Australian Government

RTA

Little Billabong

Hume Highway Duplication

ENVIRONMENTAL ASSESSMENT

DECEMBER 2006

RTA/Pub.06.XXX

Statement of Validity

Submission of Environmental Assessment
Prepared under Part 3A of the *Environmental Planning and Assessment Act 1979*.

Environmental Assessment prepared by

Name:

Qualifications:

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In respect of: Hume Highway Duplication at Little Billabong

Applicant and land details

Applicant name: NSW Roads and Traffic Authority

Applicant address:

Land to be developed: Land generally required for the construction and operation of the proposed Hume Highway Duplication at Little Billabong, as shown in Figure 4.1.

Environmental Assessment

Statement of Validity: I certify that I have prepared the contents of the environmental assessment in accordance with the Director General's requirements dated 9 October 2006, and that to the best of my knowledge, the information contained in the Environmental Assessment is neither false nor misleading.

Signature: _____

Date:

Executive Summary

The Proposal

The NSW Roads and Traffic Authority (RTA) is proposing to upgrade five sections of existing single carriageway on the Hume Highway to four lane dual carriageways in the area south of the Sturt Highway junction to Albury.

The Commonwealth Government has provided $800 million to the NSW Government to accelerate provision of dual carriageways in Little Billabong – approximately 85 kilometres south of Gundagai to approximately 93 kilometres south of Gundagai. The proposal would involve the construction of a new dual carriageway and duplication of the existing Hume Highway over approximately eight kilometres-two kilometres of new dual carriageways and approximately six kilometres of existing highway duplication. Two T-type intersections (Westby Lane Road and Little Billabong Creek Road (MR284)) would also be upgraded.

A feature of the project would be the substantial cutting of the existing vertical embankment south of Little Billabong Road and the filling of a small part of a flood prone area. Implementation would require the resumption of land, partial acquisition of private properties, removal of native vegetation, cutting works and construction of culverts. The vegetation adjoining the existing north-bound lane south of the Little Billabong Creek Road intersection of the highway would be removed. Existing substandard curves in the vicinity of the Little Billabong Creek Road would be removed as part of the proposal.

The Proposal is estimated to cost $70 million with construction anticipated to start in mid 2007 and the completion date set for the end of 2009.

The Environmental Assessment for the Little Billabong section of the Hume Highway Duplication has been prepared in accordance with the process and requirements of Part 3A of the *Environmental Planning and Assessment Act 1979* (EP&A Act). It addresses the key environmental issues associated with the Proposal and includes mitigation measures to address potential impacts. It also includes a draft 'statement of commitments' for the RTA in its management of the environmental effects that may occur during construction and operation of the Proposal.

Need and justification

Community expectation has existed for some time regarding the completion of the Hume Highway Duplication to provide a continuous, high standard dual carriageway between Sydney and Melbourne. Dual carriageways were completed in Victoria in December 2005, increasing the focus on the remaining single carriageway sections in NSW.

The Sydney-Melbourne corridor is vital to the Australian economy. It is the busiest inter-capital road corridor with approximately 40 percent of long-distance road freight movements on the National Network using the Hume Highway for at least part of their journey. Interstate freight between Sydney and Melbourne is forecast to increase by nearly 70 percent over the next 20 years and by 2025 it is expected that 5,000 to 6,000 heavy vehicles will be moving along the Hume Highway each day.

The dual carriageway sections of the Hume Highway operate at level of service (LoS) A, with significant capacity for traffic growth at this level. The single carriageway sections of the Highway operate as high as LoS B for eight hours per day (2am to 10am) and as low as LoS D for up to five hours per day (8pm to 1am) with an average operation of LoS C. The reduction to LoS D corresponds to the peak period for heavy vehicles and reflects the high

night-time percentage of heavy vehicle traffic on the Hume Highway. With no upgrade by 2016, the single carriageway sections of the Highway would deteriorate to LoS E during the period 9 pm to 1 am, with an average weekday LoS D. In 2021, this would further deteriorate to LoS E over a longer period (7 pm to 2 am), with an average of LoS D.

Fatal crash rate on the single carriageway sections of the Hume Highway is approximately 85 percent higher than the dual carriageway, and the injury crash rate on the single carriageway is approximately 40 percent higher than on the divided carriageway. The proportion of overall crashes that involve either injuries or fatalities is 14 percent higher on the single carriageway sections. Road safety is a significant community concern.

The completion of the Hume Highway Duplication would provide consistent conditions for road users, improved level of service, road safety and freight efficiency, and facilitate the forecast growth in traffic on the Highway.

The implications of no action or deferral of the Hume Highway Duplication include declining traffic and safety conditions and deteriorating community amenity. Predicted traffic growth would further exacerbate the problems currently experienced within the existing road and traffic environment.

Other options considered

Concept designs for the Proposal have focussed on the existing alignment linking to the existing dual carriageways at the north and a temporary connection to the single carriageway in the south. They have included combinations of two new carriageways using the existing Highway as one carriageway over part of the length. All but one option included two new carriageways for a small area of the northern section due to sub-standard horizontal alignment of the existing Highway. Options predominantly outside the Highway corridor were rejected due to higher costs and property severance.

Design principles and design criteria underpinning the Proposal include:

- Minimising costs and reducing earthworks (balanced cut and fill to minimise and/or avoid the importation of materials).
- Avoiding or minimising impacts on known Aboriginal and non-aboriginal heritage.
- Avoiding or minimising environmental impact on terrestrial and aquatic biodiversity.
- Minimising land take and utilising existing road reserve where possible.
- Providing safe passage and access along and to the Hume Highway.

Community and stakeholder involvement

The RTA has identified and engaged individuals, agencies, community groups and other stakeholders during investigation, design and assessment of the Proposal. The approach to consultation drew from guidelines contained in *Community Involvement Practice Notes and Resource Manual* (RTA 1998).

The principal objective of the consultation is to keep stakeholders informed and involve them in the Proposal during each stage of its development. This entails:

- Preparing and distributing information about the Proposal and aspects of the assessment studies.
- Providing a range of opportunities for the two-way exchange of information where the RTA could provide information and answer questions.

- Providing stakeholders with the opportunity to convey issues through meetings, site visits and attendance at the Planning Focus Meeting.
- Addressing community concerns and issues in the Environmental Assessment.

Statutory position and approvals

The Proposal is subject to Part 3A of the EP&A Act through an order made by the Minister for Planning under section 75B (1)(a) on the basis of its significance to the State and region.

The Hume Highway duplication is considered to be of state or regional infrastructure planning significance in that the highway:

- Is a major road link between Sydney and Melbourne.
- Forms an integral part of the eastern seaboard north-south corridor.
- Is the busiest inter-capital corridor in Australia for freight with the majority being moved overnight, thereby providing 'next day' delivery between these capitals.
- The section subject to this Environmental Assessment remains one of only five sections of single carriageway (excluding the town bypasses) either without planning approval or not yet constructed.

Part 3A makes provision for a single assessment and approval process by incorporating the relevant matters to be addressed within the assessment of the Proposal. This removes the need to seek subsequent approvals for many other Acts, with the major exceptions being the *Protection of the Environment Operations Act 1997* and the *Native Title Act 1994*.

Also under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), a proposal that is likely to result in a significant impact on a matter of National Environmental Significance must be referred to the Department of Environment and Heritage. If the Proposal is subsequently determined to be a 'Controlled Action', approval of the Commonwealth Minister of Environment and Heritage is required.

The Little Billabong section of the Hume Highway Duplication has been referred to the Minister to determine if the proposal is a controlled action in view of the removal of a vegetation community listed under the EPBC Act.

Key environmental issues

Key environmental issues were identified initially using an environmental risk analysis undertaken during the preliminary environmental assessment of the Proposal. These key issues were reviewed, considered and refined by the Department of Planning and later issued as the final Director General's Environmental Assessment Requirements. The relevant key environmental issues are discussed in the following section.

Biodiversity

Biodiversity values in the Little Billabong section vary from low to significant and include both terrestrial and aquatic. Four broad fauna habitat types occur in the study area:

- Woodland.
- Riparian habitats.
- Derived grasslands.
- Freshwater habitats (dams, creeks and wet depressions).

Habitats provide potential foraging, nesting, roosting, basking and resting sites for a variety of fauna, including the threatened Brown Treecreeper (*Climacteris picumnus*) and Squirrel Glider (*Petaurus norfolcensis*) which were recorded within the study area during the ecological surveys. The Diamond Firetail (*Stagonopleura guttata*) has also been recorded in the study area during previous surveys (CSU, 2006). The Brown Treecreeper appeared to be relatively abundant and widespread, occurring in Box-Gum woodland and River Red Gum riparian habitat. Individuals were recorded in both narrow linear roadside reserves and creek line vegetation. Observations of Diamond Firetails were few and generally relate to dense tall grass near Little Billabong Creek.

Other significant values include the occurrence of vegetation communities such the White Box (*Eucalyptus albens*)–Yellow Box (*Eucalyptus melliodora*)–Blakely's Red Gum (*Eucalyptus blakelyi*) Woodland (hereafter referred to as Box-Gum woodland) which is listed as a critically endangered ecological community under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and an endangered ecological community under the NSW *Threatened Species Conservation Act 1995* (TSC Act). This community occurs within roadside reserves and scattered fragments within cleared farmland. Moderate quality patches are restricted to road reserves where both native and exotic species are well represented.

Little Billabong Creek and its tributaries fall within the natural drainage basin of the lower Murray River and therefore form part of the endangered Aquatic Ecological Community in the Natural Drainage Basin of the Lower Murray River Catchment. This community is listed as endangered under the NSW TSC Act and *Fisheries Management Act 1994* (FM Act). Given that the Proposal would cross the anabranch of Little Billabong Creek it would affect this endangered ecological community. The Proposal also has the potential to indirectly affect Little Billabong Creek and hence the endangered ecological community. Management measures would be implemented to mitigate potential impacts on this community.

The Proposal has the potential to result in a significant decrease in the extent and quality of Box-Gum woodland within the locality through the clearance of 11.35 hectares and additional indirect impacts such as increased weed invasion. Therefore, offsets would be required to ensure there is no net loss of this community and stringent management measures implemented to prevent any potential indirect impacts on the woodland within the study area. Investigations suggest that Squirrel Gliders are currently crossing the existing single carriageway of the highway at the northern end of the Proposal, with the potential to reduce the frequency of glider crossings and increase mortality through vehicle collisions, during operation.

Murray Cod (*Maccullochella peelii peelii*) and Trout Cod (*Maccullochella macquariensis*) exist within nearby streams. Murray Cod is listed as vulnerable under the EPBC Act and Trout Cod as endangered under TSC, EPBC and FM Acts. Both species are unlikely to populate the waterways in Little Billabong Creek given its degraded nature and limited size. However, potential impacts on water quality and particularly sedimentation as a consequence of the Proposal, may have downstream impacts on these species.

Aboriginal heritage

A search of the DEC Aboriginal Heritage Information Management System in July 2006 found that there are no previously recorded Aboriginal objects or places listed within the study area although five sites have been recorded previously to the south of the study area.

Extensive archaeological survey was undertaken to assess the Aboriginal features of the study area and identify any objects or place of significance to the Aboriginal community. This included the involvement of Aboriginal stakeholders or their representatives in a walk-over

of the study area. Site types identified through the archaeological survey include scarred trees, potential archaeological deposits (PADs) and isolated finds.

A range of Aboriginal sites were recorded in this area comprising of one scarred tree, four artefact scatters and an isolated find. In addition three PADs have been identified; one large PAD is located adjacent to Billabong Creek. These items alongside the presence of creeks and streams indicate that the Proposal area contains significant evidence of Aboriginal occupation and land use. The archaeological survey found six Aboriginal sites or objects present and assessed the potential for three intact sub-surface archaeological deposits (PADs). Of the six identified sites of Aboriginal heritage three sites, two artefact scatters (LB3 and LB4), and one isolated find (LB2) and two PADs (LB-PAD-1 and LB-PAD-3) would be impacted by the Proposal.

Non-Aboriginal heritage

Three separate heritage assessments have been undertaken to consider the direct and indirect impacts of the Proposal on non-Aboriginal heritage, potential archaeological deposits and natural areas of heritage significance.

Twenty two heritage items have been identified within 100 metres of the existing highway. These include:

- Archaeological heritage – 13 sites of archaeological significance.
- Built heritage – four sites of built heritage significance.
- Landscape heritage – five landscape items.

The one archaeological site of state significance identified within the vicinity of the study area, would not be affected by the Proposal. Five of the total of thirteen items identified as having local historical significance, would be affected and of these, only the church remains are considered to be a potential archaeological item. This site has high archaeological potential and should be the subject of detailed archaeological excavation.

Hydrology

Little Billabong Creek runs parallel to the Highway on the eastern side and crosses the highway just south of the limit of the duplication. Many minor waterways cross the highway, discharging into Little Billabong Creek, which has a substantial catchment area of 246 square kilometres. Catchments in this region typically have low rates of runoff due to a number of factors such as:

- Typically dry antecedent conditions prior to rainfall because of a relatively low annual rainfall, which produces relatively high infiltration losses.
- Soil conditions which encourage relatively high infiltration losses.
- Low stream gradients and wide floodplains which provide large floodplain storage volumes that attenuate flood peaks.

Results of hydraulic modelling have shown that the Proposal would not result in any significant impact to the existing flood flow distribution for floods up to the Probable Maximum Flood (PMF), although there is an expected afflux resulting from the location of a section of the highway embankment within the floodplain. Based on these predictions, no residential properties are affected, and flood levels north of the bridge over Little Billabong Creek on Little Billabong Road are unlikely to change as a result of the Proposal.

Ultimately, the duplication of the Highway does not markedly change flood behaviour as:

- No waterways would be redirected.

- Additional impervious surface areas associated with the new carriageway are negligible as a proportion of the total catchment area, (less than 0.2%).

The groundwater catchment lies within an intermediate-scale fractured rock aquifer. Overlaying valley fill alluvium provides a shallow secondary local-scale aquifer. There are three main components to the groundwater system in the region:

A. A shallow soil-regolith system composed of the residual soil profile and weathered rock profile down to a depth of several metres.

B. A deeper fractured rock aquifer (or complex of sub-aquifers) below the base of bedrock weathering, with its upper surface marked by the water table.

C. An alluvial sand and gravel aquifer, beneath the floodplains of the main watercourses up to 70 metres thick in buried channels.

Dryland salinity is a problem associated with increased water supply in salty landscapes. The Proposal would result in additional water being available to the landscape, via increased impervious areas, and the concurrent removal of vegetation. The Highway duplication may exacerbate the salinity problem by creating an impermeable barrier to the movement of shallow groundwater. Groundwater may be impounded upslope of the road and eventually rise to the surface. Salts are then concentrated at the surface by evaporative transfer.

Potential impacts on groundwater during construction would include: the effects of earthworks and road construction, potential depletion of groundwater resources and increases in salinity. The potential for impacts of road infrastructure during operation would be minimal provided that mitigation measures are included to allow free flow of groundwater and provide minimal disturbance to creeks.

Resource management

Based on current estimates it would be expected that no extractive material resources would be required from outside of the Proposal corridor. Comprehensive geotechnical investigations are to be undertaken during the detailed designed stage in order to refine earthworks volumes and identify the quality of materials to be used in construction. As part of these investigations, there would be a detailed identification of additional fill requirements, including the types and volumes of material required and appropriate sources of this material.

Fill, including select material, could be derived from three potential sources. In order of priority, these are:

- Other duplication proposals undertaken as part of the Hume Highway Duplication.
- Licensed quarries in the adjacent area.
- Borrow pits within or adjacent to the Proposal corridor.

It is anticipated that most of the additional fill would be obtained from an existing licensed source in the local area.

Cumulative impacts

Cumulative impacts would arise from the interaction of the construction and operation of the Little Billabong section of the Hume Highway Duplication with the other four sections to be constructed simultaneously and with other major activities to be undertaken in the region over the same period.

Cumulative impacts during the simultaneous construction of five projects along the same major road corridor relate predominantly to the addition of their direct impacts on biodiversity, possible loss of sites of significance to the Aboriginal community and impacts on

non-Aboriginal heritage items. Requirements for construction resources may result in unsustainable demands producing short term difficulties with increases in project costs.

Cumulative effects during operation focus predominantly on the achievement of the transport and economic benefits of the combined projects bringing about improvements in road standards with subsequent reduction in the numbers of crashes, cost reductions for road users and improvements in regional access. The undesirable impacts of traffic, such as noise would be mitigated within the context of the individual projects and could not be considered to be cumulative.

Other environmental issues

A number of other environmental issues have been identified and considered in the assessment. These issues relate to the construction and operation of the Proposal that are not considered to be key issues. Such issues are normally associated with road projects and are routinely managed via the inclusion of specific items in the design of the Proposal or by the implementation of various measures aimed at ensuring that all necessary environmental criteria and guidelines are achieved.

Other environmental issues relating to the Proposal include:

- Traffic.
- Air quality and greenhouse gases.
- Noise and vibration.
- Visual.
- Waste.
- Landform, geology and soils.
- Land use and social.
- Hazards and risks.

Residual impacts, following the inclusion of mitigation measures in the design and the application of appropriate management measures during construction and operation, are expected to be minor.

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Glossary of terms and abbreviations

Afflux	Increase in existing flood level caused by an obstruction to the existing flow of floodwaters.
AHD	Australian Height Datum. The standard reference level used to express the relative evaluation of various features. A height given in metres AHD is essentially the height above sea level.
Alignment	A detailed geometric layout, in plan and profile, following a general route.
Alluvium	Unconsolidated deposit of gravel, sand or mud formed by water flowing in identifiable channels. Commonly well sorted and stratified.
Alluvial Plain	A relatively flat and gently sloping landform found at the base of a range of hills
Alluvial soil	Juvenile soils formed by deposition from still or moving water. Little pedological development beyond some accumulation of organic matter at the surface.
Ambient	The background level at a specific location, being a composite of all sources.
Amenity	The degree of pleasantness of an area or place.
Annual Average Daily Traffic (AADT)	Annual average daily traffic volume representing the total traffic in both directions at a specified location calculated from mechanically obtained axle counts.
Annual Exceedance Probability (AEP)	The probability of a rainfall or flood event exceeding a nominated level in a year. A one percent AEP is the probability of an event exceeding a nominated level in 100 years.
ANZECC	Australian and New Zealand Environment and Conservation Council
Aquifer	Geologic formation, group of formations, or part of a formation capable of transmitting and yielding economic quantities of water.
Aquifer properties	The characteristics of an aquifer that determine its hydraulic behaviour and its response to abstraction.
Arboreal	To live in, or be connected with, trees.
Archaeology	The scientific study of human history, particularly the relics and cultural remains of the distant past.
Archaeological Site	A site is defined as any material evidence of past Aboriginal activity that remains within a context or place that can be reliably related to that activity.
Artefact	An object, normally portable, made or modified by human hands.
Average Recurrence Interval (ARI)	Average or expected period between exceedance of a flood.
Asphalt or asphaltic concrete	A dense, continuously graded mixture of coarse and fine aggregates, mineral filler and bitumen usually produced hot in a mixing plant.
Attenuation	The reduction in sound pressure level magnitude during transmission (around a barrier or over a distance outdoors). (Unit: dB, dBA).
Background Noise Level	The ambient sound pressure noise level in the absence of the sound under investigation exceeded for 90 percent of the measurement

	period. Normally equated to the average minimum A-weighted sound pressure level.
Batter	The side slope of walls, embankments and cuttings or the degree of such slope, usually expressed as a ratio of horizontal distance to one vertical height.
Bedrock	The unweathered rock that lies below loose surface deposits of soil and alluvium.
Benefit Cost Ratio	The ratio of the present value of benefits to the present value of costs of a project.
Bore	A cylindrical drill hole sunk into the ground from which water is pumped for use or monitoring.
Borehole	A hole produced in the ground by drilling or driving.
Boundary	A lateral discontinuity of change in the aquifer resulting in a significant change in hydraulic conductivity, storativity, or recharge.
BP	Before Present as applied to the dating of Aboriginal items.
Buffer	A physical barrier, structure or width of land which encloses, partially encloses or defines a particular environment. It serves to minimise the impacts of non-desirable external influences on the adjoining environment.
Bund Wall	A wall erected to prevent the escape of various emissions into the environment (liquids, noise or views).
Canopy	The uppermost layer of foliage formed by the crowns of trees.
Carriageway	One of the two sides of a motorway where traffic travels in one direction.
Catchment	The area drained by a stream or body of water or the area of land from which water is collected.
Colluvial soils	Stony clays which have been moved downslope by soil creep and slopewash but may include a proportion of windblown red clay ('parna') and higher terrace alluvium.
Compaction	The process of compressing individual grains in a soil or sediment in response to pressure.
Concentration	On release, emissions are transported and diluted resulting in a volume of pollutant (in the case of traffic) per volume of ambient air. Measured in parts per million or micrograms per cubic metre. Ambient air quality goals are expressed in terms of concentrations.
Concept Design	Initial functional layout of a concept, such as a road or road system, to provide a level of understanding to later establish detailed design parameters.
Confined aquifer	A completely saturated aquifer in which the upper and lower boundaries are relatively impermeable layers. The groundwater is contained under sufficient pressure to cause it to rise above the aquifer if the top impermeable layer is breached.
Confining bed	A layer of relatively impermeable material underlying, overlying, or adjacent to one or more aquifers.
Confluence	The place at which two streams flow together to form one larger stream.
Conservation	The management of resources in a way that will benefit both present

	and future generations.
Contaminant	Any physical, chemical. biological or radiological substance or matter in water or soil that is not of natural origin.
Contamination	The degradation of the natural environment as a result of human activities.
Culvert	One or more adjacent, enclosed channels for conveying a stream below road formation level.
Cumulative impact	The sum effect on the environment resulting from the successive effects of several different impacts.
Cut batters	The side slopes of cuttings.
dBA	Decibels using the A-weighted scale measured according to the frequency of the human ear.
DEC	NSW Department of Environment and Conservation
Decibel	A scale unit used in the comparison of powers and levels of sound energy. The number of decibels is ten times the logarithm to the base of ten of the ratio of the powers.
Degree of Saturation	The ratio of the traffic volume entering an intersection in a specific period to the capacity of the intersection during that period.
Department of Planning (DoP)	NSW Government department responsible for planning with a role in the assessment of the proposal and making a recommendation to the Minister for Planning whether it should proceed.
Department of Natural Resources (DNR)	NSW Government department responsible for natural resource management and with a role in the assessment of the proposal and making a recommendation to the Minister for Planning whether it should proceed.
Design speed	A nominal speed used for the design of geometric features of the road, such as curves.
Discharge/Flow velocity	The rate at which liquid flows.
Drawdown	The difference between the observed water level during pumping and the pre pumping water level.
Dual carriageway	A highway or road with separated carriageways for traffic travelling in opposite directions.
Earthworks	The process of extracting, moving and depositing earth during construction.
Earthwork balance	Comparison of volume of material derived from the proposal as a result of cuts and the volume of material required as fill. Ideally these should be the same.
Ecology	The relationship between living things and their environment.
Ecologically Sustainable Development	Using, conserving and enhancing the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased.
Ecosystem	A functional unit of energy transfer and nutrient cycling in a given place. It includes all relationships within the biotic community and between the biotic components of the system.
Embankment	A mound or bank of earth or stone formed to support a roadway, serve as a protective barrier, or the like.

Emission	Discharge of a substance to the environment.
Environment	A term for all the conditions (physical, chemical, biological and social) in which an organism or group of organisms, including humans. exists.
Environmental Assessment (EA)	A formal description of a project and an assessment of its likely impact on the physical, social and economic environment. It includes an evaluation of alternatives and an overall justification of the project. The EA is used as a vehicle to facilitate public comment and as the basis for analysing the project with respect to granting approval under relevant legislation.
Environment Protection Licence (EPL)	A licence that allows pollution of the environment under controlled conditions regulated by the Department of Environment and Conservation.
Eluvial deposit	A deposit formed as the result of in situ weathering of a rock. and located at its site of formation.
EMP	Environmental Management Plan
EPA	NSW Environment Protection Authority (now part of the Department of Environment and Conservation)
EPBC Act	Environment Protection and Biodiversity Conservation Act (Commonwealth)
Equivalent Continuous Sound Level (L_{Aeq})	The constant sound level which when operating over the same time interval as a fluctuating sound over an extended time, is equivalent to the same sound energy.
Erosion	The wearing away of the land surface by the action of water, wind and ice.
Excavate	Dig into natural material and remove using specialist machinery.
Extraction	A term referring to the removal of material from the earth synonymous with quarrying.
Evapotranspiration	Loss of water from a land mass through transpiration from plants and evaporation from the soil.
Fauna	All animals including birds, reptiles, marsupials and fish.
Fill batters	The side slopes of material placed in an embankment; the degree of such slope is expressed as a ratio of x horizontal to one vertical.
Floodplain	Large flat area of alluvium adjacent to a watercourse, characterised by frequent active erosion and aggregation by channelled and overbank stream flow.
Flora	All plants
Frequency	Similar to the pitch of a musical note in sound pressure fluctuations of cycles per second (Hertz). Most sounds comprise a composite of frequencies of varying sound pressure levels in the range of 20 Hertz to 20,000 Hertz.
Grade separation	The separation of a road, rail, or other traffic so that crossing movements, which would otherwise conflict, are at different elevations.
Gradient	Rate of change of a given variable with distance, such as temperature or elevation.
$g/m^2/month$	grams per square metre per month

Ground vibration	Representing the combined speed of ground oscillation at a point from a source of vibration such as a blast or piece of mobile plant (Unit: mm/s, m/s).
Groundwater	Subsurface water contained within the saturated zone.
Habitat	The place where an organism lives; habitats are measurable and can be described by their flora and physical components.
Head (hydraulic head)	Energy contained in a water mass produced by elevation, pressure or velocity.
Heritage	Things of value which are inherited from the past.
Hydraulic gradient	The change in static head per unit of distance in a given direction.
Hydrocarbon	Any organic compound, gaseous, liquid or solid, consisting only of carbon and hydrogen.
Hydrology	The study of rainfall and surface water run-off processes.
Hydrogeology	The study of subsurface water in its geological context.
Impact	The effect of human-induced action on the environment.
Infiltration	The process of surface water soaking into the soil.
Infrastructure	Supporting installations and services supplying the needs of a project.
Interchange	A grade separation of two or more roads with one or more interconnecting carriageways or ramps.
Introduced species	Plants and animals not native to Australia and known or thought to have been brought here by humans.
Isolated find	A single stone artefact, not located within a rock shelter, and which occurs without any associated evidence of Aboriginal occupation within a specified radius.
L/s	Litres per second
L_{A10}	The noise level which is exceeded for 10 % of the sample period. During the sample period, the noise level is below LA10 level for 90% of the time. The LA10 is a common noise descriptor for environmental noise and road traffic noise.
L_{A90}	The noise level which is exceeded for 90% of the sample period. During the sample period, the noise level is below LA90 level for 10% of the time. This measure is commonly referred to as background noise level.
L_{Aeq}	The equivalent continuous sound level. This is the energy average of the varying noise over the sample period and is equivalent to the level of constant noise which contains the same energy as the varying noise environment. This measure is also a common measure of environmental noise and road traffic noise.
Landform	A specific feature of the landscape or the general shape of the land.
Lens	Geologic deposit or body bounded by at least one curved, converging surface, giving it a lens-like appearance.
Level of Service (LoS)	A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers.
Lithology	Science of the nature and composition of rock.
Local road	A road or street used primarily for access to abutting properties.

Longitudinal section	The section drawn along the length of the route.
µg/m^3	micrograms per cubic metre
µs/cm	microsiemens per centimetre
micron	Unit of measure-one millionth of a metre.
mg/L	milligrams per litre
Mitigation measures	Measures put in place to reduce an impact.
ML/day	Megalitres per day
Modelling	Use of mathematical equations to simulate and predict real events and processes.
Monitoring	Regular measurement of components of the environment to understand their condition and establish if necessary standards are being met.
Native	Local inhabitant of a defined place.
NPWS	NSW National Parks and Wildlife Service (now part of the Department of Environment and Conservation)
Overbank deposit	A flood plain deposit.
Palaeochannel	An ancient river bed, often filled with more recent sediments.
Perched water	Unconfined groundwater separated from an underlying body of groundwater by an unsaturated zone and supported by an aquitard or aquiclude.
Permeable material	Material that permits water to move through it at perceptible rates under the hydraulic gradients normally present.
pH	A measure of acidity or alkalinity of a solution, numerically equal to 7 for neutral solution, increasing with increasing alkalinity and decreasing with increasing acidity. Originally stood for the words potential of hydrogen.
Porosity	The percentage of bulk rock, which is void space between rock particles.
Recharge	Addition of water to the zone of saturation; also the amount of water added.
Recovery	The difference between the observed water level during the recovery period after cessation of pumping and the water level measured immediately before pumping stopped.
Receptor/receiver	An environmental modelling term used to describe a map reference point where the impact is predicted. A sensitive receptor is a home, work place, school or other place where people spend some time. An elevated receptor is a point above ground level.
Rehabilitation	Preparation of a final landform following extraction and its stabilisation with vegetation.
Remnant vegetation	Native vegetation remaining after widespread clearing has taken place.
Residual drawdown	The difference between the observed water level during the recovery period following pumping and the pre- pumping water level.
Resource	Potentially usable material in a defined area that can be economically extracted.

RL	Reduced level, usually in metres to an arbitrary datum.
RTA	NSW Roads and Traffic Authority
Run-off	The proportion of precipitation discharged through surface water systems.
Salinisation	The process whereby soluble salts accumulate within the soil
Sand	Sediment comprising particles ranging between 0.063mm and 2mm.
Sandstone	A fine grained rock of sedimentary origin composed primarily of sand-sized particles (0.06 to 2 mm).
Saturated zone	That part of an aquifer in which all voids are filled with water under pressure greater than atmospheric pressure.
Screen	A type of lining tube or casing of special construction, with apertures or slots designed to permit the flow of water into a well while preventing the entry of aquifer or filter pack material.
Sedimentation basin	An area where runoff is ponded to allow sediment to be deposited. The longer the period that the runoff is held, the smaller the size of the sediment deposited. Such basins have to be regularly cleaned.
Shale	A laminated sediment in which the constituent particles are predominantly in the clay size.
Silt	Sediment comprising most particles between 0.004mm and 0.063mm.
Siltstone	A fine grained rock of sedimentary origin composed primarily of silt-sized particles (0.004 to 0.06 mm).
Slopewash	Sediment transport by overland flow, as a muddy suspension
Soil Creep	The slow, gradual movement of a hill's upper layers caused by the pull of gravity on loose stones, gravel, and soft topsoil.
Species	Taxonomic grouping of organisms that are able to interbreed with each other but not with other species.
Stakeholder	An individual or group with an interest in the proposal.
Stockpile	Mound used to store material.
Storage coefficient	The volume of water an aquifer releases from or takes into storage per unit surface area per unit change in head.
Stormwater	Rainwater which runs off catchments following rain events. The untreated water is carried into creeks, rivers and lakes.
Terrestrial	Relating to the land as distinct from air or water.
Tertiary	Geologic time at the beginning of the Cainozoic era, 65 to 2 million years ago, after the Cretaceous and before the Quaternary.
Topography	The physical relief and contours of the area.
Topsoil	The surface layer of a soil profile containing most of the organic material and viable life forms and seeds.
Total Dissolved Solids (TDS)	The dissolved mineral content of groundwater, commonly expressed in milligrams/Litre.
Total Suspended Solids (TSS)	A measure of suspended solids concentrations in a waterbody and expressed in terms of mass per unit of volume.
Tributary	A stream or river that flows into a larger stream or river.

TSC Act	Threatened Species Conservation Act (NSW)
Turbidity	A measure of light penetration through a water column containing particles of matter in suspension.
Unconfined aquifer	An aquifer in which the upper boundary of the saturated zone is at atmospheric pressure.
Unsaturated zone	That part of an aquifer between the land surface and water table.
Waterlogging	Soaking of land caused by a rising water-table or excessive irrigation.
Water quality	Degree or lack of contamination.
Water table	The surface of saturation in an unconfined aquifer at which the pressure of the water is equal to that of the atmosphere.
Well	A hole sunk into the ground and completed for the abstraction or injection of water or for water observation purposes. Generally synonymous with bore.
1 in 100 Year Flood Level	The flood which occurs on average once every 100 years. Also known as the 100 year Average Recurrence Interval of a flood.

1 Introduction

Chapter 1 introduces the Hume Highway Duplication Project and the Sturt Highway to Tarcutta Proposal. It provides an outline of the project, its purpose and the structure of the Environmental Assessment report

1.1 Overview

The Roads and Traffic Authority NSW (RTA) is proposing to upgrade five sections of the Hume Highway from single carriageway to a four-lane dual carriageway in the area from the Sturt Highway junction south to Albury. The proposal is called the Hume Highway Duplication.

The sections to be upgraded are located in the area from approximately 37 kilometres south of Gundagai to approximately 41 kilometres north of Albury as listed below and shown in **Figure 1-1**.

- **Sturt Highway to Tarcutta** – from approximately 37 kilometres south of Gundagai to approximately 42 kilometres south of Gundagai, totalling approximately 6 kilometres in length.
- **Kyeamba Hill** – from approximately 67 kilometres south of Gundagai to approximately 76 kilometres south of Gundagai, totalling approximately 9 kilometres in length.
- **Little Billabong** – from approximately 85 kilometres south of Gundagai to approximately 93 kilometres south of Gundagai, totalling approximately 8 kilometres in length.
- **Yarra Yarra to Holbrook** – from approximately 98 kilometres south of Gundagai to approximately 110 kilometres south of Gundagai, totalling approximately 12 kilometres in length.
- **Woomargama to Mullengandra** – from approximately 131 kilometres south of Gundagai to approximately 141 kilometres south of Gundagai, totalling approximately 10 kilometres in length.

This document comprises the Environmental Assessment for the Little Billabong section of the Hume Highway Duplication and has been prepared in accordance with the process and requirements of Part 3A of the *Environmental Planning and Assessment Act 1979* (the *EP&A Act*).

Additional duplication works currently underway or with existing planning approval on the Hume Highway include the Albury Wodonga Hume Freeway works between Table Top and Mullengandra, the Coolac bypass and Sheahan Bridge, Gundagai. Following completion of these works and the five proposed sections of Duplication the only parts of the Hume Highway not dual carriageway will be those sections through the towns of Tarcutta, Holbrook and Woomargama. Future development of bypasses of these towns to complete full dual carriageway standard between Melbourne and Sydney will be the subject of a separate environmental planning assessment and approval process.

1.2 Hume Highway Duplication development history

There have been longstanding community expectations for the completion of duplication of the Hume Highway to provide a continuous high standard dual carriageway highway between Sydney and Melbourne. Dual carriageways were completed in Victoria in December 2005.

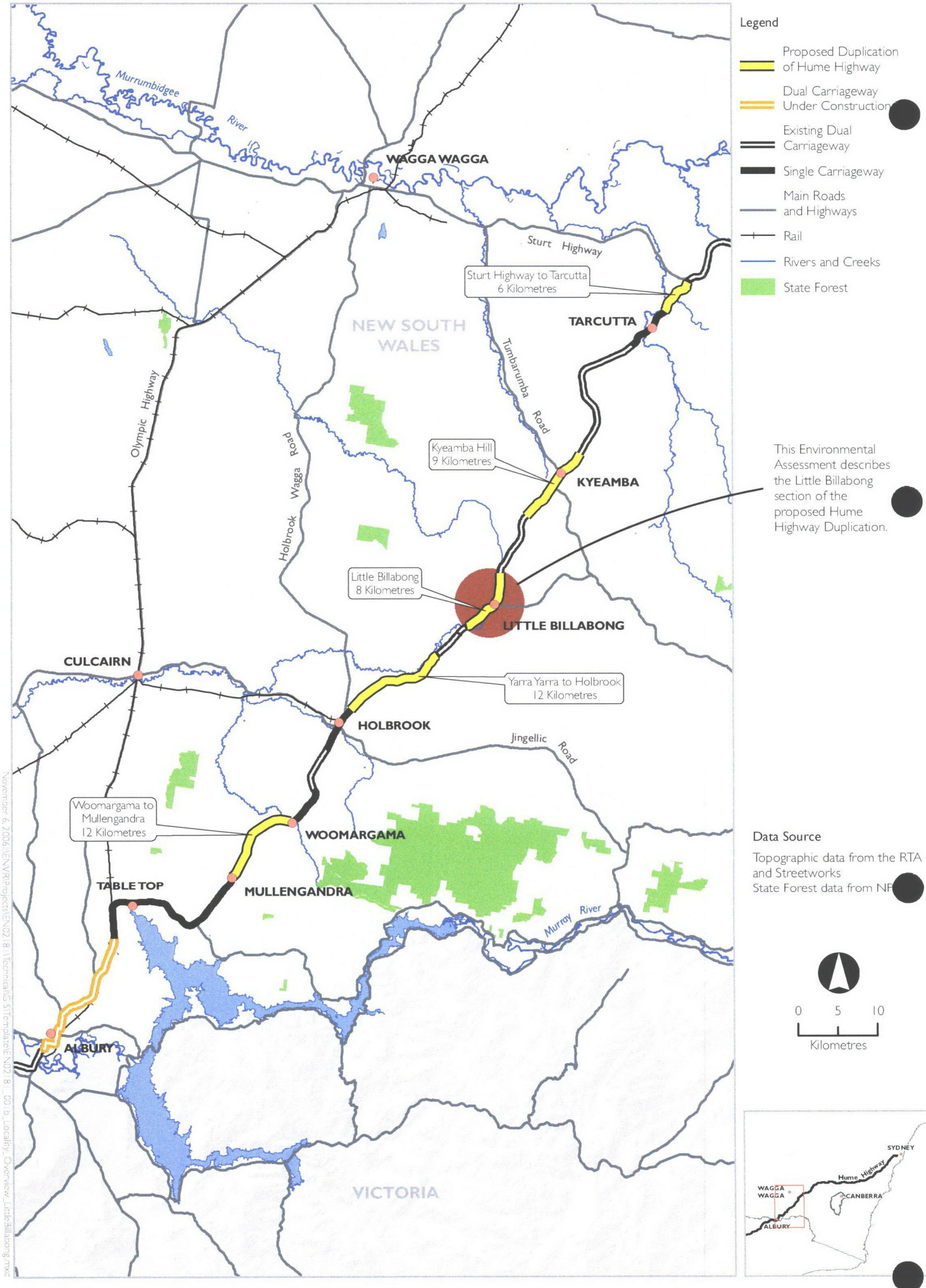

Figure 1-1 Overview of the Hume Highway Duplication

In 2004, the RTA completed the Hume Highway Strategic Planning Study to assess the long-term improvement strategy for the Highway between the Sturt Highway and Table Top. This study identified the need to complete the duplication of the Hume Highway in NSW.

In the May 2006 Federal Budget, $800 million was provided to the NSW Government through a Memorandum of Understanding between the Australian and NSW Governments to accelerate duplication of the five single-carriageway sections of the Hume Highway listed in Section 1.1.

Subject to receipt of project approval, the works are due to commence in 2007 and be completed by December 2009.

1.2.1 Context of the Environmental Assessment

Part 3A of the *Environmental Planning and Assessment Act 1979* (NSW) applies to the Hume Highway Duplication. The Minister for Planning has required a concept plan to be prepared for the Hume Highway Duplication. The Minister has also declared the Hume Highway Duplication to be a "critical infrastructure project".

The RTA requires the approval of the Minister for Planning for both the concept plan for the Hume Highway Duplication and the project application for the Proposal before the RTA may commence construction of the Proposal. The RTA has lodged a concept plan for the Hume Highway Duplication and project applications with the Director-General of Planning for each of the five sections of the Hume Highway Duplication included in the Proposal.

Director-General's Requirements have been issued for preparation of the concept plan for the Hume Highway Duplication and for the preparation of the Environmental Assessment for the Proposal. These are attached in **Appendix A**.

The assessment and approval process under Part 3A is presented in more detail in chapter 6.

1.3 Structure of the Environmental Assessment

The environmental assessment (EA):

- Describes the Little Billabong section of the proposed Hume Highway Duplication (the Proposal).
- Provides a description of the existing environment and an assessment of potential environmental impacts.
- Addresses the cumulative impacts associated with construction and operation of all five proposed sections of dual carriageway listed in Section 1.1.
- Describes the management and mitigation measures that the RTA would employ to minimise the environmental impacts of construction and operation.

The EA is set out according to the following structure:

- Introduction – summarises the Proposal and provides an overview of the assessment, the need and strategic context and existing environment (Chapters 1, 2 and 3).
- Proposal Description – provides a description of the design and construction processes of the Proposal (Chapter 4).
- Consultation and Statutory Process – outlines stakeholder consultation and details the NSW and Commonwealth statutory requirements (Chapters 5 and 6).
- Environmental Assessment – identifies the environmental issues and assesses impacts, and provides mitigation and management of those issues (Chapters 7, 8 and 9).

- Statement of Commitments – outlines the objectives and actions for managing environmental impacts of the Proposal (Chapter 10).
- Conclusion – justifies the Proposal and summarises the environmental issues (Chapter 11).

A number of appendices are attached, including the NSW Minister for Planning's Order bringing the project under Part 3A of the *EP&A Act*, the Director-General of Planning's formal Environmental Assessment requirements (DGR's), technical working papers and supporting documentation associated with the assessment of the potential environmental issues.

In accordance with the objectives and requirements of Part 3A of the *EP&A Act*, all potential environmental issues identified during the Proposal's planning and assessment are addressed in this document.

Those factors that are considered to be key issues were identified in the DGR's (see **Appendix B**) and these are described and assessed in detail in Chapter 8. A checklist of the DGR's with a cross-reference to the relevant section or sections of the Environmental Assessment is included in **Appendix C**.

Other issues which can be managed by standard management and mitigation measures widely used in the construction industry are described and assessed in Chapter 9.

2 Strategic context and need for the Proposal

Chapter 2 identifies the relationship of the Proposal to strategic infrastructure planning in both the National and State context and provides the need for and objectives of the Proposal.

2.1 NSW State Infrastructure Strategy

The State Infrastructure Strategy - New South Wales 2006-07 to 2015-16 (NSW Treasury 2006) provides strategic direction for planning and delivery of infrastructure in NSW. The *State Infrastructure Strategy* (*SIS 2006*) commits the NSW Government to funding of capital expenditure, links the planning embedded in the Sydney Metropolitan Strategy and other regional strategies with the budget, and delivers on identified infrastructure commitments. The *SIS 2006* identifies investment priorities for transport, lists roadwork initiatives planned throughout NSW and acknowledges a need for additional funding to be sourced from the Federal Government. The Hume Highway Duplication has been listed within the SIS transport infrastructure plans for the next four years and acknowledges the $800 million contribution from the Federal Government to accelerate duplication by 2009.

2.2 Australian Government AusLink program

2.2.1 AusLink White Paper

The AusLink White Paper: *Building Our National Transport Future* (the White Paper) is the Federal Government's formal policy statement on land transport that identifies national objectives for the AusLink investment program. AusLink is designed to achieve better national land transport planning, funding and investment decision-making.

The AusLink investment program seeks to promote sustainable national and regional economic growth, development and connectivity by contributing to development of an integrated National Network which:

- Improves national and interregional connectivity for people, communities, regions and industry.
- Improves national, interregional and international logistics.
- Enhances national, interregional and international trade.
- Enhances health, safety and security.
- Is consistent with the obligation to current and future generations to sustain the environment.
- Is consistent with viable, long-term economic and social outcomes.
- Is linked effectively to the broader transport network.

One of the key components of the AusLink process is the development of a strategy for each corridor of the AusLink National Network. The *Sydney-Melbourne Corridor Strategy* (currently in draft form and due for final release in mid-2007) identifies the Hume Highway as an essential road link that services freight and passenger flows between the economies of Sydney, Melbourne and Canberra, regional centres such as Albury-Wodonga, and interstate through traffic to and from South Australia and Queensland.

2.2.2 Sydney-Melbourne corridor strategy

The Sydney-Melbourne corridor is vital to the Australian economy. It is the busiest inter-capital road corridor with approximately 40 percent of long-distance road freight movements on the National Network using the Hume Highway for at least part of their journey. Interstate freight between Sydney and Melbourne is forecast to increase by nearly 70 percent over the next 20 years, and by 2025 it is expected that 5,000 to 6,000 heavy vehicles will be moving along the Hume Highway each day.

The short-term priorities (to 2013/2014) for the Sydney-Melbourne corridor target five strategic issues:

- Road safety, especially on the unduplicated section of the Hume Highway.
- The impact of urban sprawl on congestion and road transport efficiency.
- Managing road use to achieve better performance from existing infrastructure.
- The condition of road and rail infrastructure.
- The competitiveness of rail transport for interstate non-bulk freight.

These short-term priorities specifically include completing the duplication of the Hume Highway by 2012. Other short-term priorities include improved road safety, especially regarding improved fatigue management, and management of local access intersections with the Hume Highway.

The AusLink investment of $800 million announced in the 2006 Federal Budget will accelerate the Hume Highway Duplication, and allow completion of 67 kilometres of duplication by 2009. A further 20 kilometres of duplication, the bypasses of Tarcutta, Holbrook and Woomargama, are to be completed by 2012. These bypasses are not included in the Environmental Assessment and will be the subject of separate assessment and approval processes.

2.3 Hume Highway Strategic Planning Study

The *Hume Highway Strategic Planning Study* (Connell Wagner 2004) focuses on approximately 120 kilometres of the Hume Highway from its connection with the Sturt Highway (north of Tarcutta) to the Olympic Highway (north of Albury).

The study comprises an analysis of existing and future transport needs (road and rail) in this section of the highway to identify future upgrade strategies.

The study indicates that the potential achievable shift of freight from the Hume Highway to the rail network would only be marginal (in terms of the total road freight transport task) even with relatively high levels of investment in rail infrastructure. Accordingly, the study concluded that road network improvements could be justified at any level of rail infrastructure investment.

Following the analysis, the remainder of the study focuses on Hume Highway upgrade requirements and timing, based on identifying existing and future deficiencies along the highway. Recommendations from the study fall into two broad categories:

- Improvements required in the short term to address identified safety deficiencies.
- Longer-term improvements to address a shortfall in capacity and associated performance (level of service) issues.

The longer-term requirements involving upgrading the single-carriageway sections to dual carriageways are identified as being necessary by 2010 or thereabouts.

Performance of the upgraded highway (from single to dual carriageway) is predicted to be acceptable until 2021 and beyond, with a maximum level of service of C estimated for 2021 (refer to **Table 2-1** for a description of Levels of Service). Based on the traffic safety analysis undertaken, the dual-carriageway sections together with a wide median would substantially reduce the accident rate and accident severity, compared with the existing single-carriageway sections.

2.4 Proposal need and justification

The Hume Highway is the main freight corridor between Melbourne and Sydney. Community expectation regarding the completion of the Hume Highway Duplication to provide a continuous, high-standard dual carriageway between Sydney and Melbourne has existed for some time. Dual carriageways were completed in Victoria in December 2005, increasing the focus on the remaining single-carriageway sections in NSW.

The completion of the Hume Highway Duplication would provide consistent conditions for road users, and improved level of service, road safety and freight efficiency. It would also accommodate the forecast growth in traffic on the highway. These conditions are further considered in the following section.

2.4.1 Level of service

Level of Service (LoS) is a qualitative measure describing the perception by motorists or passengers of operational conditions within a traffic stream. A LoS definition generally describes these conditions in terms of factors such as speed and travel time, freedom to manoeuvre (e.g. overtaking), traffic interruptions, comfort and convenience, and safety. In general, there are six levels of service ranging from A (the best operating conditions) to F (the worst operating conditions). The LoS definitions from A to F are described in **Table 2-1**.

Table 2-1: Level of Service definitions

LoS	Description
A	Good
B	Good with minimum delays and spare capacity
C	Satisfactory with spare capacity
D	Satisfactory but operating near capacity
E	At capacity and incidents will cause delays
F	Unsatisfactory and requires additional capacity

Source: *Austroads Guide to Traffic Engineering Practice Part 2 – Roadway Capacity*

As part of the *Hume Highway Strategic Planning Study* (Connell Wagner 2004), LoS calculations were undertaken based on 2001 traffic volumes and projected to 2006, 2016 and 2021 to reflect current and future performance. In 2006, the dual-carriageway sections of the Hume Highway operate at LoS A, with significant capacity for traffic growth at this level. The single-carriageway sections of the highway operate as high as LoS B for eight hours per day (2am to 10am) and as low as LoS D for up to five hours per day (8pm to 1am) with an average operation of LoS C. The reduction to LoS D corresponds to the peak

period for heavy vehicles and reflects the high night-time percentage of heavy vehicle traffic on the Hume Highway.

The threshold for upgrading from single carriageway to dual carriageway is the point at which LoS deteriorates from C to D for a significant period. As this is already occurring on the Hume Highway, immediate upgrading of the highway is justified. With no upgrade, by 2016 the single carriageway sections of the Highway would deteriorate to LoS E during the period 9pm to 1am, with an average weekday LoS D. In 2021, this would further deteriorate to LoS E over a longer period (7pm to 2am), with an average of LoS D.

2.4.2 Road safety

The crash rates in terms of travel per 100 million vehicle kilometres travelled (Mvkt) on the single-carriageway sections of the Hume Highway between the Sturt Highway and Table Top are currently higher in all categories (fatal, injury and total), than crash rates in the adjacent dual-carriageway sections, as indicated in **Table 2-2**.

Table 2-2: Crash rates for the Hume Highway, Sturt Highway to Table Top

Road section	Crash rate (per 100 Mvkt)		
	Fatal	Injury	Total
Dual-carriageway sections Sturt Highway to Table Top	1.09	7.9	24.6
Single-carriageway sections Sturt Highway to Table Top	2.01	11.1	28.2
Combined Sturt Highway to Table Top	1.71	10.6	27.0

Source: *Hume Strategic Planning Study, prepared for the RTA (Connell Wagner 2004)*

The fatal crash rate on the single carriageway is approximately 85 percent higher than the dual carriageway, and the injury crash rate on the single carriageway is approximately 40 percent higher than on the divided carriageway. The proportion of overall accidents that involve either injuries or fatalities is 15 percent higher in the single-carriageway sections.

Within the overall averages for the single carriageway between Sturt Highway and Table Top there is a marked variation in crash rate between individual sections as shown in **Table 2-3**.

Table 2-3: Crash rates for single carriageway between Sturt Highway and Table Top

Road section	Crash rate (per 100 Mvkt)		
	Fatal	Injury	Total
Sturt Highway to Tarcutta	2.3	20	55
Kyeamba Hill	1.3	18	49
Little Billabong	4.7	11	36
Yarra Yarra to Holbrook	0.6	10	25
Woomargama to Table Top	2.5	8	18

Source: *Hume Strategic Planning Study, prepared for the RTA (Connell Wagner 2004)*

Road safety is a significant community concern. Based on these measures, some sections of single carriageway have significantly higher crash rates than the total Hume Highway as a route. As such, the proposed improvements are justified on the grounds of road safety.

2.4.3 Freight efficiency

Road freight on the Hume Highway currently moves between Sydney and Melbourne overnight, predominantly between 8.00pm and 1.00am. There is a desire to reduce travel

times and provide door-to-door delivery. This is severely affected by the reduced LoS on the existing single carriageways resulting from:

- Lower speed limits.
- Traffic congestion.
- Lack of overtaking opportunities.

There is a general industry desire to adopt higher efficiency freight vehicles, namely, B-double trailers. Further consideration and acceptance of such vehicles on the Hume Highway is dependent, amongst other matters, on the provision of high standard dual-carriageway conditions.

The Hume Highway Duplication has the potential to significantly improve freight competitiveness (against rail freight) for existing vehicles and allow further consideration of B-double trailers.

2.5 Project objective

The primary objective of the Hume Highway Duplication is to duplicate the existing single-carriageway sections of the Highway between its intersection with the Sturt Highway to north of Albury (excluding the single carriageway sections through Tarcutta, Holbrook and Woomargama) by 2009.

Additionally, the Hume Highway Duplication adopts the objectives set for the AusLink National Network which support national economic growth by developing sustainable transport solutions that:

- Increase its infrastructure handling capacity and efficiency.
- Improve its safety and security.
- Improve transport productivity on its nationally strategic and export-oriented freight corridors.
- Improve the reliability of travel on interstate and interregional corridors.
- Are consistent with viable, long-term economic and social outcomes, and with the obligation to current and future generations to sustain the environment.

The Proposal at Little Billabong is an essential component to the delivery of the overall project objectives.

2.6 Development options

Three development options were considered:

- Do nothing.
- New dual carriageway.
- Hume Highway Duplication.

Each option is discussed in the following section. The Hume Highway duplication option has been selected as the preferred option and was the subject of the five Major Project Applications submitted to the Department of Planning on 12 September 2006.

2.6.1 Do nothing

The implications of no action or deferral of the Hume Highway Duplication include declining traffic and safety conditions and deteriorating community amenity along the highway between south of the Sturt Highway and Mullengandra. Predicted traffic growth would further exacerbate the problems currently experienced within the existing road and traffic environment.

Without duplication, the predicted traffic growth would increasingly expose the deficiencies of the existing road environment between the Sturt Highway and Mullengandra over the forecast period. Specific consequences would include:

- The deterioration of traffic conditions to unacceptable levels.
- A likely increase in vehicle crashes.
- An increase in travel times.
- Inconsistency in road conditions along the Hume Highway.
- Failure to achieve the project objectives and the broader objectives of existing planning and transport strategies, in particular the Australian Government's AusLink White Paper and the NSW State Infrastructure Strategy.

2.6.2 New dual carriageway

Providing a new dual carriageway over the full 45 kilometre project length would meet road safety, traffic and freight efficiency, and community expectation objectives but would require a significantly increased investment and may delay completion and provision of the road user benefits.

A new dual carriageway would also involve higher impacts on both biodiversity and agricultural and residential lands (through increased acquisition requirements and potential property severance).

In some instances the existing Hume Highway would become redundant as the major transport corridor but would need to be retained within the local road network to provide local connectivity. This would increase the overall road network with consequent increased long-term maintenance costs.

2.6.3 Hume Highway Duplication

The existing single-carriageway sections of the Hume Highway are of a sufficient standard over significant lengths to continue to operate as one carriageway of a dual-carriageway highway. Accordingly, dual carriageways could be delivered by providing one new carriageway beside the existing highway. However, minor improvements would be required over short lengths of the existing highway to correct deficiencies or provide upgraded facilities (grade separation of intersections).

Duplicating the highway would deliver equivalent benefits to the providing new dual carriageways and would also:

- Maximise the use of an existing asset with minimal increase in the total road network.
- Reduce land acquisition and agricultural impacts.
- Minimise construction resource requirements.
- Minimise biodiversity impacts.
- Facilitate connection to the existing dual-carriageway sections.

- Minimise cost.
- Maintain the existing and recognised road transport corridor.

On these grounds duplication of the existing highway, with minor improvements to the existing highway where appropriate, was selected as the preferred option.

3 Overview of the study area

Chapter 3 provides an overview of the existing environment of the study area for the Proposal, including the identification of key natural features and built attributes. The study area is considered to be the area which may be directly or indirectly affected by the Proposal.

The primary focus of the investigations has been on an area approximately 200 metres either side of the existing highway centreline. However, it is recognised that the impacts of some aspects of the Proposal e.g. hydrology and water quality, traffic and social aspects, may extend beyond this area. Therefore, where applicable the area of assessment has been extended to cover both local and regional aspects.

3.1 Location

The study area is located within the southwest slopes of NSW within the Greater Hume Shire local government area (LGA). The Proposal is located in the on the Hume Highway approximately 371 kilometres south of Sydney and between 85 kilometres to 93 kilometres south of Gundagai. **Figure 3-1** illustrates the location of the Proposal within a regional context. **Figure 3-2** provides a locality plan and identifies important local features within the study area.

Figure 3-1 Regional context of the Proposal

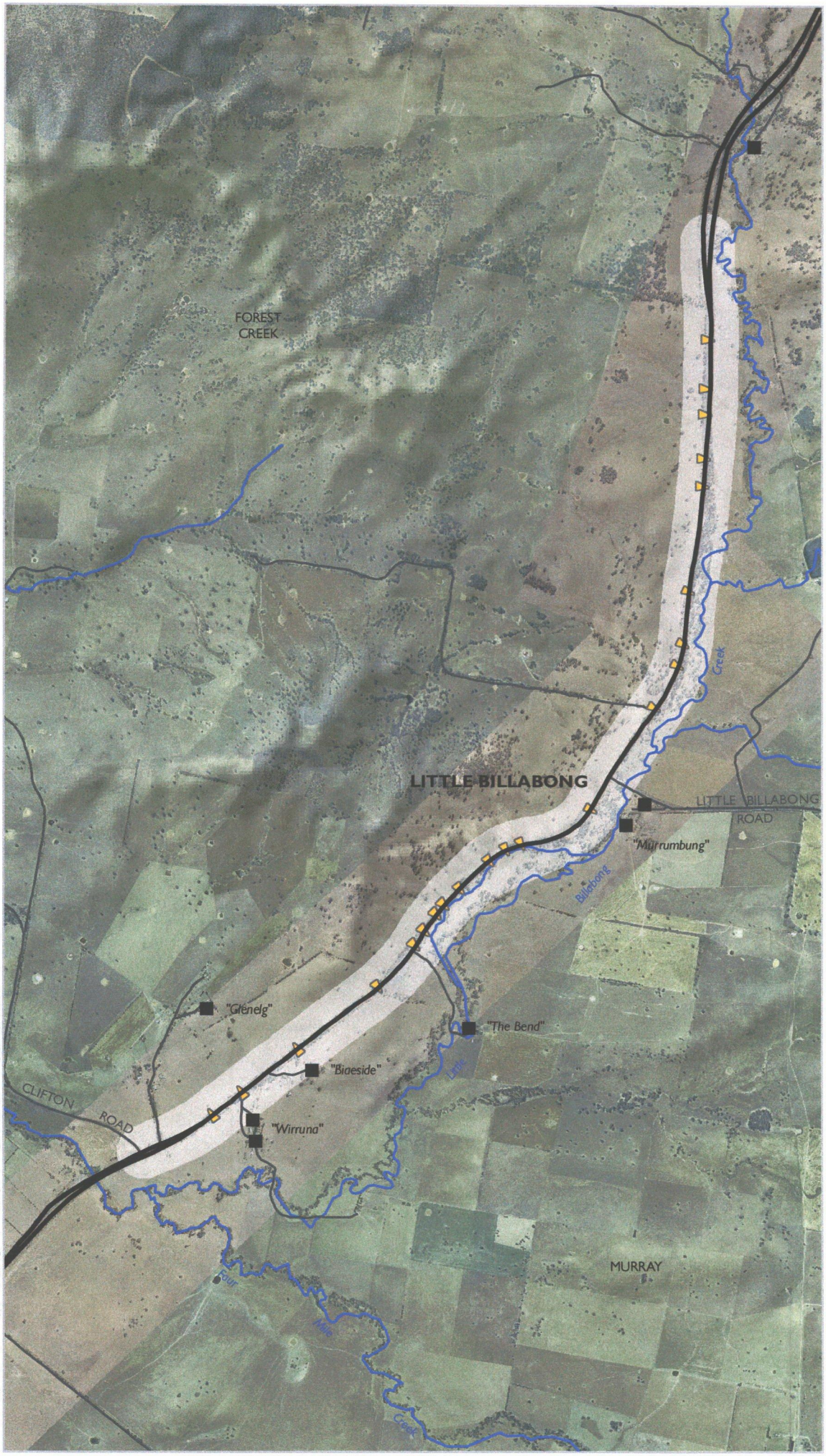

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Figure 3-2 **Study area locality plan**

3.2 Landform, geology and soils

The highway corridor traverses low hills, valleys and alluvial plains typical of the western slopes of the Great Dividing Range. The existing highway is generally located on lower footslopes, however in places it crosses short sections of floodplain.

The metamorphic rocks which underlie most of the road corridor create rows of low hills aligned north and north east in accordance with the bedrock layering. The highway within the study area traverses a number of minor slopes with elevations ranging from about 340 metres Australian height datum (AHD) in the northern section to 298 metres AHD to the south. The study area is undulating but generally slopes moderately down from north to south. In the vicinity of the Little Billabong Road intersection the highway traverses a rise at an elevation of approximately 335 metres AHD.

The northern section of the highway passes through a number of cuttings along its western boundary, the most significant being immediately south of the Little Billabong Road intersection where the highway passes through a deep vertical cutting (approximately 15m) on a small radii western bend.

The soil landscape lies within the Tarcutta soil sheet area which is as yet unpublished and unavailable for this study. However, extrapolation of the neighbouring Wagga Wagga 1:100,000 soils sheet provides a good indication of the soil landscapes likely to be found in the study area. The soil landscapes most relevant to the Proposal include:

- Colluvial soils of the lower gradient footslopes - These are stony clays which have been moved downslope by soil creep and slopewash (sediment transport by overland flow, as a muddy suspension), but may include a proportion of windblown red clay ('parna') and higher terrace alluvium. Because of their topographic situation, these soils have a tendency to become waterlogged and salinised in places. These soils are the most commonly encountered subgrade materials along the road.
- Residual soils of the upper slopes, hill crests and saddles - These are similar to the colluvial soils, but generally stonier and shallower (0.3-0.6 metres below natural ground level), with weathered bedrock beneath. Their main characteristic relevant to the Proposal is that they may act as intake areas for shallow groundwater, which may cause waterlogging further downslope.
- Alluvial soils of the main floodplains - The surface soils are predominantly silts and clays, with some sand. Soil profiles are relatively deep (0.6-1.2 metres) and may be prone to flooding, waterlogging and shrink-swell behaviour.

3.3 Climate

The nearest NSW Bureau of Meteorology monitoring station to the study area is located at Murraguldrie State Forest (station 072035) approximately ten kilometres north east of this section of the Proposal. Climate within the region can be described as dry and mild/temperate. Historical data regarding local rainfall and temperature patterns from the online metrological database (www.bom.gov.au) is summarised in the following section.

January is the hottest month with average daily maximum temperatures of 29.7 degrees Celsius and July the coldest month with average daily minimum temperatures of 1.6 degrees Celsius. Temperatures can occasionally fall below zero at night during the winter months.

Rainfall is variably distributed throughout the year, with an average annual rainfall of 891.7 millimetres. On average, rainfall peaks in July, August and September, contributing 95.0

millimetres, 95.1 millimetres and 91.0 millimetres of rainfall, respectively. However, the highest recorded rainfall event occurred in autumn where over 300 millimetres of rain fell during the month of May. The driest months occur between December, January and February with between 50.0 millimetres and 60.0 millimetres of rainfall falling on average during these months. Since 2000, the area has experienced extended drought conditions, with the last 36 months to September 2006 showing serious to severe rainfall deficiencies based on rainfall percentiles (BOM, 2006).

High humidity recorded during the winter morning hours contributes to the frequent incidence of fog which occurs most often between the months of May and August.

3.4 Water quality and hydrology

Little Billabong Creek is situated within the Upper Billabong Creek catchment and drains approximately 300,000 hectares between the Murrumbidgee and Murray River catchments. Little Billabong Creek is a major tributary of Billabong Creek, the major drainage line within the catchment, which ultimately drains into the Murray River (Baker et al. 2001).

Little Billabong Creek is the main watercourse within the study area and it originates within foothills either side of the highway at the northern end of the study area. Little Billabong creek flows south for approximately 30 kilometres before its confluence with Billabong Creek, south of the Clifton Road intersection with the highway. It runs along the entire length of the eastern boundary of the Proposal in a generally north – south alignment. Approximately mid-way through the study area, 87 kilometres from Gundagai, Little Billabong Creek is joined by Lunts Creek flowing from the east, which contributes greatly to the water volumes and creek flows south of this point.

Little Billabong Creek is crossed by the highway at two locations, in the north and south of the study area. The rock formations to the west of the alignment contain numerous springs and water seepage points that drain east into the creek. As a consequence, the highway is crossed by numerous small drainage channels, accommodated in the existing highway design via a combination of pipe and box culverts.

A severe drought is currently affecting the study area and this has resulted in many creeks becoming ephemeral, with running water present only during flash flood events. The creeks in the study area are currently under hydrological stress due to the drought conditions and extraction for the purposes of stock watering, domestic uses and irrigation.

Water quality in the Little Billabong Creek system is influenced largely by the surrounding agricultural land uses, specifically grazing. Searches for available literature on water quality data in the study area identified no relevant information. This is possibly due to the fact that the creek originates within the study area and water quality sampling would more commonly be undertaken in the lower reaches of the watercourse system.

3.5 Groundwater

The Upper Billabong Creek catchment covers approximately 300 square kilometres and contains a dual aquifer system. The major aquifer system in the catchment, in terms of groundwater transmissivity, is the alluvial sediments of the Tertiary Lachlan and Cowra Formations. This is a regional scale aquifer system that dominates the lower half of the catchment. The Lachlan Formation generally acts as a confined aquifer with thick clay layers separating sand and gravel layers which contain 'fresh' water (Baker *et al.* 2001).

Alluvial aquifers are the dominant groundwater system within the catchment with groundwater flowing from east to west. Groundwater recharge in the alluvial aquifer system occurs mainly through direct rainfall infiltration, from streams, and from the granites and Palaeozoic bedrock where the sands and gravels of the Lachlan Formation directly overlie these rocks (Baker *et al.* 2001).

Groundwater levels in most bores show a rising groundwater trend, which has tapered off in the last 10 years, presumably because of a series of dry years. Less than 1% of the catchment area has been interpreted to have surface expression of dryland salinity. Nearly half of this area is associated with waterlogging caused by the Hume Highway (Baker *et al.* 2001).

3.6 Air quality

The Hume Highway at Little Billabong traverses through a sparsely populated rural area, dominated by agricultural and grazing land, with State Forest areas to the east and south. Consequently, while air quality monitoring has not been previously undertaken, air quality in the study area is anticipated to be good given the rural nature of the area and the absence of polluting industries in the surrounding areas. Some contributors to atmospheric pollution in the study area typically include:

- Intermittent wheel dust and exhaust emissions from vehicles travelling on the local road network and the existing Hume Highway.
- Dust from agricultural land activities such as land clearing, harvesting, movement of livestock and ploughing.
- Sporadic bushfire.
- Burning of crop stubbles and pastures.

These contributions are considered to have a negligible impact on air quality in the study area. During April and May a visible smoke haze from the burning of agricultural residues is present through out the study area. Dust storms are occasional in the summer months dependent on weather conditions in areas west of Hay. Vehicle emissions from the highway are likely to be low given the relatively low average number of vehicles using the route (less than 10,000 per day) and the high rate of dissipation that can be expected in this environment. Air quality is expected to be well within air quality goals established by the NSW Department of Environment and Conservation (DEC).

3.7 Noise

The study area is located in a rural environment that has a low to moderate ambient noise level. The dominant ambient noise source in areas close to the existing highway is road vehicle noise. Road traffic noise extends away from the road corridor for some distance with a relatively steady and continuous flow of traffic. Road traffic noise would be noticeable at varying distances from the highway depending on topography and climatic conditions. The high rock formation and highway cuttings at Little Billabong are likely to act as noise attenuation barrier for road traffic to any receivers to the west. Conversely, this cutting would also act as reflector for any receivers located to the east.

Typically, road noise would be noticeable at distances up to several hundred metres from the road. Where natural topographic features such as hills and valleys occur, a reduction in noise would be apparent as the result of the localised shielding of the traffic stream.

There are four private residences located adjacent to the existing highway. The closest residence is located within 100 metres of the current road edge at the southern end of this

study area. Two other residents are located over 300 metres east of the highway at the intersection with Little Billabong Road (MR 284). There are no other noise sensitive land uses such as schools or churches in the study area.

3.8 Biodiversity

The study area comprises a mix of low undulating hills and floodplains associated with the Little Billabong Creek, in addition to prominent granitic outcrops to the west of the highway. The study area has a long history of vegetation clearing associated with agricultural and rural settlements. The vegetation that does remain exists as a fragmented mosaic of small woodland remnants, the larger of which are preserved in Travelling Stock Reserves (TSR), linear roadside reserves and riparian strips on private land.

A number of broad fauna habitat types occur in the study area, namely: dominant woodland and riparian habitats with native grasslands, rocky hillslopes, and freshwater habitats (dams, creeks and wet depressions). Rocky hillslopes are also a component of the woodland habitats, as they are typically covered with a sparse canopy of trees. Farm dams are scattered throughout the lower lying areas.

The vegetation within the immediate vicinity of the road is comprises sparse to dense native remnant woodland and a groundcover of introduced grasses and weeds within the road reserve. Cleared agricultural land with scattered mature trees dominates within the adjoining private properties.

The remnant native vegetation within the road reserve consists of a form of Eucalyptus woodland that is dominated by White Box (*Eucalyptus albens*), Yellow Box (*Eucayptus melliodora*) and Blakely's Red Gum (*Eucalyptus Blakelyi*), a woodland community commonly identified as Box-Gum Woodland. This roadside vegetation exhibits various stages of growth, however juvenile and semi-mature species are more common than mature trees. Many of the mature trees have tree hollows, which provide potential habitat for threatened fauna species known from the region, including the Squirrel Gliders, microbats and hollow-nesting birds. In addition, many of these trees are host to mistletoe, which is an important food resource for threatened bird species known to inhabit the region.

The majority of groundcover vegetation within the road reserve and adjoining properties comprises heavily grazed and degraded areas, dominated by introduced grasses and weeds. During the current study four noxious species were recorded in the study area, including Blackberry (*Rubus fruticosus*), Serrated Tussock (*Nassella trichotoma),* Paterson's Curse (*Echium plantagineum*) and St John's Wort (*Hypericum perforatum*).

There is an extensive TSR area located adjacent to the east of the highway, known as the Little Billabong TSR. This TSR contains remnant woodland and riparian vegetation associated with Little Billabong Creek and is connected to smaller areas of vegetation along creek lines within adjacent properties.

Vegetation along the riparian zones of watercourses consists of scattered Eucalyptus, along with introduced shrubs and grasses. At the time of the current study the condition of Little Billabong Creek as native species habitat was limited throughout the study area, with some areas containing pools and other parts of the creek bed dry. In general, water quality was observed to be poor directly adjacent to road crossings, and exotic species were prevalent within the riparian zone.

3.9 Landscape and visual amenity

The landscape of the study area is generally characterised by hill formations to the west and expansive floodplain areas to the east. Prominent hill formations are situated at the north-western end of the study area and the central part of the study area, adjacent to the western side of the highway. These hills are at 519 metres and 454 metres respectively and are dominant features of the regional landscape. The highway is generally elevated from the surrounding areas to the east and offers open views to the rural scene along the alignment.

At the southern end of the alignment Lunts Sugarloaf, a granitic pluton, is located to the east of the highway and at 536 metres this is the highest point in the vicinity of the highway. Vistas from the highway to Lunts Sugarloaf are provided between gaps in the vegetation for highway users travelling south.

South of the meandering section of highway near to the intersection with Little Billabong Road, the highway travels in a south easterly direction through an alluvial flood plain area associated with Little Billabong Creek. The highway is relatively straight in this section and there is little variability in the visual environment. Through much of these lower areas, a stand of mature woodland trees exists adjacent to and within the highway road reserve, creating a scenic 'tree lined' experience for highway travellers. More distant views (beyond the road reserve) comprise open grazing lands with some remnant trees and ribbons of riparian vegetation.

There are two primary viewer groups with views of the highway: road users and local residents. Up to six farmhouses and sheds are visible from the highway. All are set back from the highway, with the closest (located at 92 kilometres south of Gundagai) approximately 100 metres from the current road reserve boundary.

3.10 Aboriginal heritage

The Proposal is located proximate to the archaeologically sensitive flats and terraces of Billabong Creek. Billabong Creek represents a resource zone conducive to a high density of Aboriginal occupation, which may have persisted over the long term. Linear stands of trees line the western side of the existing road. A wider area of vegetated riparian zone associated with Billabong Creek is located along the entire eastern side of the existing road, including canopy species. Riparian vegetation is also present.

A search of the DEC Aboriginal Heritage Information Management Systems (AHIMS) in July 2006 found that there are no previously recorded Aboriginal objects or places listed within the study area although five sites have been recorded previously to the south of the study area.

3.11 Non-Aboriginal heritage

The Hume Highway has historically been the main overland route from Sydney to Melbourne and prior to 1928 was commonly known as the Great South Road. Development of the road occurred after 1928 when it was proclaimed a State Highway and renamed in honour of Hamilton Hume. By the 1930s the section of the highway from Little Billabong to the Victorian border had been permanently aligned. The line from Tarcutta to Albury was bitumen surfaced in 1936.

A number of early alignments of the highway are shown on the historical maps for the area. In 1848, associated with the spread of settlement in the area, the village of Little Billabong was established around the highway. It began when Thomas Mitchell established the Little

Billabong Run around the base of Lunt's Sugarloaf. The settlement of the area continued through trade from travellers on the road using the hotel and post office.

Twenty two heritage items have been identified within 100 metres of the existing highway within the study area. These include:

- Archaeological heritage – 13 sites of archaeological significance.
- Built heritage – four sites of built heritage significance.
- Landscape – five landscape items.

There is one archaeological site of state significance and one landscape heritage item of potential state significance identified within the study area. A number of the remaining items are considered to be of local significance and include the rural cottage located on the eastern side of the highway at the far southern end.

3.12 Land use and the community

The study area falls within the Greater Hume Shire, located south of Wagga Wagga and north of Albury. The Greater Hume Shire has an area of 5,929 square kilometres and an estimated population of 10,100. The major settlements are Jindera, Culcairn, Holbrook, Henty and Walla Walla with smaller settlements including Burrumbuttock, Woomargama, Gerogery, Walbundrie, Morven and Brocklesby. The new local government area was proclaimed in 2004 and represents the amalgamation of the former Culcairn and most of the Hume and Holbrook Shires (Habitat Planning, 2005).

The existing highway alignment passes adjacent to a small number of land parcels with one large parcel to the east occupying the majority of the land in the study area. Predominant land uses in these areas include a mixture of rural dwellings and extensive rural landholdings. Agriculture, in particular grazing, is the main land use in the study area. Cattle and sheep grazing are the primary rural activities in the area with much of the surrounding landscape cleared for this purpose. The production and harvesting of fodder crops such as lucerne and oats, while secondary to grazing activities, are common throughout the region.

The viability of the Little Billabong village has reduced over time in line with the changing nature of the rural economy in the area, and there has been a marked overall decrease in population. The former village of Little Billabong was found at the western side of the highway, north of the Little Billabong Road however, structures are no longer visible in the area.

Up to six residential dwellings are located within the study area although not all of these are currently occupied, with at least one of the dwellings presently uninhabitable. Currently occupied buildings in the study area include "Murrumbug", "Braeside", "Glenelg" and "Wirruna". A community hall, tennis court and telephone exchange are noted at the Little Billabong Road intersection. However, these structures are rudimentary and appear to be seldom used.

3.13 Road network

The Hume Highway is the primary road within local road network and is orientated generally north-south. The Hume Highway at this location consists of a single carriageway with a posted speed limit of 100 km/h. Lanes are 3.5 metres wide with a 1 metre wide sealed shoulder on either side. There is a northbound overtaking lane approximately 500 metres in length between 91.2 kilometres and 91.7 kilometres south of Gundagai.

There are two intersections within the study area. Westby Lane at 88.2km south of Gundagai is a T-junction to the west. Westby Lane is a minor local road servicing several rural properties. Little Billabong Road at 88.8 kilometres south of Gundagai is a T-junction to the east. Little Billabong Road is a State Road (Main Road 284) linking Tumbarumba to the Hume Highway.

4 Description of the Proposal

4.1 Overview of the Proposal

The Proposal would involve the construction of a new dual carriageway and duplication of the existing Hume Highway over approximately 8 kilometres from a point approximately 85 kilometres south of Gundagai. Two kilometres of new dual carriageways and approximately six kilometres of highway duplication would be constructed. Two intersections (Westby Lane and Little Billabong Road (MR284)) would also be upgraded to T-junctions.

The substandard curves on the existing highway immediately south of Little Billabong Road would be eliminated as part of the Proposal. Aside from at these locations, the highway duplication would be located within the existing road corridor. One feature of the construction phase for the Proposal would be the substantial cutting of an existing vertical embankment south of Little Billabong Road and the infilling of a small part of a flood prone area opposite this cutting.

The proposed highway alignment at Little Billabong is shown in plan in Figure 4-1a-g. Distances along the alignment are shown in metres from Gundagai and are referred to as chainages hereafter within the text.

Duplication of the highway in the Little Billabong section would start at the merge of the existing dual carriageway at chainage 84700. The existing single carriageway would generally be retained as the southbound carriageway from chainage 84700 to chainage 88500 with a new northbound carriageway constructed on the western side. From chainage 88500 to chainage 90500 a new dual carriageway would be constructed to eliminate substandard curves in the existing highway. From chainage 90500 a new northbound carriageway would be constructed to the western side and connecting to the existing dual carriageway at chainage 93100.

4.1.1 Timing and funding

As part of the federal Government budget announced in May 2006, funding was made available for duplication to the remaining single carriageway sections of the Hume Highway in NSW south of its intersection with the Sturt Highway. Funding is provided under the federal Government's $800 million package to NSW for duplication of the Hume Highway. The strategic estimate for the Little Billabong Proposal cost is approximately $70 million, assuming completion in 2009.

Specific construction timing is the responsibility of the contractor but the conditions of funding require completion by the end of 2009. It is intended that detailed design of the alignment would commence in November 2006 and that the RTA would be in a position to invite construction tenders by early 2007. The construction period is anticipated to be approximately 24 months with the completion date set for the end of 2009.

4.1.2 Delivery

The description of the Proposal is based on the current, well advanced, concept design. The next stage in design, known as detailed design, involves further refinement taking into account such aspects as issues arising from the Environmental Assessment and approvals process and information obtained during detailed geotechnical investigations.

The detailed design and construction of the Proposal will be delivered through an Alliance between the RTA and the construction contractor. Alliances are an innovative form of project delivery which encourages the pursuit of opportunities for improved project performance that may not otherwise have been explored.

Legend

Property Boundaries

Design

84700 Chainage

Data Source

Property boundaries, Design data and Aerial photograph from the RTA

0 75 150

Metres

Sheet A

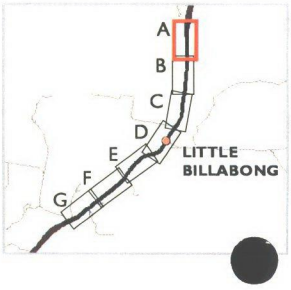

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Figure 4-1a **Horizontal alignment of the Proposal**

Legend

Property Boundaries

Design

84700 Chainage

Data Source

Property boundaries, Design data and Aerial photography from the RTA

0 75 150

Metres

Sheet B

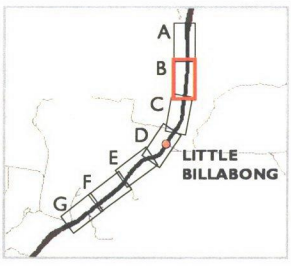

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Figure 4-1b **Horizontal alignment of the Proposal**

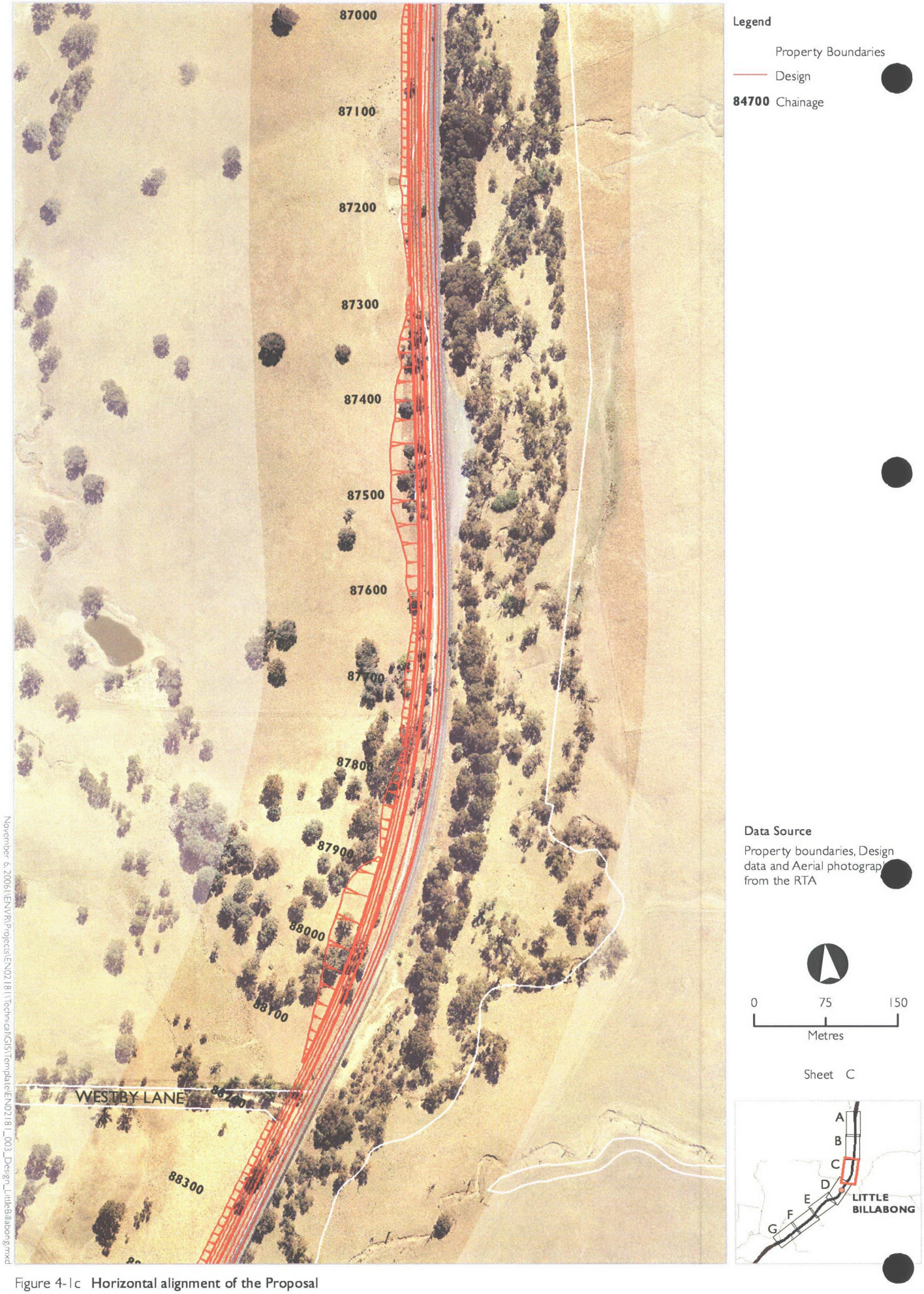
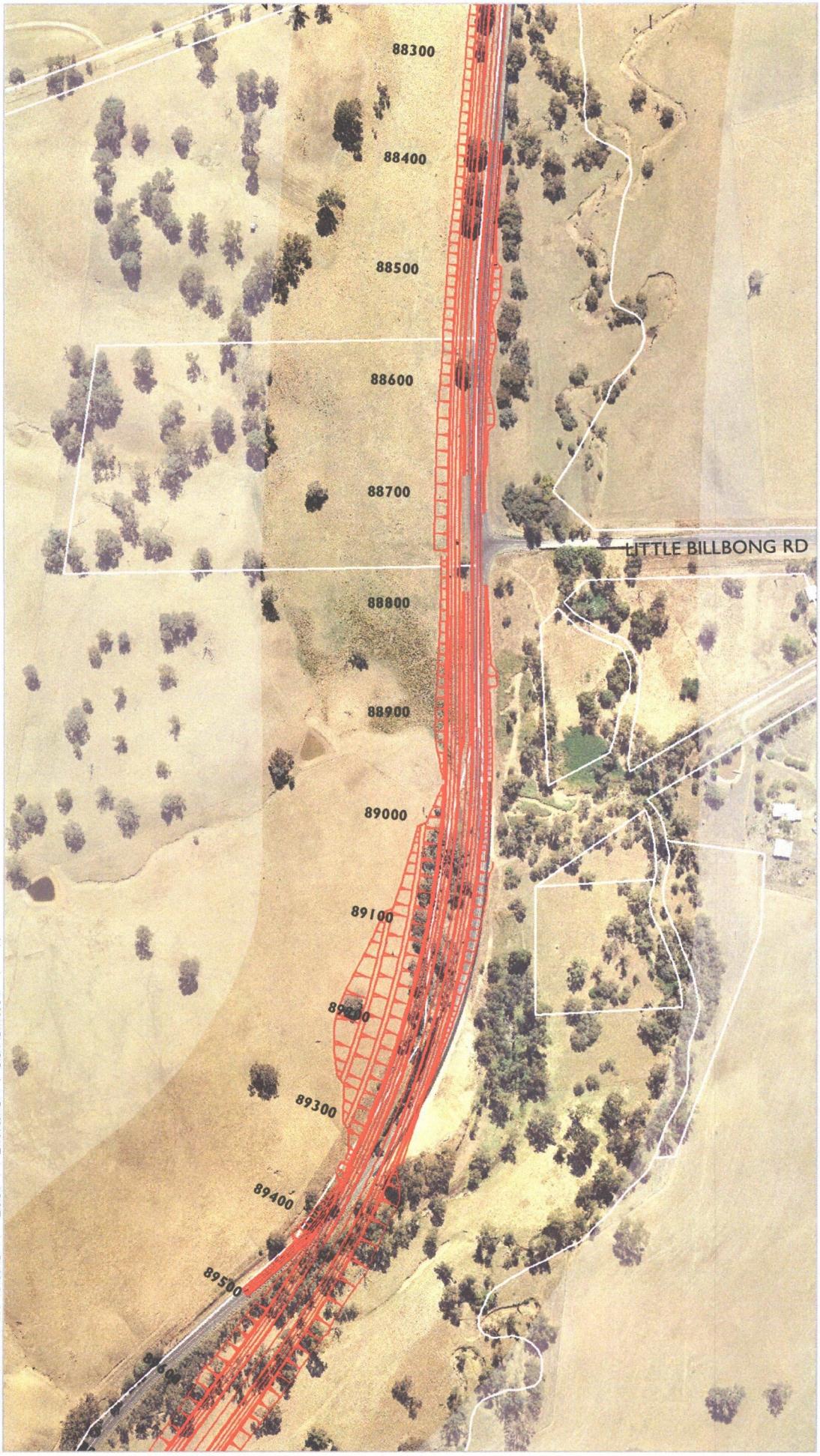


Figure 4-1c **Horizontal alignment of the Proposal**



Legend

Property Boundaries

Design

84700 Chainage

Data Source

Property boundaries, Design data and Aerial photography from the RTA

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Metres

Sheet D

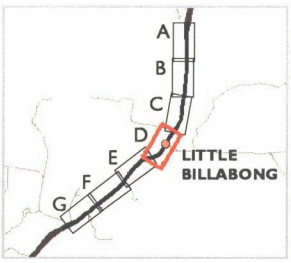

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Figure 4-1d **Horizontal alignment of the Proposal**

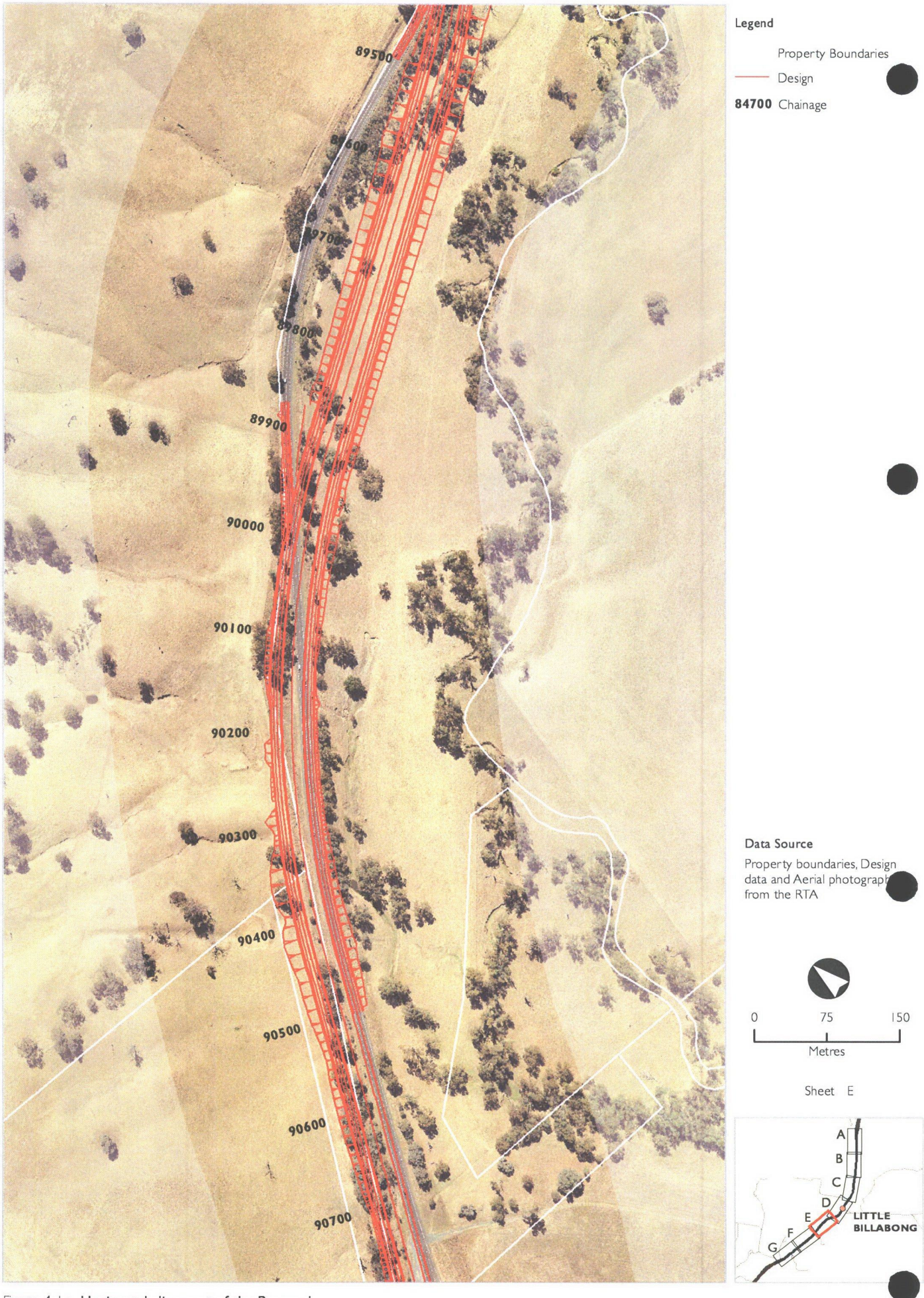
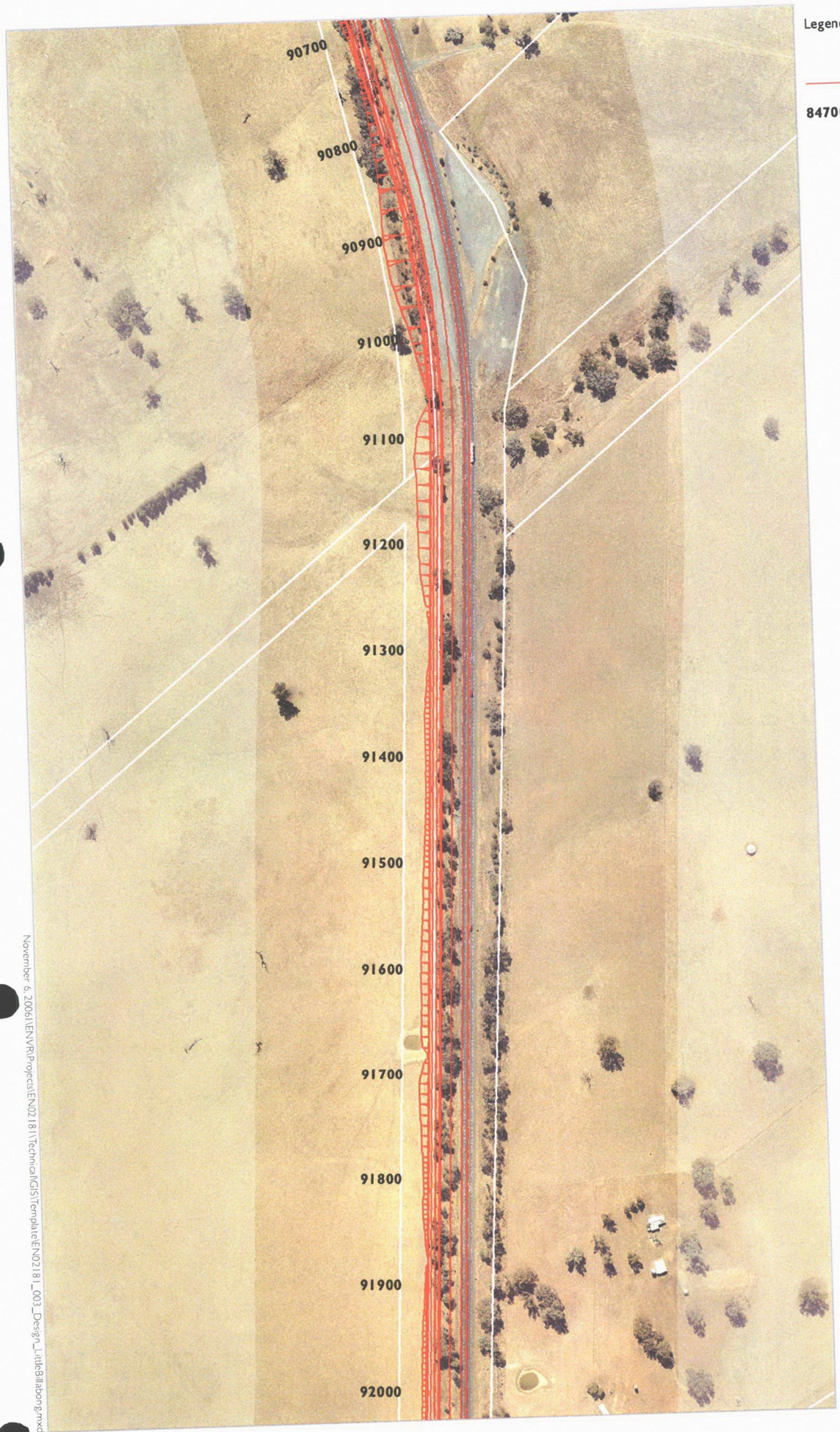


Figure 4-1e **Horizontal alignment of the Proposal**



Legend

Property Boundaries

Design

84700 Chainage

Data Source

Property boundaries, Design data and Aerial photography from the RTA

0 75 150

Metres

Sheet F

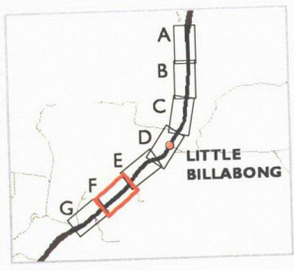


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Figure 4-1f **Horizontal alignment of the Proposal**

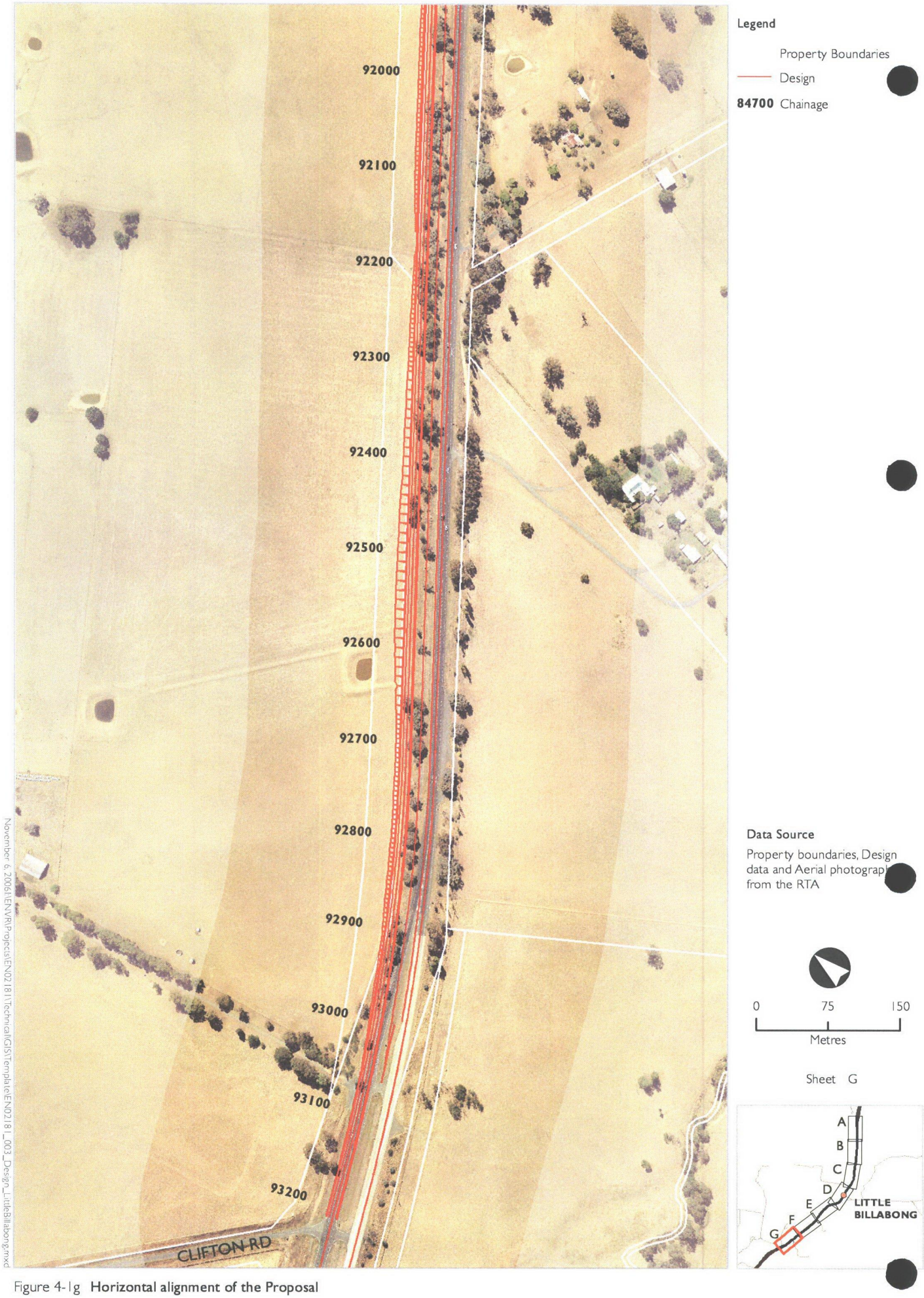


Figure 4-1g **Horizontal alignment of the Proposal**

4.2 Existing and forecast traffic

Traffic flows on the Hume Highway recorded last in 2003 at a station north of the intersection with Little Billabong Road and north of Young Street, Holbrook, indicate Annual Average Daily Traffic (AADT) (respectively) counts of 4,550 and 4,994 vehicles using this section of highway.

Heavy vehicles constitute 39 percent of total traffic volumes, much of which occurs during night time periods. Traffic growth in the study area is in the order of 2.7 percent per annum increase. Volumes on the Hume Highway in this area have risen significantly (30 to 50%) over the past 10 years. The gradual improvement in travel conditions brought about by completion of significant upgrades of the Highway would be a likely contributor to this increase.

4.3 Design decisions

Concept designs for the Proposal have predominantly focused on the existing alignment linking to the existing dual carriageways at either end. Concept designs for the Proposal have predominantly focussed on the existing alignment linking to the existing dual carriageways to the north and south.

Detailed plans involving duplication were completed in 1987 and approved for construction. The design was based on survey at the time and adopted road design and geotechnical criteria. The 1987 concept design was completed in consultation with adjacent landowners and property boundaries were established. Accordingly, the design was adopted as the basis for the current concept.

Since 1987 there have been progressive developments in both road geometry and geotechnical design criteria. As a consequence the design has been reviewed and amended to meet current requirements.

Alternative corridor alignments were considered with varying impacts on property and biodiversity. One option considered the 1987 alignment by locating a section of the highway south of the Little Billabong Road, 150 metres west of the existing corridor. This alignment required a major cut and significant property acquisition prior to rejoining to the southern section of the existing highway. Options to widen the corridor in order to maintain median vegetation but requiring additional land acquisition were also considered.

The 1987 detailed concept design required a major cut, in the order of 25 metres deep. Continuous batter slopes with a gradient of 0.5 to one were proposed. A review of the geotechnical data and current design requirements concluded that the cutting should have batter slopes of around 1.5 to one with 4.5 metre wide benching at 7 metre height increments to reduce the risk of slope failure, improve management of water flow and ease of maintenance. However, the required design modifications on this alignment substantially increased acquisition requirements and resulted in surplus material. The design has since been significantly modified to lessen the cut and surplus material volumes and reduce property acquisition.

As part of the options development phase for the Proposal, design principles were developed which aimed to provide an overarching framework and direction for the concept design. **Table 4-1** details how the preferred option responds to the design principles established for the Proposal.

Table 4-1 Response to design principles

Design Principle	Preferred Option Response
Compliance with RTA Road Design and AUSTROADS Design Guidelines	• Generally achieved. • Road safety audit conducted to assess design in road safety terms. • Two new carriageways are being provided over 2km to eliminate two substandard curves (less than 600 m radius). • The revised alignment reduces major cut but intrudes into the floodplain between 89.3km and 90.2km. This alignment has the benefit of reducing vertical grades to less than 3% and improving travel efficiency. • Road intersections are at-grade and designed to meet guidelines.
Balanced earthworks	• Generally balanced but with a slight deficit which will be further refined in detailed design. The deficit has potential to increase if unsuitable material is encountered during construction. • Balance achieved by shifting alignment to the east, south of Little Billabong Road and reducing the volume of cut.
Minimise impacts to Aboriginal heritage items and respect values.	• Alignment generally avoids the creek area and therefore avoids the areas more likely to have Aboriginal heritage items.
Minimise impacts to non-Aboriginal heritage items and respect values.	• Maintaining duplication close to existing carriageway minimises intrusion onto the crown reserve to the western side where early building foundations are present. Direct impacts avoided.
Minimise impacts to threatened species	• Duplication generally kept to the western side avoiding the native vegetation within the TSR and along the creek line thereby minimising impact on threatened species habitat. • Some vegetation within the existing corridor will be removed but much of it is more recently planted.
Minimise impacts to native vegetation	• Generally avoided by locating most of the duplication to the west of the existing highway. • Impact on vegetation to the east of the existing highway in the TSR south of MR284 limited to minimum essential length to provide appropriate horizontal alignment. • Reducing the size of the major cut has minimised associated clearing requirements. • Potential for revegetation adjacent to road corridor with cooperation of land owners. • Rural Lands Protection Board has indicated that the TSR need not be reconnected thereby limiting grazing and increasing opportunity for improvement in vegetation quality.
Minimise impacts to direct impact on waterways	• Impact on Little Billabong Creek is limited to minor intrusion into floodplain affecting an overflow flood channel. • No bridges or significant waterway crossings.
Provide safe ingress and egress	• High standard at-grade junction provided at MR284. Grade separation not warranted where there are T-junctions and low traffic volumes. • Proposed access locations meet road safety requirements. No cross highway access required.

Design Principle	Preferred Option Response
Provide safe access for school bus.	• Not specifically required within this length. • Widened shoulders provided at property entrances to accommodate school bus stops.
No increase in noise impacts at local residences.	• Generally not moving closer to any residence. • Dual carriageway improves free flow of traffic and reduces potential noise from braking and acceleration.
Minimise impacts to private land take.	• General design and median widths adopted to reduce land acquisition requirements. • Eastern shift of road alignment south of MR284 significantly reduces impacts on agricultural property.
No increase in flooding impacts.	• Flood study undertaken to assess impact on Little Billabong Creek. Results indicate minimal impact on flooding. • Alignment runs parallel to and does not cross the creek channel. • Limiting structure at Little Billabong Creek on MR284 immediately east of the highway junction is not affected.
Minimise construction costs while achieving other design objectives.	• Design amendments reduce total earthwork volumes and provide a more balanced outcome reducing overall cost. • Amended alignment east of the highway south of MR284 improves connections to the existing highway (now at-grade) improving constructability. • Much of existing highway (6km of total 8km road length) to be retained as southbound carriageway.

4.4 Design parameters

4.4.1 Road design criteria

The Proposal has been designed to comply with current RTA Road Design and AUSTROADS Design Guidelines. The design criteria are outlined in **Table 4-2**. Details of the typical cross sections for the duplication are shown in **Figure 4-2**.

Table 4-2 Key design criteria

Criteria	Proposal Standard
Design Speed	• 130 km/h Horizontal Alignment • 100 km/h Vertical Alignment
Sight Distance	• 110 km/h Stopping Sight Distance – Desirable (2.5 second reaction time) • 100 km/h Stopping Sight Distance – Minimum (2.5 second reaction time)
Horizontal Alignment	• 130km/h Horizontal Alignment Stopping Distance (2.5 second reaction time)
Grade	• Desirable maximum 4.5 per cent • Grade maximum 6 per cent
Cross Section	Lane Width • The basic configuration would be dual carriageways, each with

Criteria	Proposal Standard
	two 3.5 metre travel lanes in accordance with National Highway standards. Shoulder Configuration • The outside shoulder beyond the edge of the 3.5 metre travel lane would consist of a 2.5 metre shoulder and a 1.0 metre verge. • Where there is a guard fence on the outside the arrangement would be 2 x 3.5 metre carriageways, 2.5 metre shoulder, 1.0 metre dish curb and a 1.0 metre verge encompassing the guard fence. • The inside shoulder would consist of a 1.0 metre road edge and a 0.5 metre verge adjacent to the median area. Median Width • Generally provide a desirable 12-23 metre depressed median with landscaping. Consideration to be given to the provision of Wire Rope Safety Barrier at critical locations. • Adopt a five metre median with Wire Rope Safety Barriers and landscaping at locations where design dictates a major cost saving. All median breaks of crossovers with at grade intersections should accommodate articulated vehicle of 25 metres.
Embankments / cuttings	• Batter slope ratio of 2:1 (opportunities to increase batter/cutting grades would be investigated during geotechnical investigation).
Corridor Widths	• Nominally, to provide six metre width from tops of cuts and toes of fills to Controlled Access Boundary.
Property Access	• Access control would apply on all sections of work when new boundaries are being established. On these sections, the number of access points would be kept to a minimum.
Signposting	• Signposting will follow the format given in the RTA Guide Signs and Tourist and Tourist Signs Manual for the provision and signposting of service and tourist facilities.
Environmental Management	• The Proposal should be designed and constructed having minimum practicable impact to the natural and built environment.

4.4.2 Corridor requirements

The principal corridor criterion is to provide for a six metre width from the top of cuts and the toe of fills to the Controlled Access Road Boundary. This typically results in an average highway corridor design width of 50 metres. However, the design has taken into account constraints adjacent to the corridor and opportunities to reduce impacts on the surrounding environment. This has resulted in a variable corridor width along the alignment.

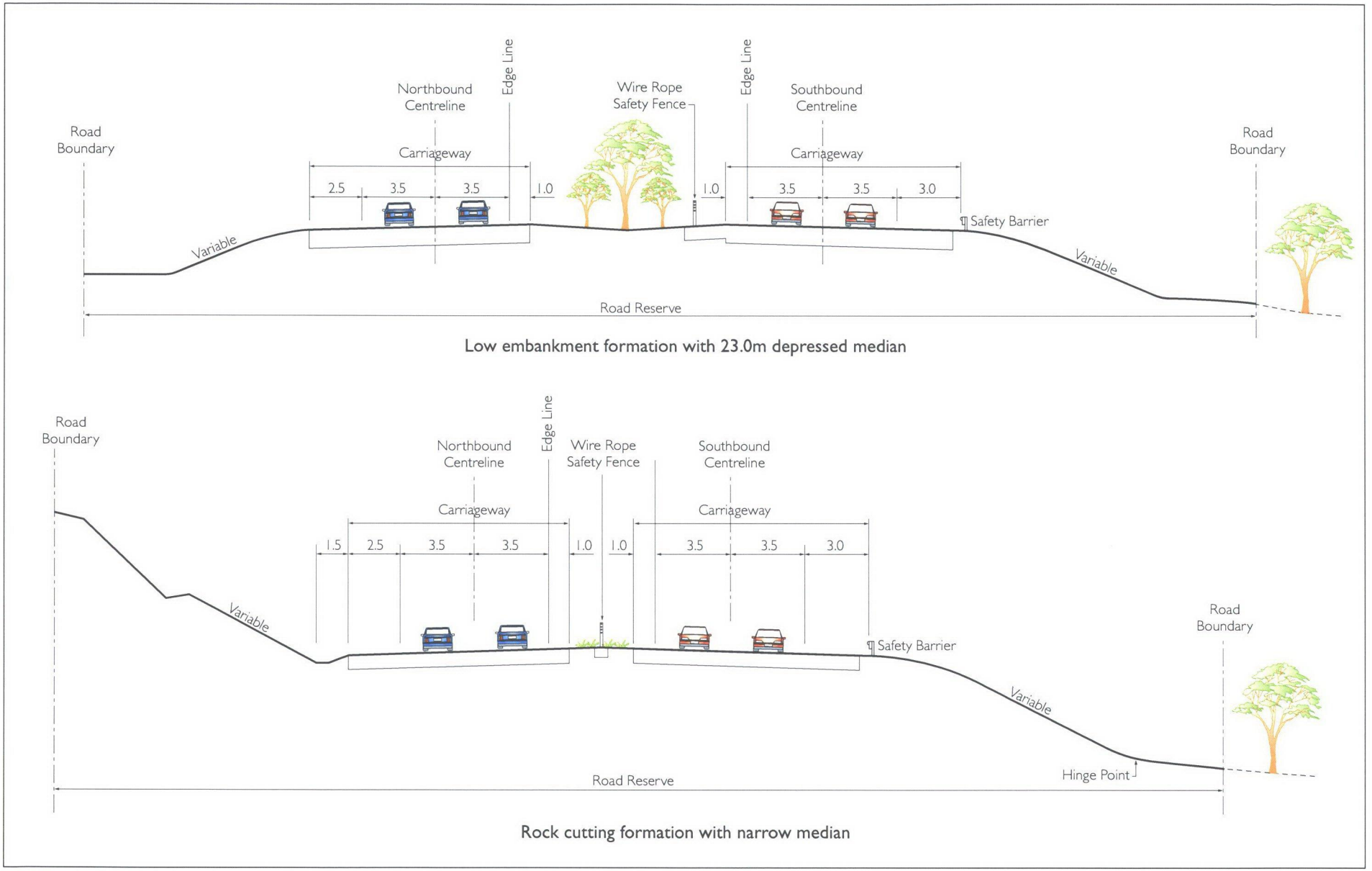


Figure 4-2 **Typical cross-sections**

4.4.3 Drainage

The new carriageway would replicate the existing highway drainage infrastructure and maintain all necessary hydrological capacities.

Concrete dish drains would be the principal system for collecting surface water from the road pavement within areas of cutting. These drains would run parallel to the road and discharge into watercourses or to land via structures such as grass swales. Where the road would be constructed on fill it is proposed to design the road pavement to direct runoff to the grass verge table drains adjacent to the shoulder lanes. Sediment control measures would be implemented to control water quality discharged into local creeks or natural drainage lines. The specific treatment to be adopted within the corridor would be identified during the detailed design.

Currently, approximately 22 culvert structures are located within the existing highway alignment, and these would generally be replicated in the Proposal. New sections of carriageway would incorporate multi-celled box culverts and / or pipe cross drains where appropriate for the waterway to be traversed and in accordance with current design standards. Existing culverts would be maintained and upgraded as necessary. Drainage for areas of new carriageway that run parallel to the existing road formation would be expected to mimic these existing structures so that current drainage patterns are maintained. For each crossing, detailed information regarding the shape of the channel would be sought to determine culvert and pipe sizes and select structures that fit into the available area. This information would be obtained during the detailed design stage.

4.4.4 Traffic and access arrangements

Controlled access would apply to all sections of the highway alignment following the establishment of new highway boundaries. The guiding principle of keeping the number of access points to a minimum would be applied, while providing suitable access to all properties.

The existing corridor abuts two landholdings to the west. Access would be maintained to individual farm paddocks in consultation with the landowners. Five access points have been included in the design of the Proposal. Subject to road safety considerations, access would be maintained to both carriageways. Limited access would be provided to the Travelling Stock Route.

The Proposal would improve access to Westby Lane and Little Billabong Road by the provision of intersections that meet appropriate standards for the upgraded Hume Highway. The current intersection locations would be maintained. Deceleration and acceleration lanes would be provided at Little Billabong Road.

Median crossover points would be provided at strategic locations along the alignment to allow access for those properties that front the highway. These crossovers are located at chainage 90700, 92000 and 92400. Some access to the highway would be restricted to left in left out access with associated acceleration and deceleration lanes. These treatments would be located at chainage 86,050, 82200 and 90100.

Temporary access to these properties would be made available during the construction period. Provision to store a minimum length of articulated vehicle 25 metres long between the property gate and the traffic lane edge line would be provided at some property accesses to cater for log and stock trucks.

4.4.5 Utilities

Some public utility services would be affected by the Proposal and would require relocation. A fibre optic cable is located parallel to the highway on the eastern side for the full length of the Proposal alignment. The new highway alignment would intersect this cable where it crosses the highway immediately north of the Little Billabong Road junction

Underground Telstra utilities are also located parallel to the highway and approximately seven kilometres would need to be relocated. The exact location of these utilities would be determined during the detailed design stage. Approval from the relevant utility authorities and organisations would be sought for these relocations prior to the commencement of work. The relocations would be funded by the Proposal and subject to separate environmental assessment.

4.4.6 Land Acquisition

In order to duplicate the highway, it would be necessary to acquire parts of some properties. The Proposal requires the acquisition of 11.4 hectares of private land used for agriculture. The acquisition is required from two large properties with frontages to the Hume Highway. Approximately 24.5 hectares of Crown land currently held as a TSR and public reserve would also be acquired.

All property acquisitions would be conducted in accordance with the RTA's Land Acquisition Policy (RTA 1999) and the *Land Acquisition (Just Terms Compensation) Act 1991*. Negotiations for property acquisition would include consultation on property adjustments where required to maintain farm management practices and provide access to the road network.

4.4.7 Landscape design

The urban and landscape design strategy for the Hume Highway Duplication has sought to "*....reflect the Highway's role as a national landmark route and a primary movement corridor between NSW and Victoria, sensitively located and formed in response to the intrinsic natural, historic and cultural qualities and features of the region*" (RTA, no date).

The urban and landscape design principles for the Proposal are as follows:

- Provide a flowing highway alignment that is responsive to, and best fits with, the landscape.
- Provide a well-vegetated, natural road corridor which protects and enhances the natural systems and ecology of the corridor.
- Provide an enjoyable and memorable motoring experience which engages with the landscape of southern NSW, makes best use of views and vistas.
- Respect and respond to the communities along the corridor, and the historically and culturally significant aspects of the corridor.
- Achieve a simple palette of highway details, elements and components consistent throughout the whole corridor, which meet safety requirements and minimise ongoing maintenance costs.

The detailed design development of highway duplication would be in accordance with the above design principles.

The principle landscape design objective for the proposal is to integrate the upgraded highway into the existing landscape. Related design objectives also aim to achieve optimal

safety for all users of the roadway and to minimise amenity and land use impacts on adjacent lands.

The duplication of the Little Billabong section of the Hume Highway is predominantly the duplication of an existing road within a rural setting. Construction activities would have no impact on any populations of significant size or built up areas. Therefore, the focus of the landscape design would be upon the interface between the rural landscape and the road corridor.

The landscape strategy for the Proposal would respond to, and be complementary with, the particular and varied contexts through which the highway passes. These would include areas of remnant natural vegetation, features of the local landform and landscape, and cultural landscapes. Wherever possible, existing vegetation would be retained within the design. The landscape strategy would be balanced to ensure that prominent road vistas are protected or enhanced where appropriate. The design would also incorporate the varied qualities and characteristics of the highway corridor journey experience, including sections enclosed by remnant woodland, or where highway travellers have opportunities to experience expansive views of the surrounding rural landscape.

Landscape works would be implemented as each stage of construction is completed in order to assist in soil conservation and erosion control, and to create an appropriate level of visual amenity within the road corridor. Opportunities for landscaping would be available within the median areas and batter embankments not constrained by rocky material. The landscape design would incorporate the use of locally occurring native species as appropriate. Landscaping would be used in the vicinity of houses that are close to the upgraded highway to reduce the extent of visual intrusion.

4.5 Construction activities

4.5.1 Road construction

Construction of the Proposal would be typical of that used for duplication of the Hume Highway over the past thirty years, and would generally entail:

- Formations being established by general "cut and fill" earthworks operations on the design alignments.
- Earthworks using select materials placed on the formation to create a road base.
- Load bearing pavement materials placed on the select layer.

In most instances, the cuts would provide the basic earthworks required for fills. Depending on the quality of material available from the cuttings, higher quality select materials may also be obtained from these cuttings. In some instances, depending on the geology of the cuttings, highest quality materials may also be used for load bearing pavement materials.

The pavement for the highway would be rigid (concrete) while local road connections and property accesses would be flexible (granular) using highest quality earthworks. Concrete requires the use of course and fine aggregates made from rock, sand, cement and other fine materials such as fly ash. Granular pavements require protection from the elements and this is achieved through bitumen sealing.

Establishment of the initial formation requires provision of drainage lines to provide continuity to naturally occurring watercourses. Runoff from the road formation itself requires other drainage lines to be established and connected to these watercourses. These drainage lines are constructed from precast concrete pipes, then backfilled with granular

materials, usually sand or other fine materials such as decomposed granite. Precast pits and grates are also used. In some instances, the natural ground conditions are wet and earthworks cannot be commenced until following placement of a drainage blanket made of rock, so as to allow free drainage.

Following completion of the initial formation, it may be possible for water to enter it subterraneously. This water would be intercepted through the provision of subsurface plastic drains surrounded by a backfill comprising sands or fine aggregates. Catch drains and dish drains are provided to intercept water that may cross the completed road surface, creating potential for a traffic hazard or for structural damage. Catch drainges are usually constructed of earth and lined with materials such as concrete or a fibrous material such as jute. In some instances concrete kerbs and gutters are also constructed.

Following completion of the formation and pavement, roadside furniture such as guideposts, guard fencing, traffic signs and pavement markers would be installed. These are all manufactured products.

The following provides an indicative overview of the likely elements of the Proposal and the sequence in which they are expected to occur.

Pre-construction activities

- Land acquisition.
- Relocation of farm dams and fences.
- Relocation of affected utilities prior to establishment on site, where appropriate.
- Notification of residents of commencement of works.
- Construction survey to identify construction footprint.

Establishment of site for construction

- Establishment of compound site (including office accommodation and facilities).
- Installation of environmental controls, including clear delineation of sensitive areas.
- Clearing/grubbing/slashing of construction footprint area.
- Fencing off area for construction and construction truck movements (including permanent controlled access boundary fencing).
- Fencing off areas to be used for stockpile sites.

Construction activities

- Earthworks (excavation of cuttings, relocation of fill material, installation of noise mound structures).
- Installation of permanent drainage (eg box and pipe culverts).
- Pavement works.
- Installation of permanent signage, safety barriers and line marking.
- Landscaping of surrounding areas.
- Site clean up.
- Open to traffic.

4.5.2 Earthworks

Extensive geotechnical investigations are to be undertaken during the detailed designed stage in order to refine earthworks volumes. The Proposal design provides for generally balanced earthworks, however a small volume of fill need to be imported. There are minor cuts and fills required along the entire length of the Proposal. A major cutting would be required at chainage 89,100. It is anticipated that this cutting would be constructed by ripping and that

the material would generally be suitable for use as fill embankments, subject to further modification (ie crushing). The majority of the material excavated at the cuttings would be suitable for use as fill for the embankments and in particular infilling of a small section of floodplain area at chainage 89,600.

In total it is anticipated that there would be approximately 376,000 cubic metres of cut material generated during construction and approximately 415,000 cubic metres of fill material required as part of the road formation with 35,000 cubic metres of select material. Concrete aggregates and sands would be imported from existing commercial quarries as close to the road corridor as is practicable.

4.5.3 Materials and quantities

In addition to earthworks material (general and select fill), the project would require use of the following materials (indicative quantities have been provided where project development has allowed estimates):

- Concrete pavement (base and sub-base) - 47,000 cubic metres.
- Minor structural concrete.
- Pipe culverts (450mm to 1200mm diameter) - 994 metres.
- Box culverts - 218 metres.
- Water - 180ML.
- Safety barriers (W-beam and WRSB) - 1700 metres.

4.5.4 Vegetation clearing

The Proposal would require the removal of native Eucalypt woodland communities and riparian vegetation totalling 14.28 hectares. Specifically the Proposal footprint would require the removal of the following amounts of vegetation community:

- Box-Gum Woodland 11.35 hectares.
- 2.42 hectares of River Red-Gum riparian woodland.

The remainder of the Proposal footprint is comprised of other vegetation including sedgeland, planted vegetation and native and exotic pasture grassland.

4.5.5 Working hours

The following working hours as provided in **Table 4-3** would be adopted for the Proposal:

Table 4-3 Construction working hours for Proposal

Day	Start Time	Finish Time
Monday – Friday	7am	7pm
Saturday	7am	4pm
Sunday and Public Holidays	No work	

The extended hours for Saturdays are possible because the Proposal is located within a rural environment (ie limited number of noise sensitive receivers). Where work would be required outside of these hours, best management practices would be followed as described in the RTA *Environmental Noise Management Manual* (RTA 2001).

4.5.6 Traffic management during construction

Management strategies would be adopted to facilitate the safe passage of construction and through traffic within the Proposal site. These measures would include providing for traffic utilisation of temporary carriageways and temporary reductions in speed limits through worksites. Control measures to manage traffic as a minimum would be consistent with the RTA *Traffic Control at Work Sites* (RTA 2003).

4.5.7 Construction compounds and work sites

Compound sites

A number of sites have been identified as suitable for a stockpile and/or compound sites. The location of these sites would depend on the final design and staging of the Proposal and would be determined during detailed design.

Construction work sites would be required for personnel, materials and plant. At least one major site would be required for the Proposal with a number of minor depot sites adjacent to works such as the Little Billabong intersection. A major work site may require an area of at least 100 metres by 100 metres. Potential work sites would generally be on:

- Residual land already owned by the RTA from previous construction works.
- Cleared areas within parts of properties acquired by the RTA for the Proposal.
- Available land within the road reserve that is not environmentally sensitive.
- Leased land adjacent to the Proposal.

Work site compounds would accommodate portable offices, vehicle parking areas and machinery and plant storage areas. Available sites would be assessed in terms of their location on the basis of best-practice industry standards for environmental and construction criteria, examples of which are:

- Located more than 100 metres from waterways.
- Located within areas of low ecological and heritage conservation significance.
- No substantial clearing of native vegetation required or located where future clearing is required for future works.
- At least 200 metres (or at least 250 metres for a temporary batch plant) distance from dwellings or other activities that may be affected by noise or other plant impacts.
- Easy and safe access to the main road network.
- Relatively level ground elevated to assist drainage and allow treatment of runoff.
- Be located above the 20 year average recurrence interval (ARI) flood level unless a contingency plan to manage flooding is prepared and implemented.

Potential compound sites currently identified within the Proposal are in the vicinity of chainage 89,200 along Westby Lane and another at chainage 98,900 which is outside of the current study area.

Stockpile sites

Several stockpile locations may be required along the Proposal due to its length. Concrete batch plant sites would also need to be established at approved locations along the route. These would be used to store, prepare and distribute concrete and stockpile aggregate for road construction. The location of these stockpiles would be finalised during detailed design. Some possible locations would be within the existing highway corridor, on cleared Crown Land, or by arrangement with local landowners.

Topsoil would require stockpiling before placement on medians, embankment slopes and shallow cut batters. Additional fill material imported from other sources may also require storage where there is a deficit of material from within an individual section of the duplication. The contractor would be required to protect stockpiles to prevent erosion and sedimentation.

Associated Construction Facilities

One concrete batch plant would be required for the Proposal. Batch plants require an area of approximately 100 metres by 100 metres. This could be located within the major work site compound to be identified for the Proposal.

5 Overview of the study area

This chapter describes the RTA's approach to community and stakeholder consultation, outlines the key stages of the consultation process and describes the consultation activities that have been undertaken to date. Issues that have been raised during consultation and future activities that will be undertaken if the Proposal is approved are also described.

5.1 Overview

The RTA understands that construction of road projects is an important issue for affected land owners, local communities living and working in the vicinity of the proposed works and road users affected by construction activity and road realignments. Accordingly, the RTA is committed to ensuring that all interested and affected parties have the opportunity to understand the nature of the proposed works, to express their comments and to have their concerns and issues understood and taken into consideration during the planning and delivery of the Proposal.

The RTA's approach to consultation for the planning and delivery of the Hume Highway Duplication is based on guidelines contained in the RTA *Community Involvement Practice Notes and Resource Manual* (RTA 1998) and on the directives in the Director General Requirements (attached in **Appendix B**). Consultation with the Aboriginal community is undertaken in accordance with the DEC's *Interim Community Consultation Requirements for Applicants* (January 2005) and *Draft Guidelines for Aboriginal Heritage Impact Assessment and Community Consultation* (July 2005) and the RTA's *Aboriginal Liaison Protocol.*

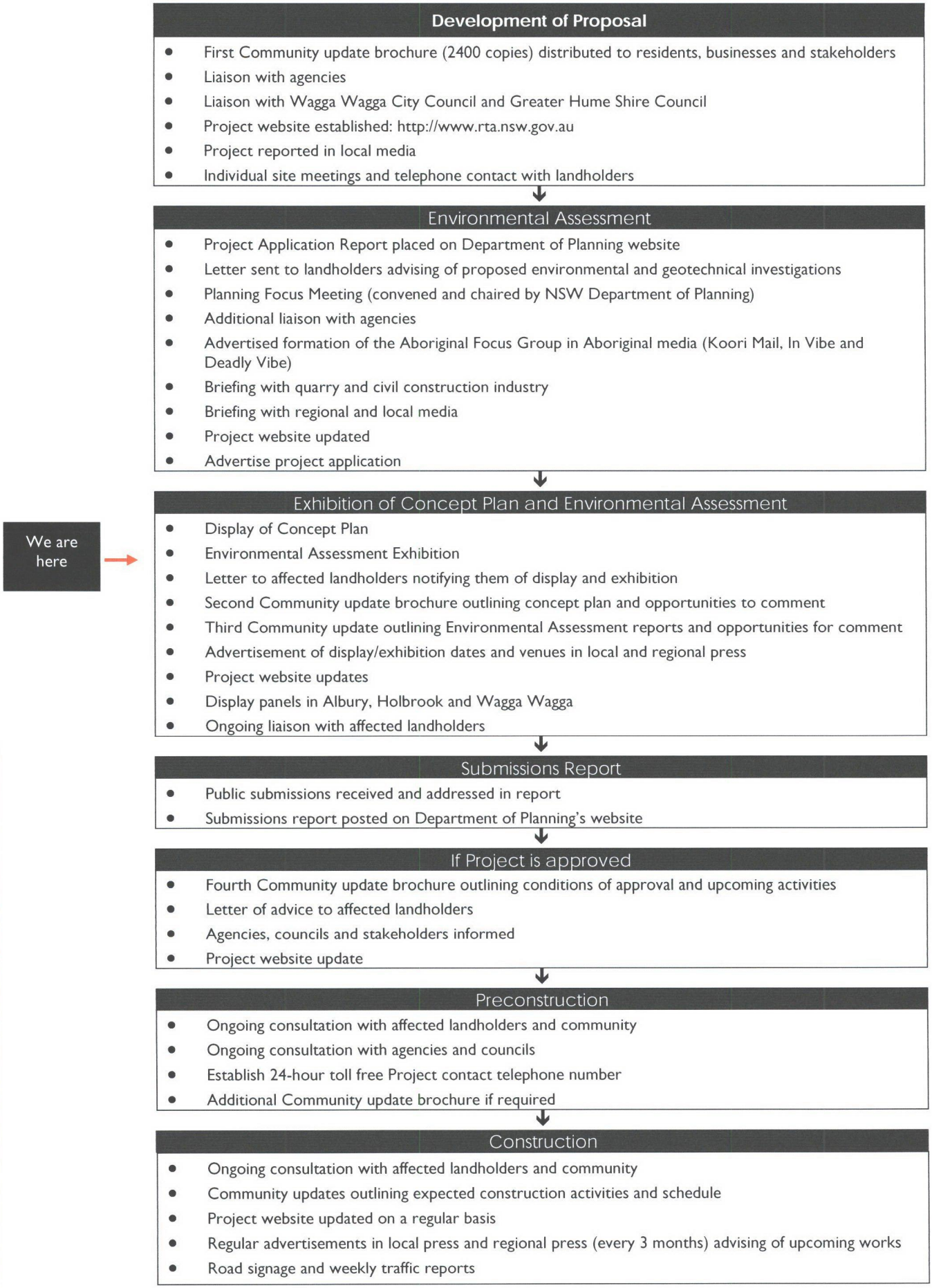
The process of consultation throughout planning, assessment and delivery of a major proposal is broken into seven broad stages as illustrated in **Figure 5-1.**

The RTA has identified and engaged with individuals, government agencies, community groups and other stakeholders during the early development of the proposed Hume Highway Duplication project and preparation of this environmental assessment. Consultation will continue with public exhibition of this document and a formal call for public submissions during the exhibition period. Consultation during project development and assessment is crucial to ensure that the best possible road design and construction plan is developed to minimise the impacts of the Proposal. The principle aim of consultation during project development and assessment is therefore to advise stakeholders that the Proposal is being developed and to seek information to assist in identifying issues of importance to the community and major stakeholders that need to be considered during the planning, design and assessment process.

A range of consultation strategies have been, and will continue to be, employed to ensure that information about the Proposal is readily available to the community and stakeholders. These strategies include publication of community information brochures, meetings with agencies and stakeholders, publication of environmental assessment documents, advertisements, press releases and press briefings. A range of strategies have also been employed to ensure that community and stakeholders can provide comment to the RTA, including making RTA project team members available for meetings with stakeholders, provision of a local project office as a central point for project inquiries and co-ordination, public exhibition of environmental assessment documents and a call for public comment during the exhibition period.

The RTA will consider all comments, and submissions received and will prepare a submissions report formally documenting issues raised during exhibition of the environmental assessment documents and indicating how they are to be addressed.

Figure 5-1: Consultation strategy flowchart



5.2 Consultation undertaken to date

The RTA has undertaken specific consultation activities to engage agencies, councils, landholders and other stakeholders. During development of the Proposal a dedicated Hume Highway Office was established in Wagga Wagga. The Hume Highway Office provides an ongoing local presence throughout the stages of the Proposal for consultation with the local community and stakeholders. Community members and stakeholders have received information on the Proposal via a number of avenues including distribution of the Community update brochure, advertising in local and regional media, establishment of the Hume Highway Duplication website, meetings, media coverage and the Henty Field Day information stall.

Issues and questions raised by the community and stakeholders have been received through the Hume Highway Office project telephone number, facsimile number, email address, postal address and in one-on-one meetings. The procedure for addressing issues raised is that they are first directed to the Project Manager for the relevant section of works and subsequently to the overall Project Manager. Where issues are not resolved at these levels, they are elevated to the Project control group.

The Proposal is located in a lightly populated rural area and the number of landholders located adjacent to the Proposal (over approximately 45 km of the Hume Highway) is approximately 70. Project Managers have therefore been able to conduct one-on-one meetings or telephone interviews with affected landholders to provide detailed information and opportunities for two-way exchange and consultation on issues identified.

Government agencies and Wagga Wagga City Council and Greater Hume Shire Council were informed about the details of the Proposal at a Planning Focus Meeting. The Planning Focus Meeting provided the opportunity for agencies and councils to raise issues and to ask questions in an open forum. Issues that were raised by government agency stakeholders at the Planning Focus Meeting (held by the Department of Planning) are described in Chapter 7, *Identification of Environmental Issues,* of this environmental assessment. Agency consultation continued throughout the environmental assessment process. RTA Project team members liaised with DEC, DEH, DNR, DoTaRS and DPI (Fisheries) to identify and discuss issues and to address design constraints and opportunities. The RTA consulted with Aboriginal stakeholders by formation of an Aboriginal Focus Group and involved the Aboriginal community in site surveys during the environmental assessment stage.

Issues raised to date by the community and by stakeholders are outlined in **Table 5-1**. This table also identifies how issues have been, or will be addressed, including outcomes and resolutions achieved and ongoing consultation processes to address unresolved or ongoing issues.

Table 5-1 Consultation activities

Date	Activity	Outcomes/Issues raised	Resolution/Ongoing Consultation
July 2006	Distribution of 1925 Hume Highway Duplication community updates to residents and businesses in postcode areas around the locality of the Proposal including: • Gerogery 2642. • Holbrook 2644. • Woomargama 2644. • Humula 2652. • Bowna 2644. • Mullengandra 2644. • Table Top 2640. • Tarcutta 2652. • Carabost 2650. • Kyeamba 2650. 500 community updates were also circulated to the offices of elected representatives in Wagga Wagga and Albury, Wagga Wagga City Council, Greater Hume Shire Council and Albury City Council, libraries in Holbrook and Albury, 17 media outlets, Albury and Wagga Wagga motor registries and the Ladysmith General Store.	The Community Update included information about the Proposal and a variety of contact details for the Hume Highway Office. A broad range of issues have been raised through this medium including through enquiries directed to the Hume Highway Office. These issues include: • Property acquisition impacts. – On agricultural production. – On infrastructure. • Access including: – Public transport access. – Emergency services access. – Heavy vehicle/over dimensional access – General access. – Landholder access. – Access for field investigations during environmental assessment. • Erosion during construction/operation; • Weed control during construction and operation; • Loss of trees within existing road corridor; and • Noise impacts during construction and operation.	Enquiries received by the Hume Highway Office are directed to the relevant Project Manager or to the overall Project Manager. The issues raised are addressed in Chapters 8, 9 and 11 of this environmental assessment Any unresolved or new issues would be managed during detailed design of the Proposal and included in construction documentation. During field work for preparation of this environmental assessment access to private property was organised by authorisation from the landholder.
July, August	Local print publications (The Border	Local media coverage of the project served to raise	Enquiries resulting from the use of local media were directed

Date	Activity	Outcomes/Issues raised	Resolution/Ongoing Consultation
and September 2006	Mail, The Eastern Riverina Chronicle, and The Daily Advertiser) have covered information on the progress of the Project more than seven times since July 2006, 3/7/06, 2/8/06, 4/8/06, 9/8/06, 7/9/06, 28/9/06, 28/9/06. Interviews concerning the projects have also been aired on local electronic media including ABC Radio Riverina, Radio 2WG Wagga Wagga, 2AY Albury and WIN TV Wagga Wagga.	awareness of the Proposal within the community and generate contact with the Hume Highway Office.	to the Hume Highway Office and were addressed by providing information and by directly answering questions. Queries that required detailed input and consideration were referred to the relevant Project Manager.
August-October 2006	Meetings and telephone conversations were held with individual landholders located adjacent to the Proposal. The Project Manager consulted with each affected landowner to discuss the Proposal and to identify issues.	Issues raised during consultation included: • Loss of productive agricultural land. • Access to highway in different directions. • Flood impacts.	Issues raised by affected landowners are subject to ongoing consultation and would be addressed in the detailed design phase of the Proposal.
8 August 2006	The Hume Highway Action Group (HHAG) was briefed on the Proposal. The HHAG includes in its membership representatives of Greater Hume Shire Council, Wagga Wagga City Council, Albury City Council, the NSW Road Transport Association and local State and Federal elected representatives.	The briefing provided a forum to communicate information about the Proposal to the HHAG, to answer questions and to receive stakeholder feedback. Issues raised at the briefing included: • Project delivery strategy. • Traffic detours and delays. • Higher mass limits. • Property impacts.	Property and traffic impact issues are addressed in Chapters 8, 9 and 11 of this environmental assessment. Unresolved issues would be addressed in the construction management plans and in detailed design.
18 August 2006	Project briefing with the NSW Department of Environment and	Dialogue with DEC commenced regarding Aboriginal heritage. DEC was informed of the planned scope of	DEC is provided with a key RTA contact at the Hume Highway Office (the RTA Archaeology and Heritage Officer for the

Date	Activity	Outcomes/Issues raised	Resolution/Ongoing Consultation
	Conservation (DEC) to discuss Aboriginal heritage processes and consultation.	field survey work and methodology to identify Aboriginal items, objects and places. DEC was informed of the level of Aboriginal consultation planned and asked that regular consultation be maintained.	Hume Highway) to facilitate consistent and ongoing consultation. Consultation with DEC to discuss Aboriginal heritage issues and the assessment process is ongoing and involves regular phone calls and meetings where required.
18 August 2006	Construction industry briefing to aid identification of design and delivery issues for the Proposal.	The RTA provided information to the construction industry to allow initial consideration of potential issues.	Detailed design and delivery issues would be addressed during the construction planning phase and specific environmental issues would be managed through construction documentation.
23 August 2006	Planning Focus Meeting attended by: • Department of Planning. • Department of Environment and Conservation. • Department of Natural Resources. • Department of Primary Industries. • Greater Hume Shire Council. • Wagga Wagga City Council.	The Planning Focus Meeting facilitated discussion of the Proposal and identification of potential key issues for environmental assessment. The issues raised at the Planning Focus Meeting are described in full in Chapter 7. The main issues raised by stakeholders mostly reflected their main areas of responsibilities and were: • Biodiversity. • Heritage. • Resource Management. • Hydrology. • Socio-economic impact.	The key issues for the Proposal are documented in the Director Generals Requirements (DGR's) which are provided in **Appendix B.** The key issues are assessed in Chapter 8 of this report. Other issues raised at the Planning Focus Meeting are largely addressed in Chapter 9 of this report. Any outstanding issues would be addressed in the construction management plans and in detailed design.
8 September 2006	Aboriginal Focus Group meeting with attendance of the Department of Environment and Conservation (DEC).	Aboriginal registrants for the Proposal were informed on the background of the Proposal and the Aboriginal heritage assessment process. The Aboriginal community was informed that the survey for the environmental assessment would be intensive.	Consultation with the Aboriginal community is ongoing.

Date	Activity	Outcomes/Issues raised	Resolution/Ongoing Consultation
		Ongoing consultation with DEC and DEC kept informed on process.	
14 September 2006	Site visit and subsequent environmental risk workshop with: • RTA Project Management and Environmental staff. • Environmental Assessment consultants (including biodiversity and heritage specialists). • Department of Natural Resources. • Department of Environment and Conservation.	Representatives from DNR and DEC were given an opportunity to inspect the study area in the company of RTA environmental and project management staff and in the company of the Environmental Assessment consultants. Information about the concept design and preliminary environmental findings of the study area was communicated, potential impacts were characterised and there was a two-way flow of information regarding potential impacts of the Proposal and site characteristics and opportunities. An environment risk workshop was undertaken following the site visit and the issues raised are documented in Chapter 7. During the environmental risk workshop the representatives from DNR and DEC communicated the expected scope of field investigations and methodology in terms of biodiversity and hydrology, including groundwater. The Environmental Assessment consultants requested that the DEC representative provide an overview of the preferred scope and methodology of field work. The Environmental Assessment consultants arranged to have the biodiversity field work methodology	DEC and DNR representatives were provided with contact details for RTA Hume Highway Duplication staff and for the Environmental Assessment consultants should they wish to raise any issues. The DEC representative provided to the Environmental Consultants and the RTA an overview of the methodology for biodiversity anticipated. The DEC representative subsequently reviewed the biodiversity field work scope and methodologies for the Proposal prepared by the Environmental Assessment consultants. DEC and DNR will be consulted by DoP during it's consideration of the adequacy of environmental assessment documentation and will have further opportunity to comment directly to DoP regarding the adequacy of this environmental assessment during exhibition by the Department of Planning.

Date	Activity	Outcomes/Issues raised	Resolution/Ongoing Consultation
		reviewed by the DEC representative before commencement.	
15 September 2006	Letter sent to individual landholders informing them of commencement of the Environmental Assessment. The letter included a request for property access to undertake field work. Numerous phone conversations with landholders followed this letter to determine appropriate and acceptable access arrangements and to comply with individual landowner requests.	Landholders were informed of the commencement of the Environmental Assessment. Issues raised included that some landholders requested that they were phoned prior to consultants gaining access for field work. Other landowner issues were concerned about the impact to stock, including lambing sheep during access to land by field workers.	Access to land for field work was conducted in direct consultation with landholders and in accordance with landowner direction. Consultation identified the potential impact on sensitive stock caused by disturbance. This issue would be discussed with relevant landholders prior to construction.
19, 20 and 21 September 2006	Hume Highway Duplication Information Stand at Henty Machinery Field Days. Over the three days the stall was staffed by RTA personnel including the Hume Highway Duplication Project Managers.	The Information Stand facilitated two-way dialogue between members of the local community and key RTA staff, increased awareness of the Proposal and facilitated discussion of issues. It focussed on one-on-one discussions and allowed interested community members to find out about issues at their own convenience. The majority of issues discussed were raised by primary producers and heavy vehicle road users and related to traffic management, traffic delay and access to properties. The majority of community members provided positive feedback and recognised the benefits of duplication of the Hume Highway.	The RTA addressed the potential impacts to traffic and property access in Chapters 8, 9 and 11 of this report.
19 September to 11 October 2006	Aboriginal archaeological survey of the proposed road corridor involving representatives of the Aboriginal community	The archaeological surveys sought to identify Aboriginal artefacts, objects, sites and Potential Archaeological Deposits (PAD) within the road proposed corridor and potentially impacted by the Proposal. The involvement of the Aboriginal community raised awareness and allowed the	Areas for further detailed investigation were identified. Additional investigations will again be conducted with the involvement of the community.

Date	Activity	Outcomes/Issues raised	Resolution/Ongoing Consultation
		community the opportunity to be directly involved in and provide input to the surveys.	
27 September 2006	Media briefing on the Hume Highway Duplication in Wagga Wagga and Albury.	The media briefing served to further raise awareness of the Proposal in the community and to provide information for dissemination. The main issue raised during the media briefing was traffic impacts during construction.	The RTA addressed the potential impacts to traffic in Chapters 8, 9 and 11 of this report.
28 September 2006	Meeting with the Commonwealth Department of Environment and Heritage (DEH) to brief the Department on the Hume Highway Duplication and indicate any potential for impacts on items listed under *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).	Dialogue with DEH regarding biodiversity commenced and information about the Proposal was communicated. The discussion focussed on known occurrences of threatened species and communities (eg. Box Gum Grassy Woodland and Derived Grassland) listed under the EPBC Act within or surrounding the Proposal sections.	The occurrence and impact to Box Gum Grassy Woodland and Derived Grassland was assessed in accordance with DEH guidelines (refer to Chapter 8.). DEC will be consulted by DoP during it's consideration of the adequacy of environmental assessment documentation and will have further opportunity to comment directly to DoP regarding this environmental assessment during its exhibition by the Department of Planning.
6 October 2006	Site inspection and general risk assessment with Department of Primary Industry (Fisheries).	Discussion of the Proposal, discussion of aquatic issues and identification of potential mitigation and/or compensation measures. DPI Fisheries noted that the aquatic systems of the study area are reasonably degraded. The main issue raised was that fish passage should be maintained. DPI Fisheries identified the potential to utilise felled trees from the Proposal in the Living Murray Re-snagging Project. This involves restoring riparian habitat in the Murray River by importing felled tree	Provision of felled trees to DPI Fisheries for use in the Living Murray Re-snagging Project has been included as a mitigation measure in this Environmental Assessment (refer to Chapter 8 of this environmental assessment). This would be performed in consultation with DPI Fisheries. The RTA has made a commitment to maintain fish passage before, during and after construction (refer to Chapter 10). DPI will have the opportunity to submit comment on this Environmental Assessment report during exhibition by the Department of Planning.

Date	Activity	Outcomes/Issues raised	Resolution/Ongoing Consultation
		trunks.	
11 October 2006	Briefing of members of the quarry products industry and transporters.	This briefing enabled the RTA to identify potential sources of construction materials for the Proposal. Issues raised by the quarry industry were that quarry equipment in the area is currently in short supply, for example crushing and drilling equipment. There is also a short supply of trucks in the area and of machinery required for hauling material.	The quarry industry agreed to assist the RTA with planning for resourcing of materials and equipment by providing information about quarry capacities, licensing and current resourcing needs. At the time of writing this information was being received by the RTA. The RTA would continue to consult with the quarry industry up to and throughout the construction planning phase to ensure that sufficient quarry and transport equipment are available to service the works.
During September and ongoing	Ongoing consultation with government agencies involving phone calls and meetings including: Department of Conservation; and Department of Lands.	Informal consultation facilitated discussion of potential impacts, mitigation and management measures, agreement of study approach and acquisition of land (TSRs) where required.	Government agencies will have the opportunity to submit comment on this Environmental Assessment report during exhibition by the Department of Planning.
Ongoing	Consultation with public transport providers is ongoing and at the time of publication a response to a letter from the RTA had not been received.	Issues raised by the RTA include: • Provision of safe access to school bus bay locations during construction and operation. • Bus bay design to provide for children and disabled persons. • Provision of bus turning bays on the Highway where required.	Further refinement would be undertaken as a result of issues raised during the Community and Stakeholder Consultation strategy which would include consultation with public transport operators and the local community and as a result of exhibition of this Environmental Assessment. Issues raised would be considered during the detailed design phase of the Proposal and for inclusion in construction documents.
Ongoing	Consultation with emergency services is ongoing and at the time of publication a response to a letter from the RTA had not been received.	Issues raised by the RTA include: • Access for emergency vehicles. • Retention or re-instatement of existing fire track	Further refinement would be undertaken as a result of issues raised during Community and Stakeholder Consultation strategy which would include consultation with emergency services and the local community and as a result of exhibition

Date	Activity	Outcomes/Issues raised	Resolution/Ongoing Consultation
		in the road reserve.	of this Environmental Assessment. Issues raised would be considered during the detailed design phase of the Proposal and for inclusion in construction documents.
Ongoing	Consultation with utility providers including Nextgen, Telstra, Country Energy, Transgrid, and Optus.	Issued raised included: • infrastructure relocation. • service impacts during construction.	Further consultation with utility providers would be undertaken as required during detailed design.

5.3 Future Consultation

Throughout future consultation for the Project the RTA is committed to continue to identify and manage issues of interest or concern to the community and/or stakeholders. The RTA values community and stakeholder input to the project delivery process and is committed to ensuring:

- That the community and stakeholders are provided with accurate and accessible information regarding the processes and activities associated with the Proposal.
- That information is provided to community and stakeholders in a timely manner.
- That the community and stakeholders have appropriate avenues for providing comment or raising concerns with respect to the Proposal.
- That a high level of responsiveness to issues and concerns raised by the community and/or stakeholders is demonstrated throughout development and delivery of the Proposal.

5.3.1 Environmental Assessment Consultation

This environmental assessment, which includes RTA's draft Statement of Commitments, will be publicly exhibited by the Department of Planning for at least 30 days. During the exhibition the public will be able to review the environmental documents, obtain information from a display panel and forward submissions to the Department for consideration in its assessment of the Proposal.

During the exhibition period, the RTA will provide opportunities for the community to discuss the Environmental Assessment with key members of the Hume Highway Duplication team and to provide comments. The dates and venues of the public display will be advertised in local and mainstream press and the Hume Highway Duplication website will be updated as required during the exhibition period. The Hume Highway Office will continue to be staffed by Project team members to receive and respond to comments or enquiries. All written comments received by the RTA will be forwarded to the Department of Planning to assist the Department in analysis of the Environmental Assessment.

The RTA will prepare a Submissions Report that addresses relevant issues raised in submissions by the community and stakeholders. The Submissions Report would give consideration to whether changes to the Proposal are required to minimise its environmental impact.

The Director General of the Department of Planning will prepare an Assessment Report that takes into account the Environmental Assessment with consideration to views and submissions of relevant government agencies, councils, stakeholders and the community.

5.3.2 Consultation during pre-construction

If the Proposal is approved, a detailed Community and Stakeholder Consultation Strategy would be prepared in accordance with the RTA's *Community Involvement Practice Notes and Resource Manual* (RTA 1998) and the relevant conditions of project approval. The Community and Stakeholder Consultation Strategy would provide detailed consultation activities to be undertaken prior to and during the construction stage, processes to ensure that information is provided to the community and stakeholders in a timely manner and a range of contact avenues for receipt of comments and feedback. Aboriginal consultation would continue to be undertaken in accordance with the DEC's *Interim Community Consultation Requirements for Applicants* (January 2005) and *Draft Guidelines for Aboriginal*

Heritage Impact Assessment and Community Consultation (July 2005) and the RTA's *Aboriginal Liaison Protocol.*

The RTA would provide opportunities for potentially affected communities and stakeholders to identify local issues and concerns prior to commencement of construction to ensure that appropriate mitigation measures are developed to manage impacts. The Hume Highway Office would be maintained throughout the pre-construction period and community updates would be disseminated as required.

5.3.3 Consultation during construction

The Hume Highway Office would be maintained during construction. A range of consultation tools would be implemented to communicate information and provide feedback opportunities for the community, including road users, businesses and other stakeholders impacted by construction activities. Consultation tools would include:

- Road signage;
- Weekly traffic reports to local media;
- Notifications of construction activities to potentially affected residents, businesses and to road users registered on a contact database;
- Community updates outlining expected construction activities and works;
- Hume Highway Duplication website updated on a regular basis;
- 24-hour toll free telephone number;
- Regular advertisements in regional and local newspapers (at three monthly intervals and prior to major construction impacts); and
- A feedback management system.

The Hume Highway Duplication website would be updated before construction commences, during construction and until completion of the works with periodic reports on the progression of works, consultation activities and planned work schedules. In addition to the variety of contact methods for the Hume Highway Office, feedback would also be received at site offices.

A feedback management system would be implemented before construction commences to record, track and respond to community and stakeholder comments. When a comment cannot be responded to immediately, a follow-up verbal response on what action is proposed would be provided within 24 hours of the next working day. The system would facilitate a written response to the comment or complaint as required if the comment or complaint cannot be resolved by an initial or follow-up verbal response.

Site meetings, telephone interviews and letterbox notifications would be important elements of consultation with affected landholders and would be in addition to the other consultation tools described above. Specific information will be provided to affected landowners at appropriate stages and ongoing consultation will be undertaken with affected stakeholders as required to resolve issues as they arise. Consultation with the Aboriginal community would be ongoing as required to resolve issues that are raised.

6 Planning and Approval Framework

This section outlines the statutory requirements for the environmental assessment and approval of the Proposal under NSW and Commonwealth Legislation.

6.1 New South Wales

6.1.1 Environmental Planning and Assessment Act

Application of Part 3A

The *Environmental Planning and Assessment Act 1979 (NSW)* (**EP&A Act**) provides a framework for environmental planning and assessment in NSW. Part 3A of the *EP&A Act* provides an assessment and approval process for major infrastructure projects.

Major infrastructure or other development that, in the opinion of the Minister for Planning, is of State or regional planning significance, may be declared under section 75B of the *EP&A Act* to be a project to which Part 3A applies.

The Minister for Planning declared the Hume Highway Duplication, of which the Proposal is a part, to be a project to which Part 3A applies by order published in the NSW Government Gazette (No 114) dated 4 September 2006.

The Minister's Part 3A declaration applies to development for the purposes of upgrading the following five sections of the Hume Highway to achieve four lanes of dual-carriageway:

- Sturt Highway to Tarcutta.
- Kyeamba Hill.
- Little Billabong (the Proposal).
- Yarra Yarra to Holbrook.
- Woomargama to Mullengandra.

These sections are shown in **Figure 1-1**.

Critical Infrastructure

The Minister for Planning may declare development subject to Part 3A to be a "critical infrastructure project" if it is of a category that, in the opinion of the Minister is essential to the State for economic, environmental or social reasons.

The Minister declared the Hume Highway Duplication to be a critical infrastructure project under section 75C of the EP&A Act. Schedule 5 of *State Environmental Planning Policy (Major Projects) 2005* was amended to list the Hume Highway Duplication as a critical infrastructure project.

The declaration of the Hume Highway Duplication as a critical infrastructure project reflects its importance to the State. Section 75T of the EP&A Act provides that certain legal proceedings can not be taken in relation to a critical infrastructure project except on application made or approved by the Minister for Planning. Section 75R limits the application of State Environmental Planning Policies to critical infrastructure projects.

Hume Highway Duplication Concept Plan

Section 75M of the EP&A Act provides that the Minister for Planning may require the proponent to submit a concept plan for a Part 3A project

The Minister for Planning has required the RTA to lodge a concept plan application for the Hume Highway Duplication.

The process under Part 3A for the assessment and approval of the concept plan is shown in **Figure 6-1** and is described as follows:

Stage 1 – Requirement for Submission of Concept Plan

The concept plan is to outline the scope of the project and any development options, set out any proposal for the staged implementation of the project and contain any other matter required by the Director-General of Planning.

The Minister for Planning has, by letter dated 12 October 2006, required the RTA to prepare a concept plan for the Hume Highway Duplication. The concept plan relates to all sections of the Hume Highway Duplication including the Proposal.

Stage 2 – Environmental Assessment Requirements

The Director-General of Planning, in consultation with relevant public authorities, prepares and issues environmental assessment requirements for the concept plan under sections 75F and 75N of the EP&A Act. The environmental assessment requirements may require an environmental assessment to be prepared. The Director-General may require the proponent to include in the environmental assessment a statement of commitments the proponent is prepared to make for environmental management and mitigation measures.

The Director-General issued environmental assessment requirements for the concept plan for the Hume Highway Duplication on 10 October 2006 which is reproduced in **Appendix B**.

Stage 3 - Preparation of Environmental Assessment

The RTA prepares an environmental assessment for the concept plan which addresses the environmental assessment requirements and submits it to the Director-General in accordance with section 75H.

Stage 4 - Public Exhibition

If the Director-General accepts the Environmental Assessment, the Environmental Assessment is placed on public exhibition for a period of not less than 30 days. During this period any person (including a public authority) may make a written submission to the Director-General.

Stage 5 – Consideration of Public Submissions

The Director-General provides copies of submissions received to the proponent or a report on the issues raised.

The Director-General then considers the submissions on the concept plan and may require the RTA to:

a) Submit to the Director-General a response to the issues raised in the submissions.

b) Prepare a preferred project report that outlines any proposed changes to the commitment to minimise its environmental impact.

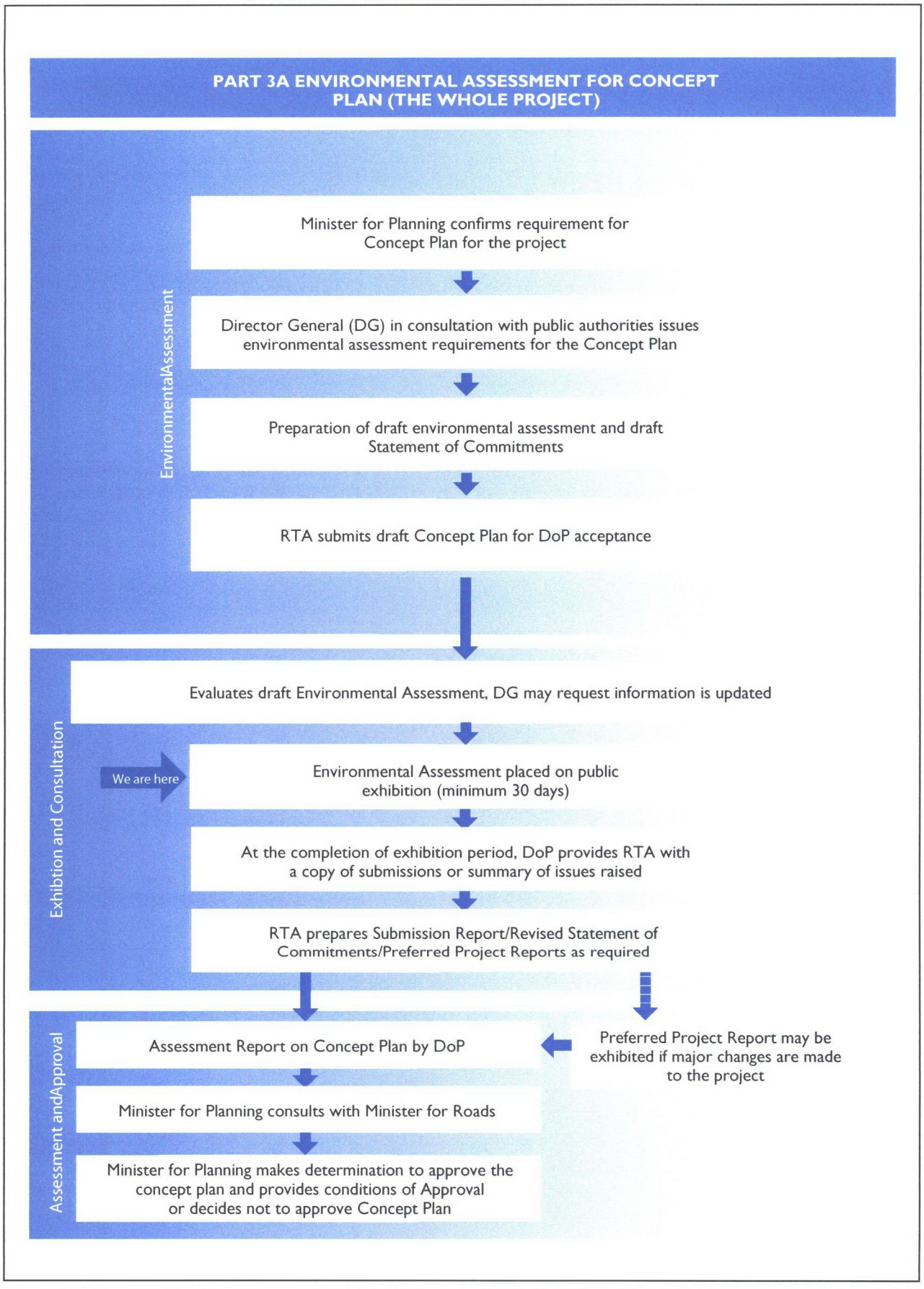


Figure 6-1 Concept Plan Assessment and Approval Process

c) Prepare a revised statement of commitments.

If any significant changes are proposed following public exhibition, the Director-General may require the RTA to make the preferred project report available to the public.

Stage 6 – Preparation of Director-General's Report

The Director-General of Planning then prepares a report under section 75I and 75N of the EP&A Act and gives a copy of that report to the Minister for the purpose of the Minster's consideration of the application for approval of the concept plan.

Stage 7 – Determination by the Minister

The Minister then decides whether or not to approve the concept plan for the Hume Highway Duplication under section 75O of the EP&A Act. If the decision is to approve the concept plan, the Minister for Planning may:

a) Determine the further environmental assessment requirements for approval to carry out the project or any particular stage of the project under Part 3A.

b) Determine that approval to carry out the project or any particular stage of the project is to be subject to the other provisions of the EP&A Act.

c) Determine that no further environmental assessment is required for the project or any particular stage of the project, in which case the Minister may determine that approval to carry out the project or that stage of the project without further application, environmental assessment or report under Part 3A.

Approval for Little Billabong Section

If the concept plan is approved by the Minister for Planning, the RTA will require further approval under Part 3A for each section of the Hume Highway Duplication including the Little Billabong Proposal.

The full process under Part 3A of the EP&A Act for the environmental assessment and determination of the approval of the Proposal is summarised in stages 1-7 below and illustrated in **Figure 6-2**. It is proposed to undertake the full process for the Proposal concurrently with the process for assessment and approval of the concept plan.

However, the Minister for Planning may elect not to require the full process to be complied with for the Proposal if the concept plan is approved. In particular, the Minister for Planning may elect not to require stages 1 – 6 below and may proceed directly to stage 7.

Stage 1 – Lodgement of Application

The RTA may lodge an application for approval of a project with the Director-General of Planning under section 75E of the EP&A Act. An application may relate to part only of a project.

The RTA lodged an application for the Proposal with the Director-General on 12 September 2006.

Stage 2 – Environmental Assessment Requirements

The Director-General of Planning, in consultation with relevant public authorities, prepares and issues environmental assessment requirements for the project under section 75F of the EP&A Act. The Director-General may require the proponent to include in an environmental assessment a statement of commitments the proponent is prepared to make for environmental management and mitigation measures.

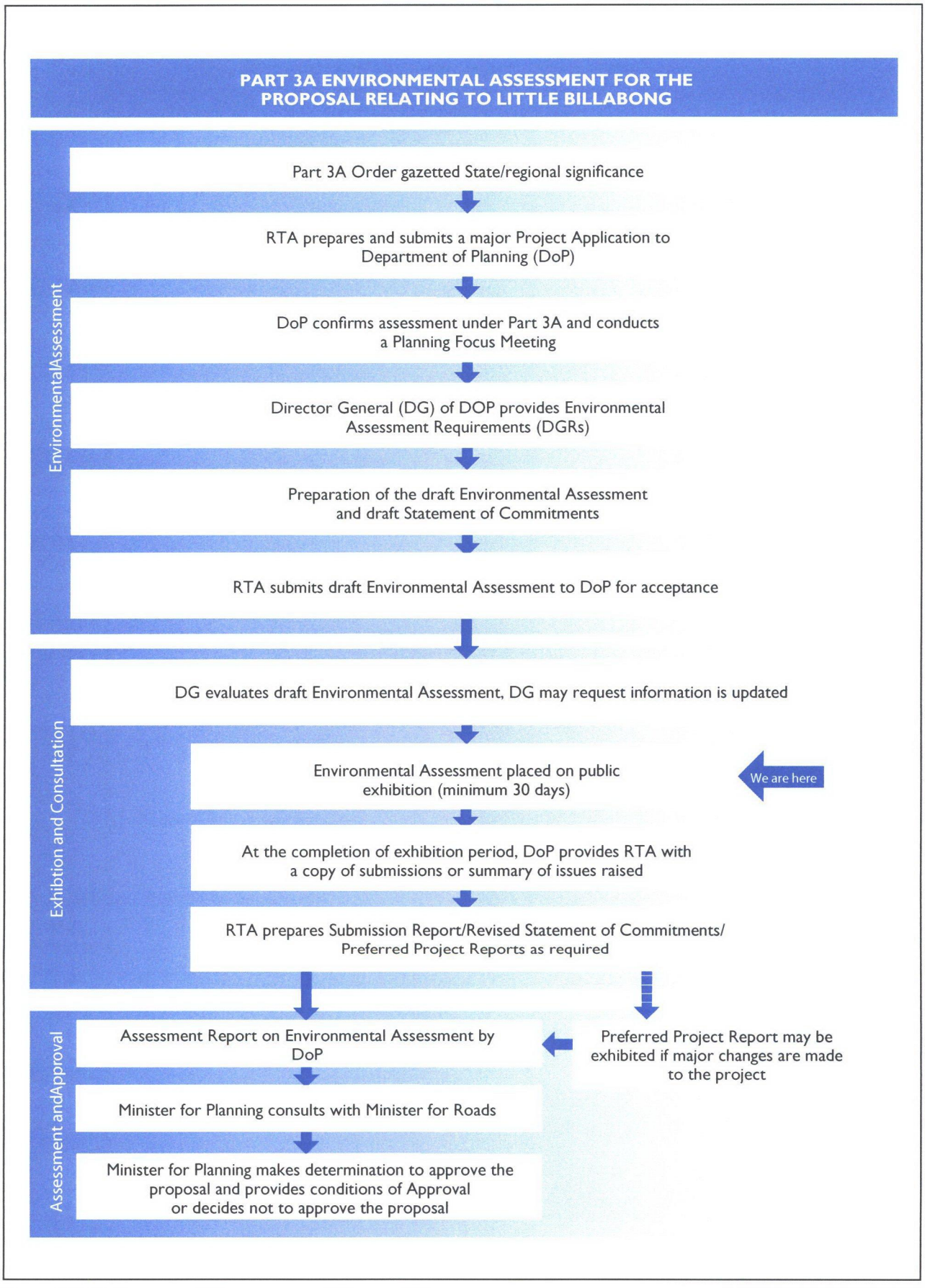


Figure 6-2 Environmental Assessment and Approval Process

The Director-General issued environmental assessment requirements for the Proposal on 1 October 2006 which are reproduced at **Appendix A**. These require the RTA to prepare an environmental assessment including a statement of commitments for the Proposal.

Stage 3 - Preparation of Environmental Assessment

The RTA prepares an environmental assessment which addresses the environmental assessment requirements and submits it to the Director-General in accordance with section 75H.

This document is the environmental assessment for the Proposal.

Stage 4 - Public Exhibition

If the Director-General accepts the Environmental Assessment, the Environmental Assessment is placed on public exhibition for a period of not less than 30 days. During this period any person (including a public authority) may make a written submission to the Director-General.

The environmental assessments for the concept plan and the Proposal are proposed to be publicly exhibited concurrently.

Stage 5 – Consideration of Public Submissions

The Director-General provides copies of submissions received to the proponent or a report on the issues raised.

The Director-General then considers the submissions on the Proposal and may require the RTA to:

a) Submit to the Director-General a response to the issues raised in the submissions.

b) Prepare a preferred project report that outlines any proposed changes to the commitment to minimise its environmental impact.

c) Prepare a revised statement of commitments.

If any significant changes are proposed following public exhibition, the Director-General may require the RTA to make the preferred project report available to the public.

Stage 6 – Preparation of Director-General's Report

The Director-General of Planning then prepares a report under section 75I of the EP&A Act and gives a copy of that report to the Minister for the purpose of the Minister's consideration of the applications for approval.

Stage 7 – Determination by the Minister

The Minister then decides whether or not to approve the Proposal and, if so, the conditions to be imposed on the approval.

6.1.2 Other Approvals

If the Minister grants an approval for the Proposal under Part 3A, then section 75U of the EP&A Act provides that the following approvals will not be required:

a) Concurrence under Part 3 of the *Coastal Protection Act 1979*.

b) Permit under section 201, 205 or 219 of the *Fisheries Management Act 1994*;

c) Approval under Part 4, or an excavation permit under section 131, of the *Heritage Act 1977*.

d) Permit under section 87 or a consent under section 90 of the *National Parks and Wildlife Act 1974*.

e) Authorisation referred to in section 12 of the *Native Vegetation Act 2003* to clear native vegetation.

f) Permit under Part 3A of the *Rivers and Foreshores Improvement Act 1948*.

g) Bushfire safety authority under section 100B of the *Rural Fires Act 1997*.

h) Water use approval under section 89, water management work approval under section 90 or an activity approval under section 91 of the *Water Management Act 2000*.

If the Minister grants an approval for the Proposal under Part 3A, then section 75V of the EP&A Act provides that the following relevant approvals under other legislation will still be required but cannot be refused:

a) An environment protection licence under chapter 3 of the *Protection of the Environment Operations Act 1997*.

b) A consent under section 138 of the *Roads Act 1993*.

Any approvals that may still be required (in accordance with section 75V or otherwise) will be identified following the completion of the planning approval process.

6.1.3 Planning Instruments

Section 75R of the *EP&A Act* relevantly provides:

- That, in the case of a critical infrastructure project, State Environmental Planning Policies (SEPPs) apply only to the extent that their provisions expressly provide.
- That environmental planning instruments (other than SEPPs) do not apply to or in respect of an approved project under Part 3A.

Notwithstanding, the environmental planning instruments which would have applied but for section 75R are discussed below:

Interim Development Order No.1 – Shire of Holbrook

Interim Development Order No.1 – Shire of Holbrook (Holbrook IDO) is a deemed environmental planning instrument under the EP&A Act. Greater Hume Council has advised that, outside urban areas, the Hume Highway road reserve and land within 400m of the road reserve is zoned 1(b) Non-Urban "B" under the Holbrook IDO. The Proposal is confined to within 400m of the road reserve.

The development control table within Holbrook IDO provides that development for the purposes of a road is permissible with development consent in the 1(b) Non-Urban "B" zone.
The Proposal is development for the purposes of a classified road under the *Roads Act 1993*. Accordingly, the operation of *SEPP No. 4 – Development Without Consent* results in the Proposal being permissible without development consent.

State Environmental Planning Policy No. 4 – Development Without Consent and Miscellaneous Exempt and Complying Development

Clause 11C of SEPP 4 provides amongst other matters, that certain development, which would otherwise be permissible with development consent, may be undertaken without

development consent provided it is for the purposes of a classified road or proposed classified road. As discussed above, the Proposal is development for the purposes of a classified road and/or proposed classified road under the *Roads Act 1993* and accordingly SEPP 4 operates to remove certain consent requirements specified in the Holbrook IDO.

State Environmental Planning Policy No.44 – Koala Habitat Protection

Greater Hume local government area (LGA) is identified within Schedule 1 of SEPP 44 as a LGA in which koalas are known to occur. The RTA has considered SEPP 44 matters notwithstanding that the development control requirements of the SEPP do not apply to the Proposal.

The potential for impacts on koalas (*Phascolarctos cinereus*) and listed feed trees known under Schedule 2 of SEPP 44 (eg. *Eucalyptus albens*, White box) as a result of the Proposal is considered within the biodiversity working paper (refer to **Appendix D**).

State Environmental Planning Policy No.55 – Remediation of land

SEPP 55 provides planning controls for the remediation of contaminated land for the purpose of reducing risks to human health and the environment. The policy specifies when consent is required for remediation work, requires all remediation work to comply with certain standards and notification requirements, and ensures that land is investigated if contamination is suspected.

State Environmental Planning Policy (Major Projects) 2005

The Major Projects SEPP identifies the Hume Highway Duplication as a critical infrastructure project.

6.2 Commonwealth Legislation

6.2.1 Environmental Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), amongst other matters, requires approval from the Commonwealth Minister for Environment and Heritage for actions which will or are likely to result in significant impacts on:

- Matters of National Environmental Significance (NES), or
- Commonwealth land (or generally where the action is being undertaken on Commonwealth land)

The Proposal is not proposed to be undertaken on Commonwealth land nor will it be likely to have a significant environmental impact on Commonwealth land. Matters of NES that are relevant to the Proposal include:

- Nationally threatened species and ecological communities.
- Migratory species protected under international agreements.
- Ramsar wetlands.

If the RTA considers that the Proposal may be or is a controlled action then the RTA must refer the Proposal to the Commonwealth Minister for Environment and Heritage for a decision on whether it constitutes a "controlled action". A referral may also be made for the Minister's decision if the RTA is considers that the Sturt Highway to Tarcutta Proposal is not a controlled action.

The Little Billabong section of the Hume Highway Duplication has been referred to the DEH Minister to determine if the Proposal is a controlled action in view of the removal of vegetation listed under the EPBC Act.

If the Proposal is determined to be a "controlled action" then approval is required from the Commonwealth Minister. If the Proposal is determined not to be a "controlled action" then Commonwealth approval is not required.

6.2.2 Other Commonwealth Legislation

Protection of places of significance to Aboriginal Australians is provided through the *Commonwealth Aboriginal and Torres Strait Islander Heritage Protection Act 1984.* Aboriginal people who believe that a place or object is threatened and believe that state government processes offer inadequate protection can apply to the Commonwealth Minister for Environment and Heritage to protect the place or object.

7 Identification of environmental issues

Chapter 7 describes the approach followed in identifying and assessing environmental issues that may arise during construction and operation of the Proposal.

7.1 Preliminary Environmental Assessment

A preliminary environmental assessment was undertaken prior to the preparation of the Project Application report. This study identified a number of key environmental issues based largely on desktop research, local experience of environmental staff based in RTA South Western Regional Office and specialist preliminary investigations on heritage and biodiversity. Key environmental issues identified as potentially requiring further, detailed investigations and research, included:

- Biodiversity – including impacts on threatened species, populations or ecological communities, the presence of aquatic ecosystems which may be sensitive to further disturbance, potential habitat for an endangered fish population and the possible presence of vulnerable flora species.
- Aboriginal heritage – including potential for artefact scatter sites, potential for scarred trees where old growth trees are present and cultural significance of landscape including creek lines, ridges and terraces which may be particularly sensitive.
- Non-Aboriginal heritage places and items listed on various planning instruments and registers or unlisted archaeological sites.

These key issues have been further investigated and are described in Chapter 8. Project specific impact mitigation and management measures are identified in Chapter 8 and in the draft Statement of Commitments in Chapter 10.

7.2 Planning Focus Meeting

A Planning Focus Meeting was convened by the Department of Planning and held on 23 August 2006 at Holbrook. Representatives of the following agencies attended:

- NSW Department of Planning;
- NSW Department of Environment and Conservation;
- NSW Department of Natural Resources;
- NSW Department of Primary Industries;
- Greater Hume Shire Council;
- Wagga Wagga City Council; and
- RTA.

The Planning Focus Meeting covered all five proposals that make up the Hume Highway Duplication from the Sturt Highway to Mullengandra. The purpose of the meeting was to provide information on the main aspects of the Proposal and enable representatives of each organisation to highlight potential environmental issues that may require further investigation. A summary of the environmental issues raised by each agency is provided in **Table 7-1**.

Table 7-1: Planning Focus Meeting environmental issues

Government Agency	Issue
Department of Planning	• Impact on travelling stock routes • Socio-economic impacts of 67 kilometres of concurrent construction • Construction hours • Resource requirements
Department of Environment and Conservation	• Vegetation clearing and potential impacts on threatened species and cultural heritage • Management of sediment, erosion, dust and noise • Survey and assessment for Aboriginal Heritage • Consultation with the Aboriginal community and Local Aboriginal Land Councils • Survey and assessment of scarred trees particularly where vegetation would be cleared • Assessment of background noise and consider noise goals • Detailed construction noise assessment required if working outside of normal hours • Consider operational impacts on residences due to changes to road alignment, traffic speeds and road surface
Department of Natural Resources	• Source and quantity of construction water • Potential impact of any run-off of salty groundwater (if used) • Potential impacts on other groundwater users • If groundwater intercepted during excavations, how would it be managed and disposed • Potential impact on flood regimes, and impact on landholders • Impact of increased run-off from new pavement • Biological and biophysical in-stream impacts of crossings
Department of Primary Industries	• Landholder access (including stock access) • Disturbed areas should be progressively rehabilitated • DPI Fisheries standard conditions would apply
Greater Hume Shire Council	• Interruptions to utilities should be avoided • Property access • Access to villages and towns • Why some proposed intersections are at grade while others are not
Wagga Wagga City Council	• Impact of water use on local users • Construction impacts on local community, particularly adjoining landowners • Construction and traffic flow impacts on the local community • Safety - how to reduce speed through towns as duplicated

Government Agency	Issue
	sections will increase speed up to the town areas • Noise and vibration impacts on heritage items

7.3 Environmental Assessment Requirements

The RTA submitted a Project Application, including the preliminary environmental assessment, to the Department of Planning on 12 September 2006 requesting the Director-General's Requirements for the Environmental Assessment. The Project Application was made available to the public on the Department of Planning's website and issued to relevant government agencies. The agencies were given a formal opportunity to consider the Proposal and provide comments to the Department of Planning to inform the development of the Director-General's formal environmental assessment requirements.

The Department of Planning issued the Director-General's environmental assessment requirements under the provisions of Part 3A of the EP&A Act on 9 October 2006. A copy of the Director-General's requirements is provided in **Appendix B**. A checklist of the requirements with cross-references to the relevant chapter(s) of the Environmental Assessment is included in **Appendix C**.

7.4 Environmental Risk Review

Following the Planning Focus Meeting, a site visit and associated environmental risk review session was held on 13 and 14 September 2006. This session was attended by representatives of the RTA, the environmental assessment consultants, the Department of Environment and Conservation and the Department of Natural Resources. While this session focussed on a similar set of issues to those identified at the Planning Focus Meeting, these were discussed and considered in more detail.

The environmental risk review for the Proposal is a qualitative assessment based on information provided in the Project Application report, the Planning Focus Meeting, and the environmental assessment. The level of environmental risk was assessed by considering the significance of the potential environmental impacts of the Proposal and the effectiveness of the proposed management measures in minimising any harm to the environment.

While the approach is qualitative, it provides an important step in the process of project planning and assessment of environmental impacts. In particular, it is used to guide scoping of environmental investigations and assessments and also to guide project design, and assist in identifying appropriate mitigation measures and management responses. The identified risks are based on the following risk categories and are summarised in **Table 7-2**.

Table 7-2: Environmental risk categories

Risk Category	Description
A	May have medium to high impact and require investigation to determine the level of potential impact and identify appropriate measures to manage and mitigate the effects.
B	May have medium to high impact but by using standard management measures, the effects can be reduced to acceptable levels
C	Has low impact and standard measures can be used to manage the effects.

Table 7-3: Environmental Risk

Environmental Factor	Risk	Risk Review	Risk Category	Document Reference
Biodiversity	• Clearing of Box-Gum Woodland • Loss of habitat for threatened species • Potential longer term impacts associated with increased habitat fragmentation	• The existing environment consists of woodland and cleared areas. It includes potential for a critically endangered ecological community (Box Gum Woodland) as well as a habitat for threatened fauna including bird, reptile and mammal species. • The risk review identified that biodiversity impacts needed further investigation to determine potential impacts and identify appropriate management and mitigation measures.	A	Chapter 8.1
Aboriginal heritage	• Disturbance of Aboriginal objects and places. • Potential destruction of these objects and places. • Disturbance of archaeological deposits and cultural values associated with the landscape.	• While there are no known Aboriginal sites in the study area, the landscape characteristics of the area represent a high potential that Aboriginal objects and places including scar trees, will be present. • The risk review identified that Aboriginal heritage needed further investigation to determine potential impacts and identify appropriate management and mitigation measures.	A	Chapter 8.2
Non-Aboriginal heritage	• Impacts on heritage items affected by the new carriageway • Potential to destroy heritage items and places not listed on any statutory register	• The preliminary heritage investigations identified a number of historic buildings and residences including stations, homesteads, hotels/inns, a church and a school. There are also potential archaeological relics. • The risk review identified that non-Aboriginal heritage needed further investigation to determine potential impacts and identify appropriate management and mitigation measures. •	A	Chapter 8.3
Resource management	• Demand on resources, including select fill and construction materials • Impacts associated with extracting fill and construction materials	• Where balanced cut and fill cannot be achieved, additional import of general fill and select material would be required. • Potential direct and indirect impacts include local site and transportation impacts. These can be managed by minimising the quantities of materials to be provided, minimising the transport distance, and other site	A	Chapter 8.5

Environmental Factor	Risk	Risk Review	Risk Category	Document Reference
		management measures		
Hydrology	• Impact of new carriageway on local flooding • Impact of water extraction on groundwater	• Based on historical data and the proximity to creek lines there is a potential for the study area to be susceptible to flooding. Hydrological studies are required to ensure that the potential long-term impacts associated with flooding are minimised. • Where feasible, construction water would be derived from groundwater. • The risk review identified that hydrology needed further investigation to determine potential impacts and identify appropriate management and mitigation measures	A	Chapter 8.4
Noise	• Noise impacts on sensitive receivers during construction and operation	• There is a small number of sensitive noise and vibration receivers scattered throughout the study area. • Short term impacts from construction activities and heavy vehicle movements although there are few sensitive receivers likely to be affected by this impact. • Noise monitoring has been undertaken to assess the potential noise and vibration impacts of project construction and operation on sensitive receivers. • Standard management measures would be employed to minimise noise and vibration impacts.	B	Chapter 9.3
Traffic	• Impact of construction traffic on local & through traffic	• Potential traffic disruptions on the highway and local connecting roads may occur during construction. These impacts are likely to be minor and limited to short time delays and reduced travelling speeds. • Carriageways would remain under traffic while the new carriageway is constructed and minor short term delays would occur as traffic switches are implemented. Delays and traffic stoppages would be minimised by providing local deviations and minor detours.	B	Chapter 9.1

Environmental Factor	Risk	Risk Review	Risk Category	Document Reference
		• Impacts on freight movements are expected to be minor as the majority of freight traffic travels at night outside the proposed construction hours. • Standard traffic management measures would be employed to minimise traffic disruption		
Air quality	• Impacts from dust and emissions of heavy construction machinery • Impact on emissions during operation of the dual carriageway	• Impacts on air quality during construction would be of short duration and have minor effects because of the rural environment and the limited number of sensitive receivers likely to be affected • During operation, vehicle emissions are not expected to increase beyond that which would be anticipated without the additional carriageway.	C	Chapter 9.2
Visual	• Alteration of existing rural landscape with addition of a new carriageway and changed intersection arrangements • Removal of visually prominent native vegetation	• The completed road would be consistent with the existing duplicated sections of the highway. • Visual impacts would be reduced by aligning with the road formation with the landscape contours • The area would be revegetated using native species reflecting the natural vegetation patterns	C	Chapter 9.4
Waste	• Generation of waste during construction activities including building materials, excess unsuitable spoil material, vegetation material	• Waste management would be undertaken in accordance with the resource management hierarchy principles of the *Waste Avoidance and Resource Recovery Act, 2001*. • Standard management measures would be employed to minimise waste impacts.	C	Chapter 9.5
Soils and water	• Disturbance of soils and potential for soils to become susceptible to erosion • During operation, water quality may be affected by surface runoff which could contain pollutants or accidental	• While soils in this region are fragile, with implementation of standard erosion and sedimentation control measures, the potential impacts and risk of soil erosion would be minimised. • The quantity of pollutants deposited at the road surface is not expected to increase during operation as traffic volumes are not expected to increase and road safety would be improved. Strict controls would	B	Chapter 9.6

Environmental Factor	Risk	Risk Review	Risk Category	Document Reference
	spills	minimise risk of pollutant contamination during construction.		
Contaminated land	• Disturbance of contaminated land and consequent impacts on air and water quality • Potential to contaminate soils through spillage of fuels or oils	• The site would be subject to a contamination investigation prior to construction and would be remediated as part of the works if required. Risks and potential negative impacts would be minimised by appropriate onsite management of any contaminated soils and remediation or removal as required.	B	Chapter 9.7
Social	• Reduction in amenity for the local community during construction • Disruption to local community during construction • Severance effects of highway duplication • Loss of land through acquisition and potential impact on land use • Impact of temporary modification to property access • Concerns about increased speed in urban areas.	• Alternative temporary or permanent property access will be established in consultation with land owner (if required) to minimise disruption • Land acquisition will be required however there is minimal land severance. • Positive economic impacts would benefit the community including increased demand for support services during construction and improved level of service and road safety conditions for the highway • Additional speed signs and speed restricted areas on urban approaches will minimise the perceived speed concerns in villages.	B	Chapter 9.8

Following consideration of the preliminary environmental assessment, the issues raised in the Planning Focus Meeting, the environmental risk review analysis and the Director General's Requirements for Environmental Assessment, the Key Environmental Issues for the Proposal are presented in **Table 7-4** and addressed in detail in Chapter 8. All the key issues were identified with Risk Category A (refer **Table 7-2**).

Table 7-4: Key environmental issues and identified risks

Key Environmental Issues	Identified Risk
Biodiversity	• Direct and indirect impacts on habitat and flora and fauna. • Cumulative impacts on communities in the region. • Protection of key habitats and corridors and impacts on riparian zones. • Success of mitigation measures.
Heritage	• Aboriginal and non-Aboriginal heritage and natural areas directly or indirectly affected. • Potential impacts on identified items and natural areas of heritage significance. • Ineffective Aboriginal community consultation.
Resource management	• Extractive material needs of the proposal particularly any extractive material activities outside the proposal corridor. • Water supply for construction
Hydrology	• Flooding, salinity and/or waterlogging. • Impacts of the proposal on flood behaviour.
Cumulative assessment	• Identification of cumulative impacts resulting from the total proposal and mitigation measures along the whole Hume Highway corridor including, but not limited to: – Changes to regional and local road network access, road usage, safety and performance. – Construction traffic management. – Biodiversity. – Demand on water resources. – Management of required changes to traffic access.

Chapter 9 of the EA provides a broad assessment of other issues, which are normally associated with the development and delivery of road projects and are routinely managed through detailed design and by the implementation of standard management and mitigation measures aimed at ensuring that all necessary environmental criteria and guidelines are achieved. They were also identified as having a low level of risk in the risk analysis (refer **Table 7-2**). These issues are outlined below:

- Traffic.
- Air quality and greenhouse gases.
- Noise and vibration.
- Visual.
- Waste.
- Geology, soils and water.
- Land use and social.
- Hazards and risks.

8 Assessment of Key Issues

Chapter 8 presents the Key Environmental Issues outlined in the Director General's Requirements for Environmental Assessment. Key features of the existing environment, consideration of potential environmental impacts and relevant mitigation measures and management responses are provided.

8.1 Biodiversity

The condition of vegetation, streams and habitats throughout the study area is variable but most are highly modified. A summary of key environmental features relevant to the Proposal is provided in the following sections. The detailed assessment of the impacts of the Proposal is contained in **Appendix D** and includes the methodology, species lists and assessment considerations.

8.1.1 Key Features of the Existing Environment

Endangered Ecological Communities

Vegetation communities present throughout the study area are fragmented and degraded. Common canopy species in these areas include White Box (*Eucalyptus albens*), Yellow Box (*Eucalyptus melliodora*) and Blakely's Red Gum (*Eucalyptus blakelyi*). These species are characteristic of the Critically Endangered Ecological Community (CEEC) White Box - *Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grasslands* under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Endangered Ecological Community (EEC) *White Box - Yellow Box – Blakely's Red Gum Woodland* under the NSW *Threatened Species Conservation Act 1995* (TSC Act). Guidelines have been prepared under both State and Commonwealth legislation outlining the key criteria that must be meet for woodland areas supporting these species to be considered representative of either the CEEC or EEC.

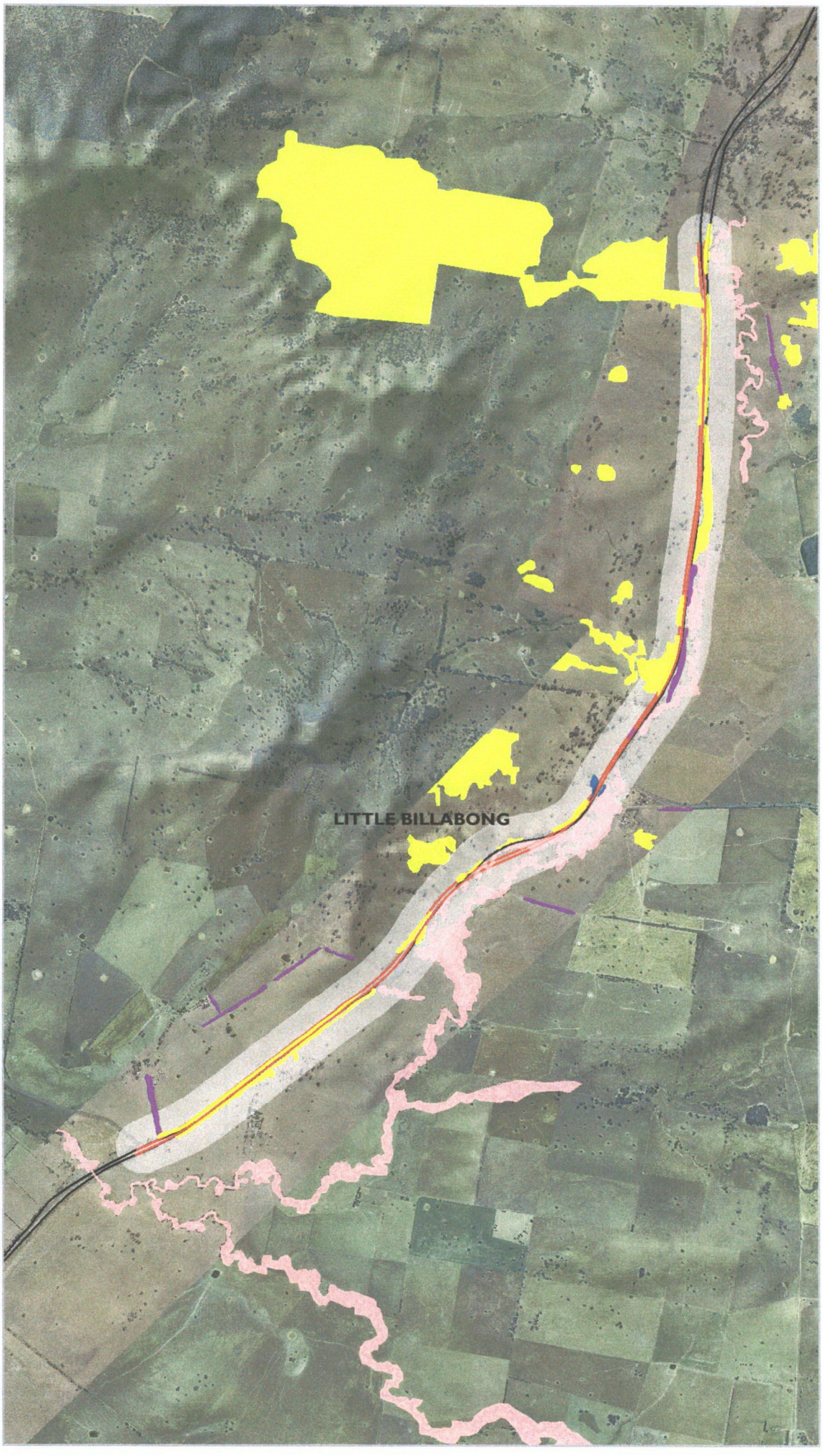
In accordance with the guidelines for identifying *White Box - Yellow Box – Blakely's Red Gum Woodland* under the TSC Act (see **Appendix D**), all areas supporting these species within the study area would be considered part of the EEC.

However, based on the Commonwealth identification guidelines, only areas those areas that have been identified as being of high quality during the current surveys or that were identified as of moderate condition and larger than 2 ha would be considered representative of the CEEC. Although areas identified to be of low quality would not considered part of the CEEC, they would be included as part of the EEC under the TSC Act.

Box-Gum Woodland (including both the EEC and CEEC) occurs within roadside reserves and scattered fragments within cleared farmland. Moderate quality patches are restricted to road reserves and Travelling Stock Routes (TSR) where both native and exotic species are well represented. Lower quality examples of this vegetation community occur within grazed pastures where exotic species are dominant and regeneration of native species is restricted. Some derived grasslands (a grassy woodland from which the trees have been removed) occur in small areas adjacent to woodland areas in the road reserve (**Figure 8-1**).

Threatened Flora

No threatened flora species were recorded in the study area. However, potential habitat is present for 10 threatened flora species previously recorded within the region and this habitat would be affected by the Proposal. Species likely to be affected are listed in **Table 8-1**.



Legend

- Proposed alignment
- Hume Highway
- Study Area
- Planted Vegetation
- River Red Gum Woodland
- Sedgeland/Reedland
- White Box - Yellow Box - Blakelys' Red Gum Woodland

Data Source

Vegetation data from SKM
Design data and Aerial photography from the RTA

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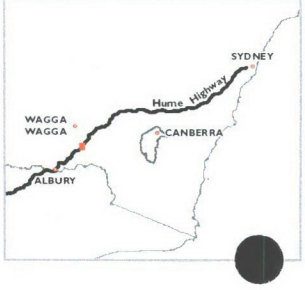

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Figure 8-1 **Vegetation communities**

Table 8-1 Threatened flora with potential habitat in the study area

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat
Ammobium craspedioides	Yass Daisy	V	V	Box–Gum Woodland
Amphibromus fluitans	River Swamp Wallaby Grass	V	V	Riparian / Wetland Habitats
Brachycome papillosa	Mossigiel Daisy	V	V	Ironbark Woodland
Caladenia arenaria	Sand-hill Spider Orchid	E		Ironbark Woodland
Caladenia concolour	Crimson Spider Orchid	E	E	Box–Gum and Ironbark Woodland
Caladenia rosella	Rosella Spider Orchid	PE	V	Ironbark Woodland
Diuris tricolour	Tricolour Diuris	V	V	Ironbark Woodland
Goodenia macabarronii	Narrow Goodenia	V	V	Ironbark Woodland
Pilularia novae-hollandiae	Austral Pilwort	E		Riparian / Wetland Habitats
Rutidosis leptorrhynchoides	Button Wrinklewort	E	E	Box–Gum Woodland
Senecio garlandii	Woolly Ragwort	V	V	Box–Gum Woodland Box–Gum Woodland
Swainsona murrayana	Small Darling-pea	V	V	Box–Gum Woodland
Swainsona recta	Small Purple-pea	E	E	Box–Gum Woodland

TSC = *Threatened Species Conservation Act 1995*;
EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*;
V = Vulnerable, E = Endangered, PE = Presumed Extinct.

Threatened Fauna

Four broad fauna habitat types occur in the study area:

- Woodland.
- Riparian habitats.
- Derived grasslands.
- Freshwater habitats (dams, creeks and wet depressions).

These habitats provide potential foraging, nesting, roosting, basking and resting sites for a variety of fauna, including the threatened Brown Treecreeper (*Climacteris picumnus*) and Squirrel Glider (*Petaurus norfolcensis*) which were recorded within the study area during the ecological surveys. The Diamond Firetail (*Stagonopleura guttata*) has also been recorded in the study area during previous surveys (CSU, 2006). The Brown Treecreeper appeared to be relatively abundant and widespread, occurring in Box-Gum woodland and River Red Gum riparian habitat. Individuals were recorded in both narrow linear roadside reserves and creekline vegetation. Observations of Diamond Firetails are few and generally relate to dense tall grass near Little Billabong Creek. Areas of high and moderate quality fauna habitat are shown on **Figure 8-2** and were identified using the presence of high quality habitat for the Squirrel Glider (*Petaurus norfolcensis*) Brown Treecreeper (*Climacteris picumnus*) and Diamond Firetail (*Stagonopleurata guttata*) to assess general threatened species habitat value, given the identified presence of these species across the study area. The criteria used to assess habitat quality are representative of the minimum attributes required for reasonable habitat health and viability for these target species and include:

- Presence and abundance of significant microhabitat features, including large mature trees, hollow-bearing trees, stags and foraging resources.
- Size of remnant patches and extent of connectivity, movement corridors and refugia between vegetated areas presence of significant keystone species and critical habitat elements.
- Height of upper strata and density of ground cover (structural diversity).
- Assessment of previous and present land use and disturbance regimes.

Two Squirrel Gliders were captured at the northern end of the Little Billabong section, one in a linear road reserve patch and the other on the opposite, western side of the Hume Highway on the edge of a larger fragment of Box-Ironbark woodland. The results suggest that Squirrel Gliders are currently crossing the highway at the northern end of the Little Billabong section across the existing single carriageway (**Figure 8-2**). The proposed widening of the highway at this location has the potential to reduce the frequency of glider crossings and increase mortality through vehicle collisions.

The Proposal also has the potential to affect habitat for a number of other threatened and migratory species previously recorded in the region. Species with the potential to be affected by the Proposal are listed in **Table 8-2**.

Legend

- Proposed alignment
- Hume Highway
- Study Area

Threatened Fauna Survey

- Brown Treecreeper
- Squirrel Glider

Threatend Fauna Habitat

- High Quality Habitat
- Moderate Quality Habitat
- Squirrel Glider Crossing Point

Data Source

Fauna survey data from SKM
Design data and Aerial photography from the RTA

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Kilometres

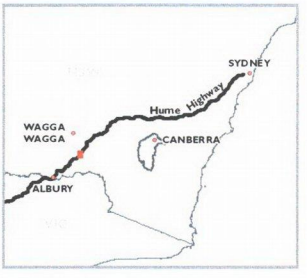

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Figure 8-2 **Threatened fauna habitat and survey records**

Table 8-2 Threatened fauna with potential habitat in the study area

Scientific Name	Common Name	TSC Act Status	EPBC Act Status	Habitat
Climacteris picumnus	Brown Treecreeper	V		Woodland and Riparian habitats
Stagonopleura guttata	Diamond Firetail	V		Woodland and Derived Grasslands
Melithreptus gularis gularis	Black-chinned Honeyeater	V		Woodland
Melanodryas cucullata	Hooded Robin	V		Woodland
Chthonicola sagittata	Speckled Warbler	V		Woodland
Neophema pulchella	Turquoise Parrot	V		Woodland and Derived Grasslands
Xanthomyza phrygia	Regent Honeyeater	E	E,M	Woodland and Riparian habitats
Lathamus discolor	Swift Parrot	E	E,M	Woodland
Polytelis swainsonii	Superb Parrot	V	V	Woodland and Riparian habitats
Ninnox connivens	Barking Owl	V		Woodland and riparian habitats
Myiagra cyanoleuca	Satin Flycatcher		M	Woodland
Hirundapus caudacutus	White-throated Needletail		M	Woodland
Merops ornatus	Rainbow Bee-eater		M	Woodland and Riparian habitats
Petaurus norfolcensis	Squirrel Glider	V		Woodland and Riparian habitats
Nyctophilus timoriensis	Greater Long-eared Bat	V		Woodland and Riparian habitats
Dasyurus maculatus	Spotted-tailed Quoll	V	V	Woodland
Litoria raniformis	Southern Bell Frog	E	V	Freshwater and riparian habitats

TSC = *Threatened Species Conservation Act 1995*;
EPBC Act = *Environment Protection and Biodiversity Conservation Act 1999*;
V = Vulnerable, E = Endangered, M = Migratory.

Aquatic Ecology

Little Billabong Creek and an anabranch of Little Billabong Creek are the only streams with the potential to be affected by the Proposal. No direct impacts on Little Billabong Creek are anticipated as a consequence of the Proposal. However, management measures would need to be implemented to minimise indirect impacts.

Crossings would be established over the anabranch of Little Billabong at two locations. At these locations, the anabranch comprises a grass channel for the most part with some areas

of pebble/gravel substrate and abundant leaf litter. The riparian zone comprises scattered native trees and an exotic pasture understorey.

Endangered Aquatic Communities and Threatened Fish

Little Billabong Creek and its tributaries fall within the natural drainage basin of the lower Murray River and therefore form part of the endangered Aquatic Ecological Community in the Natural Drainage Basin of the Lower Murray River Catchment. This community is listed as endangered under the *Fisheries Management Act 1994* (FM Act). The community includes "all native fish and aquatic invertebrates within all natural creeks, rivers and associated lagoons, billabongs and lakes of the regulated portions of the Murray River below the Hume Weir, the Murrumbidgee River below Burrinjuck Dam, and the Tumut River below Blowering Dam, as well as all their tributaries and branches." (*NSW Fisheries 2002b*). Given that the Proposal would cross the anabranch of Little Billabong Creek it would affect this endangered ecological community. Furthermore, the Proposal has the potential to indirectly affect Little Billabong Creek and hence the endangered ecological community. Management measures would be implemented to mitigate potential impacts on this community.

A number of threatened fish species are known to inhabit the waterways of the Murray-Darling Basin but potential habitat for most of these species is not present within Little Billabong Creek or its anabranch due to its small size and degraded nature.

While the Purple Spotted Gudgeon (*Mogurnda adspersa*) (western population) is considered to have the greatest potential to occur within Little Billabong Creek or its anabranch, the likelihood that threatened fish species or populations would occur there is remote.

Murray Cod (*Maccullochella peelii peelii*) and Trout Cod (*Maccullochella macquariensis*) exist within nearby streams. Murray Cod is listed as vulnerable under the EPBC Act and Trout Cod is listed as endangered under EPBC and FM Acts. Both species are unlikely to populate the waterways in Little Billabong Creek given its degraded nature and limited size. However, potential impacts on water quality and particularly sedimentation as a consequence of the Proposal may have downstream impacts on these species.

8.1.2 Assessment of Potential Impacts

The Proposal has the potential for direct and indirect impacts on biodiversity. The survey methodology and detailed assessment of potential impacts of the Proposal is included **Appendix D** and has been summarised below.

Survey Methodology

Flora surveys throughout the study area included:

- Traverses on foot and mapping of all vegetation types present within the study area.
- An assessment of the presence of Endangered Ecological Communities (EEC) scheduled under the EPBC Act and TSC Act. Remnants of White Box - Yellow Box - Blakely's Red Gum Woodland were identified using the key principles provided in the Identification Guidelines for Endangered Ecological Communities (NPWS 2002) and with consideration of the Department of Environment and Heritage (DEH) White Box-Yellow Box- Blakely's Red Gum Grassy Woodland and Derived Grassland assessment criteria (DEH 2006).

- Specific flora transects and quadrats (20 m x 20 m plots) in each vegetation unit.
- Targeted searches for any rare and/or threatened flora species for which potential habitat was present within the study area.
- An assessment of vegetation condition using 20 m x 20 m quadrats in conjunction with general random meanders.

Surveys were conducted for fauna with the potential to occur within the study area using a variety of survey techniques including:

- Standardised time-based (20 minute) diurnal bird surveys.
- Mammal trapping using Elliot A and Elliot B traps.
- Spotlighting for arboreal mammals and bats and listening for calls of megachiropteran bats.
- Harp trapping for microchiropteran bats.
- Ultrasonic bat detection.
- Call playback for the threatened nocturnal birds.
- Call playback for threatened amphibians.
- Visual searches for amphibians.
- Fauna habitat assessments including 20 m x 20 m quadrats and hollow-bearing tree transects.

A visual habitat assessment of all streams likely to be traversed by the proposed highway duplication or within close proximity to the proposed construction area was conducted using the NSW AUSRIVAS field methodology.

Potential Impacts

The potential impacts from the Proposal have been categorised into construction impacts and operational impacts.

Construction

Endangered Ecological Communities

Box–Gum Woodland of varying quality occurs throughout the study area. Based on the current Proposal footprint, it is anticipated that areas of Box-Gum Woodland, of varying quality, would need to be removed. **Table 8-3** outlines the proposed vegetation clearance, with specific reference to areas of both the EEC and CEEC. The total estimated area of Box-Gum Woodland directly cleared for the Proposal is 11.35 hectares, and the majority of this has been assessed to be of moderate quality. Of this, 2.4 hectares is considered to constitute the community as listed under the EPBC Act.

Table 8-3: Impacts on the Box-Gum Woodland vegetation community

Vegetation Community	Condition	Direct Impact (ha)	
		CEEC (EPBC Act)	EEC (TSC Act)
White Box – Yellow Box – Blakely's Red Gum Woodland	Low	-	6.77
White Box – Yellow Box – Blakely's Red Gum Woodland	Moderate	2.4	4.58
Total clearing listed communities		**2.4**	**11.35**

The total area of Box-Gum woodland to be cleared does not take account of areas that may be required for construction machinery, works depots or stockpile areas. However, it is intended (where possible) to locate these components of the construction works in areas where no clearing of native vegetation is required.

The conservation value of the vegetation was considered in the design of the road upgrade by locating the road footprint to minimise removal of remnant woodland and use existing road reserves wherever possible. However, the Proposal would also result in a small increase in isolation of vegetation on the eastern and western sides of the highway. Given that all remnants of Box-Gum woodland are endangered and of conservation value, a strategy to mitigate the impacts on this community would be developed.

The Proposal also has the potential for a number of indirect impacts on the Box-Gum Woodland community if management measures are not implemented. Potential indirect impacts include:

- Increased weed invasion in adjacent areas due to edge effects which may extend up to 50 m from the edge of the new carriageway (Bali 2000).
- Spreading of seeds of exotic species during soil disturbance for construction.
- Hydrological changes due to vegetation clearing and due to localised changes arising from the new road carriageway.
- Encroachment into areas outside the approved construction area.

Mitigation measures such as the implementation of a weed management strategy,, installation of sediment control measures and fencing of construction areas would minimise such impacts. An outline of the measures that would be implemented for this Proposal is provided in Chapter 10.

Threatened Flora

Although no threatened flora species were recorded in the study area, potential habitat for ten threatened flora species was identified and included:

- Yass Daisy (*Ammobium craspedioides*).
- River Swamp Wallaby Grass (*Amphibromus fluitans*).
- Claypan Daisy (*Brachycome muelleroides*).
- Crimson Spider Orchid (*Caladenia concolour*).
- Small Scurf-pea (*Cullen parvum*).
- Austral Pilwort (*Pilularia novae-hollandiae*).
- Button Wrinklewort (*Rutidosis leptorrhynchoides*).
- Woolly Ragwort (*Senecio garlandii*).
- Small Darling-pea (*Swainsona murrayana*).
- Small Purple-pea (*Swainsona recta*).

As a consequence of the Proposal, it is estimated that 14.28 hectares of potential habitat for these species would be removed. This was determined through calculating the footprint of the horizontal concept design, including batters and the amount of suitable habitat it was likely to disturb. This does not take account of any areas that may be required for construction machinery, works depots or stockpile areas.

The potential indirect impacts outlined for vegetation communities would also be applicable to the habitat of threatened flora species. Mitigation measures to minimise direct and indirect impacts on threatened flora species are outlined in Chapter 10.

Threatened Fauna

Potential habitat in the form of woodlands, grasslands, riparian areas and pasture are to be removed for the Proposal. High quality habitat for threatened fauna is mostly associated with River Red Gum riparian woodland habitats along Little Billabong Creek and its anabranch. This habitat supports numerous large trees, dead trees and tree-hollows providing an abundance of den and nesting opportunities for Squirrel Gliders, Brown Treecreepers and Superb Parrots. The River Red Gum riparian woodland also supports suitable habitat for the Barking Owl and prey, as well as preferred roosting and nesting habitat.

The total area of potential habitat to be removed would equate to 14.28 hectares. These areas include small portion currently utilised by a localised population of Squirrel Glider. The road widening would directly affect this species through reduction in foraging habitat and removal of tree hollows that provide potential den sites. The Proposal would also reduce the availability of potential nesting sites (tree-hollows) for the Brown Treecreeper. However, the Brown Treecreeper appeared to be relatively abundant and widespread in the study area, occurring in Box-Gum Woodland and River Red Gum riparian habitat. Individuals were recorded in both narrow linear roadside reserves and creek line vegetation, suggesting that the removal of a small percentage of tree-hollows would have a minor impact on the local population.

The Proposal would result in the additional clearance of vegetation in an already fragmented landscape and contribute to the cumulative loss of habitat for threatened fauna, particularly woodland birds and mammals.

Potential indirect impacts of the Proposal on fauna habitat and in particular habitat for threatened species during construction include:

- Disturbance of adjacent areas by encroachment from construction works.
- Degradation of habitat due to uncontrolled runoff.

Where possible, measures would be implemented to prevent indirect impacts of the Proposal on threatened species as outlined in **Table 8-4**.

Endangered Aquatic Communities and Threatened Fish

Potential impacts from construction activities on endangered aquatic communities and threatened fish include:

- Disturbance associated with the establishment of a culvert over the anabranch of Little Billabong Creek.
- Removal of a small area of limited potential habitat for the Purple Spotted Gudgeon (western population).
- Removal of riparian vegetation.

It is not possible to avoid crossing of creeks that may contain aquatic habitat of localised value. Where possible, the culverts would be designed in accordance with *Why do Fish Need to Cross the Road?* (Fairfull and Witheridge, 2003).

Although the Proposal would disturb vegetation in the riparian zone of the Little Billabong Creek anabranch, this particular area of vegetation is comprised of exotic pasture with scattered native trees.

A number of indirect impacts are also likely and would require management measures to ensure that detrimental impacts on threatened species and endangered communities do not result from the Proposal. Potential indirect impacts during from construction works include:

- Barriers to fish passage.
- Reduction of water quality.
- Increased flows due to uncontrolled runoff entering the stream.
- Degraded water quality and sedimentation of downstream areas with consequent adverse impacts on Murray Cod and Trout Cod.
- Increased erosion due to increased flows and vegetation clearance.

Management measures to address these potential impacts are outlined in **Table 8-4** and would be implemented during the construction phase of the project.

Operation

Endangered Ecological Communities

Operational impacts on Box-Gum woodland as a result of the operation of the upgraded road are anticipated. Potential impacts include:

- Increased weed invasion due to edge effects or uncontrolled runoff.
- Waterlogging and land salinity adjacent to the highway due to the large impervious surface and associated groundwater changes.

Runoff would be managed primarily through the installation of sediment control measures along the alignment complimented by the revegetation of areas adjacent to the proposed construction area to enhance the riparian zone, increase the stability of the highly erodible banks and act as an additional filter for runoff from the road surface.

Measures outlined in **Table 8-4** would be implemented to mitigate potential operational impacts to Box-Gum Woodland.

Threatened Flora

The potential operational impacts to threatened flora habitat would be the same as the potential operational impacts to endangered ecological communities. Potential impacts include:

- Increased weed invasion due to edge effects or uncontrolled runoff; and
- Waterlogging and land salinity adjacent to the highway due to the larger impervious surface and associated groundwater changes.

Measures outlined in **Table 8-4** would be implemented to mitigate potential operational impacts to threatened species habitat.

Threatened Fauna

A number of potential impacts threatened fauna species could occur during the operational stage of the Proposal. Potential impacts during the operation of the Proposal include:

- Increased fragmentation of habitat, in particular that for Squirrel Gliders.

- Increases in weed invasion and hence quality of fauna habitat.
- Increased potential for conflicts between fauna and traffic due to increase in the width of roadway.

Mitigation measures such as strategically located revegetation works to increase the total area of habitat in the study area and link isolated fragments, the establishment of a minimum width median at appropriate locations and the provision of drainage structures that are suitable for fauna movement would minimise the operational impacts of the Proposal on threatened species, their habitats and movement pathways.

Endangered Aquatic Communities and Threatened Fish

Operational impacts of the Proposal on endangered aquatic communities and threatened fish species include:

- Increased flows due to additional runoff from the impervious road surface and through new culverts.
- Increased erosion and sedimentation due to increased flows.
- Loss of aquatic habitat due to increased flow.
- Decrease in water quality due to road runoff.

Management measures would be implemented to ensure that all water entering streams from the Proposal during construction and operation would meet the water quality standards outlined in the ANZECC Guidelines (2000). Culverts would be designed so as to maintain fish passage, and to retain flow regimes as close as possible to current conditions.

Legislative considerations

Detailed assessments of the likely impacts from the Proposal on endangered ecological communities, threatened species and their habitat within the study area have been undertaken and are included in **Appendix D**. The findings of these assessments have been summarised below with respect to the relevant commonwealth and state legislation.

Commonwealth Threatened Species Assessment

An assessment of the likely impacts of the Proposal on commonwealth endangered ecological communities, threatened and migratory species was undertaken with consideration given to the *Matters of National Environmental Significance – Significant Impact Guidelines* (DEH 2006), to determine whether the Proposal requires the preparation of a Referral to the DEH Minister for the Environment under the EPBC Act. The guidelines list a number of criteria that should be used to assess the likely significance of the potential impacts of the Proposal. The assessment of the potential impacts against each of the criterion is included in the detailed assessment in **Appendix D**.

The Proposal has the potential to be considered a significant impact on the extent and quality of Box-Gum Woodland in the locality given the conservative estimate of a 2.4 ha loss (under the EPBC Act). There is no available data or benchmarks to determine what is considered an acceptable loss of the Box-Gum Woodland (critically endangered ecologically community). A strategy to offset these losses is required through a commitment to enhance or restore degraded woodland in the project area and refinement of the design may further reduce this impact. However, the matter should be referred to the Minister for the Environment for further consideration of significance.

NSW Threatened Species Assessment

An assessment of the impacts of the Proposal on species, populations and ecological communities listed under Schedules 1, 1A and 2 of the TSC Act and Schedules 4, 4A and 5A of the FM Act was undertaken. As the Proposal is to be assessed under Part 3A of the EP&A Act the impact assessment as detailed in the Ecological Assessment Report was undertaken in accordance with the *Draft Guidelines for Threatened Species Assessment* (DEC, 2005).

Based on the assessment it was concluded that the Proposal was unlikely to have a significant impact on species listed under the TSC Act for the following reasons:

- The Proposal would not disrupt the lifecycle of any threatened species such that it would place them at risk of extinction.
- Ongoing weed management and monitoring would be undertaken to prevent edge effects on areas of potential habitat for threatened flora.
- Potential habitat for all species would remain within the study area.
- A median strip at minimum width would be provided to minimise restrictions to Squirrel Glider movement.
- Measures such as the provision of drainage structures that are designed to facilitate fauna movement and strategic revegetation to enhance fauna habitat linkages would minimise the potential for isolation of potential habitat for threatened species.
- Management measures would be implemented during construction and operation to ensure water quality is maintained.
- The design of culverts would be in accordance with NSW Fisheries *Why do Fish Need to Cross the Road?* (Fairfull and Witheridge 2003) and would maintain fish passage in all waterways.

The Proposal is considered to have the potential to result in a significant decrease in extent and quality of Box-Gum woodland within the locality through the clearance of 11.23 hectares under the TSC Act, 2.4 hectares under the EPBC Act and additional indirect impacts such as increased weed invasion. Therefore mitigation measures would be required to ensure there is no net loss of this community and stringent management measures implemented to prevent any potential indirect impacts on Box-Gum woodland within the study area. These measures are detailed in Chapter 10.

8.1.3 Key mitigation and management principles

The conservation value of the vegetation was considered in the design of the road upgrade. The Proposal footprint has been located to minimise removal of remnant woodland and is located within existing linear road reserves wherever possible.

Potential impacts on streams and aquatic habitats have been avoided where possible. The decision to cross the anabranch of Little Billabong Creek rather than locate the upgrade on the western side of the road has been based on a number of factors including:

- Removing the currently inadequate curve in the highway near this section.
- Providing an improved vertical alignment (grade), especially for heavy vehicle traffic.
- Alleviating the need for substantial cutting on the western side of the road.
- Land acquisition constraints on the western side of the road.

Although there is the potential for a number of direct and indirect impacts of the Proposal on endangered communities and threatened species, the majority of these can be mitigated

or managed. Potential impacts and the proposed mitigation and management responses for both the construction and operational phases of the project have been listed in **Table 8-4**.

Table 8-4: Summary of biodiversity mitigation measures and management responses

Potential impacts	Mitigation measures and management responses
Pre-construction	
Increased potential conflict between fauna and traffic due to increase road width	• Locate revegetation works to increase fauna habitat linkages. • Reduce the median width to the minimum necessary for safe operation of the road in those areas where existing glider movement across the highway is likely to occur.
Barriers to fish passage	• Design culvert modification/extension and bridges in accordance with the requirements outlined in Fairfull and Witheridge (2003).
During construction	
Removal of Box-Gum Woodland and other vegetation including loss of fauna habitat	• Clearing of Box Gum Woodland would be kept to the minimum necessary to construct the road. Impacts would be avoided where possible and existing roadside vegetation would be maintained where safety and design are not compromised. • Implement measures to manage impacts through strategically placed revegetation works in the highway corridor. • Rehabilitate abandoned sections of the existing road corridor through physical removal of weeds and replanting of Box-Gum woodland species using local native provenance. • Native seed would be collected prior to clearing, for use in the revegetation of disturbed areas. • Where possible the landscaping of areas within the Proposal corridor would be undertaken with endemic species, thereby increasing the habitat value and visual amenity of the area. Landscaping of the area would include: – Planting of a range of locally occurring native shrubs, trees and groundcover plants. Discussion would be held with Department of Environment and Conservation regarding the choice of species, with preference shown to those species characteristic of Box-Gum Woodland. – Inclusion of logs, dead trees and other suitable habitat features in the landscaping works. – Incorporation of existing natural vegetation where possible. – Maintenance of plantings for not less than two years and until revegetation has been successful (i.e. 85% of plants have become established). – Place any transposable habitat features such as large logs and boulders in adjacent retained areas to allow their continuation as potential fauna refuge sites. • Areas disturbed during construction would be progressively revegetated.

Potential impacts	Mitigation measures and management responses
	• Where clearing of vegetation and fauna habitats will take place, a two stage clearing process would be followed, whereby non-hollow bearing trees would be felled first. • Clearing protocols would be implemented which involve checking hollow-bearing trees for the presence of bird nests and arboreal animals such as possums, gliders and bats prior to felling or pushing. Animals found to be occupying trees would be safely removed before clearing of the trees. A qualified ecologist would relocate removed animals locally into nearby woodlands. • All hollow-bearing trees to be felled would be clearly marked and their species and approximate dimensions catalogued so that hollows or nest boxes can be affixed to similar standing trees. • Hollows or nest boxes would be attached to trees with consideration of aspect, height and location appropriate for the target fauna species. • Salvaged sections of hollows or nest boxes would be attached to trees in a way that allows for tree expansion and does not poison the tree. • In conjunction with the Department of Primary Industries (NSW Fisheries) develop a strategy to allow suitable trees removed as part of construction to be utilised in MDBC Program Re-snagging and riparian restoration – Hume Dam to Yarrawonga. • The location of each relocated hollow or nest box would be recorded using GIS equipment during installation.
Increased weed invasion in adjacent areas due to edge effects	• Undertake ongoing management of weed invasion within the remaining road reserve for a period of not less than 2 years to protect the integrity of the Box-Gum Woodland. • Stockpile soil that may contain seeds of exotic species away from watercourses and vegetated areas and cover the pile to eliminate the spread of the soil and seed during rainfall and wind events.
Inadvertent disturbance of vegetation or fauna habitat outside construction area	• Clearly mark the limits of clearing and install temporary fencing around the construction footprint area to avoid unnecessary vegetation and habitat removal. • Restrict equipment and stockpiling of resources to designated areas in existing cleared or degraded land to minimise the overall impacts of the construction and avoid unnecessary vegetation and habitat removal.
Hydrological changes due to vegetation clearance, including decreased surface water quality	• Install sediment control devices and other stormwater treatment measures to control runoff from construction areas in accordance with Managing Urban Stormwater: Soils and Construction (Landcom 2004). • Sediment basins would be located in existing cleared areas where possible to minimise the loss of habitat. • Revegetate riparian zones to increase the stability of highly erodible stream banks, act as an additional filter for runoff from the road surface and minimise waterlogging and salinisation. • Aim to comply with ANZECC Water Quality Guidelines

Potential impacts	Mitigation measures and management responses
	(2000) for the quality of water in watercourses affected by the Proposal.
Barriers to fish passage during culvert upgrade and bridge construction	• Maintain fish passage at all times during the culvert extension and modification works and bridge construction.
During operation	
Increased weed invasion due to edge effects	• Undertake ongoing management and monitoring of weed invasion for a period of no less than two years following completion of the construction phase.
Waterlogging and land salinity adjacent to the highway due to the large impervious surface and associated groundwater changes	• Establish trees as well as a ground layer as part of revegetation works. • Use plant species tolerant of wet conditions in areas prone to waterlogging.
Decreased water quality in surrounding watercourses	• Revegetation of riparian zones using local native provenance to stabilise soils and act as an additional filter for runoff from the road surface. • Plant macrophytes along the stream banks to filter flow and enhance bank stability. • Aim to comply with ANZECC Water Quality Guidelines (2000) for the quality of water in watercourses affected by the Proposal.
Loss of aquatic habitats due to increased flows	• Place woody debris downstream of culverts where necessary so as not to obstruct potential fish passage.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of biodiversity, the following draft commitments have been developed for the Proposal (see **Table 8-5**). These draft commitments are also presented in full in Chapter 10.

Table 8-5: Draft commitments to manage biodiversity

Objective	Commitment
Minimise native vegetation disturbance	The limits of clearing will be clearly marked with temporary fencing installed prior to clearing.
	Equipment storage areas and stockpile areas will be located in existing cleared or degraded locations.
Minimise weed establishment	Soil containing weeds will be stockpiled away from watercourses and native vegetation.
	Noxious weeds in areas disturbed by construction activities will be managed for a minimum of two years post construction completion.
Offset impacts to Box Gum Woodland	An offset strategy for Box Gum Woodland will be developed in consultation with relevant agencies.
	Disturbed areas will be progressively revegetated using Box Gum Woodland plant species of local provenance.
	Box Gum Woodland retained in the road corridor will be enhanced by supplementary plantings.
Minimise impacts on hollow dependent fauna species	Hollow bearing trees will be checked by an ecologist for nesting fauna species prior to clearing. Fauna found nesting will be relocated to

Objective	Commitment
	suitable adjacent habitat.
	Stands containing hollow bearing trees will be cleared using a two stage clearing process with adjacent non-hollow bearing trees to be cleared first.
	Logs and dead trees will be relocated from the area of clearing to provide habitat in adjacent areas where feasible and practicable.
	Nest boxes will be fixed to suitable retained vegetation and in a way that does not damage the tree.
Maintain terrestrial fauna connectivity.	Drainage culverts will be designed to facilitate movement of fauna species where feasible.
	The median width will be designed to the minimum necessary for safe road operation where Squirrel Glider movement corridors cross the Proposal.
Minimise impacts to Pink-tailed Worm Lizard and Striped Legless Lizard	Pink-tailed Worm Lizard and Striped Legless Lizard habitat will be inspected by an ecologist prior to construction. Individuals found in the construction footprint will be relocated to adjacent suitable habitat outside of the construction footprint.
Maintain fish passage	Culverts will be designed to facilitate fish passage where appropriate.
	Fish passage will be maintained during construction.
Minimise impacts to aquatic habitat	Riparian areas disturbed by the Proposal will be progressively revegetated using plant species of local provenance.
	DPI Fisheries will be consulted regarding use of cleared vegetation in re-snagging programs for waterways.

8.2 Aboriginal heritage

This section of the Environmental Assessment provides an assessment of the potential impacts to Aboriginal heritage associated with the construction and operation of the Proposal, in addition to the measures proposed to avoid or minimise these impacts.

The assessment forms part of the ongoing assessment and consultation with stakeholders from the Aboriginal community (in accordance with the *Interim Aboriginal Community Consultation Requirements* (DEC 2004). This process is documented in Section 2.2 of **Appendix E**.

8.2.1 Key features of the existing environment

A search of the DEC Aboriginal Heritage Information Management Systems (AHIMS) in July 2006 found that there are no previously recorded Aboriginal objects or places listed within the study area although five sites have been recorded previously to the south of the study area.

To characterise the Aboriginal heritage features of the study area a full archaeological survey of the Proposal was performed. This included the involvement of Aboriginal stakeholders or their representatives in a walk over of the study area which was defined by a corridor of 100m either side of the existing road. The survey enabled identification of Aboriginal objects, sites and places, areas of potential archaeological deposit and areas of high disturbance where archaeological deposits are not expected to have survived. During the archaeological

survey, all trees subject to potential impact by the Proposal were examined for signs of scarring.

The study area is mainly comprised of creek flats and terraces with some representation of lower slope landforms. The eastern side of the study area is undulating, and the western side is slightly hillier. Billabong Creek is a major waterway in the area and is located along the entire western edge of the study area, defining a large vegetated riparian zone.

The Proposal is located proximate to the archaeologically sensitive flats and terraces of Billabong Creek. Billabong Creek represents a resource zone conducive to a high density of Aboriginal occupation, which may have persisted over the long term. Linear stands of trees line the western side of the existing road. A wider area of vegetated riparian zone associated with Billabong Creek is located along the entire eastern side of the existing road, including canopy species. Riparian vegetation is also present.

Site types found within the study area are associated with the flats and terraces of Billabong Creek, former high density Aboriginal occupation and remnant old growth trees that persist with the road reserve. A number of artefact scatters are found near Billabong Creek and a large area of Potential Archaeological Deposit (PAD) is located in the southern section of the study area, adjacent to Billabong Creek. Site types include artefact scatters, scar trees and isolated finds. While no burials were identified, soft alluvial deposits along the creek lines indicate the potential that burials may be present. The findings of the survey are summarised in **Table 8-6** and are mapped on **Figure 8-3**.

Table 8-6: Summary of Aboriginal heritage survey results

Site Number	Site Type
M1	Artefact Scatter
M2	Scarred Tree
M3	Scarred Tree
M4	Isolated Find
M5	Artefact Scatter
M6	Isolated Find
M7	Scarred Tree
M8	Scarred Tree
M9	Scarred Tree
M10	Scarred Tree
M11	Artefact Scatter
M12	Scarred Tree
M13	Scarred Tree
M14	Scarred Tree
M15	Scarred Tree
M-PAD-1	Potential Archaeological Deposit
M-PAD-2	Potential Archaeological Deposit
M-PAD-3	Potential Archaeological Deposit

Figure 8-3 **Aboriginal heritage sites (indicative only)**

8.2.2 Assessment of potential impacts

Methodology

A detailed study of the potential impacts of the Proposal on the Aboriginal archaeological heritage of the area was conducted by Kelleher Nightingale Consulting Pty Ltd, with the key findings from this study referenced in this section. A full copy of the study is provided **Appendix E**.

The archaeological assessment included both desk-based assessment of the literature and relevant databases as well as field survey of the road corridor. In addition, elements of the survey were video recorded. Field work undertaken included:

- Archaeological survey, including recording of:
  - Artefact scatters.
  - Isolated finds.
  - Scarred trees.
  - Identification of potential archaeological deposits.
- Video recording included:
  - Survey methods.
  - Aboriginal community interviews and stories associated with the area.

Following the literature review and field surveys, impact assessment was undertaken following the National Parks and Wildlife Services *Cultural Heritage Standards and Guidelines Kit* (NPWS 1997) and appropriate mitigation measures determined. Details of the literature/guidelines reviewed/referred to and field survey methods and effort are included in **Appendix E**.

Impact on Aboriginal sites: artefact scatters and isolated finds

For the purposes of the assessment, artefact scatters and isolated finds are stone objects modified by humans and can include tools, cores, flakes, and debitage (waste by-products) from the flaking process.

A total of five Aboriginal sites, comprising four artefact scatters (LB3, LB4, LB5 and LB6) and one isolated find (LB2) were identified during the archaeological survey. The proposal would impact upon the two artefacts scatters and one isolated find. One artefact scatter (LB4) is considered as having high research potential, the other (LB3) is considered of moderate research potential and is associated with a potential archaeological deposit (LB-PAD-1). The isolated find (LB2) is assessed as having low research potential.

Impact on Aboriginal sites: scarred trees

A scarred tree is a tree from which bark has been deliberately removed. Aboriginal people used the bark from trees for a number of purposes including: canoes, carrying vessels, shields, houses, tree climbing and carving designs. Today, places where scarred trees are found include river, creek and wetland reserves, road reserves and any areas where significant remnant woodland has been preserved. Major impacts that may have affected the distribution of preserved scarred trees include extensive clearance and ring-barking of floodplain forests for agriculture, logging and fuel.

The Proposal identified one scarred tree during the archaeological survey indicating the use of this landscape by Aboriginal people. The Proposal has no impact on the scarred tree (LB1).

Impact on Potential Archaeological Deposits (PAD)

A potential archaeological deposit is an area considered to have intact sub-surface deposits. The archaeological survey identified a total of three PADs located across a range of landforms including hill tops, upper hill slopes, terraces, creek banks and creek flats. In regard to scientific research potential one PAD was seen as having high potential, and the other two had moderate to high potential.

The Proposal would result in the destruction of two identified PADs, both of moderate potential (LB-PAD-1 and LB-PAD-3).

Cumulative impacts on Aboriginal heritage

The potential Aboriginal heritage impacts resulting from the Proposal have been considered as a consequence of the construction and operation of the Proposal.

The incremental effect of multiple sources of impacts (past, present and future) is referred to as cumulative impacts and provides an opportunity to consider the Proposal in a strategic context. This is necessary so that impacts associated with this Proposal and other activities in the region are examined collectively. The identification of Aboriginal heritage sites within a 100 metre corridor has allowed a more detailed consideration of the Aboriginal heritage impacts than would have otherwise been possible given the limited archaeological consideration of the area prior to this study.

A range of Aboriginal sites were recorded in this area comprising of one scarred tree, four artefact scatters and an isolated find. In addition three PADs have been identified, one large PAD is located adjacent to Billabong Creek. These items alongside the presence of creeks and streams indicate that the Proposal area contains significant evidence of Aboriginal occupation and land use. The archaeological survey found six Aboriginal sites or objects present and assessed the potential for three intact sub-surface archaeological deposits (PADs). Of the six identified sites of Aboriginal heritage three sites, two artefact scatters (LB3 and LB4), and one isolated find (LB2) and two PADs (LB-PAD-1 and LB-PAD-3) would be impacted by the Proposal.

8.2.3 Key mitigation and management principles

Table 8-7 Summary of Aboriginal mitigation measures and management responses

Potential impacts	Mitigation measures and management responses
Construction	
Earthworks occur in vicinity of isolated object (LB2), object will be impacted.	• Mitigation not recommended. • Further consultation with the Aboriginal community required.
Earthworks would impact upon artefact scatter (LB3).	• Test excavation recommended, dependent on construction design. • Further consultation with the Aboriginal community required.
Earthworks would impact upon artefact scatter (LB4).	• Test excavation recommended, dependent on construction design. • Further consultation with the Aboriginal community required.
Earthworks would impact the Potential	• Test excavation recommended, dependent on

Archaeological Deposit (LB-PAD-1).	construction design. • Further consultation with the Aboriginal community required.
Earthworks would impact the Potential Archaeological Deposit (LB-PAD-3).	• Test excavation recommended, dependent on construction design. • Further consultation with the Aboriginal community required.
The following Aboriginal heritage items are not impacted by current alignment - scarred tree (LB1), artefact scatter (LB5 and LB6) and Potential Archaeological Deposit (LB-PAD-2).	• No further mitigation required on the basis of current alignment. This assessment may change dependant upon the location of stock pile sites, compound areas and any related services.
Disturbance of Aboriginal heritage not previously identified.	• All personnel working on site would receive training in their responsibilities under the *National Parks and Wildlife Act 1974* prior to the start of construction works. • Should Aboriginal heritage items be identified during works, all works in the vicinity of the find would cease and the RTA Archaeology and Heritage Adviser, Senior Environmental Officer would be contacted. Works would not re-commence until appropriate clearance has been received.
Operational	
A number of Aboriginal heritage items identified above are not impacted by current alignment.	• These items should be recorded on the maintenance GIS to ensure that future maintenance works do not impact upon them.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of Aboriginal heritage, the following draft commitments have been developed for the Proposal (see **Table 8-8**). These draft commitments are also presented in full in Chapter 10.

Table 8-8: Draft commitments to manage Aboriginal heritage

Objective	Commitment
Minimise impact on Aboriginal heritage items	Any Aboriginal heritage items directly impacted will be managed in consultation with the Aboriginal community.
	All personnel working on site would receive training in their responsibilities under the *National Parks and Wildlife Act 1974*. Site specific training will be given to workers when working in the vicinity of identified heritage items.
	Aboriginal heritage items within the construction corridor not directly impacted will be marked on construction plans, fenced and signposted where necessary.
	Should Aboriginal heritage items be uncovered during works, all works in the vicinity of the find would cease until Aboriginal Heritage specialist advice is obtained.

8.3 Non-Aboriginal heritage

Non-Aboriginal heritage assessment has been undertaken to consider the direct and indirect impacts of the Proposal on archaeological heritage, built heritage and landscape heritage. The findings of this assessment are summarised in this section and full copies of the non-Aboriginal heritage assessment reports are contained in **Appendix F**.

Potential archaeological deposits – historical archaeology

The historical archaeology impact assessment identified and assessed the cultural significance of relics (as defined in the *NSW Heritage Act 1977*) in the study area to determine the potential impact of the proposal (Archaeological and Heritage Management Solutions & Cultural Heritage Connections 2006). The assessment involved:

- Review of heritage studies.
- Review of topographic maps to identify landscape features and structures.
- Review of historical aerial photographs.
- Use of thematic and site specific historical research to develop a predictive model of potential historical archaeological sites within the study area, identified through historical research and analysis of maps and aerial photographs.
- Survey of all sites within the study area (100m either side of the existing highway) to identify, record and assess archaeological sites identified by predictive modelling and any other previously un-identified sites.
- Assessment of the cultural significance of sites in the study area (using heritage assessment criteria).
- Assessment of the impact of the Proposal on the sites.
- Development of management or mitigation measures.

Non Aboriginal heritage – built heritage

The study of the built heritage environment identifies places of built heritage significance, including former road alignments, culverts and bridges with the potential to be affected by the Proposal (Graham Brookes and Associates 2006). Built items have been defined as constructed as opposed to natural formations and in the vicinity of the Hume Highway include dwellings, inns, farm structures, livestock compounds, fences, retaining walls, water management elements such as drains and elements such as bridges, surfacing and kerbs. The assessment involved:

- Searches of heritage lists and relevant local government heritage studies.
- Research in local archives and libraries.
- Review of current and historical aerial photographs.
- Consideration of information provided by the RTA.
- Survey of the study area (100m either side of the existing road alignment).
- Review of existing heritage studies.

Natural areas of heritage significance – landscape heritage

The study of the heritage values of the landscape considered places of heritage significance in relation to cultural landscapes associated with built elements and vegetation within 100 metres on either side of the existing carriageway (Taylor Brammer 2006). Landscape items considered include roadside plantings which form a definitive landscape element in the

overall landscape context and are an integral part of the existing highway experience and plantings typically associated with homesteads and vehicular entry ways.

The assessment included:

- Survey of the study area (100m either side of the existing highway) by foot or by car.
- Review of aerial photographs.
- Review of historic aerial photographs dated 1949.
- Topographic maps.

Assessment criteria

Heritage features/items identified were assessed against the Australian International Council on Monuments and Sites (ICOMOS) Burra Charter, which defines cultural significance as *'aesthetic, historical, scientific, social or spiritual for past, present or future generations'*. Assessments of significance are made by applying standard evaluation criteria. These criteria are:

- An item is important in the course, or pattern, of NSW cultural or natural history (or the cultural or natural history of the local area).
- An item has strong or special association with the life or work of a person, or group of persons, of importance in NSW cultural or natural history (or the cultural or natural history of the local area).
- An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in NSW (or the local area).
- An item has strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.
- An item has potential to yield information that will contribute to an understanding of NSW cultural or natural history (or the cultural or natural history of the local area).
- An item possesses uncommon, rare or endangered aspects of NSW cultural or natural history (or the cultural or natural history of the local area).
- An item is important in demonstrating the principle characteristics of a class of NSW cultural or natural places; or cultural and natural environments.

In accordance with NSW Heritage Office requirements regarding assessment of significance, the level of significance of sites, features and items were assessed as either:

- Local significance, meaning significant within the local government area; or
- State significant, meaning significant to the people of NSW.

Impacts are considered as follows:

- **High impact** denotes that the proposed development will physically affect the item or some of its important elements. The item will be demolished or landscape features; garden setting or the visual connections between related items will be physically affected.
- **Moderate impact** means that there will be a small reduction in the current physical extent of the item.
- **Minimal impact** indicates that the existing built structures represent low heritage significance or the Proposal would have no adverse impact on a significant component or a minimal impact on the setting or visual curtilage of items of heritage significance

General history of the study area

In 1848, as a result of the spread of settlement in the area the village of Little Billabong was established around the highway. It began when Thomas Mitchell established the Little Billabong Run around the base of Lunt's Sugarloaf. In the 1860s the Little Billabong Hotel was established. The post office was established in 1877. The settlement of the area continued through trade from travellers on the road using the hotel and post office. Labouring work such as shearing, fencing and general agricultural work for the larger landholders also sustained the community. Little Billabong Hotel remained at the 'heart' of the settlement into the 1880's. Around 1900 the hotel was moved to the west bank of Little Billabong Creek, but the original building was retained as a general store. The new hotel was burnt down in the late 1950s.

By 1914 there had been no new residential development at Little Billabong, the main homestead had been abandoned as had the church and school. Mining had ceased in the area. The hotel continued to function and in the post second world war period, small dairy farms developed to cater for the more substantial Holbrook market.

Prior to 1928 the main overland route from Sydney to Melbourne was known as the Great South Road. These early road routes were dictated by the need for water and pasturage; key features being natural contours water places and level, sheltered campsites. Road verges were wide to allow for feed for livestock.

Initially, the alignment of the road avoided creek crossings which required bridges, and obstructions were bypassed rather than built over. Large geological formations were avoided where possible, but the overall line was a compromise between practicality and cost.

Development of the Hume Highway occurred after 1928 when it was proclaimed a State Highway and renamed in honour of Hamilton Hume. Major works in the Little Billabong area occurred in the 1930s. Camps were set up for in excess of 200 construction workers engaged in upgrading this section.

The development of transport routes such as the Hume Highway often influenced the spread of settlement. Road infrastructure such as bridges sometimes became sites for social interaction, linked with picnicking and swimming areas. Construction of the Hume Highway itself created substantial employment opportunities, the money earned contributing to the local economy.

Roads have radically altered landscape patterns, with cuttings through hillsides and the remnants of former lines leaving evidence of their passing. Landscapes adjacent to the road corridor have been constructed and re-constructed. Roads have encouraged the spread of weeds, however the associated TSR's have preserved native vegetation when it has been extensively cleared on adjacent private holdings. Supplementary planting and preservation of roadside vegetation through community group activities has increased and encouraged biodiversity along the road corridor.

8.3.1 Key features of the existing environment

Twenty two heritage items have been identified within 100 metres of the existing highway within the study area. These include:

- Archaeological heritage – 13 sites of archaeological significance.
- Built heritage – four sites of built heritage significance.
- Landscape – five landscape items.

There is one archaeological site of state significance identified within the vicinity of the study area. A number of the remaining items are considered to be of local significance and include the rural cottage located on the eastern side of the highway at the far southern end. All are described in **Table 8-9**, and their location is shown in **Figure 8-4**.

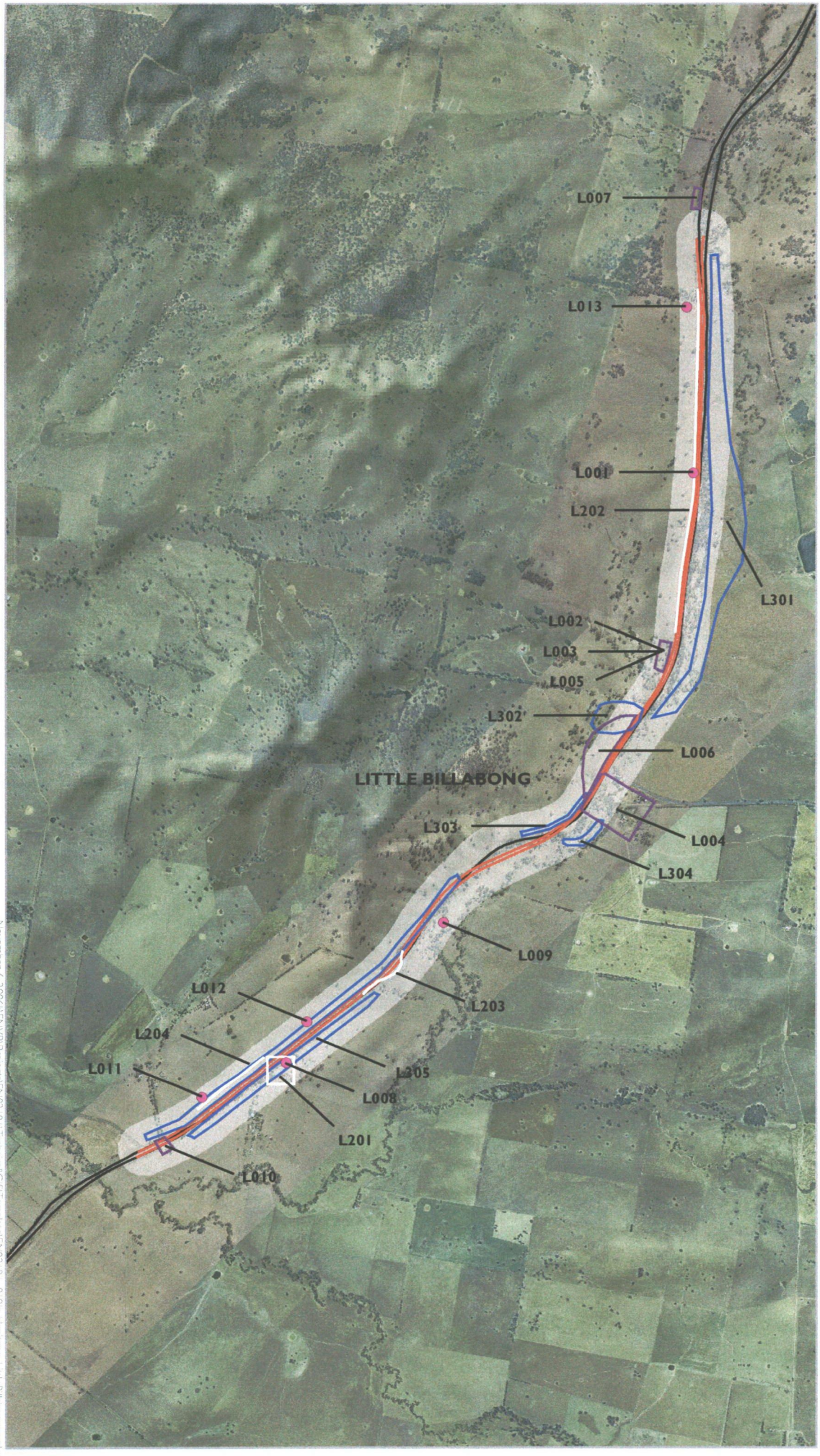

Figure 8-4 **Non-Aboriginal heritage sites**

Table 8-9: List of Non-Aboriginal heritage Items

Item	Description	Significance Assessment
Archaeology		
L001	Small artefact scatter, track and plantings on the western side of the highway. Common artefacts from the nineteenth century, which may have been re-deposited by colluvial action or dumped at some time in the past. No other indications of historic occupation.	Local heritage significance.
L002	Visible structural stone and brick remains of St Paul's, Churchmount on the western side of Hume Highway, The remains consist of a rectangular structure with a rectangular portico entrance visible at the eastern end. Buttress stubs were visible on the northern and southern sides. The church ceased to be used in 1929. The structure has been demolished to the level of the footings, however, any underfloor deposits will probably be intact. The site is associated with the historical occupation of the formerly remote pastoral settlement at Little Billabong and Hillside. It also has local heritage significance as: • The remains are strongly evocative reminders of past communities and clearly demonstrate the role of the Hume highway in the area. • Its location on an elevated hillside is symbolic of the church within historic communities. • The high archaeological potential of the underfloor deposit provides further information on the cultural history of the area. • It is rare.	Local heritage significance in terms of State heritage Assessment Criterion (a), (c), (e) and (f).
L003	Buried and visible structural remains in the form of two interrelated building platforms on the western side of the Hume highway. The remains are probably building platforms associated with a school building erected in the vicinity of St Paul's (L002) in 1903. Historic association with the former settlements and communities at Hillside and Little Billabong. The archaeological remains of the school building represent the first place in the locality where formal education facilities were established and would have been important to the local community. The remains are aesthetically pleasing reminders of the cultural development of the area, and the buried deposits have high archaeological potential and integrity.	Local heritage significance in terms of State heritage Assessment criterion (a) and (e).
L004	The site is located on the south eastern side of the Hume highway and Tumbarumba junction, opposite the southern end of the open area know as "The Cricket Pitch" (L006). Previous archaeological investigation of this area indicates that this was the location of the vanished settlement of Little Billabong. No visible remains of past occupations were identified, however the site is considered to have high archaeological potential to contain buildings and other remains associated with Little Billabong.	Highly significant potential archaeological local site in terms of State heritage assessment criterion (a), (e) and (f).

Item	Description	Significance Assessment
	The area incorporating the former settlement at Little Billabong is considered to be of local significance as the remains of this settlement would have potential to provide rare insights into aspects of early historic settlement in the area	
L005	Fence line on the western side of the Hume Highway, adjacent to L002 and L003. The fence line consists of five pit sawn eucalypt posts which are all badly weathered and partly burnt. They probably mark the boundary of the school yard (L003) and may delineate a former property boundary associated with historic subdivision of land on the hill side.	Local significance due to its historic associations with the former settlement and Little Billabong. It is not considered to have archaeological potential.
L006	A folklore site referred to colloquially as The Cricket Pitch is located opposite the junction of Tumbarumba Road and the Hume highway. The name appears to refer to the flat open nature of the area. No relics of use and occupation of the site were identified.	The Cricket Pitch is not a relic or a built heritage item, but may be an item of landscape significance to the local community. This is discussed further in the Landscape Assessment (See L302).
L007	Little Billabong Cemetery, located 150m north of the start of the duplication, within the median strip between the north and south bound lanes of the highway. The site is heavily overgrown with long grass and two headstones were identified during the survey. There is potential for as many as 140 internments in the cemetery. Cemeteries are State significant heritage items under most State Heritage assessment criteria. It is also considered have heritage significance in terms of the following: • The cemetery has historical associations with the early settlements of Little Billabong and Hillside. • It has high archaeological potential to yield further information. • It is a rare example of an early cemetery.	The cemetery is of State significance in terms of State heritage assessment criterion (e) and (f).
L008	Earthen farm dam located 100 metres from the eastern side of the Hume Highway. It is currently operational.	Local heritage significance due its historical values as an operational component of the farming industry. It has no archaeological potential.
L009	Area of open excavation or erosion between two creekline 100 metres east of the Hume highway. Previous archaeological surveys and research indicate that the site is in the vicinity of a brick pit used by the historical settlement of Little Billabong. If this is confirmed, it is a rare example of an early brick pit.	Local heritage significance (if it is the site of the Little Billabong brick pit) due to its potential historical associations with the former settlement. It has

Item	Description	Significance Assessment
		low archaeological potential.
L010	Potential archaeological deposit 200 metres south of Wirruna Homestead on the eastern side of the Hume Highway comprising three structures, cultivation and enclosures on the north side of the creek. No physical remains of historic occupation observed in recent assessment. Former building sites appear to be within ploughed field or paddock.	Local significance and some archaeological potential to yield significant information.
L011, L012, L013	Post 1949 earth walled farm dams located on the eastern side of the highway.	No archaeological significance.
Built Heritage		
L201	Rural cottage on the eastern side of the highway. L-shaped cottage with corrugated iron roof, encircling veranda and half timbered gable end. The old residence is of historic and aesthetic significance as a typical late 19th /early 20th century rural cottage retaining a high degree of architectural integrity.	Local significance.
L202	Road remnant comprising a long stretch identified by a clear line of trees running along the road reserve on the east of the existing carriageway. This appears to be the original line of the highway and this remnant has historical significance as evidence of the historical evolution of the Hume Highway and the changing of its alignment in the 1830s.	Local significance.
L203	Road remnant to the east of the current highway and east of an adjacent RTA stockpile site. It is a remnant loop of the old road comprising a dual land concrete aggregate pavement. Similar to L202.	Local significance.
L204	Road remnant comprising a track along the western side of the existing carriageway. This is marked by a line of trees. This appears to be the original line of the highway. Similar to L202 and L203.	Local significance.
Landscape Heritage		
L301	Substantial roadside vegetation to the east of the highway north of Little Billabong Road.	Local significance.
L302	The cricket ground comprises a broad grassed area. This is socially significant as a recognised social gathering place.	Local significance.
L303	Roadside cutting demonstrating the increased technological capacity of road building being evidence of the continuing modification of the highway reflecting upgrading of the highway alignment.	Local significance.
L304	Cultural planting of ribbon gum at the former location of Little Billabong. This planted row of vegetation is significant in the use of Australian native planting and recognising the appropriate use of species associated with the flood of Little Billabong Creek. This planting is of aesthetic and social significance forming a line of deliberate planting associated with the former township of Little Billabong.	Local significance.
L305	Substantial native roadside vegetation north of Clifton Road.	Local significance.

8.3.2 Assessment of potential impacts

Table 8-10 provides a summary of the items, their heritage significance and the potential for impact. Impacts during operation are only included where relevant.

Table 8-10 Summary of non-Aboriginal heritage impacts

Ref	Description	Significance	Impact
L001	Artefact scatter	Local	High
L002	Remains of church	Local	High
L003	Remains of platforms of school	Local	Nil
L004	PAD –settlement of Little Billabong	Local	Nil
L005	Fence line	Local	Nil
L006	The 'Cricket Pitch'	Local	High
L007	Little Billabong Cemetery	State	Nil
L008	Dam	Local	Nil
L009	Brick pit	Local	Nil
L010	Potential site of structural remains	Local	Nil
L011	Dam	Local	Nil
L012	Dam	Local	High
L013	Dam	Local	Nil
L201	Rural cottage	Local	Low
L202	Road remnant	Local	Low
L203	Road remnant	Local	Low
L204	Road remnant	Local	Low
L301	Roadside veg	Local	Low
L302	Cricket ground	Local	Low
L303	Roadside cutting	Local	Moderate
L304	Planted vegetation	Local	Low

Archaeological heritage

Four of the total of thirteen items identified as of local historical significance, would be affected and of these, only the church remains (L002) is considered to be a potential archaeological item. This site has high archaeological potential and should be the subject of detailed archaeological excavation.

Built heritage

The potential for impact on the four items identified as of built heritage significance is considered to be low. In order to maintain and manage the heritage values of the road remnant items L202, L203 and L204, these should be added to RTA Section 170 heritage register.

Landscape heritage

All of the four locally significant heritage items (L301- L304) would be affected by the Proposal. The level of impact for L303 is considered to be moderate. The proposed development will have minimal or nil heritage impact upon the other heritage landscape items identified in the study area.

8.3.3 Key mitigation and management principles

Management and mitigation measures for the built, archaeological and landscape features identified are provided in **Table 8-11** below.

Table 8-11: Summary of non-Aboriginal heritage mitigation measures

Potential impacts	Mitigation measures and management responses
Archaeology	
Disturbance of church remains (L002) during construction	Re-evaluate route alignment to move further away from this heritage item. If the site cannot be avoided, prior to commencement of works detailed archaeological excavation would be undertaken.
Indirect impact on L003 buried and visible structural remains	Although not directly affected by the Proposal care to be taken not to disturb the remnants during the works. Brief construction works team to protect this asset during the construction phase. If remnants are likely to be disturbed, detailed archaeological excavation would be required prior to construction.
Indirect impact on archaeological site of historic settlement (L004)	Avoid disturbance if located in new road reserve. Construction works team to be briefed to protect this asset during the construction phase.
Loss or damage to historical Fence line (L005)	Avoid disturbance if feasible. If this is not possible, map and survey site as part of archaeological investigation of Site L002 prior to construction.
Direct impact on Cricket Pitch folklore site (L006)	Assess social significance of site as part of further community consultation prior to construction.
Indirect impact on L007 cemetery site	Although not directly affected, the site is expected to be located within the new road reserve. Care should be taken not to disturb the remnants during site preparation or the course of the works. Construction works team to be briefed to protect this asset during the construction phase. Gate at the south east corner of the site should be re-established to protect asset. .
Indirect impact on L009 potential former brick pit	Although not directly affected, the site is expected to be located within the new road reserve. Disturbance should be avoided if feasible. Construction works team to be briefed to protect this asset during the construction phase.
Indirect impact on L010 potential site of structural remains	Although not directly affected, the site is expected to be located within the new road reserve. Disturbance should be avoided if feasible. Construction works team to be briefed to protect this asset during the construction phase.
Built Heritage	
Loss of three road remnants (L202, L203 and L204)	Protection of these items during construction. Assessment of the remnants to determine the potential to yield archaeological evidence. Preparation of an archaeological management plan to provide management guidelines for the retention and conservation of these remnants.

Potential impacts	Mitigation measures and management responses
Landscape Heritage	
Indirect impact on roadside vegetation (L301)	Minimise disturbance to existing vegetation associated with the works and undertake suitable replanting with appropriate native species.
Potential impact on the Cricket Pitch folklore site (L302)	Further investigation of the Cricket Pitch folklore site to be undertaken.
Potential impact on the roadside cutting (L303)	Undertaken archival recording of the relationship cutting and surrounding area to record the ongoing evolution of the highway in accordance with Heritage Office Guidelines.
Loss or damage to row of ribbon gum planting (L304)	Further investigation of the line of Ribbon Gums in relation to the former hamlet at Little Billabong. Minimise disturbance to existing vegetation associated with the works and undertake suitable replanting with appropriate native species.
Loss or damage to roadside planting (L305)	Minimise disturbance to existing vegetation associated with the works and undertake suitable replanting with appropriate native species.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of non-Aboriginal heritage, the following draft commitments have been developed for the Proposal (see **Table 8-12**). These draft commitments are also presented in full in Chapter 10.

Table 8-12: Draft commitments to manage non-Aboriginal heritage

Objective	Commitment
Minimise impacts on Non-Aboriginal heritage items	Where the Proposal will directly impact heritage items of state and local significance, detailed heritage investigations and/or research will be performed prior to construction. Information collected will be documented in appropriate archival records.
	Where heritage items are not directly impacted care will be taken to not disturb them. This will include briefing of the construction works team to protect such assets during the construction phase, minimising access and clear delineation of items including fencing and signage where necessary in consultation with a heritage specialist. Identified heritage items will be clearly marked on construction plans.
	All personnel working on site would receive training in their responsibilities under the *Heritage Act, 1977*. Site specific training will be given to workers when working in the vicinity of identified heritage items.
	Should heritage items be uncovered during works, all works in the vicinity of the find would cease until specialist heritage advice is obtained.

8.4 Hydrology

8.4.1 Key features of the existing environment

Hydraulic conditions

The Proposal is located within the Little Billabong Creek catchment (illustrated on **Figure 8-5**) which covers an area of approximately 246 square kilometres. The topography includes a mixture of hills and floodplains and most of the main streams have low gradients. There are areas of scattered forest within the catchment but the majority of the land has been cleared for agriculture. Within the study area Little Billabong Creek runs parallel to the highway on the eastern side and crosses the highway just to the south of the study area, under existing dual carriageways. The existing highway includes 23 culverts draining areas predominately to the west of the exiting alignment.

Australian Rainfall and Runoff – A Guide to Flood Estimation (The Institute of Engineers Australia 2001) indicates that catchments in this region typically have low rates of runoff with the runoff coefficient for the 1 in 10 AEP flood event being between 10 percent and 20 percent. The low runoff coefficient is due to a number of factors such as:

- Typically dry antecedent conditions prior to rainfall because of a relatively low annual rainfall, which produces relatively high infiltration losses.
- Soil conditions which encourage relatively high infiltration losses.
- Low stream gradients and wide floodplains which provide large floodplain storage volumes that attenuate flood peaks.

As a consequence, records of flood inundation affecting the area are generally absent. Upstream of the Proposal there is a bridge built in 1970 crossing over the Little Billabong Creek on the Little Billabong Road (Main Road 284). There has been no report of flood overtopping the bridge or the road approaches. The calculated high flood level in 1970 was RL 318, approximately 1m below the deck level of the bridge.

Groundwater conditions

Section 3.2 provides a general description of the geology of the study area. The groundwater catchment lies within an intermediate-scale fractured rock aquifer. Overlaying valley fill alluvium provides a shallow secondary local-scale aquifer. There are three main components to the groundwater system in the region:

A. A shallow soil - regolith system composed of the residual soil profile and weathered rock profile down to a depth of several metres.

   This through flow 'aquifer' is low yielding and extremely variable in salinity, with salinisation particularly prevalent within the surface two metres at localised flow cells. It is not, however, part of the hydrogeological system, as it lies generally above the main water table. In places, it is important in flushing salt from the soil profile.

B. A deeper fractured rock aquifer (or complex of sub-aquifers) below the base of bedrock weathering, with its upper surface marked by the water table (Lachlan Formation).

   This system is unconfined in its upper reaches, but becomes confined beneath colluvial clay blankets in footslope locations (where the Hume Highway alignment is most commonly located). In places, artesian pressures may have developed in recent decades. The salinity of this groundwater is variable, but generally increases close to discharge areas (valley bottoms, gully floors and floodplain edges) due to evaporative concentration of dissolved salts.

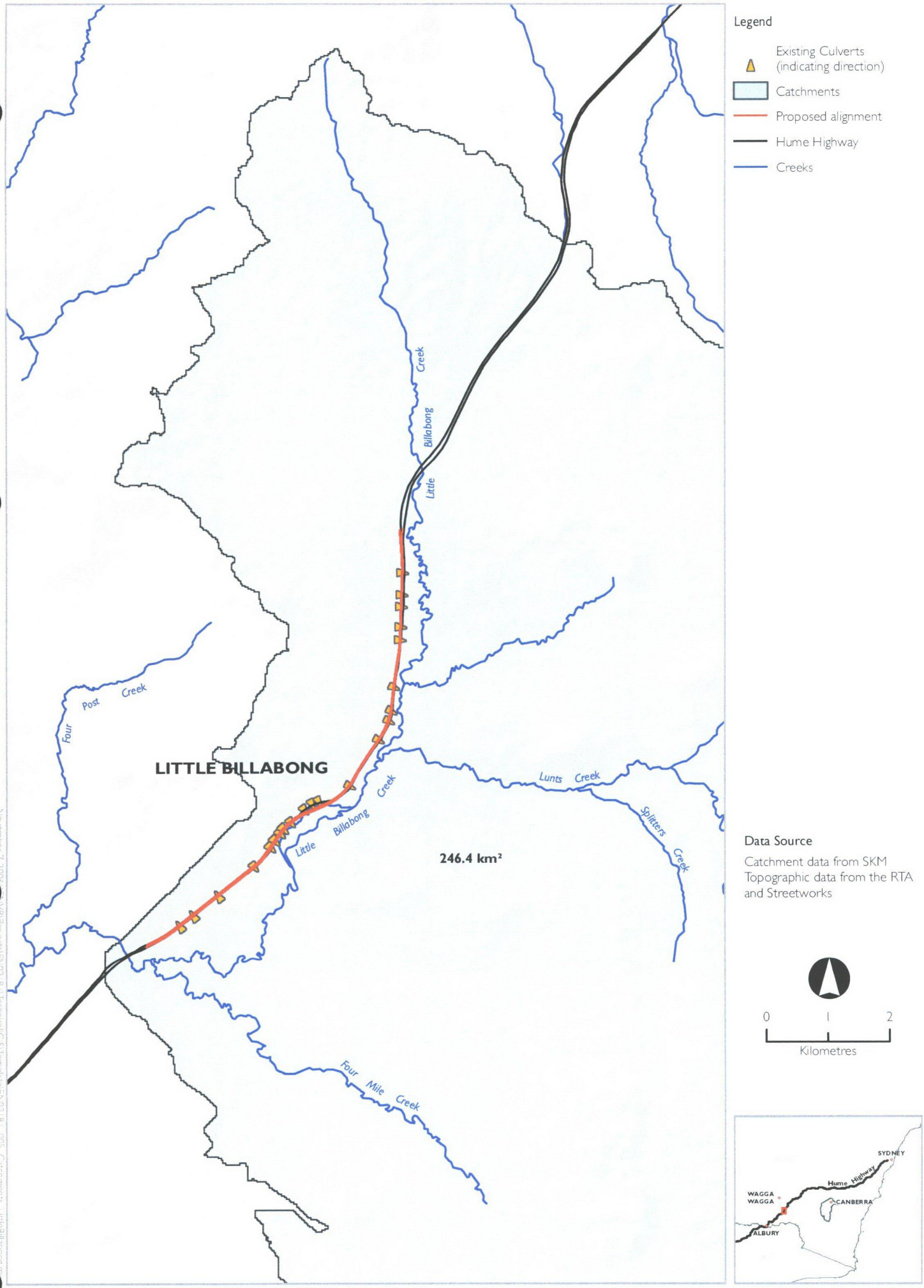

Figure 8-5 Local waterways and catchment areas

C. An alluvial sand and gravel aquifer, beneath the floodplains of the main watercourses up to 70 metres thick in buried channels (Cowra Formation).

Superficial waters follow the routes outlined by the alluvial sediments within the Tarcutta and Kyeamba catchments in particular. The unconfined aquifers in the alluvial sediments are more commonly accessed for domestic and farm supplies. Groundwater levels in the alluvial aquifers have remained steady over the last 30 years (Cresswell et al. 2003).

These aquifers may be confined or semi-confined beneath a capping of recent clay and silt deposit which are locally several metres thick. These aquifers are likely to be the highest-yielding, with the best individual wells discharging up to one megalitre per day (ML/day). Riverina Water County Council has reported individual yields of up 110 L/sec in the East Wagga Wagga bores located in up to 76m of alluvial deposit, (RWCC, 2002). Aquifer water quality in this area is generally reported to be very good, with very low Total Dissolved Solid (TDS) values. Yields and aquifer thickness are expected to increase in a north westerly direction, as the buried channels deepen towards the Murrumbidgee River.

The groundwater system of the Upper Billabong Creek catchment comprises of two types of aquifers:

- Confined to semi-confined, regional-scale alluvial aquifers of variable permeability: the Lachlan Formation and the Cowra Formation.
- Fractured rock aquifers which underlie the alluvial aquifers and maintain local groundwater flow systems (Baker, et al. 2001).

Alluvial aquifers are the dominant groundwater system within the catchment with groundwater flowing from east to west. Groundwater recharge in the alluvial aquifer system occurs mainly through direct rainfall infiltration, from streams, and from the granites and Palaeozoic bedrock where the sands and gravels of the Lachlan Formation directly overlie these rocks (Baker, et al. 2001).

Regional water use

The DLWC (2000) study paper of the Tarcutta catchment provides an indication of water use patterns in the region. The study paper shows a total allocation of 2,044 ML, including 13 high yield licences. The average entitlement for an irrigation license is approximately 190 ML (DWLC, 2000). It is estimated that the annual usage of this allocation at Tarcutta is 1,129 ML, suggesting that there are a number of sleeper licences (water allocations which are not being utilised), or excess water available under the allocation for other purposes. Almost 95 per cent of usage is taken up by irrigation uses with the remainder used for town water supplies.

Groundwater levels within the catchment are highly dependent on rainfall conditions with cumulative rainfall trends correlating strongly with groundwater trends (Cresswell, et al. 2003). These trends are most apparent in shallow alluvium areas where rainfall and resulting stream flow is likely to influence groundwater levels (DLWC, 2000). Since 2000, the area has experienced extended drought conditions, with the last 36 months to September 2006 showing serious to severe rainfall deficiencies based on rainfall percentiles (BOM, 2006).

Detailed hydrogeological information for the vicinity of the Proposal was obtained from a number of sources and included Department of Natural Resources (DNR) borehole locations data base (DNR, 2006). A corridor five kilometres wide on either side of the

Hume Highway between Tarcutta and Little Billabong Creeks contains 125 registered wells and boreholes dating back to 1930. However, only a small proportion of these would be still equipped and producing water. Many of these bores were never licensed for use, although they are still registered by the DNR. The depth of many of the bores is less than 20 metres, with fewer than 10 per cent deeper than 50 metres. Standing water levels, where noted in the records, are mostly in the range between 2 to 25 metres, indicating the variability of the water table within the region.

Figure 8-6 shows a regional profile, with registered bores and known yield figures above 1L/sec (DNR, 2006). Standing water levels range from about 2 metres below ground in the Tarcutta and Kyeamba Creek alluvium, down to about 15 metres below ground at Gumly Gumly. Towards Billabong Creek, yields have been reported up to 12L/sec at depths of up to 25 metres, in alluvial deposits as recently as 2003.

Bore yields, given for only about 10 per cent of the sites, are in the range 1 to 15 litres per second (L/sec) (around 0.1 to 1.5 megalitres per day (ML/day)). About 80 per cent of these bores are located within broad drainage valleys where higher yielding bores have traditionally been located. There is alluvium of approximately 30 to 40 metres depth near Tarcutta which produces individual yields of up to 6L/sec of good quality water (RWCC, 2002). An apparent paleochannel approximately 5 kilometres west of the Hume Highway in the vicinity of Billabong Creek has been identified where yields of 50-60 L/sec have been recorded during previous logs. However, the precise location and extent of the paleochannel is uncertain at present (pers comm. DNR).

Bedrock wells are likely to be at the lower end of the discharge range, with granite bores less productive than ones in the metamorphic rocks. Historically, the igneous rocks have low yields in the region of <0.3 L/sec and bore drilling should therefore be avoided in these rock formations. Salinity, where given in the data, is stated as <500 milligrams per litre (mg/L) TDS. However, it is likely that many of the bores are only of stock quality, with salinities in the range of 500 to 3000 mg/L. Nevertheless, the completion and equipping of a borehole is evidence that the water is of some useful quality.

Existing salinity and waterlogging

Dryland salinity and high salinity levels in local waterways are known environmental issues in the region. Salinity is highly variable throughout the catchment with deeper aquifers commonly being slightly fresher than upper aquifers (Cresswell et al. 2003). Areas of localised salinisation have been found south of the Proposal, however actual areas of waterlogging and salinity would be dependent on the nature of the soils and the presence and strength of a subsurface layer of clay material which can preclude the upward movement of water. Where this impact has been identified, it is likely to be caused by poor drainage of shallow lateral flows leading to saline outbreaks because of subsequent evapo-transpiration, rather than rising saline groundwater (RTA, 2006).

8.4.2 Assessment of potential impacts

Flooding behaviour

The existing highway generally follows a curved alignment along the edges of the floodplain. The Proposal would involve a straight section of highway embankment approximately 600m crossing the floodplain, from chainage 89400 to 90000 (see **Figure 4.1**). In order to consider the impacts of flooding resulting from the Proposal a hydraulic study has been prepared (see **Appendix G**). Although the volume of surface water runoff from the highway would be approximately doubled, the increase in impervious area as a proportion of the local catchments along the route and actual increase in flows is likely to be negligible and unlikely to represent a measurable increase in peak flows downstream of the Proposal.

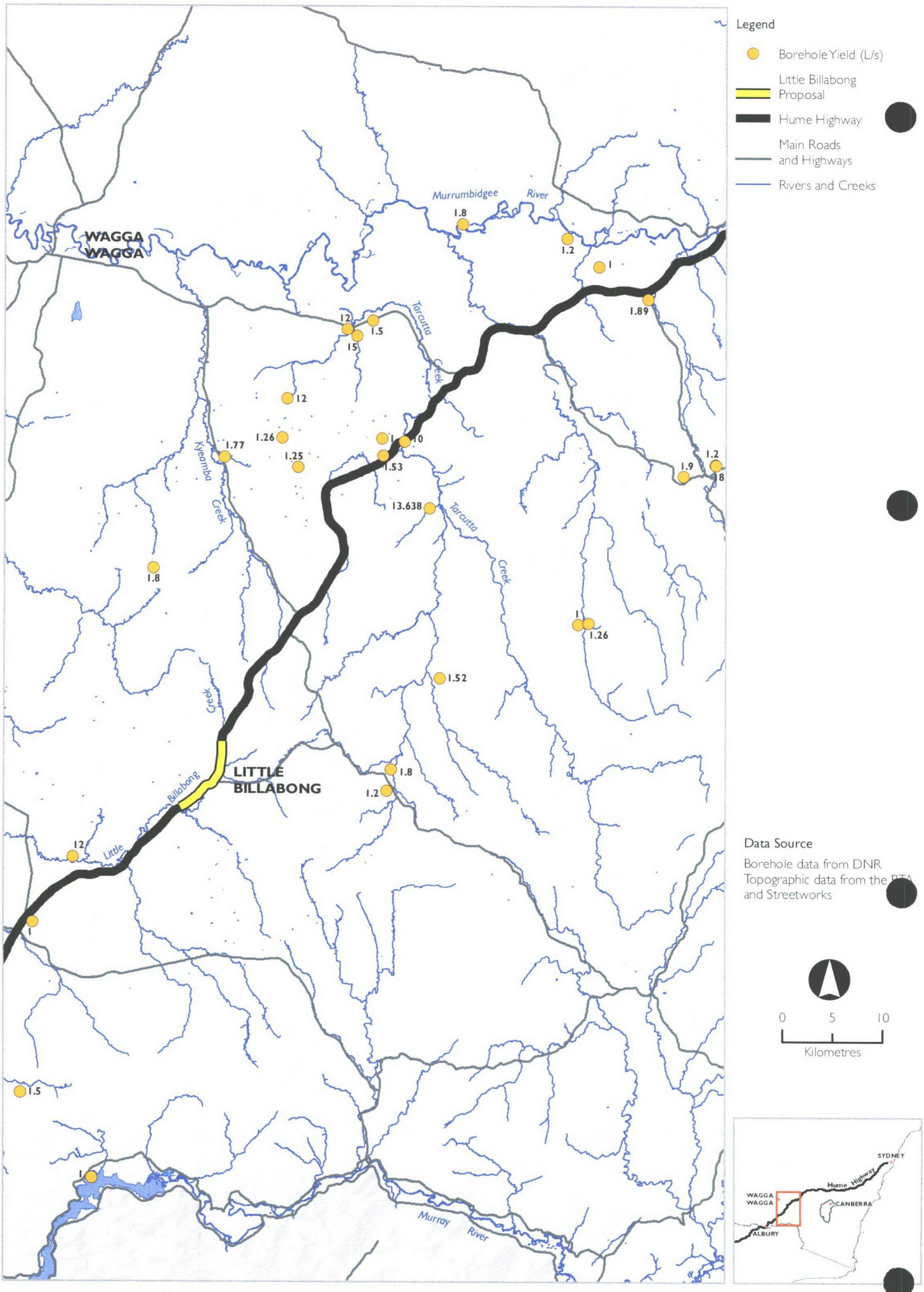

Figure 8-6 Groundwater bore localities and bore yields

The location of a section of the highway embankment within the floodplain would result in the introduction of a steep bank in the general vicinity of chainage 89700. A numerical model was established in order to determine flood levels and to assess the hydraulic behaviour of Little Billabong Creek due to the new alignment. The steady state backwater computer program HEC-RAS was used for this purpose. Survey of stream cross sections covering approximately 4.5 km from upstream to downstream of chainage 89700 was used in this model.

Results of the modelling have shown that the Proposal would have no significant impact to the existing flood flow distribution for floods up to the Probable Maximum Flood (PMF). However, increase in backwater is considered high upstream of chainage 89700 where maximum encroachment of the highway embankment onto the floodplain occurs. There is also a predicted increase in flow velocity between chainages 89700 and 89100, which would necessitate the incorporation of scour protection into the design of embankments.

The Proposal would have no substantial impact to the existing flood flow distribution. Afflux from a 1:100 year flood is dissipated from 416mm at chainage 89700 to 37 millimetres just downstream of the bridge on Little Billabong Road, representing an approximate afflux impact of 800 metres. There is no predicted change in flood level upstream of the bridge on Little Billabong Road as a result of the Proposal during the 1:100 year flood. Within the study area, afflux above 300mm occurs over a short stream length of approximately 300m, and whilst flood heights are predicted to be higher as a result of the incursion into the floodplain, the increase in extent is expected to be marginal.

Anecdotal evidence sourced during the hydraulic study has indicated that the duration of the peak floods occurs over an approximate 5 hour period, with flood peak returning to within creek banks in 6 hours. Based on these predictions, no residential properties are affected, although a pump which is already submerged in peak floods experiences increased inundation and therefore may need to be elevated.

Ultimately, the duplication of the Highway does not markedly change flood behaviour as:

- No waterways are being redirected.
- Additional impervious surface areas associated with the new carriageway are negligible as a proportion of the total catchment area (less than 0.2%).

Water resource requirements

Large volumes of water would be required for the Proposal during construction. Experience from similar projects undertaken within the region has suggested that volumes of water required during construction can peak at approximately 300L/m^3 of earth moved during summer, and drop to somewhere between 50 to 100L/m^3 during cooler months. These figures would equate to somewhere in the order of 1 to 2 ML/day during peak summer earthworks. Basing likely water requirements on these figures, during earthworks and in connection with compaction and dust suppression, it is expected that the Little Billabong section of the Hume Highway duplication would require approximately 163 ML of construction water, based on a total earthworks estimate of 545,000m^3. Water to manufacture concrete pavement would be additional to this, and total approximately 10ML, based on an expected requirement of approximately 1ML per km of two lane freeway. Other water requirements would include site compounds and worker facilities, and these are expected to create minimal water requirements in comparison to other construction activities.

The water may be purchased from the Riverina Water County Council, servicing Wagga Wagga and towns like Tarcutta and Woomargama. Given the limited volume of surface water within the catchment, particularly in the current drought conditions, it is likely that construction water would need to be derived from groundwater stores. Potential impacts of using groundwater within the catchment would include its depletion within the catchment, and subsequent impacts on other groundwater users.

Based on investigations to date including DNR records of groundwater allocations and historical figures regarding water use, it is likely that the construction water requirements of the Proposal could be met. Detailed hydrogeological assessment to determine the condition and availability of local groundwater sources is being undertaken separately for the RTA, and the findings of that assessment will determine water availability for the project.

Water conservation measures would be implemented to reduce water volumes required for construction. Measures including construction water reuse, the use of surfactants to reduce water demand during compaction and dust suppression, undertaking compaction early in the day when evaporation rates are lower and dry compaction of lower courses of embankments would reduce required water volumes for construction. These measures are to be further considered as part of the detailed design.

Water procurement and delivery

If groundwater is a feasible source of water for construction, specific management measures would need to be implemented to prevent adverse impacts on other groundwater users within the catchment. A detailed hydrogeological assessment to identify the extent and nature of the groundwater system is to be undertaken by the RTA and would aid in determining the most appropriate locations for any water extraction. This assessment would be undertaken in consultation with DNR and would also consider delivery mechanisms required should suitable groundwater sources not be located within or immediately adjacent to the study area.

During construction, facilities would be required to transport and store water prior to use, including storage tanks, reservoirs and possibly temporary pipelines or tanker trucks to convey water from source to storage. Details relating to these facilities and activities are unknown at this stage and would be determined once water sources are confirmed. The type of storage would be determined based on construction requirements and the volume and locations of water required to be stored. Where possible, covered reservoirs would be preferable to reduce evaporative loss during the summer months.

Groundwater contamination

Pollution of the groundwater during construction may result from accidental spills or changes in the hydrological regime (for example during earthworks, or placement of ancillary facilities). Groundwater vulnerability mapping has been undertaken for the Murrumbidgee Catchment (DLWC, 1999). These maps indicate that within Little Billabong, the vulnerability of the aquifer system to contamination adjacent to the Proposal is moderate to moderately high, as shown on **Figure 8-7**.

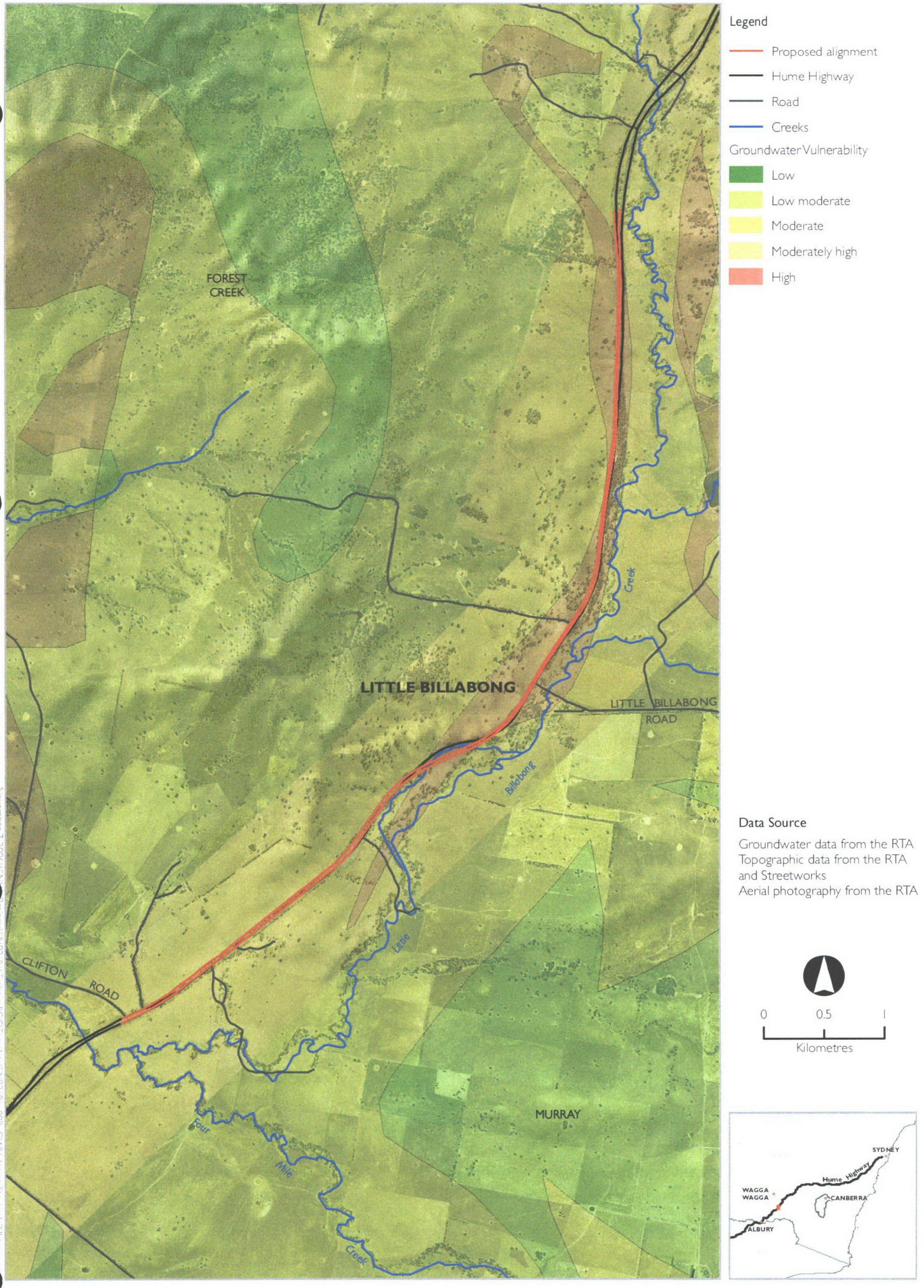

Figure 8-7 **Groundwater contamination vulnerability**

In general, confined and semi-confined groundwater systems are less susceptible to contamination from direct surface infiltration of a pollutant because a less permeable boundary provides a barrier to groundwater movement (DLWC, 1999). To manage areas identified as having a moderately high vulnerability to groundwater pollution, stormwater detention basins used during construction to manage surface water runoff would be suitably located so as to ensure that highway runoff is managed appropriately to prevent contamination of local groundwater.

During construction, earthworks that involve cutting below existing surface levels would have the potential to interact with any shallow groundwater flows, and potentially affect construction programs. Construction activities adjacent to these areas may increase the risk of pollution of the watertable and may require additional earthworks to provide suitable drainage systems to transport groundwater away from construction sites. Detailed consideration of these issues would be undertaken prior to and during construction, following completion of the hydrogeological assessment.

The ongoing pollution associated with vehicle exhaust, pavement, brake and tyre wear associated with rural highways (Legret and Pagaotto, 1999) would have the potential to interact with the aquifers, which locally within the study area are classified of moderate or moderately high groundwater vulnerability to pollution (DLWC, 1999). The incorporation of operational detention basins may serve to minimise this pollution potential through the interception of contaminants before they are released into the wider environment. However these would need to be lined with an impervious material to prevent seepage of contaminants into groundwater. However, the duplication of the Hume Highway would not in itself create increased traffic volumes, and pollution of this kind is directly related to vehicle volumes.

Salinity and waterlogging

In general, dryland salinity is a problem associated with increased water supply in salty landscapes (Spies and Woodgate, 2005). The Proposal would result in additional water being available to the landscape, via increased impervious areas in the form of additional highway pavement, and the concurrent removal of vegetation. The climate, land cover, soil characteristics, salt stores and the hydrogeology and geomorphology of the landscape determine whether this increase in water is enough to cause dryland salinity (Coram, et al., 2001).

The highway could aggravate the existing salinity problem by creating an impermeable barrier to the movement of shallow groundwater. Groundwater is impounded upslope of the road and eventually rises to the surface. Salts are then concentrated in the surface by evaporative transfer. In addition, the removal of mature vegetation along the highway corridor may encourage water tables to rise in the local area thus exacerbating the waterlogging and salinisation problems.

A detailed hydrogeological assessment would be undertaken so that areas vulnerable to impacts relating to waterlogging and salinity would be avoided during construction. The outcomes of this assessment would allow a consideration of appropriate management responses to any long term impacts, including the modification of the movement of groundwater, stemming from the operation of the Proposal. Different management responses are required for the two groundwater systems within the local area:

- Within the local alluvial system recharge reduction should be targeted through the establishment of trees or high water-use vegetation (deep rooted perennial pastures) at each flow cell rather than as a general coverage (Creswell *et al* 2003; Woolley 2006).

- Direct pumping of groundwater may be an option in the deeper aquifer. However, Ridley and Pannell (2005) recommend that this approach is only used where plant-based measures are not considered cost effective or act quickly enough to protect assets due to the uncertainty surrounding potential downstream impacts.

Salinity and groundwater are often closely linked and therefore implementation of management measures such as the establishment of trees is also likely to assist with potential salinity and waterlogging issues.

Hazards to infrastructure

Potential impacts on the operational life of the new carriageway can result from groundwater seepage adjacent to the pavement. Increase in the water content of the sub-pavement can decrease soil stiffness and cause greater pavement deflections (Kelley, 1999). Where localised shallow groundwater flows are identified adjacent to the highway, the implementation of lateral drainage structures such as blind ditches, parallel to the highway alignment would be incorporated to channel localised flows to a lower gradient, thus preventing any highway seepage and keeping subgrade pavement dry (Yuan, et al, 2006). The implementation of this measure would consider any secondary impacts associated with minor diversions of groundwater flows and adjacent landowners.

8.4.3 Key mitigation and management principles

Table 8-13: Key hydrological management and mitigation principles

Potential impacts	Mitigation and Management Principles
Prior to construction	
Impacts on the local groundwater system, including impacts on adjoining properties	• Undertake a detailed hydrogeological survey of the study area, to determine the local characteristics of the groundwater system and identify opportunities and constraints for the Proposal at both the construction and operation stages. Particular attention would be given to the ability of the groundwater system to provide for the water requirements of the Proposal. • Identify areas that would be suitable for groundwater extraction, considering as a minimum the following: - Impacts on adjoining land uses and properties. - Requirements for transportation or conveyance of water from the source to the construction site. - Facilities to store water within the construction site, including options to increase water use efficiency, and minimisation of any water loss, for example through evaporation.
During construction	
Interacting with shallow groundwater flows, increased pollution potential and requirements for additional drainage infrastructure to manage additional subsurface water flows.	• Develop drainage infrastructure and as necessary land management initiatives, for example re-vegetation of local flow cells to manage any groundwater seepage, into the construction site. • Ensure erosion and sediment controls employed to manage surface water quality impacts are suitable to protect pollution of the groundwater.
During operation	

Potential impacts	Mitigation and Management Principles
Pollution of the watertable from highway runoff and accidental spills	• Convert construction sediment basins to permanent water quality control ponds at conclusion of works where the designed stormwater treatment train includes operational stormwater retention basins. • The assessment for the provision of spill containment would be made on the basis of a site specific risk assessment which would take into consideration of the following: - The sensitivity of the receiving environment (with consideration given to sensitive groundwater resources and threatened ecological communities). - The likelihood of an accident occurring that would result in a spill (e.g. local road intersections). - The proximity of the discharge point to the receiving waters. - Opportunities to utilise alternative methods to manage spills, including emergency services response.
Impacts on the local groundwater system, including impacts on adjoining properties.	• Consider the findings of the detailed hydrogeological survey of the study area, to determine the local characteristics of the groundwater system and identify opportunities and constraints for the Proposal at both construction and operation stage.
Potential for induced localised dry land salinity	• Develop strategies to manage groundwater issues associated with surrounding land uses, including management of recharge areas in consultation with local stakeholders, as necessary.
Groundwater impact on required bore depth of other users within catchment	• Research into current bores, depths and uses by landholders. Avoidance of areas where aquifers are currently heavily drawn upon by pumping by landholders.
Waterlogging and associated impacts to vegetation and land capability	• Recharge reduction through the establishment of trees or specific cropping patterns in local flow cells as necessary, and in consultation with local stakeholders.
Decreased pavement life	• Install appropriate subsurface drainage infrastructure, for example blind ditches, in areas identified as having shallow groundwater levels, to divert groundwater away from pavement sub-grade.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of hydrology, the following draft commitments have been developed for the Proposal (see **Table 8-14**). These draft commitments are also presented in full in Chapter 10.

Table 8-14: Draft commitments to manage hydrology

Objective	Commitment
Minimise the impact on groundwater resources	A detailed hydrogeological survey of the study area will be undertaken prior to construction to establish baseline groundwater conditions. Particular consideration will be given to the ability of the groundwater system to provide for the water requirements of the Proposal. Consultation with DNR will occur

Objective	Commitment
	to assist in identifying appropriate groundwater resources.
Minimise the impact on groundwater resources and land capability and manage land degradation relating to waterlogging and salinisation	Strategies will be developed to manage groundwater issues associated with surrounding land uses, including management of recharge areas in consultation with DNR.
Minimise impact of high watertable on road infrastructure	Appropriate subsurface drainage infrastructure (eg. blind ditches) will be installed in areas identified as having shallow groundwater levels, to divert groundwater away from pavement sub-grade.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of hydrology, the following draft commitments have been developed for the Proposal (see **Table 8-15**). These draft commitments are also presented in full in Chapter 10.

Table 8-15: Draft commitments to manage hydrology

Objective	Commitment
Minimise the impact on groundwater resources	A detailed hydrogeological survey of the study area will be undertaken prior to construction to establish baseline groundwater conditions. Particular consideration will be given to the ability of the groundwater system to provide for the water requirements of the Proposal. Consultation with DNR will occur to assist in identifying appropriate groundwater resources.
Minimise the impact on groundwater resources and land capability and manage land degradation relating to waterlogging and salinisation	Strategies will be developed to manage groundwater issues associated with surrounding land uses, including management of recharge areas in consultation with DNR.
Minimise impact of high watertable on road infrastructure	Appropriate subsurface drainage infrastructure (eg blind ditches) will be installed in areas identified as having shallow groundwater levels, to divert groundwater away from pavement sub-grade.

8.5 Resource management

8.5.1 Material requirements

The Proposal would involve major cutting and fill activities along the alignment. The majority of fill material for low lying areas of the Proposal would be sourced from a large cutting in the south at approximate chainage 89100. The horizontal and vertical ratios for cut batters from which the material would be sourced would be finalised during detailed design and subject to further geotechnical investigations, however where possible flatter batters have been allowed for (2:1 or flatter). Based on current estimates it would be expected that no fill material resources would be required from outside of the Proposal corridor. **Table 8-16** summarises the general material requirements and their potential sources.

Table 8-16: General material requirements

Phase	Aspect	Technique	Material	Source	Availability
Drainage					
	Wet ground conditions	Rock Blanket	Rock	Quarry	Quarry Products
	Culverts	Pipes	Concrete	Commercial Precast Yards	Readily
	Culverts	Headwalls	Concrete		
	Culverts	Wingwalls	Concrete		
	Culverts	Backfill	Sand, fines	Onsite or quarry	Quarry Products
	Culverts	Inlet & outlet protection	Rock	Quarry	Quarry Products
	Subsoil	Pipes	Plastic	Commercial	Readily
	Subsoil	Backfill	Sand, fines	Onsite or quarry	Quarry Products
	Surface	Catch or Dish Drains	concrete, fibre	Commercial	Readily
Earthworks					
	General	Cut and Fill and compaction	Earth	Onsite or quarry	Quarry Products
	Select Layer	Cut and Fill and compaction	Higher Quality earth	Onsite or quarry	Quarry Products
Pavement					
	Concrete	Batch Plant onsite	Aggregates	Onsite or quarry	Quarry Products
	Concrete	Batch Plant onsite	Sand	Onsite or quarry	Quarry Products
	Concrete	Batch Plant onsite	Flyash	Commercial	Readily
	Concrete	Batch Plant onsite	Cement	Commercial	Readily
	Concrete	Batch Plant onsite	Highest quality earth	Onsite or quarry	Quarry Products
	Granular	Cut and Fill and compaction	Bitumen	Commercial	Readily
		Seal		Commercial	Readily
Furniture					
		Guideposts		Commercial	Readily
		Guard fencing		Commercial	Readily
		Signs		Commercial	Readily
		Pavement Markers		Commercial	Readily
		Linemarking	Paint	Commercial	Readily

Some 455,000 cubic metres of material would be cut and filled on the Little Billabong Proposal. The Proposal would also require the use of select and fill material, concrete cement aggregates, steel, fuel, asphalt and water. It is also likely that a concrete batching plant would be required on site and the estimated quantities for production of the concrete and for providing material not obtainable from onsite cut and fill operations, are shown in **Table 8-17**.

Table 8-17: Estimates of quarry materials to be imported

Extractive material requirement	Required amount
Imported Fill (m3)	nil
Imported Select Fill (m3)	40,000
Drainage Blanket Rock (m3)	nil
Base & Sub-base (tonne) (excludes concrete pavement)	20,000
Concrete Aggregates	
20/14mm Aggregate (tonne)	35,000
10/7mm Aggregate (tonne)	20,000
Coarse Sand (tonne)	30,000
Fine Sand (tonne)	5,000
Sealing Aggregate (tonne)	10,000

*Notes (from **Table 8-17**):*

- *Estimates are based on limited design and geotechnical information and actual requirements may be subject to change.*
- *Imported fill and imported select fill quantities assume select material can generally be sourced from within site earthworks.*
- *Concrete aggregate quantities have been estimated for pavement only and exclude; kerbs, gutters lined drains and structures (bridges and culverts).*
- *Sealing aggregate quantities have been estimated for where it is intended to use the existing carriageway as a future carriageway and exclude sealing required between pavement layers in the new construction*
- *No allowance has been made for specialised materials for drainage or retaining wall construction.*

Sourcing quarry products

Although the intention would be to obtain as much material as possible from within the Proposal corridor, concrete pavement layers may be required from quarries.

Accordingly, a briefing of the quarry industry based in the local government areas of Wagga Wagga, Tumut, Young, Leeton, Gundagai, Greater Hume, Albury and Wodonga (Victoria) was held on 11 October 2006. The purpose of the meeting was to:

- Brief the industry on the construction aspects of the Hume Highway Duplication.
- Seek comment on the impacts of the resource requirements on the industry.
- Identify any particular issues the industry felt would impact on them.

The Hume Highway Duplication was explained to the industry with the following comments:

- It is likely that construction would be underway at all five Hume Highway Duplication Proposals simultaneously i.e. the need for quarry materials would be simultaneous rather than one location after another.

- Multiple concrete batching plants may be operating at any given time, reinforcing the need for adequate supply requirements.
- Construction would likely commence around May/June 2007, with the immediate need being for rock for drainage blankets, sands and other fines for backfill materials for pipes.
- There would be only two full concrete paving seasons (summers of 07/08 and 08/09) and a half season (summer of 09) and this would likely mean that the major quantities of aggregates and sand for concrete would need to be available around the summer of 07/08.
- The alliances would be likely to seek delivery from more than one quarry to ensure supply in a timely manner.
- The alliances may seek to enter into alliance style agreements with one or more quarries, in other words engage not as a supplier but as a partner.
- The alliances may alternately seek to take over the operations of a quarry for the duration of the works.

In response to these comments, the industry representatives provided the following comments:

- The industry could cope with the project from existing quarries.
- A majority of representatives had already had contact with some contracting companies.
- Individual quarries will be checking their licence conditions (e.g. extraction volume, hours of operation and the like).
- Some quarries may need to seek different hours of operation in order to meet volume requirements.
- Some quarries may need to invest in newer crushing equipment in order to meet both quality and volume requirements.
- Stockpiling of materials at quarries prior to delivery at sites may need to be looked at by individual quarries i.e. room, licence conditions.

Quarries still need to ascertain if they can participate within their current licence conditions or whether they need to seek new approvals. It should be noted, however, that there is still approximately one year prior to significant earthworks being undertaken and some 18 months before significant volumes of select and pavement materials may be needed.

Following the meeting, one firm indicated that it would be lodging a development application in early 2007 for a new quarry location at Holbrook. It has an estimated resource size of some 2,000,000 tonnes and an annual extraction volume of some 200,000 tonnes will be sought. The material is microgranite and this is expected to yield material suitable for all quarry products required i.e. select, granular pavement, aggregates and sands for concrete and the like.

Another quarry site, at Kyeamba Gap, is in RTA ownership and may yield some 100,000 tonnes. Kyeamba Gap quarry was last used for the construction of the dual carriageways between Kyeamba Hill and Little Billabong and the site is yet to be restored.

8.5.2 Assessment of potential impacts

It is proposed that a balanced cut and fill design would be achieved for the Little Billabong Proposal. Balanced earth works would reduce environmental impacts by:

- Minimising the impact of construction works.

- Minimising the cost of construction works.
- Minimising or negating the cost of importing fill materials to the site.
- Minimising or negating the cost of waste material from the site.

The design process has taken advantage of good quality materials known to be in proposed cuts, while cut batters can be flattened to provide higher quality materials for select and pavement layers. Where necessary, cuts would also be designed to provide earthworks, select and pavement materials for "export" to other adjacent sites where there is a shortfall. Notwithstanding this, if additional select material and concrete/pavement related materials are required it would be imported from outside of the Proposal corridor. This material may be sourced from nearby suppliers, other Proposal sections, the existing Kyeamba Gap quarry, other licensed quarries, or be the subject of appropriate environmental impact assessment for new or re-started extractive operations.

Assessment of Kyeamba Gap quarry

Table 8-18 summarises the key environmental considerations associated with the Kyeamba Gap quarry site.

Table 8-18: Kyeamba Gap Quarry environmental aspects

Issue	Kyeamba Gap Quarry
Statutory Planning	*Tumburrumba LEP 1988* does not prohibit quarries in Rural 1a zone. Proposal would be under Part 3A Critical Infrastructure.
Ownership	RTA owns the site and it is associated with previous road construction.
Ecology	There are only isolated regrowths of Box Gums with no understorey. The surrounding area is heavily impacted by bushfire and many regrowth trees have been killed.
Heritage	Area is highly disturbed and there is no evidence of original land surface within the quarry area. There are neither visible historic artefacts nor a likelihood of Aboriginal objects or places.
Noise	The nearest residence is over 2km away and is separated by high terrain.
Air quality	The nearest residence is over 2km away and is separated by high terrain and the quarry is some 200m from the highway. Water would be used to suppress dust.
Hydrology	Small unstable drainage lines run through the site. These will need to be recontoured, stabilised and managed. Sediment control would be required at the lowest point of the quarry.
Traffic	Access to the quarry is via the abandoned highway, with direct access onto the 4 lane Hume Highway close to the top of the hill at Kyeamba Gap. Lines of sight are reasonable and vehicles are able to gather speed down the gradient shortly after entering the highway. There is a cross over with reasonable lines of sight at the location for trucks entering the quarry access road (old highway).
Utilities	There are no powerlines in the area and a diesel generator would be required to provide power on site.
Water source	Water would be trucked in and stored on site. Water would be used for dust suppression and achieving moisture content of material.

In general terms, quarry activities are normally conducted on a campaign basis with the frequency and duration of each campaign dependent on the type and volume of material required for a specific road construction project. As a result, extracted material requires processing, blending, if necessary, and storage in stockpiles in quantities sufficient to service construction needs. It is then progressively removed by truck to the construction sites. Activities would be:

- Removal and storage of top soil and overburden.
- Extraction of raw material, by blasting, if necessary.
- Processing and stockpiling of gravel.
- Blending of gravel, if required.
- Loading and haulage of gravel by truck to the construction sites.
- Progressive rehabilitation of the site.

Most of the works associated with operations at a quarry would be conducted by contractors using specialised plant and equipment. These would be undertaken in compliance with all relevant legislation and associated guidelines.

Environmental objectives and targets have been identified for the assessment of the impacts of resource extraction and haulage from Kyeamba Gap (see **Table 8-19)**. These comply with the relevant legislation and would reflect the requirements of the consent conditions.

Table 8-19: Environmental objectives and targets for material extraction operations

Issue	Objective	Target
Noise and Vibration	Minimise the impact of operational noise, vibration and blasting and ensure compliance with all relevant legislation and guidelines	Operational noise does not exceed DEC guideline limits and vibration does not result in complaints or cause structural damage to local buildings and structures. Blasting overpressure does not exceed defined DEC limits.
Air Quality	Minimise and control all emissions to the air	Dust from site operations and maintenance complies with DEC specified air quality criteria. Vehicle and plant emissions comply with regulations.
Access and Traffic	Minimise the impact of operational traffic on local communities	Total truck movements generated by haulage of extracted material do not generate complaints, or adversely affect local roads.
Erosion and Sediment Control	Minimise erosion, sedimentation and impacts on water quality of local watercourses	Soil erosion control measures are incorporated in the site operational procedures. The internally draining site would have little impact on the hydrologic regime of downstream waterways.
Water Management	Protection of local groundwater resources	The final maximum depth of extraction will be determined following detailed groundwater investigations. Extraction will not be undertaken below this level.
Flora and Fauna	Minimise the risk of impacts to the natural environment (especially threatened species) and rehabilitate the site with	Areas of significant flora and fauna are protected. The site is successfully revegetated with the appropriate species in conformity with the approved

Issue	Objective	Target
	an appropriate mix of local species	rehabilitation plan.
Rehabilitation	Complete staged rehabilitation in conformity with the approved plan.	The site is successfully rehabilitated within three years of the cessation of extraction and certified as such by a qualified landscape architect.
Social Impact Management	Ensure that the impacts of the project on local communities are understood and where feasible minimised.	Establish a consultation program to inform members of the community and provide for community participation in decision making.
Heritage	Ensure that items of Aboriginal archaeological or European heritage significance are recognised and protected or conserved during operations.	Heritage items identified are protected.
Visual Amenity	Minimise visual and amenity impacts during project operations.	No complaints received regarding visual impacts during project operations.
Waste Management	Manage waste generated during operations in accordance with the preferred hierarchy of minimisation, reuse, recycling and disposal.	Quantities of waste to disposal reduced and those to reuse increased. Wastes for disposal stored in appropriate areas and removed on a regular basis.
Emergency Response	Ensure that appropriate procedures and training are in place to deal with emergencies.	Emergency response procedures to be maintained and training up to date.
Hazard, Risk and Safety	Ensure that the handling and storage of dangerous goods on site does not result in pollution of the environment or cause harm to individuals.	Storage and handling of hazardous materials complies with legislative requirements. Any pollution incidents contained and cleaned up without impact on the environment or injury to personnel. All incidents recorded.

An extractive material operation is normally divided into three phases (it should be noted that not all of these may be relevant to current operations):

- Pre-operational during which various site works are put in place. These include the construction of the water management system which is required for the operation of the site but does not involve extraction of material for commercial purposes. Such operations involve the use of heavy machinery and would need to comply with all the criteria established to control the main extraction activities on the site.
- The operational phase which consists predominantly of the phased extraction of material for processing and subsequent use.
- Progressive rehabilitation of the site to an agreed ground profile with screen planting.

Each of these comprises one part of a continuous process employing similar activities and using the same machinery. During the operational phase, environmental issues would be addressed progressively to ensure that:

- The completed project complies with environmental performance criteria as prescribed in all applicable standards and legislation.
- Environmental management strategies are fully evaluated to ensure impacts are minimised.

Consultation would be undertaken with all relevant authorities including the Department of Planning, the Department of Environment and Conservation, the Department of Primary Industries and the Department of Natural Resources, prior to and during operation, and post operation during decommission, as necessary.

8.5.3 Key mitigation and management principles

Detailed design and construction planning considerations would include minimising the quantities of materials required and the distance to transport materials. The design would be developed to maximise the use of materials from within the proposal corridor and the recycled content of materials. Existing licensed sources (eg. quarries) would be used to supply any required additional material, or alternative locations suitable for sourcing additional fill or select material would be identified and separate assessment and approvals would be sought. In design development and construction planning, consideration would be given to optimising mass haul efficiency and minimising truck movements.

The following strategic principles would guide the management of Kyeamba Gap quarry, or establishment of new extractive material operations.

Air Quality

Ground disturbance, vehicle movement and material processing all have the potential to produce high levels of dust during dry or windy weather. Various means are available to minimise this occurrence and to comply with appropriate criteria. These are:

- Minimising internal vehicle movements necessary to transport material to the processing plant.
- Ensuring that all roadways or exposed areas subject to substantial use by vehicles are regularly watered during dry or windy weather. All operations should cease during periods of exceptionally high wind.
- All stockpiles of topsoil should be vegetated as soon as possible.
- Rehabilitation should take place as soon as possible on completion of extraction from a particular phase of the project.
- All payloads must be covered on trucks leaving the process plant.

Environmental Noise

During all stages of development noise emissions that may arise as a result of project operations would be controlled in order to comply with the criteria established by the Department of Environment and Conservation. Best environmental management and work practices would be employed to ensure that any noise and vibration impacts are minimised at the nearest potentially affected sensitive receptors. These would include:

- Operation of all mobile equipment at a sufficient distance from sensitive receptors or behind suitable acoustic shields at an increasing depth as the extraction progresses.
- Fitting all mobile equipment with residential grade muffler systems with the overall noise level checked on an annual basis to ensure that the lowest achievable emission level is maintained.

- Implementation of a programme of environmental noise monitoring if necessary, to identify any potential impacts and introduce mitigation measures as necessary.

Water Management

The objective of water management on the site is to ensure that there is zero net impact on the receiving waters up to the 1% AEP storm event for suspended solids, total phosphorus and total nitrogen. Management strategies would ensure that the capacity to capture runoff from this storm is always available, other than during or within five working days of any rainfall events.

Operation of the site would provide an internal drainage system to ensure that all runoff generated on the site flows to an excavated pit or sediment retention basin. This would ensure that sediment is retained on site and quality maintained in the discharge waters. The resulting spillover from these basins would provide water flows equivalent to that experienced prior to extraction activities on the site. No flooding would therefore be introduced downstream.

Erosion and Sediment Control

Most of the potential soil loss on the site would be the result of sheet or rill flow. Calculated soil losses from the works area (excluding batters) will vary between 35 and 228 tonnes per hectare per year depending on the erodibility of the subsoil material. However slope length can be reduced by the installation of earth banks (catch drains) anywhere where soil loss needs to be further reduced.

Flora and Fauna

Site clearance would inevitably lead to the removal of some existing vegetation. The location of a new quarry or extension of an existing extraction operation should be sited, where possible, to avoid the large-scale removal of native vegetation. If removal is necessary, a detailed assessment would be required to identify the characteristics and quality of the vegetation and define a strategy for the maintenance, and possibly the enhancement of its values. If any listed plants, species or communities would be affected, specific measures would be identified to offset any losses.

Habitat values for known threatened fauna species would also need to be defined and any necessary measures identified to minimise any losses and compensate for its removal.

Rehabilitation

The rehabilitation of the site to a landform with an appropriate vegetation community is a key outcome of the development. This would inevitably lead to changes including the removal of some existing vegetation and the reshaping of the ground profile. It is important therefore that the rehabilitation of the site achieves:

- A landform that is sympathetic to the surrounding topography and avoids the introduction of a profile that is alien to the visual character of the area.
- Avoids the introduction of unnaturally steep slopes within the constraints imposed by the availability of fill material.
- Retains suitable gradients that allow the site to drain to those watercourses fed by the site prior to extraction activities.
- Recreation of native vegetation on all those areas not suitable or appropriate for other uses.

Site rehabilitation would be undertaken in stages following the phasing of extraction. Inevitably it will require amendment as the site operations reveal site characteristics not known at the start of the process. As a result the Rehabilitation Plan would be subject to a process of continual review, amendment and approval.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of resources, the following draft commitments have been developed for the Proposal (see **Table 8-20**). These draft commitments are also presented in full in Chapter 10.

Table 8-20: Draft commitments to manage resources

Objective	Commitment
Reduce demand on resources	Geotechnical investigations will be undertaken to identify suitable material on site for any additional fill material requirements.
	The Proposal will be designed to achieve balanced earthworks where feasible.
	Construction practices to minimise water use including investigating opportunities to reuse and recycle water will be adopted.
	Appropriate water sources for the construction will be investigated and identified in consultation with DNR.
Minimise transport associated with the demand for resources	Where feasible, suitable materials will be obtained from local existing licensed quarries.

8.6 Cumulative impacts

Cumulative impacts of the Proposal are considered to be environmental effects (either beneficial or adverse) arising from the Proposal that may operate cumulatively with the environmental effects of other road proposals or activities which have been, or would be, carried out.

Methodology

As such Section 8.6 considers the potential cumulative impacts of all five sections of the proposed Hume Highway Duplication and the potential interaction of this Proposal with other known and proposed developments and activities in or close to the study area. It is important to assess the total cumulative effect of such impacts as they may not be considered to be significant on their own, but they may become more important and require more intensive management when the sum total of the potential cumulative impact is considered.

Cumulative impact was considered in terms of spatial (site, local and regional) and temporal (short, medium and long-term) environmental effects. For the purposes of this assessment the spatial and temporal parameters were identified as:

- Short-term = construction period of the Proposal.
- Medium-term = over the next ten year period from the commencement of operation of the Proposal.
- Long-term = being approximately 30 years (the average life of constructed assets) from the commencement of operation of the Proposal.
- Site = the Proposal's construction work areas.
- Local = the area within approximately 1 kilometre of the works.

- Regional = the Hume Highway Duplication corridor and / or surrounding local government areas.

Other road proposals

As described within Chapter 1, this Proposal is one of five sections of road works forming the proposed Hume Highway Duplication. The other proposals which form the Hume Highway Duplication are:

- The Sturt Highway to Tarcutta section totalling approximately 6 kilometres in length.
- The Kyeamba Hill section totalling approximately 9 kilometres in length.
- The Yarra Yarra to Holbrook section totalling approximately 12 kilometres in length.
- The Woomargama to Mullengandra section totalling approximately 10 kilometres in length.

Additional duplication and improvement works currently underway, or with existing planning approval, on the Hume Highway between Gundagai and Albury include:

- The Albury Wodonga Hume Freeway works (scheduled to open in mid 2007) including the section between Table Top and Mullengandra (scheduled for completion by 2009).
- The Coolac bypass (scheduled to commence in late 2006).
- Sheahan Bridge, Gundagai (scheduled to commence in 2007).
- The West Street interchange, Gundagai (scheduled to open in December 2006).
- The Tarcutta truck and trailer interchange facility (scheduled to open in late 2006).

Bypasses at Tarcutta, Holbrook and Woomargama are also proposed to achieve full duplication of the Hume Highway between Melbourne and Sydney. These bypasses are planned for completion by 2012.

In addition to the road proposals described above, the RTA and local councils are expected to undertake a number of minor road works, such as pavement rehabilitation and shoulder widening, as part of their annual maintenance of the local and regional road network.

Other infrastructure proposals

Over the next five years, the Australian Rail Track Corporation (ARTC) are proposing to upgrade the 592 kilometres of track and signalling on the Main South Line from Macarthur (near Campbelltown) to Albury. Parts of these upgrade works include necessary rehabilitation of the existing track between Junee and Albury and the construction of passing lanes. From Wagga Wagga to Albury, the Main South Line generally runs north to south following the alignments of the Olympic Highway and the Hume Highway (south of its intersection with the Olympic Highway). Sections of the track where it is proposed to construct passing lanes include:

- Harefield and Bomen.
- Wagga Wagga and Uranquinty.
- The Rock and Yerong Creek.
- Henty and Culcairn.
- Gerogery and Table Top.

Other activities or potential contributing factors

For the purpose of this assessment other activities and potential contributing factors have been identified where known environmental stresses in the affected area exist and the Proposal is likely to increase or decrease those stresses. These other activities and potential contributing factors are:

- Agricultural practices, eg irrigation and watering animals, sowing and harvesting of crops and pastures and burning-off.
- Seasonal influences, eg traffic volumes increasing during Easter and Christmas holiday periods.

8.6.1 Assessment of cumulative impacts

Transport and freight efficiency

There have been long standing expectations for the upgrading of the Hume Highway to provide a continuous high standard dual carriageway highway between Sydney and Melbourne. The Proposal is part of the overall strategy to upgrade the Hume Highway and in this regard has been developed on a strategic basis to address the key objectives of improving the vital passenger and freight connection between NSW and Victoria.

In general the Proposal has been explicitly designed and justified on the basis of the strategic and associated cumulative benefits of the Hume Highway Duplication. The completion of the Hume Highway Duplication would provide consistent conditions for road users and accommodate the forecast growth in traffic on the Hume Highway. In particular the Hume Highway Duplication would provide a number of significant and positive cumulative benefits to the region in both the medium and long-term including:

- Improved safety of the Hume Highway by providing a route with separated carriageways and improved vertical and horizontal alignment.
- Improved level of service.
- Decreased travel time and increased fuel and travel efficiency.
- Reduced vehicle operating costs.
- Improved connectivity and accessibility throughout the region.

It is anticipated that the above benefits would increase following completion of the bypasses at Tarcutta, Holbrook and Woomargama.

The Hume Highway Strategic Planning Study (Connell Wagner 2004) comprised an analysis of the existing and future transport needs for the Hume Highway between the Sturt Highway and Table Top in relation to both road and rail modes to identify future upgrade strategies. The analysis indicated that the potential achievable shift of freight from the Hume Highway to the rail network would only be marginal (in terms of the total road freight transport task) even with relatively high levels of investment in rail infrastructure.

Changes to regional and local road network

The Proposal has an important role as part of the Hume Highway Duplication in delivering cumulative improvements in travel speeds and driver safety between Albury and the Sturt Highway. At the completion of the duplication works, the improved road conditions on the Hume Highway could potentially attract traffic from other routes, including the Olympic Highway and Sturt Highway. However given the relatively dispersed nature of trip origins and destinations of traffic using these routes and the small traffic volumes on these roads, the potential transfer is expected to be minor and its impact is not expected to be significant to either the total volume of traffic on the Hume Highway or to the traffic volumes and amenity of the alternative routes.

Any increase in traffic volumes would have a minimal effect on capacity and functionality of the Proposal and the Hume Highway Duplication as a whole. Any negative impacts, including an increase in traffic on the Hume Highway would be more than offset with the net positive

cumulative benefits of reduced traffic on other roads as well as benefits of any transferred traffic travelling on a safer road and associated travel time and travel cost savings.

Construction traffic management

The Proposal would result in short-term delays to the road users of the local and regional road network (including the Hume Highway) as a result of:

- Works being undertaken to duplicate the Hume Highway.
- An increased number of heavy vehicle movements associated with the construction of Proposal.

Impacts on freight movements are expected to be minor since the critical period for heavy vehicles on the Hume Highway occurs at night and it is anticipated that the majority of works would be undertaken outside of this period. However, the impacts associated with the Proposal are expected to combine with similar impacts from the other road proposals described above and in particular the other proposals which form the Hume Highway Duplication. Any additional heavy vehicle movements associated with the proposed upgrade work on the Main South Railway would also contribute to delays to road users on the local and regional road network.

It is anticipated that the cumulative effect of delays and reduced travelling speeds would be experienced in the short-term at a local and / or regional scale. The extent of the impact would also be influenced by seasonal influences in traffic volumes (ie delays would be increased during holiday periods when traffic volumes generally increase) and agricultural practices (eg. additional heavy vehicles used during harvesting would contribute to delays). A co-ordinated approach to construction traffic management would be implemented to effectively minimise the cumulative impacts.

Social and land use

The construction of the Proposal would require temporary and / or permanent modifications to existing property accesses within the site. It is anticipated that similar modifications would be required for all the other proposals as part of the Hume Highway Duplication. However, the cumulative effect of changes to property access would only be considered local due to the impacts only affecting property owners individually. Additionally the cumulative effect would only be experienced during the short-term. Nevertheless, the RTA would apply a consistent management approach regarding changes to property access for the Hume Highway Duplication which would maintain access throughout construction and minimise impacts on agricultural practices.

When operational, the guiding principle for property access would be to provide a gap in the median between the north and south bound carriageways, subject to satisfying safety requirements and road design issues to enable direct access to both the north and southbound carriageways. Where this is not possible, it is anticipated that the opportunity for access to both directions of the Hume Highway would not require additional travel of more than 1 kilometre (ie. 500 metres to the nearest median break). In this regard the impacts on access would generally not extend beyond the site and hence cumulative effects in the medium to long-term would be negligible.

Given the nature of existing zoning and landuse it is not expected that the Proposal itself or in combination with other road proposals or activities would lead to any major landuse changes in a local or regional scale. Any potential stimulation to development due to the road improvements would be more likely taken up in the major towns including Albury and

Wagga Wagga, and perhaps to a lesser extent Holbrook, all of which would be positive to the local economies.

A number of property owners would be affected by the loss of part of their property as a result of the Proposal. This is also the situation for all the other proposals as part of the Hume Highway Duplication. As the proposed duplication alignment for all the Hume Highway Duplication proposals predominantly follows the existing alignment the majority of property impacts (ie. the loss of agricultural land) would be narrow strip acquisitions of generally large land parcels. In this regard the loss of agricultural land as a result of the Hume Highway Duplication would be negligible and the impact on the viability of individual properties minimal. However, when combining the loss of agricultural land of the Hume Highway Duplication with the expected loss (and severance issues) of other Hume Highway proposals, particularly the bypasses, the cumulative loss of agricultural land and its associated impacts would be greater.

Biodiversity

The Proposal would result in a number of potential biodiversity impacts including vegetation loss, indirect vegetation impacts (including edge effects), habitat fragmentation and / or loss, direct fauna mortality during construction and increased risk of fauna mortalities during operation and weed invasion. A number of these potential impacts, such as weed invasion and the risk of fauna mortalities would be effectively minimised through the implementation of best practice flora and fauna management measures. Impacts which have the potential to combine with similar impacts on other proposals to result in adverse cumulative effects include those associated with vegetation loss and habitat fragmentation and / or loss.

As described in Section 8.1, the Proposal would result in the loss of 14.3 hectares of native vegetation. This would include 11.6 hectares of the White Box, Yellow Box, Blakely's Red Gum Woodland as defined under the TSC Act and 2.4 hectares of the White Box-Yellow Box-Blakely's Red Gum Woodland and derived native grasslands as defined under the EPBC Act. The other proposals as part of the Hume Highway Duplication also result in the clearance of Box Gum Woodland (as it is defined under both the TSC Act and EPBC Act). The areas of vegetation clearance for these communities as a result of the Hume Highway Duplication are described in **Table 8-21**.

Table 8-21: Areas of Box Gum woodland to be cleared

Proposal	White Box, Yellow Box, Blakely's Red Gum woodland (TSC Act)	White Box-Yellow Box-Blakely's Red Gum woodland and derived grasslands (EPBC Act)
Sturt Highway to Tarcutta	2.3 hectares	0.3 hectares
Kyeamba Hill	12.2 hectares	11.3 hectares
Little Billabong	11.6 hectares	2.4 hectares
Yarra Yarra to Holbrook	9.7 hectares	9.7 hectares
Woomargama to Mullengandra	21.1 hectares	21.1 hectares
Total	56.9 hectares	44.8 hectares

Table 8-21 describes the potential loss of Box Gum Woodland as a result of the Hume Highway Duplication. The cumulative effect of the loss of Box Gum Woodland (as it is defined under both the TSC Act and EPBC Act) is a long-term and regional impact.

As described in Section 8.1, the Proposal would result in habitat fragmentation and / or loss of habitat for a number of threatened species listed under the both the TSC Act and EPBC Act. In particular the Proposal would affect habitat for the Squirrel Glider, the Pink-tailed

Worm Lizard and the Striped Legless Lizard. The other proposals as part of the Hume Highway Duplication also result in impacts to the habitat of these three threatened species and there is potential for the other road proposals, such as the bypasses, to also result in similar impacts. As such, the cumulative effect would be of a regional scale and either medium or long-term based on the availability of similar habitat adjacent those areas which are impacted.

Aboriginal heritage

A local specific cumulative assessment was undertaken as part of the assessment of the potential impacts to Aboriginal heritage resulting from the Proposal and is provided in Section 8.2.2. Regarding the cumulative effects at a regional scale, the Proposal in combination with the other proposals as part of the Hume Highway Duplication would result in a greater impact to objects, sites and places of Aboriginal cultural heritage significance such as scarred trees and potential archaeological deposits. It is probable that other road proposals, such as the bypasses, may contribute to the impacts from the Hume Highway Duplication following further investigation required as part of their environmental assessment. Therefore, it is anticipated that the cumulative effect associated with impacts to Aboriginal heritage would be considered long-term and regional.

Non-Aboriginal heritage

The Proposal would result in a number of potential Non-Aboriginal heritage impacts including items of built, archaeological and landscape heritage. Similar impacts would be experienced on the other proposals as part of the Hume Highway Duplication. Heritage items of Local or State significance that would be affected by the Hume Highway Duplication are summarised in **Table 8-22**.

Table 8-22: Heritage items of Local and State significance that would be subject to impact

Proposal	Built heritage	Archaeological	Landscape
Sturt Highway to Tarcutta	T204-T206,	T001, T006,T007, T008	T301-T304
Kyeamba Hill	K201, K202, K203, K204, K205	N/A	K302-K310,
Little Billabong	L202-L204	L002, L005, L006	L303
Yarra Yarra to Holbrook	H202-H204	H002, H003, H102, H103, H104, H105, H009	HH301, H302, H304, H306, H307
Woomargama to Mullengandra	M205, M208-M211	M001, M005, M007, M008,	M301-309

The three State significant heritage items that would be impacted by the Hume Highway Duplication are:

- The former Travellers Joy Inn (K203).
- An archaeological relic site including a drain, artefact scatter and buried structural remains associated with a store (H003).
- The Royal Oak Inn (M205).

There would be no impact upon the fabric of K203 and M205 and any impacts from the Proposal would be upon the setting in which these items are located. It is considered that any impacts on K203 and M205 could be appropriately managed to maintain the heritage value both during and after construction. The potential impact upon H003 would be managed by avoiding where possible or by undertaking a detailed archaeological excavation.

The non-Aboriginal heritage items of local significance that would be lost include roadside cuttings, roadside vegetation such as, cultural plantings and native vegetation, dams and buried structural remains associated with farming buildings. With the exception of vegetation and remnant sections of old road pavement, the majority of locally significant sites that would be impacted are considered unique to a specific section of the Hume Highway Duplication. In this regard the cumulative effect associated with impacts to the majority of locally significant sites would be considered long-term at a local scale. Furthermore, in regard to locally significant remnant sections of old road pavement, the cumulative effects would be long-term at a regional scale. As such, appropriate mitigation principles for managing the cumulative impact on remnant sections of old road pavement have been developed and are included below in **Table 8-23**.

Extractive materials

The resource needs for the construction of the Proposal and consideration of the environmental impacts associated with obtaining these resources is described in Section 8.5. As previously acknowledged in Section 8.5, where feasible the Proposal would be designed to achieve balanced earthworks, however it is expected that the Proposal would require higher quality materials for select, granular and concrete pavement layers and that these materials could be sourced from quarries. This also applies to the other proposals forming the Hume Highway Duplication.

The cumulative effect of sourcing higher quality materials for the Hume Highway Duplication would be considered to have a short-term impact on the availability of material resources in the region. To consider and address this impact, quarry industry representatives were briefed on 11 October 2006 on the material resource requirements. As a result of this briefing, the quarry industry indicated that the demand for material resources for the whole Hume Highway Duplication can be met. As such it is anticipated that with ongoing consultation with the quarry industry that the cumulative demand on material resources would be manageable.

Water resources

This Proposal would require substantial volumes of water over the duration of the construction period for dust suppression, compaction and for manufacture of concrete pavement, estimated to be a maximum of 173 mega litres. Section 8.4.2 describes potential options for sourcing water from Riverina Water County Council or local groundwater stores.

Despite the existing environmental stresses regarding availability of water resources, the Proposal is not anticipated to have any major consequences or impacts on the local water supply. However, as each of the other proposals as part of the Hume Highway Duplication requires a similar volume of water for construction in addition to the other road and infrastructure proposals described above potentially also requiring a similar volume, it is expected that the potential cumulative demand for water associated with road works in the region would be significant.

It is anticipated that any cumulative effect on water resources would be experienced in the short-term at a regional scale. The extent of the impact would also be influenced by seasonal agricultural practices (eg irrigation and watering animals), the investigation of alternative dust suppression techniques that may be available to minimise water use during construction and the availability of water. A co-ordinated approach to minimising water use and optimising the sourcing of water would be adopted to minimise cumulative impacts. Using a combination of sources such as existing dams, temporary dams and groundwater extraction, would assist in minimising the residual cumulative impacts on water supply.

8.6.2 Key mitigation and management principles

A general principle of management and mitigation of environmental impacts is that where possible the identified impacts should be managed and mitigated to the greatest extent possible within the boundaries of the proposed project and, where necessary within the immediate vicinity of the proposal.

The majority of cumulative effects described above would be managed and mitigated to the greatest extent practicable at the individual Proposal level using strategies and practices identified in Chapters 8 and 9 of the Environmental Assessment documents for each section of the Hume Highway Duplication.

The following table lists measures designed to minimise potential cumulative impacts that may be required in addition to the strategies and practices outlined in Chapters 8 and 9 to obtain optimum environmental outcomes for the proposed project as a whole.

Table 8-23: Key cumulative impact management and mitigation principles

Impact	Mitigation
Changes to regional and local road network	• In consultation with local council and NSW Police, monitor whether speeds through town increase following opening of the duplicated sections of Highway. • If issues/concerns arise consider implementation of management/mitigation measures including: – Signposting. – Increased police surveillance. – Speed transition zones. – Speed cameras. – Tactile road surface treatments (ie rumble strips).
Construction traffic management	• Co-ordinate traffic management plans and construction planning for each section of the proposed Hume Highway Duplication works to ensure minimal cumulative disruption to traffic, particularly during peak periods including school and public holidays. • Consider minor deviations where possible to ensure one lane remains open to traffic in each direction, especially in peak periods.
Social and land use	• Consult with affected land owners or neighbours regarding a wide range of design and construction issues to keep neighbours fully informed regarding the design and delivery of the works. • Maintain property access to north and southbound carriageways.
Biodiversity	• An impact offsets package including compensatory habitat and habitat improvement works would be determined through discussions with relevant government agencies (DEC and potentially DEH) to address any unmitigated cumulative losses of biodiversity and or habitat loss resulting from the proposed Hume Highway Duplication project as a

Impact	Mitigation
	whole. • Minimise removal of vegetation in the road corridor as far as practicable and protect vegetation located in close proximity to construction activity to minimise impacts.
Aboriginal Heritage	• Preservation and recording of identified Aboriginal heritage items where appropriate in consultation with the Aboriginal community.
Non-Aboriginal heritage	• Representative examples of old road pavement will be preserved in some sections of the Hume Highway Duplication to minimise the cumulative impact of changing and removing a large section of existing road.
Water resources	• A combination of water supply sources will be considered using a co-ordinated approach and in consultation with relevant government agencies and stakeholders to ensure cumulative impacts on water supply are minimised. • In consultation with Council and DNR, the impacts of extraction from Holbrook town water supply will be considered and assessed (if required).

It is a general principle of effective impact mitigation and management that the issues identified as giving rise to an impact are addressed at the source to remove and/or minimise the impact as far as possible and then to seek to mitigate any outstanding impact that remains.

The issues identified above that give rise to potential cumulative impacts will therefore be principally and most effectively addressed at the individual proposal level through the application of management and mitigation measures as identified throughout Chapters 8 and 9. In addition Chapters 8 and 9 take a precautionary approach and identify management and mitigation measures and associated decision making processes (eg consultation with stakeholders) that provide sufficiently generous mitigation to offset both immediately identified impacts and potential additional or cumulative impacts that may arise. The consolidated draft statement of commitments is accordingly considered complete and sufficient to address both the impacts identified in Chapters 8 and 9 at their source and the potential cumulative effect that these impacts may have in concert with similar issues arising on other projects and activities in the region. Therefore, no new commitments are identified as necessary for the management and mitigation of cumulative impacts.

9 Consideration and management of other issues

Chapter 9 of the Environmental Assessment provides an assessment of those issues relating to the Proposal that are not considered to be key issues. These issues are normally associated with road projects and are routinely managed via the inclusion of specific items in the design of the Proposal or by the implementation of standard and best practice management and mitigation measures.

Residual impacts, following the inclusion of mitigation measures in the design and the application of appropriate management measures during construction and operation, are expected to be minor.

9.1 Traffic

The Hume Highway is the principal road transport corridor connecting Sydney and Melbourne and provides for interstate traffic. It also serves regional and local transport functions and thus is an important part of the NSW State and regional road network (RTA 2006). The reliable and efficient operation of the Hume Highway is vital to the economies of both NSW and Victoria. The Hume Highway Duplication would greatly improve operation of the road, however, construction works would create temporary delays. Traffic management measures would be implemented to keep any delays to road users during the upgrading process to a minimum and that relevant and timely information about these delays is available.

The closest traffic recording site is located immediately north of Little Billabong Road (MR284) within the Proposal length. Approximate traffic volumes for the study area for 2003 were 4,500 vehicles per day (AADT) with heavy vehicle transport comprising approximately 39 percent of the highway traffic. The peak period for heavy vehicles is between 8pm to 1am. The higher volume of heavy vehicles and lower volume of general traffic on the highway at night means that a high proportion of total night time traffic is heavy vehicles. Detail of the most recent vehicle traffic counts as collected in 2003 are provided in **Table 9-1**.

Table 9-1 Vehicle traffic counts for Hume Highway at Little Billabong

Vehicle	Count	Classification
Light vehicles	2,785	(AustRoads Classes 1-2 – cars, short vehicles)
Heavy vehicles	1,314	(AustRoads Classes 3-9 – rigid trucks, buses, semi trailers, etc)
Super heavy vehicles	451	(AustRoads Classes 10-12 – B-Doubles, etc)
Total	4,550	

Over the Proposal length, 23 crashes were recorded in the six years to December 2005 (provisional data for September 2005 and December 2005 quarters) resulting in one fatal, nine casualty and thirteen tow away crashes. The crash rates are generally consistent with the typical crash rates for two lane non-divided roads as detailed in **Table 9-2**.

Table 9-2: Crash rates for Hume Highway at Little Billabong

	Little Billabong (per km per year)	Little Billabong (per 100Mvkt)	Stereotypical Crash Rate (per 100Mvkt)
Fatal crash rate	0.02	1.3	1.4

Casualty crash rate	0.19	12.7	15.6
Towaway crash rate	0.27	16.5	17.2
Total crash rate	0.49	29.2	32.8

Of the total 23 crashes, 11 were categorised as 'off path on curve' and nine of these occurred on the two curves immediately south of Little Billabong Road. These curves have advisory speeds of 95km/h and are proposed to be improved by realigning the southbound carriageway (existing highway) between 88.5km and 90.5km south of Gundagai.

The Proposal is likely to cause traffic disruptions on the Hume Highway and local connecting roads during construction. It is anticipated that impacts on motorists would be limited mainly to short time delays and an increase in travelling times during periods of the construction works.

During the construction period six main strategies would be implemented to reduce the impact on traffic in the study area and would include:

- Proactive and coordinated planning throughout the construction process.
- Safe provision for traffic to be made at all work sites.
- Delays to traffic at each work site would be minimised.
- Duplication works would be coordinated to minimise cumulative delays.
- Informing the road user about:
  - work locations;
  - timing of works;
  - hours of work;
  - speed zoning;
  - changed traffic conditions;
  - the delays they are likely to encounter; and
  - other routes which might be suitable.
- Local community awareness of the works.

The existing carriageway of the Hume Highway would generally remain under traffic while the new carriageway is constructed and minor short-term would occur as traffic switches are implemented to facilitate construction. Delays and traffic stoppages would be minimised by the provision of local deviations and minor detours. Similarly, where crossovers are required it is anticipated that minor short-term impacts would occur when traffic is diverted to the new carriageway.

Impacts on freight movements are expected to minor as the majority of heavy vehicles using the Hume Highway in the study area travel at night (8pm to 1am) and the majority of works would be undertaken outside this period.

Homesteads and farms within the Proposal site have direct access to the highway. During construction there is the potential that while heavy machinery is operating in the vicinity of these access points that access would be temporarily curtailed or suspended. Construction traffic management plans would be developed to address these issues and include provisions to maintain access to all adjacent properties and side roads. Where possible, construction traffic would be separated from highway users by the early clearance of the alignment and the development of construction lanes where this is necessary.

Duplication to create a dual carriageway road would improve safety by reducing accident rates and severity. Overall the Proposal would result in an improved level of service, road safety conditions and freight efficiency for the Hume Highway.

Adverse traffic impacts as a result of the Proposal during both construction and operation are considered to be minor and manageable through the implementation of standard mitigation measures. The improvements to safety and transport efficiencies are expected to provide substantial benefits for highway users. Specific mitigation measures are provided in **Table 9-3**.

Table 9-3 Key traffic management and mitigation principles

Potential impacts	Management and mitigation principles
During Construction	
Delays to motorists	• Develop management measures for the Proposal in accordance with *RTA QA Specification G10 – Traffic Control at Work Sites*. These measures would outline construction vehicle movement arrangements, developed with specific regard to other road works in the region, local traffic movement requirements (stock or machinery) and peak traffic volumes, including long weekends and holiday periods. • Plan construction methods for the project to minimise road closures.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of traffic, the following draft commitments have been developed for the Proposal (see **Table 9-4**). These draft commitments are also presented in full in Chapter 10.

Table 9-4: Draft traffic commitments

Objective	Commitment
Minimise impact on traffic due to construction	Construction vehicle movement arrangements will be developed to minimise impacts on other road users with specific regard to other road works in the region, local traffic movement requirements (stock or machinery) and peak traffic volumes, including long weekends and holiday periods.
	Construction will be planned to minimise disruption to traffic including use of road occupancy licences, variable message signage, static signage and co-ordination between sections as far as feasible through Hume Highway Duplication co-ordination meetings.

9.2 Air quality and greenhouse gases

The principal source of air emissions in the study area is traffic on the Highway although the relatively low average number of vehicles using the route does not have more than a minor effect on local air quality. Existing air quality can therefore be expected to be good, consistent with rural environments generally and well within relevant air quality goals. Road-related emissions are very unlikely to influence air quality parameters such as particulate matter, nitrogen dioxide or carbon dioxide levels. Given that potentially sensitive receivers are set well back from the road, the potential for vehicle emissions to cause impacts on the local community is negligible.

Carbon dioxide is however a major contributor to the greenhouse effect. The machinery used for the construction of the Proposal would lead to the emission of carbon dioxide, which would be offset by the fuel efficiencies that would occur once the Proposal is in operation. In addition, measures to conserve energy would be implemented during construction and operation.

Dust would be generated during construction of the Proposal especially during earthworks. Depositing dust, if present at sufficiently high levels, can reduce the amenity of an area and affect the health of local residents. The total mass of dust generated during the construction of the Proposal would depend on the silt and moisture content of the soil and the type of operation being conducted. Major sources of dust would be bulldozers, scrapers, excavators and wind erosion from exposed surfaces including temporary construction site areas. Any quarrying operations would also contribute to dust emissions, although this is likely to be remote from the site of the road works.

DEC guidelines stipulate that maximum total dust deposited from any source should be no more than 4 grams per square metre per month over a 12-month period (DEC 2001). Typical dust deposition rates in a rural environment such as that adjacent to this section of the Hume Highway would be in the range of 1 to 2 grams per square metre per month. The Proposal should therefore contribute no more than 2 grams per square metre per month. Monitoring would be undertaken to ensure that dust deposition resulting from construction, in combination with other dust sources, does not exceed this criterion.

Vehicle emissions from diesel powered construction equipment would also occur. This source is likely to generate negligible emissions at nearby residential receivers as equipment would be operated intermittently during construction and would be dispersed across a number of construction sites.

Computer modelling of similar projects in rural areas (*Upgrading the Pacific Highway - Bulahdelah* RTA 2004) has shown that all air quality parameters would remain well within air quality goals within the proximity of highway traffic (0 to 50 metres) even with traffic volumes modelled twice as high as those expected on this section of the Hume Highway. Air quality impacts cannot therefore be considered to be a key issue during operation of the Proposal.

Increases in carbon dioxide concentrations in the atmosphere are expected to cause increases in temperature. Individual road projects are unlikely to have a noticeable effect on greenhouse gas emissions. However, a reduction in emissions from the construction of the Proposal could be achieved at minimal cost through the use of renewable energy sources such as bio-fuels and renewable electricity.

Approximately 14 percent of total carbon dioxide emissions in NSW are estimated to come from the transport sector. Emissions of carbon dioxide from motor vehicles are directly proportional to fuel consumption. The proposal would improve the level of service, particularly for heavy vehicles, and would increase transport efficiency, thereby reducing fuel consumption per kilometre travelled.

Air quality impacts as a result of the Proposal during both construction and operation are not considered to be significant and would be manageable through the implementation of standard mitigation measures provided in Table 9-5.

Table 9-5: Key air quality management and mitigation principles

Potential impacts	Management and mitigation principles
During Construction	
Reduction in air quality	• Implement dust emission control measures which may include: watering dry surfaces; covering loads on trucks transporting material to and from site; spray planting cover crop of sterile grasses on long term stockpiles; and removing mud and dirt tracked on to road surfaces. • Monitor and record the effectiveness of measures implemented to control dust emissions. • Rehabilitate disturbed areas as soon as earthworks are complete or where earthworks on disturbed areas are dormant for greater than eight weeks. • Monitor emissions from plant and equipment to determine compliance with Australian Design Rules and manufacturers specifications. • Increase the frequency of dust emission controls such as watering when winds reach a velocity greater than 2.5m per second and modify work practices during high wind events. • Comply with Greenhouse gas emission targets established for the Proposal (50% renewable energy used in site compounds during construction 50% use of bio-fuels in construction vehicles).

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of air quality and greenhouse gases, the draft commitments in **Table 9-6** have been developed for the Proposal. These draft commitments are also presented in full in Chapter 10.

Table 9-6: Draft air quality and greenhouse gases commitments

Objective	Commitment
Minimise generation of dust	Dust would be visually monitored and where necessary the following mitigation measures will be implemented: • Watering of dry exposed surfaces; • Covering loads on trucks transporting material to and from site at all times; • Spray planting cover crop of sterile grasses on long term stockpiles and exposed areas; and • Preventing, and where necessary removing mud and dirt tracked on to road surfaces.
Minimise greenhouse gas emissions	Plant and equipment will be maintained in a proper and efficient condition and operated in a proper and efficient manner.
	Greenhouse gas emission targets for the construction of the Proposal will be in line with government guidelines.
	Hardstand material or rumble grids will be installed at entry and exit points to minimise the tracking of soil and particulates onto pavement surfaces.
	Stockpiles will be established on slopes less than 2:1 (horizontal to

Objective	Commitment
	vertical).
	All stockpiles sites will be designed, established, operated and decommissioned in accordance with *RTA Stockpile Management Procedures 2001*. Stockpiles will be located not less than 100m from the high bank of any rivers or drainage lines.
	Rehabilitation of disturbed areas will be undertaken progressively.

9.3 Noise and vibration

Ambient noise levels have been measured at key locations along the route to provide information on the current noise environment. Although these measurements provide data on the level of the existing traffic noise, the purpose of the survey is to gather data that is used to validate the predictive accuracy of the road traffic noise model and to provide input to the construction noise impact assessment.

The noise criteria for the Proposal are set independently of the measured noise levels, however, the need for noise mitigation has been assessed, based on a combination of the noise criteria and the existing noise conditions along the Proposal route.

Noise monitoring was performed during November 2006, over a nominal one week period. The location details of the noise monitoring equipment are as follows:

1) Location 1 – X

The $L_{A10,(18\ hour)}$ and $L_{Aeq,(15\ hour)}$ and $L_{Aeq,9\ (hour)}$ road traffic noise indices and the L_{Amax} descriptors were calculated on a daily basis for these monitoring locations and are summarised as the median of the combined daily results. The daily noise measurement profile is shown graphically in **Appendix H** and summarised in **Table 9-7**.

Table 9-7 Summary of traffic noise monitoring results(dB(A))

Monitoring Location	$L_{A10\ 18\ hour}$	$L_{Aeq\ 15\ hour}$	$L_{Aeq9\ hour}$	L_{Amax} Day	L_{Amax} Night
Location 1 – X					

Table 9-8 presents the summary data for day evening and night time monitored noise levels. The L_{A90} 10th percentile monitoring data provides the basis for setting noise goals for the construction activity based on the DEC's noise criteria. While the L_{A10} 50th percentile is not used in the setting of noise criteria, the assessment of construction noise levels should recognise influences from the existing environment.

Table 9-8 Unattended noise monitoring results at location 1

Date	Day		Evening		Night	
	L_{A90}#	L_{A10}*	L_{A90}#	L_{A10}*	L_{A90}#	L_{A10}*
Median						

#

*

At Little Billabong the nearest receivers are residential dwellings located on the eastern side of the highway at chainage 92000 approximately 120 metres from the road reserve. However, residential receivers are located intermittently on both sides of the highway all of which are in excess of 120 metres distance. No sensitive land uses exist within the study area.

Noise from construction activity is measured as the single value noise level that is exceeded for 10 percent of the time (L_{A10}). Major construction activity for the duplication is expected to last approximately 18 months, during which time construction noise would vary depending on the particular activity and its location to sensitive receivers along the duplicated section of highway.

The Department of Environment and Conservation (DEC) recommends limiting the free-field $L_{A10\ (15\ minute)}$ noise levels from a construction site (or works) to meet the goals detailed in the DEC Environmental Noise Control Manual (ENCM, 1994), Chapter 171 Construction Site Noise. These noise goals are dependent on the existing background noise levels and the expected duration of the works. The noise goals for any given duration of construction activity are detailed in **Table 9-9**.

Table 9-9: DEC construction criteria guidelines

Criterion No.	Duration of Works	DEC L_A10 Guidelines
1	Construction period of 4 weeks and under	The L_{A10} level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 20 dB(A).
2	Construction period greater than 4 weeks and not exceeding 26 weeks	The L_{A10} level measured over a period of not less than 15 minutes when the construction site is in operation must not exceed the background level by more than 10 dB(A).
3	Construction period greater than 26 weeks	The EPA does not provide noise control guidelines for construction periods greater than 26 weeks duration. However, it is generally accepted that provided L_{A10} noise levels from the construction area do not exceed a level of 5 dB(A) above background, then adverse (intrusive) noise impacts are not likely to be experienced at nearest sensitive receptor locations.

Restrictions are also placed on the hours of construction to ensure that the acoustic amenity of the closest residences is protected. Hours of operation for construction works should follow standard construction times listed below. An allowance for negotiated variations to these times with the DEC would be necessary where construction works would need to take place at times outside these hours for operational, safety and access reasons.

- Monday to Friday: 7am to 6pm.
- Saturday: 8am to 1pm.
- No audible construction work to take place on Sundays or public holidays.

For the construction phase of Hume Highway Duplication, noise sources would be continually moving and are not expected to be located in any one area for more than 26 weeks. Noisiest construction activities are earthworks, drainage and bridging which involve the movement of heavy machinery such as bulldozers and scrapers. Earthworks and construction of major structures such as bridges usually have the longest duration at each location.

Blasting may also be required for excavation of cuttings and should have an appropriate management plan implemented where these works may cause vibratory impacts at a sensitive receiver and/or private or public utility. Vibration levels resulting from blasting would largely depend on the charge used and details such as stemming, depth and type of

detonating cord. Blasting criteria are to be established to maintain the amenity of residents by defining maximum levels of blast overpressure and ground vibration. Careful design can normally maintain blast overpressure and vibration levels to within the relevant criteria.

Impacts of operational noise generated by the Proposal have been assessed using the Environmental Criteria for Road Traffic Noise from the DEC and additional information contained in the RTA *Environmental Noise Management Manual* (ENMM) (RTA 2001).

Road traffic noise goals are taken from the Department of Environmental Conservation (DEC) *Environmental Criteria for Road Traffic Noise* (ECRTN) guideline. The appropriate noise goal identified for the duplication of the Hume Highway from this guideline is for a road redevelopment. The base criteria for this type of road project are recommended as a daytime level of $L_{Aeq\ (15hour)}$ 60 dB (A) and night time level of $L_{Aeq\ (9hour)}$ 55 dB (A). Assessment methodologies and application of these noise criteria to a road project are covered in the RTA *Environmental Noise Management Manual* (ENMM).

Depending on the extent of impact of the current traffic noise environment at a receiver location, the base criteria may be modified for a redeveloped road. These modifying values are known as the allowance criteria. At a location where there is an existing road traffic noise impact, the allowance criteria are used in assessing the appropriate forms of noise mitigation. The ECRTN and the ENMM specify that the allowance for a road redevelopment should be within +2 dB(A) of future noise levels calculated for the existing road use at the equivalent time of project opening.

These results are based on the future traffic scenario for the existing road alignment with projected traffic flows for the year 2009. These values provide the basis for assessing the allowance criterion when compared to the duplicated road design. The design alignment uses the estimated traffic volumes for the year 2019, nominally 10 years after project opening. These results are compared to the ECRTN base criterion and where they exceed these base values, the allowance values are calculated to determine appropriate mitigation requirements for the individual receivers.

The individual receivers for each section were identified using high-resolution aerial photography and the location of these receivers is shown in **Figure 9-1**. These receivers were then individually assessed against the ECRTN criterion for a road redevelopment, night time noise emission, as this is the limiting criterion for the project. The results for each section of road and each receiver are discussed below.

The results in all cases represent the unmitigated noise impacts for a residential dwelling. The RTA would aim to reduce the actual noise impacts of the preferred route to ensure that noise levels at all dwellings comply with the ECRTN criterion through the use of appropriate noise mitigation measures.

The predicted noise levels for each receiver in Little Billabong are shown in **Table 9-10**.

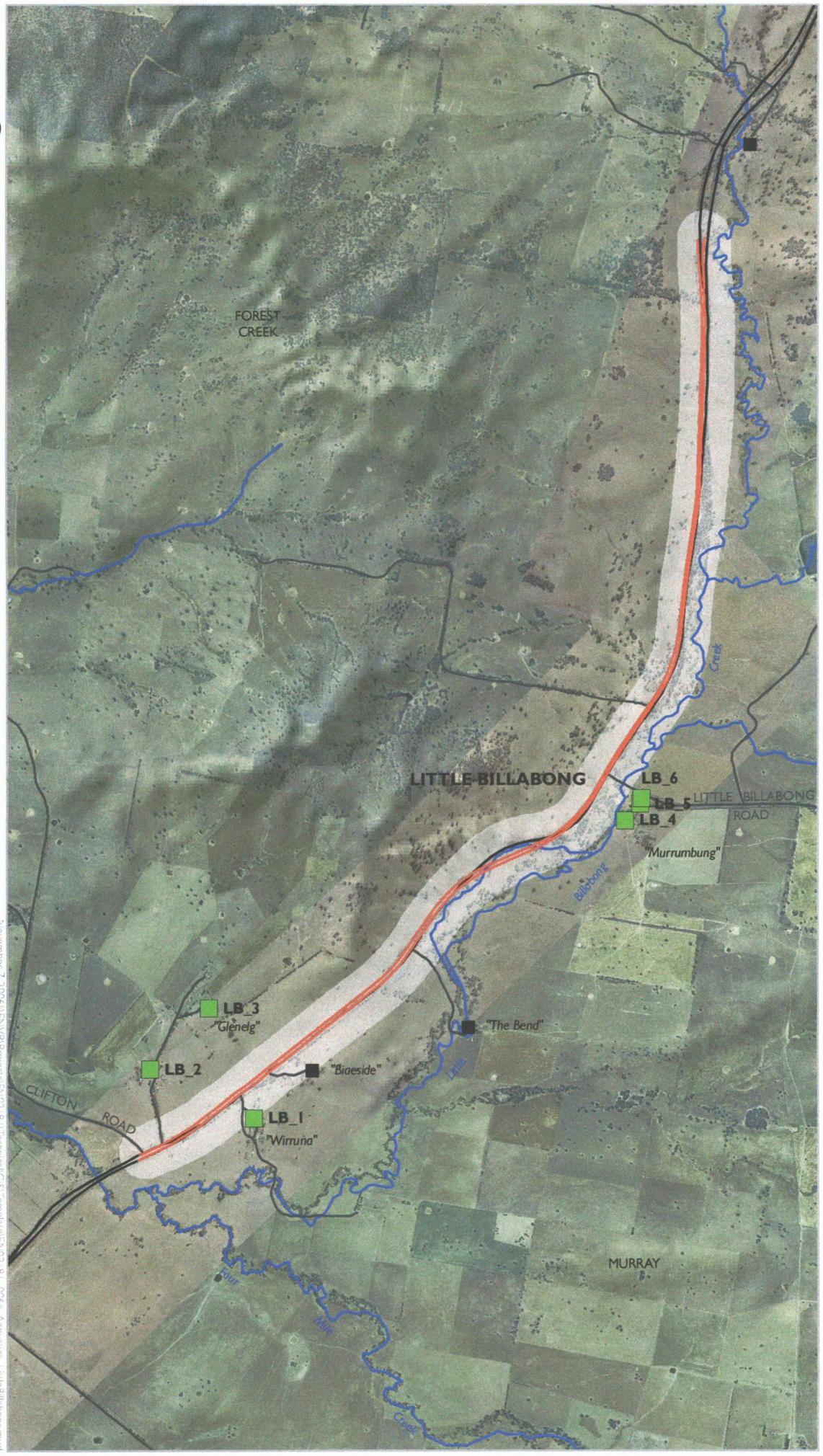

Figure 9-1 **Noise receivers**

Table 9-10: Predicted noise impacts at Little Billabong receiver locations

Designation	Predicted $L_{A}eq$ Noise Levels 2019		Predicted $L_{A}eq$ Noise Levels 2009		Noise goals	
	Day (15 hour)	Night (9hour)	Day (15 hour)	Night (9hour)	Day (15 hour)	Night (9hour)
LB_1	53	53	52	52	60	55
LB_2	46	46	46	45	60	55
LB_3	47	47	47	46	60	55
LB_4	54	53	52	52	60	55
LB_5	53	53	51	51	60	55
LB_6	53	53	51	51	60	55

In all instances, the receivers in Section 3 are predicted to be below the ECRTN base criterion for night time noise impacts for the year 2019 traffic scenario. No further consideration of mitigation is required for these receivers for the modelled road design alignment. If, however, changes to the design alignment are made in future, a re-assessment of these receivers may be necessary. **Table 9-11** below provides a summary of the noise and vibration mitigation measures.

Table 9-11: Key noise mitigation and management principles

Potential impacts	Mitigation measures and management responses
Pre Construction	
	• Undertake building condition surveys on buildings and structures within the potential radius of effect prior to commencement of rockbreaking and pile-driving activities. • Develop a Noise, Vibration and Blast Management Plan and Community Consultation Program as supplementary plans of the Construction Environmental Management Plan.
During Construction	
	• Adopt best management practices consistent with the RTA's Environmental Noise Management Manual (ENMM, 2001). • Restrict construction activities to normal construction hours wherever necessary — that is, 7.00 am to 6.00 pm, Monday to Friday; 8.00 am to 1.00 pm, Saturdays (7.00 am if inaudible at residences); and no work on Sunday or public holidays. Work outside these hours would require consultation with the Department of Environment and Conservation and the local community. • Undertake community consultation before commencing construction activities outside normal hours, and advise Department of Environment and Conservation, in accordance with the RTA's Environmental Noise Management Manual Practice Note vii — Roadworks Undertaken Outside of Normal Working Hours. • Implement controls on construction equipment and activities in accordance with Australian Standards and RTA specifications. Regularly inspect, test and maintain all stationary and mobile plant equipment to ensure that emission levels do not deteriorate over the life of the project. • Notify residents prior to noisy or vibration generating activities.

	• Provide residents with a contact name and number should any complaints or questions wish to be raised.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of noise impacts, the following draft commitments have been developed for the Proposal (see **Table 9-12**). These draft commitments are also presented in full in Chapter 10.

Table 9-12: Key noise and vibration management and mitigation principles

Objective	Commitment
Establish baseline conditions prior to start of construction.	As necessary, condition surveys will be undertaken on buildings and structures within the potential area of vibration impact prior to commencement of rock-breaking and blasting activities.
Minimise the impact of construction noise and vibration on surrounding residents and where necessary, comply with all relevant standards to reduce noise and vibration to an acceptable level	Construction activities will be restricted to construction hours for the Proposal. The hours will be 7.00am to 7.00pm Monday to Friday; 7.00am to 4.00pm Saturdays and no work on Sunday or public holidays.
	Consultation with affected residences will be carried out before commencing construction activities outside the construction hours for the Proposal.
	All plant and equipment will be well maintained and fitted with adequately maintained silencers which meet the vehicle design specifications.
	Prior consultation and notification will be undertaken with nearby residences that may be affected by noise or vibration generating activities.
Minimise the operational noise impact on nearby residences	A reasonable and feasible approach will be adopted to minimise operational noise impacts. This will be developed further during detailed design and in consultation with relevant property owners.

9.4 Visual

The Proposal has been designed to minimise the contrast between the local topography and the road by aligning the formation as much as possible with landscape contours. Duplication mostly parallel and adjacent to the existing highway also reduces visual impacts by limiting the proposal to a single, existing road corridor. Key landscape design objectives include, but are not limited to:

- Providing a flowing highway alignment that is responsive to, and best fits with, the landscape.
- Providing an enjoyable and memorable motoring experience which engages with the landscape of southwest NSW, and makes best use of views and vistas.
- Providing a well-vegetated road corridor that is cognisant of the natural systems and ecology of the corridor.

The visual environment of the study area typically comprises the existing highway infrastructure, occasional farm buildings and residential homesteads, cleared hill slopes, meandering creek lines and pockets of remnant and planted woodlands. The dominant visual features along the alignment include the prominent hill formations situated at the north western end of the study area, the large rock cutting opposite Little Billabong Road, forming the western edge of the highway at this location. In addition, the stands of vegetation on adjoining lands and within the road reserve corridor are a very noticeable aspect of the environment when travelling through the study area.

Other visual aspects specific to Little Billabong include the alluvial floodplain areas associated with Little Billabong Creek and the associated ribbons of riparian vegetation.

Residential properties that have clear lines of site to the Proposal site are located on the eastern side of the highway at chainage 88900, 91900, 92400 and on the eastern side at chainage 93000 near to the southern most extremity of the proposed alignment. Views of the Proposal from these properties are obscured by vegetation at most locations. Locations where the current highway would be most visible are between chainage 91200 and 92200. The dwellings located west of the highway are situated in such a way that local topography and vegetation removal would offer views to the new highway formation.

During construction, the works would be visible from both the highway and a number of properties within the study area. A particularly noticeable aspect of the Proposal would be the extension of the existing large cutting at chainage 92200, opposite Little Billabong Road. At this location this cutting would be extended back into a series of benches with a large amount of fresh rock being exposed and vegetation removed from the batter slope. The homestead situated east of the highway at this location would be the primary viewer to this area, with a direct line of sight west to the Proposal.

For road users a mixture of deep and shallow cuts, a series of fill embankments and generally cleared exposed corridors would be visible along the length of the construction area. The visual affects of vegetation clearing for adjacent landowners and motorists would be more noticeable at the southern end of the Proposal corridor. This would be attributable to the need to clear a substantial amount of the existing dense linear corridor vegetation at this location.

There would be some short-term loss of amenity during the construction activity. This would be minimised as much as possible through the progressive rehabilitation of cuttings, embankments and median areas throughout the construction period.

The proposed highway infrastructure would not contrast to any great extent with the existing visual environment at the Proposal site and in surrounding areas. The road alignment would be generally within the existing alignment of the road corridor and thus the overall visual impacts are not likely to be high. The majority of the new highway alignment would be at a similar elevation to the surrounding ground level, and would not be constructed upon high embankments or require deep cuttings. The works are intended to 'tie-in' with the already duplicated sections of the highway at either end, and in this respect the Proposal would introduce an element of continuity of the visual environment and realise the urban and landscape design vision for the transport corridor.

However, for some properties located close to the current highway alignment boundary the changes would be more noticeable as the works would be situated in the immediate foreground. This is likely to be more pronounced at the Little Billabong intersection, in the middle section of the Proposal, where substantial cut and fill works are required. This would include a major cut into an existing hill slope and the construction of fill embankments to cross the floodplain areas adjacent to the present highway. These works would result in more substantial changes to the local landscape.

The proposed cutting and embankments works required at this location are in relatively close proximity (around 300 metres) to one occupied residential property, which would likely to be able to view the Proposal. The residents may be aware of the construction activities and operational aspects of the Proposal. The visual impact of this infrastructure

would be moderate to high on this property, however this would be reduced through the implementation of mitigation measures.

The changes would also be evident to the motorists using the highway however none of these changes are likely to interrupt views or vistas of the surrounding areas. The landscape treatment would be sympathetic to the existing environment and this would assist in reducing the visual bulk of the embankments. Not withstanding, it is noted that these cuttings and embankments would be prominent features within the context of the local area.

It should be noted that on the whole few interruptions to views of the surrounding areas would occur as a result of the proposal, as viewed from the highway or from residential properties. Existing mature vegetation would be retained wherever possible. Landscape treatments to be incorporated in the design would be mindful of the retention of existing view corridors. The use of pasture grasses and low shrubs in the low lying areas would reflect the surrounding floodplain landscapes and maintain the existing landscape character.

Table 9-13: Key visual management and mitigation principles

Potential impacts	Management and mitigation principles
During construction	
Reduction in visual quality of the roadside environment	• Minimise the width of disturbance required on fill embankments where construction requires the removal of native vegetation. • Stabilise all disturbed areas with native local species reflecting natural vegetation patterns. • Include native tree species in the plant mix in areas where guard rails are present. • Include planting on both sides of new perimeter fences. • Use dark coloured transparent fence material. • Where planting is proposed on steep embankments, stabilise the area with erosion-control matting and a mulch topping to improve final appearance.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of visual impacts, the following draft commitments have been developed for the Proposal (see **Table 9-14**). These draft commitments are also presented in full in Chapter 10.

Table 9-14: Draft visual commitments

Objective	Commitment
Minimise visual impact and continue existing landscape and vegetation types	Disturbed areas will be progressively revegetated using plant species of local provenance selected in consultation with a qualified landscape officer.
	The landscaping plans for the Proposal will consider the retention of existing views and vistas from the highway having regard to road user safety requirements.
	Cuttings and embankments will be graded out wherever feasible to reflect and best fit the characteristics of the local landform.

9.5 Waste

Waste management in NSW is regulated by a number of acts, including the *Protection of the Environment Operations Act 1997* and the *Waste Avoidance and Resource Recovery Act 2001*. The latter Act establishes a waste hierarchy (avoid, recover and dispose) that encourages the efficient use of resources, avoids environmental harm and provides for the continual reduction in waste generation. The DEC is the lead agency in NSW on waste management and has established an implementation framework in the *Waste Avoidance and Resource Recovery Strategy 2003*'. The Waste Strategy 2003 provides guidance to industries, communities and groups on waste management priorities for action. The NSW Government *Waste Reduction and Purchasing Policy* (WRAPP) requires agencies to implement the waste hierarchy and to maximise the recycled content of material purchases.

During construction, the following activities would contribute to the on site generation of waste:

- Earthworks.
- Drainage works.
- Clearing and grubbing.
- Restoration works on existing pavement.
- Equipment maintenance.
- Site office activities.

The key waste streams to be generated by the above activities would include:

- Concrete.
- Scrap metal.
- Green waste.
- Sewage from compound site.
- Excavated soil.
- Reclaimed asphalt.
- General construction waste.
- Fuels, oils, liquids and chemicals.
- Contaminated/unsuitable rock/soils.
- Paper and cardboard.

Where possible, material from extractive works would be reused for construction of fill embankments or for select or sub-base components of the formation. Green waste would be used for erosion and sedimentation control, provision of habitat, or mulched and incorporated in landscaping works. All other waste streams that cannot be utilised within the Proposal would be removed and disposed of in accordance with the *Protection of the Environment Operations Act 1997*.

Initially, there would no waste streams derived from the operation of the Proposal. Pavements have been designed for a 40 year design life so that it would be unlikely that during this time that anything more than minor routine maintenance would be necessary. Routine maintenance may include rotomilling and replacement of asphalt pavements on the existing carriageway in which case waste material would be taken off site or incorporated into road shoulders.

The management of waste is not considered a key issue given that sufficient measures remain in place to address the disposal and reuse of waste material in order to minimise potential impacts. Standard mitigation measures are listed in **Table 9-15**.

Table 9-15: Key waste management and mitigation principles

Potential impacts	Management and mitigation principles
During construction	
Production of waste Failure to comply with the requirements of the relevant legislation.	• Identify strategies to 'reduce, reuse and recycle'; Reuse of material on-site would have priority over recycling. Where recycling is more feasible, carry out recycling in accordance with the NSW Government's *Waste Avoidance and Resource Recovery Strategy 2003*, and the *Waste Reduction and Purchasing Policy*. • Transport excavated material not suitable for on-site reuse or recycling, to a site that may legally accept that material for reuse or disposal. • Ensure that wastes are classified and managed in accordance with the *Protection of the Environment Operations Act 1997*, and other Acts where applicable. • Source materials to avoid the creation of excess waste. • Develop strategies to appropriately manage contaminated material if encountered. • Chip leaf material and small branches of native vegetation to use as mulch in revegetation works.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of waste, the following draft commitments have been developed for the Proposal (see **Table 9-16**). These draft commitments are also presented in full in Chapter 10.

Table 9-16: Draft waste commitments

Objective	Commitment
Reduce creation of waste and maximise re-use and recycling.	Reuse and recycling and avoidance strategies in accordance with the *NSW Government's Waste Avoidance and Resource Recovery Strategy 2006* will be adopted..
Ensure waste generated is managed appropriately	Waste materials will be classified and managed in accordance with *DEC Environmental Guidelines: Assessment and Classification & Management of Liquid and Non-liquid Wastes.*

9.6 Geology, soils and water

The highway corridor traverses low hills, valleys and alluvial plains typical of the western slopes of the Great Dividing Range. The existing highway has been generally located on lower footslopes but in places crosses short sections of floodplain.

The predominant bedrock unit within the study area is composed of metamorphic and meta-sedimentary rocks such as slate, phyllite, metasandstone and metasiltstone. The rocks are of late Ordovician age, but have since been extensively deformed, regionally metamorphosed and intruded by granitic rocks.

Three typical soil types are evident throughout the area:

- Colluvial soils of the lower gradient footslopes – These soils are stony clays and due to their topographic situation can have a tendency to become waterlogged and salinised in places.
- Residual soils of the upper slopes, hill crests and saddles - These are similar to the colluvial soils and tend to act as intake areas for shallow groundwater, which may cause waterlogging further downslope.
- Alluvial soils of the main floodplains – These are surface soils comprised predominantly of silts and clays, with some sand, and are prone to flooding, waterlogging and shrink-swell behaviour.

Little Billabong Creek is a major tributary of Billabong Creek, which in turn flows into the Murray River. Within the study area Little Billabong Creek flows parallel to the existing highway along the eastern side. Areas to the west of the highway within the study area drain into Little Billabong creek via a total of 23 culverts.

Incised channels, eroding banks, declining water quality, degraded riparian zones and changing hydrology are common characteristics of streams within the region (Landcare Australia 2006). The creeks in the study area are currently under hydrological stress due to recent drought conditions and extraction for the purposes of stock watering, domestic uses and irrigation.

The bedrock environment is robust and would not be expected to be impacted as a result of the proposal. Localised instability is possible in rock cutting batters, particularly in the area of major cutting located near the Little Billabong Road intersection. These cuttings would be constructed using supporting measures that include rock bolting or mesh where considered appropriate.

The soils at lower elevations within the study area are the result of both colluvial and alluvial processes with residual soils similar to colluvial soils located on upper slopes and saddles. The main impact of construction activities on these soils would be related to soil erosion. Clearing of protective vegetation during the construction phase will result in increased susceptibility of underlying unconsolidated soils to both wind and water erosion. The alluvial silts and fine sand soils on the floodplain areas will be particularly erodible. Mitigation measures including the installation of erosion and sedimentation controls, dampening exposed surfaces and progressive and early revegetation strategies would be implemented.

An additional effect of road construction on the soils in the Little Billabong area is expected to be localised waterlogging. This would occur where road embankments, which are laid on stripped and compacted soil sub-grades, act as subsurface dams blocking downslope movement of shallow groundwater (that is, through flow moving along the A/B soil profile interface).

During construction the Proposal would have the potential to reduce water quality downstream through the discharge of sediment laden stormwater. The removal vegetation, earthworks and installation of drainage infrastructure would make underlying unconsolidated soils susceptible to both wind and water erosion. Potential impacts on water quality are also likely from substances such as oils carried from the road surface into adjacent streams. Measures including retention of vegetation where possible, progressive replanting of disturbed areas, sedimentation fencing and other appropriate control devises would be implemented as part of the Proposal to reduce the risk of dirty water discharges.

The Proposal would result in an increase in impervious surfaces from the duplication of the highway and the concentration of runoff. Higher flow volumes and velocities have the potential to result in changes to in-stream morphology of the waterways. Although the volume of surface water runoff from the highway would approximately double, the increase in impervious area as a proportion of the local catchments along the route (less than 0.2% of total catchment area) and actual increase in flows is likely to be negligible and is unlikely to result in a measurable increase in peak flows downstream of the Proposal. Impacts on stream morphology are therefore expected to be minimal. Localised impacts can be managed through design measures such as scour protection and the design of culverts to minimise water velocities.

During operation, potential impacts on water quality are also likely from substances such as oils carried from the road surface into adjacent streams. The new highway section may facilitate the build up of pollutants during dry weather, from where they can disperse and be carried downstream to local waterways during rainfall events. Pavement runoff includes road derived pollutants such as oils, rubber, sediment and metals which may contaminate the adjoining catchment. However, no additional traffic is anticipated on the highway as a result of the Proposal beyond long-term traffic growth attributable to population increases in metropolitan centres. Therefore, existing pollutant load could be expected to continue in the short-term. Dish drains coupled with piped drains would collect surface water from the road pavement within areas of cutting. Pavement runoff from fill embankments would be directed over the road shoulder to be collected by grassed table drains running parallel to the road.

As a dedicated dangerous goods route, accidental spillages from crashes or malfunctioning equipment travelling along the Hume Highway has the potential to occur and pollute land adjacent to and water downstream of the Proposal. However, improvements in carriageway alignment, improved motor vehicle efficiency and reduction in collision potential, would serve to reduce the likelihood and severity of incidents and associated accidental spillages.

Management measures would be developed in accordance with *Landcom Managing Urban Stormwater: Soils and Construction (4th edition) 2004* and in consultation with a RTA Soil Conservation Panel consultant for the construction phase of the proposal, and would include but not be limited to the measures outlined in **Table 9-17**.

Table 9-17: Key soil and water management and mitigation principles

Potential impacts	Management and mitigation principles
During construction	
Pollution of waterways /reduction in water quality/degradation of land	• Retain grass/shrub cover on the soil surface in the vicinity of drainage lines to minimise erosion and sedimentation impacts when clearing. • Install sediment basins in the early stages of construction and divert as much dirty runoff to these basins as possible. Turbid runoff would be treated on-site with flocculants or other suitable measures to an acceptable quality for subsequent release. • Divert clean runoff around the site by installing diversion drains at the upstream limits of construction areas. • Maintain and check the erosion and sedimentation controls on a regular basis with records kept and available on request. • Clear sediment from behind barriers on a regular basis and manage all controls to work effectively at all times. • Install scour protection in creek/river banks areas at risk of

	erosion. • Install culverts as early as possible in the construction process to ensure that transverse drainage is in place during early stages of construction. Permanent stream protection measures and other waterway structures would also be completed as quickly as possible. • Include hardstand material or rumble grids at entry and exit points to minimise the tracking of soil and particulates onto pavement surfaces. • Establish stockpiles on slopes less than 2:1 (horizontal to vertical). • Design, establish, operate and decommission all stockpiles in accordance with RTA *Stockpile Management Procedures 2001*. Locate stockpiles not less than 100m from the high bank of any rivers or drainage lines. • Undertake site rehabilitation of disturbed areas progressively as stages are completed. • Grade out cuttings and embankments, wherever practicable, to reflect the characteristics of the local natural landform, returning the land to its former use wherever possible.
During operation	
Pollution of waterways /reduction in water quality/degradation of land	• Convert construction sediment basins to permanent water quality control ponds at conclusion of works where the designed stormwater treatment train includes operational stormwater retention basins. • Provide spill containment would be based on detailed risk assessment. Where conversion of construction sedimentation basins to spill containment basins would be considered necessary, basins would incorporate an inverted low flow pipe and anti seep collars to provide effective spill containment.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of soil and water, the following draft commitments have been developed for the Proposal (see **Table 9-18**). These draft commitments are also presented in full in Chapter 10.

Table 9-18: Draft soil and water commitments

Objective	Commitment
Minimise scour impacts	Scour protection will be installed in creek/river bank areas at risk of erosion as necessary.
	Culverts will be installed as early as possible in the construction program to ensure that transverse drainage is in place during early stages of construction. Permanent stream protection measures and other waterway structure requirements will also be established as early as possible.
Minimise the risk of water contamination and pollution of local watercourses	Any construction materials and fuels stored or used on site will be managed to minimise the risk of water contamination.
	Operational stormwater controls will be implemented to meet identified receiving water objectives. These may include dispersed stormwater treatment through grassed swales, constructed treatment measures such as operational stormwater retention basins and the use

Objective	Commitment
	of gross pollutant traps.
	The requirement for spill containment will be made on the basis of a site specific assessment which considers: • The sensitivity of the receiving environment. • The likelihood of an accident occurring that would result in a spill. • The proximity of the discharge point to the receiving waters. • The condition of the receiving waters.
Minimise disturbance to landform, geology and soils and prevent erosion and sedimentation	A soil conservationist will be engaged to provide advice on management of soils through detailed planning and construction.
	Erosion and sedimentation controls will be installed, maintained and managed prior to and during construction. The principles in *Managing Urban Stormwater - Soils and Construction, Volume 2 - Book 4 - Main Road Construction* will apply.
	Sediment will be cleared from behind barriers on a regular basis and controls will be monitored and maintained to ensure they work effectively at all times.
	Hardstand material or rumble grids will be installed at entry and exit points to minimise the tracking of soil and particulates onto pavement surfaces.
	Stockpiles will be established on slopes less than 2:1 (horizontal to vertical).
	All stockpiles sites will be designed, established, operated and decommissioned in accordance with *RTA Stockpile Management Procedures 2001*. Stockpiles will be located not less than 100m from the high bank of any rivers or drainage lines.
	Disturbed areas will be progressively rehabiliated.

9.7 Contaminated Land

A search of the DEC contaminated sites register undertaken for the Greater Hume Shire local government area revealed no listed contaminated sites within or adjacent to the study area. Notwithstanding:

- Contamination may not have been regulated by the DEC under the *Contaminated Land Management Act 1997* or the *Environmentally Hazardous Chemicals Act 1985*.
- The DEC may currently be regulating contamination at the site through a licence or notice under the *Protection of the Environment Operations Act 1997*.

The risk and potential negative impacts associated with the disturbance of contaminated soils (and possibly groundwater) would be minimised through contamination investigation, preparation of Remediation Action Plans, appropriate onsite management of contaminated soils, remediation or removal of contaminated soils and validation of excavated areas as required. Any remediation undertaken would be a positive impact as appropriate remediation of the site during construction would prevent contaminant migration and potential problems in the future.

Management measures to deal with potential impacts with contaminated lands would be implemented as outlined in **Table 9-19**.

Table 9-19: Key contaminated land management and mitigation principles

Potential impacts	Management and mitigation principles
Pre Construction	
Soil contamination risk	• Undertake a preliminary assessment of potential contaminated sites that may be impacted by the Proposal. • Undertake contamination investigation, appropriate onsite management of contaminated soils, remediation or removal of contaminated soils and validation of excavated areas, as required.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of contaminated land, the following draft commitments have been developed for the Proposal (see **Table 9-20**). These draft commitments are also presented in full in Chapter 10.

Table 9-20: Draft contaminated land commitments

Objective	Commitment
Identification and investigation of potentially contaminated sites	A review will be undertaken of all land impacted by the Proposal to identify potentially contaminated sites. Potentially contaminated sites will be further investigated in accordance with the *RTA's Contaminated Land Management Guideline.*
Management of previously unidentified contamination	If site contamination investigations indicate that contaminants are present on the site in concentrations above the intended land use criteria, then an appropriate risk based management plan approach would be developed in accordance with the *RTA's Contaminated Land Management Guideline.* Where contamination is found to pose unacceptable risk to either the environment or human health receptors a remedial action plan will be developed and remediation works will be undertaken.

9.8 Land use and social

The Hume Highway is a route of strategic national importance. It is the main road transport corridor linking Sydney and Melbourne and serves intrastate and interstate users. Approximately 20 million tonnes of freight each year is transported within the corridor (RTA, 2006).

The existing highway alignment passes adjacent to a small number of land parcels with one large parcel to the east occupying the majority of the land in the study area. Predominant land uses in these areas include a mixture of rural dwellings and extensive rural landholdings. Agriculture, in particular grazing, is the main land use in the study area. Cattle and sheep grazing are the primary rural activities in the area with much of the surrounding landscape cleared for this purpose. The production and harvesting of fodder crops such as lucerne and oats, while second to grazing activities, are common throughout the region.

Up to six residential dwellings are located within the study area although at least one of the dwellings is presently uninhabitable. Currently occupied buildings in the study area include "Murrumbug", "Braeside", "Glenelg" and "Wirruna". A community hall, tennis court and telephone exchange are located at the Little Billabong Road intersection. However, these structures are rudimentary and appear to be seldom used.

During construction the Proposal would have a negative impact on regional and interstate commercial operators and nearby local residents utilising the highway to travel north and south through the Proposal corridor. Impacts would relate to traffic delays along the alignment where works would be conducted to provide crossovers and connections to the existing formation. During these phases of construction speed limitations, diversions and measures to separate construction traffic would be implemented to maintain safety for road users and construction personnel alike.

There would be short-term impacts on the general amenity of the study area during construction due to an increase in noise, dust nuisance and general deterioration of the visual quality of the environment. These amenity impacts would be minimised through management of noise and dust emissions and maintaining tidy and well managed site compound areas. Landscaping of the roadside areas would mitigate visual amenity impacts during the construction phase.

During operation, the Proposal would provide positive social and economic benefits both locally and within a regional context. Road users would benefit from increased traffic efficiency and travel time savings attributable to improvements in both vertical and horizontal alignment, and increased passing opportunities.

Negligible impacts on land use would occur as a result of the Proposal either during construction or operation due to the relatively small land acquisition requirements within the context of the larger land parcels affected.

Impacts on land use and social factors as a result of the Proposal during either construction or operation are considered to be minor in this context and would be manageable through the implementation of standard mitigation measures provided in **Table 9-21**.

Table 9-21: Key land use and social management and mitigation principles

Potential impacts	Management and mitigation principles
Pre construction	
Delays attributed to land acquisition	• Negotiate all property acquisitions in accordance with RTA *Land Acquisition Policy*, and undertake compensation in accordance with the *Land Acquisition (Just Terms Compensation) Act, 1991*. Resolve property acquisitions and/or leasing arrangements between the RTA and property owners prior to commencement of works as appropriate.
During Construction	
Disruption of property access points	• Avoid blocking existing access to properties wherever possible. Where not possible, provide suitable temporary access. • Establish contact point for affected property owners to obtain information about the works programs and advise the RTA/construction contractor of matters relevant to their property. • Provide advance notification to property owners on construction programmes and access arrangements. • Incorporate property access arrangements in Construction Traffic Management Plans.

During operation	
Final landform may affect existing access due to changes in levels	• Regrade existing access ways. Where not practicable, provide suitable alternative access, the location of which will be determined in consultation with the landowner.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of land use and social impacts, the following draft commitments have been developed for the Proposal (see **Table 9-22**). These draft commitments are also presented in full in Chapter 10.

Table 9-22: Draft land use and social commitments

Objective	Commitment
Minimise property impacts to adjacent landholders	All property acquisitions will be negotiated in accordance with *RTA Land Acquisition Policy*, and compensation provided in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.
Minimise impacts to property access following construction	Negotiations for property acquisition will include consultation on property adjustments where required to maintain farm management practices.
Minimise impact to local and regional roads from construction traffic impacts	Dilapidation surveys of regional and local roads used by construction traffic will be undertaken. The RTA will be responsible for any necessary repair of deterioration attributable to the impacts of construction traffic.
Minimise the social and economic impact of the construction works on the local community	Property access will be maintained for the duration of construction with any temporary access requirements provided in consultation with adjacent landowners where necessary.
	Advance notification will be given to property owners on project schedules, construction works and access arrangements.

9.9 Hazards and risks

The Proposal would give rise to a number of hazards and risks during both construction and operation.

During construction, in the absence of appropriate environmental management measures, there is the potential for receiving water bodies, land and dependent ecosystems to be adversely affected by the Proposal. The receiving environment may be affected by:

- dangerous and hazardous goods (explosives, fuels, lubricants, oils, cement, paints, solvents and other additives);
- construction and building waste;
- maintenance of plant and equipment;
- increased sedimentation and turbidity of waterways; and
- spread of noxious weeds.

The implementation of appropriate mitigation measures for erosion, sedimentation and pollution control would minimise the risk to the receiving environment.

The use of dangerous goods may have occupational health and safety implications for workers and transient members of the public. However, none of the materials or goods used during the construction process, with the exception of explosives (if required), would have the potential to affect members of the public directly. The implementation of Australian Standards for the storage and handling of dangerous goods would reduce the potential for adverse affects on the workforce or members of the public.

Crashes or incidents involving members of the public moving through and adjacent to work sites would have the potential to occur during construction. Standard measures including the implementation of traffic management strategies to divert traffic away from work areas, separate construction vehicles and plant from the road network, and to slow traffic through and adjacent to the work site would reduce the risks to members of the public.

During operation there is the potential for contaminants arising from normal operation of the highway (tyre and brake wear, engine oil leaks, litter) or chemicals from accidental spillages to adversely affect the quality of the local environment. The main route for these contaminants to the environment is via water flows from pavement surfaces. The installation of appropriate sedimentation controls would reduce the risk to the environment.

Risks to members of the public during operation would relate to incidents involving the release of dangerous goods. The Hume Highway is a designated dangerous goods route. Crashes involving vehicles transporting chemicals and other dangerous goods would generally affect only a small area with hazards relating to toxic effects, fire and explosions. The Proposal is located within a sparsely populated area and any incidents would have limited potential to affect those not directly involved in a crash or incident. In the event of an incident involving dangerous goods, emergency services equipped to deal with chemical spillages are located at Holbrook and it would be anticipated that response times would be low.

The Proposal has been designed to meet relevant design guidelines for highways and would contribute to an overall improvement in driving conditions. The Proposal would reduce the likelihood of hazardous goods incidents and serious head-on collisions through separation of north and southbound traffic.

The Proposal would have the potential to create a number of hazards and risks during both construction and operation. However, the identified hazards and risks would be normal for a highway and are manageable through the implementation of standard mitigation measures provided in **Table 9-23**.

Table 9-23: Key hazard and risk management and mitigation principles

Potential impacts	Management and mitigation principles
During Construction	
Risk to human life and degradation of the natural environment	• Develop and implement procedures to achieve compliance with all legislative and industry standard requirements for the safe handling and storage of hazardous substances and dangerous goods. • Bund storage areas for oils and other hazardous liquids in accordance with Australian Standards and collect any spillages for off-site disposal at a licensed facility.

	• Conduct activities with the potential for spillage such as refuelling, maintenance of equipment, mixing of cutting oil and bitumen in bunded areas away from watercourses. • Undertake potentially hazardous and contaminating activities (such as washing construction plant, refuelling plant and handling hazardous chemicals) only at appropriate locations that have adequate environmental protection measures.

Following consideration of the mitigation and management principles outlined above, and the general issues relating to the management of hazards and risks, the following draft commitments have been developed for the Proposal (see **Table 9-24**). These draft commitments are also presented in full in Chapter 10.

Table 9-24: Draft hazards and risks commitments

Objective	Commitment
Minimise the risk of an incident during construction	Bunded storage areas will be located away from watercourses and will be established for oils and other hazardous liquids in accordance with Australian Standards. Spillages will be contained and collected for appropriate disposal.
	Activities with the potential for spillage such as refuelling, maintenance of equipment, mixing of cutting oil and bitumen will be conducted in bunded areas to prevent discharge into watercourses.
	Potentially hazardous and contaminating activities (such as washing construction plant, concrete mixers, bitumen surfacing equipment and handling hazardous chemicals) will be conducted in bunded areas away from watercourses.

10 Draft statement of commitments

10.1 Overview

Chapters 8 and 9 of the Environmental Assessment have identified key principles for the environmental management of the potential impacts associated with the Proposal. Chapter 10 presents many of these principles as draft commitments that the RTA will undertake as part of the construction and operation of the Proposal. The draft commitments may be revised in response to stakeholder and community input during the display of the Environmental Assessment. Following approval of the Proposal, the revised commitments would guide subsequent phases of the proposal development to minimise impacts on the environment. Any consortium or contractor involved in the future planning approvals, design, construction and/or operation phases of the Hume Highway Duplication would be required to undertake all works in accordance with these commitments.

10.2 Draft commitments

The draft Statement of Commitments, including commitments relating to key issues assessed in Chapter 8 and other issues assessed in Chapter 9 is provided in **Table 10-1**. The statement of commitments includes:

- An objective.
- Details of the commitment.
- Reference to the timing of when the commitment applies (pre-construction, construction and post construction).
- Reference to any guiding principle influencing the objective and implementation of the commitment.

Table 10-1: Draft Statement of Commitments

Objective	Ref #	Commitment	Timing	Guiding principle
General				
Ensure the adequacy and compliance of environmental management measures.	GE1	Dedicated environmental personnel will be appointed to monitor the performance of the environmental management measures of the Proposal.	Pre-Construction and Construction	
Consultation				
Ensure effective and receptive consultation with the community is undertaken.	C1	Newsletters and media coverage will be used regularly to cover the proposed works schedule, areas in which these works are proposed and the construction hours. The newsletters and media coverage will provide contact names and phone numbers of relevant staff.	Pre-Construction and Construction	RTA Community Involvement Practice Notes and Resource Manual (RTA 1998)
	C2	An internet site which contains periodic updates of work progress, consultation activities and planned work schedules will be established and maintained regularly. The internet site will provide contact names and phone numbers of relevant staff.	Pre-Construction and Construction	RTA Community Involvement Practice Notes and Resource Manual (RTA 1998)
Ensure effective management of complaints	C3	A 24 hour toll-free complaints contact telephone number will be established for the Proposal.	Pre-Construction	RTA Community Involvement Practice Notes and Resource Manual (RTA 1998) AS 4269 Complaints Handling
	C4	A system to receive, record, track and respond to complaints within a specified timeframe will be established.	Pre-Construction and Construction	RTA Community Involvement Practice Notes and Resource Manual (RTA 1998) AS 4269 Complaints Handling
Biodiversity				
Minimise native vegetation disturbance	B1	The limits of clearing will be clearly marked with temporary fencing installed prior to clearing.	Construction	RTA QA Specification G40 Clearing and Grubbing

Objective	Ref #	Commitment	Timing	Guiding principle
	B2	Equipment storage areas and stockpile areas will be located in existing cleared or degraded locations.	Construction	RTA Stockpile Management Procedures 2001
Minimise weed establishment	B3	Soil containing weeds will be stockpiled away from watercourses and native vegetation.	Construction	RTA QA Specification R178 Vegetation
	B4	Noxious weeds in areas disturbed by construction activities will be managed for a minimum of two years post construction completion.	Construction and Post-Construction	RTA QA Specification G40 Clearing and Grubbing
Offset impacts to Box Gum Woodland	B5	An offset strategy for Box Gum Woodland will be developed in consultation with relevant agencies.	Pre-Construction and Construction	DEC Restoration and Rehabilitation Guidelines
	B6	Disturbed areas will be progressively revegetated using Box Gum Woodland plant species of local provenance.	Construction	
	B7	Box Gum Woodland retained in the road corridor will be enhanced by supplementary plantings.	Construction and Post-Construction	RTA QA Specification R178 Vegetation
Minimise impacts on hollow dependent fauna species	B8	Hollow bearing trees will be checked by an ecologist for nesting fauna species prior to clearing. Fauna found nesting will be relocated to suitable adjacent habitat.	Construction	
	B9	Stands containing hollow bearing trees will be cleared using a two stage clearing process with adjacent non-hollow bearing trees to be cleared first.	Construction	
	B10	Logs and dead trees will be relocated from the area of clearing to provide habitat in adjacent areas where feasible and practicable.	Construction	
	B11	Nest boxes will be fixed to suitable retained vegetation and in a way that does not damage the tree.	Construction and Post-Construction	
Maintain terrestrial fauna connectivity.	B12	Drainage culverts will be designed to facilitate movement of fauna species where feasible.	Pre-Construction	
	B13	The median width will be designed to the minimum	Pre-Construction	

Objective	Ref #	Commitment	Timing	Guiding principle
		necessary for safe road operation where Squirrel Glider movement corridors cross the Proposal.		
Minimise impacts to Pink-tailed Worm Lizard and Striped Legless Lizard	B14	Pink-tailed Worm Lizard and Striped Legless Lizard habitat will be inspected by an ecologist prior to construction. Individuals found in the construction footprint will be relocated to adjacent suitable habitat outside of the construction footprint.	Pre-Construction	
Maintain fish passage	B15	Culverts will be designed to facilitate fish passage where appropriate.	Pre-Construction	*Why do fish need to cross the road?* Fairfull and Witheridge (2003)
	B16	Fish passage will be maintained during construction.	Construction	
Minimise impacts to aquatic habitat	B17	Riparian areas disturbed by the Proposal will be progressively revegetated using plant species of local provenance.	Construction	
	B18	DPI Fisheries will be consulted regarding use of cleared vegetation in re-snagging programs for waterways.	Pre-Construction	
Aboriginal Heritage				
Minimise impact on Aboriginal heritage items	AH1	Any Aboriginal heritage items directly impacted will be managed in consultation with the Aboriginal community.	Pre-Construction, Construction and Post-Construction	
	AH2	All personnel working on site would receive training in their responsibilities under the *National Parks and Wildlife Act 1974*. Site specific training will be given to workers when working in the vicinity of identified heritage items.	Pre-Construction and Construction	*National Parks and Wildlife Act 1974*
	AH3	Aboriginal heritage items within the construction corridor not directly impacted will be marked on construction plans, fenced and signposted where necessary.	Pre-Construction and Construction	
	AH4	Should Aboriginal heritage items be uncovered during works, all works in the vicinity of the find would cease until	Construction	

Objective	Ref #	Commitment	Timing	Guiding principle
		Aboriginal Heritage specialist advice is obtained.		
Non-Aboriginal Heritage				
Minimise impacts on Non-Aboriginal heritage items	H1	Where the Proposal will directly impact heritage items of state and local significance, detailed heritage investigations and/or research will be performed prior to construction. Information collected will be documented in appropriate archival records.	Pre-Construction	RTA Heritage Guidelines and *Heritage Act 1977*
	H2	Where heritage items are not directly impacted care will be taken to not disturb them. This will include briefing of the construction works team to protect such assets during the construction phase, minimising access and clear delineation of items including fencing and signage would be provided where necessary in consultation with a heritage specialist. Identified heritage items will be clearly marked on construction plans.	Pre-Construction and Construction	RTA Heritage Guidelines
	H3	All personnel working on site would receive training in their responsibilities under the *Heritage Act, 1977*. Site specific training will be given to workers when working in the vicinity of identified heritage items.	Pre-Construction and Construction	
	H4	Should heritage items be uncovered during works, all works in the vicinity of the find would cease until specialist heritage advice is obtained.	Construction	
Resource Management				
Reduce demand on resources	RM1	Geotechnical investigations will be undertaken to identify suitable material on site for any additional fill material requirements.	Pre-Construction	
	RM2	The Proposal will be designed to achieve balanced earthworks where feasible.	Pre-Construction	

Objective	Ref #	Commitment	Timing	Guiding principle
	RM3	Construction practices to minimise water use including investigating opportunities to reuse and recycle water will be adopted.	Pre-Construction and Construction	
	RM4	Appropriate water sources for the construction will be investigated and identified in consultation with DNR.	Pre-Construction	
Minimise transport associated with the demand for resources	RM5	Where feasible, suitable materials will be obtained from local existing licensed quarries.	Construction	
Hydrology				
Minimise the impact on groundwater resources	G1	A detailed hydrogeological survey of the study area will be undertaken prior to construction to establish baseline groundwater conditions. Particular consideration will be given to the ability of the groundwater system to provide for the water requirements of the Proposal. Consultation with DNR will occur to assist in identifying appropriate groundwater resources.	Pre-Construction	
Minimise the impact on groundwater resources and land capability and manage land degradation relating to waterlogging and salinisation	G2	Strategies will be developed to manage groundwater issues associated with surrounding land uses, including management of recharge areas in consultation with DNR	Construction	
Minimise impact of high watertable on road infrastructure	G3	Appropriate subsurface drainage infrastructure (eg. blind ditches) will be installed in areas identified as having shallow groundwater levels, to divert groundwater away from pavement sub-grade.	Construction	
Traffic				
Minimise impact on traffic due to construction	T1	Construction vehicle movement arrangements will be developed to minimise impacts on other road users with specific regard to other road works in the region, local traffic movement requirements (stock or machinery) and peak traffic volumes, including long weekends and holiday	Construction	RTA QA Specification G10 Control of Traffic

Objective	Ref #	Commitment	Timing	Guiding principle
		periods.		
	T2	Construction will be planned to minimise disruption to traffic including use of road occupancy licences, variable message signage, static signage and co-ordination between sections as far as feasible through Hume Highway Duplication co-ordination meetings.	Construction	RTA QA Specification G10 Control of Traffic
Social and Economic Considerations				
Minimise property impacts to adjacent landholders	E1	All property acquisitions will be negotiated in accordance with *RTA Land Acquisition Policy*, and compensation provided in accordance with the *Land Acquisition (Just Terms Compensation) Act 1991*.	Pre-Construction	*Land Acquisition (Just Terms Compensation) Act 1991* RTA Land Acquisition Policy
Minimise impacts to property access following construction	E2	Negotiations for property acquisition will include consultation on property adjustments where required to maintain farm management practices.	Pre-Construction	
Minimise impact to local and regional roads from construction traffic impacts	E3	Dilapidation surveys of regional and local roads used by construction traffic will be undertaken. The RTA will be responsible for any necessary repair of deterioration attributable to the impacts of construction traffic.	Pre-Construction and Post-Construction	
Minimise the social and economic impact of the construction works on the local community	E4	Property access will be maintained for the duration of construction with any temporary access requirements being provide in consultation with adjacent landowners where necessary.	Construction	
	E5	Advance notification will be given to property owners on project schedules, construction works and access arrangements.	Pre-Construction and Construction	
Air Quality and Greenhouse Gases				
Minimise generation of dust	A1	Dust would be visually monitored and where necessary the following mitigation measures will be implemented:	Construction	

Objective	Ref #	Commitment	Timing	Guiding principle
		• Watering of dry exposed surfaces; • Covering loads on trucks transporting material to and from site at all times; • Spray planting cover crop of sterile grasses on long term stockpiles and exposed areas; and • Preventing, and where necessary removing mud and dirt tracked on to road surfaces.		
Minimise greenhouse gas emissions	A2	Plant and equipment will be maintained in a proper and efficient condition and operated in a proper and efficient manner.	Construction	Australian Design Rules and relevant manufacturers specifications
	A3	Greenhouse gas emission targets for the construction of the Proposal will be in line with government guidelines.	Construction	
Noise and Vibration				
Establish baseline conditions prior to start of construction.	N1	As necessary, condition surveys will be undertaken on buildings and structures within the potential area of vibration impact prior to commencement of rock-breaking and blasting activities.	Pre-Construction	*Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration* (ANZECC 1990)
Minimise the impact of construction noise and vibration on surrounding residents and where necessary, comply with all relevant standards to reduce noise and vibration to an acceptable level	N2	Construction activities will be restricted to construction hours for the Proposal. The hours will be 7.00am to 7.00pm Monday to Friday; 7.00am to 4.00pm Saturdays and no work on Sunday or public holidays.	Construction	
	N3	Consultation with affected residences will be carried out before commencing construction activities outside the construction hours for the Proposal.	Construction	*RTA Environmental Noise Management Manual* Practice Note vii - Roadworks Undertaken Outside of Normal Working Hours
	N4	All plant and equipment will be well maintained and fitted	Construction	AS 2436-1981 Guide Noise

Objective	Ref #	Commitment	Timing	Guiding principle
		with adequately maintained silencers which meet the vehicle design specifications.		Control an Construction, Maintenance and Demolition Sites
	N6	Prior consultation and notification will be undertaken with nearby residences that may be affected by noise or vibration generating activities.	Construction	
Minimise the operational noise impact on nearby residences	N7	A reasonable and feasible approach will be adopted to minimise operational noise impacts. This will be developed further during detailed design and in consultation with relevant property owners.	Construction and Post-Construction	*RTA Environmental Noise Management Manual. Environmental Criteria for Road Traffic Noise* (DEC 1999)
Visual				
Minimise visual impact and continue existing landscape and vegetation types	V1	Disturbed areas will be progressively revegetated using plant species of local provenance selected in consultation with a qualified landscape officer.	Construction	RTA QA Specification R178 *Vegetation*
	V2	The landscaping plans for the Proposal will consider the retention of existing views and vistas from the highway having regard to road user safety requirements.	Pre-Construction and Construction	
	V3	Cuttings and embankments will be graded out wherever feasible to reflect and best fit the characteristics of the local landform.	Construction	
Waste Minimisation and Management				
Reduce creation of waste and maximise re-use and recycling.	W1	Reuse and recycling and avoidance strategies in accordance with the *NSW Government's Waste Avoidance and Resource Recovery Strategy 2006* will be adopted..	Construction	*Waste Avoidance and Resource Recovery Strategy 2006*
Ensure waste generated is managed appropriately	W2	Waste materials will be classified and managed in accordance with *DEC Environmental Guidelines: Assessment and Classification & Management of Liquid and Non-liquid Wastes.*	Construction	DEC Environmental Guidelines: *Assessment and Classification & Management of Liquid and Non-liquid Wastes*

Objective	Ref #	Commitment	Timing	Guiding principle
Geology, Soils and Water Quality				
Minimise scour impacts	S1	Scour protection will be installed in creek/river bank areas at risk of erosion as necessary.	Pre-Construction and Construction	RTA QA Specification G38 *Soil and Water Management*
	S2	Culverts will be installed as early as possible in the construction program to ensure that transverse drainage is in place during early stages of construction. Permanent stream protection measures and other waterway structure requirements will also be established as early as possible.	Construction	
Minimise the risk of water contamination and pollution of local watercourses	S3	Any construction materials and fuels stored or used on site will be managed to minimise the risk of water contamination.	Construction	*Managing Urban Stormwater: Soils and Construction* (Landcom 2005).
	S4	Operational stormwater controls will be implemented to meet identified receiving water objectives. These may include dispersed stormwater treatment through grassed swales, constructed treatment measures such as operational stormwater retention basins and the use of gross pollutant traps.	Pre-Construction and Construction	
	S5	The requirement for spill containment will be made on the basis of a site specific assessment which takes consideration of the following: • the sensitivity of the receiving environment; • the likelihood of an accident occurring that would result in a spill; • the proximity of the discharge point to the receiving waters; and • the condition of the receiving waters.	Pre-Construction and Construction	
Minimise disturbance to landform, geology and soils and prevent erosion	S6	A soil conservationist will be engaged to provide advice on management of soils through detailed planning and	Pre-Construction and Construction	

Objective	Ref #	Commitment	Timing	Guiding principle
and sedimentation		construction.		
	S7	Erosion and sedimentation controls will be installed, maintained and managed prior to and during construction. The principles in *Managing Urban Stormwater - Soils and Construction, Volume 2 - Book 4 - Main Road Construction* will apply.	Pre-Construction and Construction	*Managing Urban Stormwater - Soils and Construction*, Volume 2 - Book 4 - Main Road Construction
	S8	Sediment will be cleared from behind barriers on a regular basis and controls will be monitored and maintained to ensure they work effectively at all times.	Construction	
	S9	Hardstand material or rumble grids will be installed at entry and exit points to minimise the tracking of soil and particulates onto pavement surfaces.	Construction	
	S10	Stockpiles will be established on slopes less than 2:1 (horizontal to vertical).	Construction	*RTA Stockpile Management Procedures 2001*
	S11	All stockpiles sites will be designed, established, operated and decommissioned in accordance with *RTA Stockpile Management Procedures 2001*. Stockpiles will be located not less than 100m from the high bank of any rivers or drainage lines.	Construction	*RTA Stockpile Management Procedures 2001*
	S12	Rehabilitation of disturbed areas will be undertaken progressively.	Construction	
Contaminated Land				
Identification and investigation of potentially contaminated sites	CL1	A review will be undertaken of all land impacted by the Proposal to identify potentially contaminated sites. Potentially contaminated sites will be further investigated in accordance with the *RTA's Contaminated Land Management Guideline.*	Pre-Construction	*Contaminated Land Management Guideline* (RTA 2005) *Guidelines for Assessing Service Station Sites* (EPA1994) *Sampling Design Guidelines* (EPA

Objective	Ref #	Commitment	Timing	Guiding principle
				1995)
Management of previously unidentified contamination	CL2	If site contamination investigations indicate that contaminants are present on the site in concentrations above the intended land use criteria, then an appropriate risk based management plan approach would be developed in accordance with the *RTA's Contaminated Land Management Guideline*. Where contamination is found to pose unacceptable risk to either the environment or human health receptors a remedial action plan will be developed and remediation works will be undertaken.	Pre-Construction and Construction	*Contaminated Land Management Guideline* (RTA 2005) *SEPP 55 – Remediation of Land* *Contaminated Land Management Act 1997* DEC Guidelines for NSW Site Auditor Scheme
Hazard and Risk				
Minimise the risk of an incident during construction	R1	Bunded storage areas will be located away from watercourses and will be established for oils and other hazardous liquids in accordance with Australian Standards. Spillages will be contained and collected any spillages for appropriate disposal.	Construction	AS 1940 *The Storage and Handling of Flammable and Combustible Liquids*
	R2	Activities with the potential for spillage such as refuelling, maintenance of equipment, mixing of cutting oil and bitumen will be conducted in bunded areas to prevent discharge into watercourses.	Construction	AS 1940 *The Storage and Handling of Flammable and Combustible Liquids*
	R3	Potentially hazardous and contaminating activities (such as washing construction plant, concrete mixers, bitumen surfacing equipment and handling hazardous chemicals) will be conducted in bunded areas away from watercourses.	Construction	AS 1940 *The Storage and Handling of Flammable and Combustible Liquids*

11 Justification and conclusion

Chapter 11 provides the justification for the Proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the Proposal is in the public interest.

11.1 Justification

11.1.1 Environmental considerations

The environmental issues considered during construction and operation of the Proposal are identified in Chapter 7. That chapter describes the results of the preliminary environmental assessment undertaken during the preparation of the Project Application, covers the environmental issues raised during the Planning Focus Meeting and documents the subsequent environmental risk review. By considering both potential impacts and available mitigation strategies, the environmental risk review has assisted project design, assessment and the broader decision making process.

Chapters 8 and 9 include assessments of the both the 'key' and 'other' environmental issues identified for the Proposal. Key environmental issues are biodiversity, Aboriginal and non-Aboriginal heritage, resource management, hydrology and cumulative impacts. Justification of the Proposal in the context of biophysical, social and economic impacts is provided in the following section.

Biophysical

Consideration of impacts on the biophysical environment was fundamental to the design process. Vegetation impacts have been avoided and mitigated as far as possible through design development and other measures. Nonetheless, a total of 14.28 hectares of vegetation would be removed as a result of the Proposal, of which 11.35 hectares would be the Box Gum woodland listed under the TSC Act as an endangered ecological community. Initiatives directed at offsetting the remaining residual impacts on biodiversity would be considered in consultation with the relevant government agency and other stakeholders.

During construction, water supply would be an issue for particular management and control. Multiple options for sourcing of water would be considered with the aim of ensuring that long-term impacts on groundwater and surface water resources are minimised.

Following the implementation of standard and best practice management procedures and the inclusion of appropriate mitigation measures, major residual issues associated with other biophysical impacts including water quality, soil and erosion control are unlikely.

The environmental management and mitigation measures for impacts on the biophysical environment have been incorporated in the Draft Statement of Commitments for the Proposal (refer to Chapter 10).

Social

The existing Hume Highway is the dominant built feature in the rural landscape. The proposed duplication would represent an incremental change, which would have a minor impact on the social environment and maintain accessibility to the surrounding rural communities. The Proposal has been designed to minimise potential social impacts, including property acquisition. It incorporates a number of management and mitigation measures to

address impact issues. These have been incorporated in the Draft Statement of Commitments for the Proposal (refer to Chapter 10).

No major issues have been identified with respect to land use, property acquisition, noise, visual, air quality, as described in Chapters 8 and 9. Issues relating to Aboriginal and non-Aboriginal heritage are being addressed through continuing consultation and investigation.

Economic

The completion of the Hume Highway Duplication would result in a road user benefit to cost ratio of between 1.3 and 1.5 to 1 depending on the traffic growth scenario and the adopted cost contingency derived from long term reduction in road user and accident costs and travel time saving benefits. This represents a good investment of public money for the benefit of current and future generations.

There would be substantial long-term national and State-wide economic benefits of the Hume Highway Duplication including time and vehicle operating efficiencies and associated savings in freight costs. These benefits are particularly significant in relation to the Hume Highway as the busiest inter-capital corridor in Australia for both freight and passenger transport and in the context of expected increases in travel demand. The Proposal is an essential component to the Hume Highway Duplication and therefore fundamental to the realisation of the identified benefits.

The Proposal is anticipated to have positive economic impacts for the local and regional community during construction. Temporary but positive impacts include those associated with local provision of support services and input to the local economy by construction personnel.

11.1.2 Suitability of the site

The existing corridor is the most suitable site for the Proposal as it utilises an existing asset (the existing Hume Highway as a carriageway) and allows impacts on the environment to be minimised.

11.1.3 Public interest

The Hume Highway is a route of strategic national significance serving intrastate and interstate users as the main road transport corridor linking Sydney and Melbourne.

Traffic conditions on the Hume Highway are unique as a substantial proportion of daily traffic comprises heavy vehicles and a considerable proportion of heavy vehicle movements occur during the night. This gives rise to unusual characteristics in relation to highway capacity. The level of service on the single carriageway sections of the highway gradually deteriorates over time reaching LoS D for the five-hour period from 8pm to 1am. At this level, traffic flow approach instability with drivers severely restricted in their freedom to manoeuvre within the traffic stream. This situation occurs every night of the week and has rapidly deteriorated since 2001 when the affected period occurred for only one hour. The level of service is predicted to deteriorate further, reaching LoS E during the period 9pm to 1am by 2016 and during the period from 7pm to 2am by 2021 if no improvements are made to the route. The average level of service across the whole day is expected to have similarly deteriorated.

The Proposal, as a component of the Hume Highway Duplication, would see an improvement on opening from an unsatisfactory level of service with substantial delays to a good level of service with minimum delays and spare capacity.

Fatal crash rates on the undivided sections of the Hume Highway were approximately 85 per cent higher than those on the divided sections over the period between 1997 and 2002 and injury and total crash rates were approximately 40 per cent and 15 per cent higher respectively. Total crash rates on the divided road sections are similar to current crash rates for the Hume Highway as a whole within NSW. Total crash rates on the undivided sections are higher.

Total crash rates on the undivided sections of the Highway have steadily increased over the past five years and this trend could be expected to continue. In particular, the number of head-on crashes would increase as traffic volumes continue to grow and the level of service of the road deteriorates to an unacceptable level beyond 2011 during the afternoon and night time periods on weekdays and during holiday periods.

The Proposal is an important component of the Hume Highway Duplication which would improve the efficiency of travel, safety and accessibility of the road. Crashes would be expected to be reduced to the level experienced on the divided-carriageway sections of the Highway cutting the current total crash rate by approximately 57 per cent.

In this context, the Australian and NSW Governments have recognised that it is in the public interest to proceed with the Hume Highway Duplication. The Australian Government has allocated $800 million to the Hume Highway Duplication with the NSW Government recognising the importance of the Hume Highway Duplication by declaring it a critical infrastructure project.

11.2 Ecologically sustainable development

Ecologically sustainable development (ESD) is the use, conservation and enhancement of community resources so that ecological processes, and hence the quality of life, are sustained and improved for present and future generations. It is based on four principles:

- The precautionary principle.
- Social equity and inter-generational equity.
- Conservation of biological diversity and ecological integrity.
- Improved valuation and pricing of environmental resources.

The principles of ecologically sustainable development have been an integral consideration in the process of developing the Proposal (and the Hume Highway Duplication as a whole) and assessing its benefits and effects. Moving forward, the preparation and exhibition of the environmental assessment makes detailed information about the Proposal available to inform public discussion. This assists the development of the Proposal in accordance with ESD principles and the decision on whether it should proceed.

The precautionary principle deals with certainty in decision making. It requires that planning for the Proposal adopts best practice environmental assessment techniques, and the Proposal itself adopts best practice environmental goals, standards and measures to minimise risks associated with the potential environmental impacts.

The assessment in this document has been prepared for the RTA by environmental specialists and has relied on the best available technical information. The use of this information coupled with best practice environmental standards, goals and measures has also been relied on in the development of mitigation measures to minimise the risks associated with potential environmental impacts. Additionally, the surveys and studies referred to Chapters 8 and 9 have been developed in consultation with government agencies and other stakeholders.

Social equity within the current generation requires that the economic and social benefits of the proposed development are distributed appropriately among all members of the community. It is also necessary that environmental safeguards against degradation of flora and fauna, groundwater, surface water, cultural heritage, visual, acoustic and air amenity are implemented to ensure that no part of the community would be unacceptably disadvantaged.

The potentially adverse impacts on environmental resources likely to affect social equity have been assessed and mitigation measures included in the Proposal. These measures relate to erosion and sediment control, surface and groundwater management, air quality controls, noise controls, traffic and waste management. Implementation of the mitigation measures would result in a reduction in effects on social and inter-generational equity.

The principle of conservation of biological diversity and ecological integrity has been considered throughout the assessment process. While the Proposal has been designed to minimise impacts on local native vegetation, its implementation would result in the removal of significant areas of Box-Gum Grassy Woodland, a listed threatened ecological community under State and Commonwealth legislation. Initiatives directed at offsetting the residual impacts on the Box-Gum Grassy Woodland would be considered in consultation with the relevant government agency and other stakeholders. Such initiatives include progressive revegetation using Box-Gum Grassy Woodland seed of local provenance and enhancing areas of Box-Gum Grassy Woodland to be retained in the road corridor with supplementary plantings.

The principle of valuation involves consideration of all environmental resources which may be affected by the Proposal, including air, water, land and living things. Whilst it is difficult to place a monetary value on the residual environmental and social effects of the Proposal, the value placed on environmental resources on and around the corridor is evident in the extent of environmental investigations, planning and design of impact mitigation measures to minimise irreversible damage to those resources.

11.3 Conclusion

The Proposal would assist in meeting the primary objective of Hume Highway Duplication which is to provide dual carriageways for the Hume Highway between its intersection with the Sturt Highway to north of Albury (excluding the single carriageway sections through Tarcutta, Holbrook and Woomargama). The Proposal has important economic and road user benefits which assist the Hume Highway Duplication in meeting the AusLink National Network objectives of supporting national economic growth. It will contribute to the development of sustainable transport solutions that:

- Increase infrastructure handling capacity and efficiency.
- Improve safety and security.
- Improve transport productivity on nationally strategic and export-oriented freight corridors.
- Improve the reliability of travel on interstate and interregional corridors.
- Are consistent with viable, long-term economic and social outcomes, and with the obligation to current and future generations to sustain the environment.

Reducing potential environmental impacts of the Proposal has been a major consideration during design development. The development of management and mitigation measures has been a key feature of the environmental assessment process and firm commitments to implement appropriate management and mitigation measures have been made.

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