7.10 Air quality

This section assesses air quality impacts of the project. The assessment is supported by an air quality study, which is presented in the Air quality working paper (Volume 4 – Working paper 11) and is summarised below. The assessment has been prepared to meet the relevant Director General's requirements in **Table 7-71** as well as the relevant requirements of Schedule 2, Part 3 of the *Environmental Planning and Assessment Regulation 2000*.

Table 7-71 Director General's requirements – air quality

Director General's requirements	Where addressed
The EIS must address the following specific matters: **Air Quality** – including but not limited to: The EIS must address air quality matters including but not limited to activities that have the potential to impact on local and regional air quality and details of the proposed mitigation measures to prevent the generation and emission of dust.	Section 7.10.3 & 7.10.4 Section 7.10.5

7.10.1 Guidelines and methodology

The Environmental Protection Authority (EPA) has set air quality assessment criteria as part of their *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (DEC, 2005). In general, these criteria relate to the total concentration of a pollutant in the air and not just the contribution from project-specific sources.

While the EPA also set criteria for other pollutants from motor vehicles, such as air toxics, the pollutants listed in **Table 7-72** are key pollutants for road air quality assessments. For each of the key pollutants, an acute (short term exposure) and chronic (longer term exposure) criterion has been identified by the EPA. The potential human health impacts of the key pollutants are described in the Air quality working paper (Volume 4 - Working paper 11).

Table 7-72 EPA assessment criteria for key pollutants for road air quality assessments

Pollutant	Averaging time	Criterion
Carbon monoxide	Maximum 1-hour average	30 mg/m^3
	Maximum 8-hour average	10 mg/m^3
Nitrogen dioxide	Maximum 1-hour average	246 $\mu g/m^3$
	Annual average	62 $\mu g/m^3$
Particulate matter	Maximum 24-hour average	50 $\mu g/m^3$
	Annual average	30 $\mu g/m^3$

$\mu g/m^3$ = micrograms per cubic metre. mg/m^3 = milligrams per cubic metre.

The air quality criteria have been used to assess both the existing air quality and the potential impacts of the project.

Operational assessment methodology

Vehicle emission estimates and dispersion modelling was used to quantify potential air quality impacts of the project and included consideration of background air quality, future traffic volumes and the proportion of heavy vehicles.

Review of air quality and meteorological data

Air quality monitoring can be used to characterise the existing air quality of an area and to establish “background” levels. No air quality monitoring has been carried out specifically for the project. The EPA operates an air quality monitoring and meteorological station at Richmond. As well as meteorological data, the station measures both particulate matter and nitrogen dioxide concentrations and is situated in a residential/semi-rural area. Air quality data sourced from this location would be representative of the study area. While the Richmond air quality monitoring station does not monitor carbon monoxide concentrations, 8-hour carbon monoxide concentrations are measured at Prospect also located within the northwest Sydney region. Regional air quality data for 2011 is presented in **Table 7-73**. No hourly carbon monoxide concentration records were available.

Traffic forecasts

Average daily traffic volumes from Windsor Road for 2016 and 2026 were forecasted including hourly volumes and the proportion of heavy vehicles (see Traffic and Transport working paper – Volume 4 working paper 3). **Table 7-73** summarises the traffic data used for this assessment.

Table 7-73 Summary of existing and forecast traffic for 2016 and 2026

Road		Existing (2011)		Opening year (2016)		10yrs after opening (2026)	
		No. vehicles	% Heavy vehicles	No. vehicles	% Heavy vehicles	No. Vehicles	% Heavy vehicles
Bridge Street	Northbound	9767	7.0	10,623	7.0	12,297	7.0
	Southbound	9366	7.0	10,103	7.0	11,685	7.0
Wilberforce Road	Eastbound	6459	7.2	6961	7.2	7996	7.2
	Westbound	6784	7.0	7253	7.0	8278	7.0
Freemans Reach Road	Northbound	3776	6.6	4166	6.6	4881	6.6
	Southbound	3104	7.0	3396	7.0	4012	7.0

Dispersion modelling

The Tool for Roadside Air Quality (TRAQ) developed by RMS, was used to estimate air quality impacts associated with the project. Vehicle emission factors from the World Road Association are used by TRAQ to estimate vehicle emissions factors for different road gradients, vehicle speeds and for vehicles conforming to different European emission standards (PIARC, 2004). Existing pollutant levels in the area from EPA monitoring stations was included in the TRAQ background air quality database and incorporated into the dispersion model. This is a conservative approach to estimating air quality impacts as does not consider any improvements to regional air quality resulting from improved vehicle emissions.

Construction assessment methodology

A qualitative air quality assessment was undertaken for the construction works. The assessment identified the proposed construction activities, the potential for generation of air emissions, the effects of local meteorology, and the resultant potential for impacts on sensitive receivers. Specifically tasks for assessment of the construction works were:

- Identification of the location and intensity of key construction activities.
- Identification of the types of air emissions associated with these construction activities.
- Identification of the location of sensitive receivers.
- Characterisation of the existing air quality at sensitive receiver locations.
- Assessment of the prevailing meteorological conditions in the study area and the potential for these to influence air emissions from the project.
- Assessment of the potential for air emissions from project construction to adversely affect sensitive receivers.
- Identification of options to avoid, mitigate or manage any impacts on sensitive receivers.

The existing bridge was also assessed for the presence of lead based paint and asbestos. Where the presence of lead based paint and/or asbestos was identified, measures to prevent these substances entering the environment during demolition were identified (see **Section 7.10.5**).

7.10.2 Existing environment

Land use and sensitive receivers

The land use in the study area towards the south of the Hawkesbury River is comprised mainly of commercial and residential premises while to the north the primary land use is rural residential and agricultural. The area also includes a number of parks and open space areas, such as Thompson Square parkland within Windsor town centre and Macquarie Park on the north side of the river.

Sensitive receivers for potential air quality issues include low density residential properties, and commercial properties such as motels located to the east of Bridge Street. To the west of Bridge Street, sensitive receivers are largely local businesses such as hotels and eateries. Sensitive receivers on Freemans Reach Road and Wilberforce Road include rural residential properties and a turf farm.

Climate and meteorology

The region is characterised by mild to warm summers and cold winters. Climatic data collected by the Bureau of Meteorology (BoM) at Richmond RAAF, around three kilometres west of the study area. The data reveals January is typically the warmest month with a mean daily maximum temperature of 30°C. July and August are the coolest months with a mean daily minimum temperature of 4°C. Rainfall data collected at Richmond RAAF show that February is usually the wettest month with mean rainfall of 125 millimetres, falling over an average of eight days in the month. The lowest monthly rainfall on average is in July and August, both with a mean monthly rainfall of 32 millimetres over four rain days. The mean annual rainfall is 738 millimetres with an average of 74 rain days each year (Bureau of Meteorology, 2012).

Meteorological conditions, as opposed to climatic conditions, are those which are focussed on smaller geographical and time scales. Local meteorology and, in particular, wind patterns are important for the transportation and dispersion of air pollutants. On a relatively small scale, winds are largely affected by the local topography, but at larger scales, there are synoptic scale influences, such as sea breeze circulations and regional drainage flows that can drive the meteorological conditions for a particular location. It is important to understand the local meteorological conditions in air quality assessments, especially for the early works activities where there could be significant dust generation.

Meteorological data, including temperature, wind speed and wind direction, have been obtained from the BoM Automatic Weather Station (AWS) at Richmond RAAF for 2011. On an annual basis, the most common wind directions are from the south southwest to southwest; however northeast to east north-easterly winds are also prevalent. The site experiences generally light winds with an average annual wind speed on 2.4 metres per second (m/s). The highest seasonal average wind speeds occur during spring; averaging 2.6 metres per second; here a similar trend to the annual wind direction is observed with winds frequently from the northeast to east northeast and from the south southwest to southwest. During the summer the wind direction is highly variable with winds from the northeast to southwest, with wind speeds averaging 2.5 metres per second. Autumn has the lowest seasonal average wind speed at 2.2 metres per second with winds frequently from the south southwest to southwest. Like autumn, in winter winds commonly come from the southwest. The average wind speed in winter is the same as the annual wind speed.

Air quality

To assess potential air quality impacts it is necessary to have information on existing pollutant levels in the area in which the project would be likely to contribute to these levels.

Regional air quality data for 2011 is presented in **Table 7-72**. No hourly carbon monoxide concentration records were available. In the absence of published hourly data for carbon monoxide it has been assumed that the maximum 1-hour concentration would be equal to the maximum 8-hour concentration which is recorded as a rolling average.

Background regional air quality data from the region in 2011 is assessed against EPA air quality criteria in **Table 7-72**.

There were no exceedances of the recorded carbon monoxide (8-hour average concentration of 10 mg/m^3 with an 8-hour maximum of 1.9 mg/m^3 (OEH, 2011). Both the maximum 1-hour average and annual average nitrogen dioxide concentration recorded at Richmond are well below the EPA criteria of 62 µg/m^3 and 246 µg/m^3 respectively (OEH, 2011). The maximum 24-hour particulate matter concentration of 40 µg/m^3 is below the relevant criterion. The annual average particulate matter concentration for 2011 is well below the EPA criterion of 30 µg/m^3 (OEH, 2011).

Overall the 2011 regional air quality is be considered to be good as there were no exceedances of relevant air quality criteria.

Table 7-74 Background air quality compared against relevant EPA air quality criteria

Pollutant	Averaging time	Recorded concentration	EPA criterion
Carbon monoxide	Maximum 1-hour average	1.9 mg/m^3	30 mg/m^3
	Maximum 8-hour average	1.9 mg/m^3	10 mg/m^3
Nitrogen dioxide	Maximum 1-hour average	54 µg/m^3	246 µg/m^3
	Annual average	9 µg/m^3	62 µg/m^3
Particulate matter	Maximum 24-hour average	40 µg/m^3	50 µg/m^3
	Annual average	13 µg/m^3	30 µg/m^3

7.10.3 Construction and demolition impacts

The main potential impact on air quality during construction and demolition would be generation of dust during earthworks and other construction activities. The potential for dust to be generated would depend on the silt and moisture content of the soil, the types of operations being carried out, the size of exposed areas and the prevailing wind conditions.

The use of petrol or diesel driven plant, machinery and work vehicles (including barges) would also result in some emissions to air. The types of plant and equipment required during construction would typically include excavators, cranes, graders, vibratory rollers, haul trucks, backhoes, bitumen and asphalt spraying plants, line-marking equipment, water carts and bulldozers. Primary sources of dust emissions associated with project construction would include:

- Clearing of vegetation and topsoil by bulldozers and/or backhoes.
- Excavation and levelling of soil by bulldozers, backhoes and/or excavators.
- Movement of soil and fill by dump trucks and scrapers.
- Wind erosion from unsealed surfaces and stockpiles.
- Vehicles travelling along unsealed areas.

A total of 12,300 cubic metres of fill material would be required for the construction works. Local fill from the project construction site in the order of 1,500 cubic metres would be reused where possible, although additional imported fill of around 10,800 cubic metres would be required.

There is potential for dust emissions to cause impacts if activities are located close to sensitive receptors, such as residential dwellings and/or local businesses. The magnitude of dust impacts would depend on the amount of earthworks involved at a particular location, the duration of activities, and the local meteorology at the time, particularly the wind speed and direction in relation to sensitive receivers. The following discussion provides a qualitative assessment of potential dust impacts, taking into consideration the local wind patterns and the proximity of work sites to nearby sensitive receptors.

Annually, winds within the study area are most commonly from the southwest and northeast. This highlights the potential for adverse dust impacts at sensitive receivers to the northeast and southwest of the site. Some rural properties lie to the northeast but most sensitive receivers are located to the southwest and comprise commercial and residential premises within the town centre. Construction activities conducted over spring and summer would have the highest potential for observed impacts and sensitive receivers within the town centre due to increased frequency of winds from the northeast.

A hazardous materials audit was undertaken on the structure of the existing Windsor Bridge to identify any hazardous substances of concern, such as asbestos and lead based paint. The audit took the form of a visual inspection of the bridge structure and services and sampling of suspect materials. Samples of material suspected of containing asbestos or lead based paint were collected and tested (see **Section 7.6**). No asbestos was identified, however lead based paints were detected on the iron piers and cross bracings of the bridge structure. This poses a potential risk of inhalation of fine particles containing lead based paint during demolition. Environmental management measures for demolition of the existing bridge to safeguard against exposure to lead based paints are discussed in **Section 7.6** and **Section 7.10.5**).

7.10.4 Operational impacts

The model predictions of carbon monoxide, nitrogen dioxide and particulate matter concentrations during operation of the project are provided in **Table 7-73**, **Table 7-74** and **Table 7-75**.

The following points should be noted in relation to the operational air quality assessment:

- Predicted pollutant concentrations from the project when added to background concentrations are likely to be an over estimation of pollutants as the background concentration would include existing regional vehicle emission concentrations.
- The highest pollutant concentrations would be near the kerb and concentrations would rapidly decrease with distance from the kerb, due to dispersion.
- Predicted decreases in pollutant concentrations between the existing case and the scenarios for 2016 and 2026 are due to the assumed reduction in the proportion of older vehicles on the road.
- Operational impacts are based on worst case metrological conditions and as such on average, carbon monoxide, nitrogen dioxide and particulate matter concentrations would be lower than predicted.

Carbon monoxide

The modelled carbon monoxide concentrations at the kerb due to the project for the current, 2012 and 2016 traffic volumes are presented in **Table 7-73**. Carbon monoxide concentrations along the alignment of the project in 2016 and 2026 would be lower than current concentrations due to the decrease in vehicle emissions from improved technology and lower emissions standards over time.

When the concentrations of carbon monoxide from vehicles using the project were added to the background carbon monoxide concentration, the total concentration would be well below the relevant EPA criteria.

Nitrogen dioxide

The modelled nitrogen dioxide concentrations at the kerb due to the project for the current, 2012 and 2016 traffic volumes are presented in **Table 7-74**.

Nitrogen dioxide concentrations along the alignment of the project in 2016 and 2026 would be lower than current concentrations due to the decrease in vehicle emissions from improved technology and lower emissions standards over time.

When the concentrations of nitrogen dioxide from vehicles using the project were added to the background carbon monoxide concentration, the total concentration would be well below the relevant EPA criteria.

Table 7-75 Carbon monoxide levels at the kerb

Year	Averaging Period	Distance from kerb (m)	CO concentration (mg/m^3) Due to Roadway	Background	Total	EPA Criteria (mg/m^3)	Assessment
Bridge Street							
2011	Maximum 1-hour	0	0.8	1.9	2.7	30	Below criterion
	Maximum 8-hour	0	0.5	1.9	2.4	10	Below criterion
2016	Maximum 1-hour	0	0.5	1.9	2.4	30	Below criterion
	Maximum 8-hour	0	0.3	1.9	2.2	10	Below criterion
2026	Maximum 1-hour	0	0.2	1.9	2.1	30	Below criterion
	Maximum 8-hour	0	0.1	1.9	2.0	10	Below criterion
Wilberforce Road Street							
2011	Maximum 1-hour	0	0.5	1.9	2.4	30	Below criterion
	Maximum 8-hour	0	0.4	1.9	2.3	10	Below criterion
2016	Maximum 1-hour	0	0.3	1.9	2.2	30	Below criterion
	Maximum 8-hour	0	0.2	1.9	2.1	10	Below criterion
2026	Maximum 1-hour	0	0.1	1.9	2.0	30	Below criterion
	Maximum 8-hour	0	0.1	1.9	2.0	10	Below criterion
Freemans Reach Road							
2011	Maximum 1-hour	0	0.3	1.9	2.2	30	Below criterion
	Maximum 8-hour	0	0.2	1.9	2.1	10	Below criterion
2016	Maximum 1-hour	0	0.2	1.9	2.1	30	Below criterion
	Maximum 8-hour	0-10	0.1	1.9	2.0	10	Below criterion
2026	Maximum 1-hour	0	0.1	1.9	2.0	30	Below criterion
	Maximum 8-hour	0	0.1	1.9	2.0	10	Below criterion

Table 7-76 Nitrogen dioxide levels at the kerb

Year	Averaging Period	Distance from kerb (m)	Nitrogen dioxide concentration (µg/m^3) Due to Roadway	Background	Cumulative	EPA Criteria (µg/m^3)	Assessment
Bridge Street							
2011	Maximum 1-hour	0	44.8	54.0	98.8	246	Below criterion
	Annual Average	0	9	9.0	18.0	62	Below criterion
2016	Maximum 1-hour	0	30.9	54.0	84.9	246	Below criterion
	Annual Average	0	6.2	9.0	15.2	62	Below criterion
2026	Maximum 1-hour	0	21.2	54.0	75.2	246	Below criterion
	Annual Average	0	4.2	9.0	13.2	62	Below criterion
Wilberforce Road							
2011	Maximum 1-hour	0	32.4	54.0	86.4	246	Below criterion
	Annual Average	0	6.5	9.0	15.5	62	Below criterion
2016	Maximum 1-hour	0	22.1	54.0	76.1	246	Below criterion
	Annual Average	0	4.4	9.0	13.4	62	Below criterion
2026	Maximum 1-hour	0	15.1	54.0	69.1	246	Below criterion
	Annual Average	0	3	9.0	12.0	62	Below criterion

Year	Averaging Period	Distance from kerb (m)	Nitrogen dioxide concentration (µg/m³)			EPA Criteria (µg/m³)	Assessment
			Due to Roadway	Background	Cumulative		
Freemans Reach Road							
2011	Maximum 1-hour	0	19.6	54.0	73.6	246	Below criterion
	Annual Average	0	3.9	9.0	12.9	62	Below criterion
2016	Maximum 1-hour	0	13.7	54.0	67.7	246	Below criterion
	Annual Average	0	2.7	9.0	11.7	62	Below criterion
2026	Maximum 1-hour	0	9.5	54.0	63.5	246	Below criterion
	Annual Average	0	1.9	9.0	10.9	62	Below criterion

Particulate matter

Dispersion modelling of particulate concentrations along the proposed alignment in 2016 and 2026 are lower than the existing case for particulate concentrations across both pollutant averaging periods. This is due to assumed reductions in the proportion of older vehicles resulting in improved vehicle emissions in future years.

With the exception to predicted maximum 24-hour particulate concentrations, predicted particulate concentrations along Bridge Street and Windsor Road are within the EPA criterion when added to existing background concentrations. For Bridge Street and Windsor Road the predicted 2016 and 2026 concentrations of maximum 24-hour particulates, when added to the background concentration indicated exceedences of the maximum 24-hour particulate concentration at the kerb, dissipating to concentrations within the 50µg/m³ criterion within 10 metres of the road. These predicted exceedances would occur even if the project was not to proceed as the growth in traffic and the location of the road alignment would remain relatively the same. Also the largest source particulates in the assessment are from background levels, rather than from traffic on the road and the contribution of traffic to particulate concentrations would decrease over time. The maximum 24-hour particulate concentration at nearby sensitive receptors would be within the EPA goal.

Table 7-77 Particulate levels at the kerb

Year	Averaging Period	Distance from kerb (metres)	Particulate matter (µg/m³) Due to Roadway	Background	Cumulative	EPA Criteria (µg/m³)	Assessment
Bridge Street							
2011	Maximum 24-hour	0	16	40.0	56.0	50	Above criterion
	Annual Average	0	6.4	13.0	19.4	30	Below criterion
2016	Maximum 24-hour	0	14.5	40.0	54.5	50	Above criterion
	Annual Average	0	5.8	13.0	18.8	30	Below criterion
2026	Maximum 24-hour	0	14.9	40.0	54.9	50	Above criterion
	Annual Average	0	5.9	13.0	18.9	30	Below criterion
Wilberforce Road							
2011	Maximum 24-hour	0	11.6	40.0	51.6	50	Above criterion
	Annual Average	0	4.6	13.0	17.6	30	Below criterion
2016	Maximum 24-hour	0	10.3	40.0	50.3	50	Above criterion
	Annual Average	0	4.1	13.0	17.1	30	Below criterion
2026	Maximum 24-hour	0	10.5	40.0	50.5	50	Above criterion
	Annual Average	0	4.2	13.0	17.2	30	Below criterion
Freemans Reach Road							
2011	Maximum 24-hour	0	7.1	40.0	47.1	50	Below criterion
	Annual Average	0	2.8	13.0	15.8	30	Below criterion
2016	Maximum 24-hour	0	6.5	40.0	46.5	50	Below criterion
	Annual Average	0	2.6	13.0	15.6	30	Below criterion
2026	Maximum 24-hour	0	6.8	40.0	46.8	50	Below criterion
	Annual Average	0	2.7	13.0	15.7	30	Below criterion

In summary no adverse air quality impacts are predicted during operation as a reduction in the proportion of older vehicles on the road would result in a reduction in roadside air quality impacts despite increased traffic volumes.

Regional air quality

The project would provide a new river crossing and intersections that have been designed to achieve a high level of service for road users and to operate efficiently. This would result in less congestion, improved travel times and reduced fuel usage. Overall, there would be a minor reduction in the amount of air pollutants emitted into the regional airshed by vehicles using the project.

7.10.5 Environmental management measures

Construction

Dust control measures will be included in the Construction Environmental Management Plan to minimise the risk of impacts on sensitive receivers. Dust environmental management measures will include:

- Covering of all materials transported to and from the construction site.
- Covering of or spraying water on stockpiles of soil or other erodible materials, particularly during dry or windy conditions.
- Suppressing dust on unsealed surfaces, temporary roadways, and other exposed areas using water trucks, hand held hoses, temporary vegetation or other appropriate practices.
- Imposing work vehicle speed limits on unsealed surfaces.
- Locating stockpiles as far away from residences as practically possible.
- Minimising the extent of disturbed areas as far as practicable.
- Rehabilitating disturbed areas as quickly as possible.
- Modifying or stopping dust generating activities during very windy conditions.
- Operating and maintaining vehicles and equipment in accordance with manufacturer's specifications.
- Visual monitoring of air quality to verify the effectiveness of controls and enable early intervention.
- Installing wheel wash facilities to reduce tracking of mud and soil off-site.
- A procedure to receive, respond and monitor complaints about air quality and other environmental issues.

Demolition

Demolition of existing bridge structures containing lead based paints will be undertaken in accordance with the following:

- Australian Standard AS 4361.1 – 1995 - Guide to lead paint management, Part 1: Industrial applications.
- Australian Standard AS 4361.2 – 1998 - Guide to lead paint management, Part 2: Residential and commercial buildings.
- Australian Standard AS 2601 – 2001 - The demolition of structures.

The options for the management of lead based paints during the demolition of the existing bridge structure (based on the respective Australian standards) are as follows:

- Containment – this option will involve the implementation of a high level of containment to prevent dust and debris spreading beyond the immediate works site during demolition.
- Paint stabilisation – paint stabilisation will require the existing surfaces to be stabilised with another non-hazardous covering. During both stabilisation and structure removal, a moderate level of containment will be required.

- Paint removal – paint removal will require the existing painted surfaces to be removed prior to demolition. During paint removal, a high level of containment will be required. Little to no containment will be required to manage the demolition of the structure following removal of the lead based paints.

Regardless of the implementation of either of these options, the management of lead based paints will entail:

- Containment of the work area and implementation of procedures and systems to prevent dust and debris spreading beyond the immediate work area.
- Exclusion of the public from the work area.
- Regular clean-up and disposal of debris during the work period.

No asbestos was identified during the site inspection and laboratory analysis. Nevertheless, in the unlikely event that asbestos is discovered, the subject works will be carried out in accordance with the Guide to the Control of Asbestos Hazards in Buildings and Structures (NOHSC, 1988) and Code of Practice for the Safe Removal of Asbestos (NOHSC, 2002). An employer must ensure that air monitoring is carried out if a risk assessment as described by the Occupational Health and Safety Regulation 2001 indicates the need for one.

Operation

No environmental management measures would be required to mitigate air quality impacts during operation of the project.

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