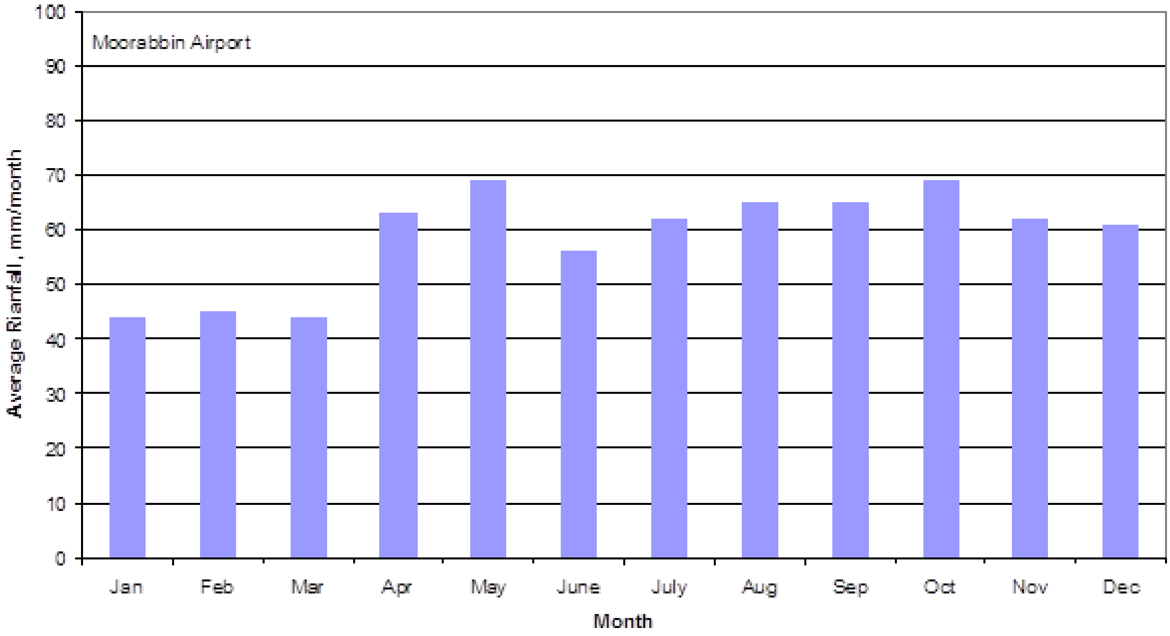


Figure 13.2 Monthly rainfall at Moorabbin Airport

Significant variability in the pattern of annual rainfall and the total rainfall was recorded at Moorabbin Airport from 1971 to 2017. In addition to the year-to-year variation in rainfall, longer-term patterns are observable with sequences of wet years and sequences of mostly dry years (droughts).

Wind

Figure 13.3 shows the wind rose from Moorabbin Airport for the last five years. A wind rose shows the frequency of occurrence of wind speed and direction at a given location. The median annual wind speed in the area averages 4.4 metres per second (m/s) recorded for the previous five years of meteorological data from Moorabbin Airport, which reflects the largely flat open terrain in the area with no hills or other major obstacles to the path of the winds. Wind direction is predominantly from the north or south-west, with only a small proportion of wind from the north-east and east.

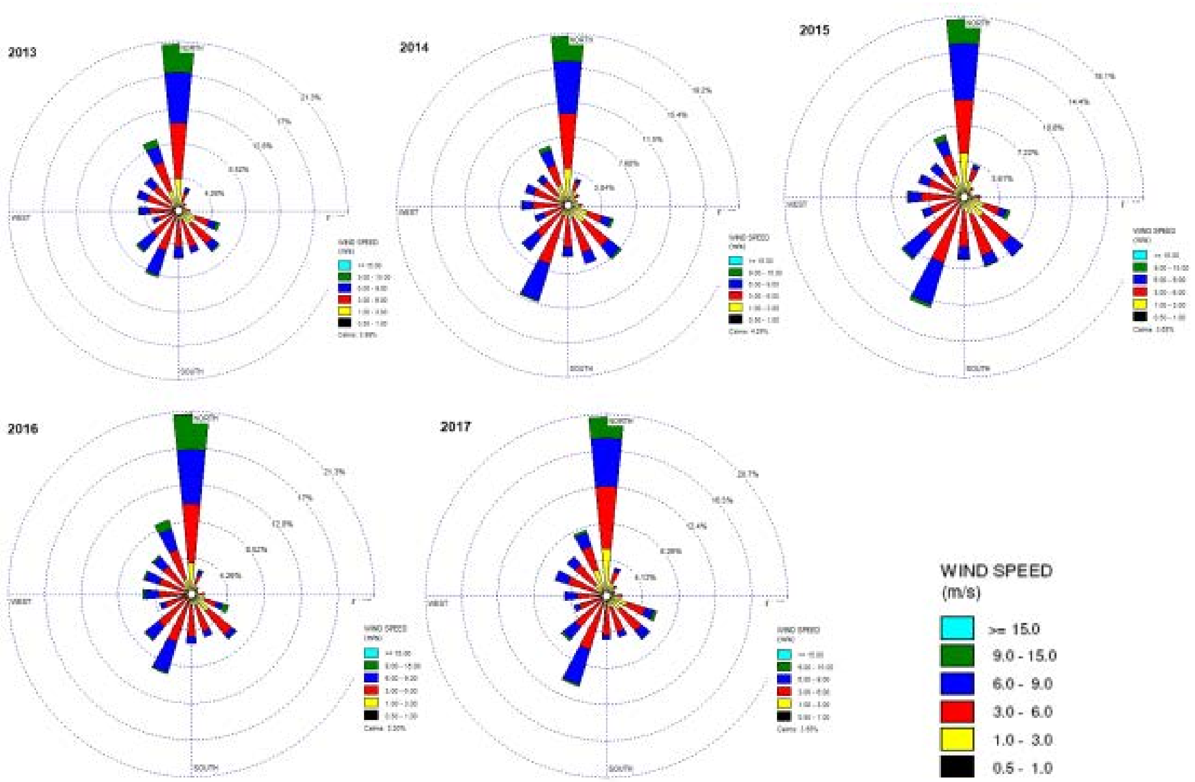


Figure 13.3 Wind roses for annual wind data at Moorabbin Airport

13.6.2 Background air quality

Background air quality was derived from monitoring station records maintained by the EPA, located mainly at Brighton. Table 13.5 summarises the background concentrations used for the assessment.

Table 13.5 Background concentrations (1-hour averaging period)

Pollutant	1-hour background concentration (µg/m^3)
Carbon monoxide (CO)	870
Nitrogen dioxide (NO_2)	48
Particulate matter ($PM_{2.5}$)	9
Particulate matter (PM_{10})	20

13.6.3 Sensitive receptors

Sensitive receptors were identified based on the Reference Design and the land use adjacent to the project.

SENSITIVE RECEPTORS

People or places that may be impacted by air emissions. Examples of sensitive locations include *'hospitals, schools or residences'* (EPA 2001).

SENSITIVE LAND USE

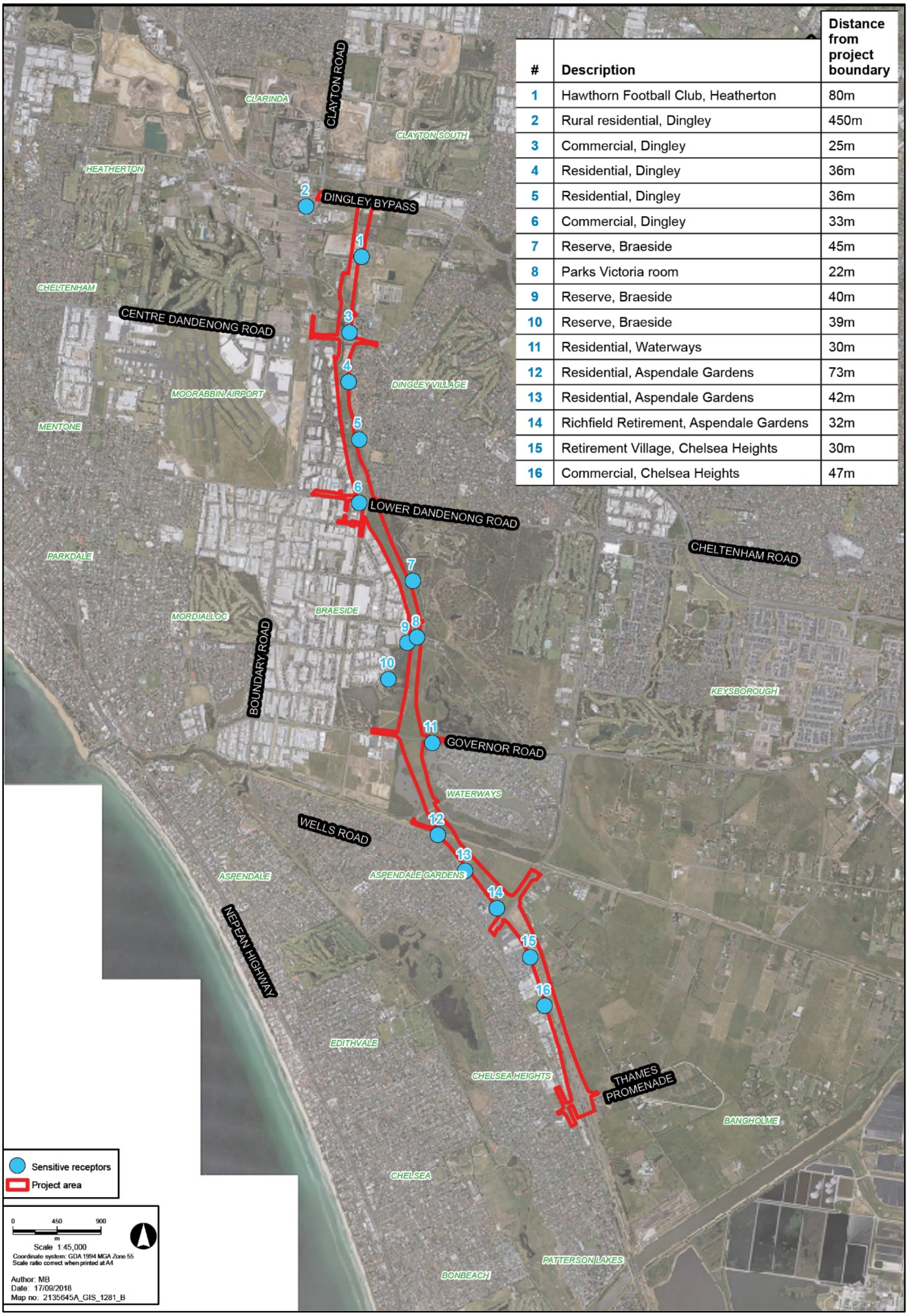
A sensitive land use is *'any land uses which require a focus on protecting the beneficial uses of the air environment relating to human health and wellbeing, local amenity and aesthetic enjoyment, for example residential premises, childcare centres, pre-schools, primary schools, education centres or informal outdoor recreation sites'* (EPA 2013).

The assessment considered both existing sensitive receptors and future land zoning, where development is yet to occur. As required by the VicRoads screening procedure, the distance from the road to a sensitive receptor is the distance from the closest edge of any trafficked lane and the nearest boundary of the sensitive receptor. Where a sensitive receptor was located within a 50m radius of an intersection, the distance from both roads was considered. Sixteen air quality sensitive receptors were identified for the project, as shown in Figure 13.4.

In addition, an assessment of general receptors near the road corridor was undertaken. The study area was divided into five sub-areas, listed as A to E from north to south. A description of the sub-areas is provided in Table 13.6 along with adjacent land uses and the buffer distances from the project to sensitive receptors in sub-area sections A to E.

Table 13.6 Description of sub-area sections and distances of sensitive receptors from the project

Buffer distances and receptor description – west (m)		Sub-area section	Buffer distances and receptor description – east (m)	
Mostly commercial/rural uses Nearest rural house at 80m	80	A Dingley Bypass to Centre Dandenong Road	80	Mostly commercial/rural uses Football club (proposed)
Redwood Gardens Industrial zone Typical buffer 49m to 60m	45 to 65	B Centre Dandenong Road to Lower Dandenong Road	35	Mostly residential (Dingley Village)
			45	Chadwick Reserve
Generally industrial/commercial uses Typical buffer 40m to 70m Minimum buffer of 25m	40 to 70	C Lower Dandenong Road to Governor Road	45 to 50	Braeside Park and wetlands
Wetlands/residential/open space Typical buffer 40m to 70m Minimum buffer of 25m Retirement village buffer of 83m	40 to 70	D Governor Road to Springvale Road		Mostly open space/wetlands/ residential
Commercial/retirement village Retirement village buffer of 35m from project and 22m from Mornington Peninsula	90		140	Residential
Commercial/retirement village (Chelsea Heights)	81	E Springvale Road to Thames Promenade	60	Mostly open space



#	Description	Distance from project boundary
1	Hawthorn Football Club, Heatherton	80m
2	Rural residential, Dingley	450m
3	Commercial, Dingley	25m
4	Residential, Dingley	36m
5	Residential, Dingley	36m
6	Commercial, Dingley	33m
7	Reserve, Braeside	45m
8	Parks Victoria room	22m
9	Reserve, Braeside	40m
10	Reserve, Braeside	39m
11	Residential, Waterways	30m
12	Residential, Aspendale Gardens	73m
13	Residential, Aspendale Gardens	42m
14	Richfield Retirement, Aspendale Gardens	32m
15	Retirement Village, Chelsea Heights	30m
16	Commercial, Chelsea Heights	47m

Figure 13.4 Air quality sensitive receptors

13.7 RISK ASSESSMENT

An ERA was undertaken to identify environmental risks associated with the construction and operation of the project. Where initial risks were rated as 'medium' or higher (with standard controls in place) these issues were further assessed and investigated in the Air Quality Impact Assessment and Greenhouse Gas Impact Assessment Reports. Where necessary, additional controls were identified as part of the Impact Assessment to reduce the identified risks to acceptable levels. These controls have been incorporated into the environmental performance requirements (EPRs) for the project. The initial risks were then re-assessed following application of the environmental performance requirements to derive the residual risk ratings. The methodology for the risk assessment has been described in Chapter 4: *EES assessment framework and approach*.

The risk assessment identified a range of potential air quality and greenhouse gas impacts, all of which were assessed to be of negligible or low risk to the environment with the application of standard and additional controls and supported by the environmental performance requirements (EPRs). These risks include the potential for construction and operation to produce increased dust and emissions, impacting on sensitive receptors, an increase in greenhouse gases as a result of the project and localised increase in emissions associated with maintenance activities.

A list of all air quality and greenhouse gas related risks (apart from those considered 'negligible') are provided in Table 13.7. Unlike other chapters of this EES, low risks have been included here in consideration of community interest. Full details of the ERA for air quality, including a cumulative risk assessment, are provided in Appendix F: *Air quality impact* assessment, Appendix G: *Greenhouse gas impact assessment* and Attachment I: *Environmental risk assessment report*. Section 13.8 sets out the results of the impact assessment completed to confirm the risk rating.

Table 13.7 Air quality and greenhouse gas risk

Risk	Impact pathway	Primary impact	Project phase	Initial risk rating	EPR ref.	Residual risk rating
R-AQR2	Dust impacts on nearby sensitive receptors during the construction phase	Potential for nuisance and respirable dust to nearby residents during site clearing, topsoil stripping and overburden earthworks, filling and excavation.	C	Low	EM2	Low
R-AQR3	Air emission impacts on nearby sensitive receptors during the construction phase	Increasing gaseous emissions from earthmoving machinery impact on air quality.	C	Low	EM2	Low
R-AQR4	Air emission impacts on nearby sensitive receptors during construction phase	Increasing gaseous emissions from construction machinery impact on air quality.	C	Low	EM2	Low
R-AQR5	Contaminants impact on nearby sensitive receptors during operation	Increased air emissions (particulates, including dust and gaseous products) from the increased vehicle numbers based on wider road section (greater capacity) impact on air quality.	O	Low	AQ1	Low
R-AQR6	Dust impacts on nearby sensitive receptors during operation	Localised air emissions associated with occasional maintenance activities impact on air quality.	O / M	Low	AQ1	Low

Risk	Impact pathway	Primary impact	Project phase	Initial risk rating	EPR ref.	Residual risk rating
R-GHG3	Air quality impacts during construction	Construction activities lead to direct and indirect scope 1, 2 and 3 GHG emissions leading to a significant contribution to State greenhouse gas emission levels.	C	Medium	GG1 GG2	Low
R-GHG4	Air quality impacts during operation	Ongoing use of the road leads to an increase in indirect scope 3 GHG emissions over its design life in comparison to the no project scenario.	O	Low	GG1 GG2	Low

13.8 IMPACT ASSESSMENT AND MITIGATION

13.8.1 Construction

Construction dust (risk R-AQR2)

An assessment of potential dust impacts during the construction of the project was undertaken as part of the Air Quality Impact Assessment by Consulting Environmental Engineers. Results are presented below for TSP and PM which relate to air quality risk R-AQR2.

TOTAL SUSPENDED PARTICULATES (TSP) AND PM_{10}

Peak TSP and PM_{10} concentrations were calculated for the following construction stages:

- clearing and stockpiling of topsoil
- filling and compaction of the base of the road
- pavement and landscaping.

Higher dust concentrations were predicted during filling and compaction activities, because more material would be transported, handled and compacted, and more earthmoving equipment would operate. Subsequent analysis of TSP and PM_{10} levels focused on this stage of construction.

Both TSP and PM_{10} concentrations were modelled using the weather conditions of the two worst (i.e. hottest and windiest) days for erosion and transport of dust using 2013 to 2017 weather data. The concentrations of each year were plotted against the distance from the project. The results are shown in Figure 13.5 and Figure 13.6. The figure shows one side of the road, but the same distribution and impacts would apply to either side of the road depending on the wind direction.

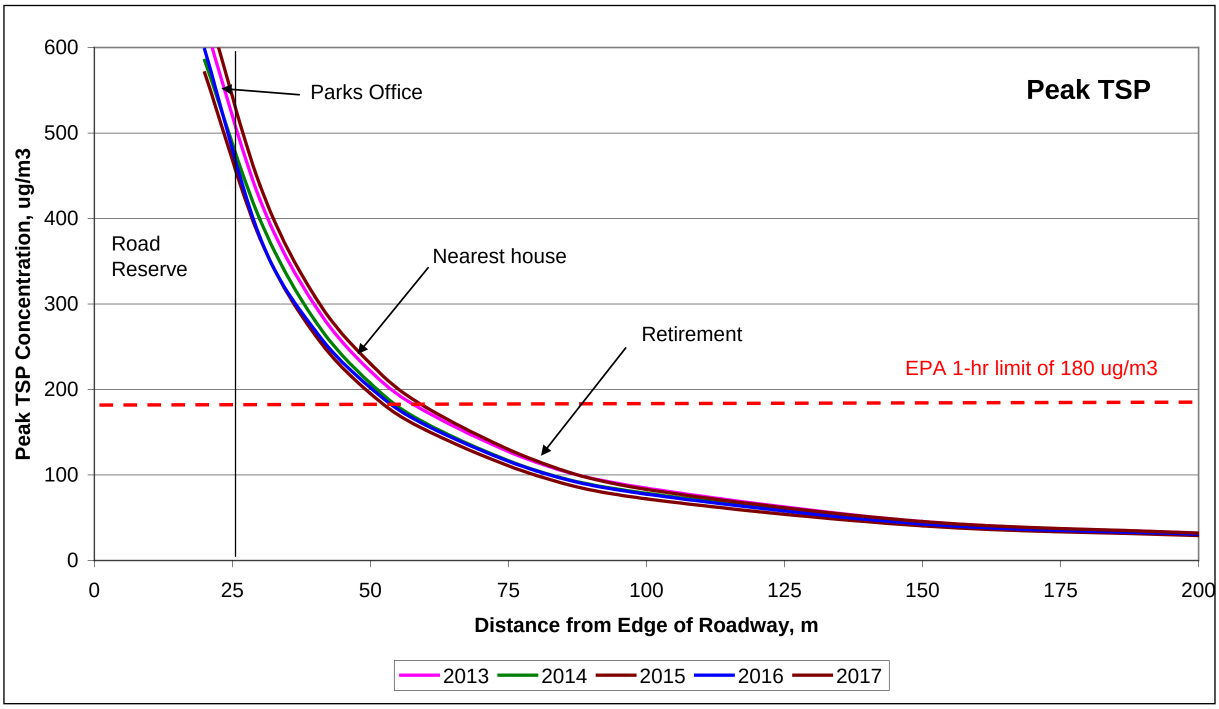


Figure 13.5 Predicted TSP Distribution using the worst two days in years 2013 to 2017

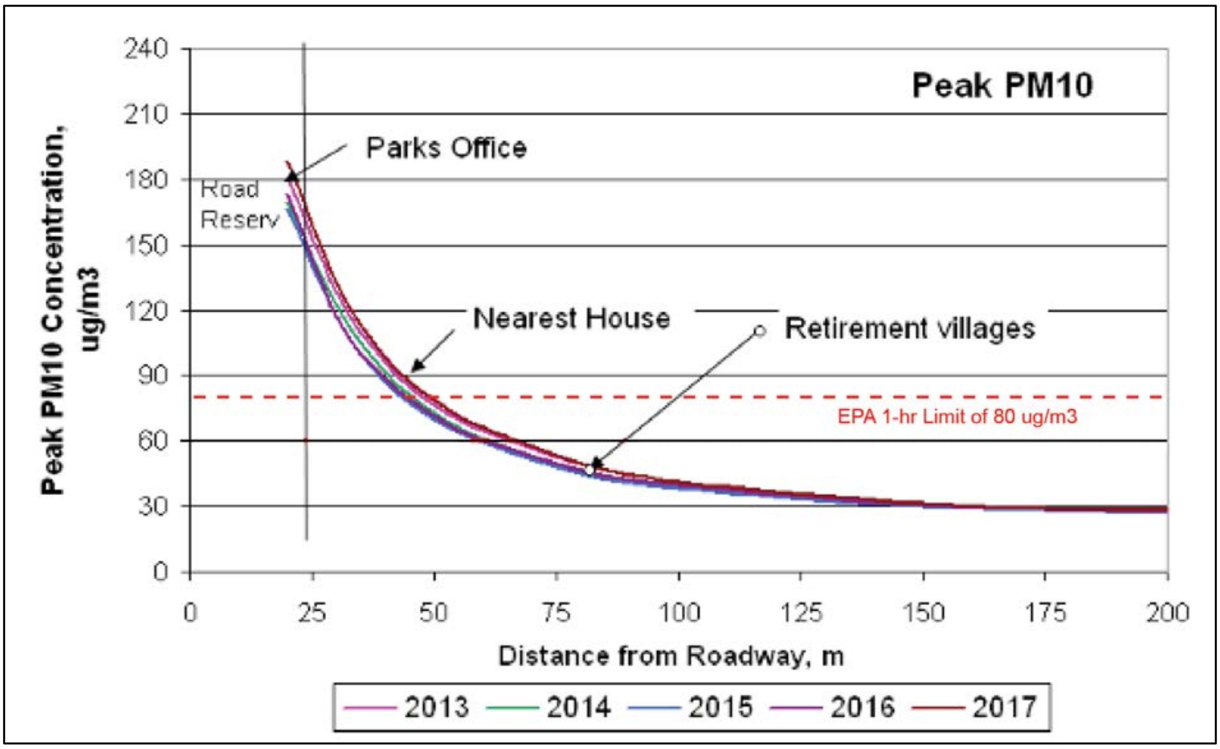


Figure 13.6 Predicted PM_{10} Distribution using the worst two days in years 2013 to 2017

Conclusions for both the TSP and PM_{10} modelling are summarised below:

- Impacts on the two retirement villages would be low as the predicted TSP and PM_{10} concentrations are expected to be below the design criteria.
- Residences located between 60m and 200m from the roadway (about 40m to 180m from the project boundary) would experience low construction dust impacts, within the design criteria. However, they may experience higher dust levels than normal on a few days of peak construction (earthworks) during the program.
- Residences between 50m and 60m distance from the roadway (about 35m to 40m from the project boundary) are predicted to experience elevated TSP levels (dust impacts) on up to 10 days during the construction period (on the worst weather days) unless dust control measures are implemented. Impacted residences include:
  - a long strip of houses in Dingley Village between Centre Dandenong Road and Lower Dandenong Road
  - five houses in Aspendale Gardens
  - a strip of houses in Chelsea Heights near Springvale Road.
- The Parks Victoria office in Braeside Park (including the demountable lunchroom) are predicted to experience high dust levels over short periods, however this would not have a significant impact on rural land, parks, open space or most commercial properties, and would be managed through standard controls within a CEMP and in EPR AQ2 in Section 13.9.

The extent of dust depends on several factors including weather conditions, construction procedures and sequence, and the extent to which standard dust mitigation measures are implemented. On the worst day (hot and windy), nuisance dust could extend for up to 200m from the construction area. In these instances, dust levels would require monitoring at the downwind edge of the construction zone using dust monitors as outlined in the *EPA Victoria Publication 480: Environmental Guidelines for Major Construction Sites* and *VicRoads Contract Specification Section 177* as included in EPR AQ2. In the event of a reading above the trigger limits (to be determined in the construction environmental management plan (CEMP) to be developed by the Contractor in accordance with EPR AQ2, action would be needed to reduce dust emission.

Risk R-AQR2 relating to construction dust would remain low with the application of standard controls. The residual 'low risk' due to the potential for higher dust effects during hot, dry weather conditions, which would be harder to control but would be temporary. Standard mitigation measures within a CEMP would include: reducing ground works and movement of materials on hot, dry days by using fewer trucks, by spreading the work over a longer time period or by moving to an area that is not adjacent to houses on those days. Where possible filling activities should be planned for the period from June to October to reduce dust. Watering of roads and works areas would also control dust.

As described above, the impact assessment found dust levels to be within the design criteria at all sensitive receptors, therefore, no additional mitigation measures are required beyond the CEMP controls indicated.

Landfill odour assessment

The route of the project would cross a former landfill site just south of Dingley Bypass. The project would cover 0.94ha of landfill, which is estimated to contain a 5m layer of waste.

Construction of the project would involve laying a 0.6m thick layer of coarse gravel on the site and driving piles through the landfill into the soil below to provide support for the bypass structure. Landfill gases are expected to be released during pile driving, and would continue to seep to the surface and into the gravel layer. Further detail on construction methods is provided in Chapter 18: *Soils and contaminated land*.

LANDFILL GAS

Formed by the decomposition of organic material in landfills. It is composed mainly of methane and carbon dioxide and a small amount of other organic compounds such as hydrogen sulphide. Methane is a potent greenhouse gas.

The key air quality issue is the potential odour impact of hydrogen sulphide or other odorous gases being released from the landfill during construction of the project. As no sensitive receptors occur within 300m of the landfill site (see Figure 18.5), the potential for piling works to cause odour impacts at distant receptors is unlikely.

Methane was detected in elevated concentrations in monitoring wells in and immediately adjacent to the landfill, as well as in a manhole to the west of the former Enviromix Landfill. However, surface methane monitoring across the site found only background concentrations, which were considered safe.

Based on the available data, odour would not be a concern because of the low emission rate of hydrogen sulphide and the distance (300m) to the nearest sensitive receptors. The roadway would also be designed without a concave lower surface (to avoid gas collection) and with a fresh air layer between the road and the gravel layer to permit gases to escape and disperse (see EPR CLM4 in Chapter 18: *Soils and contaminated land*).

Construction greenhouse gas emissions (risk GHG3)

Greenhouse gas emissions from construction activities were initially rated as medium risk (GHG3) and are estimated to be 68.5kT CO_2-e. The embodied carbon in materials (Scope 3) used during construction would be the largest emissions source of the construction phase (66 percent). Currently, the use of fossil fuels such as diesel is necessary to operate plant and equipment and to construct all infrastructure elements of the project. However, the impacts of greenhouse gas emissions from this phase would be minimised through (EPR GG1 and GG2):

- a detailed design that seeks a volume reduction in materials
- the procurement of construction materials with a reduced lifecycle impact, in accordance with VicRoad's Sustainable Procurement Guidelines
- encouraging locally sourced and/or prefabricated materials in accordance with VicRoad's Sustainable Procurement Guidelines
- procurement of energy efficient construction equipment
- creating a Sustainability Management Plan, as part of the CEMP, which would include use of mandatory actions to monitor and report construction phase greenhouse gas emissions.

Greenhouse gas emission impacts from vegetation removal would be less than one percent of the project's construction emissions. Risks relating to the accidental release of greenhouse gas emissions from utility works, or associated with additional energy use from inefficient works were unable to be quantified in this assessment. However, their likely contribution to the project's total greenhouse gas emissions is considered immaterial when evaluated as part of the materiality assessment. In order to minimise impacts from construction energy-related emissions, the project would purchase a minimum of 20 percent of construction phase energy from an accredited GreenPower product, as per EPR GG2.

Risks GHG1, GHG2 and GHG5 were initially identified as low risks (included in Appendix G: *Greenhouse gas impact assessment*) in relation to initial phase, construction material selection and construction vehicle emissions. These have been assessed as residual low risk with standard controls and the EPRs in place, including consideration of sustainable material sourcing and best practice measures with construction vehicle and plant operation.

Direct emissions (Scopes 1 and 2) would account for 22.8kT CO2-e over the 24-month construction period, which equates to approximately 11.4kT CO2-e a year. This is equivalent to 0.01 percent of Victoria's total 2016 greenhouse gas emissions. The construction phase of the project is therefore unlikely to exceed the NGER Scheme threshold for a facility. A breakdown of the project's construction greenhouse gas emissions by source and scope are shown in Table 13.8. These emissions relate to risk GHG3, which has a medium initial risk but with additional controls will be mitigated to a low residual risk.

Table 13.8 Greenhouse gas emissions summary for construction phase by emission source and scope annually

GHG summary by activity	Scope 1 (tonne CO_2-e p.a)	Scope 2 (tonne CO_2-e p.a)	Scope 3 (tonne CO_2-e p.a)	Total (tonne CO_2-e p.a)
Site office/general areas	210	–	16	226
Demolition and earthworks	4,049	–	266	4,315
Construction – pavements	330	–	3,504	3,834
Construction – structures	5,862	–	17,694	23,556
Construction – drainage	751	–	588	1,339
Construction – road furniture	207	–	783	990
Total	**11,422**	–	**22,852**	**34,259**

13.8.2 Operation

Vehicle emissions assessment

TRAFFIC PREDICTIONS AND EMISSION RATES

Traffic volumes were predicted for two years, the opening year (2021) and 2031 and broken down into the five sections of the road. These numbers were used in the air modelling to estimate the emission levels at sensitive receptors. The traffic volumes for 2031 considers future road conditions based on population growth and road upgrades, and indicates that traffic numbers will increase by 7% by 2031. As vehicle emissions are expected to reduce by 10 to 12 percent during this time, it is expected that the total vehicle emissions on the project in 2021 would be approximately the same as those in 2031 (Appendix F: *Air quality impact assessment*).

Traffic volume scenarios were developed and simulated using the VITM. The simulations provided:

- daily average traffic volumes
- peak hourly AM and PM traffic volumes
- traffic volumes for each section of the project (as detailed in Table 13.6).

Vehicle emissions are influenced by the speed of the vehicles. Generally, vehicle emissions are released at a speed of 60km/hr and increase by six percent (for petrol cars) and 16 percent (for diesels) at 100km/hr. Emissions are substantially higher in congested traffic with speeds of 20km/hr or less.

Emissions are also affected by the gradient of the road. There is a significant increase in fuel use and vehicle emissions on uphill slopes compared to downhill slopes. This effect on the project would be minor, given the generally flat terrain and because the lengths of the road with gradients are relatively short.

Calculated average fleet emission factors for 2031 are shown in the Table 13.9. There is potential for emission rates from 2031 to be considerably lower than shown in Table 13.11 as vehicles become more fuel efficient and especially if hybrid and electric vehicles become more widely used. There has been a substantial reduction in vehicle emission rates over the last decade and a further reduction is projected until the year 2021. Based on this trend, it is reasonable to expect a further substantial reduction by the year 2031.

Table 13.9 Vehicle emission rates

Year	Emission rate (g/km)			
	Carbon monoxide	Nitrogen dioxide	PM_{10}	$PM_{2.5}$
2017	4.4	0.50	0.069	0.050
2021	4.0	0.46	0.064	0.045
2031	3.6	0.42	0.060	0.042

PREDICTED CONCENTRATIONS AT SENSITIVE RECEPTORS

The predicted 99.9 percentile concentrations (peak concentrations) (including background concentration) at the sensitive receptors for the four key air quality parameters are listed in Table 13.10. These peak concentrations are reported along with the design criteria for compliance purposes (see Section13.4).

Table 13.10 Concentrations at sensitive receptors against the design limit

Number	Description	Suburb	Predicted peak concentrations (1-hour) per air quality parameter			
			Carbon monoxide	Nitrogen dioxide	PM_{10}	$PM_{2.5}$
SEPP (AQM) 1-hour Design criteria (µg/m^3)			**29,000**	**190**	**80**	**50**
1	Hawthorn Football Club, Heatherton	Heatherton	1,050	82	33	16
2	Rural Residential, Dingley	Dingley	900	50	31	14
3	Commercial, Dingley	Dingley	1,490	169	42	21
4	Residential, Dingley	Dingley	1,310	148	38	19
5	Residential, Dingley	Dingley	1,390	148	38	20
6	Commercial, Dingley	Dingley	1,400	132	39	20
7	Reserve, Braeside	Braeside	1,275	129	36	18
8	Parks Victoria lunchroom, Braeside	Braeside	1,610	165	42	22
9	Reserve, Braeside	Braeside	1,300	120	38	19
10	Reserve, Braeside	Braeside	1,360	121	38	19
11	Residential, Aspendale Gardens	Waterways	1,480	140	39	21
12	Residential, Aspendale Gardens	Aspendale Gardens	1,340	88	35	17
13	Residential, Aspendale Gardens	Aspendale Gardens	1,480	133	37	19
14	Richfield Retirement	Aspendale Gardens	1,630	161	39	20
15	Retirement Village, Chelsea Village	Chelsea Heights	1,480	166	40	21
16	Commercial, Chelsea Village	Chelsea Heights	1,580	128	38	18

All modelled peak concentrations are compliant with the design criteria at each receptor and for all pollutants.

The operational impacts on air quality are expected to be negligible for carbon monoxide, PM_{10} and $PM_{2.5}$ as the concentration of air pollutants from vehicles is predicted to be well within the design criteria.

For predicted levels of nitrogen dioxide, the results indicate that:

- all receptors would be below the design criterion
- all residences and receptors more than 20m from the roadway (all those identified in proximity of the project) would be below the design criterion.

Risk R-AQR5 relates to the impacts of operational traffic emissions on the project. This was initially identified as a low risk, and following the impact assessment is considered to remain a low risk, primarily due to the improved traffic flow, average speed and reduced congestion and travel time as a result of the project which will improve fuel consumption efficiency for existing road users. Further, EPR AQ1 requires that the project must be designed and constructed in accordance with SEPP AQM and State Environment Protection Policy (Ambient Air Quality).

Operational greenhouse gas assessment

Greenhouse gas emissions from the project's operation (including maintenance but excluding road user emissions) would be approximately 0.96kT CO_2-e pa. The majority (81 percent) of greenhouse gas emissions would relate to electricity consumption for road lighting. Greenhouse gas emissions from the use of fossil fuels to operate plant and equipment and site vehicles, combined, would represent approximately 12 percent of the total operational greenhouse gas emissions.

The operation and maintenance phase of the project is very unlikely to exceed the NGER Scheme threshold for a facility. These impacts would be mitigated through the identified EPRs GG1 and GG2, including:

- using energy efficient plant and equipment to minimise power requirements
- monitoring of lifecycle assessment and greenhouse gas emissions through infrastructure sustainability (IS) benchmarking
- meeting Infrastructure Sustainability Council of Australia's (ISCA) IS ratings applied to the project.

A breakdown of the annual greenhouse gas emission sources and scope from the project's operation (including maintenance) are summarised in Table 13.11.

Table 13.11 Annual greenhouse gas emissions summary for the project's operational activities (including maintenance) by emission source and scope

GHGE summary by activity	Scope 1 (tonne CO_2-e p.a)	Scope 2 (tonne CO_2-e p.a)	Scope 3 (tonne CO_2-e p.a)	Total (tonne CO_2-e p.a)
Maintenance materials	51	0	66	117
Lighting	0	698	81	779
LED traffic signals	0	58	7	65
Total	**51**	**756**	**154**	**961**

Operational impacts from vehicle traffic (risk GHG4)

Emissions from fuel combustion of vehicles on the road network in 2031 were calculated for both the "with project" and "without project" scenarios using data obtained from the latest VITM and are shown in Table 13.12.

Table 13.12 Estimated total annual greenhouse gas emissions from road traffic on the Victorian road network

Greenhouse gas emissions (kT of CO_2 -e)	Light vehicles	Heavy vehicles	Total emissions
Without project 2031	21,889	6,848	28,737
With project 2031	21,871	6,271	28,142

The results calculated indicate that up to 13kT CO_2 -e would be saved annually because of the project. This is attributed to the increase in average speed of the road network which would improve the efficiency of fuel consumption due to reduced congestion and wait times. Based on the findings from the model, the potential for the project to significantly contribute to a reduction in Victoria's annual greenhouse gas emissions for the transportation sector is positive.

The estimation of future traffic greenhouse gas emissions does not include changes in the fuel efficiency or type of vehicle fuel over time. Anticipated future improvements in fuel efficiency of vehicles would reduce greenhouse gas emissions and, ultimately the relative future greenhouse gas emissions under both the "with project" and "without project" scenarios.

13.9 ENVIRONMENTAL PERFORMANCE REQUIREMENTS (EPRs)

Table 13.13 sets out the EPRs developed for air quality and greenhouse gas emissions.

Table 13.13 Environmental performance requirements (EPRs)

EPR number	Environmental performance requirements	Project phase
AQ1	**Air quality (operation)** The project must be designed and constructed to minimise air quality impacts during operation and to ensure the requirements of relevant legislation, policies and guidelines are met, including but not limited to: • *State Environment Protection Policy (Air Quality Management)* • *State Environment Protection Policy (Ambient Air Quality).*	Design
AQ2	**Air quality (construction)** Best practice environmental management measures must be implemented to minimise dust, odour and other air emissions must be implemented in accordance with relevant legislation, policies and guidelines including, but not limited to: • EPA Victoria Publication 480: *Environmental Guidelines for Major Construction Sites.*	Construction
GG1	**Greenhouse gas monitoring and reporting** Minimise and manage greenhouse gas emissions (GHG) arising from construction, operation and maintenance through the integration of sustainable design practices. Create a Sustainability Management Plan (SMP) which includes mandatory actions to monitor and report construction phase greenhouse gas emissions and to benchmark predicted operational phase greenhouse emissions in accordance with Mat-1 and Ene-1 credits of the Infrastructure Sustainability (IS) rating tool (v1.2).	Design, Construction, Operation
GG2	**Emissions reduction** The materials and equipment for the project must be selected with the intent to reduce the project associated GHG emissions during the construction and operational phases. A verifiable improvement in project GHG emissions must be achieved by achieving a minimum of Mat-1 (Level 1) and Ene-1 (Level 2) credits of the Infrastructure Sustainability (IS) rating tool (v1.2). A minimum of 20% of construction phase energy must be purchased from an accredited GreenPower product.	Design, Construction, Operation

13.10 CONCLUSIONS

An air quality assessment was undertaken to assess the potential construction and operational impacts of the Mordialloc Bypass (Freeway) project on the environment. The assessment was undertaken to address key scoping requirements to ensure that the environment is protected.

The main air quality impacts assessed were:

- dust emissions from earthworks during construction (vegetation clearing, filling and excavating)
- landfill odour
- vehicle emissions during operations
- greenhouse gas emissions at all stages of the project.

Modelling of air emissions was undertaken to predict the potential impacts on the local environment and sensitive receptors.

Dust from construction activities is predicted to be greatest during roadway and embankment formation and laying of the pavement base. The impacts of dust are expected to be experienced within 60m of the project boundary (on normal days) and 100m on dry days with strong winds. Recommended standard management measures, including watering down stockpiles and unsealed surfaces, would be implemented to limit the extent of dust and the likelihood of adverse effects on sensitive receptors as outlined in EPR EM 2. This would enable the associated risks AQR1 to 4 and the aggregate construction dust risk AQR6 to remain as low with the application of standard controls and EPRs.

Operational impacts on air quality are expected to be negligible for carbon monoxide, PM_{10} and $PM_{2.5}$. Predicted levels of nitrogen dioxide at all nearby sensitive receptors are expected to be below the SEPP (AQM) design criterion. AQR5 reflects this with a residual low risk rating for operational traffic emissions with the application of standard controls including design in accordance with EPR AQ1.

During construction, greenhouse gas emissions would be minor, at less than half the annual NGERS reporting threshold for a facility.

Greenhouse gas emission modelling results indicated that once operational up to 13kT CO_2-e would be saved annually as a result of the project. This positive impact is attributed to the increase in average speed of traffic on the road network and reduced congestion which will improve the efficiency of fuel consumption of road users.

All greenhouse gas emission risks would remain low from initial to residual, and would not require additional mitigation. GG1 and GG2 provide the appropriate performance requirements for the construction and operation stages.