20. Air quality

A climate and air quality assessment of the preferred alignment was prepared in March 2007. The outcomes of the assessment are detailed in the Technical Report 4 – *Climate and Air Quality Assessment* (NSW Roads and Traffic Authority 2007e), and summarised below.

20.1 Existing air quality and meteorology

The prevailing air quality in the Macleay Valley is characteristic of a rural environment with some urban development. The regional airshed relevant to the proposed upgrade comprises the Macleay River floodplain and the lower reaches of the Macleay River Valley including Kempsey and Frederickton. No major air pollution-generating sources are located in immediate vicinity of the proposed upgrade. Bushfires can result in substantial amounts of air pollution from smoke. However, the effects of bushfire smoke are generally short-term and intermittent. Minor, local incidents of dust associated with quarrying activities as well as with general rural and residential activities, light industry, and from local and arterial roads may occur. Four potential sources of emissions were noted in the area, including a brick works, two petroleum wholesalers and a timber sawmill. Emissions from motor vehicles would be the primary contributor to air pollution in the locality. However, given the good quality of air within the Macleay Valley it is evident that motor vehicle emissions do not affect prevailing air quality conditions.

The average annual wind speed for the Kempsey region is 4.3 metres per second, with the primary wind direction from the north-west and west. Gradient wind flows from the north-east predominate during summer, whilst westerlies and north-westerlies dominate throughout the rest of the year. Fog is also prevalent during various times of year, particularly on the Macleay River floodplain.

In the absence of ambient air quality data for the Kempsey region, data from the Beresfield monitoring location was adopted. This site is located approximately 300 kilometres south of the proposed upgrade. The measured air quality at this monitoring location would be influenced by higher traffic flows and greater industrial emissions than expected at Kempsey.

Although not site-specific, the data from Beresfield is considered to provide a conservative estimate of indicative ambient air quality for the Kempsey area. Air quality at Kempsey would be expected to be better given the prevailing land use in the region.

The nearest potentially affected sensitive receivers have been identified as, but not limited to, the following:

- Kempsey Seventh Day Adventist Church, 108 Crescent Head Road, Kempsey.
- Kempsey Adventist Primary School, 108 Crescent Head Road, Kempsey.
- Frederickton Public School, Great North Road, Frederickton.
- Frederickton golf course, Yarrabindinni Road, Frederickton.
- Kempsey East Public School, Innes Street, Kempsey.
- East Kempsey cemetery, Naiooka Street, Kempsey.
- Frederickton Uniting Church, Macleay Street (Pacific Highway), Frederickton.
- Frederickton cemetery, Great North Road, Frederickton.
- Bellimbopinni Public School, Pacific Highway, Bellimbopinni.

Adopted background levels of particulate matter, nitrogen dioxide and sulfur dioxide per month (in 2003) are provided in Table 3-1 of Technical Report 4 – *Climate and Air Quality Assessment* in Volume 2.

20.2 Construction

Air emissions during the construction of the proposed upgrade would generally comprise dust and vehicular emissions.

The construction activities most likely to generate dust include the movement of construction traffic on paved and unpaved roads, wind erosion of aggregate storage piles, clearing of groundcover and topsoil, earthmoving activities, and transport and stockpiling of soil and construction materials.

The worst case total dust level, calculated for a 10-hour construction day, was predicted to be between 157 kilograms (total suspended particulate) and 63 kilograms based on a period when excavation and fill and topsoil transport are at their peak over a typical work area off 1000 metres by 200 metres. The predicted levels of particulate matter are not considered excessive and are not expected to result in reduced local air quality at the nearest potentially affected receptors, given the implementation of the recommended safeguards.

Measures to reduce the quantity of dust generated as a result of construction activities would include:

- Water spraying of internal unsealed access roadways and work areas and any other areas in need of water spraying.
- Undertaking revegetation or stabilising procedures in disturbed areas as soon as construction activities are completed to minimise the potential for wind blown dust.
- Avoiding or minimising dust-generating activities during dry and windy conditions.
- Moving dust-generating activities to less sensitive locations where warranted.
- Imposing site speed limits on all construction vehicles where required.
- Restricting vehicle and machinery movements to designated areas.
- Rumble grids and wheel-wash facilities installed in appropriate locations to remove mud and dust from vehicles.
- Where applicable, sealed roads swept to remove deposited material that could generate dust.
- Loads of loose, potentially dust-generating material covered to prevent wind-blown dust emissions and spillages.

Dust management would be developed and included as part of the Air Quality Management Plan.

Emissions from vehicles during the construction phase would be associated with diesel and petroleum-fuelled vehicles. The odour impacts of these emissions would be minimal. Construction activities would include operation of vehicles and machinery that would generate carbon monoxide, carbon dioxide, oxides of nitrogen, sulfides and trace amounts of non-combustible hydrocarbons. Emission rates and the impact associated with the emissions would vary based on the power output of the combustion engines, the quality of the fuel, and the condition of the combustion engines. Air quality impacts associated with vehicular emissions are considered unlikely provided that the construction contractor meets the requirements of the relevant legislation/guidelines. Plant and other equipment would be well maintained and regularly serviced.

Greenhouse emissions during construction and operation are discussed in Section 20.4.3.

20.3 Operation

Air quality impacts of the proposed upgrade during operation would relate to increased traffic and emissions on the highway. During operation of the proposed upgrade, the traffic capacity of the highway would be increased. Traffic volume increases are discussed in Chapter 15 - *Traffic, transportation and access*.

Emission rate estimates were calculated with consideration of the modelled traffic flow data and were based on emission rates for passenger petrol vehicles and heavy duty diesel vehicles only. However, emissions from surrounding roads were not considered.

The calculated peak hour emission rates on the proposed upgrade and the existing Pacific Highway with and without the proposed upgrade are shown in Tables 5-3 and 5-4 of Technical Report 4 – *Climate and Air Quality Assessment* in Volume 2.

Although impact potential is a function of flow conditions, vehicle speed, composition topography, meteorological conditions and existing background levels, the following impact profiles could be expected for each link:

- *Pacific Highway, south of South Street* - decrease with proposed upgrade for 2011 flow conditions.
- *Pacific Highway, south of South Street* - decrease with proposed upgrade for 2021 flow conditions.
- *Pacific Highway, north of Frederickton* - decrease with proposed upgrade for 2011 flow conditions.
- *Pacific Highway, north of Frederickton* - slight increase with the proposed upgrade for 2021 conditions. This increase reflects the traffic forecasts for this section with increased traffic volumes expected from local traffic choosing to travel along the proposed upgrade to the Frederickton interchange, accessing Kempsey from the north to avoid congestion across the Macleay River bridge and in South Kempsey.
- *Bypass, north of Stuarts Point Road interchange* - no material change in pollutant levels for 2011 flow conditions.
- *Bypass, north of Stuarts Point Road interchange* - no material change in pollutant levels for 2021 flow conditions.

The method used to model air quality impacts and the limitations associated with the model are detailed in Section 5.2.2 of Technical Report 4 – *Climate and Air Quality Assessment* in Volume 2. Concentrations of carbon monoxide, nitrogen oxides, hydrocarbons and particulate matter likely to be produced with and without the proposed upgrade in 2011 and 2021 were predicted. Maximum 1-hour (and where relevant 8-hour) concentrations were predicted.

Three off-set distances (10, 20 and 50 metres) from the near-side carriageway were assessed. Predicted levels are presented in Table 20-1 and 20-2.

Table 20-1 **Maximum predicted incremental concentrations (2011)**

Road / location assessed	Off-set distance (m)	Pollutant									
		CO – 1 hr		CO – 8 hr		NO_2 – 1 hr		Benzene – 1 hr		PM_{10} – 1 hr	
		Upgrade	No upgrade	Upgrade	No upgrade	Upgrade	No upgrade	Upgrade	No upgrade	Upgrade	No upgrade
Pacific Highway, south of South Street											
	0	2.77	1.92	1.40	0.96	396.5	303.4	0.033	0.023	17.1	13.3
	10	1.27	0.89	0.90	0.62	182.3	141.9	0.015	0.011	7.8	6.2
	50	0.38	0.27	0.33	0.23	54.2	43	0.005	0.003	2.3	1.9
Pacific Highway, north of Frederickton											
	0	2.28	2.03	1.14	1.02	297.2	261.3	0.027	0.024	12.6	11.0
	10	1.06	0.95	0.74	0.66	137.7	121.5	0.012	0.011	5.8	5.1
	50	0.32	0.29	0.27	0.24	41.3	36.8	0.004	0.003	1.8	1.6
Bypass, north of Stuarts Point interchange											
	0	1.87	1.87	0.93	0.93	298.5	298.5	0.022	0.022	13.2	13.2
	10	0.87	0.87	0.60	0.60	139.3	139.3	0.010	0.010	6.1	6.1
	50	0.26	0.26	0.22	0.22	42.2	42.2	0.003	0.003	1.8	1.8
Ambient air quality goal		30mg/m^3 - 1 hour		10mg/m^3 - 8 hour		246µg/m^3 - 1 hour		0.029µg/m^3 - 1 hour		50µg/m^3 - annual	

Notes: *Values shown shaded are incremental impacts predicted to exceed the adopted ambient air quality goal*
CO = carbon monoxide NO_2 = nitrogen dioxide PM_{10} = Particulate matter 10µm (microns) in aerodynamic diameter mg/m^3 = milligrams per cubic metre µg/m^3 = micrograms per cubic metre

Source: *Technical Report 4 – Climate and Air Quality Assessment*

Table 20-2 **Maximum predicted incremental concentrations (2021)**

Road / location assessed	Off-set distance (m)	Pollutant									
		CO – 1 hr		CO – 8 hr		NO_2 – 1 hr		Benzene – 1 hr		PM_{10} – 1 hr	
		Upgrade	No upgrade	Upgrade	No upgrade	Upgrade	No upgrade	Upgrade	No upgrade	Upgrade	No upgrade
Pacific Highway, south of South Street											
	0	1.83	1.25	0.94	0.63	405.9	309.6	0.022	0.016	13.7	10.4
	10	0.83	0.57	0.60	0.41	183.6	142.6	0.010	0.007	6.2	4.7
	50	0.24	0.17	0.21	0.15	53.3	42.6	0.003	0.002	1.8	1.6
Pacific Highway, north of Frederickton											
	0	1.35	1.36	0.68	0.69	274.5	279.5	0.016	0.016	9.3	9.3
	10	0.62	0.63	0.44	0.44	126.1	128.6	0.007	0.008	4.3	4.3
	50	0.18	0.19	0.16	0.16	37.6	38.0	0.002	0.002	1.2	1.3
Bypass, north of Stuarts Point interchange											
	0	1.29	1.29	0.65	0.65	309.2	309.2	0.016	0.016	10.4	10.4
	10	0.59	0.59	0.42	0.42	142.2	142.2	0.007	0.007	4.7	4.7
	50	0.18	0.18	0.15	0.15	42.2	42.2	0.002	0.002	1.4	1.4
Ambient air quality goal		30mg/m^3 - 1 hour		10mg/m^3 - 8 hour		246µg/m^3 - 1 hour		0.029µg/m^3 - 1 hour		50µg/m^3 - annual	

Notes: *Values shown shaded are incremental impacts predicted to exceed the adopted ambient air quality goal*
CO = carbon monoxide NO_2 = nitrogen dioxide PM_{10} = Particulate matter 10µm (microns) in aerodynamic diameter mg/m^3 = milligrams per cubic metre µg/m^3 = micrograms per cubic metre
Source: *Technical Report 4 – Climate and Air Quality Assessment*

Carbon monoxide

Compliance with the adopted 1-hour goal of 30 milligrams per cubic metre was predicted to be achieved for each off-set distance. With the proposed upgrade, an improvement in incremental pollution levels would be expected. The peak 1-hour incremental pollutant level was predicted to be 1.92 milligrams per cubic metre (with the proposed upgrade). As such, no cumulative carbon monoxide issues would be expected.

Predicted 8-hour pollutant levels were all well below the adopted ambient air quality standard of 10 milligrams per cubic metre.

Nitrogen dioxide

An exceedance of the 1-hour nitrogen dioxide goal of 246 micrograms per cubic metre was predicted both with and without the proposed upgrade (in 2021) at each road assessed. Incremental pollutant levels above the adopted ambient air quality goal occurred at the roadside.

At distances of 10 metres and greater, compliance with the nitrogen dioxide ambient air quality goals would be expected.

It is anticipated that future improvements in emissions controls for road vehicles would significantly reduce the actual level of pollutant impact.

Benzene

Compliance with the adopted 1-hour goal for benzene of 0.029 milligrams per cubic metre was predicted at each off-set distance with the proposed upgrade (2011 and 2021 conditions).

One exceedance was predicted at the road-side, at the Pacific Highway, south of South Street under 2011 conditions without the proposed upgrade.

PM_{10}

The predicted dust concentration levels are all well below the adopted ambient air quality goal for PM_{10} of 50 micrograms per cubic metre. No cumulative issues are anticipated.

Summary

The proposed upgrade would be expected to result in a decrease in air emissions and associated pollutant levels associated with traffic due to improved traffic flow conditions. Further, emissions and associated pollutant levels would be expected to improve from 2011 to 2021 due to improved fuel composition and associated combustion technologies.

With the proposed upgrade, emission rates and associated pollutant levels would generally decrease in comparison to conditions without the proposed upgrade. Reduced impact potential would also be expected as the source of emissions would generally be moved away from existing urban areas through the bypassing of Kempsey and Frederickton.

Pollutant levels with the proposed upgrade would be typical of a rural-residential area adjacent to a major road.

Concentration of pollutants owing to emissions associated with the proposed upgrade at nearby residences and local schools would be expected to be significantly lower than the adopted Department of Environment and Climate Change air quality goals (refer Table 20-2).

Compliance with ambient air quality goals and satisfactory local ambient air quality would be expected at the nearest potentially affected sensitive receivers (assuming an offset of at least 10 metres from the nearest carriageway) outlined in Section 20.1.

20.4 Summary of management measures

Standard and project-specific mitigation and management techniques for air quality impacts arising from the construction of the proposed upgrade are included in the draft Statement of Commitments for the proposed upgrade in Appendix D and are summarised below.

As vehicle emission impacts are effectively managed at source via vehicle fuel standards and vehicle maintenance and emissions testing, no specific operational mitigation measures are identified.

The preferred approach to addressing road-based air quality impacts is through state or region-wide strategies, such as progressive tightening of vehicle air emission standards; in service inspections to ensure vehicle muffler/exhaust systems are well maintained; and the integration of transport and land use planning.

In addition, it is anticipated that over time the turnover in the vehicle fleet would see progressive removal of less efficient vehicles from the roads, thereby reducing vehicle emissions.

Air quality

- Prepare and implement an Air Quality Management Sub Plan as part of the CEMP. The Sub Plan will identify:
  - Potential sources of dust.
  - Dust management objectives consistent with Department of Environment and Climate Change guidelines.
  - Mitigation measures to be implemented, including measures during weather conditions where high level dust episodes are probable (such as strong winds in dry weather).
  - A progressive rehabilitation strategy for exposed surfaces with the aim of minimising exposed surfaces.
  - A monitoring program to assess compliance with the identified objectives. Monitoring for dust deposition and particulate concentration will be undertaken in accordance with the DECC Guideline – *Approved Methods for Sampling and Analysis of Air Pollutants in New South Wales (1998a).*
- Ensure that construction vehicles using public roads are maintained to prevent any loss of load, whether dust, liquid or soils. Facilities will be provided at exit points of all construction sites/ compounds to minimise tracking mud, dirt or other material onto a public road or footpath. In the event of any spillage, the RTA will remove the spilled material as soon as practicable within the working day of the spillage.
- Ensure that all plant and equipment used in connection with the Activity are maintained and operated in a proper and efficient manner.
- Implement a dust monitoring program. Dust would be visually monitored and, where necessary, the following mitigation measures will be implemented:
  - Watering of dry exposed surfaces.
  - Covering loads on trucks transporting material to and from site at all times.
  - Spray planting cover crop of sterile grasses on long term stockpiles and exposed areas.
  - Preventing and, where necessary, removing mud and dirt tracked on to road surfaces.