NSW Roads and Maritime Services

WOOLGOOLGA TO BALLINA | PACIFIC HIGHWAY UPGRADE

ENVIRONMENTAL IMPACT STATEMENT

MAIN VOLUME 1B

Chapter 18 – Other issues

Chapter summary

This chapter provides an assessment of the potential impacts on greenhouse gas emissions, air quality and waste; issues that were not identified as key issues for the EIS.

During construction, the majority of greenhouse gas impacts would be from clearing vegetation. Much of the cleared vegetation would not be replaced and the carbon stored in the vegetation would be lost. It would be possible to mitigate this impact by minimising the amount of clearance, and by revegetating cleared areas once construction is complete.

Initial estimates indicate the project would reduce greenhouse gas emissions from traffic by 15,000 tonnes of carbon dioxide per year (from 2026 onwards). This moderate decrease in traffic emissions would be due to the slightly shorter overall length of the Pacific Highway and the likelihood of less congestion. Emissions savings from reduced travel would offset construction related emissions about 70 years after opening.

The air quality assessment found that air quality impacts from construction would largely result from dust generated during earthworks and other activities associated with road construction. While such activities have the potential to affect sensitive receptors, appropriate mitigation would ensure potential dust-generating activities are subject to a high level of control. Air quality monitoring would also be undertaken during construction to monitor the dust sources.

A computer model used to predict levels of air pollutants that could be found near the roadside once the project is open to traffic (2016) and 10 years after opening (2026), showed there would be no exceedance of air quality criteria at any sensitive receptor location. There would be no adverse impacts on air quality from the operation of the project.

Constructing the project would generate a number of waste streams, including:

- Excavation wastes
- Timber and green wastes
- Demolition wastes
- Construction materials
- Packaging materials.

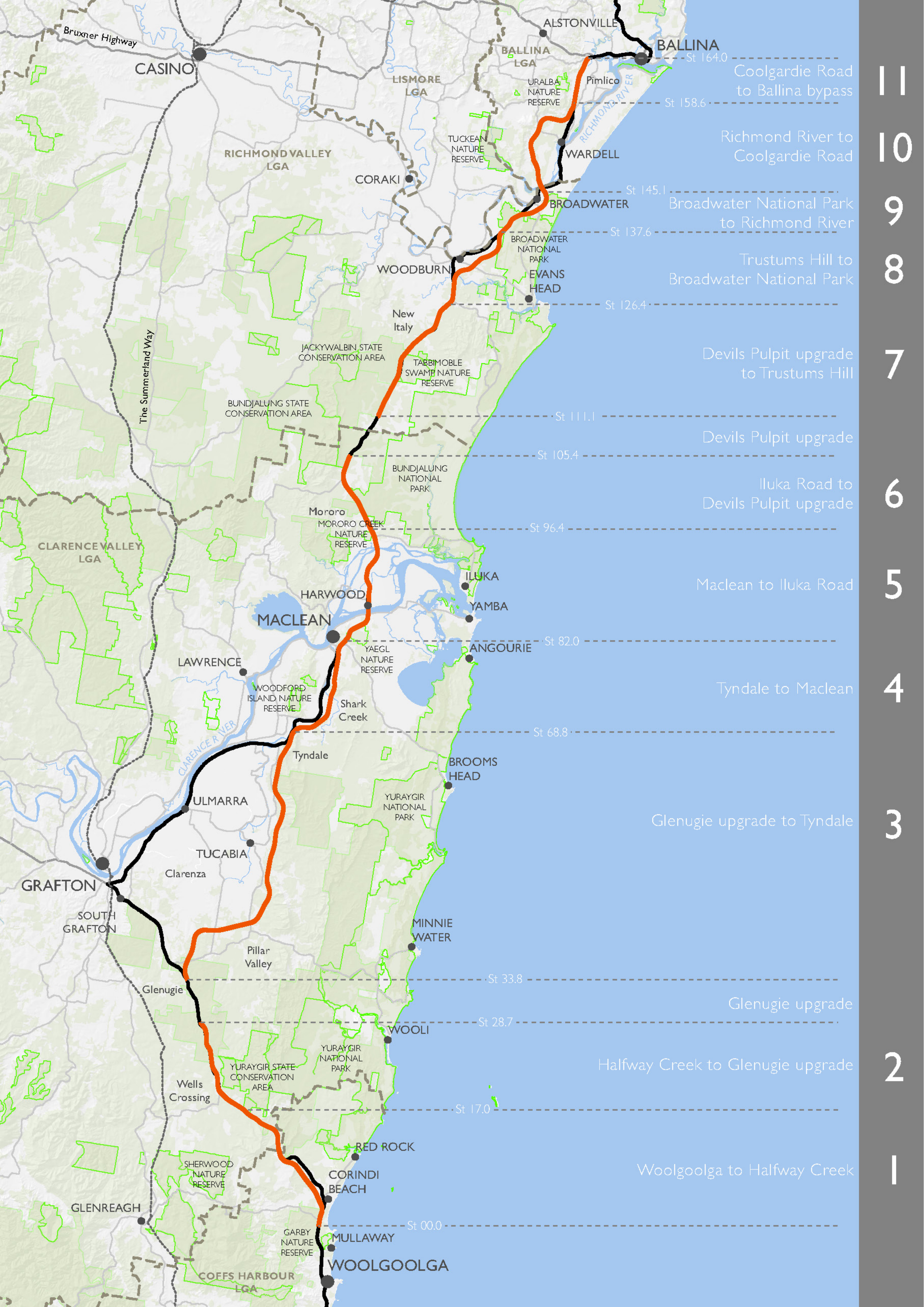
The operation of the project would generate limited waste, which would be mainly from road maintenance activities and road users.

Where materials cannot be reused and recycled, all waste would be handled and disposed in accordance with the *Protection of the Environment Operations Act 1997*.

A resource management strategy would be developed to identify resource consumption and waste minimisation and management measures would be included in the Construction Environmental Management Plan.

RMS 12.604B

ISBN 978-1-922041-81-4



Bruxner Highway
CASINO
ALSTONVILLE
BALLINA
BALLINA LGA
LISMORE LGA
URALBA NATURE RESERVE
Pimlico
RICHMOND RIVER
St 164.0
Coolgardie Road to Ballina bypass
11
St 158.6
TUCKEAN NATURE RESERVE
WARDELL
Richmond River to Coolgardie Road
10
RICHMOND VALLEY LGA
CORAKI
St 145.1
BROADWATER
Broadwater National Park to Richmond River
9
St 137.6
BROADWATER NATIONAL PARK
WOODBURN
EVANS HEAD
Trustums Hill to Broadwater National Park
8
St 126.4
New Italy
JACKYWALBIN STATE CONSERVATION AREA
TABBIMOBLE SWAMP NATURE RESERVE
The Summerland Way
Devils Pulpit upgrade to Trustums Hill
7
BUNDJALUNG STATE CONSERVATION AREA
St 111.1
Devils Pulpit upgrade
St 105.4
BUNDJALUNG NATIONAL PARK
Iluka Road to Devils Pulpit upgrade
6
Mororo
MORORO CREEK NATURE RESERVE
St 96.4
CLARENCE VALLEY LGA
ILUKA
HARWOOD
YAMBA
Maclean to Iluka Road
5
MACLEAN
St 82.0
YAEGL NATURE RESERVE
ANGOURIE
LAWRENCE
WOODFORD ISLAND NATURE RESERVE
Shark Creek
Tyndale to Maclean
4
CLARENCE RIVER
St 68.8
Tyndale
BROOMS HEAD
ULMARRA
YURAYGIR NATIONAL PARK
Glenugie upgrade to Tyndale
3
TUCABIA
Clarenza
GRAFTON
SOUTH GRAFTON
MINNIE WATER
Pillar Valley
Glenugie
St 33.8
Glenugie upgrade
St 28.7
WOOLI
YURAYGIR NATIONAL PARK
YURAYGIR STATE CONSERVATION AREA
Wells Crossing
Halfway Creek to Glenugie upgrade
2
St 17.0
RED ROCK
SHERWOOD NATURE RESERVE
CORINDI BEACH
Woolgoolga to Halfway Creek
1
GLENREAGH
St 00.0
GARBY NATURE RESERVE
MULLAWAY
WOOLGOOLGA
COFFS HARBOUR LGA

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18. Other issues

This chapter provides a high level assessment of issues not identified as key issues in the Director General's environmental assessment requirements or have not been identified as requiring a comprehensive level of assessment in the environmental risk analysis as outlined in Chapter 19 (Environmental risk analysis).

These issues include:

- Greenhouse gas emissions
- Air quality
- Waste and resource management

The level of assessment reflects the fact that these are issues commonly associated with road projects and are appropriately addressed through the design process or by implementing best practice management and mitigation measures.

18.1. Greenhouse gas emissions

An assessment was undertaken to assess the direct and indirect impacts of the project on the generation of greenhouse gas emissions. This chapter summarises the methods used in the assessment and the key findings.

18.1.1. Assessment methodology

Greenhouse gases absorb outgoing infra-red radiation reflected from the earth, which generates heat. This heat warms the atmosphere. This is known as the greenhouse effect, which is linked to climate change. The primary, human-produced greenhouse gas is carbon dioxide.

Human activities, including the combustion of carbon-based fuels, increase the concentration of greenhouse gases in the atmosphere. This leads to greater absorption of infra-red radiation and an increase in atmospheric temperature. This is known as the enhanced greenhouse effect.

The following six greenhouse gases are covered under international climate change agreements, and have been considered in this assessment:

- Carbon dioxide (CO_2)
- Methane (CH_4)
- Nitrous oxide (N_2O)
- Sulphur hexafluoride (SF_6)
- Hydro fluorocarbons (HFCs)
- Perfluorocarbons (PFCs).

Each greenhouse gas behaves differently in the atmosphere with respect to its ability to trap outgoing radiation and its residence time in the atmosphere. To achieve a common unit of measurement, each greenhouse gas has been compared to the warming potential of carbon dioxide over a 100-year period. This provides a global warming potential for each greenhouse gas, which can be applied to the project's estimated emissions. The resulting aggregated emissions are referred to in terms of carbon dioxide-equivalent emissions (or CO_2-e).

KEY TERM – Carbon dioxide equivalent (CO_2-e)

A metric measurement used to compare the emissions from various greenhouse gases based upon their global warming potential.

To help standardise greenhouse gas assessments of road construction projects, RMS – in collaboration with other state (and New Zealand) transport authorities – has released the Greenhouse Gas Assessment Workbook for Road Projects (Transport Authorities Greenhouse Group, 2011). This workbook is used to estimate construction, operation and maintenance stages of road projects but does not estimate the greenhouse emissions associated with traffic. Emissions associated with traffic from the project have been calculated using RMS' Tools for Roadside Air Quality (TRAQ) (RTA, 2008).

The Greenhouse Gas Protocol (2001) – an international standard for calculating greenhouse gas inventories, has classified greenhouse gas emissions into three categories (called 'Scopes') based on their source:

- Scope 1 emissions include all greenhouse gas emissions directly released from the project activities (including from fuel use), such as exhaust emissions from combustion engines
- Scope 2 emissions include all indirect greenhouse gas emissions related to the import of energy used by the project; such as the consumption of purchased electricity
- Scope 3 emissions include other indirect emissions for which the project is not directly responsible, but over which it has influence. These include emissions from the extraction and production of construction materials and fuels, transport-related activities in vehicles not owned or controlled by the project, outsourced activities and waste disposal.

This project includes emissions from Scopes 1 and 3. Scope 2 emissions are not assessed as no imported electricity has been forecast, rather it is assumed that all electricity to be used for construction would be generated on-site via diesel generators.

18.1.2. Impact assessment

Construction

Emission sources during construction would include:

- Vegetation clearing: The removal of vegetation is often the largest contributor to greenhouse gas emissions on large infrastructure projects. First, the breakdown of organic matter as waste material directly releases stored carbon dioxide to the atmosphere. Second, because vegetation absorbs carbon dioxide from the atmosphere (by photosynthesis); where vegetation has been removed, this ability to act as a carbon sink is lost
- Equipment: Most construction equipment is operated by the burning of fossil fuels, which creates greenhouse gas emissions
- Construction materials: Different construction materials contain varying levels of embodied emissions – for example, high-strength concrete contains a greater proportion of cement, which has a high level of embodied emissions compared to fly-ash, which is used as a substitute in lower-strength applications
- Construction transport: All construction-related transportation creates greenhouse gas emissions from the consumption and burning of fossil fuels
- Electricity: Electricity is generally consumed by site offices, for lighting, and for security. Emissions from electricity consumption are generally low in comparison to other sources during construction.

Greenhouse gas emissions were calculated for a range of sources, for each of the 11 sections of the upgrade from Woolgoolga to Ballina. Emissions were calculated for both construction and operation (operational emissions were based on current and projected traffic flows).

Greenhouse gas emissions from construction are shown in Figure 18-1.

As shown in Figure 18-1, during construction, the majority of the greenhouse gas impact would be from clearing vegetation. Much of the cleared vegetation would not be replaced and the carbon stored in the vegetation would be lost.

Another considerable impact would be linked to the manufacture of construction materials. As a major construction material, concrete is a considerable emissions source. The project would also use large quantities of asphalt, as well as precast concrete and structural steel in structures such as bridges and culverts. Steel is typically produced with high levels of recycled content, with recycled steel having about half the embodied emissions of virgin steel.

Construction fuel consumption across the project has been estimated using factors for similar road building projects sourced from the Transport Authorities Greenhouse Group Workbook. The calculation assumes a fleet of diesel vehicles is used across the project. Using biofuels (biodiesel, ethanol, or blends such as E10 or B80) can dramatically reduce the carbon footprint of a piece of construction equipment.

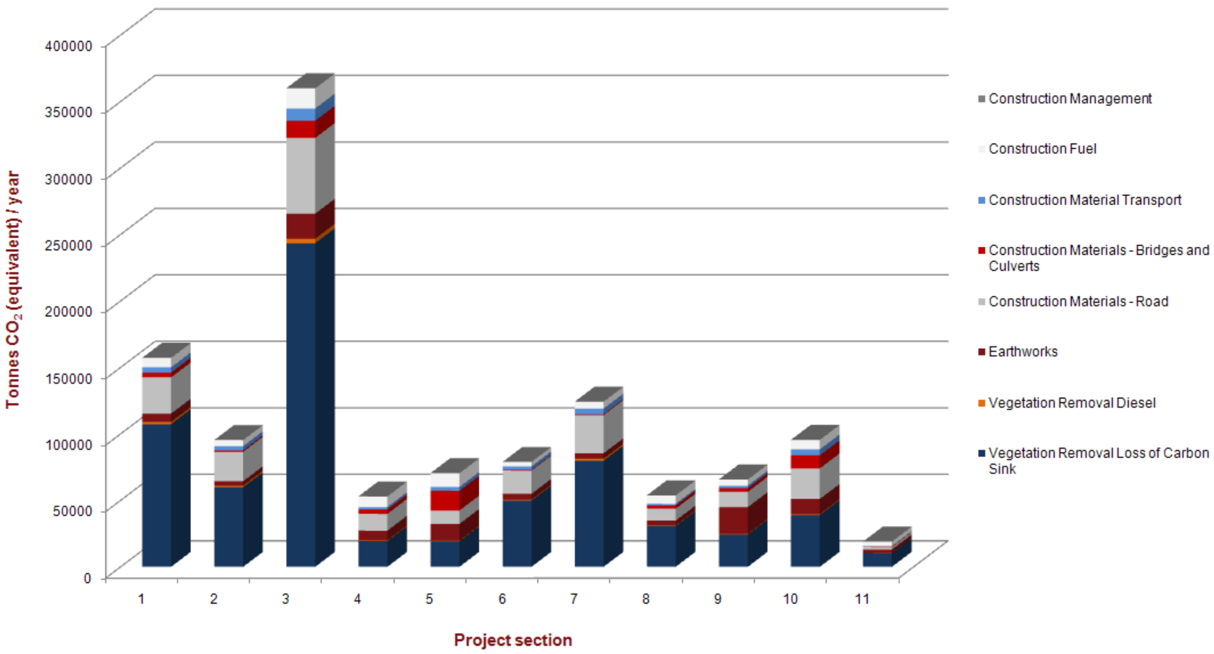

Figure 18-1: Greenhouse gas emissions estimated from construction

It is estimated that emissions savings from reduced travel would offset construction related emissions (mainly vegetation removal) about 70 years after opening.

Operation

Emission sources during operation relate to traffic using the upgraded highway. Traffic estimates for the project were obtained from the Working Paper - traffic and transport (SKM, 2012) and associated greenhouse gas emissions calculated using TRAQ (RTA, 2008). Emissions are influenced by:

- Route selection: A vehicle's fuel consumption is influenced by route selection, and through changes in road grade, travel speed and length of travel. Once the project is completed, through the improved road conditions and reduction in highway length, traffic forecasts indicate the total travel time would decrease by an average of 25 minutes for vehicles travelling the full project length and the total vehicle kilometres travelled would decrease by about 150,200 kilometres per year. Reductions in travel time and kilometres, and improved road gradients, would lead to reduced fuel consumption, and therefore reduced emissions
- Traffic flow: Fuel consumption and greenhouse gas emissions are directly influenced by the level of congestion (free-flowing traffic consumes less fuel than congested and idling traffic)
- Road surface: The roughness of the road surface influences the amount of fuel consumed by vehicles. Typically, highway upgrade projects lead to reduced fuel consumption and greenhouse gas emissions from improvements to the road surface.

In addition, emissions are attributable to:

- Electricity: Consumed by street lighting and signals
- Maintenance: Maintenance activities create greenhouse gas emissions due to the use of fuel and electricity, and from embodied emissions in maintenance materials and components.

Figure 18-2 shows the annual greenhouse gas emissions from vehicles using the Pacific Highway in 2011 and estimates for the project in 2016 (its planned year of opening) and 2026 (10 years after opening). Emissions are shown for the 11 sections of the project and include both the upgraded sections and bypassed sections of the highway to provide a fair comparison with the current highway.

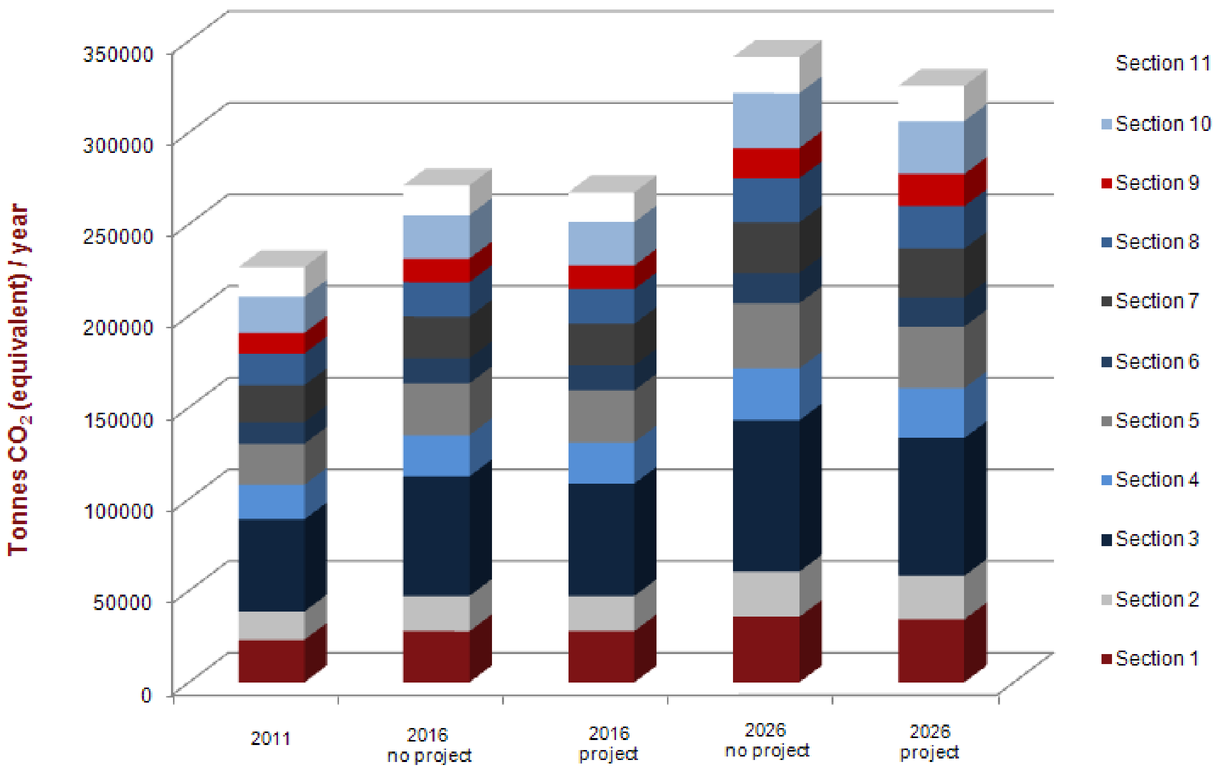

Figure 18-2: Greenhouse gas emissions estimated during operation

As shown in Figure 18-2, in 2016, the emissions from the project would be about 250,000 tonnes of carbon dioxide per year, in 2026, the emissions estimate is about 310,000 tonnes of carbon dioxide per year. If the project were not completed, the emissions from the Pacific Highway with no upgrade would be about 325,000 tonnes of carbon dioxide per year.

Therefore, initial estimates indicate the project would reduce greenhouse gas emissions from traffic by 15,000 tonnes of carbon dioxide per year (from 2026 onwards). As indicated above, this emission saving would offset construction emissions 70 years after opening. These estimates take into account future improvements in vehicle emission standards as well as forecast traffic flows and volumes.

18.1.3. Management of impacts

The project incorporates a number of measures to manage greenhouse gas emission impacts. These are listed in Table 18-1.

Table 18-1: Greenhouse gas emissions: Mitigation measures

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Carbon stored in vegetation	GHG1	• Vegetation clearance would be minimised where feasible. Areas to be revegetated would be revegetated with native species, where practicable, taking into account potential for offsetting lost CO_2 from clearance.	Construction	All
Embodied carbon in concrete production	GHG2	• Flyash content within concrete would be specified where feasible. Contractors would be required to propose recycled content construction materials where they are cost, quality and performance competitive.	Pre-construction / construction	All
Re-use of excavated road materials	GHG3	• Reuse of excavated road materials would be maximised as far as possible where they are cost, quality and performance competitive to reduce use of materials (with embedded energy).	Pre-construction / construction	All
Embodied carbon in steel	GHG4	• Steel with high recycled content would be specified where feasible where they are cost, quality and performance competitive. Contractors would be required to propose recycled content construction materials where they are cost, quality and performance competitive.	Pre-construction / construction	All
Carbon in fuel	GHG5	• The feasibility of using biofuels (biodiesel, ethanol, or blends such as E10 or B80) would be investigated by the contractor, taking into consideration the capacity of plant and equipment to use these fuels, ongoing maintenance issues and local sources. Works would be planned to minimise fuel use.	Construction	All
Energy consumption: construction	GHG6	• An energy management plan would be developed during the construction of the project. The plan would include a commitment to monitor on-site energy consumption and identify and address on-site energy waste.	Pre-construction / construction	All
Energy consumption: operation	GHG7	• RMS would investigate the use of LED lighting in place of incandescent lamps as part of the project's detailed design, and use them where practicable to reduce electrical energy consumption. Any energy-efficient alternatives would have to meet lighting standards for major roads.	Operation	All
Education	GHG8	• An education program would be developed and delivered to the construction personnel to promote energy-efficient work practices.	Construction	All

18.2. Air quality

An assessment was undertaken to assess the direct and indirect impacts on air quality from the project during construction and operation. This chapter summarises the methods used in the assessment and key findings.

18.2.1. Local meteorology

Meteorological conditions, as opposed to climatic conditions, are those which relate to smaller areas and time scales.

Local meteorology and wind patterns are key in the moving and dispersing air pollutants. On a relatively small scale, winds are mainly affected by local topography; across bigger areas, there are other influences, including sea breezes that can affect meteorological conditions.

Local meteorological conditions are important when considering air quality impacts because the project involves earthworks and the potential for considerable dust generation during dry and windy weather.

The project may require a number of early works or enabling works that may generate dust. These works could include large areas of soft soils that would need to be treated before constructing the highway on top. These soft soils sites provide appropriate indications of areas across the project where substantial earthwork activities would take place adjacent to populated areas. These areas are located and have been grouped into five distinct regions for the purposes of considering local meteorology, as shown in Table 18-2.

Table 18-2: Meteorological regions: soft soil sites

ID	Soft soil sites – general region	Relevant project sections
1	Wells Crossing	Section 1 and Section 2
2	Shark Creek	Section 3
3	Maclean	Section 4 to Section 6
4	Woodburn	Section 7 to Section 9
5	Ballina	Section 10 and Section 11

Meteorological data, including temperature, wind speed and wind direction, have been generated for each of the five regions identified above using The Air Pollution Model, developed by CSIRO (2008). The Air Pollution Model is a meteorological and air pollution model that uses weather data to consider hourly wind direction, wind speed, temperature and atmospheric stability.

The wind roses show the frequency of wind speeds and wind directions, based on one year of data. While wind patterns vary from day to day, most regions experience similar wind patterns from year to year. The general pattern of winds for 2008 would be similar to other years for the five meteorological regions across the project.

According to The Air Pollution Model, it can be seen from the wind roses in Figure 18-3 to Figure 18-7, that, at Wells Crossing, Maclean and Ballina, the most common winds are from the south-east to the south-south-east. Winds in the Shark Creek and Woodburn areas can be from all directions, and there is generally no one dominant wind direction.

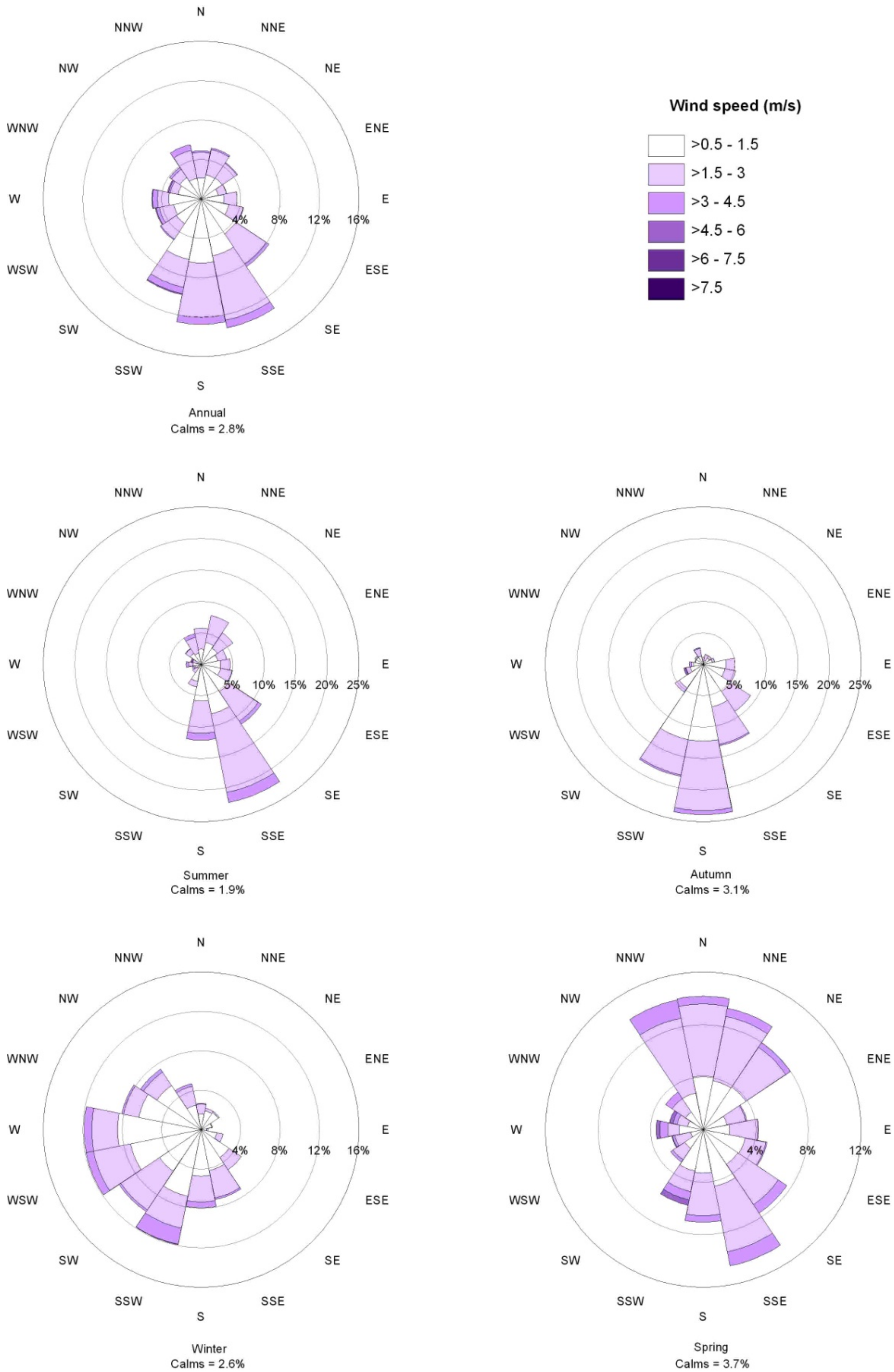

Figure 18-3: Wind roses for the Wells Crossing region (CSIRO, 2008)

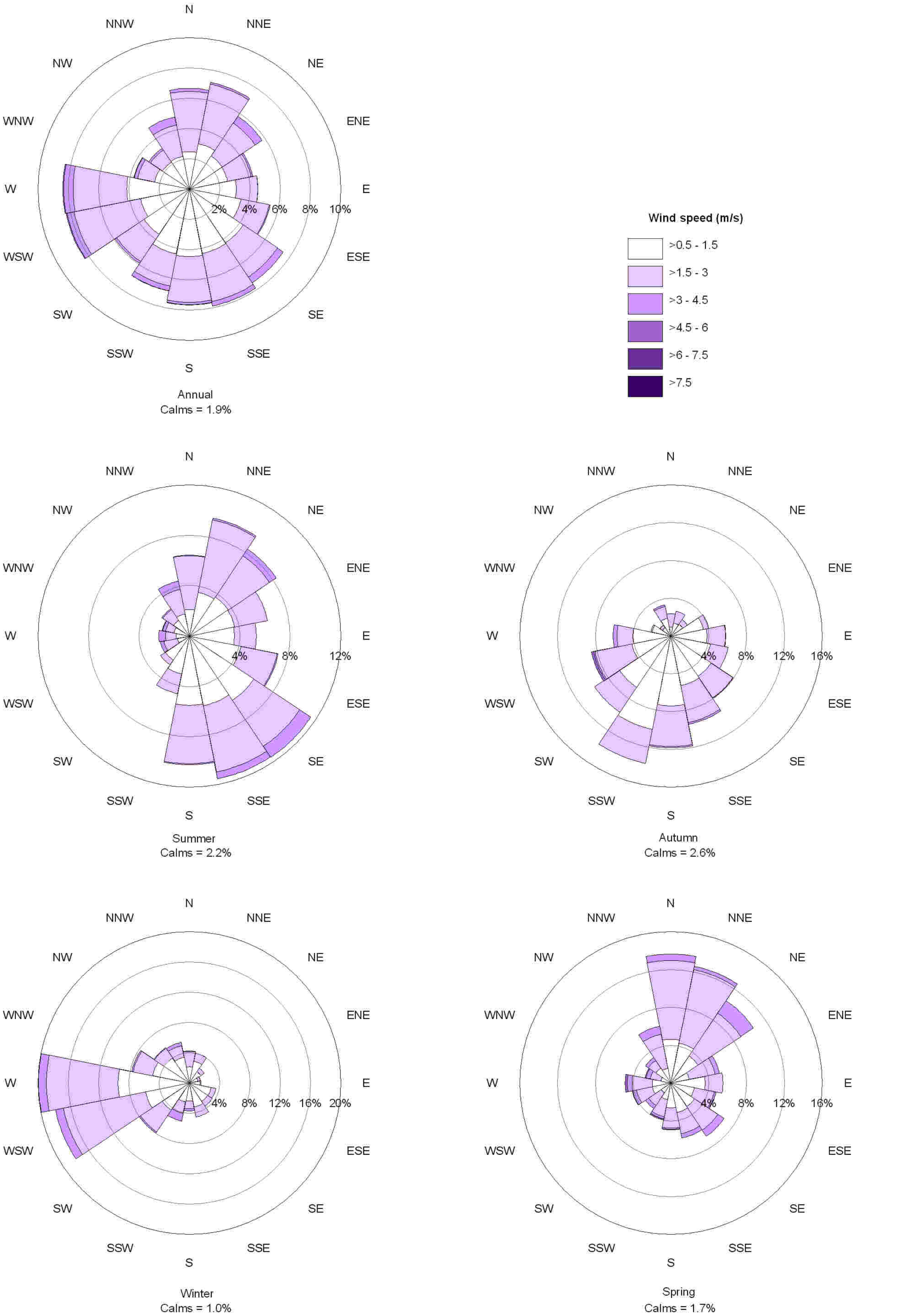

Figure 18-4: Wind roses for the Shark Creek region (CSIRO, 2008)

Figure 18-5: Wind roses for the Maclean region (CSIRO, 2008)

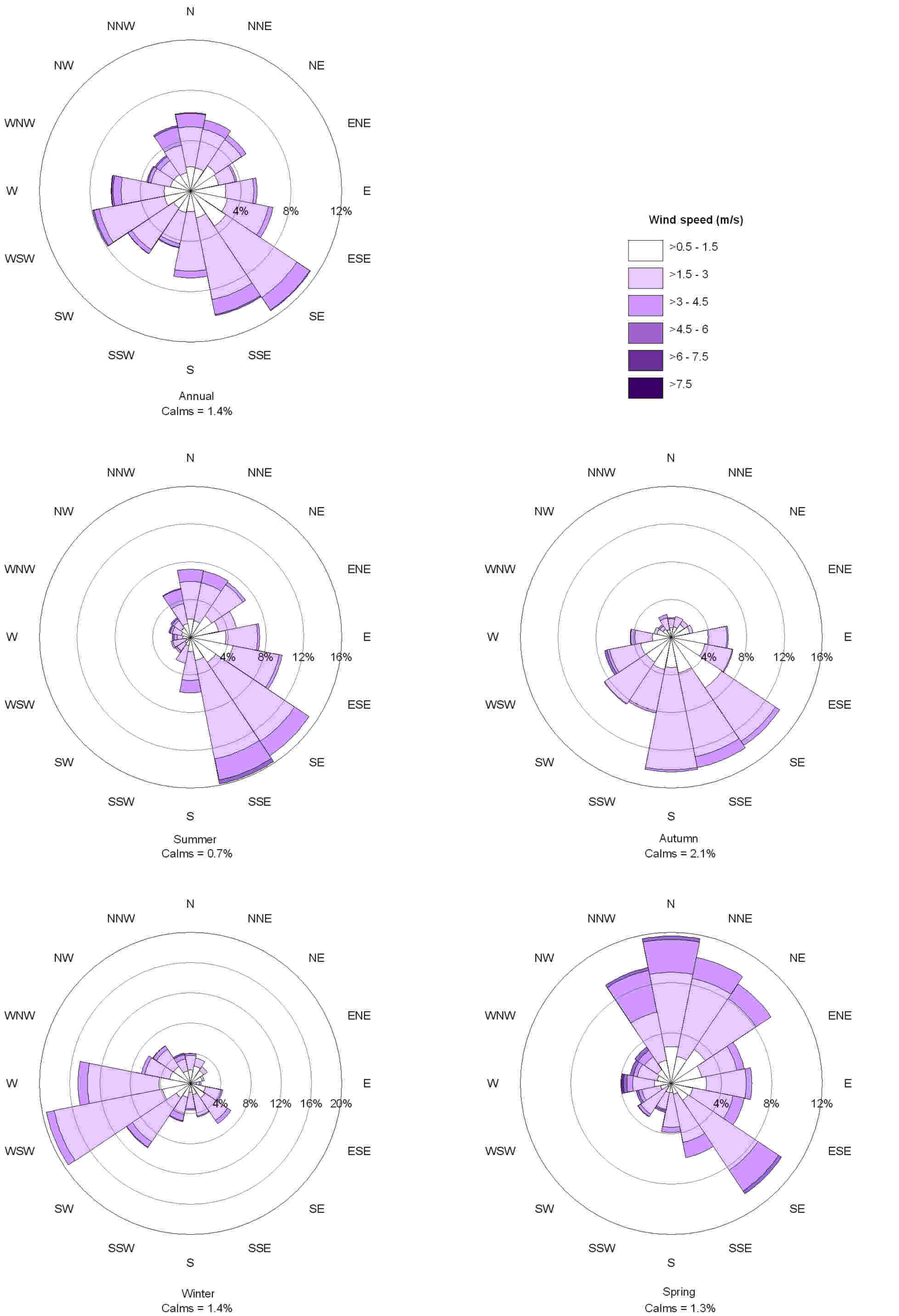

Figure 18-6: Wind roses for the Woodburn region (CSIRO, 2008)

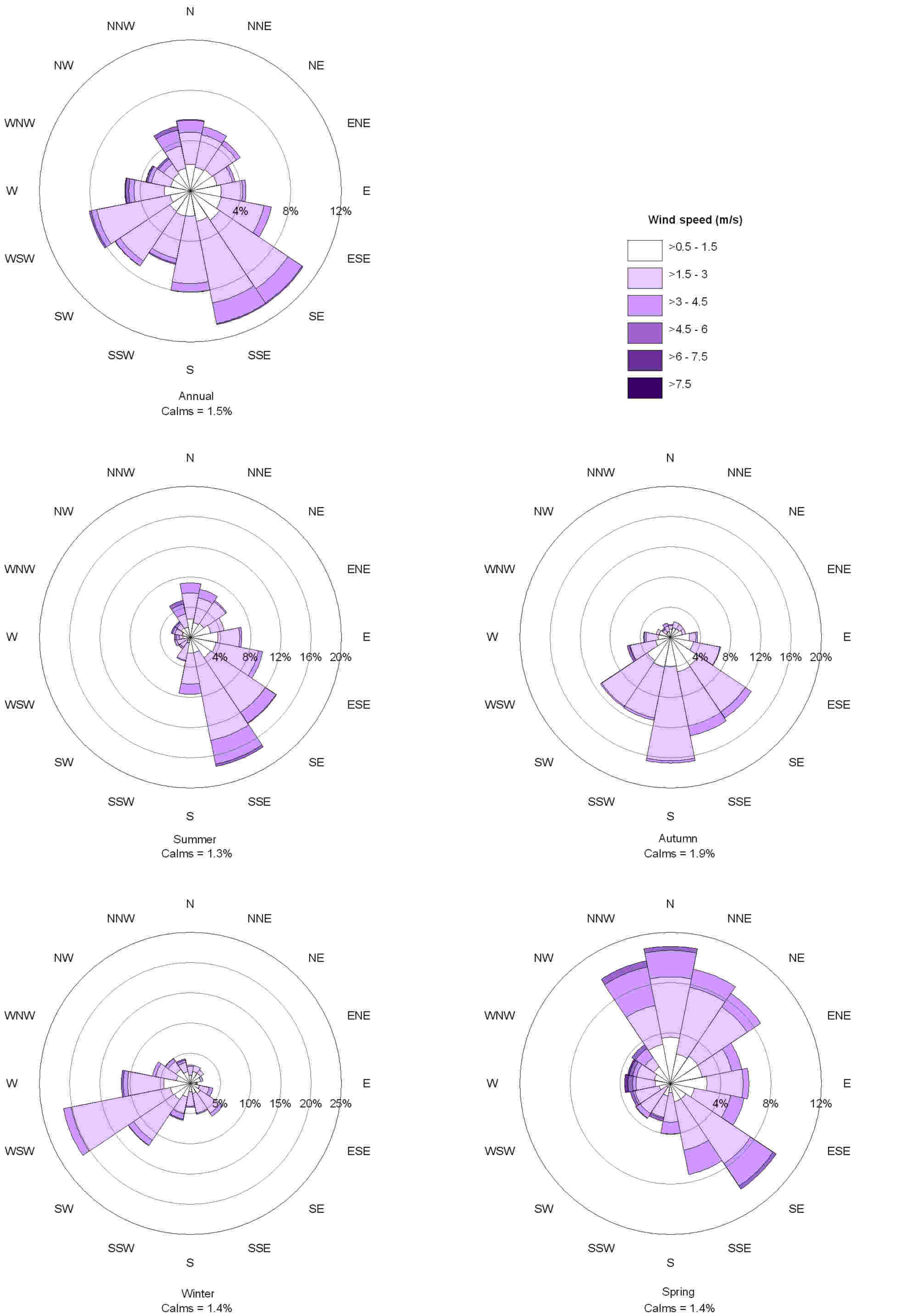

Figure 18-7: Wind roses for the Ballina region (CSIRO, 2008)

Table 18-3 shows the annual average wind speeds for each meteorological region. It shows that:

- Woodburn has an annual average wind speed of 2.5 metres per second, which is a moderate average wind speed
- Maclean and Ballina have an annual average wind speed of around two metres per second
- Shark Creek and Wells Crossing have an annual average wind speed of 1.6 metres per second.

Table 18-3: Simulated average wind speeds for the project region

Meteorological region	Average wind speed, as simulated by The Air Pollution Model (TAPM) for 2008 (m/s)				
	Summer	Summer	Summer	Summer	Summer
Wells Crossing	1.7	1.7	1.7	1.7	1.7
Shark Creek	1.7	1.7	1.7	1.7	1.7
Maclean	2.0	2.0	2.0	2.0	2.0
Woodburn	2.5	2.2	2.6	2.7	2.5
Ballina	2.1	1.8	1.9	2.2	2.0

18.2.2. Existing air quality

There is limited information on existing air quality on the North Coast because areas located away from larger regional centres generally do not have air quality monitoring stations. The main reason for this is that pollutants generally do not occur in high enough concentrations at these locations to cause adverse environmental or health impacts. As such, monitoring for pollutants on a long-term basis is usually only carried out in large regional or metropolitan areas.

Air quality monitoring has not been carried out specifically for this project. However, RMS monitored air quality at a site adjacent to the Pacific Highway at Korora between Korora Public School and the Korora Rural Fire Brigade, north of Coffs Harbour. This is one of the most trafficked sections of the highway. Monitoring was undertaken from October 2005 to January 2006, which included the more heavily trafficked holiday period when traffic emissions are likely to be higher than typical levels in the area. Therefore, the data provide a conservative (or worse case) indication of the air quality likely to be found on the North Coast and close to the Pacific Highway.

Average daily traffic on the Pacific Highway at the time of monitoring was around 19,700 vehicles (RTA, 2004). Meteorological data from October 2005 to January 2006 were also measured. The monitoring data are summarised in Table 18-4.

Table 18-4: Summary of Korora air quality monitoring data

Measurement	Value	Environment Protection Authority criteria
Maximum 1-hour average CO	1.2 mg/m^3	30 mg/m^3
Maximum 8-hour average CO	0.3 mg/m^3	10 mg/m^3
Maximum 1-hour average NO_2	74 µg/m^3	246 µg/m^3
Maximum 24-hour average PM_{10}	38 µg/m^3	50 µg/m^3

The data from Table 18-4 show that the pollutant concentrations on the Pacific Highway at Korora were below the relevant air quality criteria for all pollutants. (Note that the major contributor to carbon monoxide and nitrogen dioxide levels would have been traffic emissions while the contributors to particulate matter would have included motor vehicles, local construction activities, industry, sea-salt, pollens, bushfires and dust storms).

At the time of monitoring (2005–06), the highway was carrying around 20,000 vehicles per day. It is likely that concentrations today would be lower (near a similar grade road carrying 20,000 vehicles per day) because of improvements in vehicle emission technology.

Table 18-5: Environment Protection Authority assessment criteria for relevant air pollutants

Pollutant	Averaging time	Criterion
Carbon monoxide (CO)	Maximum 1-hour average	30,000 µg/m3
	Maximum 8-hour average	10,000 µg/m3
Nitrogen dioxide (NO2)	Maximum 1-hour average	246 µg/m3
	Annual average	62 µg/m3
Particulate matter (as PM10)	Maximum 24-hour average	50 µg/m3
	Annual average	30 µg/m3

µg/m^3 = micrograms per cubic metre

The EPA has set criteria for other pollutants from motor vehicles. These include air toxics like volatile organic compounds. However, the pollutants listed in Table 18-5 typically make up the greatest amount of those pollutants found near a road. Therefore, air toxics have not been considered further as recent air quality monitoring indicates low levels of background air toxics (OEH, 2012), and because they only make up a small amount of air pollutants found near the roadside. Therefore, the study's focus is on carbon monoxide, nitrogen dioxide and particulate matter. This is considered adequate for qualifying the air quality impacts of the project.

18.2.3. Assessment methodology

Construction assessment methodology

A qualitative air quality assessment was undertaken to cover construction. The assessment methodology involved:

- Identifying the location, type and intensity of key construction activities
- Identifying the location of the nearest sensitive receptors to construction activities
- Characterising the existing air quality environment at these locations
- Assessing the prevailing meteorological conditions
- Outlining how potential impacts on air quality would be managed and mitigated.

Operational assessment methodology

For the operational air quality impact assessment, the Tool for Roadside Air Quality developed by Roads and Maritime Services has been used to estimate potential air quality impacts from the project.

Near roadside pollutant concentrations (for carbon monoxide, nitrogen dioxide and particulate matter) have been predicted using existing and forecast average daily traffic volumes from the project for its year of opening (2016) and 10 years thereafter (2026). Model results were compared to Environment Protection Authority (EPA) air quality assessment criteria (see below) and conservative estimates of existing background levels.

Air quality criteria

The EPA has set air quality assessment criteria as part of its Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (DEC, 2005). Air quality criteria have been used to assess the potential for ambient air quality to create adverse health or nuisance impacts.

The most important emissions from motor vehicles are oxides of nitrogen (NOx), carbon monoxide (CO) and particulate matter (that is, particulate matter with equivalent aerodynamic diameters equal or less than 10 microns (PM10)). The magnitude of vehicle emissions and the potential impacts from the project would depend on the volume, speed and type of traffic, and on the ability of the local environment to disperse emissions.

Table 18-5 summarises the air quality criteria relevant to the project. Background air quality levels and these criteria have been used to assess impacts.

KEY TERM – Particulate matter

Is a range of particles that exists in the air we breathe. Particulate matter is commonly called 'dust' and exists naturally in the atmosphere; examples include sea-salt spray and pollens. Particulate matter can be increased due to human activities such as vehicle exhaust, industrial processes, power stations, mining, farming and wood heaters, or smoke from bushfires. Exposure to particulate matter can be associated with health and amenity impacts (NSW Health, 2012).

18.2.4. Impact assessment

Construction

Air quality impacts from construction would largely result from particulate emissions, which could be generated during earthworks and other road construction activities. The total amount of particulate emissions generated would depend on several factors. These could include the silt and moisture content of the soil, the types of operations being carried out, the size of exposed areas, the frequency of water-spraying (to suppress dust) and the speed of machinery.

A range of plant and equipment would be required during construction. These 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 particulate matter from the project are likely to include:

- Clearing of vegetation and topsoil by bulldozers and/or backhoes
- Excavation and levelling of soil by bulldozers, backhoes and/or excavators
- Construction of embankments on soft soil sites
- Blasting or processing of rock
- Movement of soil and fill by dump trucks and scrapers
- Wind erosion from unsealed surfaces and stockpiles
- Vehicle (exhaust) emissions from construction
- Dust from the wheels of construction vehicles travelling on unsealed areas.

There is potential for particulate matter to cause a nuisance if dust-generating activities are located close to sensitive receptors, such as residential dwellings and local businesses. The magnitude of dust impacts would depend various factors. These include the amount of earthworks, activity duration and local meteorology, particularly wind speed and direction.

Table 18-6 summarises a qualitative assessment of potential impacts for each project section. It takes into account local wind patterns and the proximity of earthworks to sensitive receptors.

Vehicle emissions during construction would generally be linked to the combustion of petroleum products, such as diesel and gasoline. The operation of machinery during construction and general site operations would generate fine particulate. These emissions would include soot, carbon monoxide, carbon dioxide, oxides of nitrogen, sulphides and trace amounts of non-combustible hydrocarbons. Emission rates and potential impacts would depend on the fuel quality and power output, and the condition of the combustion engines. This impact would be considered minimal provided equipment is appropriately maintained.

Table 18-6: Air quality impacts from construction activities

Section	Comment
1	Section 1 is largely outside the existing road reserve. Considerable vegetation clearance would be required. This would expose earth, resulting in potential dust impacts. About 235,000 tonnes of excavated material would be exported to other sections of the project. Blasting and/or processing of rock would be required during the excavation of the cuttings in this section. Annually, winds within the study area most commonly occur from the south-south-east to south. The annual pattern of winds creates a greater potential for adverse dust impacts at sensitive receivers to the north-north-west and north of the project. However, the majority of sensitive receivers are located at Dirty Creek, south of the project. This section of the project traverses or is adjacent to vegetated or low-density rural residential land. To address community concerns regarding dust deposition on local blueberry farms near Dirty Creek, adjacent to the road corridor along Range Road, potential impacts have been considered. Dust deposition on vegetation can lead to the formation of layers or crusts, which block stomata. This hinders photosynthesis, slows carbon dioxide intake, and affects the rate of starch formation. There are no dust deposition guidelines relating to health or the condition rating of plant species, but studies regarding the effects of dust deposition from vehicle exhausts on roadside plants indicate reductions in photosynthesis occur at dust deposition levels of greater than 5 g/m^2 (Thompson, 1984). Additionally the Coal Mining Potential in Upper Hunter Valley – Strategic Assessment (DoP, 2005) notes that dust deposition levels of in excess of 0.75 g/m^2/day can have adverse impacts on plant production. Both of these levels are considered high and unlikely to occur during earthworks required for the project. Therefore, it is unlikely an increase in dust deposition levels during construction would affect nearby farms, as the dust is unlikely to hinder photosynthesis.
2	The majority of this section would be constructed within or adjacent to the existing road reserve. A lower level of vegetation clearance and earthworks would be required for this section compared to other sections of the project. About 155,000 tonnes of imported fill would be required and blasting and/or processing of rock would be required during the excavation of cuttings. Annually, winds within the study area most commonly occur from the south-south-east to south. The annual pattern of winds creates a greater potential for adverse dust impacts at sensitive receivers to the north and north-north-west of the site. This section of the project traverses or lies adjacent to vegetated or low-density rural residential and pastoral land, with the largest number of sensitive receivers located at the northern end of the project.
3	Section 3 is outside the existing road reserve. Considerable vegetation clearance would be required. This would expose earth resulting in potential dust impacts. A large amount of earthworks is required: 3,130,000 tonnes of excavated material would be transported as fill to other sections of the project. Blasting and/or processing of rock would be required during the excavation of cuttings. The main cut would be just north of Tyndale and would be excavated to a depth of up to 21 metres. There is the potential for dust impacts at nearby sensitive receivers during excavation and blasting. Annually, winds within the study area are highly variable. The annual pattern of winds creates the potential for adverse dust impacts at all sensitive receivers surrounding the site. This section of the project traverses or lies adjacent to vegetated or low-density rural residential and pastoral land. The majority of sensitive receivers are located near the proposed interchange at Tyndale.
4	Section 4 would be constructed along the existing highway and would not require large amounts of vegetation clearance. Some earthworks would be required, with about 365,000 tonnes of excavated material exported to other sections. Blasting and/or processing of rock would be required during excavation of cuttings. Key cut locations would be north of Shark Creek and north of McIntyres Lane, to a depth of around 26 and 12 metres, respectively. This section requires construction of a number of embankments on soft soil sites. These sites (and their anticipated embankment footprint) include: South of Shark Creek (about 90,000 square metres) North of McIntyres Lane (25,000 square metres) North and south of Edwards Creek including the interchange at Maclean and the eastern service road (250,000 square metres).

Section	Comment
	There is potential for dust impacts at nearby sensitive receivers during excavation, emplacement of fill and blasting works at these locations. Annually, winds within the study area are highly variable. The annual pattern of winds creates the potential for adverse dust impacts at all sensitive receivers surrounding the project. This section of the project traverses or lies adjacent to low-density rural residential and pastoral land and small vegetated areas. The majority of sensitive receivers are located near the interchange at Maclean.
5	Section 5 would be constructed within or adjacent to the existing road reserve. This section would require some vegetation clearance and a large amount of earthworks with considerable import of fill material (about 1,270,000 tonnes). Blasting and/or processing of rock would be required during the excavation of the cuttings. Section 5 involves construction of a number of embankments on soft soil sites. These sites (and the anticipated embankment footprint) are: The embankment area south of the bridge over the Clarence River (60,000 square metres) The embankment areas north of the proposed bridge and south of the interchange at Harwood (15,000 square metres) North and south of Serpentine Channel (10,000 square metres for the northern embankment) South of Carrolls Lane (15,000 square metres). There is the potential for dust impacts at nearby sensitive receivers during excavation, emplacement of fill and blasting works at these locations. Annually, winds within the study area are highly variable. The annual pattern of winds creates the potential for adverse dust impacts at all sensitive receivers surrounding the site. This section of the project traverses or lies adjacent to low-density rural residential and pastoral land and small vegetated areas. The majority of sensitive receivers are located in the built-up areas of Townsend in Maclean and Harwood.
6	Section 6 would be constructed within or adjacent to the existing road reserve. Minimal vegetation clearance would be required. About 230,000 tonnes of imported fill would be required. At this stage, there is not likely to be blasting or processing of rock required during the excavation of cuttings. However, this would be determined during detailed design and following further site investigation. Annually, winds within the study area are highly variable. The annual pattern of winds creates the potential for adverse dust impacts at all sensitive receivers surrounding the site. This section of the project traverses or lies adjacent to vegetated or low-density rural residential and pastoral land.
7	Section 7 would be constructed within or adjacent to the existing road reserve. Minimal vegetation clearance would be required. About 155,000 tonnes of imported fill would be required. Blasting and/or processing of rock would be required during the excavation of the cuttings. Annually, winds within the study area most commonly occur from the south-east to south-south-east. The annual pattern of winds creates a greater potential for adverse dust impacts at sensitive receivers to the north-west and north-north-west of the site. This section of the project traverses or lies adjacent to vegetated or low-density rural residential and pastoral land with the majority of sensitive receivers located adjacent to the northern portion of the project.
8	Section 8 would be constructed largely within or immediately adjacent to the existing road reserve. It would require some vegetation clearance. About 135,000 tonnes of cut material would be exported to other sections. Blasting and/or processing of rock would be required during the excavation of the cuttings. Key cut locations are at the interchange at Woodburn and at Lang Hill, cut to a depth of up to around 15 and 18 metres, respectively. This section also requires emplacement of fill at soft soil sites located north and south of Tuckombil Canal, with the embankment footprint at this site expected to be 30,000 square metres. There is the potential for dust impacts at nearby sensitive receivers during excavation, emplacement of fill and blasting works at the above locations. Annually, winds within the study area most commonly occur from the south-east to south-south-east. The annual pattern of winds creates a greater potential for adverse dust impacts at sensitive receivers to the north-west and north-north-west of the site. This section of the project traverses or lies adjacent to vegetated or low-density rural residential and pastoral land. Sensitive receivers are clustered near the interchange at Woodburn and along Evans Head Road, which runs in a north-west/south-east direction.

Section	Comment
9	Section 9 is relatively small. A small portion of the section at the northern end would be constructed away from the existing road reserve. Some vegetation clearance would be required. This section requires a large amount of fill (about 700,000 tonnes), which would be transported from other sections. Blasting and/or processing of rock would be required during the excavation of cuttings. Annually, winds within the study area most commonly occur from the south-east to south-south-east. The annual pattern of winds creates a greater potential for adverse dust impacts at sensitive receivers to the north-west and north-north-west of the site. This section traverses Broadwater National Park. Greater densities of sensitive receivers are located to the north of the park and are largely rural residential properties.
10	Section 10 would be constructed largely outside the existing road reserve. This section would require large amounts of vegetation clearance. Only minor amounts of fill would be required for this section (about 15,000 tonnes). Blasting and/or processing of rock would be required during the excavation of the cuttings. The main cut location is just west of Wardell and may be excavated to a depth of up to 21 metres. There is the potential for dust impacts at nearby sensitive receivers during excavation and blasting works. Annually, winds within the study area most commonly occur from the south-east to south-south-east. The annual pattern of winds creates a greater potential for adverse dust impacts at sensitive receivers to the north-west and north-north-west of the site. This section of the project traverses or lies adjacent to vegetated or low-density rural residential and pastoral land. The majority of sensitive receivers are located at the northern end of this section to the east and west and are screened by remnant vegetation.
11	This section generally follows the alignment of the existing road reserve. Minimal vegetation clearing is required. Approximately 350,000 tonnes of fill is required from other sections of the project. An embankment is required on soft soil sites located north of Whytes Lane and south of Duck Creek and the total embankment footprint is anticipated to be 100,000 square metres. It is not likely that blasting and/or processing of rock would be required during the excavation of cuttings in this section. However, this will be determined during detailed design and following further site investigation. Annually, winds within the study area most commonly occur from the southeast to south southeast. The annual pattern of winds creates a greater potential for adverse dust impacts at sensitive receivers to the northwest and north-northwest of the site. This section of the project traverses or lies adjacent to vegetated or low density rural residential and pastoral land. The largest portion of sensitive receivers are located at the southern portion of this section east of the project.

Operation

The assessment considered the potential air quality impacts from the project once the upgraded highway is open to traffic. The assessment used a computer-based dispersion model to predict[1] pollutant concentrations likely to be found near the roadside, and coming from motor vehicles. The assessment results have been compared to air quality assessment criteria published by the EPA (DEC, 2005). Background air quality was also considered to identify how air quality could change once the project is open to traffic.

Existing and forecast traffic volumes have been considered for the existing Pacific Highway assuming the project is not built (the existing Pacific Highway scenario) and once the project is open to traffic. Various scenarios were considered, in terms of the project's intended year of opening (2016), 10 years after opening, and with and without the project.

[1] Model predictions are based on a worst case scenario and the following points should be noted when reading the operational air quality assessment below:

Predicted existing pollutant concentration contributions from the highway when added to background concentrations recorded at Korora are likely to be an over estimation as existing measurements would be inclusive of vehicle emission concentrations.

For all pollutants assessed, the highest concentrations would be near the kerb and concentrations would decrease with distance from the kerb, due to dispersion.

Observed decreases in pollutant concentrations between the existing case and projected 'no project' scenarios for 2016 and 2026 is likely attributed to assumed reductions in the proportion of older vehicles in the fleet simulating improved vehicle emissions in future years.

The dispersion modelling results across the project shows that:

- Once open to traffic, predicted concentrations of pollutants (carbon monoxide, nitrogen dioxide and particulate matter) across the project in 2016 and 2026 would be lower than the existing situation. When added to the background concentration, the forecast air quality levels would be well below EPA criteria for all averaging periods
- Where the highway would largely deviate from the existing alignment (sections 4, 6,7 and 11), reduced traffic flows on the existing highway would result in lower amount of pollutants along the existing highway (in 2016 and 2026)
- The existing Pacific Highway scenarios for 2016 and 2026 would have maximum 1-hour and 8-hour carbon monoxide levels equal to or greater than the project. This is because of greater traffic congestion along the existing highway, and less congestion across the project
- Existing Pacific Highway scenarios for 2016 and 2026 would have maximum 1-hour and annual average nitrogen dioxide levels greater than the project. This is because of greater traffic congestion along the existing highway, and less congestion across the project
- Existing highway scenarios for 2016 and 2026 would have pollutant contributions for particulate matter greater than the project. This is because of greater traffic congestion along the existing highway, and less congestion across the project.

In summary, modelling shows that there would be no exceedance of air quality criteria across the project. Therefore, the project is predicted to result in an overall improved air quality as compared to the existing Pacific Highway scenario.

Cumulative impact assessment

A search of the Department of Planning and Infrastructure Major Project Register was completed in April 2011 for the local government areas of Coffs Harbour, Clarence Valley, Richmond Valley and Ballina. Projects of relevance to air quality include a number of proposed Pacific Highway upgrade projects and expansion of the existing quarry at Kungala.

Adjoining Pacific Highway upgrade projects currently under construction are the Sapphire to Woolgoolga and Devils Pulpit upgrades. These projects could result in temporary dust impacts during construction which, if followed by or concurrent with the project’s construction, could create cumulative air quality impacts for local sensitive receivers.

Vehicle emissions during operation of the project along with other Pacific Highway upgrades are likely to result in an overall reduction in carbon monoxide, oxides of nitrogen and particulate matter levels due to improved traffic flow. The cumulative effect of these projects is likely to be an overall improvement in air quality across the project.

An application has been lodged to reactivate and expand the previously approved and operated sandstone and iron ore quarry at Kungala Road, about five kilometres west of the start of Section 2. An environmental impact assessment is currently being prepared for this quarry project. Quarries are generally managed to minimise dust emissions and to keep impacts within the site boundary. The cumulative effect on air quality due to dust from this quarry and the project would be negligible.

18.2.5. Management of impacts

Measures identified for the management of air quality impacts are detailed in Table 18-7.

Table 18-7: Air quality mitigation measures

Issue	Mitigation ID no.	Mitigation measure	Timing	Relevant section
Air quality management planning	AQ1	An air quality management plan would be developed for the construction stage of the project prior to the start of construction. The air quality management plan would address all aspects of construction including spoil handling, machinery operating procedures, soft soil treatments, stockpile management, traffic management, haulage, dust suppression and monitoring.	Pre-construction	All
Air quality management during construction	AQ2	An air quality management plan would be prepared and implemented by the contractor during construction to mitigate dust. The following dust mitigation measures would be used on-site and included as part of the management plan: • Covering materials transported to and from construction sites. • Covering or spraying water on stockpiles of soil or other potential dust generating materials, particularly during dry or windy conditions. • Temporarily seed and stablise temporary stockpiles that are planned to be in place for long periods • Imposing speed limits for vehicles and equipment travelling on unsealed surfaces. • Minimising the extent of disturbed areas as far as practicable. This would be achieved by staging the works to minimise the number of disturbed areas at any one time. • Progressively rehabilitating disturbed areas as soon as practicable. • Suppressing dust on unsealed surfaces, temporary roadways, stockpiles and other exposed areas using water trucks, hand held hoses, temporary vegetation and other practices. • Modifying or stopping dust generating activities during very windy conditions. • Installing wheel wash facilities at appropriate locations to reduce tracking of mud and soil off-site. • Monitoring air quality, both visually, using instrumentation and/or depositional dust gauges, near representative sensitive receptors to verify the effectiveness of controls. • Amend controls where necessary to minimise any impacts identified through monitoring, consider the use of mitigation measures (such as covers) where dust is impacting water tanks or other drinking water sources, and cannot be controlled at the dust source.	Construction	All

18.3. Waste and resource management

RMS would manage the project in accordance with the principles of ecologically sustainable development (ESD). This chapter addresses the ESD processes that RMS would implement in relation to waste and resource management.

18.3.1. Assessment methodology

The *Waste Avoidance and Resource Recovery Act* 2001 (WARR Act) and the *Protection of the Environment Operations Act* 1997 (POEO Act) are the key documents that govern the issues of waste generation, reuse, recycling, transport and disposal and establish a waste minimisation hierarchy that prioritises waste solutions, according to how successfully they conserve natural resources. The first priority is given to reducing the overall amount of waste, followed by the reuse and then recycling of any wastes that are unavoidably created, with disposal a last resort. The aim is to extract the maximum practical benefits from the products and to manage waste in the best possible way.

Waste is defined under the POEO Act to include:

a) any substance (whether solid, liquid or gaseous) that is discharged, emitted or deposited in the environment in such volume, constituency or manner as to cause an alteration in the environment;
b) any discarded, rejected, unwanted, surplus or abandoned substance;
c) any otherwise discarded, rejected, unwanted, surplus or abandoned substance intended for sale or for recycling, processing, recovery or purification by a separate operation from that which produced the substance;
d) any processed, recycled, re-used or recovered substance produced wholly or partly from waste that is applied to land, or used as fuel, but only in the circumstances prescribed by the regulations; or
e) any substance prescribed by the regulations to be waste.

The waste regulatory framework is outlined in further detail in this section.

Regulatory framework

Protection of the Environment Operations Act 1997

The regulatory framework is centred on the POEO Act, which specifies the requirements for licences and the regulation of activities that have the potential to pollute or harm the environment. Further the POEO Act:

- Integrates Environment Protection Authority licensing with the development approval procedures under the Environmental Planning and Assessment Act 1979.
- Provides for the issuing of clean-up notices, prevention notices and prohibition environment protection notices.
- Classifies environment protection offences and penalties.
- Allows for mandatory audits and provides authorised officers' with the power to undertake investigations.
- Provides for a public register to be kept by all regulatory authorities, which includes information on all licences, review of licences, prosecutions, legal notices and the conclusions of any mandatory audit reports.

The POEO Act also makes it an offence to unlawfully transport waste material (Section 143); to use the premises as a waste facility without the authority to do so (Section 144); or provide misleading information regarding waste storage, transport and disposal (Section 145).

Waste Avoidance and Resource Recovery Act 2001

The *Waste Avoidance and Resource Recovery Act 2001* promotes waste avoidance and resource recovery by developing waste avoidance and resource recovery strategies and programs such as the extended producer responsibility scheme for industry. The Act establishes a waste hierarchy, which comprises the following principles:

Avoidance of waste: Minimising the amount of waste generated during construction by avoiding unnecessary resource consumption (that is, avoiding the use of inefficient plant and construction equipment and avoiding materials with excess embodied energy, waste and excessive packaging)
Resource recovery: Re-using, reprocessing and recycling waste products generated during construction to minimise the amount of waste requiring disposal
Disposal: Resources that cannot be recovered are to be disposed of appropriately to minimise potential adverse impacts on the environment.

In addition, the Waste Avoidance and Resource Recovery Strategy 2007 (DECC, 2007) provides guidance on waste management priorities.

Environmentally Hazardous Chemicals Act 1985

The *Environmentally Hazardous Chemicals Act 1985* provides the Environment Protection Authority with the authority to declare chemical substances as chemical wastes and to make chemical control orders relating to those substances that are declared as chemical wastes. Chemical control orders are made when chemicals or chemical wastes pose serious threats to the environment and there are particular challenges in their management.

The Environmentally Hazardous Chemicals Act also provides that by reason of a chemical control order, an authorised licence be obtained for certain activities relating to the of manufacturing, processing, keeping, distributing, conveying, using, selling or disposing of an environmentally hazardous chemical or a declared chemical waste.

Protection of the Environment Operations (Waste) Regulation 2005

This Regulation sets out provisions around the way waste is managed in terms of storage and transportation as well as reporting and record keeping requirements for waste facilities. It also provides for:

- Setting special requirements for the management of certain special wastes including asbestos.
- Payment of waste contributions (also referred to as a waste and environment levy) by the occupiers of licensed waste facilities for each tonne of waste received at the facility or generated in a particular area.
- Exemption of certain occupiers or types of waste from paying waste contributions and deductions to be claimed in relation to certain types of waste. (See below for details regarding relevant road waste exemptions)

The *Protection of the Environment Operations (Waste) Regulation 2005* also enables the Environment Protection Authority to issue general resource recovery exemptions to promote the re-use of certain materials.

These ‘resource recovery exemptions’ are granted by Environment Protection Authority where the land application or use as fuel of a waste material is a genuine, fit for purpose, reuse of the waste rather than another path to waste disposal. An exemption facilitates the use of these waste materials outside of certain requirements of the waste regulatory framework.

Environment Protection Authority will issue a resource recovery exemption only where the intended use:

- will be beneficial
- will cause no harm to the environment or human health.

In order for an exemption to apply, all the conditions of the exemption must be met. These conditions include, but are not limited to, sampling and testing requirements, chemical thresholds, use restrictions and record-keeping requirements.

Exemptions issued by Environment Protection Authority:

- do not release those using them from the requirement to obtain the necessary planning consents or approvals from the appropriate regulatory authority
- do not alter or override the requirements or conditions of any other relevant legislation in relation to the waste being applied to land or used as fuel, such as the need to maintain a Material Safety Data Sheet
- do not apply to any waste received at a licensed landfill
- do not apply to waste received for processing at a recycling facility.

The Environment Protection Authority issues both general and specific resource recovery exemptions. A general exemption can be issued for commonly recovered, high-volume and well-characterised waste materials. These exemptions may be used by anyone, without seeking approval from Environment Protection Authority, provided the generators, processors and consumers fully comply with the conditions they impose.

Where no general resource recovery exemption is available for the intended use, an application may be made to Environment Protection Authority for a specific exemption, which would then be issued by the agency, if appropriate.

The following general resource recovery exemptions are of most relevance to road construction projects:

- Excavated natural material (Excavated Natural Material Exemption 2008 (EPA, 2008a)).
- Excavated public road material (Excavated Public Road Material Exemption 2012 (EPA, 2012)a)
- Raw mulch (Raw Mulch Exemption (EPA, 2008b))
- Reclaimed asphalt pavement (Reclaimed Asphalt Pavement Exemption (EPA, 2012b))
- Recovered aggregate (Recovered Aggregate Exemption (EPA, 2010))
- Stormwater (Stormwater Exemption (EPA, 2008c))
- Treated Drilling Muds (Treated Drilling Mud Exemption (EPA, 2009))

18.3.2. Impact assessment

Construction

Construction of the project would generate a number of waste streams, including:

- Excavation wastes
- Timber and green wastes
- Demolition wastes
- Construction wastes including:
  - Wastes generated from concrete or asphalt batching plants.
  - Waste generated from chemical/spill clean-up or remediation.
  - Waste generated from remediation of contaminated material.
  - Waste generated from Acid Sulfate Soil treatment.
  - Sediment/sludge from sediment basin desilting.
  - Waste water from tannin affected water, contaminated runoff from concrete bridge decks, water captured in excavations; and dam de-watering.
- Packaging materials.
- Waste produced from the maintenance of construction vehicles and plant, which might include oils, fluids, fuels, tyres.
- Sewage and general waste from construction compounds.

- Miscellaneous wastes.
- General waste from office and compounds.

These construction wastes are addressed in the following sections.

The mismanagement of these waste streams has the potential to result in the following impacts:

- Excessive waste being directed to landfill
- Various types of waste being generated and stored onsite, with the potential for misclassification
- Contaminated waste not being correctly disposed of
- Water pollution
- Land contamination.

Excavation wastes

Excavation wastes would mostly include Virgin Excavated Natural Material (VENM) and Excavated Natural Material (ENM). As far as practicable, earthworks material generated from the project would be re-used for the construction of embankments, in subgrade pavement layers and as verge material. During detailed design, the earthworks balance would be further refined to source as much material as required for the project. The current earthworks balance estimate in Chapter 6 (Description of the project – construction) indicates that around 550,000 cubic metres of unsuitable material would be generated during construction. There is the possibility that this amount may increase depending on the specific geotechnical issues encountered at sites that may require more material to be excavated (eg wet ground conditions) than has been estimated. The earthworks balance would be revised during detailed design reduce the potential for unsuitable material where possible. Unsuitable material would be re-used through flattening batters, in the construction of noise or visual mitigation mounds and on project landscaping.

Other measures that RMS would consider include alternative ground treatment measures to reduce the need to excavate the unsuitable spoil and identification of areas within the project that may be used to fill with the unsuitable material such as use in landscaping at Lang Hill or Lumleys Hill.

Waste material generated from excavations has the potential to cause water pollution if not stockpiled and re-used in accordance with the construction Soil and Water Management Plan.

KEY TERM – Virgin Excavated Natural Material

Virgin Excavated Natural Material (VENM) is natural material that has been excavated or quarried from areas that are not contaminated with manufactured chemicals or process residues, as a result of industrial, commercial, mining or agricultural activities, and that does not contain sulphidic ores or soils.

KEY TERM – Excavated Natural Material

Excavated Natural Material (ENM) is naturally occurring rock and soil (including materials such as sandstone, shale, clay and soil) that has been excavated from the ground; contains at least 98% (by weight) natural material; and does not meet the definition of VENM.

Where sections of the existing Pacific Highway or local roads are excavated, the re-use of this material would be done in accordance with the conditions attached to the general resource recovery exemption, Excavated Public Road Material Exemption 2012 (EPA, 2012a). Where this material has not been subjected to potentially contaminating sources, it can be reused within the road corridor without further testing or any specific licensing requirements. Where this material is suspected of being subject to contamination (e.g section of road is adjacent to a service station, or an old sheep dip), testing and classification of this material would be undertaken to ensure any potential impact on the environment are minimised, and to ensure the material is handled and managed appropriately (RMS, 2012d).

There is also the potential for contaminated soils to be excavated as part of the project. Refer to Chapter 9 (Soils, sediment and water) for further detail on potential impacts from contaminated soil. These soils would be classified by soil tests (before construction, where possible, or after they are uncovered) and would be disposed of in accordance with the Waste Classification Guidelines (DECC, 2008), and any contamination management plan or remediation action plan developed for the project.

Timber and green wastes

It is estimated that construction would require the clearing of 947 hectares of vegetation, with an additional 25 hectares required for ancillary facilities. Wastes would include logs, mulched timber and weeds). Millable and other timber resources in areas to be cleared would be harvested and used off-site. Non- millable vegetation to be removed would, where possible, be used on site for fauna habitat structures, fauna habitat recreation or be mulched. It is estimated that mulching would generate around 1.1 million cubic metres of mulch. Mulch has the potential of creating tannin affected water, which in turn has the potential of causing water pollution if not managed appropriately.

KEY TERM - Tannin Affected Water

Tannins are naturally occurring plant compounds. The generation of tannins is generally highest from mulched vegetation. The main concern with the discharge of tannin affected water is that it may increase the biological oxygen demand (BOD) of the receiving environment. Increase in BOD may result in the decrease in dissolved oxygen, which is identified as the main cause of 80% of fish kills in NSW rivers and estuaries (RMS, 2012a).

Mulch would be used, where possible, in landscaping and soil and erosion control measures for the project. Weeds would be disposed of off-site.

Demolition wastes

Waste would be generated from the demolition and removal of existing structures, road pavement and utilities. Waste materials expected to be generated include asphalt, concrete, gravel, scrap metal, structures demolition waste and road base. Over 70 properties would require the removal of one or more structures and a number of services (such as water mains, sewer lines, septic tanks, utility poles) would become redundant and require removal or demolition. Where practicable, houses, redundant services and other structures would be deconstructed rather than demolished to allow as much material as possible to be recycled off-site. There is also the potential to uncover asbestos in some structures, which has the potential to cause health risk to both the workers and the surrounding community. All asbestos material would be removed by certified contractors and appropriately disposed of at a licensed facility.

It is estimated that around 30 hectares of highway pavement would be removed for the project. This pavement could be re-processed for use on-site in the sub-pavement layers, to reduce the need to dispose of the pavement at an off-site facility.

Where possible, wastes would be removed off-site to a recycling facility or would be disposed of at a licensed waste facility.

Construction wastes and packaging materials

It is possible that the project could generate excess construction materials through accidental over-sourcing or construction and/or design changes that result in a reduced need once materials are sourced. This could include steel re-enforcing, conduits and pipes, concrete and asphalt, timber formwork, chemicals such as pesticides and herbicides and paint and metal and electrical cabling. Where possible, these left over items would be re-used on the project (e.g. made available for use on an adjoining section); re-processed (concrete, asphalt) for use as road base or backfill; removed off-site to a recycling facility or disposed of at a licensed waste facility.

The operation of concrete and asphalt plants have the potential of creating large amounts of waste material if quality specifications are not met after the batching process. Where possible this material would be used for non-structural elements or elements that do not require the same standard of concrete or asphalt such as minor access tracks, or elements within temporary construction compounds such as pathways. Cured concrete can be crushed down to a recovered aggregate and be utilised in general fill, pavement materials (such as SMZ), and minor construction elements such as access tracks.

Waste generated from the excavation and remediation of contaminated soils or Acid Sulfate Soils is addressed in Chapter 9 Soils, sediments and water, of this EIS.

Sediment basins have the potential of generating large quantities of fine silty material, which, if not managed appropriately, have the potential of causing water pollution. Where suitable, the sediment removed from basins would be used on-site such as in landscaping or in non-structural sections of fill embankments, such as flattened batters.

Materials delivered to site would result in packaging waste. This would include cardboard, paper, plastic and glass. Where possible, materials would be bought in bulk to minimise the amount of package required. Sources of material that have sustainable packaging design, recycled and recyclable packaging would be favoured over other material sources where cost effective. All wastes would be collected and recycled or disposed of at an approved facility.

Waste from maintenance activities

Waste would be produced from the maintenance of construction vehicles and plant. This would include tyres, waste fuels and oils, oils and lubricant containers. All of which have the potential of causing both land contamination and water pollution if not managed appropriately. These wastes would be disposed of off-site at licensed waste facility or removed from site by certified waste contractor.

Sewage and general waste from construction compounds

Sewage and general waste would be generated from construction compounds through amenities and offices. Wastes generated could include domestic waste by workers, sewage, office wastes (paper, cardboard, plastic, bottles, cans, paper and food wastes). Inappropriate disposal of these waste streams have the potential of causing both land and water pollution. Appropriate recycling facilities would be provided at all construction compounds to further minimise the amount of waste required to be disposed in landfill.

Miscellaneous wastes

The project would impact on a number of RMS stockpile sites within the existing highway corridor. These stockpiles contain temporarily store wastes from road maintenance activities. Some of these sites may be potentially contaminated. Any contaminated waste from these sites would be classified and appropriately disposed of at a licensed facility. Where possible, material would be reused in sub-pavement layers of the embankments to reduce the need to dispose of the material at local landfill (RMS, 2012b).

Waste may also be generated by construction aids such as drilling muds (if specified as a result of detailed geotechnical investigations). Drilling muds have the potential to cause water pollution if not managed appropriately. Common drilling muds can be treated and reused in sub-pavement layers of embankment construction, if quality specifications are met. Otherwise treated drilling muds can be reused in combination with unsuitable material when fattening batters.

Operation

Limited waste would be generated from the operation of the project. It would mainly be from road maintenance activities and road users. Maintenance wastes would likely to include:

- General waste and sewage from rest areas.
- Vegetation trimmed from remnant vegetation and landscaped areas.
- Excess concrete and asphalt from pavement repairs.
- Vehicle oils and greases from maintenance vehicles.
- Vegetation, soil and silt from the clearing of drains, bridges and culverts.
- Litter generated by road users along the highway.

There is also potential for contaminated waste to be generated as a result of fuel spills, accidents or leaks. Water quality control ponds and swales would be constructed to capture any highway runoff including any spilt fuel or oil (refer to Section 5.3.11 of this EIS). RMS would regularly manage and clear these ponds, with any material either re-used on site or disposed of at an appropriate facility and in accordance with Waste Classification Guidelines Part 1: Classifying Waste (EPA, 2008).

Operational water quality control ponds would be required to be maintained when the sediment settling zone of the water quality basin is exceeded. The maintenance of operational water quality basins have the potential of generating relatively large quantities of fine silty material, which has the potential of impacting water quality if not managed appropriately. As re-use options may be limited during operation, and the potential for heavy metal contamination of this sediment, consideration would need to be given to classifying the material in accordance with the Waste Classification Guidelines (DECC, 2008), and disposing of the material at a licensed waste facility (depending on the outcome of the waste classification).

Litter from road users has the potential to cause both land and water pollution. Waste receptacles would be provided at all rest stops along the alignment, in an attempt to encourage the travelling public to dispose of their litter responsibly. Baffle boards in operational water quality basins would act (in a limited capacity) as a gross pollutant trap for floating litter, however, operational water quality basins would have minimal capacity in retaining non-floating litter. The RMS Operational Environmental Management System already includes provisions for roadside litter collection.

18.3.3. Management of impacts

Earthworks would potentially generate the greatest amount of waste. To ensure the amount of waste is minimised, the construction contractor would manage earthworks requirements across the entire project, with construction staging taking into account efficient resource use and opportunities for re-using materials to limit waste generation.

RMS would also investigate whether unused resources could be used on other Pacific Highway projects.

Where materials cannot be reused and recycled, all waste would be handled and disposed in accordance with the *Protection of the Environment Operations Act 1997*.

A resource management strategy would be developed across the project to identify potential resources and minimise waste. Resource consumption and waste minimisation and management measures would be included in the Construction Environmental Management Plan for the project. This Resource Management Strategy would refer to the relevant RMS Specifications which promote the purchasing and use of recycled content for both the road construction and maintenance materials.[2]

KEY TERM – Excavated Public Road Materials

Excavated Public Road Materials (EPRM) include rock, soil, bitumen, reclaimed asphalt pavement, gravel, slag from iron and steel manufacturing, fly and bottom ash, concrete, brick and ceramics excavated during the construction and maintenance of public roads and road public infrastructure facilities.

Off-site disposal of Virgin Excavated Natural Material (VENM) (RMS, 2012b), Excavated Natural Material (ENM) (RMS, 2012c), Excavated Public Road Material (EPRM) (RMS, 2012d) and recovered aggregates (RMS, 2012e) to other public or private land is permitted if the landholder completes, signs and returns a Section 143 Notice (POEO Act) to the RMS prior to the waste being transported to the landholder's site. The receiving landholder would need to attach written evidence that legal consent has been granted from the local council or planning consent authority showing that the material can be legally accepted onto the landholders site.

The proposed waste management measures for the project are listed in Table 18-8.

[2] The following construction and maintenance RMS specifications allow for the procurement and use of recycled and recovered material: QA Spec R116 – Asphalt; QA Specs 3051/3052; QA Spec 3071; QA Spec 3252; QA Spec R178; QA Spec R73; Various concrete specifications; QA Spec R75; G36, G38 and G39; R63; and R50.

Table 18-8: Waste management measures

<table>
<tr><th>Issue</th><th>Mitigation ID</th><th>Mitigation measure</th><th>Timing</th><th>Relevant section</th></tr>
<tr><td rowspan="2">Sustainable management of resources</td><td>WM1</td><td>The cut-and-fill balance of the project would be further refined to obtain as much material as possible for reuse on the project.</td><td>Pre-construction</td><td>All</td></tr>
<tr><td>WM2</td><td>A resource management strategy would be prepared for construction of the project to identify the hierarchy for sourcing and use of resources. It would include provisions:
Available project cutting material (including Select Material Zone (SMZ) and verge material) would be used for the construction of embankments, SMZ and verge within that section to the extent that it is suitable
Project sections with a deficit in material would import surplus material from other project sections in preference to external sources
Where possible, the distances that earthworks materials are moved across the project as a whole would be minimised, notwithstanding the above two requirements
Any unsuitable material would be used for landscaping or disposed of within each project section, either for batter flattening or noise mounds or placed in stockpile
Contractors will reduce the amount of unsuitable waste generated during excavations, where feasible (eg treatment at source)
Other locations of disposal of unsuitable material will be considered including borrow source areas created as part of the project
The generation and management of unsuitable material during project earthworks will be monitored to ensure appropriate management of the issue
The resource management strategy would also identify:
Details on materials that would be sourced from the project (including location and type)
Viable material suppliers (including water) near the project
Proposed sustainable material sources practices (such as use of recycled materials or wastewater)
Materials that could be recycled and re-used on-site or transferred to other project sections.</td><td>Pre-construction / construction</td><td>All</td></tr>
<tr><td rowspan="2">Minimising construction waste</td><td>WM3</td><td>A waste register would be maintained by each contractor, detailing types of waste collected, amounts, date, time, and details of disposal.</td><td>Construction</td><td>All</td></tr>
<tr><td>WM4</td><td>Where possible, materials would be bought in bulk to minimise the amount of package required. Sources of material that have sustainable packaging design, recycled and recyclable packaging would be favoured over other material sources where cost effective.</td><td>Construction</td><td>All</td></tr>
</table>

Issue	Mitigation ID	Mitigation measure	Timing	Relevant section
	WM5	• Waste material generated on-site will be dealt with in accordance with the *Protection of the Environment Operations Act 1997* and Waste Classification Guidelines Part 1: Classifying Waste (DECCW, 2009).	Construction	All
	WM6	• Waste minimisation and management measures would be developed based on the principles in the *Waste Avoidance and Resource Recovery Act 2001,* the NSW Government's Waste Reduction and Purchasing Policy, and waste exemptions including: • Excavated Natural Material Exemption (EPA, 2008a) • Excavated Public Road Material Exemption (EPA, 2012a) • Raw Mulch Exemption (EPA, 2008b) • Reclaimed Asphalt Pavement Exemption (EPA, 2012b) • Recovered Aggregate Exemption (EPA, 2010) • Stormwater Exemption (EPA, 2008c) • Treated Drilling Mud Exemption (EPA, 2011) • Measures would seek to avoid, minimise, re-use, recycle, treat or dispose of waste streams during construction and address transport and disposal arrangements.	Construction	All
	WM7	• Chemical, fuel and lubricant containers, and solid and liquid wastes would be disposed of in accordance with the requirements of Waste Classification Guidelines Part 1: Classifying Waste (DECCW, 2009).	Construction	All
	WM8	• Millable timber would be harvested for reuse off site. All other felled timber would be reused on-site in the form of habitat recreation or mulch in landscaping and erosion and sedimentation controls. Where mulch cannot be reused on-site, consideration would be given to making the mulch available to the public in accordance with the RMS Environmental Direction 25 (2012) and the Raw Mulch Exemption (EPA, 2008b).	Construction	All
	WM9	• Sediment removed from sedimentation basins would, where appropriate, be used on-site in landscaping and/or flattening of batters.	Construction	All
	WM10	• The use of recycled products in construction works would be investigated.	Construction	All
	WM11	• Where feasible, the contractor would be required to re-use materials. This could include, but is not limited to, concrete formwork or surplus concrete pours.	Construction	All

Issue	Mitigation ID	Mitigation measure	Timing	Relevant section
	WM12	• Site inductions and on-site training will be required to include waste minimisation principles and measures.	Construction	All
	WM13	• At site compounds, on-site recycling facilities would be provided for recycling paper, plastic, glass and other re-useable materials. Liquid waste such as paints and solvents would be disposed of in accordance with the Waste Classification Guidelines Part 1: Classifying Waste (DECCW, 2009) and the *Protection of the Environment Operations Act 1997*.	Construction	All
	WM14	• Regular visual inspections would be conducted to ensure that work sites are kept tidy and to identify opportunities for reuse and recycling.	Construction	All
Management of waste water	WM15	• Water captured in excavations will be required to be either: • Managed in accordance with the construction Soil and Water Management Plan • Transferred to a licensed sediment basin, treated and discharged in accordance with any licence conditions that apply to the discharge of water, or • Re-used for construction water or dust suppression	Construction	All
	WM16	• Tannin rich leachate generated from mulch stockpiles would be managed in accordance with the RMS Environmental Direction – Management of Tannins from Vegetation Mulch (2012). • Any tannin impacted water captured in bunded areas or traps would not be released into the environment. • Tannin effected water would be removed from bunded areas or traps within five days of a rainfall event and used as construction water, dust suppression or landscape watering. These activities would be managed to prevent any pooling or runoff tannin impacted water. The reuse of this water would also be in accordance with the mitigation measures identified in Chapter 10 of this EIS.	Construction	All
Management of operational wastes	WM17	• Appropriate waste and recycling facilities would be provided at rest areas and heavy vehicle checking stations.	Operation	All
	WM18	• All operational waste would be managed in accordance with the Roads and Marine Services waste management procedures and Environmental Management System.	Operation	All
	WM19	• Green waste from highway maintenance activities would be collected and, where possible, recycled for mulch within the road reserve.	Operation	All
	WM20	• Collection and removal of roadside litter would be undertaken in accordance with the RMS Environmental Management System.	Operation	All

Issue	Mitigation ID	Mitigation measure	Timing	Relevant section
	WM21	• Sediment removed from operational water quality basins would, where appropriate, be classified in accordance with the Waste Classification Guidelines (DECCW, 2009), and be disposed of in accordance with the *Protection of the Environment Operations (Waste) Regulation 2005*. Where possible, this material would be reused within the road corridor.	Operation	All

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