



New England Highway bypass of Muswellbrook

Chapter 6.14 Climate change

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6.14 Climate change

6.14.1 Methodology

Climate change has the potential to impact on the proposal through changes to weather events and be impacted by the proposal through the emission of greenhouse gases (GHG), which contribute to climate change.

The impact of the proposal on climate change has been considered in a qualitative assessment guided by the emissions scopes described below and by considering the likely construction methods, materials, and maintenance activities.

The impact of climate change on the proposal has been reviewed in consideration of the existing climate conditions and forecast climate conditions. Forecast climate conditions were taken from the Hunter Climate change snapshot of the NSW and Australian Capital Territory (ACT) Regional Climate Modelling (NARClIM) project in collaboration with the Environment, Energy and Science Group, DPIE.

GHG have been categorised into scopes which relate to whether they were a direct or indirect emission and their origin. There are three scopes of GHG emissions:

- **Scope 1:** GHG emissions released directly from on-site activities associated with the proposal, such as the combustion of fossil fuels in vehicles and motors and from the removal of vegetation
- **Scope 2:** GHG emissions released indirectly from an off-site activity, for example the generation of electricity which is used during the construction and operation of the proposal
- **Scope 3:** GHG emissions released indirectly as a result of acquiring and disposing of materials for the proposal, for example the combustion of fossil fuels to transport building materials to a construction site, and the consequent break down of building wastes such as vegetation and wood releasing carbon dioxide emissions in the decay process. GHG emissions would also be associated with the offsite production and transport of materials used in the maintenance of the road.

6.14.2 Existing environment

The existing climate within the Muswellbrook area is characterised by hot summer days and cool dry winters with considerably more intense rainfall in the summer months. Muswellbrook LGA is in a summer dominated rainfall pattern, however heavy isolated falls have been known during winter. Average maximum and minimum temperatures and average rainfall for the Muswellbrook area are provided in Table 6-67. It should be noted that the closest bureau station is based in Scone.

Based on the climate change projections from the NARClIM project, the Hunter is expected to experience an increase in all temperature variables (average, maximum and minimum) for the near and far future (OEH, 2014). Rainfall is projected to decrease in the period between 2020 and 2039 in spring and winter and to increase in autumn (OEH, 2014). The projections are shown in Table 6-67 alongside the existing environment.

In general, the climate in Muswellbrook is expected to become hotter and drier which is likely to result in more intense storms, floods, droughts and bushfire events.

Table 6-67: Existing and forecast climate at Muswellbrook

Climate Variable	Existing	Projected increase or decrease ¹			
		2020	2039 (Near Future)	2060	2079 (Far Future)
Average maximum temperatures	24.5°C		0.7°C		2.1°C

Climate Variable	Existing	Projected increase or decrease ¹			
		2020	2039 (Near Future)	2060	2079 (Far Future)
Average minimum temperatures	10.1°C		0.7°C		2.1°C
Average rainfall (Summer)	192.5mm		-5 to 0%		10 to 20%
Average rainfall (Autumn)	126.4mm		10 to 20%		10 to 20%
Average rainfall (Winter)	118.7mm		-5 to 0%		0 to 5%
Average rainfall (Spring)	152.6mm		-5 to 0%		0 to 5%

¹ Office of Environment and Heritage, 2014. *Hunter Climate Change snapshot*.

6.14.3 Potential impacts

Construction

Impact of the proposal on climate change

The likely sources of GHG emissions during construction of the proposal are listed in Table 6-68.

While measures would be carried out where possible to reduce GHG emissions, most of the emissions would be largely unavoidable. Therefore, the proposal would contribute to climate change. However, the volume of GHG emissions would be negligible on a national and global scale and the proposal is anticipated to have a negligible impact on climate change during construction.

Table 6-68: Likely GHG emissions during the construction of the proposal

GHG sources	Details	Assessment
Scope 1 emissions		
Construction equipment	GHGs would be generated from fossil fuel combustion in plant, equipment and vehicles used for construction activities	Construction activities would be planned to minimise movements on-site and use lower emission equipment, however GHG emissions related to construction activities would be unavoidable
Generator use	Generators may be required during construction. This would create GHG emissions through the combustion of diesel or other fossil fuels	The use of generators would be limited to circumstances that would reduce the overall length of the construction program, for example to power lights during night works or to power equipment prior to connection to the local power supply. By reducing the overall length of construction, other sources of emissions would be reduced
Vegetation removal	Around 97.92 hectares of native vegetation and 90.17 hectares of non-native vegetation would need to be cleared to accommodate the proposal	The proposal has been designed to minimise the amount of vegetation clearing that would otherwise release stored carbon

GHG sources	Details	Assessment
		and reduce the ongoing GHG retention within vegetated areas
Scope 2 emissions		
Electricity	It is expected that a small amount of electricity would be required during construction, which would be associated with power for the on-site construction buildings and worker facilities	Electricity would be purchased from the grid, which largely comprises electricity generated from fossil fuels
Scope 3 emissions		
Construction materials	Extraction and production of materials used for construction of the proposal, such as concrete, steel, road base, pipes, cables, conduits and other materials would result in GHG emissions	Recycled materials or materials left over from other projects would be used where possible, however GHG emissions related to the production of materials would be unavoidable
Construction waste	The mulching of cleared vegetation would result in increased GHG emissions, as the breakdown of organic matter to waste material directly releases stored carbon dioxide to the atmosphere	GHG emissions related to the processing of construction waste would be unavoidable
Construction transport	GHGs would be generated by staff travelling to and from the construction site and by any transportation related to the movement of construction materials, equipment or plant to the proposed road corridor	Construction staging would be developed to minimise haulage and other construction vehicle movements, however GHG emissions would be unavoidable

Impact of the proposal on climate change

Climate change projections for the near future represent an average of projections for the period of 2020 to 2039 (refer to Table 6-67). Construction of the proposal is expected to commence in late 2022 and therefore the near future projections are relevant to the proposal.

Construction of the proposal may be susceptible to climate change impacts, including changes in frequency of temperature extremes, and frequency and intensity of rainfall events. The potential impacts associated with these changes include:

- Effect of extreme temperatures on the health and safety of construction workers
- Delays in expected timeframes as a result of weather including rainfall and flooding events
- Increase in risk of erosion and sedimentation, and other environmental impacts from extreme rainfall and flooding.

Operation

Impact of the proposal on climate change

The likely sources of GHG emissions during the operation of the proposal are listed in Table 6-69.

Table 6-69: Likely GHG emissions during the operation of the proposal

GHG sources	Details	Assessment
Scope 2 emissions		
Electricity	Electricity would be required during the operation of the proposal for lighting at new intersections	Electricity would be purchased from the grid, which largely comprises electricity generated from fossil fuels. Lighting would only be installed at the proposal's connections and not along the entire alignment, minimising electricity use
Scope 3 emissions		
Traffic	<p>The proposal is not expected to increase traffic volumes, therefore there is not anticipated to be an increase in vehicle emissions as a result of the proposal</p> <p>The proposal would cater for a projected growth in traffic volumes which would occur independent of the proposal</p>	The proposal would enable traffic to continue at a more consistent speed rather than slowing and increasing speed when travelling through the town of Muswellbrook. This would result in a more efficient use of fuel
Road infrastructure maintenance	Diesel fuel use for the operation of maintenance equipment and the delivery of maintenance materials	Maintenance activities would be planned to minimise movements on-site and use lower emission equipment. Recycled materials or materials left over from other projects would be used where possible
Road infrastructure maintenance	Use of materials for maintaining the road pavement	
		Emissions generated from maintenance activities would be relatively small in comparison with the indirect emissions associated with the fuel consumed by vehicles using the bypass

Impact of climate change on the proposal

Climate and weather can have an impact on the road surface and the safety of a road. The biggest influences on road surface are moisture and temperature, both of which can lead to faster rates of deterioration.

As rainfall decreases overall, the rate of moisture related road surface deterioration should slow (Austroads, 2004). However, this could be offset by an increase in ambient temperatures, which may accelerate the rate of deterioration of any seal binders. Drier conditions may also cause pavements to age more quickly due to oxidation and embrittlement (Austroads, 2004). However, these effects are expected to be minor over time and in combination with the Transport maintenance regime are likely to have a negligible impact.

More intense rainfall and flooding events could put pressure on drainage infrastructure for the road including culverts and open drainage channels. Recognising this, the drainage design for the proposal provides the required flood immunity for the proposal, minimises potential flooding impacts on upstream and downstream properties and has factored in an increase in rainfall intensity to consider the effect of climate change.

6.14.4 Safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
Climate Change	Construction equipment, plant and vehicles will be appropriately sized for the task, serviced frequently and will not be left idling when not in use	Construction Contractor	Construction	Additional safeguard
Climate Change	Opportunities to use low emission construction materials, such as recycled aggregates in road pavement and surfacing, and cement replacement materials will be investigated and incorporated where feasible and cost-effective	Construction Contractor	Construction	Additional safeguard
Climate Change	Construction site layouts will be designed to reduce travel distances and double handling of materials to reduce fuel usage and emission generation	Construction Contractor	Construction	Additional safeguard
Climate Change	Raw materials will be managed to reduce energy requirements for their processing. For example, stockpiled materials will be covered or provided undercover storage where possible to reduce moisture content of materials, and therefore the process and handling requirements	Construction Contractor	Construction	Additional safeguard
Climate Change	Locally produced goods and services will be procured where feasible and cost effective to reduce transport fuel emissions	Construction Contractor	Construction	Additional safeguard
Climate Change	Materials with lower emissions intensity will be specified in the selection of maintenance materials	Transport	Operation	Additional safeguard
Climate Change	The most energy efficient street lighting appropriate for project needs will be specified	Transport	Operation	Additional safeguard