

4 Description of the project

This chapter describes the project, including the route alignment, corridor width, main project elements, ancillary facilities, design standards and construction activities. It addresses the Director-General's requirements (DGRs) for the description of the project as shown below.

Director-General's requirements	Where addressed
<i>A detailed description of the project including:</i>	
Route alignment and corridor width.	Section 4.2.1 and Section 4.2.4
Design elements (requirements for bridges, culverts, Level of Service, pedestrian and cyclists, rest areas and service centres, etc).	Section 4.2 and Section 7.1
Clear identification of and/or options for the proposed location of ancillary facilities (eg compound site, batching plants, etc).	Section 4.4.7
Resourcing (eg construction material needs, spoil disposal, natural resource consumption including water supply sources).	Sections 4.4.4 to 4.4.6
Potential staging.	Section 4.4.10

4.1 Project scope

4.1.1 The project

Roads and Maritime Services (RMS) proposes to upgrade 11.6 kilometres of the Princes Highway between Toolijooa Road south of Gerringong and Schofield's Lane southwest of Berry, in New South Wales (NSW) (the project), to achieve a four lane divided highway (two lanes in each direction) with median separation. The project includes bypasses of Foxground and Berry.

The project comprises the following key features:

- Construction of a four lane divided highway (two lanes in each direction) with median separation (wire rope barriers or concrete barriers where space is constrained, such as at bridge locations).
- Bypasses of the Foxground bends and the Berry township.
- Construction of around 6.6 kilometres of new highway where the project deviates from the existing highway alignment at Toolijooa Ridge, the Foxground bends and the Berry township.
- Provision for the possible widening of the highway (if required in the future) to six lanes within the road corridor and, in some areas, construction of the road formation to accommodate future additional lanes where safety considerations, traffic disruption and sub-optimal construction practices are to be avoided.

- Grade-separated interchanges at:
 - Toolijooa Road.
 - Austral Park Road.
 - Tindalls Lane.
 - East of Berry at the existing Princes Highway, referred to as the northern interchange for Berry.
 - West of Berry at Kangaroo Valley Road, referred to as the southern interchange for Berry.
- A major cutting at Toolijooa Ridge (around 900 metres long and up to 26 metres deep).
- Six lanes (two lanes plus a climbing lane in each direction) through the cutting at Toolijooa Ridge for a distance of around 1.5 kilometres.
- Four new highway bridges:
 - Broughton Creek bridge 1, a four span concrete structure around 170 metres in length and nine metres in height.
 - Broughton Creek bridge 2, a three span concrete structure around 75 metres in length and eight metres in height.
 - Broughton Creek bridge 3, a six span concrete structure around 190 metres long and 13 metres in height.
 - A bridge at Berry, a 19 span concrete structure around 600 metres long and up to 12 metres in height.
- Three highway overbridges:
 - Austral Park Road interchange, providing southbound access to the highway.
 - Tindalls Lane interchange, providing southbound access to and from the highway.
 - Southern interchange for Berry, providing connectivity over the highway for Kangaroo Valley Road along its existing alignment.
- Eight underpasses including roads, drainage structures and fauna underpasses:
 - Toolijooa Road interchange, linking Toolijooa Road to the existing highway and providing northbound access to the upgrade.
 - Property access underpass in the vicinity of Toolijooa Ridge at chainage 8400.
 - Dedicated fauna underpass in the vicinity of Toolijooa Ridge at chainage 8450.
 - Property access underpass between Toolijooa Ridge and Broughton Creek at chainage 9475.
 - Combined drainage and fauna underpass in the vicinity of Austral Park Road at chainage 12800.
 - Combined drainage and fauna underpass in the vicinity of Tindalls Lane at chainage 13320.
 - Dedicated fauna underpass in the vicinity of Tindalls Lane at chainage 13675.
 - Property access underpass between the Tindalls Lane interchange and the northern interchange for Berry in the vicinity of at chainage 15100.
- Modifications to local roads, including Toolijooa Road, Austral Park Road, Gembrook Lane, Tindalls Lane, North Street, Queen Street, Kangaroo Valley Road, Hitchcocks Lane and Schofields Lane.
- Diversion of Town Creek into Bundewallah Creek upstream of its confluence with Connollys Creek and to the north of the project at Berry.

- Modification to about 47 existing property accesses.
- Provision of a bus stop at Toolijooa Road and retention of the existing bus stop at Tindalls Lane.
- Dedicated u-turn facilities at Mullers Lane, the existing highway at the Austral Park Road interchange, the extension to Austral Park Road and Rawlings Lane.
- Roundabouts at the southern interchange for Berry and the Woodhill Mountain Road junction with the exiting Princes Highway.
- Two culs-de-sac on North Street and the western end of Victoria Street in Berry.
- Tie-in with the existing highway about 75 metres north of Toolijooa Road and about 440 metres south of Schofields Lane.
- Left in/left out only provisions for direct property accesses to the upgraded highway.
- Dedicated public space with shared pedestrian/cycle facilities along the southern side of the upgraded highway from the playing fields on North Street to Kangaroo Valley Road.
- Ancillary operational facilities, including permanent detention basins, stormwater treatment facilities and a permanent ancillary facility site for general road maintenance.

Construction activities would include:

- Site preparation and establishment works.
- Temporary construction facilities, including construction compounds, stockpile sites, creek crossings, sediment control basins and haulage roads.
- Temporary works, including relocation/protection of services, traffic facilities and side tracks.
- Earthworks and bridge construction.
- Pavement construction.
- Drainage construction.
- Road furniture installation.
- Site restoration and landscaping.

The project and the key features of the project are shown in **Figure 4-1**, **Figure 4-2** and **Figure 4-3**.

During detailed design, refinements could be made to the design features and construction methods (refer to **Section 4.3.4** for further detail).

4.2 Project elements

4.2.1 Route alignment from north to south

The project is described below in three sections.

Section one – Toolijooa Road interchange to Austral Park Road (Chainages 7650 – 12300)

As depicted in **Figure 4-1**, the project within this section would consist of around 4.7 kilometres of new highway. The alignment would depart from the Princes Highway at the Toolijooa Road interchange to bypass Foxground bends and re-join the Princes Highway near the Austral Park Road interchange.

The Toolijooa Road interchange would provide north facing ramps only including a northbound on-ramp and south bound off-ramp. The ramps would be constructed as part of the adjacent Gerringong upgrade project and provide temporary connectivity of the new highway to Toolijooa Road, until the proposed interchange is complete. Toolijooa Road would be realigned about 50 metres to the west of its existing location to accommodate the interchange. Toolijooa Road would pass under the new highway and connect with the existing Princes Highway. When the interchange is complete, the realigned Toolijooa Road would connect to the north facing ramps that would be constructed prior to the project.

The alignment would bypass Foxground bends and cross Toolijooa Ridge, a prominent ridge within the landscape. This would require a major cutting around 900 metres in length and varying in depth to a maximum of around 26 metres, with a 10 metre average depth. The cutting would be benched at about 10 metre intervals, with the uppermost batter to be 'rolled back' to provide a gradual slope that is consistent with the surrounding landscape. A third lane would be provided in each direction in the Toolijooa Ridge cutting, and would be designated as a climbing lane.

The alignment would then cross the Broughton Creek floodplain, curving back to the south before crossing Broughton Creek on a new bridge structure near the current highway alignment. The alignment would continue across the floodplain on an embankment, at a maximum height of about 5.5 metres, and would cross Broughton Creek two more times. The width of the embankments would be in accordance with the lane widths provided in **Section 4.2.2** and **Section 4.2.3**. An emergency vehicle u-turn facility would be provided at chainage 10950 (refer to **Figure 4-1** and **Section 4.2.12**).

The alignment would re-join the existing highway immediately after the Austral Park Road interchange, with the upgraded highway in a cutting (around 11 metres in depth) and the southbound on-ramp bridging over the highway. A northbound off-ramp would provide a connection to the retained highway which would continue to service Broughton Village and Foxground. Further details of interchanges are presented in **Section 4.2.4**.

Fauna crossings, including rope bridges would be constructed to aid fauna passage, particularly near Broughton Creek (refer to **Figure 4-1**). Refer to **Section 4.2.9** and **Section 7.3** for further details.

There would be no direct property access to the new highway alignment within this section of the project. Current property access would be maintained in sections along the retained existing Princes Highway, which would become a local road and by providing property underpasses at chainages 8400 and 9475 (refer to **Section 4.2.7**). The exception would be for properties close to the Austral Park Road interchange. At this location, a residual section of the highway to the west of the new alignment would be modified to form part of the interchange, requiring existing property access to be realigned.

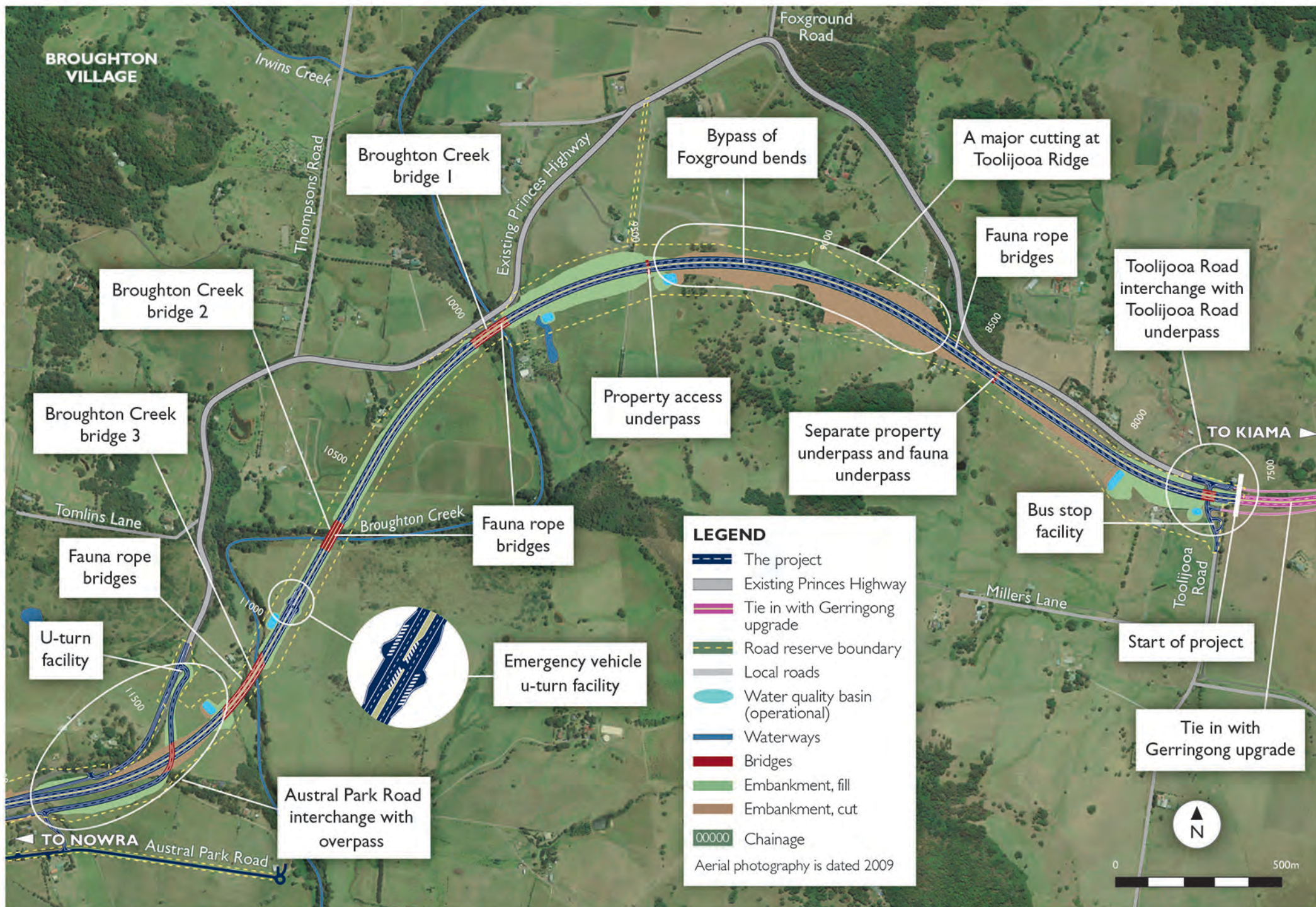


Figure 4-1 Section 1 (Toolijooa to Austral Park Road)

Section two – Austral Park Road to the northern interchange for Berry (chainages 12300 – 15500)

Section two of the project would start at chainage 12150 where the project alignment would re-join the existing Princes Highway near Austral Park Road and extend to the northern interchange for Berry (chainage 15500) (refer to **Figure 4-2**).

The proposed alignment within this section generally follows the Princes Highway and would involve the widening and realignment of 3.4 kilometres of the highway. While parts of the existing highway would be used for the project, the majority of these sections of highway would require regrading and reconstruction to satisfy current road design standards.

As the alignment passes through this section, the project would incorporate a series of cuttings and embankments to respond to the undulating terrain. The most significant of these is a cutting near Tindalls Lane with a maximum depth of around 11 metres.

The other key features of this section would include:

- The extension and upgrade of Austral Park Road to provide safe access to properties on the eastern side of the project. The Austral Park Road interchange would provide direct southbound access to the upgraded highway for those properties, with northbound access provided via a two-way overbridge connection over the project to the existing highway and the Toolijooa Road interchange. Southbound vehicles would access Austral Park Road via the Toolijooa Road interchange and the existing highway to the two-way connection over the project.
- Crossing the Eastern Gas Pipeline (refer to **Figure 4-18**).
- Tindalls Lane interchange to provide access to and from Tindalls Lane in both directions and act as a u-turn facility for highway traffic. The interchange accesses would be formed by modifying sections of the existing highway and would require the construction of a new overbridge.
- A permanent ancillary facility site at the Tindalls Lane interchange that would be used by RMS and Shoalhaven City Council for road maintenance purposes (refer to **Section 4.2.15**).

Residual sections of the existing Princes Highway would be retained near Austral Park Road and near Tindalls Lane interchange to provide access to the new highway.

Fauna rope bridges and underpasses would be provided in this section (refer to **Figure 4-2**). Refer to **Section 4.2.9** and **Section 7.3** for further details.

Where no local road access would be provided, direct property access would be maintained along this section of the highway. These accesses would be limited to left-in left-out by the inclusion of a central median barrier for road safety reasons and these residents would rely on the Austral Park Road and Tindalls Lane interchanges for movements other than left in/left out. .

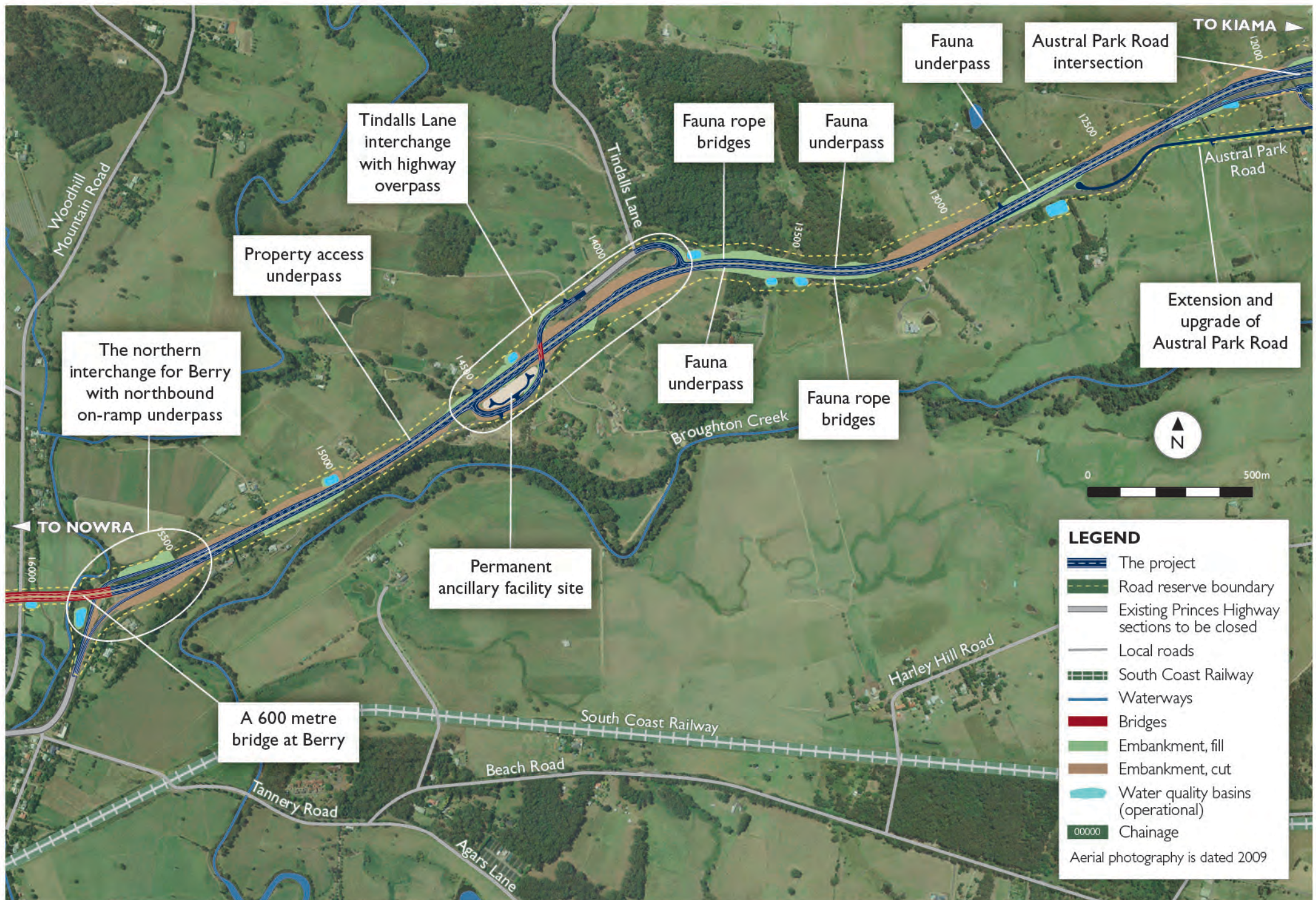


Figure 4-2 Section 2 (Austral Park Road to the northern interchange for Berry)

Section three – Berry (chainages 15500 – 19200)

Section three of the project would be between the northern interchange for Berry and the Schofields Lane junction where it would re-join the existing two lane highway. In addition to the northern interchange, this section would include the bypass of Berry, the southern interchange for Berry, the Schofield Lane junction upgrade, a tie-in to the existing Princes Highway and the u-turn facility at Mullers Lane.

North of Berry, the proposed alignment would generally follow the existing Princes Highway along a ridgeline, before curving and deviating towards the west. A northbound on-ramp and southbound off-ramp at the northern interchange would utilise the existing Princes Highway to provide access to and from Berry. A roundabout would be constructed at the intersection of the existing highway (Queen Street) and Woodhill Mountain Road to provide a u-turn facility for local traffic.

The proposed alignment would then curve towards the west to pass north of Berry. At this point, a proposed bridge would span a length of around 600 metres to cross Broughton Mill Creek and Bundewallah Creek. The maximum height of the bridge would be around 12 metres, close to the northern interchange for Berry. It would then drop in height to around 6.7 metres at Woodhill Mountain Road, and finally to a height of around 3.5 metres at the abutment on the western side of Bundewallah Creek. From here, the proposed alignment would continue in a south-west direction opposite Alexandra Street at chainage 16600, where it would start to curve round to run east-west opposite Albany Street at chainage 16800. This section has been referred to as the North Street corridor for the purpose of this environmental assessment.

The alignment would transition from an embankment of around two metres in height to a cutting along the North Street corridor to tie in with the southern interchange. The majority of this section would be at the existing ground level or in a cutting.

The highway would cross North Street where it intersects with George Street at about chainage 17400, separating North Street into two sections. East of this location a cul-de-sac would be provided on North Street west of the junction with Edward Street. To the west a cul-de sac would be provided on North Street immediately east of the last residence. A local road would be provided to connect the northbound interchange ramps with Rawlings Lane (north of the project) and a u-turn and garbage collection facility would be provided on Rawlings Lane to allow for garbage trucks to turn around and service the two properties on Rawlings Lane (refer to **Section 4.2.5**).

A green space buffer would be provided between North Street and the project. This buffer would separate North Street from the project and the noise barrier proposed along the southern side of the alignment. The noise barrier would extend between the western end of the bridge at Berry, along the length of the North Street corridor and the southbound off-ramp of the southern interchange, located at the intersection of Queen Street and Kangaroo Valley Road. The barrier would be four metres high from the pavement of the project with low level landscaping at the base of the traffic side of the barrier where feasible. A landscaped embankment would be built close to the top of the barrier on the North Street side to minimise the visual impact. The embankment would be sloped at 2:1 or flatter with a flat landscaped section at the top and there would be a stock fence constructed at the base of the slope.

Town Creek, a small ephemeral watercourse, would be diverted and connect to Bundewallah Creek north of the project (refer to **Figure 4-3**). Refer to **Section 4.2.11** for further details.

At the southern interchange for Berry, the highway would be in a cutting around 7.5 metres deep, with Kangaroo Valley Road bridging over the highway. Kangaroo Valley Road would remain close to the existing ground surface level and the provision of a wide bridge with pedestrian and shared cyclist facilities on both sides separated from traffic, would maintain connectivity between Berry town centre and the residential development to the north-west along Kangaroo Valley Road and beyond. The shared pedestrian and cyclist facilities on the Kangaroo Valley Road overbridge would connect into a similar facility running east-west along the northern side of North Street between the southern interchange for Berry and the Berry sportsground at the eastern end of North Street.

The southern interchange would provide for all traffic movements entering and exiting Berry in both northbound and southbound directions and would ensure flood free access to Berry in a 1 in 100 year flood event. A four metre high noise barrier would be constructed along the northbound off-ramp of the southern interchange for Berry. It would be located between Huntingdale Park Road and the off-ramp and would be around 200 metres in length, south from the Kangaroo Valley Road overbridge.

At its junction with the existing Princes Highway, Victoria Street in Berry would be closed with a cul-de-sac. Access to the project from Victoria Street would be via Queen Street and the southern interchange for Berry.

From the southern interchange, the southbound lanes of the upgraded highway would follow the existing highway alignment with the new northbound lanes construction on the western side of the current highway. The Schofields Lane junction would be upgraded, and traffic accessing the project at this location would be restricted to left-in left-out movements due to the inclusion of a wire rope median barrier on the upgraded highway. A tie-in would be constructed west of Schofields Lane where the duplication finishes, to safely transition highway traffic to or from a four to a two lane configuration (refer to **Figure 4-3**). Further details regarding tie-ins are provided in **Section 4.4.8**. The tie in would remain until the proposed future upgrade of the highway south of the project (the proposed Berry to Bomaderry upgrade) is completed.

Direct property access would be maintained along this section of the highway, but would be restricted to left-in left-out movements. A u-turn facility would be constructed at Mullers Lane (chainage 19625), and would be designed to cater for heavy vehicle movements. The u-turn facility would enable motorists from properties located along the eastern side of the project to turn safely and travel north.

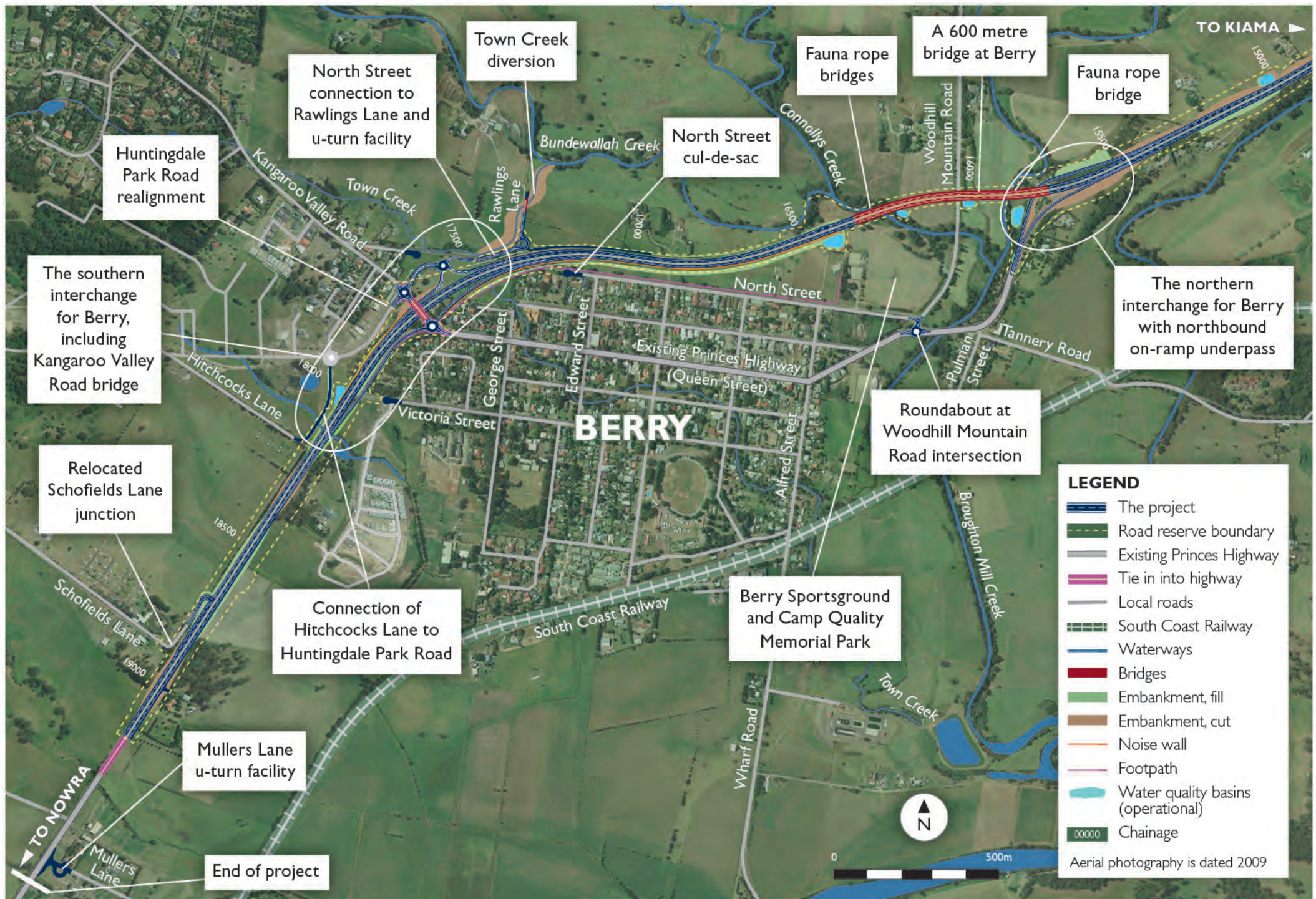


Figure 4-3 Section 3 (Northern interchange for Berry to Mullers Lane)

4.2.2 Road grade and lane widths

A typical cross section that has been adopted for the project is shown in **Figure 4-4** and **Figure 4-5**. The project has been designed in accordance with the RMS' 'Road Design Guide' (RTA, 1998) and has considered subsequent design guide updates.

Two 3.5 metre wide lanes would be provided in each direction, separated by a five metre wide central median with a wire rope safety barrier (or a concrete barrier if space is constrained) and one metre wide shoulders. An outer shoulder would typically be 2.5 metres wide, increasing to three metres where a safety barrier is provided. A verge would be provided, and would vary between one to two metres in width depending on topography and safety barrier requirements.

The typical cross section would vary within the Toolijooa Ridge cut where six lanes would be constructed to accommodate a climbing lane in each direction (refer to **Figure 4-6**).

The desired maximum grade for the project is six per cent, with an absolute maximum grade of eight per cent.

The vertical alignment of the highway has been designed for a speed of 100 kilometres per hour with a horizontal design speed of 110 kilometres per hour. The project would have a posted speed limit of 100 kilometres per hour.

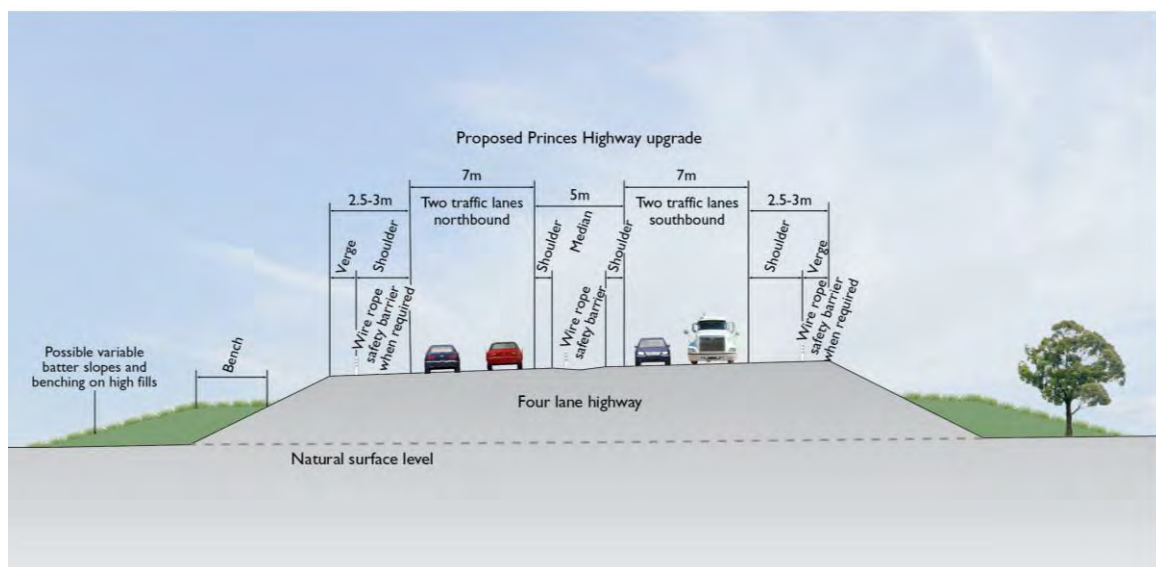


Figure 4-4 Cross section of typical four lane configuration on embankment

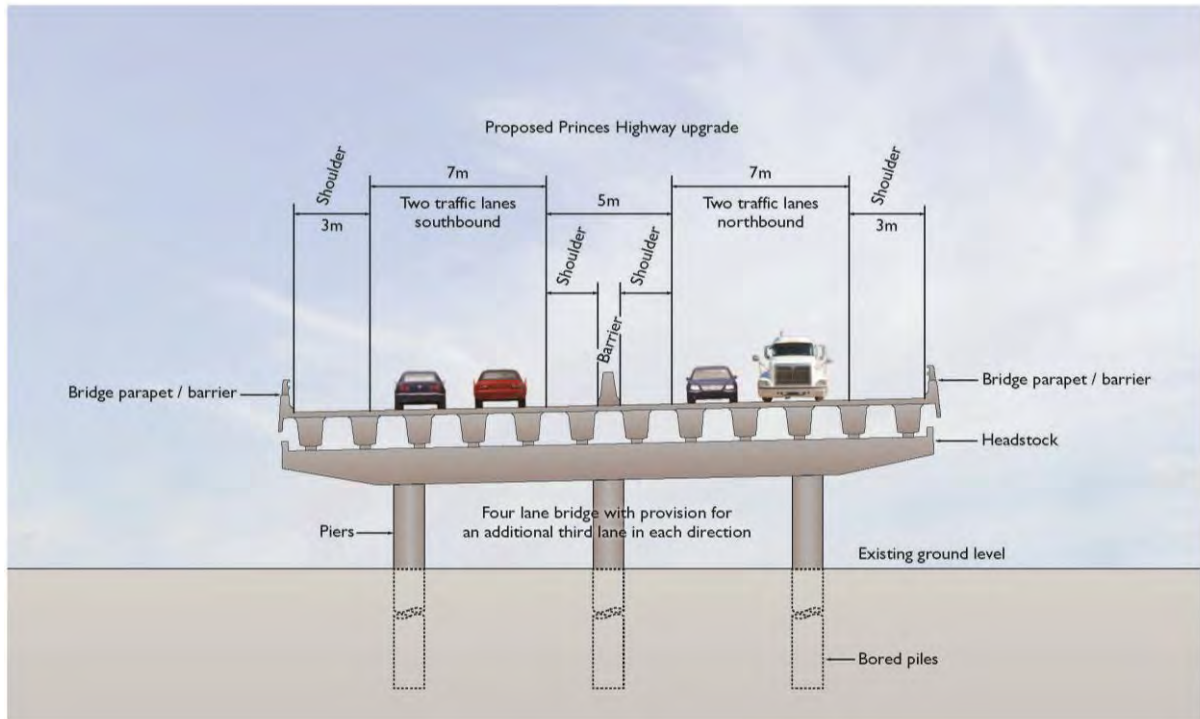


Figure 4-5 Cross section of a typical bridge

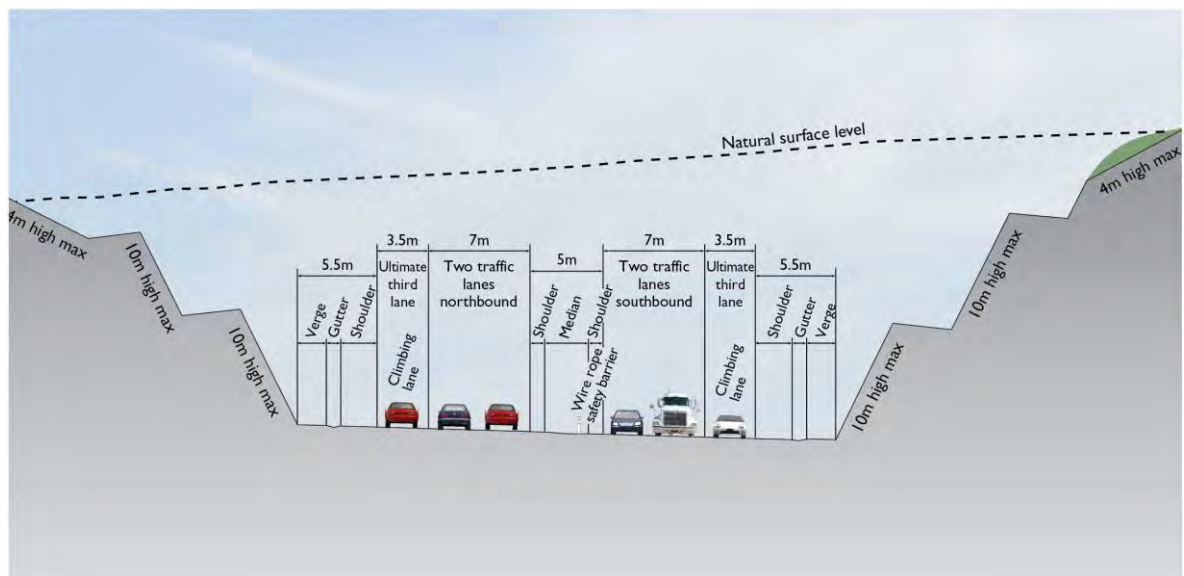


Figure 4-6 A typical cross section of Toolijooa Ridge cutting

4.2.3 Level of service

The Princes Highway both north and south of Berry currently operates at level of service (LoS) D in both the morning and afternoon peak periods. During holiday peak periods, the operational performance of the Princes Highway deteriorates to an unacceptable LoS E at most locations. By 2037, the Princes Highway would operate at an unacceptable LoS E or LoS F for all peak periods in the absence of the project.

Following construction, the highway would operate at LoS A or LoS B throughout the project area during typical morning and afternoon peak periods. During the busiest northbound and southbound holiday peak periods, the highway would operate at LoS C or better. Further details are provided in **Section 7.1**.

4.2.4 Corridor width and project footprint

The typical corridor width (or road reserve) would vary from 25 metres to 140 metres in response to the terrain and environmental constraints of the corridor, as well as the requirements for interchanges, fencing, drainage structures (such as stormwater treatment basins) and access ways for maintenance vehicles. Provision for pedestrians and cyclists have been included as part of the project (refer to **Section 4.2.17**).

The road reserve for the project would provide an ultimate six lane configuration (three lanes in each direction) to accommodate any need to further widen the Princes Highway in the future. Future widening would be generally an outside third lane and would not form part of this project.

However, where significant structures (such as the bridge at Berry), difficult earthworks (such as the crossing of soft soils near Broughton Creek) or substantial cuttings are required, the formation of the third lane would be constructed as part of the project to minimise costs and disruptions for future construction and operation.

The climbing lanes that would be constructed as part of the project at Toolijooa Ridge would revert to standard third travel lanes when future traffic volumes dictate the ultimate six lane highway configuration is required.

Interchange ramps have also been designed to accommodate an additional third lane on the outside of the carriageway without requiring significant changes under operation.

The width of the project footprint (the width required to construct the project) varies from 55 metres to 170 metres. This includes temporary sediment control basins, haulage routes, stockpile and compound sites within the immediate corridor that would be required during construction.

The concept design may change during detailed design if flattening of slopes at significant embankments or cuttings to accommodate urban design objectives is required. This would be dependent on the availability of suitable materials and volumes of spoil from major cuttings and would be subject to further impact assessment if necessary.

Further detail on the construction is provided in **Section 4.4**.

4.2.5 Junctions and interchanges

The following unsignalled junctions and interchanges are proposed as part of the project:

- Three half interchanges (Toolijooa Road, Austral Park Road and the northern interchange for Berry).
- One 'Type-S' interchange (Tindalls Lane interchange).
- One full interchange (southern interchange for Berry).
- Four junction modifications associated with changes to local roads (Austral Park Road, Gembrook Lane, Woodhill Mountain Road and Schofields Lane).
- Three u-turn facilities (near the Austral Park Road interchange, Rawlings Lane and Mullers Lane).

Toolijooa Road interchange

The grade-separated Toolijooa Road half interchange (refer to **Figure 4-7**) would consist of north facing ramps only, providing a northbound on-ramp and a southbound off-ramp. Toolijooa Road would be realigned to join the existing highway, passing under the upgrade. Southbound access from Toolijooa Road to the new highway would be from the existing highway and the Austral Park Road interchange to the south. Similarly, northbound access to Toolijooa Road would be from the Austral Park Road interchange and the existing highway.

The north facing ramps would be constructed as part of the Gerringong upgrade, with temporary tie-ins with Toolijooa Road and the existing highway. The interchange would be completed with the proposed realignment of Toolijooa Road and the construction of the highway alignment from chainage 7650.

The Toolijooa Road interchange would provide highway access to and from the north for the properties and communities located at Foxground and along the existing highway, which would be kept as a local access road. It would also provide highway access to and from the north for properties along Toolijooa Road and beyond.

A bus stop facility would be provided on the eastern side of Toolijooa Road close to the southbound off load ramp.

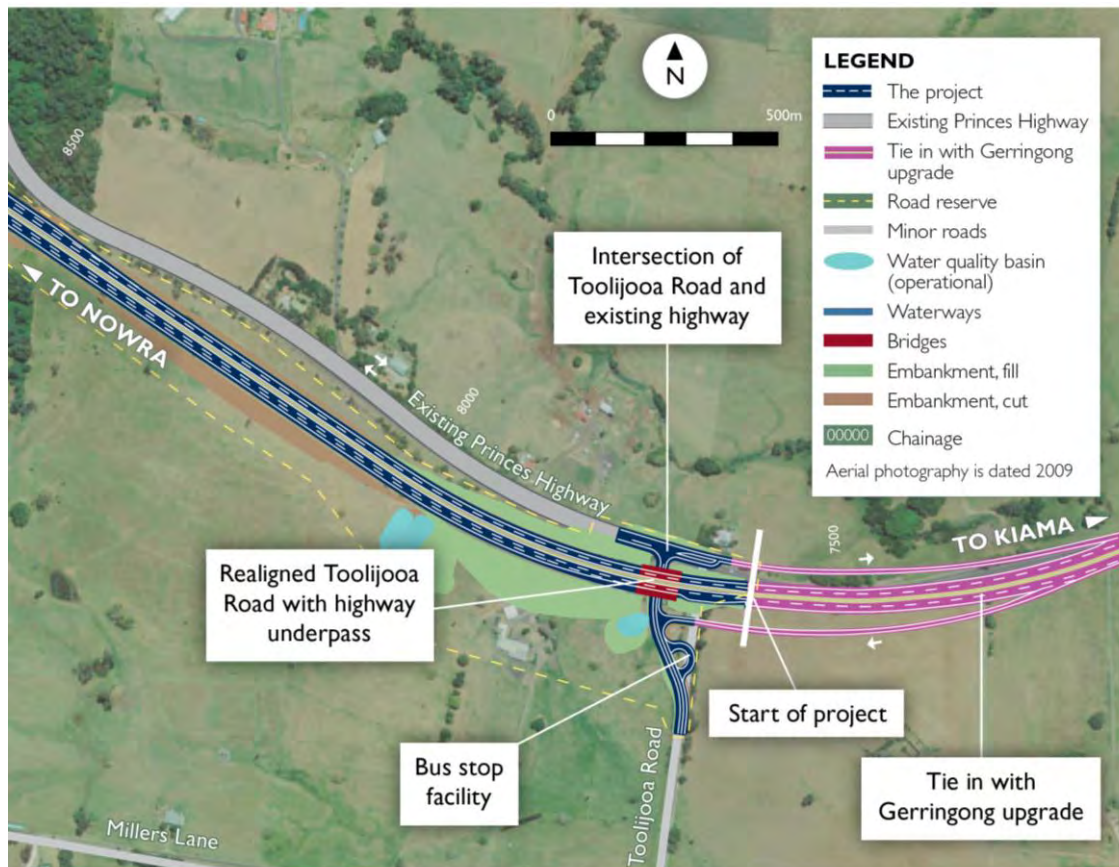


Figure 4-7 Toolijooa Road interchange

Austral Park Road interchange

The Austral Park Road half interchange (refer to **Figure 4-8**) would consist of a northbound off-ramp and a southbound on-ramp serving traffic to and from the south. A new two way local road connects the existing highway via a bridge over the upgraded highway to Austral Park Road and the southbound on-ramp. Austral Park Road would cross over the new highway with a bridge to connect on the eastern side of the project. Austral Park Road would be connected to the new two way local road and the southbound on-ramp by a two way service road.

Together, the Toolijooa Road and Austral Park Road interchanges would perform the function of an 'all movements' interchange, with the existing highway providing a connection between the two interchanges and maintaining access to properties along the existing highway and the local road network.

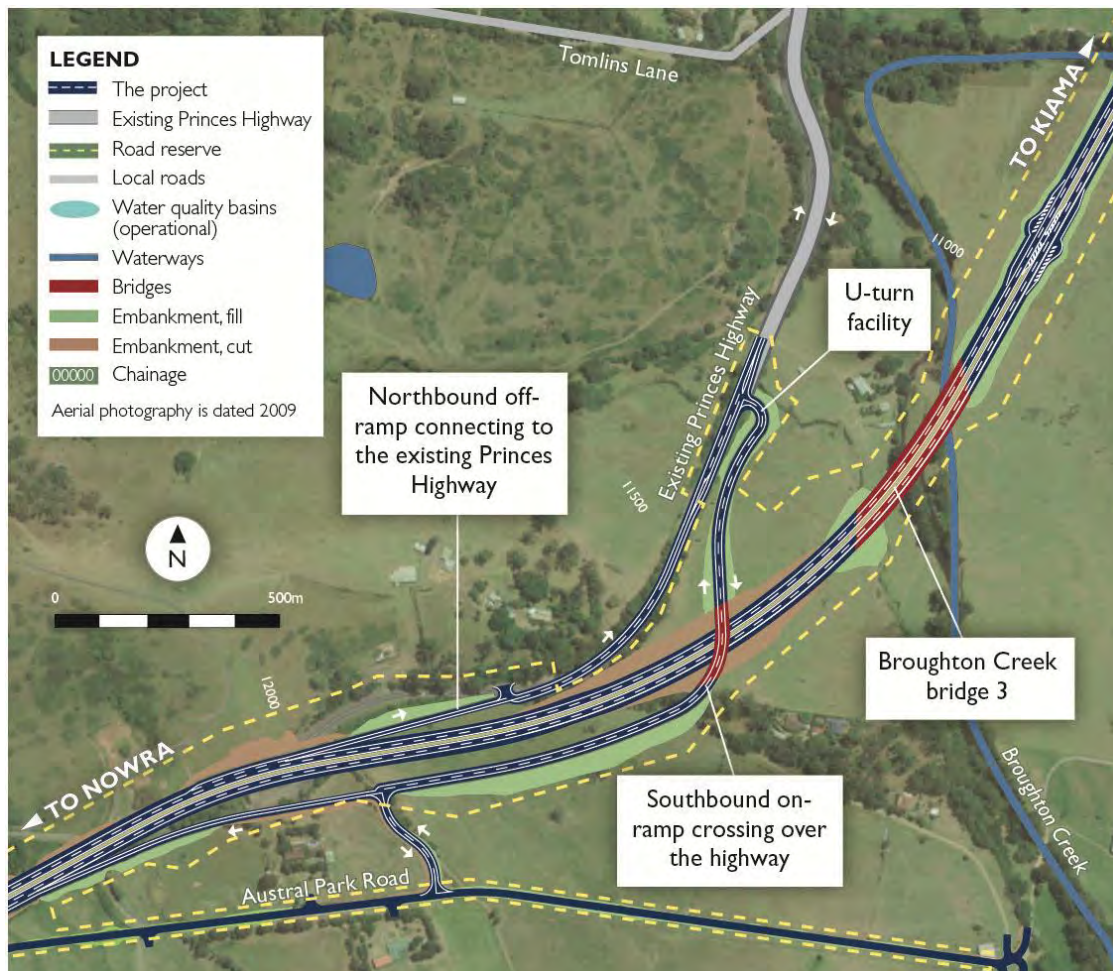


Figure 4-8 Austral Park Road interchange

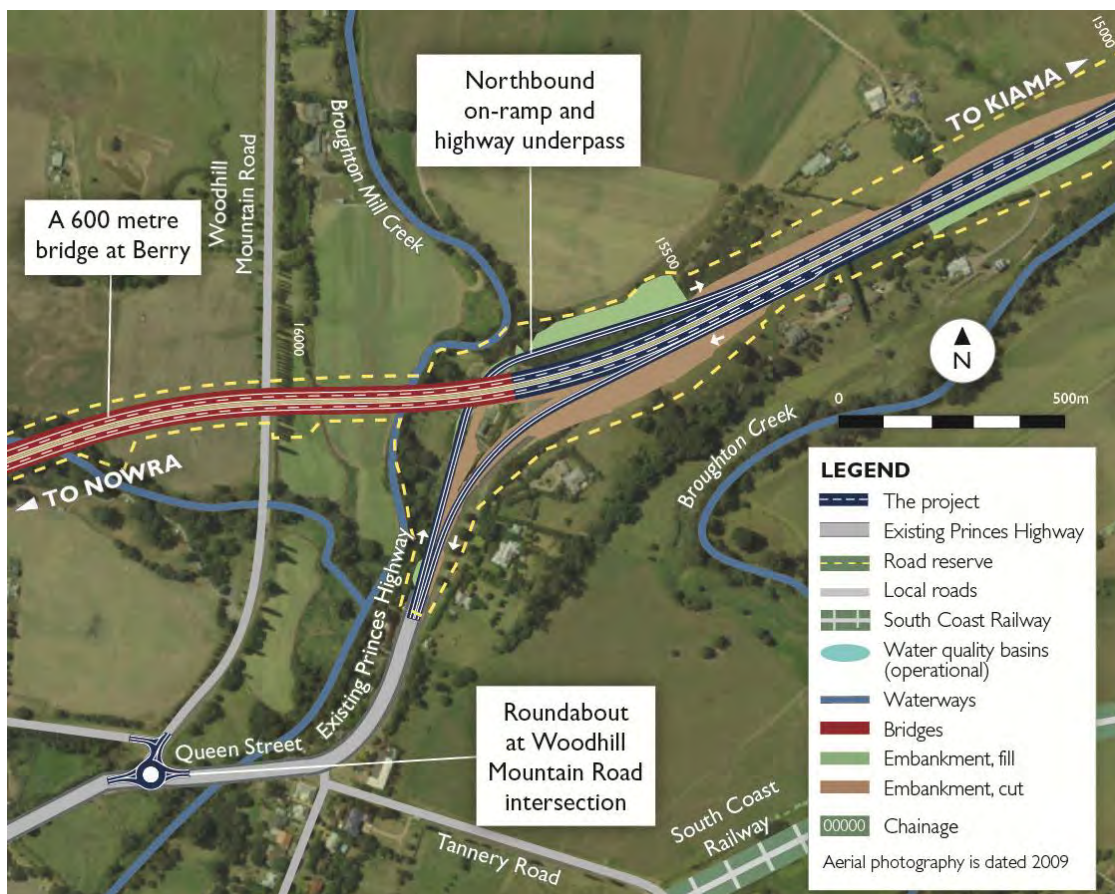
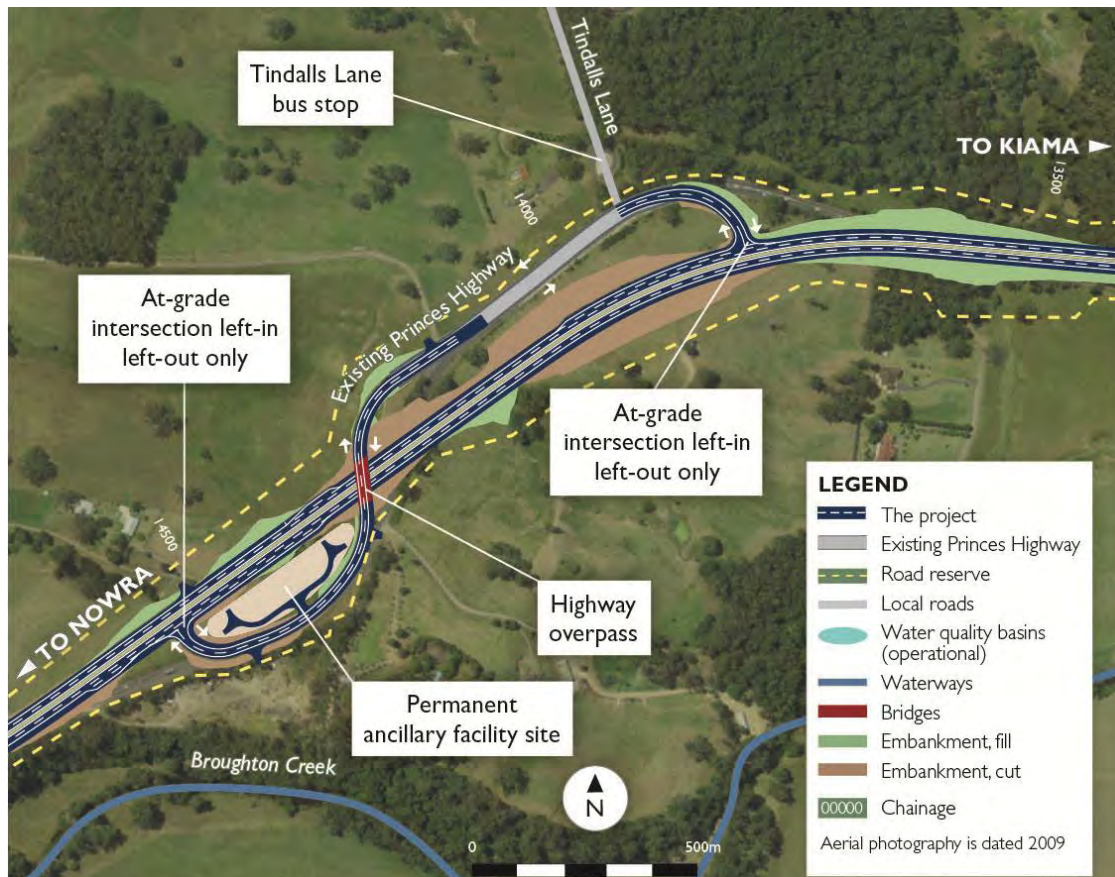
Tindalls Lane interchange

The Tindalls Lane S Type interchange (refer to **Figure 4-9**) would consist of two at grade left-in left-out junctions. The interchange would cross the upgraded highway with a bridge, effectively allowing for all directional movements. A deceleration lane would be provided at each junction.

The interchange would also act as a u-turn facility for highway traffic travelling in both directions. The interchange would incorporate sections of the existing highway and the current bus stop facility at Tindalls Lane would be retained. A permanent ancillary facility site would be provided within the southern 'loop' for use by local RMS and Shoalhaven Council road maintenance organisations, with access to the upgraded highway via the interchange junctions.

Northern interchange for Berry

The northern half interchange for Berry (refer to **Figure 4-10**) would consist of a northbound on-ramp and a southbound off-ramp, serving traffic to and from the north. The southbound off-ramp would follow sections of the existing highway, while the northbound on-ramp would be on a new alignment passing under the new bridge over Broughton Mill Creek. Both ramps would connect to the existing highway just north of Tannery Street.



Southern interchange for Berry

At the southern interchange for Berry (refer to **Figure 4-11**), the highway would pass through a cutting with Kangaroo Valley Road bridging over the highway. Kangaroo Valley Road would be maintained close to current ground surface level, retaining the existing standard of connectivity between the Berry township and the residential development to the north-west along Kangaroo Valley Road and beyond.

The southern interchange would provide for all traffic movements entering and exiting Berry in both northbound and southbound directions and would ensure flood free access to Berry in a 100 year flood event.

The northbound off-ramp would pass under the Kangaroo Valley Road overbridge ending at a new round about. This roundabout has a two way connection to Kangaroo Valley Road and Rawlings Lane as well as a connection to the northbound on-ramp.

Two new roundabouts would be built on Kangaroo Valley Road, one at each end of the overbridge. The roundabout at the northern end of the overbridge would connect to Huntingdale Park Road and to the two-way off and on-ramps.

The roundabout at the southern end of the overbridge would connect to the southbound off-ramp, Queen Street and the southbound on-ramp. Pedestrian and cyclist access would be provided on both sides of the Kangaroo Valley Road bridge (refer to **Section 4.2.15**).

Figure 4-12 provides a cross section of the proposed Kangaroo Valley Road overbridge. It would include a 2.5 metre shared pedestrian and cyclist path on both sides, separated from the traffic lanes by a 1.5 metre wide verge with planter box landscaping.



Figure 4-11 Southern interchange for Berry

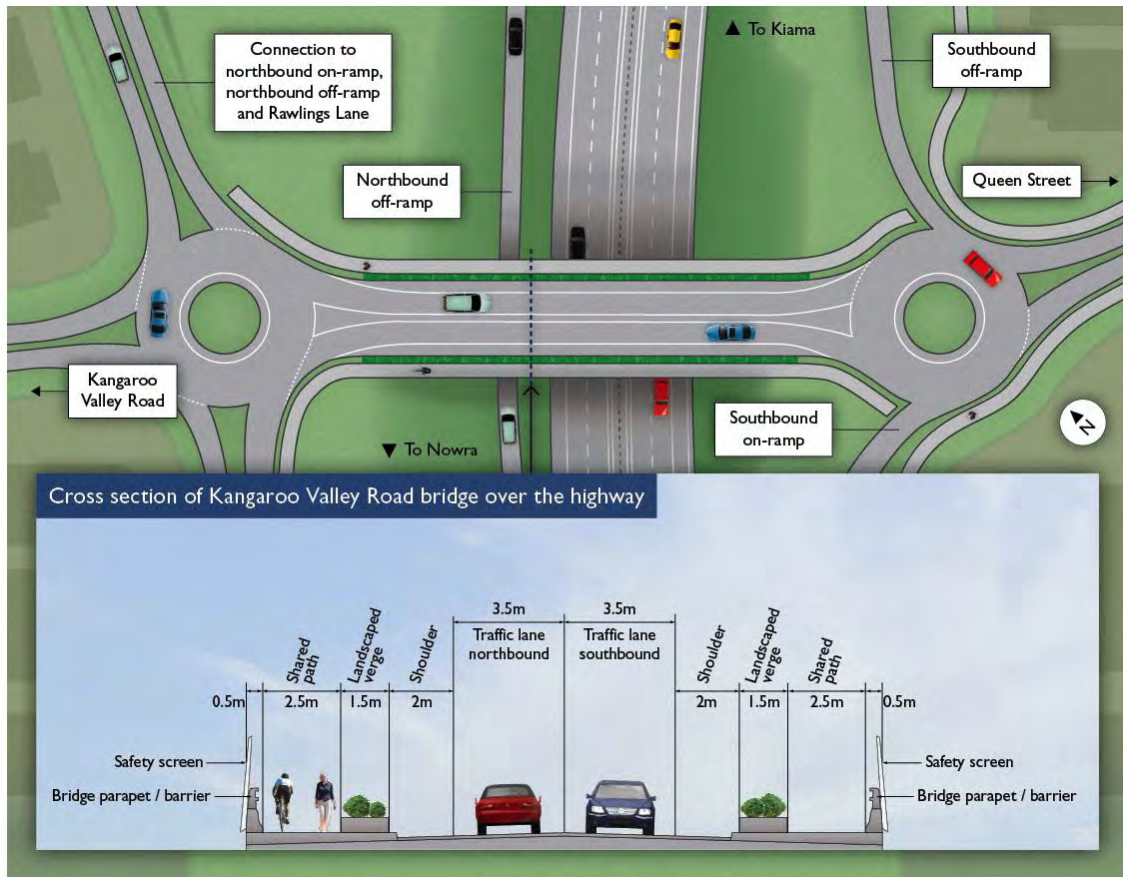


Figure 4-12 Bird's eye view and cross section of the Kangaroo Valley Road bridge at the southern interchange



Figure 4-13 Artist's impression of Kangaroo Valley Road and southern interchange precinct
Image by CM+ (2012)

Schofields Lane junction

The Schofields Lane junction would be relocated about 50 metres north of the existing junction of Schofields Lane and the current Princes Highway, preserving the current access to 'Graham Park'. It would be restricted to a left-in left-out only movements with a deceleration lane provided (refer to **Figure 4-14**).



Figure 4-14 Schofields Lane junction

U-turn facilities at Austral Park Road interchange, Rawlings Lane and Mullers Lane

Austral Park Road interchange

Properties north of the project, west of the southbound on-ramp connection to the existing highway and east of the Tindalls Lane interchange would not be able to access the upgraded highway directly to travel south. These properties would be required to travel north and then perform a u-turn at the Austral Park Road interchange in order to travel south on the upgraded highway. The two way local road connecting to the southbound on-ramp would facilitate this u-turn movement (refer to **Figure 4-8**).

Rawlings Lane

A u-turn facility would be constructed as part of the realignment of Rawlings Lane. This facility would provide for garbage pick-up for the two properties on Rawlings Lane and has been design to cater for both light and heavy vehicles (refer to **Figure 4-11**).

Mullers Lane

Properties east of the project, south of Schofields Lane would only be able to enter the highway in a southerly direction at left-in left-out junctions. Traffic wishing to travel north would travel south on the Princes Highway, turn left into Mullers Lane and utilise the u-turn facility provided. A protected right hand turn on to the highway would be provided from Mullers Lane. The u-turn facility has been designed to cater for both light and heavy vehicles (refer to **Figure 4-14**).

4.2.6 Local roads

Some junctions and local roads would be modified as a result of the project.

Residual sections of the existing highway that would be retained for the provision of access would be reclassified as local service roads, and ownership transferred to Kiama Municipal Council and Shoalhaven City Council as appropriate. This handover would be conducted in accordance with RMS' standard project handover and finalisation processes, following completion of the project.

The project would require the closure of the intersection of the Princes Highway and Hitchcocks Lane. As a result, road access to Hitchcocks Lane would be provided from Huntingdale Park Road as part of the project. The existing intersection of Victoria Street and the highway would also be closed and access to the highway from Victoria Street would be provided via Queen Street and the southern interchange for Berry.

Proposed road closures and modification to local roads and intersections along the alignment are detailed in **Table 4-1**.

Table 4-1 Proposed changes to local roads

Local road	Description of change
Toolijooa Road	Toolijooa Road would be realigned as part of the nearby interchange and a new bus stop installed (refer to Figure 4-7 and Section 4.2.4 for details).
Austral Park Road	Extension and realignment of Austral Park Road to provide access to properties in the vicinity of the Austral Park Road interchange (refer to Figure 4-2).
	Construction of a cul-de-sac at the western end of Austral Park Road extension. Construction of an access road between Austral Park Road and the southbound on-ramp to provide access to the project.
	Change from privately leased public road reserve to a formed public road.
Gembrook Lane	Movement of the current junction with the highway about 200 metres south.
Woodhill Mountain Road, Berry	Construction of a new roundabout to facilitate u-turn manoeuvres at the junction of Woodhill Mountain Road with the existing Princes Highway in Berry (refer to Figure 4-10).
North Street	Severance of North Street into two sections by the project. Construction of a cul-de-sac with property access on the eastern side of the upgraded highway, where the alignment would cross North Street. Construction of a cul-de-sac on the western side of the upgraded highway. Connection of North Street on the western side of the project to Rawlings Lane would be via Kangaroo Valley Road and the new southern interchange (refer to Figure 4-11).

Local road	Description of change
Queen Street	Change from being part of the Princes Highway to a local road.
Rawlings Lane	Removal of the current junction of North Street and Rawlings Lane.
	Realignment of Rawlings Lane to connect to the new Kangaroo Valley Road (southern) interchange. Construction of a u-turn facility (for trucks) and garbage collection facility at the southern end of Rawlings Lane (refer to Figure 4-11).
Kangaroo Valley Road	A new bridge on the existing grade would allow Kangaroo Valley Road traffic to cross over the new highway (refer to Figure 4-11).
Huntingdale Park Road	Construction of a roundabout at the junction of Huntingdale Park Road and Kangaroo Valley Road.
Victoria Street	Closure of the western end of Victoria Street with the construction of a cul-de-sac with a property access tied into the cul-de-sac.
Hitchcocks Lane	Closure of the intersection with the highway. Construction of a property access connection between Hitchcocks Lane and Huntingdale Park Road that would become a local road.
Schofields Lane	Movement of the current junction with the highway about 50 metres north (refer to Figure 4-14).
Mullers Lane	Construction of a u-turn facility (refer to Figure 4-14).

4.2.7 Bridges

Four new major highway bridges, three overbridges and one highway underpass are proposed. These are summarised in **Table 4-2** and a typical cross section is shown in **Figure 4-5**. Each highway bridge has been designed with consideration of the 'Bridge Aesthetics: Design guidelines to improve the appearance of bridges in NSW' (RTA, 2003) and would comprise of:

- Four 3.5 metre wide lanes.
- Three metre wide outer shoulders.
- 2.5 metre wide inner shoulders.

The exception to this is the bridge at Berry, where the shoulders would be three metres wide on the outside adjacent to the bridge barriers and would vary up to three metres in width on the inside, depending on the sight distance. Provision for an additional third lane in each direction would be constructed as part of the project. It would be accommodated by reducing shoulder widths should additional capacity be required.

Crash barriers are proposed at all bridges, with safety throw-screens provided at overbridges with formalised pedestrian access. Formalised pedestrian and cyclist access is only proposed at Kangaroo Valley Road overbridge. No pedestrian or off road cyclist access is proposed along the bridge at Berry.

Maintenance bays would be provided to access abutments at all bridges. A maintenance bay is proposed at the southern end of the bridge at Berry, with access at the northern end available via the on-ramp.

Table 4-2 Proposed bridge structures

Chainage (km)	Description	Type	No. spans	Length (m)	Width (m)	Maximum height (m)	Piers
7700	Toolijooa Road underpass, as part of the Toolijooa Road interchange	Continuous super T ^a	1	32	25	8.5	0
9900	Broughton Creek bridge 1	Continuous super T	4	170	25	9	6
10650	Broughton Creek bridge 2	Continuous super T	3	75	25	8	4
11125	Broughton Creek bridge 3	Continuous super T	6	190	25	13	10
11500	Austral Park interchange overbridge	Cast <i>in situ</i> post tensioned voided slab	1	55	10	8.5	0
14300	Tindalls Lane interchange overbridge	Cast <i>in situ</i> post tensioned voided slab	1	60	13	9	0
15800	The bridge at Berry	Continuous super T	19	600	25	12	54
17675	Kangaroo Valley Road overbridge	Cast <i>in situ</i> post tensioned voided slab	1	48	20	7.5	0

^a – A type of precast concrete bridge girder.

4.2.8 Property access

Direct property accesses would not be provided where the project would deviate from the existing highway alignment. Residents within these sections would continue to access their properties from the existing highway, which would be reclassified as a local road, or via the existing local road network. Detailed impacts to individual property accesses as a result of the project are provided in **Section 7.9**.

Three highway underpasses at chainage 8400 and 9475 and 15100 (box culverts) would be provided where properties would be severed from the existing highway by the project, or where access to the project cannot be provided. Alternative accesses to two North Street properties within Berry affected by the North Street road closure would be provided from the North Street cul-de-sac. Alternative access to the properties on the northern side of North Street would be provided from Rawlings Lane.

Where the project follows the existing highway alignment, direct property access would be provided or consolidated via property access roads where feasible. Direct connections to the highway would include a deceleration lane and signposting, but would be restricted to left-in left-out movements. **Figure 4-15** shows an indicative representation of this arrangement.

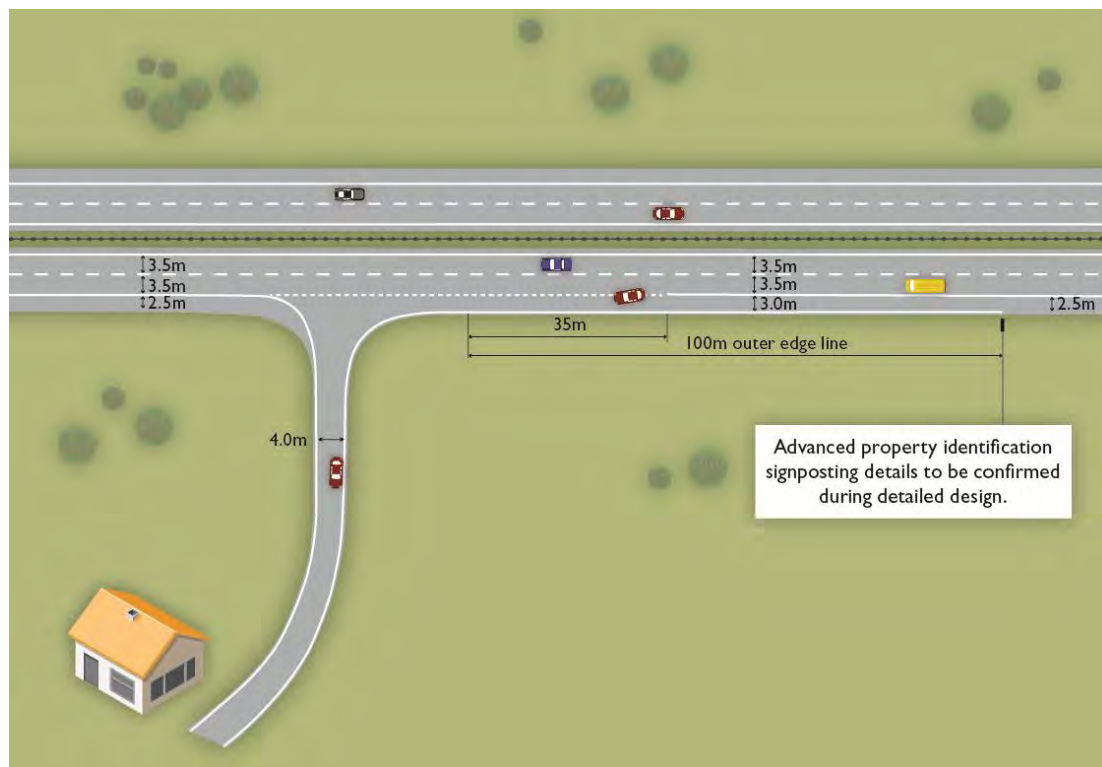


Figure 4-15 Typical rural property access (lengths shown are indicative only)

A central wire rope median barrier would provide significant safety benefits in line with the project objectives by preventing right turn movements across traffic. Motorists wishing to turn right from their properties would be required to turn left onto the proposed highway, and change direction at the nearest interchange or u-turn bay. u-turn bays are provided at Mullers Lane, Rawlings Lane and the Austral Park Road interchange. **Figure 4-16**, **Figure 4-17** and **Figure 4-18** illustrate the property access arrangements for these affected motorists.

Where the current access point could not be maintained, entrances to properties would be relocated. This could include direct access to the upgraded highway at a new location, or to an existing local road (eg at the upgraded Austral Park Road), or to a service road or via a right of way across a private property.

Consultation with property owners about their individual property accesses has been undertaken and is summarised in **Chapter 6** and assessed in **Section 7.9** of this environmental assessment.

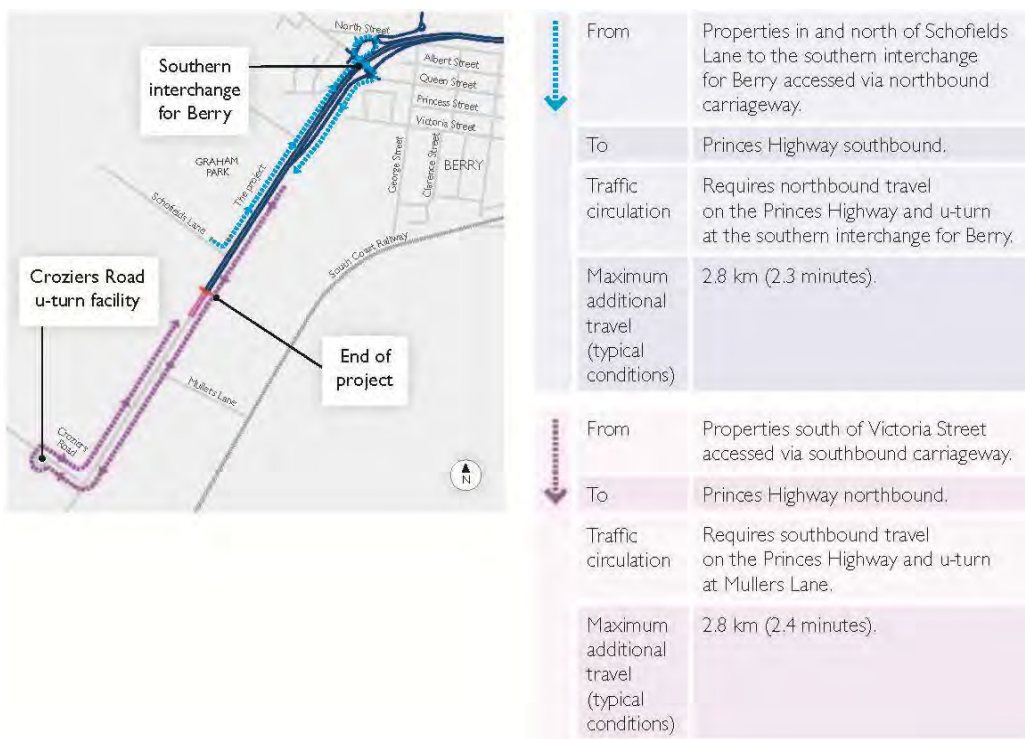


Figure 4-16 Property access arrangements between Austral Park Road and Tindalls Lane

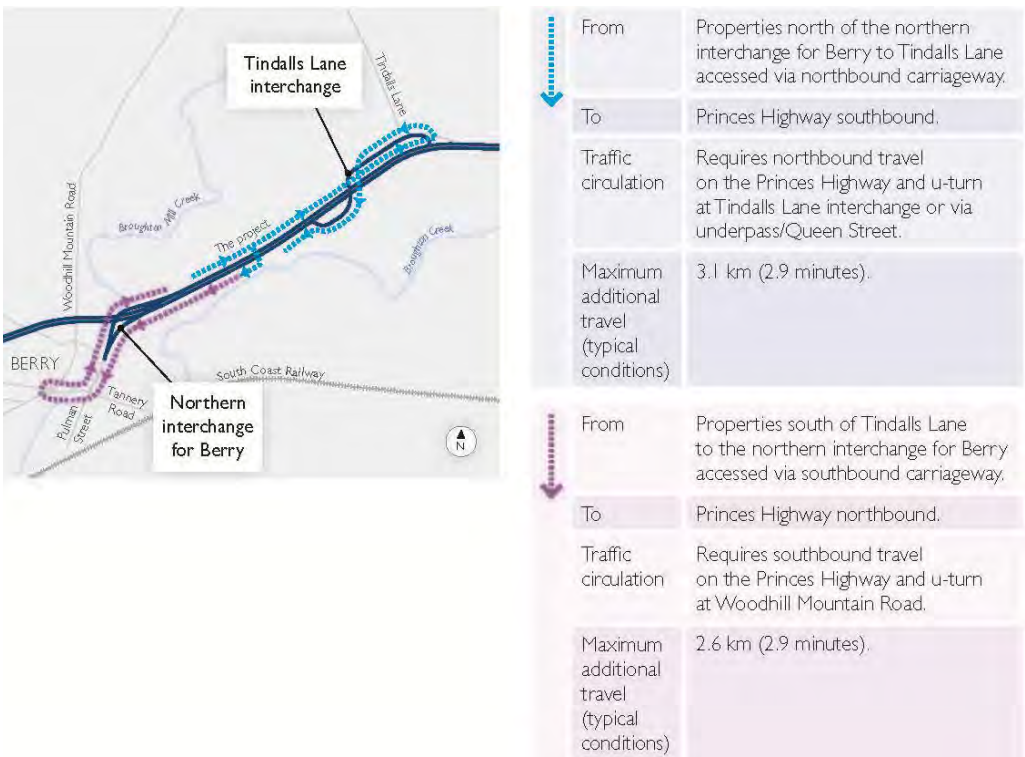


Figure 4-17 Property access arrangements between Tindalls Lane and the northern interchange for Berry

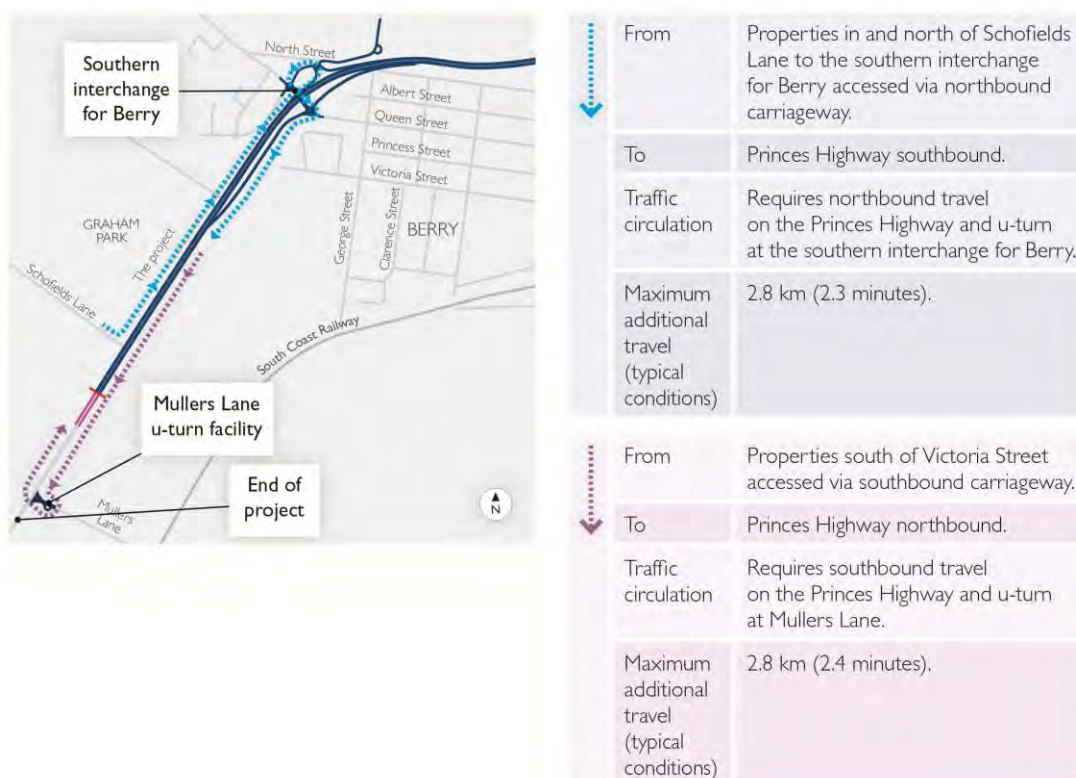


Figure 4-18 Property access arrangements between the southern interchange for Berry and Schofields Lane

4.2.9 Property acquisition

The highway alignment has been designed to restrict land acquisition and to limit the severance of private properties. Based on the concept design, the project would require acquisition of around 63.8 hectares of land over and above land previously acquired by RMS, affecting 51 private properties or properties owned by Shoalhaven City Council. Twelve properties would be severed by the project to create two or more allotments. Five of the twelve properties have already been acquired by RMS (refer to **Section 7.9** and **Section 7.10**). A table showing all properties that have been or would be acquired has been provided in **Section 7.9**.

Where partial acquisitions are required, RMS would realign private property fencing as part of preliminary construction work.

The total area that would be acquired for the project may change as the project alignment is refined during the detailed design phase of the project, or in response to any changes resulting from the exhibition of this environmental assessment and any conditions of approval issued by the Minister for Planning and Infrastructure.

All partial and full property acquisition would be undertaken in accordance with the 'Land Acquisition Information Guide' (RTA, March 2011) and the *Land Acquisition (Just Terms Compensation) Act 1991*. Consultation with all affected property owners has been undertaken at all stages of the project development (refer to **Chapter 6**) and would continue to occur during detailed design.

4.2.10 Drainage structures and fauna crossing structures

Drainage and fauna crossing structures would include:

- 16 pipe culverts.
- Five box culverts, including one dedicated drainage culvert, two dual use culverts for drainage and fauna passage and two dedicated fauna underpasses.

Drainage structures

The project includes 19 drainage structures, including three box culvert structures and 16 pipe culvert structures. Two of these box culverts would have a dual purpose as fauna underpasses and are discussed further in the fauna crossing structures section below. Existing drainage structures would be replaced and upgraded to satisfy the project design requirements.

Cuttings, embankments, bridges and pavements would each have drainage systems to collect surface water runoff. These would comprise gutters, pits, berms and catch drains and pipes. Surface drainage at bridges would be collected and conveyed longitudinally to the main highway drainage system rather than discharging directly into the receiving waterway.

The final design and configuration of the culverts, scour protection measures and drainage systems would be confirmed during the detailed design phase of the project.

Permanent water quality basins

Runoff would be discharged to water quality basins and associated grass swales at various locations along the length of the project (refer to **Section 7.4**). Water quality basins would be within the project footprint. The size of water quality basins would be based on providing 300 cubic metres of working volume per hectare of catchment. The locations of the basins would also be based on avoiding and protecting sensitive receiving environments. Biofiltration systems would also be considered during detailed design and would be used to protect sensitive receiving environments along the project alignment (refer to **Section 7.4.4**).

Fauna crossing structures

Four box culverts would be provided to serve as fauna underpasses (refer to **Section 7.3**). Two of the culverts would be dedicated to fauna movement only and two would serve a dual drainage and fauna movement function. The location and dimension of these structures are provided in **Table 4-3**.

Table 4-3 Dimensions of fauna underpasses

Chainage	Location	Type	Width	Length
8450	Toolijooa Ridge	Dedicated fauna underpass box culvert	1.5 metres	45 metres
12800	Western end of the Austral Park Road extension (1200 metres east of Tindalls Lane)	Dual use box culvert	1.5 metres	60 metres
13320	600 metres east of Tindalls Lane	Dual use box culvert	1.5 metres	50 metres
13680	300 metres east of Tindalls Lane	Dedicated fauna underpass box culvert	1.5 metres	55 metres

Fauna 'furniture' such as rocks, piping, raised log railings and refuge poles would be included within the dedicated dry passage part of the culverts. The new highway bridges would also act as fauna underpasses.

In addition to the box culverts that would provide fauna underpasses, 17 rope bridges would be located at all creek crossings, on Toolijooa Ridge, east of Tindalls Lane and at the bridge at Berry. Rope bridges would cross over the project, under the new highway bridges, adjacent to the project and over the existing highway. Fauna crossing structures locations and design have been identified through ecological investigations, consultation with NOW, OEH and Southern Rivers Catchment Management Authority and in conjunction with local environment groups, such as local Landcare groups (refer to **Section 7.3** and **Figure 4-1** to **Figure 4-3**).

4.2.11 Town Creek diversion

Town Creek is a small ephemeral watercourse that passes directly through the Berry township. Upstream from the area around North Street, Town Creek is a degraded channel through highly modified grazing lands that only flows during or following a rainfall event. An open channel would be constructed to divert the section of Town Creek above North Street into Bundewallah Creek north of the project (refer to **Figure 4-3**).

Diverting Town Creek enables the proposed alignment in the vicinity of North Street and the Kangaroo Valley Road interchange to be lowered resulting in a lower apparent height of the proposed noise barrier along North Street. The diversion would also provide flood protection up to the 1 in 100 year flood event to the highway and the access into Berry at the southern interchange.

Flows would be diverted up to the 1 in 100 year flood event and the diversion channel would be sized to accommodate this flood event. The start of the diversion would be formed close to where the creek currently crosses North Street. The channel would run along the western edge of Rawlings Lane before crossing under the lane at a bridge. It would then run along the eastern edge of Rawlings Lane before joining Bundewallah Creek and include a meander as part of the design.

The length of the diversion would be about 400 metres and the width of the impacted area would be between 20 metres and 50 metres and this includes the batters that would be constructed on either side of the channel. One side of the diversion would be steeper than the other side with gradients between 2:1 and 10:1. This would allow for both revegetation of the steeper slope and grazing on the gentler slope. The diversion would be constructed to provide a balance between agricultural activities, weed maintenance and biodiversity values and would be grassed and planted with native vegetation. The design of the diversion would include scour protection, at the bends of the diversion, to prevent erosion and scour during high flow periods. The design of the diversion, including the width of the channel in low flows and the overall footprint would be confirmed during the detailed design in consultation with relevant stakeholders. The creek diversion is discussed further in **Section 7.3** and **Section 7.5**.

Town Creek currently flows through the Berry township and joins Broughton Mill Creek south of Berry. The diversion of Town Creek would be designed so that there is no net loss of flow from the Broughton Mill Creek system.

Typically a creek diversion would require an approval under section 91 of the *Water Management Act 2000*, however due to section 75U(1)(h) of *EP&A Act 1979* this approval is not required. This is discussed further in **Section 5.3.1**.

4.2.12 Utility services

The major utilities that would be impacted by the project are shown in **Figure 4-19**, and include the Eastern Gas Pipeline (operated by Jemena), fibre optic cables (operated by Optus and Telstra), a low voltage electricity distribution network (operated by Endeavour Energy), and sewage and water pipelines (operated by Shoalhaven Water). The utility providers have been consulted in relation to the project and feedback, where provided, is summarised in **Chapter 6**.

The areas where utilities cross the project corridor would be either excavated for cuttings or filled to create embankments due to the construction requirements of the project. At these locations, utilities would either require protection and/or relocation to cater for the project and to ensure the continuation of services during construction.

Where sections of the existing highway would be upgraded, any existing minor utilities would be relocated as required to suit the new alignment. Temporary utility diversions may also be undertaken should the new permanent alignment be located within the active construction footprint.

These works would occur during the pre-construction stage of the project and would be supported by a detailed survey of the proposed alignment to identify all utilities affected. Modifications to the affected utilities would be in accordance with the design and construction methods approved by the relevant service authorities.

Eastern Gas Pipeline

The most significant gas asset in the project area is the Eastern Gas Pipeline, which is owned and operated by Jemena. The Eastern Gas Pipeline was constructed in 2000 and runs from northern Victoria to western Sydney. It is a 450 millimetre diameter 15 MPa main pipeline buried at a depth between 0.9 metres and 1.2 metres below ground level. The gas main broadly follows the entire project within a 1.5 kilometre margin either side, crossing under the existing highway in the vicinity of Tindalls Lane, to the north of Berry.

Preliminary consultation with Jemena indicated that the construction of an embankment at this location would be feasible. However, further consultation would be required during detailed design. This would determine the appropriate protection measures required to maintain the integrity of the pipeline during construction and operation. This would likely include the encasement of the pipeline in accordance with Jemena's specifications.

Electrical transmission lines

Endeavour Energy operates a number of electrical transmission lines in the area including:

- An overhead 132 kV transmission line that traverses the western side of Berry.
- A 33 kV transmission line that generally follows the South Coast Railway line from the northern extent of the project area to Berry.
- An overhead 11 kV network and local low voltage distribution network which corresponds to the local road network over the entire project area.

Adjustments to the alignment and associated infrastructure of Endeavour Energy's low voltage electricity network would be required, both where the existing highway alignment would be widened, and along local roads within Berry which would be modified as part of the project. The 11 kV distribution lines along Woodhill Mountain Road would require adjustment due to the construction of the bridge at Berry. The preferred options would be to bury the lines underground and under the bridge. The final option for this adjustment would be determined in conjunction with the service provider.

Sewer and water pipelines

Shoalhaven Water operates a sewer and water network in the Shoalhaven local government area (LGA), which includes Berry. Water is provided to Berry from reservoirs located in the vicinity of Kangaroo Valley Road, around 400 metres west of the intersection with Bundewallah Road. Two asbestos cement mains pipes leave the reservoir and run along Kangaroo Valley Road to the intersection with North Street and then along North Street to the intersection with George Street. Another runs south west from Kangaroo Valley road, along Hitchcocks Lane to George Street. It then runs south west along the rail line. The sewer network in Berry extends as far east as Pulman Street, and culminates at the Berry Wastewater Treatment Plant off Wharf Road, south of Berry. The Berry Wastewater Treatment Plant discharges to Broughton Creek.

During the pre-construction stage of the project, the following would be completed for these utilities in consultation with Shoalhaven Water:

- Adjustment of the Shoalhaven Water sewer main along Kangaroo Valley Road, aligning the main between Kangaroo Valley Road and North Street to avoid the cutting at the southern interchange at Berry.
- Concrete encasement of the Shoalhaven Water sewer and water mains along North Street and Hitchcocks Lane, where the highway would cross the sewer alignment.
- Relaying Shoalhaven Water's water mains within ducts in the new Kangaroo Valley Road overbridge.

Telecommunications

Optus operates a fibre optic cable between Sydney and Melbourne. South of Berry, this cable traverses the project on a similar alignment to the Eastern Gas Pipeline and Endeavour Energy's 132 kV transmission line. North of Berry, the cable alignment is similar to the Eastern Gas Pipeline alignment and crosses under the existing highway around 1.5 kilometres east of Tindalls Lane.

The major Telstra asset located in the vicinity of the project is a fibre optic cable that runs between Sydney and Melbourne. This cable follows the southern side of the South Coast Railway Line through the project area.

Telstra also owns and operates fibre optic inter-exchange network cables between telephone exchanges which carry high volumes of data between Berry and Kangaroo Valley and between Berry and Nowra.

During the pre-construction stage of the project, the following would be completed for these utilities:

- Realignment of the Optus fibre optic cable, where it traverses the eastern side of the corridor north of Berry for around 800 metres, and encasing the cable where it crosses the highway around 1.5 kilometres north of Tindalls Lane.
- Relaying of the Telstra fibre optic cable and Shoalhaven Water's water mains within ducts in the new Kangaroo Valley Road overbridge.

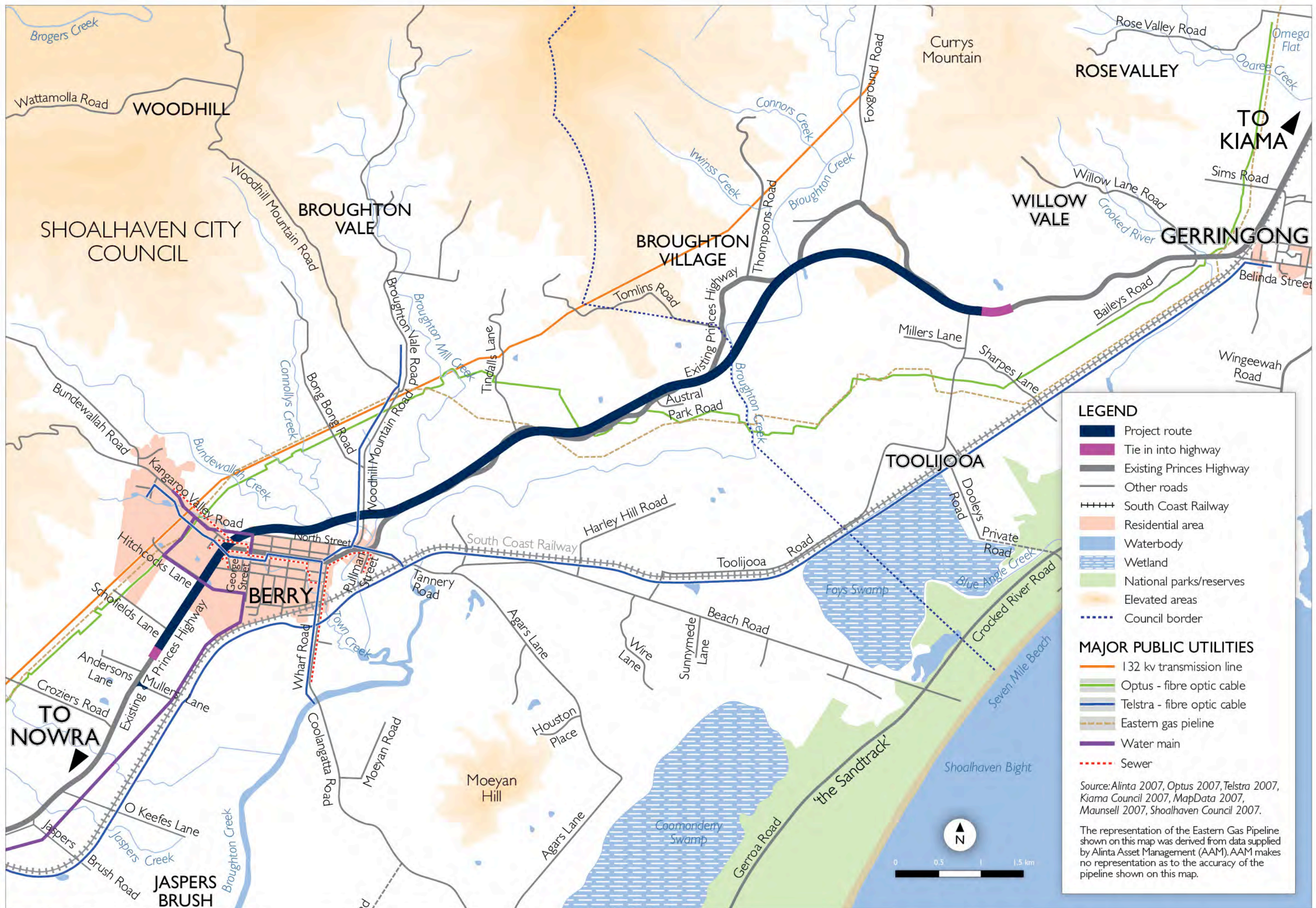


Figure 4-19 Major utilities within the project corridor

4.2.13 Emergency facilities

An emergency u-turn facility would be provided between the interchanges at Toolijooa Road and Austral Park Road (chainage 10950). The proposed median barrier would be discontinued and a permanent gap would be provided. Signposting would denote that the facility is for use by emergency vehicles and RMS vehicles only. A lay-by with an emergency telephone would be provided on both sides of the highway.

Dedicated at-grade public u-turn facilities are not proposed on the highway on the basis that the frequency of grade-separated interchanges and off line u-turn facilities included as part of the project minimises the need for such facilities.

In the case of a significant traffic incident that blocks all lanes, the emergency u-turn facility would be used to redirect traffic to contra flow under emergency services control. The continuous median safety barrier would also have the ability to be 'dropped' at key locations when a u-turn facility is needed.

The 'Sandtrack' would also be maintained as an alternative route during major incidents, as currently identified in the 'Incident Response Plan for HW1 Princes Highway within Kiama Municipal Council boundaries' (RTA, 2010) and 'Incident Response Plan for HW1 Princes Highway within Shoalhaven City Council boundaries' (RTA, 2010).

4.2.14 Service centres

The project would not include the provision of land or services for a future service centre.

The proposed signage strategy would direct motorists to Gerringong, Berry and Bomaderry for fuel and refreshments and other services.

4.2.15 Heavy vehicle rest areas

The project would not include the provision for heavy vehicle rest areas for northbound or southbound traffic.

Upgrades of existing heavy vehicle rest areas north and south of the project area are currently being planned and are proposed by RMS within the scope of other projects. These upgrades would also be likely to reduce the occurrence of fatigue related crashes. Further details are provided in **Chapter 3**.

4.2.16 Operational ancillary facilities

A permanent ancillary facility site would be provided at the Tindalls Lane interchange, utilising excess land in between the highway and a modified section of the existing highway (refer to **Figure 4-2**). The site would be about 0.8 hectares in area and would be accessed from the existing highway. It would be used for the interim storage of materials and equipment required for road maintenance, and would be jointly used by the RMS, Shoalhaven City Council and/or their contractors. The volume of material stored at the site would vary depending on maintenance requirements. The layout of the facility would be subject to detailed design, but would include site fencing, silt fences, screening and permanent stormwater detention and treatment facilities. A description of construction ancillary facilities is provided in **Section 4.4.7**.

4.2.17 Pedestrian and cyclist facilities

Dedicated pedestrian and cyclist facilities would not be provided along the main alignment of the project, but pedestrians and cyclists would be able to safely use the 2.5 metre wide outer shoulder of the highway. Under the ultimate three lane scenario, the shoulders on the bridge at Berry would be reduced to accommodate the additional traffic lanes and cyclists approaching Berry from either direction would be directed through Berry as the bridge at Berry would no longer provide cycling facilities.

A 2.5 metre off-road shared pedestrian/cycle path would be provided on both sides of the Kangaroo Valley Road overbridge. A shared pedestrian/cycle path would also be provided south of the southern interchange for Berry, connecting Kangaroo Valley Road to Queen Street and Mark Radium Park. Another path would be provided east of the interchange, connecting Kangaroo Valley Road to Queen Street and the North Street corridor. This path would extend along the northern edge of North Street to the Berry sportsgrounds.

Connections to adjoining pedestrian and cyclist networks would be considered during detailed design and with consideration to the existing pedestrian access mobility plans for the township of Berry (refer to **Section 7.6**).

4.2.18 Street furniture and Berry entry statements

Roadside furniture elements would be included along the length of the project for safety reasons, indicating delineation, directional guidance, fauna exclusion and for security purposes. Indicative details on the street furniture are provided in **Table 4-4** and the location and design of these elements would be further refined during detailed design. All roadside furniture elements would be designed in accordance with the urban design objectives set out in **Section 4.3.2**.

The new Berry access points would be landscaped with plants consistent with the landscape character of Berry. Signs would be designed legibly to allow road users to transition from the highway into town in a safe manner (refer to **Section 7.6**).

As the northern interchange for Berry would be visually separated from the township (when travelling southbound), relocation of the existing Alexander and David Berry memorial to the Berry interchange would be considered in consultation with Shoalhaven City Council. Existing Kiama Municipal Council area and Shoalhaven City Council area entry statements would also be relocated in consultation with the two councils, where they are affected by the project.

South of Berry, between Schofields Lane and the southern interchange for Berry and Schofield's Lane a permanent variable message sign (VMS) for northbound traffic would be installed on the western side of the project (refer to **Table 4-4**). If appropriate this VMS may be installed early in the construction phase to provide advice on traffic network changes, safety and travel time advice to motorists during the construction period.

Southbound traffic would be serviced by the use of a proposed, permanent VMS just north of Belinda Street and would be constructed as part of the Gerringong upgrade.

Table 4-4 Street furniture

Item	Indicative details
Safety barriers	A range of safety barriers (with the appropriate transitions) would be provided to protect vehicles from potential collision hazards and would be tailored depending on safety requirements. This would include wire rope barriers, concrete barriers and steel beam barriers where appropriate.
Line marking	Line marking would be in accordance with RMS standards and would include reflective lines and raised pavement markers. Additional delineation would be provided by way of standard reflectors on safety barriers and guideposts.
Traffic signs	Traffic signs would be provided to ensure the legibility, consistency and compatibility between the project and the State road network, and would satisfy regulatory requirements. The signposting scheme would be developed in accordance with RMS guidelines and in consultation with relevant stakeholders.
VMS	A VMS would be installed to provide up-to-date, real time road safety and travel information for motorists, including information on alternative routes or diversions in the event of a major incident, or information on the condition of other regionally significant roads (such as Kangaroo Valley Road). The VMS would face northbound traffic and be located within the road reserve south of the off-ramp at the southern interchange for Berry. A minimum height clearance of 5.5 metres from the roadway would be provided. The proposed location for the VMS would be between chainage 18650 and 18700. This location ensures the VMS would be located outside of areas of environmental sensitivity such as threatened species habitat. The site would be selected to avoid significant impacts to residences, businesses or local accesses.
Lighting	Highway lighting would be limited to grade-separated intersections which would generally have ramp terminals, merge/diverge, and weaving areas lit in accordance with AS/NZS 1158 Code of Practice for Public Lighting.
Fencing	Fencing would be provided along the boundary of the road reserve and private land to demarcate land ownership. Temporary security fencing may be utilised during construction, however it would not be required for operation and would be removed on completion. Dedicated fauna exclusion fencing would be provided to prevent fauna accessing the highway. It would be located around 200 metres on either side of fauna underpasses, and along the northern side of the western abutment of the bridge at Berry (refer to Section 7.3).
Council area entry statements	Entry statements for the Municipality of Kiama and Shoalhaven City would be provided along the project alignment in proximity to the LGA boundary in accordance with the applicable council standard. The location and design would be determined in consultation with each council.

4.2.19 Noise attenuation

Noise attenuation would be considered during detailed design and in consultation with affected landowners to reduce road traffic noise levels at the residential properties located along Huntingdale Park Road and the North Street corridor. The indicative locations of proposed noise barriers are shown in **Figure 4-3**.

The proposed North Street noise barrier would be on the southern side of the project. It would extend from the western end of the bridge at Berry to the southern interchange for Berry and would be around four metres in height above the road surface. The barrier would likely consist of a precast concrete barrier with low level landscaping at the base of the barrier on the side of the project, where feasible. A landscaped embankment would be built close to the top of the barrier on the North Street side to minimise the visual impact.

The proposed Huntingdale Park Road noise barrier would likely be located along the northbound off-ramp for the southern interchange for Berry and based on the proposed design, would be around four metres in height and around 200 metres long. The final details of height and length would be determined during detailed design. Noise barriers constructed as part of the project would be designed in accordance with the RMS 'Noise wall design guidelines: Design guidelines to improve the appearance of noise walls in NSW' (RTA, 2007).

In addition to the noise barriers, some isolated residences would be considered for architectural treatments where project noise limits would be exceeded. Low noise pavement and low noise bridge joints would also be considered.

Treatments would be determined where feasible and reasonable in consultation with affected landowners and in accordance with the *Road Noise Policy* (OEH 2011) and the Environmental Noise Management Manual (RTA, 2001) during the detailed design stage of the project. Noise attenuation requirements are discussed in **Section 7.2**.

4.3 Design

4.3.1 Design criteria

The project has been designed in accordance with the 'Road Design Guide' (RTA, 1998) and has considered subsequent amendments to the guide. The design criteria applied to the project is provided in **Table 4-5**.

Table 4-5 Design criteria

Criteria	Requirement
Highway alignment and cross section	
Design speed	Horizontal 110 kilometres per hour Vertical 100 kilometres per hour
Minimum "K" value ^a	Crest 66 Sag 33.4 ^b
Stopping sight distance	Reaction time 2.5 seconds Horizontal 210 metres Vertical 175 metres
Horizontal radius	On line upgrade minimum 600 metres Off line construction minimum 750 metres
Upgrade lanes (in each direction) Ramps	2 ^c 1
Climbing lanes	Loss of truck speed to 40 kilometres per hour and LoS D 20 years after construction
Grade	Desirable maximum 6 per cent ^d Absolute maximum 8 per cent
Lane width (including interchange ramps and auxiliary lanes)	3.5 metres

Criteria	Requirement
Shoulder width	Nearside (outside) 2.5 metres Offside (median) minimum 1 metre
Median width ^e – No right turn bay	With wire rope barrier 5 metres With Type F concrete barrier 2.6 metres
Median width ^e – Right turn bay treatment required	10 metres
Clearance to boundary	Minimum 6 metres
Flood immunity	1 in 100 year storm event for new structures. A minimum of 1 in 20 year storm event if an existing structure can be utilised subject to structural capacity adequate for new design life.
Batters	Fill < 1.5 metres high – 4:1 (maximum slope) Fill > 1.5 metres high – 2:1 (maximum slope) Cut 2:1 or flatter – 7 metres maximum between benches Cut steeper than 2:1 – 10 metres maximum between benches
Design vehicle highway	25 metre B-double 12.5 metre single unit truck (emergency vehicle u-turn bays) 19 metre semi-trailer (access u-turn bays)
Design vehicle local road	19 metre semi-trailer (unless designated a B-double access)
Design vehicle – property access	19 metre semi-trailer (farm residence and paddock access by negotiation with the land owner)
Bridges^f	
Outside shoulder	2.5 – 3 metres (to match approach shoulder width)
Median shoulder	Minimum 1 metre
Vertical clearance – over highway	5.3 metres
Vertical clearance – over regional and local road	4.6 metres

Notes:

- The K value is a geometric design term used to determine the length of vertical curvature along a road between two varying grades.*
- Refers to sag vertical curves which are concave upwards. This is used to determine headlight and comfort criteria.*
- Provision for future widening on the outside would be included. The climbing lanes would occupy the ultimate third lane at Toolijooa Ridge.*
- No criteria applies regarding maximum length of grade.*
- Measured edgeline to edgeline.*
- The details of Kangaroo Valley Road bridge have been provided in **Section 4.2.4** with respect to pedestrian and cyclist access and widths.*

4.3.2 Urban design principles and objectives

As discussed in **Chapter 2 and Chapter 3**, the project objectives are supported by six urban design objectives, which have been considered during the development of the concept design and form the basis of the landscape and visual assessment documented in **Section 7.6 and Appendix I**. The detailed design of the project would be in accordance with the following objectives:

Objective 1 – Provide a flowing highway alignment that is responsive and integrated with the natural landscape

- Respond to the grain of the landscape in route selection, including following the edge of valleys and hills and avoiding disruption to vegetation stands, including both natural vegetation and cultural plantings.
- Integrate cut and fill embankments with surrounding terrain by grading out and varying slopes.
- Consider independently grading carriageways.
- Preserve cultural patterns in the landscape.
- Avoid significant features of the areas through which the alignment passes as much as possible.
- Vary the gradient of the earthworks to provide visual interest and reflect the characteristics of the surrounding landform and landscape.
- Grade cuttings and embankments wherever practicable to best fit the characteristics of the local landform, returning the land to either its former use or replacing vegetation lost to the project.

Objective 2 – Protect the natural systems and ecology of the corridor

- Avoid areas of natural vegetation, particularly those containing threatened species and communities.
- Minimise disruption to natural drainage patterns both through route selection and road design.
- Minimise the number of crossings of Broughton Creek and other creeks in the study area.
- Use medians and road verges to maximise habitat value and maintain pollination paths and wildlife movement patterns where feasible.
- Highway corridor landscape qualities and characteristics should respond to and be integrated with the areas through which it passes.
- Integrate water quality basins with the landscape form and character.

Objective 3 – Protect and enhance the heritage and cultural values of the corridor

- Avoid items of identified European and Aboriginal heritage and cultural value.
- Acknowledge and respond to the heritage and cultural values of the rural landscape.
- Acknowledge and respond to Aboriginal value placed on the broader landscape.
- Reduce the visual and noise impact of the highway through the design of the project.
- Consider the important value of the productive landscape within the landscape.

Objective 4 – Respect the communities and towns along the highway

- Minimise the impact of the project on the amenity of Berry residents.
- Provide effective and efficient access to Berry.
- Design new town access points as an important and integral part of the town, ensuring a clear and consistent access way.
- Minimise the disruption and loss of amenity to rural communities in the study area.

Objective 5 – Provide an enjoyable, interesting highway with strong visual connections to the immediate hinterland and the mountains to the west

- Acknowledge the role of this section of Princes Highway as an important part of a longer scenic drive along the NSW south coast.
- Maximise opportunities for high quality and varied views of the coast, the rural landscape and adjacent mountain ranges.
- Provide visual connections and easy, well marked access to the towns along the route.
- Use landscape treatments to soften the road appearance for the road user without compromising opportunities for key views.
- Consider the heritage of the highway in the upgrade so that where practicable, road users may experience it.

Objective 6 – Develop a simple and unified palette of elements and details that are easily maintained

- Develop a consistent approach to bridge development along the project. Urban design principles to be consistent with those outlined in the 'Bridge Aesthetics: Design guidelines to improve the appearance of bridges in NSW' (RTA, 2003).
- Develop a consistent approach to the design of noise barriers along the project. Urban design principles to be consistent with those outlined in the 'Noise wall design guidelines: Design guidelines to improve the appearance of noise walls in NSW' (RTA, 2007).
- Develop an integrated strategy for the avoidance, minimisation and improved appearance of shotcrete as outlined in the 'Shotcrete Design Guidelines: Design guidelines to avoid, minimise and improve the appearance of shotcrete' (RTA, 2005).
- Develop a consistent approach to the design of soft landscape along the project. Planting design principles to be consistent with those outlined in the 'Landscape Guideline: Landscape design and maintenance guidelines to improve the quality, safety and cost effectiveness of road corridor planting and seeding' (RTA, 2008).

4.3.3 Landscape framework

A landscape framework has been developed for the project which would provide the structural layout for the future landscape design of the project while being responsive to the design objectives. It responds to the four key landscape character precincts identified within the project. These landscape character precincts reflect the natural and built environments, and are referred to as the Toolijooa Ridge, Broughton Creek, North Berry and Berry Township landscape character precincts (refer to **Section 7.6**).

The landscape treatment details would be finalised during detailed design and subject to consultation with relevant stakeholders.

4.3.4 Design refinement

The project description presented in this environmental assessment represents the project concept design. Sufficient flexibility has been provided in the design to allow for its refinement during detailed design or in response to any submissions received following the exhibition of the environmental assessment or to minimise environmental impacts. The final design may therefore vary from the concept design presented in this chapter. This would include, but is not limited to, the flattening of cuttings and embankments at the Toolijooa Ridge cutting and the Broughton Creek floodplain, design of noise attenuation measures (in consultation with affected property owners), the appearance of the entry into Berry, the design of the Kangaroo Valley Road overpass, access arrangements (in consultation with landowners), the diversion of Town Creek and the design of the space between the proposed highway and North Street, including landscaping and pedestrian and cyclist access.

4.4 Construction activities

4.4.1 Overview of construction activities

Details of the proposed pre-construction and construction activities are provided in **Table 4-6**.

The methods used to construct the project would be conventional techniques employed on major road projects, adapted to account for project-specific environmental and social constraints. Local access requirements and the geotechnical conditions would influence the final choice of construction techniques to ensure the project is constructed in a safe, operationally functional, and efficient manner. The types of equipment and plant requirements would be refined during detailed design and during the development of the construction methodology by the construction contractor.

Table 4-6 Potential pre-construction and construction activities

Component	Typical activities	Typical plant, equipment and materials
Site establishment	- Fencing of the road corridor. - Implementation of initial environmental safeguards. - Establishment of construction site facilities and access. - Additional surveys and geotechnical investigations, as required. - Installation of temporary traffic controls and line marking.	Fences, portable sheds, portable toilets and fuel storage tanks.
Relocation/ protection of services	- Consultation with relevant service providers on service relocation. - Relocation or protection of services.	Trucks, cranes, excavators, elevated work platform vehicle, backhoes and trenchers and small equipment.

Component	Typical activities	Typical plant, equipment and materials
Site preparation	- Vegetation clearing and grubbing. Processing (including recycling) of various materials for use in fencing or landscaping activities. - Installation of site sediment and erosion controls and pollution management measures. - Stripping and stockpiling of topsoil for reuse. - Construction of internal haulage and access routes. - Adjustment of some property accesses. - Construction of temporary creek crossing structures.	Trucks, bulldozers, scrapers, excavators, backhoes and small equipment.
Earthworks and bridge construction	- Removal and stockpiling of spoil and unsuitable material. - Earthworks, including blasting and movement of materials along the alignment from cutting to fill embankment areas. - Ground improvements for soft soils (refer to Section 4.4.3). - Batter treatments. - Bridge construction, including abutments and delivery of pre-cast elements and installation of piers.	Piling rigs, trucks, bulldozers, excavators, scrapers, graders, water carts, compactors, rollers, blasting equipment, rock crushing equipment and elevated work platform vehicle.
Drainage and fauna crossings	- Preparation of construction diversion drains and sedimentation ponds. - Construction of road drainage structures, including culvert extensions and permanent sediment basins.	Concrete pumps, cranes, excavators, trucks, trenching equipment, small equipment and elevated work platform vehicle.
Pavements	Construction of pavement layers including selected material, sub-surface drainage, sub-base and base layers and surfacing.	Trucks, graders, water carts, compactors, trenching equipment, bitumen sprayers, asphalt paver, vibratory rollers and rubber-tyre rollers.
Improvements to existing highway	- Earthworks. - Construction of pavement layers including selected material, sub-surface drainage, sub-base and base layers and surfacing as required.	Graders, backhoes, trucks, water carts, vibratory compactors, trenching equipment, bitumen sprayers, vibratory rollers and rubber-tyre rollers.

Component	Typical activities	Typical plant, equipment and materials
Other works	• Installation of safety barriers, lighting, fencing and roadside furniture. • Line marking and raised pavement markers. • Sign posting. • Landscaping. • Installation of noise barriers. • Relocation of property accesses.	Trucks, fencing and barrier materials, landscaping materials, cranes, line markers and small equipment.
Finishing works	• Removal of temporary works. • Progressive rehabilitation of disturbed areas. • Restoration and landscaping of temporary sites. • Site clean-up and disposal of all surplus waste materials.	Trucks and landscaping materials.

4.4.2 Pre-construction

Post approval surveys would likely include:

- Pre-clearing and habitat surveys to delineate buffer or no go zones.
- Geotechnical surveys, as required.
- Heritage surveys and salvage works, as required.

4.4.3 Earthworks

Fill batters would be generally sloped at 2:1 horizontal to vertical. Cut batters would vary from around 2:1 to 1:1 or steeper where geological conditions permit. The typical batter slope satisfies the short and long-term stability requirements of the fills, and may be flattened to accommodate urban design objectives (such as, flattening batters from 2:1 to up to 10:1 where appropriate) and constraints such as maintenance and road safety. Vertical or steep cuts in soils and highly weathered rock along the project may require soil nailing, rock bolting or retaining structures to satisfy short and long-term stability requirements.

Cut and fill batters within the road reserve would be revegetated with native trees, shrubs and groundcovers, consistent with roadside clearance and sight line requirements and in accordance with the landscaping design described in **Section 7.6**.

Based on the concept design, the total earthworks volume is estimated at around 1.3 million cubic metres. It is envisaged the majority of this material would be generated from excavating cuttings and processed for use in embankments and road foundations.

Around 1.0 million cubic metres of material would be used as embankment fill and around 70,000 cubic metres of material required for the select material zone (SMZ) could be sourced from cuttings. The SMZ is a foundation layer for the road pavement which needs material with higher strength qualities.

It is predicted that including an allowance for unsuitable material of around 100,000 cubic metres the earthworks cut to fill balance would be within 50,000 cubic metres (refer **Section 4.4.5**).

Soft soils and acid sulfate soils

Soft soils are present along the floodplains of Broughton Creek and the floodplain to the east of Berry near Broughton Mill Creek, Bundewallah Creek and Connollys Creek. Acid sulfate soils are also potentially present within these areas.

Ground improvements would be required to ensure areas of soft ground are sufficiently stable for the construction of the project and the long-term durability of the completed project. There are a number of methods that can be applied to address this issue, and it is possible that a combination of methods would be applied. These could include:

- Removal of the unsuitable alluvial soils and replacement with a suitable fill to remove the soft soils.
- Preloading or surcharging of embankments. Preloading refers to the placement of a temporary embankment to cause the compression of the soft soils ahead of the construction of the project. The temporary embankment would be equal to or greater in weight to the final structure. Surcharging refers to an additional load to an embankment to make allowance for soil settlement following construction.

Other measures, such as the installation of wick drains, stone columns or deep soil mixing are not currently considered necessary due to the limited extent and impact of soft soils on this site.

However, the methods applied to treat areas of soft soil and the time taken to treat the soft soils would be determined during the detailed design. It would also be considered in the context of corresponding areas of potential acid sulfate soils (refer to **Section 8.1**).

Ground improvement works would typically commence during the earthworks and bridge construction stage of the project. However, the staged treatment of soft soils and the monitoring of soil settlement may be required over the duration of the construction period. This would depend on the findings of the further geotechnical work undertaken to inform the detailed design and method chosen.

Blasting

Construction of the cutting at Toolijooa Ridge may require the use of explosives, with typically one blast occurring per day. It is also proposed that simultaneous blasts may be undertaken. Simultaneous blasts would reduce both the number of blasts and the duration of construction at Toolijooa Ridge. It is expected that vibration limits would be complied with however overpressure is likely to exceed the appropriate levels.. Further details are provided in **Section 7.2**.

Dewatering

Deep excavations and cuttings may require temporary localised dewatering during the construction phase to artificially lower the watertable in order to maintain dry working conditions within excavations. Dewatering may also be required during construction of bridge footings. Construction site dewatering would be managed through a work method statement prepared in accordance with the 'Technical Guidelines for the Environmental Management of Construction Site Dewatering' (RTA, 2011). Refer to **Section 7.4** for further details.

4.4.4 Construction materials

Construction would require various materials and pre cast elements including, but not limited to, the following:

- General fill (of varying quality) for use in earthworks.
- Pavement materials, including verge material and road base and sub-base.
- Materials for lining drainage channels.
- Aggregate for use in concrete and asphalt.
- Sand for use as backfill around pipes and for asphalt and concrete.
- Cement and concrete.
- Bitumen.
- Steel for use in reinforcement of bridges and structures.
- Wood for use in formwork and other temporary structures.
- Safety barriers, signage and other road furniture.
- Lighting poles and lamps.
- Geotextiles and geofabrics.
- Fencing.
- Utility materials.
- Topsoil.
- Water.
- Pre-cast pits, pipes, culverts, and headwalls for drainage works.
- Pre-cast barriers, noise attenuation, and other road furniture.
- Pre-cast bridge girders, decks, piles, and abutments.

The quantities of the key natural resource materials required are provided in **Section 4.4.6**.

Material sources

Materials for the select fill would preferably be sourced from the deeper cuttings throughout the project, where the material is of suitable quality. This would minimise the need for imported fill material. Cut or other material that is deemed unsuitable or is excess would be stockpiled and stabilised until needed as part of the landscaping or possibly used as visual screening or for noise mounds during construction. Further investigations would be undertaken to determine the availability of quality fill and select material.

Additional construction materials would be sourced off site. This may include fill or select material to address shortfalls in required volumes in the event that material won by the project is found to be unsuitable. The majority of raw and manufactured materials would be hauled from quarries and batch plants located to the north of the site at Shellharbour, Dunmore, Albion Park, and Bombo (refer to **Table 4-7** for further detail).

Local sources of construction materials would be used where practical to minimise haul distances. Although the South Coast Rail line is near the project, it is unlikely to be economically viable to haul by rail and therefore materials would likely be transported via the Princes Highway. Pre-cast elements would be transported along existing road and internal haul roads directly to the work site.

Table 4-7 Indicative sources of construction material

Material type	Source
Fill*	Various, Dunmore, Albion, Albion Park, Bombo
Select material*	Various, Tomerong, Falls Creek
Base and sub-base	Tomerong, Shellharbour, Dunmore, Bass Point, Port Kembla
Bitumen	Clyde, Kurnell
Sand	Kurnell, Mittagong, Shellharbour, Dunmore, Bass Point, Port Kembla
Aggregate	Shellharbour, Dunmore, Bass Point, Port Kembla, Dunmore
Cement	Berrima, Port Kembla
Steel	Various
Specialist pre-cast concrete elements	Sydney and Newcastle metropolitan area
Asphalt	Various suppliers within the region
Concrete	Various suppliers within the region

** Required in the event that material obtained as a result of earthworks is not suitable.*

4.4.5 Spoil and waste disposal

Waste streams would be generated during the construction phase of the project, including the following:

- Waste from existing structures that require demolition, such as bricks from residences.
- Excavated soil and rock which is unable to be reused within backfilling or restoration.
- Contaminated soils or acid sulfate soils that may be exposed during construction, and if exposed, would require off-site disposal (refer to **Section 8.1**).
- Surplus material from construction and general site reinstatement, such as fencing, sediment, concrete, steel, formwork, and sand bags.
- Packaging materials from items delivered to site, such as pallets, crates, cartons, plastics and wrapping materials.
- Vegetative waste from clearance and grubbing.
- Plant and vehicle maintenance waste, such as oil containers.
- General office wastes generated by onsite personnel, such as paper, cardboard, beverage containers and food wastes.
- Sewage waste generated through the use of personnel facilities.

A management strategy to limit the extent of excess spoil generated by the project and methods to dispose of excess spoil would be implemented. This may include the following options:

- Reduction of spoil volume through detailed design refinement or use within the project.
Further geotechnical investigation during detailed design may lead to design refinements that reduce the predicted volume of excess spoil.
The flattening of embankment slopes where space is available.
Consideration of engineering, geotechnical, urban design and land take of the major cut at Toolijooa Ridge to limit the amount of excess material generated.
Formation of noise mounds.
Use of material for any preloading of soft soils.
Excess spoil could be used for preloading activities, however the required volume is not expected to be substantial.
- Provision of excess spoil to adjoining landowners, Shoalhaven City Council or other parties requiring spoil.
This may include the provision of excess spoil to Shoalhaven City Council to provide stock mounds in flood prone areas as part of its flood mitigation works in the Broughton Creek floodplain, which are still under investigation by the council.
Any provision of excess spoil to a third party would be dependent on the demonstration by the third party that it has obtained the necessary approvals for the use of the spoil (such as a development consent from the local council or a licence under Section 143 of the *Protection of the Environment Operations Act 1997*). Appropriate environmental controls would be installed at sites where excess spoil would be delivered.

4.4.6 Natural resource consumption

The indicative quantities of raw materials required for project construction are identified in **Table 4-8**.

Table 4-8 Indicative resource quantities required for construction

Resources	Amount
General fill (obtained from site, if suitable)	1,300,000 m ³
Select material zone (SMZ)	70,000 m ³
Steel	13,000 tonnes
Cement (for in situ components)	28,000 m ³
Asphaltic concrete	47,000 m ³
Road base	85,000 m ³

There are a number of suppliers in the region capable of providing resources for the project. These quarries can provide soft rock materials such as sand, aggregate and hard rock materials such as blue metal and road base.

A number of major quarries in the region have recently had or are in the process of having project applications assessed by the NSW Department of Planning and Infrastructure for major expansions to their operations. Major expansions have occurred or are proposed to occur at the Bass Point quarry, Gerroa sand quarry and Nowra brickworks quarry. These quarries are within about 40 kilometres of the project area and would be capable of supplying most types of materials required for the construction of the project.

Indicative water requirements for various activities during construction are identified in **Table 4-9**. It has been estimated that around 100 megalitres per year of construction water would be required. Construction water would be sourced as follows in order of priority:

- Recycled effluent from the tertiary treatment plant at Gerringong Gerroa and/or Berry.
- Surface water, sourced from on-site detention basins.
- Surface water, sourced from watercourses where it would not be detrimental to the aquatic environment of the waterway.
- Potable water, supplied by Shoalhaven Water.
- Groundwater, sourced from de-watering that may be required at the Toolijooa Ridge cutting.

These sources and quantities would be subject to refinement during the detailed design phase of the project. However, the extraction of water (from watercourses or groundwater sources) and the use of potable water are not currently proposed. In the event there is an identified need for groundwater and potable water, their use would be the subject of a separate impact assessment process.

Table 4-9 Indicative water volumes required for construction

Activities	Volumes
Compaction of earthworks	18 litres per cubic metre for compaction 70 litres per cubic metre for stabilisation
Dust suppression	As required, but average 70,000 litres per day.
Planted vegetation maintenance	120,000 litres per day in extreme weather

4.4.7 Ancillary facilities

During site preparation works, compound sites (administration, road and bridge construction compounds), temporary stockpiling sites, mobile crushing and screening plants, bridge girder casting yards and sedimentation detention basins would be established to support construction.

A number of potential ancillary facility site locations have been selected, as illustrated in **Figure 4-20** based on the criteria listed in **Table 4-10**. Properties that are currently owned by RMS have been preferentially assessed. Typical works undertaken within ancillary facilities would include site establishment and landscaping, stockpiling, earthworks, pavement construction, drainage construction, street furniture installation and site restoration. The typical equipment used during these stages has been presented in **Table 4-6**. The environmental impacts of activities and plant are separately assessed in **Chapter 7**. The description of typical activities that would be undertaken at the ancillary facilities is described later within this section.

Alternative or additional sites may be identified during detailed design or at a later stage during construction. The selection of any additional or alternative site compounds, bridge compound and temporary stockpile sites would also be considered against the site selection criteria detailed in **Table 4-10**.

Table 4-10 Selection criteria for ancillary facility sites

Selection criteria
Location
Locate within the project alignment or directly adjacent to the project.
Preferably located on land that is in RMS ownership. If RMS owned land is not available or suitable for use, ancillary construction facilities are to be located (in order of preference) on: • Sites that can be leased from Council. • Sites that can be leased from private owners.
Stockpiling sites are not to be located on slopes with a gradient greater than 2:1 horizontal to vertical.
Locate other compound sites on relatively level ground.
Provide a minimum one to two hectares to cater for the ancillary facility.
Services
Locate compound sites where they can be easily serviced with electricity and potable water.
Locate stockpile sites where they can be easily serviced/supplied with the appropriate quality of water.
All ancillary sites are to have direct and safe access to the road network.
Access points are to be at a distance from residences (to avoid traffic conflicts) where practicable.
Environmental
Wherever possible, sites are to be located above the 1 in 100 year flood level. If sites cannot be located above the 1 in 100 year flood level, they could be located above the 1 in 20 year flood level subject to the implementation of appropriate mitigation measures to reduce flood risk and impacts on the surrounding environment (such as provision of a sufficient freeboard for storage areas).
Locate facility more than 50 metres from watercourses*.
No clearing of Endangered Ecological Communities (EECs), threatened flora species or threatened fauna habitat.
No substantial vegetation clearing. Ancillary sites are to be located on land of existing low conservation significance for flora and fauna.
No exceedance in air quality targets for construction, as discussed in Section 8.1.4 and provided in Table 8-1 .
Wherever possible, sites are to be located and designed to satisfy noise and vibration management levels, relevant to the noise catchment area, and vibration goals at the sensitive receiver (or building, in the case of vibration). If noise management levels or vibration goals cannot be met, feasible and reasonable mitigation measures, the restriction of hours of operation and/or negotiated agreements with affected parties would be considered.
Heritage
Locate on sites that have a low likelihood of having Aboriginal or non-Aboriginal heritage significance and/or potential.
Sites or areas of moderate to high Aboriginal and/or non-Aboriginal heritage significance and/or potential, including known sites, potential archaeologically sensitive areas and areas of Aboriginal cultural significance, are not to be used for ancillary facilities except where the impact is authorised and managed by a relevant approval or an approved Heritage Management Plan.

** Refers to the working footprint of the facility. The property on which the site is located may encompass or may extend within the 50 metre buffer to the watercourse.*

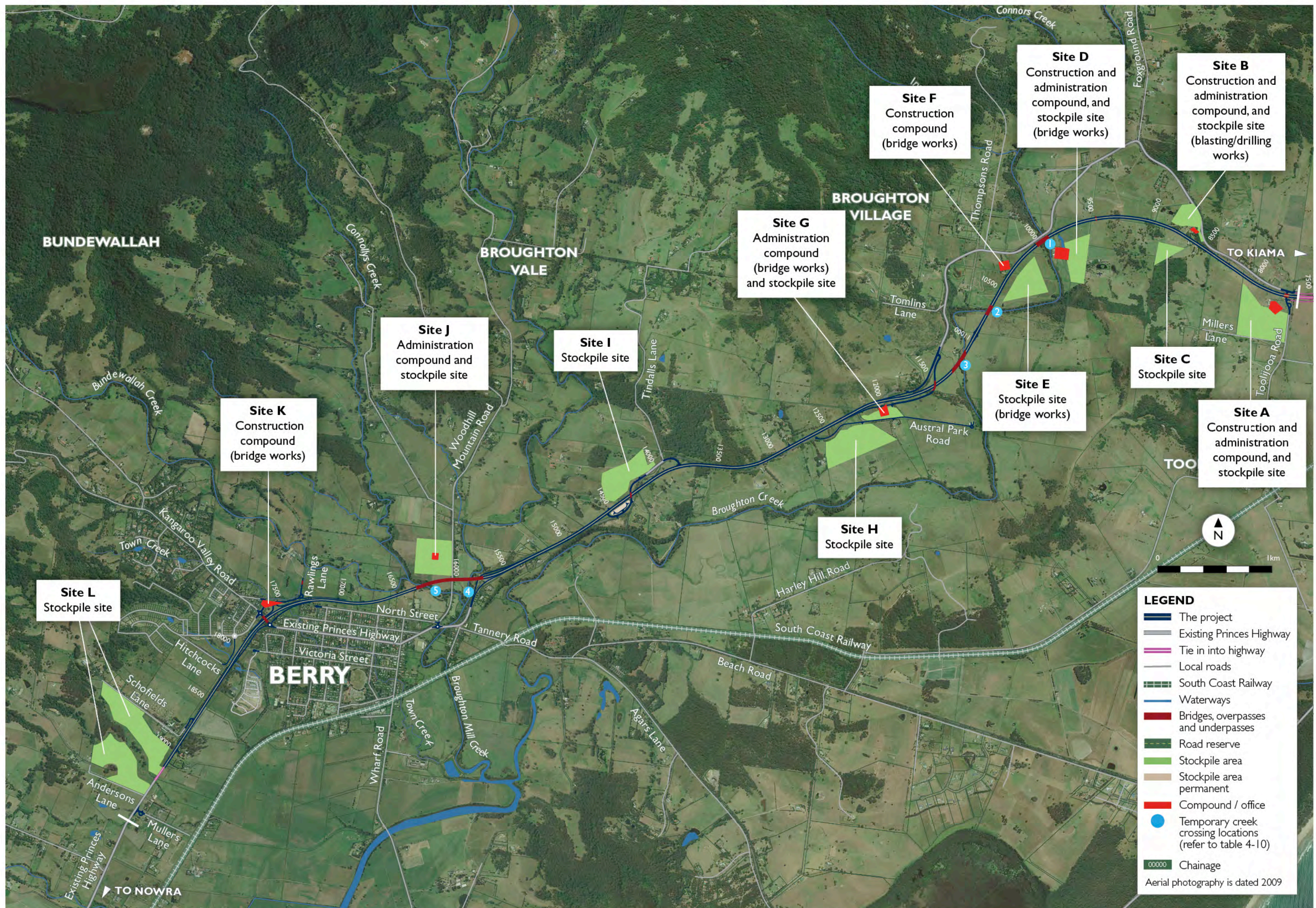


Figure 4-20 Locations of potential construction ancillary facilities

Site compounds

Three types of site compounds would be required for the project:

- Administration compounds – These would be the centre for project coordination and communication, and provide employee and visitor amenities and car parking.
- Construction compounds – These would vary in size and provide a supporting role to the administration compounds. They would be used to enclose machinery and materials, including chemicals, to be used in the works. A construction compound may also be provided to cast bridge girders on site, temporarily store pre-cast concrete components, aggregates and mobile machinery for asphalt production and rock crushing.
- Bridge compounds – These would be similar to construction compounds but would specifically support bridge construction works.

Site compounds may provide a mix of services, and provide both construction and administrative support. Site compounds may also be co-located with stockpile sites.

The establishment of site compounds would form part of the site establishment works, and would include:

- Erection of site fencing, and establishment of erosion and sediment control measures.
- Clearing and levelling the site to facilitate drainage.
- Construction of hard stand areas, including dedicated hard stand for plant and equipment, plant inspection and maintenance, vehicle wash down, and bunded storage areas for fuels and chemicals.
- Construction of pre-fabricated or purpose built temporary offices, crib sheds and storage sheds, which may be supplemented by existing dwellings if present on the site.
- Establishment of temporary utility connections, if not pre-existing, or sewerage storage and pump out facility if no sewerage connection can be made.

The location and layout of site compounds would be designed with consideration for the natural and built environment, and the location of sensitive receivers. Environmental mitigation and management measures would be established, implemented and monitored throughout the course of construction.

Stockpile sites

Construction stockpile sites would temporarily store materials for construction, or materials generated from within the construction site. This could include road base constituents, stripped topsoil, pre-cast concrete components, rock crushing and screening machinery, crushed rock and excess spoil unsuitable for project use.

Site establishment activities for all stockpile sites would include the erection of site fencing and establishment of sediment and erosion control measures. The sites would be managed in accordance with the 'Stockpile Site Management Procedure' (RMS, 2011).

Sedimentation detention basins

Sedimentation detention basins would be required when the project alignment is cleared of vegetation. Sedimentation basins would be excavated at low-lying areas adjacent to the formation, close to natural watercourses, and may be incorporated as a permanent part of the drainage works.

All sedimentation detention basins would be sized in accordance with the requirements of 'Managing Urban Stormwater; Soils and Construction' Volume 1 4th Edition (Landcom, 2004) and 'Volume 2D – Main Road Construction' (DECCW, 2008).

Potential locations for sedimentation detention basins have been identified and the final number and location for sediment basins would be determined during detailed design in accordance with relevant policies and procedures. Temporary construction sedimentation detention basins may be constructed at the proposed location(s) of the operational water quality basins. These temporary sedimentation detention basins could be converted into permanent operational water quality basins if appropriate (refer to **Section 4.2.10**).

Details of the temporary erosion and sediment controls would be included in the erosion and sediment control plan, within the construction environmental management plan (refer to **Section 8.1**).

4.4.8 Temporary works

Construction would require temporary works and facilities to:

- Support or facilitate the construction of the project, such as temporary creek crossings.
- Divert traffic or services around various construction stages.
- Minimise the impact on the natural environment.

The temporary works and facilities listed below may be required to construct the project, and would be dependent on the construction methods selected by the construction contractor.

Any area required in addition to that permanently acquired may be temporarily leased from the property owner, following consultation and negotiation.

Temporary creek crossings

Temporary creek crossings would be provided near each proposed bridge structure during the construction period to maximise the efficiency of construction activity around bridges and reduce travel on the highway by construction vehicles. The type and location of each temporary creek crossing is generally described in **Table 4-11** and shown on **Figure 4-20**.

The preferred locations and design of the temporary creek crossing have been identified to minimise potential impacts to water quality, terrestrial ecology and aquatic ecology. The final design and location would be determined during detailed design, however all crossings would be designed with consideration to 'Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings' (Fairfull and Witheridge, 2003) and to minimise afflux.

Following completion of construction activities, the riparian areas at the temporary creek crossings would be rehabilitated. Offsets would also be provided for the loss of River Flat Eucalypt Forest at these locations, which is listed as an EEC under the *Threatened Species Conservation Act 1995* (refer to **Section 7.3.4** and **Appendix J**).

Table 4-11 Temporary creek crossings

ID no.	Temporary creek crossing location	Description
1	Broughton Creek, immediately downstream of the proposed Bridge 1 crossing of Broughton Creek	Bridge
2	Broughton Creek, east of the proposed bridge structure, about 20 metres upstream	Bridge
3	Broughton Creek, south of the proposed bridge structure, about 10 metres downstream	Bridge
4	Broughton Mill Creek, south of the proposed bridge structure, about 25 metres downstream	Bridge or an arch structure
5	Bundewallah Creek, east of the proposed bridge structure, about 20 metres downstream	Bridge or an arch structure.

Side tracks

Where construction works would interact with the existing road network, traffic diversions would be built to enable off line construction. Side tracks would be generally sealed and temporary line marking and traffic control devices used to maintain existing road network functionality during construction.

Temporary traffic facilities

Where significant volumes of traffic would be generated by site activities, temporary traffic facilities, would be required to ensure safe and efficient entry and egress for construction vehicles: These would include:

- Right turn bays.
- Traffic signals.
- Roundabouts.

Tie-ins

A temporary tie-in with Toolijooa Road and the existing highway would be provided as part of the Gerringong upgrade. It would be about 800 metres in length and would remain in place until the completion of the Toolijooa Road interchange.

A tie-in would also be constructed south of Schofields Lane, where the project finishes, to safely transition highway traffic from the four lane configuration back to the existing two lane highway configuration. The tie-in would be about 230 metres in length and would remain until the proposed future upgrade of the highway south of the project (the Berry to Bomaderry upgrade) is completed.

Temporary utility diversions

Construction staging may be such that utilities would need to be removed from their current alignment and placed on a temporary alignment for a significant duration of the works (refer to **Section 4.2.10**).

Haulage roads

Where possible, the proposed alignment would be used for mass haulage of materials. Once the alignment is cleared of vegetation, internal haulage routes would be established to link excavation sites and construction compounds to the various work areas. The location of haulage roads would be limited to the proposed alignment and corridor, including where the new alignment would utilise the existing road corridor. This may require the introduction of temporary traffic management measures.

The existing highway would be used by construction traffic and local roads including Woodhill Mountain Road and Kangaroo Valley Road may be used to access ancillary facilities. This is discussed in **Section 7.1**.

4.4.9 Construction work hours

Standard construction hours in NSW are between:

- 7am and 6 pm Monday to Friday
- 8am and 1pm Saturday.

RMS is seeking approval for standard construction hours plus additional time at the start and end of each day (extended construction hours). Extended construction hours would apply across the project, except in close proximity to the Berry township. Targeted consultation has already been undertaken with affected residents.

Out of hours works would also be required. Work outside of standard construction hours and extended construction hours would be undertaken in accordance with approvals and notification requirements of any Environmental Protection Licence for construction of the project.

Extended construction hours and out of hours works are discussed further below.

Extended work hours

When required, certain activities would be undertaken during extended construction hours as follows:

- Between 6am and 7pm Monday to Friday for the noise catchments including Toolijooa cut, Broughton Creek floodplain to about Tindalls Lane; and major bridge works (outside Berry township).
- Between 8am and 5pm on Saturdays for the noise catchments including Toolijooa cut, Broughton Creek floodplain to about Tindalls Lane; and major bridge works (outside Berry township).
- Outside of known likely major traffic peaks (such as avoiding the Friday evening prior to a public holiday long weekend).

It is not proposed to undertake work during extended working hours in close proximity to the Berry township. Construction work hours, extended working hours and out of hours work are discussed further at **Section 7.2.4**.

Activities that would be undertaken during these extended construction periods are as follows, and potential noise impacts are described and assessed in **Section 7.2**.

- Compound operation and general office duties.
- Maintenance activities.
- Deliveries of materials, such as large pre-cast concrete components.
- Haulage of material.
- Concrete works including pouring, curing and concrete cutting where required.
- Pile driving and/or boring at bridges, excluding bridge at Berry.
- Finishing works.
- Earthworks, including haulage placement and compaction.
- Drilling, haulage and rock crushing activities associated with blasting activities at Toolijooa Ridge.
- Completion of tie-ins at interchanges, temporary traffic facilities and traffic switches to enable highway traffic flows to be maintained during construction.
- Placement of bridge girders where proposed bridges cross operating roadways.
- Utility adjustments where required

Extended construction hours at the start and finish of each working day are considered to be in the public interest as they would:

- Shorten the overall construction period by approximately three months or 10 per cent. This would minimise the disruption to the Princes Highway and improve access to the NSW south coast. It would also minimise impacts to local businesses that may be experienced during the construction period.
- Reduce the public's exposure to a substandard and inefficient road, reducing the potential for crashes.
- Potentially reduce the overall cost of construction.

Consultation with affected residents would be undertaken prior to work commencing as part of the Construction Noise and Vibration Management Plan. Consultation was undertaken in September 2011, in which feedback generally supported extended hours. The outcome of the consultation is discussed further in **Chapter 6** and **Section 7.2** of this environmental assessment.

Out-of-hours work

Some construction activities would also be undertaken outside of the standard and extended construction hours in the following circumstances:

- If works do not cause construction noise to exceed the noise management levels.
- For the delivery of materials or oversized structural elements such as pre-cast bridge elements, required outside these hours by the police or other authorities for safety reasons.
- Where it is required in an emergency to avoid the loss of lives, property and/or to prevent environmental harm.
- As agreed through negotiations between RMS and potentially affected sensitive receivers. Any such agreement would be recorded in writing and a copy kept on-site for the duration of the works.
- As agreed by the EPA for a specific activity, determined on a case-by-case basis.

Specific activities are described in **Table 4-12**. These would need to be undertaken outside of normal and extended construction hours to ensure road safety, minimise disruption to regional and local traffic flows and/or for technical and timetabling reasons.

A Construction Noise Management Plan and Community Consultation Plan would be prepared to provide a framework for managing out of hours work. This would be implemented in conjunction with the Environment Protection Licence for the project, and would ensure appropriate notification periods are utilised.. All feasible and reasonable mitigation measures would be implemented to ensure that the potential for adverse impact on the local community is minimised.

Table 4-12 Possible out-of-hours construction work.

Activity	Justification
Completion of tie-ins at interchanges and temporary traffic facilities, and completion of temporary diversions and traffic switches.	Completing or installing these items at night when traffic flows on the Princes Highway are lower would minimise disruption to regional and local traffic and minimise any potential safety conflict between construction personnel and traffic.
Bridge girder placement where bridges cross operating roadways.	During construction, bridge girders would be placed across operating roadways. Due to the potential safety risks to road users and construction personnel associated with operating over the existing alignment, these works would need to be undertaken at night when there are lower traffic flows. Avoiding peak periods would also minimise the disruption to traffic.
Delivering large pre-cast concrete components, such as bridge girders.	To minimise disruption to highway and local traffic flows.

Activity	Justification
Concrete cutting	Concrete sampling for quality control purposes requires cutting of cores from the concrete pavement. Depending on the hardening rate of the concrete, core sampling may require cutting any time within four and 24 hours after the concrete pavement is laid. RMS specifications state the timing requirements for concrete sampling after it has been laid and this may need to be undertaken outside normal construction hours. Construction compounds would also need to be operational during this period to support these activities.
Concrete pouring/curing	Similar to the requirements for concrete cutting, RMS has specifications for the placement of concrete that relate to temperature and rainfall. Specifically, concrete pouring and curing cannot occur when the temperature is below 5°C or above 38°C, and concrete, when curing, cannot be exposed to rain. Average temperatures for the region do not fall below or above these temperatures, however the frequency of rain events may require more intensive concrete pour/curing activity during periods of good weather.
Utility adjustments	Utility adjustments typically need to be undertaken during out of hours work periods to minimise the impact on consumers, road traffic and ensure the safety to improve the safety of workers involved.
Refuelling operations and maintenance	To maximise the plant and machinery operations during the recommended standard hours, and thus reduce the overall duration of the project, refuelling operations of plant and machinery are proposed at: • 5am to 7am Monday to Saturday or • 6pm to 9pm Monday to Friday or • 1pm to 9pm Saturday.

4.4.10 Staging

The construction activities required for the project would pose a number of staging challenges. Sections involving the widening or duplication of the existing highway pose greater construction and road user management challenges. They would require the widening of road shoulders, temporary ramps and traffic switches to enable the highway to remain open during construction.

Other than the partial use of completed sections of the highway during construction, it is not intended that completed sections of the project would be opened prior to the completion of the full project.

As a result of these challenges, a number of staging options have been developed. There are currently three potential staging options for the construction of the project which differ in the sequence of construction events but would ultimately deliver the project in the same manner.

The first option would be to deliver the project in four stages based on whether construction would occur on line or off line. The four stages would be based around the following geographical areas:

- Toolijooa Road to Austral Park Road (off line).
- Austral Park Road to the bridge at Berry (on line).
- The bridge at Berry to Kangaroo Valley Road (off line).
- Kangaroo Valley Road to Schofields Lane (on line).

The second option would be to deliver the project in two stages with discrete construction zones within each stage. The zones would be developed with the aim to achieve an earthworks balance (cut equal to fill) across each stage. The two stages would be:

- Toolijooa Road to the eastern end of the bridge at Berry.
- The bridge at Berry to Schofields Lane.

The third option would be to deliver the project through a series of early works packages followed by a remaining road works package. The road works package would be delivered in a similar way to option two, with stages and construction zones developed to achieve balanced earthworks:

- Construction of the Toolijooa Road interchange.
- Construction of all bridges.
- Remaining road works:
 - Toolijooa Road interchange to the eastern end of the bridge at Berry.
 - The bridge at Berry to Schofields Lane.

Further details of each staging option are provided in the concept design report for the project which is available on the project website (www.rms.nsw.gov.au/fbb). The final staging strategy would be determined prior to construction.