

# NSW Roads and Maritime Services

## WOOLGOOLGA TO BALLINA | PACIFIC HIGHWAY UPGRADE ENVIRONMENTAL IMPACT STATEMENT

### MAIN VOLUME 1B

#### Chapter 20 – Environmental risk analysis

##### Chapter summary

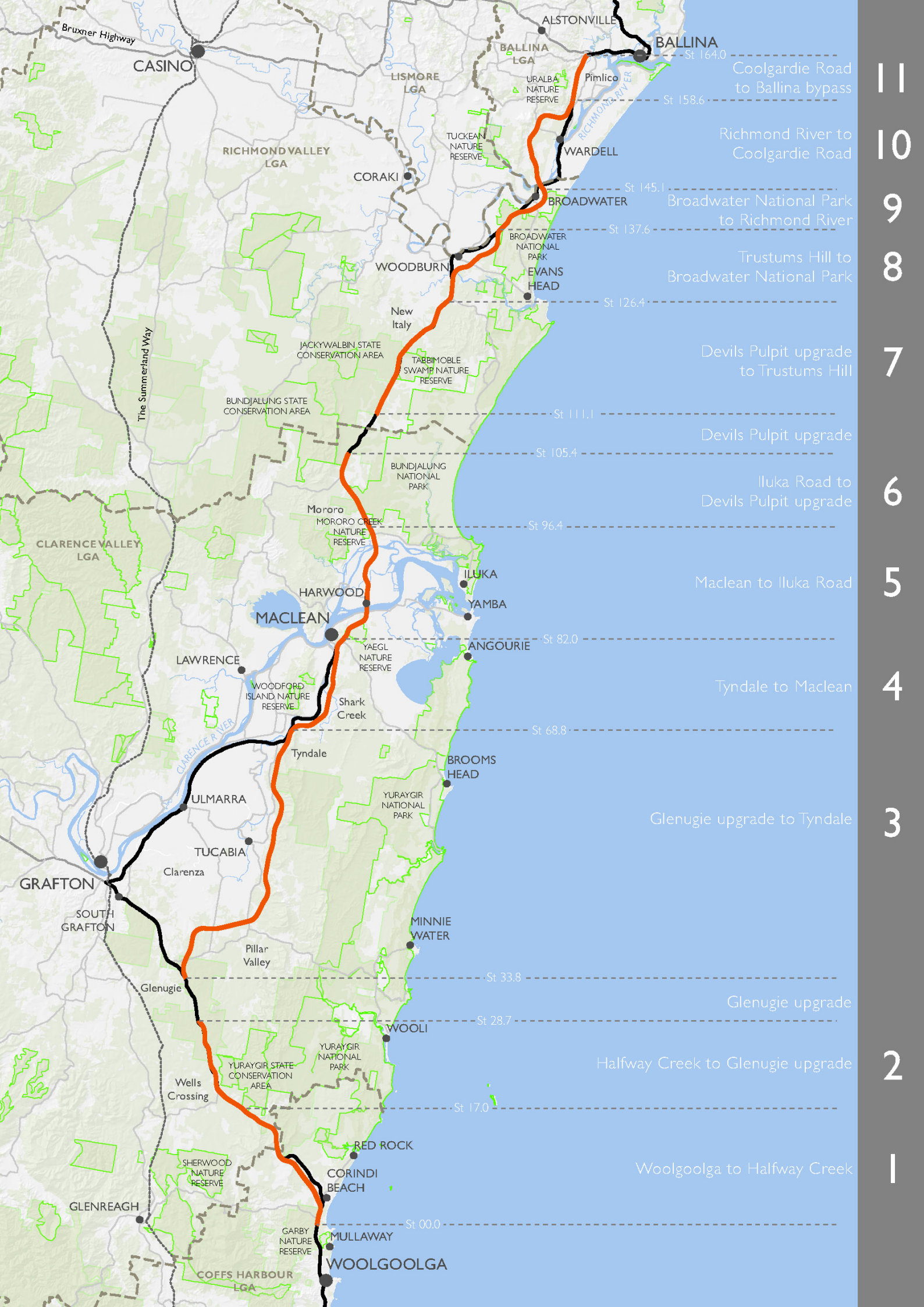
An environmental risk analysis of potential environmental impacts associated with the project (construction and operation) was undertaken as part of the EIS. The analysis did not identify any additional key environmental impacts to those in the Director-General's environmental assessment requirements.

The analysis summarised in this chapter found that with the mitigation and management measures proposed in Chapter 19 there was a potential for high to moderate impacts to remain for the following issues:

- Hydrology and flooding
- Biodiversity
- Visual amenity, urban design and landscaping
- Aboriginal heritage
- Noise and vibration
- Land use and property
- Social and economic.

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## 20 Environmental risk analysis

This chapter explains how environmental issues for the project were identified through an environmental risk analysis process, and documents the findings of that process.

Reference	Director General's requirements	Where addressed
Environmental risk analysis	The EIS must include an environmental risk analysis to identify potential environmental impacts associated with the project (construction and operation), proposed mitigation measures and potentially significant residual environmental impacts after the application of proposed mitigation measures. Where additional key environmental impacts are identified through this environmental risk analysis, an appropriately detailed impact assessment of this additional key environmental impact must be included in the EIS.	Section 20.2

### 20.1 Overview

Before lodging the State significant infrastructure project application the then RTA (now RMS) reviewed the outcomes of preliminary investigations and community and stakeholder consultation and identified those environmental issues of most importance for the project through a preliminary environmental risk analysis.

The findings formed the basis of the project application and helped the Director-General formulate the 'key issues' for the project as outlined in the Director-General's environmental assessment requirements. RMS also referred the project to the Commonwealth Government Department of Sustainability, Environment, Water, Population and Community. The referral provided an overview of the potential impacts of the project and included the Director-General's environmental assessment requirements. The Director-General's requirements were subsequently modified to incorporate the environmental assessment requirements provided by the Department of Sustainability, Environment, Water, Population and Community after the project was determined to be a controlled action to be assessed under the *Environmental Planning and Assessment Act 1979* as an accredited assessment process. The modification provided further detail on the specific matters for the environmental assessment but did not identify any additional key issues to be assessed.

The process of environmental risk analysis continued during preparation of the environmental impact statement. The emphasis was on using the detailed information gathered during the assessment process to review the environmental aspects of the project. More specifically, the analysis:

- Identified environmental issues, including key issues in the DGRs (refer to Appendix A), and any other issues
- Examined potential impacts (during both construction and operation) and proposed mitigation measures in relation to the identified issues
- Identified the nature and extent of impacts likely to remain after mitigation measures are applied.

Based on this analysis, an environmental risk category was assigned to each potential impact to enable the identification of any matters that might be considered as additional key environmental impacts. The environmental risk categories are described in Table 20-1.

**Table 20-1: Risk categories**

Risk category	Description
Key issue	High or moderate impact (actual and perceived) requiring further investigation to identify specific management and mitigation measures.
Other issue	Moderate or low impact that can be managed effectively with standard and best practice management and mitigation measures.

## 20.2 Risk analysis summary

A summary of the environmental risk analysis is provided in Table 20-2. The analysis did not identify any additional key environmental impacts to those in the Director-General's environmental assessment requirements.

Those issues identified as key issues in the Director-General's environmental assessment requirements (DGRs) remain key issues after the analysis.



Table 20-2: Environmental risk analysis – summary

Issue	Key issue in DGRs	Potential impacts	Analysis – proposed mitigation measures and any potentially significant impacts remaining after their application	Risk category following analysis	EIS reference
Hydrology and flooding	Yes	<p>The following high potential impacts were identified:</p> <ul style="list-style-type: none"> <li>• Alteration to flood behaviour due to road infrastructure structures placed on floodplain</li> <li>• Increases in flood afflux levels during flood events in 15 catchments</li> <li>• Increases in duration of flood inundation.</li> <li>• Increases in flood impacts and damage costs on residential properties and cane land</li> <li>• Change to creek bed and bank stability due to increases in runoff volumes and flow rates</li> <li>• Impacts to flood evacuation and access movements.</li> </ul>	<p>The following high to moderate impacts would remain after application of mitigation measures HF1 to HF26as set out in Section 8.4 and Chapter 19:</p> <ul style="list-style-type: none"> <li>• Low to moderate localised increases in the peak 100 year ARI flood level upstream of the project boundary in all catchments, only two areas would have increases that exceed flood management objectives</li> <li>• Slight localised increases in inundation duration at 11 catchments. Moderate to high impact at only one area in the Clarence River catchment which would exceed the flood management objectives</li> <li>• Low to moderate increase in damage costs for the larger Clarence and Richmond river catchments.</li> <li>• Low to moderate localised impacts from increased velocity at two catchments.</li> <li>• Future climate change may affect design flood immunity levels of the carriageways</li> <li>• Low to moderate localised impacts in five catchments to access or warning time available for an impending flood event (ie for flood evacuation or stock movements).</li> </ul> <p>No potentially significant residual impacts are expected to remain after the application of the proposed management measures.</p>	Key issue	<p>Chapter 8</p> <p>Working paper – Hydrology</p> <p>Working paper – Groundwater</p>

Issue	Key issue in DGRs	Potential impacts	Analysis – proposed mitigation measures and any potentially significant impacts remaining after their application	Risk category following analysis	EIS reference
Soils sediments and water	Yes	<p>The following high potential impacts were identified:</p> <ul style="list-style-type: none"> <li>• Potential for groundwater discharge during construction, resulting in localised drawdown of groundwater resources</li> <li>• Moderate impact to Rous Water borefield should contaminants infiltrate to the water source</li> <li>• Changes to water chemistry altering aquatic habitats, including threatened species habitats</li> <li>• Major impacts to various sensitive receiving environments through accidental release of water pollutants during construction or operation</li> <li>• Impact to water quality due to fuels and leaks and inappropriate storage of material</li> <li>• Changes in water chemistry, in particular pH values, either during construction or operation affecting aquatic ecosystems</li> <li>• Exposed soils during earthworks or landscaping will erode and cause sedimentation of waterways and aquatic environments</li> <li>• Potential acidic leachate from exposure of acid sulfate soils</li> <li>• Potential release of tannins for stored mulch piles.</li> <li>• Disturbance of contaminated material causing pollution of the environment.</li> </ul>	<p>The following low to moderate impacts would remain after application of the mitigation measures SSW1 to SSW80 as set out in Section 9.4 and Chapter 19:</p> <ul style="list-style-type: none"> <li>• Overall, a low to moderate risk of localised drawdown of groundwater resources.</li> <li>• Low risk of impacts on water quality as a result of accidental spills.</li> <li>• Minor, localised increases in turbidity, suspended sediment and minor localised changes to water quality in the waterways during construction and operation.</li> <li>• Low to moderate risk of acid leachate affecting soils or waterways</li> <li>• Low to moderate risk of release of tannins.</li> <li>• Low risk of disturbing contaminated material and causing pollution.</li> </ul> <p>No potentially significant residual impacts are expected to remain after the application of the proposed management measures.</p>	Key issue	<p>Chapter 9</p> <p>Working paper – Water quality</p> <p>Working paper – Groundwater</p>



Issue	Key issue in DGRs	Potential impacts	Analysis – proposed mitigation measures and any potentially significant impacts remaining after their application	Risk category following analysis	EIS reference
Biodiversity	Yes	<p>The following high potential impacts were identified:</p> <ul style="list-style-type: none"> <li>• Clearing and fragmentation of native vegetation, including threatened ecological communities and loss of habitat for threatened species</li> <li>• Loss and fragmentation of terrestrial fauna habitat impacting on threatened species and populations, including direct impacts on threatened flora and potential impacts on threatened fauna as a result of habitat loss and fragmentation</li> <li>• Creation of barriers to fauna movement</li> <li>• Weed invasion and edge effects</li> <li>• Impacts on aquatic habitat resulting from impacts on hydrology, groundwater and water quality.</li> </ul>	<p>The following high impacts would remain after application of the biodiversity strategy including threatened species monitoring, the connectivity and offset strategies and the mitigation measures B1 to B66 as set out in Section 10.4 and Chapter 19:</p> <ul style="list-style-type: none"> <li>• Loss of about 948 hectares of native vegetation and habitat, including around 338 hectares of threatened ecological communities. Loss of an additional 25 hectares of native vegetation at ancillary facility locations. The total loss of vegetations represents 37 per cent of the total 2522 hectares of vegetation cleared for the Pacific Highway Upgrade Program</li> <li>• Significant impact to five endangered ecological communities including one critically endangered ecological community- Lowland Rainforest of Subtropical Australia listed under the EPBC Act</li> <li>• Significant impact to 12 threatened flora species (six listed under both the TSC Act and the EPBC Act)</li> <li>• Significant impact to 24 threatened fauna species (five listed under both the TSC Act and the EPBC Act)</li> <li>• Potential for significant impact to one endangered population listing under the TSC Act - emu population in the NSW North Coast Bioregion and Port Stephens LGA area</li> <li>• High to moderate loss and fragmentation of terrestrial fauna habitat and creation of barriers to fauna movement.</li> <li>• Minor risk of spread of weeds some which are noted as weeds of national significance.</li> </ul>	Key issue	<p>Chapter 10</p> <p>Working paper – Biodiversity assessment</p>

Issue	Key issue in DGRs	Potential impacts	Analysis – proposed mitigation measures and any potentially significant impacts remaining after their application	Risk category following analysis	EIS reference
			<ul style="list-style-type: none"> <li>Potential for significant impact to aquatic habitats in the study area through modification of waterways, changes in water quality, changes to hydrological conditions and changes to the habitat of threatened fish species (Two listed under both the TSC Act and the EPBC Act).</li> <li>High to moderate indirect impacts associated with edge effects for the project, with an additional 431 hectares considered to be edge affected.</li> </ul> <p>Impacts on biodiversity are expected to remain significant.</p>		
Visual amenity, urban design and landscaping	Yes	<p>The following high potential impacts were identified:</p> <ul style="list-style-type: none"> <li>Change to landscape character and visual environment as a result of large cuttings, bridges, interchanges and realignment of the highway away from the existing road corridor</li> <li>Temporary visual impacts as a result of construction activities and ancillary facilities.</li> </ul>	<p>The following high to moderate impacts would remain after application of the urban design and landscape strategy to be implemented in accordance with the Pacific Highway urban design framework (RTA 2005) and the mitigation measures UD1 to UD14 as set out in Section 11.4 and Chapter 19:</p> <ul style="list-style-type: none"> <li>Overall low to moderate impact on landscape character, but high to moderate impact on landscape character as a result of cuttings, bridges, new infrastructure and the alignment through the vegetated section of Bingal Creek (Wardell).</li> <li>High to moderate visual impacts where the project follows a new alignment, requires forest removal, is located in scenic landscape such as near Wardell, and at specific viewpoints.</li> </ul> <p>Any significant impacts are mitigated so that they would ultimately blend acceptably into a new rural coastal landscape.</p>	Key issue	<p>Chapter 11</p> <p>Working paper – Urban design, landscape character and visual impact assessment</p>

Issue	Key issue in DGRs	Potential impacts	Analysis – proposed mitigation measures and any potentially significant impacts remaining after their application	Risk category following analysis	EIS reference
Aboriginal heritage	Yes	<p>The following high potential impacts were identified:</p> <ul style="list-style-type: none"> <li>Disturbance and / or destruction of Aboriginal sites, artefacts and cultural places.</li> <li>Salvage of artefacts from impacted Aboriginal sites</li> <li>Impacts on unknown Aboriginal sites or artefacts that may be present within the project boundary.</li> </ul>	<p>The following moderate to high impacts would remain after application of the Aboriginal heritage management plan, developed in consultation with Aboriginal stakeholders and the mitigation measures AH1 to AH43 as set out in Section 12.4 and Chapter 19</p> <ul style="list-style-type: none"> <li>High impact from destruction of 38 Aboriginal archaeological sites and one potential archaeological deposit</li> <li>Overall low impact on cultural heritage resources (including as a result of impact to 11 Aboriginal cultural places) although likely to be a moderate to high loss between Woodburn and Ballina.</li> </ul> <p>No potentially significant residual impacts are expected to remain after the application of the proposed management measures.</p>	Key issue	<p>Chapter 12</p> <p>Working paper – Aboriginal cultural heritage assessment</p>
Non-Aboriginal historic heritage	Yes	<p>The following high potential impacts were identified:</p> <ul style="list-style-type: none"> <li>Disturbance and or destruction of items of heritage significance, including items listed on heritage registers</li> <li>Changes in the visual character and viewsheds of historical heritage items, precincts or places.</li> </ul>	<p>The following moderate impacts would remain after application of the non-Aboriginal heritage management plan and the mitigation measures HH1 to HH54 as set out in Section 13.4 and Chapter 19:</p> <ul style="list-style-type: none"> <li>Indirect impacts on the State heritage register listed item and change to access for the - New Italy Settlement Sites under the Class M upgrade resulting in low impact</li> <li>Loss of 2 hectares (0.001 per cent) of the State listed item- High Conservation Value Old Growth Forest resulting in low heritage impact</li> </ul>	Key issue	<p>Chapter 13</p> <p>Working paper – Non-Aboriginal historic heritage</p>

Issue	Key issue in DGRs	Potential impacts	Analysis – proposed mitigation measures and any potentially significant impacts remaining after their application	Risk category following analysis	EIS reference
			<ul style="list-style-type: none"> <li>Direct low to moderate impacts including full demolition, partial demolition or damage of 12 items of local heritage significance including five sites that are listed on local environmental plans</li> <li>Low to negligible indirect impacts including from vibration from construction close to heritage items and change to views.</li> </ul> <p>No potentially significant residual impacts are expected to remain after the application of the proposed management measures.</p>		
Traffic and transport	Yes	<p>The following high potential impacts were identified:</p> <ul style="list-style-type: none"> <li>Temporary disruptions / delays to local and highway traffic</li> <li>Temporary restrictions to private access roads</li> <li>Permanent adjustment to some private property access roads and local / regional roads</li> <li>Changed traffic patterns likely to be short-term while road users adjust and become familiar with changed traffic patterns.</li> </ul>	<p>The following moderate impacts would remain after application of the traffic management plan and the mitigation measures T&amp;T1 to T&amp;T21 as set out in Section 14.4 and Chapter 19:</p> <ul style="list-style-type: none"> <li>Moderate disruption of local travel patterns and increased travel times for some users of the local road network and Pacific Highway</li> <li>Permanent changes in property access</li> <li>Permanent changes in access to the existing Pacific Highway, and project once complete</li> <li>Temporary and permanent road closures causing moderate impacts during construction and operation.</li> </ul> <p>No potentially significant residual impacts are expected to remain after the application of the proposed management measures.</p>	Key issue	Chapter 14 Working paper – Traffic and transport assessment

Issue	Key issue in DGRs	Potential impacts	Analysis – proposed mitigation measures and any potentially significant impacts remaining after their application	Risk category following analysis	EIS reference
Noise and vibration	Yes	<p>The following high potential impacts were identified:</p> <ul style="list-style-type: none"> <li>Temporary noise and vibration impacts on sensitive receivers during construction.</li> </ul> <p>Noise impacts on sensitive receivers during operation:</p> <ul style="list-style-type: none"> <li>Levels of operational traffic noise are predicted to exceed relevant criteria at 219 residential receiver locations.</li> </ul>	<p>The following high to moderate impacts would remain after application of the construction noise and vibration management plan and the mitigation measures CNV1 to CNV32 and ONV 1 to ONV3 as set out in Section 15.4 and Chapter 19:</p> <ul style="list-style-type: none"> <li>High to moderate temporary construction noise impact at residential properties. These include properties located near ancillary facilities. Noise affected properties include those near major bridge sites, major cuts and fills, and during periods of concrete cutting, blasting, rock hammering and piling. The level of impacts would depend on the agreed working hours and would be more apparent during extended / out of hours work</li> <li>Moderate to low permanent operational traffic noise impacts. Noise levels would be mitigated to meet the noise criteria wherever feasible. Noise mitigation options may need to be considered for around 219 properties. Finalisation of noise mitigation would be during detailed design to ensure internal noise levels are within acceptable limits</li> <li>Moderate permanent increase of noise at external residential areas at several properties currently not exposed to road traffic noise</li> <li>Low to negligible potential impacts from vibration during construction and operation.</li> </ul>	Key issue	<p>Chapter 15</p> <p>Working paper – Noise and vibration assessment</p>

Issue	Key issue in DGRs	Potential impacts	Analysis – proposed mitigation measures and any potentially significant impacts remaining after their application	Risk category following analysis	EIS reference
			Some properties would be noise affected during operation. No potentially significant residual impacts are expected to remain after the application of the proposed management measures. However some sensitive receivers may experience temporary high impacts during construction.		
Land use and property	Yes	<p>Direct property impacts, including:</p> <ul style="list-style-type: none"> <li>Property acquisition, incorporating acquisition of agricultural land, land used for quarrying, private rural properties and commercial enterprises.</li> <li>Changes in use to agricultural land, regionally significant farmland, fragmentation and severance of agricultural properties, and changes in access arrangements</li> <li>Direct impacts to State forests and land reserved under the National Parks and Wildlife Act, 1974.</li> </ul> <p>Land use impacts, including:</p> <ul style="list-style-type: none"> <li>Impacts on farm dams, cane drain, flood mitigation channels, and property related infrastructure including access, storage sheds and fencing.</li> </ul>	<p>All property and land acquisitions would be undertaken in accordance with relevant legislation, controlling provisions and RMS policy and compensatory land would be provided for loss of national park. The following high to moderate impacts would remain after application of the mitigation measures LU1 to LU31 as set out in Section 16.4 and Chapter 19:</p> <ul style="list-style-type: none"> <li>High to moderate impact from property acquisition (total and partial) affecting 564 land parcels and 60 residential dwellings, associated outbuildings and storage sheds. Low to moderate impacts from change to access, severance and sterilisation at some properties</li> <li>High to moderate impact from permanent loss of about 954 ha of agricultural land, across 293 agricultural land parcels, of which about 386 ha are regionally significant farm land</li> <li>Moderate impact from acquisition of about 204 ha of land within State forests. Direct impacts and changes to the State forest road network. Loss of about 17 ha of land within Broadwater National Park, 1.7 ha of land within Yaegl Nature Reserve and around 40 ha of land within Wells Crossing Flora Reserve</li> </ul>	Key issue	<p>Chapter 16</p> <p>Working paper – Land use and property assessment</p>

Issue	Key issue in DGRs	Potential impacts	Analysis – proposed mitigation measures and any potentially significant impacts remaining after their application	Risk category following analysis	EIS reference
			<ul style="list-style-type: none"> <li>Low impact from acquisition of about 15 farm dams and changed catchment areas and drainage for 10 farm dams</li> <li>Negligible to low impact on cane drains and flood mitigation channels</li> <li>Negligible to low impact on property related infrastructure including fencing</li> <li>Moderate impact from permanent loss of seven properties currently zoned for quarry uses.</li> </ul> <p>Residual impacts on property and land would be significant for some landowners, organisations and businesses affected.</p>		
Social and economic	Yes	<p>The following high potential impacts were identified:</p> <p>Loss of business and tourism from reduction in passing trade:</p> <ul style="list-style-type: none"> <li>Economic impacts to town centres from bypasses</li> <li>Short-term benefits to the local economy during construction.</li> </ul> <p>Socio-economic impacts during construction and operation:</p> <ul style="list-style-type: none"> <li>Road traffic impacts on the amenity of neighbouring properties and land uses</li> <li>Changes in access to properties, local roads, localities and towns.</li> </ul>	<p>The following high to moderate impacts would remain after application of the mitigation measures SE1 to SE17 as set out in Section 17.4 and Chapter 19:</p> <ul style="list-style-type: none"> <li>Low to moderate economic impacts to town centres from bypasses of Grafton, South Grafton, Ulmarra, Woodburn, Broadwater and Wardell</li> <li>Direct and indirect impacts to businesses from construction and land acquisition which includes potential for moderate to high impacts on seven properties used for quarrying in Tucabia, Broadwater and Bagotville.</li> <li>Moderate to low noise and visual impacts in areas not previously affected by highway traffic, with potential flow-on effects on amenity and property characteristics.</li> </ul> <p>Residual impacts on property and land would be significant for some landowners, organisations and businesses affected.</p>	Key issue	Chapter 17 Working paper – Socio-economic assessment



Issue	Key issue in DGRs	Potential impacts	Analysis – proposed mitigation measures and any potentially significant impacts remaining after their application	Risk category following analysis	EIS reference
Greenhouse gas emissions	No	<p>The following moderate to low potential impacts were identified:</p> <ul style="list-style-type: none"> <li>Greenhouse gases would be emitted from construction plant, equipment and vehicles</li> <li>Greenhouse gases would be embodied in materials consumed in construction or impacted by the project, such as vegetation removal and soil disturbance.</li> </ul>	<p>The following moderate to low impacts would remain after application of the energy management plan and the mitigation measures GHG1 to GHG8 as set out in Section 18.1.3 and Chapter 19:</p> <ul style="list-style-type: none"> <li>Moderate impact from emission of greenhouse gases from clearing of vegetation, manufacture of construction materials and fuel consumption.</li> <li>Low or no operational impact, initial estimates indicate the project would slightly reduce greenhouse gas emissions from traffic emissions, once operational.</li> </ul> <p>No potentially significant residual impacts are expected to remain after the application of the proposed management measures.</p>	Other issue	Chapter 18
Air quality	No	<p>The following moderate to low potential impacts were identified:</p> <ul style="list-style-type: none"> <li>Potential for decreases in air quality during construction associated with dust generating activities and emissions from heavy construction machinery.</li> </ul>	<p>The following low impacts would remain after application of the air quality management plan and the mitigation measures AQ1 to AQ2 as set out in Section 18.2.5 and Chapter 19:</p> <ul style="list-style-type: none"> <li>Potential for low, short-term decreases in local air quality during construction associated with dust generating activities and emissions from heavy construction machinery.</li> </ul> <p>No potentially significant residual impacts are expected to remain after the application of the proposed management measures.</p>	Other issue	Chapter 18

Issue	Key issue in DGRs	Potential impacts	Analysis – proposed mitigation measures and any potentially significant impacts remaining after their application	Risk category following analysis	EIS reference
Resource management and waste	No	<p>The following moderate potential impacts were identified:</p> <ul style="list-style-type: none"> <li>• Disposal of unsuitable or surplus earthworks material (around 550,000 cubic metres)</li> <li>• Disposal of an estimated 1.1 million cubic metres of green waste (not including millable timber)</li> <li>• Disposal of materials resulting from replacement of existing pavements (around 30 hectares)</li> <li>• Depletion or sterilisation of non-renewable resources, including sand and aggregate materials.</li> <li>• Direct impacts to existing quarries.</li> </ul>	<p>The following moderate to low impacts would remain after application of the resource management strategy and the mitigation measures WM1 to WM21 as set out in Section 18.3.3 and Chapter 19:</p> <ul style="list-style-type: none"> <li>• Moderate quantities of waste requiring disposal.</li> </ul> <p>No potentially significant residual impacts are expected to remain after the application of the proposed management measures.</p>	Other issue	Chapter 18

## References

Roads and Traffic Authority of NSW (RTA) 1999, *Land Acquisitions Policy Statement*, Roads and Traffic Authority of NSW (RTA), Sydney, Australia.

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