6.13 Air quality

This section provides a summary of the assessment of potential air quality impacts during construction and operation of the proposal and identifies mitigation measures to address these impacts. A detailed assessment of air quality impacts is presented in the Technical working paper – Air quality (Appendix O).

6.13.1 Methodology

The air quality assessment involved the following:

- Identifying the key air quality related risks from the proposal
- Establishing prevailing climate and meteorological conditions around the proposal using publicly available data from the Bureau of Meteorology monitoring station at Marrangaroo
- Establishing prevailing ambient air quality conditions around the proposal using publicly available data from Department of Planning, Industry and Environment (DPIE) air quality monitoring stations at Richmond, Bathurst and Camden (the closest monitoring stations to the proposal). Parameters measured include particulate matter less than 10 microns (PM_{10}) and less than 2.5 microns ($PM_{2.5}$), nitrogen dioxide ($N0_2$), carbon monoxide (CO)
- Identifying air quality sensitive receivers with the potential to be adversely affected by the proposal
- Assessing potential air quality impacts during construction and operation of the proposal. TRAQ dispersion modelling was used to predict the potential changes to air quality as a result of the operation of the proposal. Pollutants modelled include CO, N02, $PM_{10,}$, $PM_{2.5}$, and benzene. This was then compared against Environment Protection Authority air quality criteria to determine if further detailed air quality modelling would be required
- Identifying mitigation measures to address or manage potential air quality impacts.

6.13.2 Existing environment

The nearest automatic weather station (AWS) with long-term records in relation to the proposal is located at Marrangaroo, approximately 17 kilometres to the north. Key meteorological statistics recorded at the station between 2018 and 2020 are summarised in Table 6-113.

Meteorological conditions

Table 6-113 Local meteorological statistics (Marrangaroo)

Statistic	2018	2019	2020
Mean wind speed (m/s)	1.7	1.6	1.7
99th percentile wind speed (m/s)	5.5	5.8	5.3
Per centage of calm winds (%) (wind speeds less than 0.5 m/s)	27.7	30.8	27.1
Per centage of winds >6 m/s (%)	0.4	0.7	0.3

Hourly records of wind speed and wind direction were examined and the data showed that the wind speed statistics do not vary significantly from year to year. Wind patterns in the vicinity of the proposal are characteristic of the western foothills of the Blue Mountains, with the prevailing winds being from the east and west.

Air quality conditions

DPIE has established a network of monitoring stations across NSW to understand current air quality conditions and impacts, and to help identify programs to improve air quality. The closest air quality monitoring stations to the proposal are located at Richmond, Bathurst and Camden. Data from these stations have been examined and compared to relevant impact assessment criteria in order to understand the existing air quality conditions for the key pollutants that are relevant to the proposal. Table 6-114 identifies the parameters measured at each site.

Table 6-114 Measured parameters at nearby DPIE monitoring stations

Station	Distance from proposal	Measured parametres
DPIE Richmond	60 kilometres	PM_{10}, $PM_{2.5}$,
DPIE Bathurst	50 kilometres	PM_{10}, $PM_{2.5}$, NO_2
DPIE Camden	70 kilometres	CO

Table 6-115 shows the assumed background levels that apply in the vicinity of the proposal. The justification for these background levels is also provided, with conservative approaches adopted in most instances.

Measured CO and NO2 concentrations have been consistently below NSW EPA air quality impact assessment criteria.

Particle levels (as PM_{10} and $PM_{2.5}$) is influenced by many sources including mining activities, construction works, bushfires and 'burning off', industry, vehicles, roads, wind-blown dust from nearby and remote areas, fragments of pollen, mould, and domestic wood fires.

Concentrations of PM_{10} and $PM_{2.5}$ increased across NSW from 2018 to 2020 due to dust from the widespread, intense drought and smoke from bushfires and hazard reduction burning (OEH 2019). These events adversely influenced air quality with multiple days observed when PM_{10} and $PM_{2.5}$ concentrations exceeded NSW EPA criteria.

Table 6-115 Assumed background levels in the vicinity of the proposal.

Pollutant	Averaging time	Assumed background level	Notes
CO	1-hour	5.6 mg/m3	Maximum 1-hour concentration from DPIE Camden (2016 to 2020)
	8-hour	2.3 mg/m3	Maximum 8-hour concentration from DPIE Camden (2016 to 2020)
NO_2	1-hour	66 µg/m3	Maximum 1-hour concentration from DPIE Richmond (2016 to 2020)
	Annual	10 µg/m3	Highest annual concentration from DPIE Richmond (2016 to 2020)
PM_{10}	24-hour	49.9 µg/m3	Maximum 24-hour average in 2016 and 2017 from DPIE Bathurst, noting that data collected 2018 to 2020 were affected by drought, dust storms and bushfires. Air quality data from DPIE Bathurst is considered to be more representative of the

Pollutant	Averaging time	Assumed background level	Notes
			proposal area than DPIE Richmond which is located to the east within the Sydney Greater Metropolitan Area (GMA).
	Annual	14.1 µg/m3	Highest annual concentration from DPIE Bathurst in 2016 and 2017 noting the issues with the data collected in 2018 and 2020, and preference compared to DPIE Richmond outlined above.
$PM_{2.5}$	24-hour	17.5 µg/m3	As above for 24-hour averaged PM_{10}.
	Annual	6.1 µg/m3	As above for annually averaged PM_{10}.

6.13.3 Potential impacts

Construction

The potential construction air quality risks for each section of the proposal are outlined in Table 6-116. The Little Hartley to River Lett and Coxs River Road sections were considered together due to their proximity and concurrent construction programs.

Table 6-116 Summary of unmitigated air quality risks

Construction air quality risk	Consequence	Sensitivity	Risk rating
Little Hartley to River Lett and Coxs River Road			
Dust	Moderate	Likely	High
Exhaust emissions	Insignificant	Unlikely	Low
Blast emissions	N/A	N/A	N/A
Odours and hazardous substances	Moderate	Possible	High
River Lett to Forty Bends			
Dust	Moderate	Likely	High
Exhaust emissions	Insignificant	Unlikely	Low
Blast emissions	Moderate	Possible	High
Odours and hazardous substances	Minor	Unlikely	Low
Forty Bends to Lithgow			
Dust	Minor	Almost certain	High
Exhaust emissions	Insignificant	Unlikely	Low
Blast emissions	N/A	N/A	N/A
Odours and hazardous substances	Minor	Unlikely	Low

The key air quality issue during construction of the proposal is expected to be dust generated from construction activities as well as from wind erosion of exposed areas. Dust emissions from construction works have the potential to cause nuisance impacts if not properly managed. Dust impacts during construction would largely result from cutting, embankment filling, vegetation clearing, topsoil stripping, stockpiling of soil, general material handling, driving on unsealed roads and demolition of redundant assets and structures.

The total amount of dust generated would depend on the quantities of material handled, silt and moisture content of the soil, the types of operations being carried out, exposed areas, frequency of water spraying and speed of vehicles and machinery operating on unpaved roads and areas.

All four sections of the proposal are determined to present a 'high' risk of dust impacts during construction and measures commensurate to this level of risk have been recommended.

In addition to construction dust, there are a range of other potential air quality issues. These include:

- Exhaust emission from the combustion of fossil fuels generated by equipment and construction plant
- Blast emissions such as NOx and particulate emissions where blasting is required to remove hard rock in cuttings
- Odours arising from uncovered contaminated and/or hazardous materials, and other airborne hazardous materials, which may be generated during demolition and excavation activities.

Potential impacts from construction plant and equipment exhaust emissions are anticipated to be low, owing to the expected intensity of construction operations, setback distances from surrounding sensitive receivers, and the linear nature of the proposal.

Blasting would be limited to the River Lett to Forty Bends section of the proposal and would represent a high risk for air quality impacts. Where possible, blasting would be timed to avoid the early morning and late afternoon when meteorological conditions are typically least favourable.

There is potential for odours and impacts from airborne hazardous materials during demolition activities. These risks may also be present during excavation works, noting the presence of potentially contaminated soils and areas of illegal dumping within the construction area.

With the implementation of the safeguards and management measures outlined in Section 6.13.4, significant air quality impacts associated with dust, exhaust emissions, odours, and airborne hazardous materials are not anticipated.

Operation

The potential operational impacts of the proposal have been quantified using dispersion modelling. Results from the modelling have been assessed by examining the spatial differences between, with and without proposal scenarios, and also in terms of the potential for the proposal to cause exceedances of the EPA air quality impact assessment criteria at sensitive receivers. Potential impacts to specific sensitive receivers are described in Section 5.2 of Appendix O.

Little Hartley to River Lett

Results at the most-affected receiver along the eastern component of the Little Hartley to River Lett section of the proposal are listed in Table 6-117. This represents the receiver where the change from the background level is highest.

The Great Western Highway would move around 20 metres closer to some receivers as a result of the proposal. This would have the potential to increase 24-hour average PM_{10} concentrations greater than the EPA's 50 micrograms per cubic metre criterion at one sensitive receiver. It is noted that the predicted contribution of the proposal to this exceedance was up to 0.2 micrograms per cubic metre or 0.4 per cent, noting that the adopted background concentration was 49.9 micrograms per cubic metre. The proposals

contribution represents a minor increase and in and of itself is not considered likely to adversely impact on nearby sensitive receivers. The maximum 24-hour averaged PM_{10} cumulative concentration of 50.2 micrograms per cubic metre is within the range of historical maximum values recorded at the nearest DPIE monitoring stations in Bathurst and Richmond, which have been measured as high as 320 ug/m3 and 238 ug/m3 respectively.

Concentrations of the other pollutants, as well as annually averaged PM_{10} were predicted to remain below the relevant EPA assessment criteria.

Table 6-117 Predicted air quality impacts at the most-affected receiver – Little Hartley to River Lett (east)

Pollutant	Averaging time	EPA assessment criteria	Assumed background level	Concentration with proposal 2026	Concentration with proposal 2036
CO (mg/m^3)	1-hour	30	5.6	5.7	5.7
	8-hour	10	2.3	2.3	2.4
NO_2 ($\mu g/m^3$)	1-hour	246	66	66.2	66.9
	Annual	62	10	10.2	10.2
PM_{10} ($\mu g/m^3$)	24-hour	50	49.9	50.1	50.2
	Annual	25	14.1	14.2	14.2
$PM_{2.5}$ ($\mu g/m^3$)	24-hour	25	17.5	17.7	17.8
	Annual	8	6.1	6.2	6.2
Benzene ($\mu g/m^3$)	1-hour	29	-[1]	0	0.1

Note 1: No assumed background level for benzene as this is not measured at DPIE air quality monitoring stations

Results at the most-affected receiver along the western component of the Little Hartley to River Lett section of the proposal are listed in Table 6-118. This represents the receiver where the change from the background level us highest.

The concentrations of each pollutant at the most-affected receiver were predicted to remain at or below the EPA's impact assessment criteria. This section of the proposal would not result in any adverse local operational air quality impacts.

Table 6-118 Predicted air quality impacts at the most-affected receiver – Little Hartley to River Lett (west)

Pollutant	Averaging time	EPA assessment criteria	Assumed background level	Concentration with proposal 2026	Concentration with proposal 2036
CO (mg/m^3)	1-hour	30	5.6	5.7	5.7
	8-hour	10	2.3	2.4	2.5
NO_2 ($\mu g/m^3$)	1-hour	246	66	65.9	66
	Annual	62	10	10	10
PM_{10} ($\mu g/m^3$)	24-hour	50	49.9	50	50
	Annual	25	14.1	14.1	14.1
$PM_{2.5}$ ($\mu g/m^3$)	24-hour	25	17.5	17.6	17.6

Pollutant	Averaging time	EPA assessment criteria	Assumed background level	Concentration with proposal 2026	Concentration with proposal 2036
	Annual	8	6.1	6.1	6.1
Benzene (µg/m^3)	1-hour	29	-[1]	0	0

Note 1: No assumed background level for benzene as this is not measured at DPIE air quality monitoring stations

Coxs River Road

Results at the most-affected receiver along the Coxs River Road section of the proposal are listed in Table 6-119. This represents the receiver where the change from the background level is highest.

Changes in concentrations as a result of the proposal concentrations were predicted to remain below the EPA's impact assessment criteria, except for 24-hour averaged PM_{10} where the exceedances would be experienced at six sensitive receivers. Exceedances at these locations are a result of the Great Western Highway alignment moving closer to the receivers. These exceedances primarily remain the result of the elevated adopted 24-hour averaged PM_{10} background concentration of 49.9 micrograms per cubic metre, with the proposal's contribution to the highest cumulative value of 51.5 micrograms per cubic metre being 1.6 micrograms per cubic metre or less than 3.1 per cent. The proposals contribution represents a minor increase and in and of itself is not considered likely to adversely impact on nearby sensitive receivers. Further, the maximum 24-hour averaged PM_{10} cumulative concentration of 51.5 micrograms per cubic metre is within the range of measured historical maximum values which have been measured as high as 320 ug/m3 and 238 ug/m3 respectively.

Table 6-119 Predicted air quality impacts at the most-affected receiver – Coxs River Road

Pollutant	Averaging time	EPA assessment criteria	Assumed background level	Concentration with proposal 2026	Concentration with proposal 2036
CO (mg/m^3)	1-hour	30.0	5.6	5.8	5.8
	8-hour	10.0	2.3	2.5	2.5
NO_2 (µg/m^3)	1-hour	246.0	66.0	71.5	71.2
	Annual	62.0	10.0	11.1	11.0
PM_{10} (µg/m^3)	24-hour	50.0	49.9	51.4	51.5
	Annual	25.0	14.1	14.6	14.7
$PM_{2.5}$ (µg/m^3)	24-hour	25.0	17.5	19	19.1
	Annual	8.0	6.1	6.6	6.7
Benzene (µg/m^3)	1-hour	29.0	-[1]	0.1	0.2

Note 1: No assumed background level for benzene as this is not measured at DPIE air quality monitoring stations

River Lett to Forty Bends

Results at the most-affected receiver along the River Lett to Forty Bends section of the proposal are listed in Table 6-120. This represents the receiver where the change from the background level is highest.

Changes in concentrations as a result of the proposal concentrations were predicted to remain below the EPA's impact assessment criteria, except for 24-hour averaged PM_{10} where the exceedances would be experienced at eight receivers. Exceedances at these locations are a result of the Great Western Highway alignment moving closer to the receivers. These exceedances primarily remain the result of the elevated

adopted 24-hour averaged PM_{10} background concentration of 49.9 micrograms per cubic metre, with the proposal's contribution to the highest cumulative value of 51.1 micrograms per cubic metre being 1.2 micrograms per cubic metre or less than 2.4 per cent. The proposals contribution represents a minor increase and in and of itself is not considered likely to adversely impact on nearby sensitive receivers. Further, the maximum 24-hour averaged PM_{10} cumulative concentration of 51.1 micrograms per cubic metre is within the range of measured historical maximum values which have been measured as high as 320 ug/m3 and 238 ug/m3 respectively.

Table 6-120 Predicted air quality impacts at the most-affected receiver – River Lett to Forty Bends

Pollutant	Averaging time	EPA assessment criteria	Assumed background level	Concentration with proposal 2026	Concentration with proposal 2036
CO (mg/m^3)	1-hour	30.0	5.6	6.2	6.4
	8-hour	10.0	2.3	2.8	2.8
NO_2 ($\mu g/m^3$)	1-hour	246.0	66.0	71.1	70.9
	Annual	62.0	10.0	11.0	11.0
PM_{10} ($\mu g/m^3$)	24-hour	50.0	49.9	50.9	51.1
	Annual	25.0	14.1	14.5	14.6
$PM_{2.5}$ ($\mu g/m^3$)	24-hour	25.0	17.5	18.5	18.7
	Annual	8.0	6.1	6.5	6.6
Benzene ($\mu g/m^3$)	1-hour	29.0	-[1]	0.1	0.1

Note 1: No assumed background level for benzene as this is not measured at DPIE air quality monitoring stations

Forty Bends to Lithgow

Results at the most-affected receiver along the Forty Bends to Lithgow section of the proposal are listed in Table 6-121. This represents the receiver where the change from the background level is highest.

Changes in concentrations as a result of the proposal concentrations were predicted to remain below the EPA's impact assessment criteria, except for the 24-hour averaged PM_{10} concentration for the 2031 assessment horizon which would be experienced at four sensitive receivers. The contribution of the proposal to this exceedance was up to 0.2 micrograms per cubic metre or 0.4 per cent, noting that the adopted background concentration of 49.9 micrograms per cubic metre. Again, the maximum 24-hour averaged PM_{10} cumulative concentration of 50.1 micrograms per cubic metre is within the range of historical maximum values which have been measured as high as 320 ug/m3 and 238 ug/m3 respectively. The proposals contribution represents a minor increase and in and of itself is not considered likely to adversely impact on nearby sensitive receivers.

Table 6-121 Predicted air quality impacts at the most-affected receiver – Forty Bends to Lithgow

Pollutant	Averaging time	EPA assessment criteria	Assumed background level	Concentration with proposal 2026	Concentration with proposal 2036
CO (mg/m^3)	1-hour	30.0	5.6	5.7	5.7
	8-hour	10.0	2.3	2.3	2.4
NO_2 ($\mu g/m^3$)	1-hour	246.0	66.0	66.5	66.7

Pollutant	Averaging time	EPA assessment criteria	Assumed background level	Concentration with proposal 2026	Concentration with proposal 2036
	Annual	62.0	10.0	10.1	10.1
PM_{10} (µg/m^3)	24-hour	50.0	49.9	50.0	50.1
	Annual	25.0	14.1	14.1	14.2
$PM_{2.5}$ (µg/m^3)	24-hour	25.0	17.5	17.6	17.7
	Annual	8.0	6.1	6.1	6.2
Benzene (µg/m^3)	1-hour	29.0	-[1]	0.0	0.0

Operation greenhouse gases

Total annual CO_2 equivalent (CO_2-e) greenhouse gas emissions were modelled for five scenarios (refer Table 6-122):

- Do nothing 2021 – Existing traffic conditions in the year 2021
- With proposal 2026 – Traffic conditions the planned opening year, with the proposal
- Do nothing 2026 – Traffic conditions in the planned opening year, without the proposal
- With proposal 2036 – Traffic conditions 10 years after the planned opening year, with the proposal
- Do nothing 2036 – Traffic conditions 10 years after the planned opening year, without the proposal

With the proposal CO_2 equivalent greenhouse gas emissions were predicted to increase by 10.9 per cent compared to emissions from existing operations. Compared with the relevant no proposal options (i.e. Do nothing 2026 and Do nothing 2036), relative increases of up to 3.7 per cent and 3.1 per cent were predicted at the year of opening (2026) and 2036 respectively. These increases are a result of marginal increases in heavy vehicle flows, as well as speeds facilitated by the proposal.

Table 6-122 Predicted annual CO2 equivalent operational greenhouse gas emissions

Assessment scenario	Predicted annual greenhouse gas emission (CO_2-e tonnes)	Percentage change compared with existing traffic conditions (2020)	Percentage change compared with equivalent 2026 or 2036 Do nothing scenario
Do nothing 2021	19,981	-	-
With proposal 2026	21,129	+5.8 per cent	+3.7 per cent
Do nothing 2026	20,369	+1.9 per cent	-
With proposal 2036	22,136	+10.9 per cent	+3.1 per cent
Do nothing 2036	21,470	+7.5 per cent	-

6.13.4 Safeguards and management measures

Table 6-123 Safeguards and management measures – air quality

No	Impact	Environmental safeguards	Responsibility	Timing	Reference	Locations
AQ01	Air quality management	Develop and implement an Air Quality Management Plan (AQMP) as part of the Construction Environmental management Plan (CEMP). In addition to detailing how the measures above should be implemented, the AQMP should also identify: • Potential sources of air pollution (including odours and dust) during construction. • Air quality management objectives consistent with any relevant published guidelines. • Methods to manage works during strong winds or other adverse weather conditions. • A progressive rehabilitation strategy for exposed surfaces. • When the air quality, suppression and management measures need to be applied, who is responsible, and how effectiveness will be assessed. • A monitoring program to record whether the air quality mitigation, suppression and management measures have been applied; and assess the effectiveness of the applied measures.	Construction contractor	Prior to and during construction	Appendix O	All
AQ02	Dust emissions	Minimise the extent of disturbed and exposed areas, and revegetate	Construction contractor	During construction	Appendix O	All

No	Impact	Environmental safeguards	Responsibility	Timing	Reference	Locations
	during construction	finished areas as soon as possible				
AQ03		Minimise the drop heights of materials	Construction contractor	During construction	Appendix O	All
AQ04		Review and where necessary modify or suspend activities during dry and windy weather and background air quality conditions.	Construction contractor	During construction	Appendix O	All
AQ05		Cover or otherwise regularly stabilise (with water sprays or binders) stockpiles	Construction contractor	During construction	Appendix O	All
AQ06		Regularly water haul routes and ensure that all loads are covered	Construction contractor	During construction	Appendix O	All
AQ07		Regularly inspect and remove debris from plant and equipment to avoid the tracking of materials on to the adjacent road network	Construction contractor	During construction	Appendix O	All
AQ08		To the extent practical, position ancillary sites and stockpiles away from nearby sensitive receivers	Construction contractor	Prior to construction	Appendix O	All
AQ09	Exhaust emissions from plant and equipment used during construction	Inspect all plant and equipment before it is used on-site	Construction contractor	Prior to and during construction	Appendix O	All
AQ10		Ensure all vehicles, plant, and equipment operate in a proper and efficient manner.	Construction contractor	During construction	Appendix O	All
AQ11		Switch off all vehicles, plant and equipment when not in-use	Construction contractor	During construction	Appendix O	All
AQ12		Avoid the use of diesel or petrol-powered generators and use mains electricity or battery powered equipment where practicable.	Construction contractor	During construction	Appendix O	All
AQ13	Odours and airborne	Apply odour supressing agents to materials as	Construction contractor	During construction	Appendix O	All

No	Impact	Environmental safeguards	Responsibility	Timing	Reference	Locations
	hazardous substances from uncovered contaminated materials	necessary to minimise related impacts should any contaminated or hazardous materials be uncovered during the works				
AQ14		Adhere to relevant requirements for removal and disposal listed in the Work Health and Safety Act 2011, and Work Health and Safety Regulation 2017.	Construction contractor	During construction	Appendix O	All
AQ15	Emissions to air and visual impacts from blasting activities	Prior to firing, review and confirm that the blast would not likely result in any dust or fume-related impacts. This should include a review of whether meteorological conditions (ie inversions, wind speeds and directions, stability, time of day, cloud cover, temperature and humidity are suitable	Construction contractor	During construction	Appendix O	River Lett to Forty Bends
AQ16		Where possible, avoid blasting during early morning and late afternoon when meteorological conditions are typically least favourable in terms of the potential for blast-related impacts	Construction contractor	During construction	Appendix O	River Lett to Forty Bends

Other safeguards and management measures that would address air quality impacts are identified in sections 6.2 Traffic and transport