Transport for NSW

Chapter 20

Air quality

NSW GOVERNMENT

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20.Air quality

This chapter provides the air quality assessment of the project, including consideration of greenhouse gases. It describes the existing air environment, assesses the potential impacts during construction and operation (including estimated generation of greenhouse gases), and provides measures to mitigate and manage the impacts identified.

20.1 Approach

New transport infrastructure can emit pollutants into the atmosphere during construction and operation. Dust generated from unsealed exposed earth and exhaust from construction vehicles are common air quality issues during construction, which must be minimised to avoid nuisance impacts on surrounding sensitive receivers. The main potential operation issue for new light rail projects relates to particulate matter or dust generated from the braking of light rail vehicles and maintenance works.

Potential air quality impacts during construction and operation were assessed using a qualitative, risk-based approach in general accordance with *Guidance on the assessment of dust from demolition and construction* (Institute of Air Quality Management (IAQM), 2014). The assessment was also undertaken in accordance with:

- the SEARs (see Appendix A (SEARs compliance table))
- applicable legislation (including the POEO Act and the Protection of the Environment Operations (Clean Air) Regulation 2010 (NSW))
- other relevant policies and guidelines, including the A*pproved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (NSW EPA, 2016) ('the Approved Methods'), the National Environment Protection (Ambient Air Quality) Measure (the Air NEPM), and the *Technical Framework – Assessment and Management of Odour from Stationary Sources in NSW* (DEC, 2006).

Greenhouse gas is a collective term for gases that absorb outgoing infrared radiation reflected from the earth. The process of absorbing infrared radiation in the atmosphere generates heat and gradually warms the atmosphere. This is known as the greenhouse effect, which is linked to climate change. Human activities, including the combustion of carbon-based fuels, increase the concentration of greenhouse gases in the atmosphere. This leads to greater absorption of infrared radiation and an increase in atmospheric temperature. Identifying the likely scale of potential emissions associated with a project provides a baseline from which further greenhouse gas reduction measures can be developed through the project life cycle.

The greenhouse gas assessment was undertaken in accordance with the National Greenhouse and Energy Reporting Regulations 2008 (updated July 2020) and other key relevant policies and guidelines, including the *National Greenhouse Accounts Factors* (Department of Industry, Science, Energy and Resources, 2021), *ISO 14064-1:2006 Greenhouse gases – Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals* and the Fifth Assessment Report (AR5) of the Intergovernmental Panel on Climate Change (2014).

20.1.1 Study area

The study area for the air quality assessment includes the project site and a 350 metre buffer around the site, consistent with *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014).

The assessment of greenhouse gases was activity-based and not associated with a geographical study area.

20.1.2 Key tasks

Air quality assessment

Air quality may be affected by a number of pollutants, each of which has different emission sources and potential effects on human health and the environment. The air quality assessment focused on the highest risk impacts with the potential to occur during construction and operation.

The air quality assessment involved a qualitative, risk-based assessment, which included:

- reviewing the background air quality environment, including air quality and meteorological data sourced from the Department of Planning and Environment and Bureau of Meteorology monitoring networks
- identifying sensitive receivers with the potential to be adversely affected by air quality impacts
- identifying and assessing potential construction dust impacts in accordance with *Guidance on the assessment of dust from demolition and construction*
- qualitatively assessing the potential for air quality impacts during the operation and maintenance of the light rail vehicles
- identifying mitigation measures.

Assessment criteria

No project-specific criteria were applied for construction air quality impacts. This is due to the difficulty in quantifying dust emissions from construction activities and the ability to effectively mitigate impacts by implementing standard construction management measures and erosion controls. As such, the construction assessment criteria have been mainly sourced from the Approved Methods. The criteria are provided in Appendix H (Air quality background data).

A review of the main air quality risks from operation identified minimal potential for minor emissions (see section 20.4). As a result, no specific criteria were applied for operational air quality impacts.

Greenhouse gas assessment

The desktop greenhouse gas assessment involved:

- identifying relevant aspects of energy use and greenhouse gas emissions from construction and operation across three categories (described below)
- preparing activity estimates using information from Parramatta Light Rail Stage 1 and the definition design and preliminary construction planning for the project
- identifying appropriate energy content and emissions factors
- estimating the projected tonnes of carbon dioxide equivalent emissions for each activity and total greenhouse gas emissions attributable to the project.

Emission categories

Potential emissions are calculated across three different categories (known as 'scopes') to help differentiate between direct emissions from sources that are owned or controlled by a project, and upstream indirect emissions that are a consequence of project activities, but which occur at sources owned or controlled by another entity. The three categories are defined in Table 20.1, together with those emissions in each category that are considered relevant to the project.

Table 20.1 Greenhouse gas emissions categories and emissions relevant to the project

Emission category	Definition	Emissions relevant to the project
Scope 1	Direct greenhouse gas emissions into the atmosphere (such as from plant and equipment using fuel).	Fuel consumption (including related infrastructure, civil works and maintenance), vegetation removal and transportation of staff, materials and equipment within the project site.
Scope 2	Indirect greenhouse gas emissions from the consumption of electricity.	Emissions from electricity consumed during construction, such as at compounds and for lighting. Emissions from electricity consumed to operate light rail vehicles.
Scope 3	Other indirect emissions (not included in Scope 2) due to upstream or downstream activities, such as emissions associated with road users or the embodied energy within a material used during construction.	Transport and disposal of waste, emissions associated with embodied energy of construction materials, and the extraction, production and transport (including transport to site) of purchased fuels, electricity and materials.

A number of assumptions were made as part of the greenhouse gas assessment. These are described in Appendix H (Air quality background data).

20.1.3 How potential impacts have been avoided or minimised

The approach to design development included a focus on avoiding and/or minimising the potential for impacts during key phases of the design process. As described in Chapter 5 (Alternatives and options) a project corridor and alignment options assessment process was undertaken to identify the preferred alignment. This process considered a range of factors, including locating and refining the alignment to (where practicable) maximise the distance from residential receivers and optimise the alignment to reduce curves and gradients. The design and construction planning for the project has also been refined to minimise the potential for impacts, including:

- maximising the use of existing transport corridors, which would reduce the need for major earthworks (a source of dust)
- co-locating the stabling and maintenance facilities needed for the project with the Parramatta Light Rail Stage 1 facility, which is located in an industrial area away from sensitive receivers
- balancing the cut and fill needs across the project to reduce the need for extensive stockpiling
- avoiding the need for piling to support track foundations in the stabling and maintenance facility to ensure that the existing remediation capping layer is not disturbed and there are no odorous or contaminated particle releases
- siting construction compounds, including stockpiles, away from sensitive receivers as far as practicable.

Operational air emissions are expected to be minor. Ambient air quality may improve due to the project as a result of a shift in transport patterns (increased use of public transport once the project is available), and any associated reduction in the use of private vehicles. Similarly, the anticipated transport mode shift would also have a positive impact in terms of a reduction in greenhouse gases.

20.2 Existing environment

20.2.1 Ambient air quality

Local emission sources

Local emission sources, including industrial and domestic activity, natural sources and local transport emissions, all contribute to existing air quality. A desktop review identified the following potential air pollution sources in the study area:

- industrial facilities with reported air emissions
- other businesses, such as service stations and smash repairers
- exhaust emissions from road networks
- bushfire smoke from fires
- domestic activities, such as wood-fired home heaters and lawn mowing
- dust from dust storms
- dust from construction activities.

The National Pollutant Inventory lists 23 sites that are sources of emissions within about five kilometres of the project site (see Appendix H (Air quality background data)). The most significant pollutants reported were products of combustion and fuel storage (carbon monoxide, nitrogen dioxide, particulate matter (PM_{10} and $PM_{2.5}$), sulphur dioxide and volatile organic compounds).

General characteristics

Ambient air quality in Sydney is influenced by a number of factors, including topography, prevailing meteorological conditions (such as wind and temperature, which vary seasonally), and local and regional air pollution sources (such as motor vehicles, industrial facilities and bushfires). Consequently, regional air quality can be highly variable and affected by events occurring a significant distance away.

Sydney's air quality has generally improved over the last few decades (OEH, 2018). The improvements have been attributed to initiatives to reduce emissions from industry, motor vehicles, businesses and residences.

While levels of nitrogen dioxide, sulphur dioxide and carbon monoxide continue to be below national standards, levels of ozone and particulates (PM_{10} and $PM_{2.5}$) still exceed the standards on occasion.

Monitoring results

Monitoring data from the two closest air quality monitoring stations to the project site (Chullora and Parramatta North) was reviewed to determine historical trends (see Appendix H (Air quality background data)).

The review noted that $PM_{2.5}$ concentrations exceeded the ambient air quality goal of 25 µg/m^3 on occasion:

- the Chullora monitoring station recorded exceedances 2.7 per cent of the time (between 2016 to 2020)
- the Parramatta North monitoring station recorded exceedances 3.3 per cent of the time (between 2018 to 2020).

Similarly, 24 hour average PM_{10} concentrations exceeded the ambient air quality goal of 50 µg/m^3 on occasion, most likely due to bushfires and dust storms:

- the Chullora monitoring station recorded exceedances 2.2 per cent of the time (between 2016 to 2020)
- the Parramatta North monitoring station recorded exceedances 3.5 per cent of the time (between 2018 to 2020).

However, the annual average PM_{10} concentration for all years is below the annual average goal of 25 µg/m^3, except at the end of 2019 (during the 2019/2020 bushfires).

Figures showing ambient $PM_{2.5}$ and PM_{10} concentrations are provided in Appendix H (Air quality background data).

20.2.2 Local meteorology

Weather data was obtained from the Bureau of Meteorology Sydney Olympic Park (Archery Site) automatic weather station (site number 066212) (accessed 26 October 2021), which is located about 200 metres from the project site at the nearest point.

The five-year wind rose from the Sydney Olympic Park weather station (see Figure 20.1) shows that calm, light, gentle and moderate winds (speeds of less than 0.5 metres per second to five metres per second) occur the majority of the time, with the predominant wind direction being from the north-west.

High speed wind conditions (winds greater than five metres per second) occur about eight per cent of the time. High speed wind conditions are likely to lead to the highest rate of fugitive dust emissions and nuisance dust during construction, and are also those where pollutants are readily dispersed after emission. Most high winds occur from the north-west and south-east, suggesting that dust impacts would be more likely to occur opposite to these directions.

Further information on local climate is provided in section 21.2.

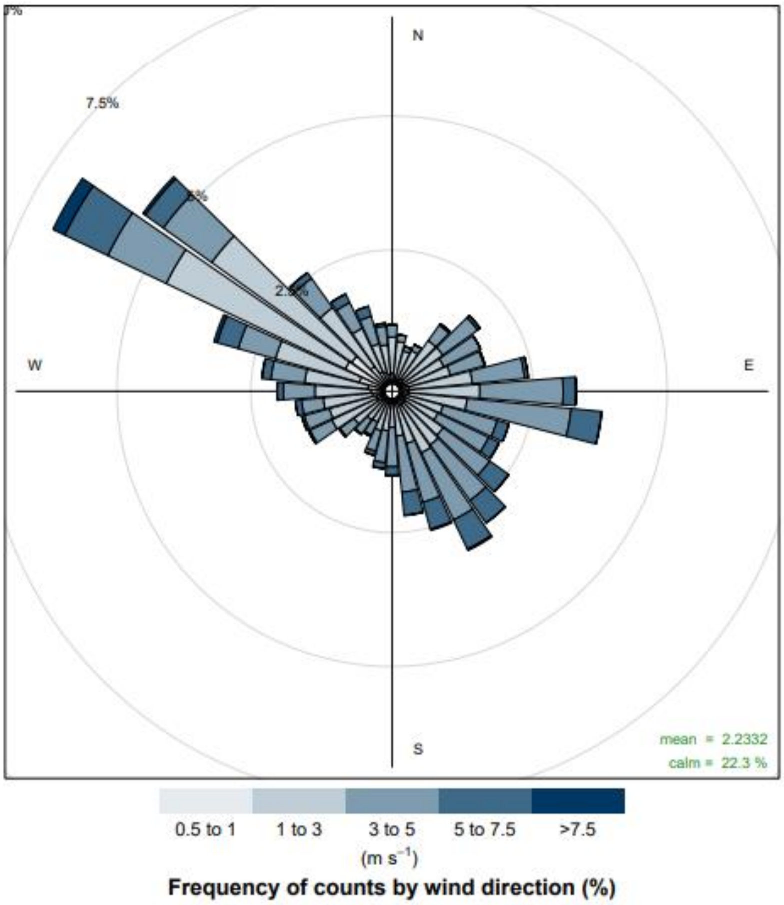

Figure 20.1 Five-year wind rose

20.2.3 Sensitive receivers

Sensitive receivers are locations where people live and work that could be sensitive to changes in air quality for reasons of human health or amenity. Some environmental features such as wetlands may also be considered sensitive to changes in air quality, particularly dust. Sensitive receivers near the project site are shown on Figure 2.2 in Technical Paper 3 (Noise and Vibration).

Residences, schools, sports grounds, hospitals, aged care centres, offices and public recreation areas are considered to be sensitive receivers in relation to the potential health and amenity impacts of dust. The potential for indirect impacts on biodiversity (including as a result of dust generation) is considered in Chapter 16 (Biodiversity).

In accordance with the *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014) receivers have been classified as low, medium or high risk. The classification is based on the distance from the project site, the number of receivers at each location, and land use type (such as residential, educational, medical, commercial, industrial, etc.). Areas with high-risk receivers are those that included greater than 100 receivers within 50 metres of the project site, or between 10 and 100 receivers within 20 metres of the project site. Areas with high-risk sensitive receivers include:

- Rydalmere – residential receivers along Antoine, South and Dorothy streets, and cross streets
- Ermington – residential receivers along South, Tristram and Boronia streets, Heysen Avenue, and cross streets
- Lidcombe – residential receivers along Uhrig Road and Carter Street, and cross streets.

Sensitive receivers considered by the air quality assessment are described in Appendix H (Air quality background data).

20.3 Assessment of construction impacts

20.3.1 Potential emission sources

During construction, there is the potential for impacts from airborne particulate matter and dust deposition. Fine particles associated with exhaust emissions from vehicles and plant used during construction are accounted for in the emission factors for earthmoving and handling used by the air quality assessment. Exhaust emissions during construction are expected to be discontinuous, transient, and mobile.

In summary, potential emissions during construction include:

- dust from work activities
- exhaust emissions from construction plant and equipment
- odours or other gaseous emissions due to excavation in potentially contaminated areas or the exposure of acid sulfate soils.

20.3.2 Dust generation risk

During construction, the primary risk to local air quality would be the generation of dust. Airborne particulate matter has the potential to cause adverse health or nuisance impacts if not properly managed. Due to the project's urban setting, there is also potential for dust emissions to contain:

- contaminants mobilised by the disturbance of contaminated soils in key areas of concern (see Chapter 18 (Soils and contamination))
- other hazardous materials, such as the release of asbestos fibres, heavy metals, silica dust or other pollutants during the demolition of buildings that contain hazardous materials.

Key construction activities that have the potential for dust generation include:

- removal/demolition – any activity that involves the removal of existing building or redundant structures
- vegetation clearing – any activity that involves the removal or trimming of vegetation
- earthworks – ground disturbance activities, such as soil stripping, ground levelling, excavation and landscaping, which involve the excavation, stockpiling, transport and/or disposal of materials
- built construction works – any activity that involves providing new structures or modifying existing structures, including buildings and roadways
- vehicle track out – the movement of dust and dirt by construction vehicles from the project site onto the public road network
- compound sites (see Figure 7.1 to Figure 7.6) – these are usually unpaved with high vehicle movements and can store equipment and materials.

The risk of dust arising in sufficient quantities to cause annoyance and/or the potential for health impacts was determined for each activity type by considering the scale and nature of the works and the sensitivity of the area.

An assessment of the construction dust risk to receivers in each suburb in the study area was undertaken (see Appendix H (Air quality background data)). Based on this assessment, the following activities were identified as having the highest potential for emissions to air during construction:

- activities at or near compound sites, including storage and handling of excavated and fill materials, and regular movement of heavy vehicles
- construction of bridges due to the extent of works required for these structures (including abutments and bridge decks) and the need to work with potentially dusty material (concrete grinding and cutting)
- removal/demolition of existing structures and infrastructure, particularly where buildings would be acquired as part of the project site and during concrete cutting.

Earthworks and vehicle movements have the potential to create a large dust impact. However, such risks have been identified as low or negligible due to the general shallowness of the excavations and the potential to use only short distances of unpaved roads (less than 50 metre intervals).

In relation to the above activities, there is potential for dust from activities/works at the compound sites in Camellia and work areas for the bridge between Camellia and Rydalmere to contain contaminants such as asbestos or heavy metals due to the presence of existing contamination (see Chapter 18 (Soils and contamination)). These areas generally correspond with industrial land uses and include minimal sensitive receivers. Where sensitive receivers are located, the potential for impacts due to contaminants in dust emissions would be localised and managed consistent with the general approach to managing dust impacts (described below). In addition, works at the compound site at 37A Grand Avenue Camellia would be undertaken in accordance with a remediation action plan (see Chapter 18), the objective of which would be to minimise the potential for health impacts to the community due to existing contamination.

Management and mitigation measures included in the air quality management plan (see section 20.6) would be implemented to minimise dust and mitigate the effects of construction on local air quality. Measures relating to the inspection and removal of any hazardous materials present are regulatory procedures that govern the actions taken to minimise the risk of harm due to release or removal of these materials. Further information on the management of hazardous materials is provided in Chapter 18 (Soils and contamination) and Chapter 19 (Hazards and risks).

With the application of the proposed measures, the risk of dust would be substantially minimised and well managed.

20.3.3 Exhaust emissions

The main source of exhaust emissions would be the combustion of diesel fuel and petrol from heavy vehicles, mobile excavation machinery, and/or stationary combustion equipment.

The volume of emissions from construction vehicles and machinery would depend on the type of fuel used, the power output and condition of the engine, and duration of operation.

Exhaust emissions would involve periodically localised emissions of carbon monoxide, particulate matter (PM_{10} and $PM_{2.5}$), oxides of nitrogen, sulfur dioxide, volatile organic compounds, and polycyclic aromatic hydrocarbons associated with the combustion of diesel fuel and petrol.

Exhaust emissions generated during construction would not materially contribute to emissions in the study area, given the existing traffic levels. For example, it is estimated that construction would generate up to about 63 truck movements per day in Rydalmere; however, the nearest main road in this area, Silverwater Road, had an average daily traffic count of 55,962 vehicles in 2021 (Transport for NSW, Traffic Volume Viewer, accessed 18 January 2022). Emissions from construction vehicles and plant would be dispersed along the project site and intermittent in nature, depending on particular construction activities.

20.3.4 Odours

Although there is the potential to encounter contamination in various locations along the project site (see Chapter 18 (Soils and contamination)), the key areas of concern with respect to odorous emissions are:

- Camellia – the potential to encounter contamination during works in Camellia is high due to the historical use of the area for industrial activity.
- Parramatta River – the potential to encounter soil, sediment and groundwater contamination during works within and adjacent to the river is high due to the presence of contamination from activities in Camellia, and current and historical industrial land uses located on either side of the river.
- Wentworth Point (along Hill Road) and Sydney Olympic Park – there is the potential to encounter landfill gas due to the historical use of parts of these areas for landfilling. This is described further in section 20.3.5.

Excavation of soils in Camellia and adjacent to the Parramatta River could result in the release of hydrocarbon odours. The potential for sensitive receivers to be impacted due to emissions from excavation in these areas is considered low, given the limited extent of excavation proposed and the distance to sensitive receivers in these areas.

In addition, works along the Paramatta River foreshore area have the potential to disturb acid sulfate soil materials during excavation and treatment. This can produce an offensive odour, predominantly due to 'rotten egg gas' (hydrogen sulphide). Works with the potential to disturb acid sulfate soils would be undertaken in accordance with an acid sulfate soils management plan (see Chapter 18 (Soils and contamination)).

Any odours would be localised and temporary and minimised by controlling the amount of exposed soil or sediment.

20.3.5 Landfill gas

The breakdown of putrescible waste and organic matter in a landfill generates methane, carbon dioxide and other trace gases (landfill gas) that may pose hazards to site safety, human health and the surrounding environment. While methane and carbon dioxide are odourless, other components of landfill gas, such as hydrogen sulfide and ammonia can be odorous, affecting local amenity. Methane may be explosive if concentrations reach five to 15 per cent by volume in air. Carbon dioxide can be an asphyxiant if sufficient volumes collect in a confined space.

As the project would involve works in areas used for historical landfilling in Sydney Olympic Park, there may be the potential for an initial release of any trapped gases when excavating below the capped layers in this area, resulting in increased odour potential.

Due to the age of the landfills, it is expected that the majority of putrescible waste has degraded. However, there would be ongoing low production of landfill gas from other sources. Works within Sydney Olympic Park would be undertaken with the assumption that high levels of methane and landfill gas would be present, and appropriate management measures would be put in place. These would include, at a minimum, relevant occupational work health and safety precautions, measurements of methane concentrations using a gas meter, and restrictions on hot works.

As described in Chapter 18 (Soils and contamination) Sydney Olympic Park is currently managed in accordance with a management plan, which documents the procedures to be followed during any works in this area. Construction would be carried out in accordance with this plan and in consultation with Sydney Olympic Park Authority. Further information, including relevant mitigation measures, are provided in section 20.6 and Chapter 18 (Soils and contamination). Implementation of the proposed mitigation measures are expected to effectively manage potential landfill gas impacts during construction.

20.3.6 Greenhouse gases

Estimated construction emissions (measured in tonnes of carbon dioxide equivalent (t CO_2-e)) by source and scope are provided in Table 20.2.

Scope 3 emissions account for the majority (86 per cent) of estimated construction-related emissions, with the largest proportion of these coming from embodied emissions within materials used. About 10 per cent of estimated emissions are from plant and equipment that consume fossil fuels (Scope 1 emissions), and about three per cent are from Scope 2 emissions associated with electricity consumption.

The project's structural elements (such as bridges and concrete slab track) account for the majority of Scope 1 emissions (from plant and equipment use) and Scope 3 emissions (embodied emissions within materials). This is due to the amount of concrete and steel required.

The quantity of construction emissions equates to an average of 27,783 t CO_2-e per annum, which accounts for less than 0.08 per cent of annual NSW greenhouse gas emissions based on data from 2019 (NSW EPA, 2019b).

Measures are provided in section 20.6 to reduce greenhouse gas emissions during construction.

Table 20.2 Greenhouse gas emissions by emission source and scope - construction

Activity	Scope 1 (t CO_2-e)	Scope 2 (t CO_2-e)	Scope 3 (t CO_2-e)	Total (t CO_2-e)	Percentage of total emissions (%)
Diesel consumption of equipment	8,830	n/a	452	9,282	8.4
Land clearing	2,395	n/a	n/a	2,395	2.2
Electricity from grid (NSW)	n/a	3,644	327	3,971	3.6
Materials – concrete	n/a	n/a	47,060	47,060	42.4
Materials – asphalt	n/a	n/a	13,925	13,925	12.5
Materials – road base	n/a	n/a	936	936	0.8
Materials – steel	n/a	n/a	20,784	20,784	18.7
Materials – PVC	n/a	n/a	1,110	1,110	1
Materials transport	n/a	n/a	7,753	7,753	7
Waste transport	n/a	n/a	194	194	0.2
Worker transport	n/a	n/a	149	149	0.1
Waste (construction and demolition)	n/a	n/a	3,574	3,574	3.2
Total (tCO_2-e)	**11,225**	**3,644**	**96,265**	**111,134**	**100**
Total (%)	**10.10**	**3.28**	**86.2**		**100**

20.4 Assessment of operation impacts

20.4.1 Air quality

During operation, potential air quality impacts would be mainly associated with:

- particulate matter and deposited dust generated by:
  - light rail vehicles braking and any associated wear
  - the deposition of sand to provide grip
  - maintenance activities
- exhaust emissions from vehicles or equipment used to undertake maintenance (including along the alignment and at the stabling and maintenance facility).

Braking and wear from wheels on rails would result in very low levels of emissions of metal particulates. These particulate emissions are expected to be minor and would result in minimal contribution to ambient PM_{10} concentrations beyond the light rail corridor. There may also be minor particulate emissions from the deposition of sand between the light rail vehicle wheels and track to provide additional grip when required (for example to stop during wet weather or climb steep gradients). The sanding system used would result in targeted application only, to maximise traction and minimise excessive sand deposits.

Where maintenance activities require excavation and stockpiling of material there would be the potential for dust emissions. As the area of any disturbance would is likely to be small, any potential impacts would be minimal and managed in accordance with Transport for NSW's standard operating procedures.

The maintenance of project infrastructure and activities at the stabling and maintenance facility would generate some minor gaseous emissions. These emissions would be associated with the combustion of fuel in plant, vehicles and machinery. Any emissions would be intermittent and transient in nature, and would be managed in accordance with Transport for NSW's standard operating procedures.

The project is expected to result in a net benefit to local air quality as a result of a shift in transport patterns in the study area, and associated reduction in the use of private vehicles. This has the potential to reduce air pollution emissions from road transport and congestion within the region.

20.4.2 Greenhouse gases

Greenhouse gas emissions would be generated during operation by activities including:

- electricity to power light rail vehicles, signalling, lighting, close-circuit television and communications systems and other activities at stops and the stabling and maintenance facility
- combustion of fuel in maintenance plant, equipment and vehicles
- disposal of general waste from light rail vehicles/customers and the stabling and maintenance facility.

Table 20.3 provides the estimated operational greenhouse gas emissions by source and scope.

Table 20.3 Summary of greenhouse gas emissions during operation

Activity	Scope 1 (t CO_2-e)	Scope 2 (t CO_2-e)	Scope 3 (t CO_2-e)	Total (t CO_2-e)	Percentage of total emissions (%)
Diesel consumption – maintenance	43	n/a	n/a	n/a	0.6
Electricity from grid (NSW)	n/a	6,349	570	n/a	95
Operational waste	n/a	n/a	322	n/a	4.4
Total annual (t CO_2-e)	**43**	**6,349**	**892**	**7,284**	**100**
Total 100 year lifecycle (t CO_2-e)	**4,337**	**634,861**	**89,192**	**728,390**	**200**

As shown in Table 20.3, operation is estimated to generate about 7,284 t CO_2-e per annum. Over a 100 year operational lifecycle, this equates to a total of about 728,390 t CO_2-e. Consumption of electricity to power light rail vehicles and associated infrastructure accounts for about 82 per cent of these emissions. The project is aiming to procure renewable energy for electricity consumption during operation.

The project is expected to generate a modal shift from private vehicles to public transport, with the project removing an estimated 25,000 cars from the road network by 2041, resulting in 187,500 fewer car kilometres each day. This would result in a reduction of about 2.24 t CO_2-e per day or the equivalent of about 817 t CO_2-e per year.

20.5 Cumulative impacts

20.5.1 Air quality

Cumulative impacts are generally due to emissions of particulate matter when two projects are under construction in the same area at the same time or a project is being constructed adjacent to a facility with existing emissions. *Guidance on the assessment of dust from demolition and construction* (IAQM, 2014), notes that projects or facilities within 350 metres of a project have the potential to result in cumulative impacts. As such, a review was undertaken of facilities that reported emissions during the 2019-2020 National Pollutant Inventory reporting period (see Appendix H (Air quality background data)) and key developments located within 350 metres of the project site.

Other projects that have the potential to result in cumulative impacts if construction occurs at the same time as the project are listed in Table H.9 in Appendix H (Air quality background data). Table H.9 also lists existing facilities that reported emissions of particulates during the reporting period; however, it is likely that the potential for cumulative impacts due to dust emissions compared to other emissions would be low due to the type of activities undertaken at these facilities. No development projects or existing facilities that reported emissions were identified in Rydalmere.

With the application of the proposed mitigation measures (see section 20.6), the potential for cumulative air quality impacts during construction would be substantially minimised and well managed.

No cumulative impacts are expected during operation, as the project is expected to result in a net benefit to local air quality (see section 20.4.1).

20.5.2 Greenhouse gas

Emissions generated during construction and operation would contribute to the cumulative generation of greenhouse gases from the construction and manufacturing industries.

The project (when estimated construction and operation greenhouse gas emissions are considered) is not expected to significantly (and cumulatively) increase NSW's total greenhouse emissions, as it would account for less than 0.1 per cent of NSW's entire greenhouse gas emissions (based on 2019 data).

20.6 Mitigation and management measures

20.6.1 Approach to mitigation and management

The assessment identified that the main potential for air quality impacts would be during construction, when dust and odour impacts could occur if works are not effectively managed.

Air quality management during construction

The key approach to managing air quality impacts during construction, including dust and emissions from construction plant, would involve preparing and implementing an air quality management plan as part of the CEMP. The plan would define the processes, responsibilities and management measures to minimise potential impacts on air quality. Further information on the CEMP is provided in Chapter 23 (Environment management and mitigation) and Appendix J (Outline CEMP)). The requirements for the air quality management plan would align with the *Air Quality Management Guideline* (Transport for NSW, 2015).

Odour impacts

The potential for odour emissions and impacts during construction would depend on the methodology adopted by the contractor for excavation within contaminated areas and the management of excavated materials.

An odour management strategy would be prepared and implemented to identify work methods and management measures to ensure that:

- the area exposed is minimised at any one time
- significant odour issues are avoided
- any odour issues are rapidly identified and effectively resolved.

The odour management strategy would involve:

- confirming the proposed work methods and mitigation measures that aim to limit odour at sensitive receivers
- confirming the approach and action plan if significant odour issues occur, as well as other complementary procedures and actions in response to odour complaints.

The odour management strategy would complement the air quality management plan. Further mitigation measures to manage impacts from landfill gas are provided in Chapter 18 (Soils and contamination).

During operation, air quality would be managed in accordance with Transport for NSW's standard operating procedures.

Greenhouse gases

Measures to set energy targets and reduce potential greenhouse gas during construction and operation would be documented in an energy and greenhouse gas strategy, guided by the *NSW Government Resource Efficiency Policy* (OEH, 2014) and Infrastructure Sustainability Council (ISC) requirements. Underpinning this strategy would be the application of a carbon emissions management hierarchy as follows:

- avoid or reduce emissions – for example, minimising the weight of rolling stock to reduce the energy required to operate vehicles, or procuring low energy embodied materials
- improve efficiency – for example, using energy efficient lighting, or powering compounds through connection to grid electricity to reduce generator use
- source renewable energy (on site) – for example, incorporating solar voltaic cells at light rail stops
- source renewable energy (off site) – for example, purchasing renewable energy for construction and operational energy consumption throughout the project life cycle.

20.6.2 List of mitigation measures

Measures that will be implemented to address potential air quality impacts and reduce greenhouse gas emissions are listed in Table 20.4.

Table 20.4 Air quality and greenhouse gas risk mitigation measures

Impact/issue	Ref	Mitigation measure	Timing
General air quality impacts	AQ1	An air quality management plan will be prepared as part of the CEMP and implemented during construction. The plan will detail processes, responsibilities and measures to manage air quality, odour and landfill gas and minimise the potential for impacts during construction. The plan will include an air quality, odour and landfill gas monitoring program, which will be undertaken for the duration of construction.	Pre-construction, construction
Odour emissions	AQ2	An odour management strategy will be developed prior to construction and implemented for the duration of works involving ground disturbance in Camellia, near the Parramatta River and in Sydney Olympic Park. The strategy will include: • proposed work methods and mitigation measures that aim to limit odour at sensitive receivers • routine observation of weather conditions • regular odour surveys at receptor locations by appropriately qualified professionals (mitigation measure AQ4) • measures to minimise the generation of odour at the end of each work day/shift • mechanisms for investigating odour complaints, including conduct of additional odour surveys (mitigation measure AQ4) • contingency and rectification measures should significant odour issues occur at sensitive receivers in the vicinity of the project site.	Pre-construction, construction

<table>
<tr><th>Impact/issue</th><th>Ref</th><th>Mitigation measure</th><th>Timing</th></tr>
<tr><td></td><td>AQ3</td><td>Odour surveys will be undertaken at downwind receivers during works involving ground disturbance in Camellia, near Parramatta River and in Sydney Olympic Park in accordance with Determination of odorants in ambient air by field inspection (VDI 3940, 1993).
The odour surveys will be undertaken:
• daily, for one hour when works commence, and prior to works completing
• if wind conditions drop below three metres per second
• if an odour complaint is received.
If significant odour issues are observed in the vicinity of sensitive receivers, the contingency and rectification measures defined by the odour management strategy will be implemented (see AQ2).</td><td>Construction</td></tr>
<tr><td>Energy use and greenhouse gases</td><td>GHG1</td><td>An energy and greenhouse gas strategy will be prepared to document the greenhouse reduction targets for the construction and operational stages of the project. The strategy will:
• be prepared in accordance with Infrastructure Sustainability Council and NSW Government Resource Efficiency Policy (OEH, 2014) requirements
• identify the key initiatives that will be explored further to meet these targets in accordance with the carbon emissions management hierarchy
• be reviewed throughout the project lifecycle.</td><td>Design, construction, operation</td></tr>
<tr><td></td><td>GHG2</td><td>Opportunities to reduce construction and operational greenhouse gas emissions will be investigated including, but not limited to:
• purchasing electricity derived from a renewable energy source
• the use of biodiesel in plant and equipment
• connecting compound sites to grid electricity, where available
• the use of low embodied energy and recycled materials
• promoting the selection of energy efficient rolling stock, electrical equipment and maintenance vehicles.
Preferred measures will be defined in the energy and greenhouse gas strategy.</td><td>Design</td></tr>
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