# 8. Environmental risk analysis

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

| DGRs | Where addressed |
|---|---|
| Environmental Risk Analysis: | |
| The environmental assessment 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. | Section 8.2. |
| 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 environmental assessment. | Section 8.3. |

## 8.1 Overview

An analysis was undertaken, which:

- Identified environmental issues, including key issues in the DGRs and any other issues.
- Examined potential impacts and proposed mitigation measures in relation to the identified issues.
- Examined impacts likely to remain after application of mitigation measures.

Based on this analysis, an environmental risk category was assigned to each impact. This enabled the identification of any matters that might be considered as additional key issues and established the basis for an appropriately detailed assessment of those additional key issues to be included in this environmental assessment.

## 8.2 Risk analysis

The environmental risk categories assigned to each impact are described in Table 8-1. The environmental risk analysis is summarised in Table 8-2. The findings of the analysis are provided in Section 8.3.

Table 8-1 Risk category descriptions

| Risk category | Description |
|---|---|
| A | May have high or moderate impacts. Detailed assessment necessary to determine the level of potential impact and to develop appropriate measures to mitigate and manage the impacts. |
| B | May have high or moderate impacts. These can be mitigated by the application of standard environmental management measures. |
| C | Has low impacts. These can be managed by standard environmental management measures. |

Impacts that have been assigned a risk category of 'A' are considered in all cases to indicate key issues. The environmental risk analysis has automatically allocated a risk category of 'A' to all key issues identified in the DGRs.

Noise and vibration, and traffic and transport, were identified as key issues in the *Hume Highway Upgrade Tarcutta Bypass: Preliminary Environmental Assessment* (RTA 2008a) and the DGRs. However, further detailed assessment of these issues has determined that standard mitigation measures could be implemented to manage their impacts during construction and operation. Were it not for their inclusion as key issues, the risk levels for noise and vibration, and traffic and transport would be reassessed as 'B' and 'C' respectively.

## 8.3 Findings

The environmental risk analysis identified one key issue additional to those included in the DGRs. This issue, and its consideration in the environmental assessment, is identified in Table 8-2.

Table 8-2 Environmental risk analysis — summary

| Issue | DGRs — key issue? | Potential impacts | Analysis — proposed mitigation measures and residual impacts after their application | Risk category following analysis | Environmental assessment reference |
|---|---|---|---|---|---|
| Traffic and transport | Yes | Disruption to the existing local traffic network during construction:<br>▪ Temporary disruptions/delays to local and highway traffic.<br>▪ Temporary road closures/diversions.<br>▪ Temporary restrictions to private access roads.<br>▪ Increased construction traffic on the existing road network. | ▪ Standard traffic management measures would be employed during construction to minimise traffic disruptions on the highway and local connecting roads. These management measures would be developed in accordance with RTA QA Specifications (RTA 2008c) and the RTA's *Traffic Control at Work Sites Manual* (RTA 2003a).<br>▪ Property access would be maintained for the duration of the construction. If required, temporary or alternative access would be provided in consultation with the affected landowner(s). | A (would be C if not a key issue) | Section 9.7<br>Technical Paper 7 (Volume 2) |
| | | Permanent adjustment to some private property access roads. | ▪ Permanent changes to the local road network/access would be developed in consultation with the relevant road authority and affected landowners. | | |
| | | Changed traffic patterns (local and regional):<br>▪ Potential negative impacts that may occur are likely to be short-term while road users adjust and become familiar with changed traffic patterns. | ▪ Changes to the road network in the project area would be clearly signposted. | | |
| | | Changes to travelling stock routes. | ▪ The project would be designed to facilitate the continued use of the travelling stock route across the highway from the Travelling Stock Reserve (western side) to Humula Road (eastern side). Any changes to the route would developed in consultation with the Hume Livestock Health and Pest Authority. | | |

| Issue | DGRs — key issue? | Potential impacts | Analysis — proposed mitigation measures and residual impacts after their application | Risk category following analysis | Environmental assessment reference |
|---|---|---|---|---|---|
| | | Traffic and transport benefits would be expected in relation to travel efficiency and road safety (the latter particularly along the existing highway and main street of Tarcutta village). | ▪ The project would likely improve traffic efficiency and road safety for traffic using the project and the existing highway. | | |
| | | Cumulative benefits for travel efficiency during operation:<br>▪ Associated benefits with construction and operation of the proposed Holbrook and Woomargama bypass projects and other Hume Highway duplication projects. | ▪ The three bypasses, in conjunction with the duplication projects, would lead to a cumulative reduction in travel time for vehicles on the Hume Highway and an improvement in safety for road users. | | Section 3.2 |
| Flora and fauna | Yes | Clearing of native vegetation, including endangered ecological communities and loss of habitat for threatened species:<br>▪ Approximately 16 hectares of native vegetation would be cleared, comprising:<br>▸ Seven hectares of the threatened ecological community Box Gum Woodland (including six hectares of Box Gum Woodland listed as critically endangered ecological community under the *Environmental Protection and Biodiversity Conservation Act 1999*).<br>▸ Four hectares of the threatened ecological community Inland Grey Box Woodland.<br>▸ Four hectares of River Red Gum Very Tall Open Forest.<br>▸ One hectare of Derived Native Grassland.<br>▪ This vegetation also provides habitat for a range of threatened species dependent on woodland habitats (eg Brown Treecreeper, Hooded Robin, Grey-crowned Babbler, Diamond Firetail). | ▪ Biodiversity impacts would be managed following the 'avoid, minimise, mitigate, offset' hierarchy. Management measures for vegetation loss include limiting the extent of clearing, controlling weeds and revegetation. Measures to manage the loss of fauna habitat include providing alternate habitat and developing fauna crossing treatments. A biodiversity offset package would be developed to manage the residual impacts on ecological values.<br>▪ Assessments indicated that impacts to threatened species and endangered ecological communities would not be significant. | A | Section 9.1<br>Technical Paper 1 (Volume 2) |

| Issue | DGRs — key issue? | Potential impacts | Analysis — proposed mitigation measures and residual impacts after their application | Risk category following analysis | Environmental assessment reference |
|---|---|---|---|---|---|
| | | The project could create barriers for the movements of threatened species through the landscape:<br>▪ The threatened Squirrel Glider has been recorded in the study area. A widened road corridor may create a barrier to the gliders' east–west movements.<br>▪ The widened road corridor may prohibit small, sedentary fauna (eg ground-dwelling/arboreal mammals, reptiles and amphibians) from crossing the highway east–west. | ▪ To facilitate the safe movement of fauna across the highway, natural and artificial crossing treatments would be investigated in consultation with DECC. | | |
| | | Impacts on threatened aquatic communities:<br>▪ Tarcutta and Keajura creeks form part of the threatened Aquatic Ecological Community in the Natural Drainage System of the Lower Murray River Catchment.<br>  ▸ New bridge and culvert structures over Tarcutta and Keajura creeks (including temporary crossings during construction) may alter creek bed characteristics and affect sediment loading in the watercourses. Fish assemblages may be affected by the watercourse crossings, including impacts on threatened species (Southern Pygmy Perch). | ▪ Watercourse crossings (permanent and temporary) would be designed and constructed in accordance with the Department of Industry and Investment's *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull and Witheridge 2003).<br>▪ Works within the main watercourse of Tarcutta Creek would be avoided during the breeding season of the Southern Pygmy Perch (September to January) unless mitigation measures are developed in consultation with the Department of Industry and Investment. | | |
| | | Potential longer-term impacts associated with increased habitat fragmentation:<br>▪ Approximately six hectares of remnant vegetation (including some threatened ecological communities) may be introduced to new edge effects due to the project.<br>▪ Clearance of linear vegetation along roadside and watercourses would fragment fauna corridors. | ▪ Revegetation works would be located to increase fauna habitat linkages. | | |

| Issue | DGRs — key issue? | Potential impacts | Analysis — proposed mitigation measures and residual impacts after their application | Risk category following analysis | Environmental assessment reference |
|---|---|---|---|---|---|
| | | Cumulative biodiversity impacts associated with the construction of the proposed Holbrook and Woomargama bypass projects and other Hume Highway duplication projects:<br>▪ Biodiversity impacts of the project are likely to be more significant as a result of biodiversity impacts from other projects. Cumulative impacts would include a greater extent of clearing of native vegetation and habitats, including endangered ecological communities, and further fragmentation of habitats. | ▪ A biodiversity offset package would be implemented to address residual and cumulative impacts. | | |
| Aboriginal heritage | Yes | Direct impacts on Aboriginal archaeological and cultural objects, sites, and natural and landscape values. | ▪ Any Aboriginal heritage items would be managed in accordance with the Aboriginal Cultural Heritage Assessment Report (CHAR), developed in consultation with Aboriginal stakeholders and DECCW.<br>▪ All excluded archaeological and cultural sites in the construction site boundary would be fenced and identified as 'environmentally sensitive areas' prior to construction.<br>▪ Archaeological salvage excavation of archaeological sites would be undertaken to mitigate impacts on significant archaeological sites, where required, prior to commencement of construction in the area to be salvaged.<br>▪ Salvage through collection of artefacts would be undertaken, where required, prior to construction. | A | Section 9.2<br>Technical Paper 2 (Volume 2) |

| Issue | DGRs — key issue? | Potential impacts | Analysis — proposed mitigation measures and residual impacts after their application | Risk category following analysis | Environmental assessment reference |
|---|---|---|---|---|---|
| Noise and vibration | Yes | Noise and vibration impacts on sensitive receivers during construction:<br>▪ Vibration impacts could occur during some construction activities (eg piling, blasting (if undertaken)).<br>▪ Noise impacts. | ▪ A construction noise and vibration management plan would be developed and implemented through the CEMP. The plan would include:<br>▸ A notification and negotiation procedure where noise impacts from evening and night-time construction activities are above criteria. This would involve consultation with sensitive receivers to develop appropriate management measures.<br>▸ A specific notification procedure for any blasting activities.<br>▸ Procedures for dealing with and responding to complaints.<br>▸ Procedures for noise monitoring and auditing to verify compliance with the predicted noise impacts. | A (would be B if not a key issue) | Section 9.5<br>Technical Paper 6 (Volume 2) |
| | | Noise impacts on sensitive receivers during operation:<br>▪ Noise reduction at some sensitive receivers.<br>▪ Noise increases at some sensitive receivers.<br>▪ Changes to direction of received noise. | ▪ Operational noise would be managed to meet the noise criteria applicable to the project where reasonable and feasible measures are agreed in consultation with affected landowners. | | |

| Issue | DGRs — key issue? | Potential impacts | Analysis — proposed mitigation measures and residual impacts after their application | Risk category following analysis | Environmental assessment reference |
|---|---|---|---|---|---|
| Hydrology | Yes | Impacts on water sources and users through water demand for construction:<br>▪ Approximately 200 megalitres of water would be required over the two year construction period. This may affect availability of water for other users. | ▪ Water for construction would be sourced from (in order of preference):<br>▸ Temporary sediment basins (where feasible).<br>▸ Groundwater bores.<br>▸ Existing farm dams (in consultation with landowner).<br>▸ Off-site sources.<br>▪ Groundwater extraction would be monitored. Mitigation measures would be implemented where levels indicate that the project is potentially having an adverse impact. | A | Section 9.4<br>Technical Papers 4 and 5 (Volume 2) |
| | | Flooding impacts due to altered flooding behaviour of Tarcutta and Keajura creeks:<br>▪ Increased afflux, changes to impacts on property. | ▪ The project has been designed to minimise change in afflux. Detailed design would seek to further manage changes in afflux.<br>▪ Bridge and drainage structures would be designed to minimise possible rises in flood levels, and preserve hydraulic connectivity of floodplain storage areas and flow paths. | | |
| | | ▪ Impacts on waterways and water quality due to:<br>▸ Erosion and sedimentation.<br>▸ Fuel spills and leaks.<br>▸ Inappropriate classification, storage and disposal of liquid and non-liquid wastes. | ▪ Standard best practice environmental management measures would be implemented during construction in accordance with *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Ed.* (Landcom 2006) and *Managing Urban Stormwater: Soils and Construction, Volume 2D, Main Road Construction* (DECC 2008b).<br>▪ Operational water quality treatment measures would incorporate structural and non-structural measures to control road run-off pollutants entering Tarcutta and Keajura creeks. | | |

| Issue | DGRs — key issue? | Potential impacts | Analysis — proposed mitigation measures and residual impacts after their application | Risk category following analysis | Environmental assessment reference |
|---|---|---|---|---|---|
| Social and economic | Yes | Loss of business from reduction in passing trade:<br>▪ Economic impacts.<br>▪ Loss of local services. | ▪ Continue consultation would be undertaken with Wagga Wagga City Council through detailed design and construction to assist in developing strategies to encourage the continued viability of Tarcutta.<br>▪ The project would be designed to facilitate easy access into and out of the village.<br>▪ Appropriate signposting would be provided. | A | Section 9.6 |
| | | ▪ Short-term benefits to local economy during construction. | ▪ Construction materials and other products and services would be sourced locally as far as possible. | | |
| | | Changes to connectivity:<br>▪ Reduced connectivity for some residences. | ▪ Connectivity would be maintained through the provision of a local service road for rural residences on the western side of the project. | | |
| | | Direct property impacts, including property acquisition, land use viability, infrastructure and severance. | ▪ Consultation would be undertaken with all affected landowners throughout detailed design and construction to develop and implement measures to mitigate impacts on land use viability, infrastructure and severance.<br>▪ All property acquisitions would be undertaken in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991* and the RTA's (1999a) *Land Acquisition Policy*. | | |
| Non-Aboriginal heritage | No | Impacts on non-Aboriginal heritage items and cultural values:<br>▪ The project would directly impact the curtilage of the State Heritage Register listed Hambledon Homestead Complex resulting in an impact on its cultural landscape and setting. A historic brick well within this curtilage may be impacted by the project. | ▪ Heritage impacts would be managed through a non-Aboriginal heritage management plan.<br>▪ The project would seek to minimise impacts to the State Heritage Register listed Hambledon Homestead Complex during detailed design.<br>▪ Relevant mitigation (eg archival record, test/salvage excavation) would be implemented | A | Section 9.3<br>Technical Paper 3 (Volume 2) |

| Issue | DGRs — key issue? | Potential impacts | Analysis — proposed mitigation measures and residual impacts after their application | Risk category following analysis | Environmental assessment reference |
|---|---|---|---|---|---|
| | | ▪ Potential for the discovery of unidentified items.<br>▪ The cultural landscape and setting of Tarcutta General Cemetery and Tarcutta House. | for impacted heritage items including the Hambledon Homestead Complex (and historic brick well if impacted).<br>▪ A remote sensing survey and monitoring of topsoil stripping within 100 metres of the formal Tarcutta General Cemetery boundary would be undertaken by a suitably qualified heritage specialist to identify the presence of any potential burials or other features.<br>▪ Assistance would be provided for the development of a conservation management plan for Hambledon Homestead Complex. This would be in consultation with the landowner and relevant government agencies.<br>▪ A revised and updated heritage listing of the Hambledon Homestead Complex would be prepared and lodged with the Heritage Branch (Department of Planning).<br>▪ All excluded items in the construction site boundary would be fenced and identified as exclusion zones prior to construction.<br>▪ Any landscaping and urban design would take into consideration the heritage values of Hambledon Homestead Complex, Tarcutta House and Tarcutta General Cemetery in consultation with relevant landowner(s) and a suitably qualified heritage specialist. | | |
| Soils and water quality | No | Erosion and sedimentation during construction and operation. | ▪ Standard best practice environmental management measures would be implemented during construction in accordance with *Managing Urban Stormwater: Soils and Construction, Volume 1, 4th Ed.* (Landcom 2006) *Managing Urban Stormwater: Soils and Construction,* | B | Section 10.1 |

| Issue | DGRs — key issue? | Potential impacts | Analysis — proposed mitigation measures and residual impacts after their application | Risk category following analysis | Environmental assessment reference |
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| | | | *Volume 2D, Main Road Construction* (DECC 2008b).<br>▪ A soil conservation specialist would be appointed to the project during design and construction to advise on the appropriate treatments to minimise erosion and sedimentation.<br>▪ (Refer to 'Hydrology' issue for further discussion of mitigation of impacts on water quality.) | | |
| Visual amenity and landscape | No | Positive impacts on urban design and landscape:<br>▪ The visual amenity of Tarcutta village may be improved by the reduction of through-traffic.<br>Negative impacts on urban design and landscape:<br>▪ The clearance of native vegetation, extensive earthworks and construction of a new highway may reduce the visual amenity of the area. | ▪ The objectives identified in the urban design and landscape strategy would be incorporated into the project. | B | Section 10.2 |
| Air quality | No | ▪ Air quality impacts on road users and sensitive receivers during construction.<br>▪ Potential for short-term decreases in local air quality during construction associated with dust-generating activities and emissions from heavy construction machinery. | ▪ Standard dust and emission control measures would be implemented to manage construction air quality impacts. | C | Section 10.3 |

| Issue | DGRs — key issue? | Potential impacts | Analysis — proposed mitigation measures and residual impacts after their application | Risk category following analysis | Environmental assessment reference |
|---|---|---|---|---|---|
| Hazards and risk | No | Hazards to the environment, workers and the public during construction associated with transport, handling and storage of hazardous materials. | ▪ Potential environmental hazards and risks associated with construction activities would be identified prior to construction, with standard management measures and contingency plans implemented throughout the construction period.<br>▪ Occupational health and safety hazards would be managed by preparation and implementation of a site-specific safety management plan and safe work method statements. | C | Section 10.4 |
| | | Risks to the environment, and human health and safety associated with the transport of hazardous goods on the project. | ▪ Spill containment measures/facilities for incidents near sensitive environments would be incorporated into the design of the project. | | |
| Contaminated land | No | Contaminated land within the construction site boundary:<br>▪ A stockpile located at the south-western end of the project known to contain road base and bitumen fragments would be directly impacted by the project.<br>▪ Potential contamination risk associated with removal of farm sheds/buildings on property in the northern section of the project. | ▪ All potentially contaminated waste (including known road base stockpile) would be classified according to the *Waste Classification Guidelines: Parts 1 and 2* (DECC 2008a) and disposed of to a suitably-licensed disposal facility or reused in the construction works as appropriate.<br>▪ Standard contingency measures (including for unknown contaminants, asbestos containing materials and site operations during construction) would be implemented to allow for further investigation and treatment/disposal as appropriate. | C | Section 10.5 |

| Issue | DGRs — key issue? | Potential impacts | Analysis — proposed mitigation measures and residual impacts after their application | Risk category following analysis | Environmental assessment reference |
|---|---|---|---|---|---|
| Sustainable management (greenhouse gases, waste, energy) | No | Consumption of energy and generation of greenhouse gases and waste during construction of the project:<br>▪ Greenhouse gases would be emitted from construction plant, equipment and vehicles.<br>▪ Greenhouse gas emissions would be embodied in materials consumed in construction or impacted by the project, such as vegetation removal and soil disturbance.<br>▪ Energy-consuming activities over the two year construction period would be extensive. Energy used would be in the form of fuel and electricity.<br>▪ Waste generated during construction. | ▪ Energy efficient work practices would be implemented, including consideration of:<br>▸ Energy efficient design of site buildings.<br>▸ Design of site compounds and the batch plant to minimise unnecessary vehicle movement.<br>▸ Regular servicing of site plant and equipment.<br>▸ Training of construction personnel in energy efficient plant operation.<br>▸ The use of accredited GreenPower.<br>▸ Use of locally sourced materials where available and of suitable quality.<br>▪ Use of recycled materials, such as replacement of cement with fly ash, recycled aggregate, and recycled content in steel, where possible.<br>▪ Waste management would be undertaken in accordance with the waste hierarchy (avoid, minimise, reuse/recycle, dispose) principles of the *Waste Avoidance and Resource Recovery Act 2001*. A waste management system would be prepared and maintained throughout construction. | C | Section 10.6 |