

3 Description of the proposal

The RTA proposes to duplicate the Princes Highway to a four lane divided carriageway between Mount Pleasant and Toolijooa Road. The proposal includes a:

- Grade-separated interchange at Rose Valley Road incorporating four-way traffic access to and from Gerringong via a bridge over the highway, a two-way service road and overbridge spanning the South Coast Railway Line at Fem Street.
- Grade-separated interchange at Belinda Street providing four-way, flood free traffic access to and from Gerringong and incorporating a two-way service road running under the highway connecting to Willowvale Road.
- Bridge structure spanning a realigned Crooked River, incorporating Bailey's Road and an existing cattle underpass.
- Northbound climbing lane between Rose Valley Road and the top of Mount Pleasant.
- Southbound climbing lane for approximately 800 m from Belinda Street on ramp.
- Property acquisition and the setting of corridor boundaries for the provision of future widening to six lanes (three in each direction).
- Extensive drainage structures maintaining cross drainage flow in the low lying area of Omega Flat.
- Future augmentation to six lanes by widening to the outside of the carriageway at Omega Flat, Rose Valley Road interchange and north of Gerringong Bends.

Detailed discussion on each element of the concept design and the design refinements that have been undertaken in developing the concept design are documented in the Concept Design Report. The Concept Design Report is available on the project website www.princeshighwayupgrade.com.au.

The proposal is detailed in Figure 3.1.

3.1 Existing road and infrastructure

The horizontal and vertical alignments of the existing largely two lane highway between Mount Pleasant and Toolijooa Road require upgrading to meet current safety and traffic efficiency requirements. The highway has limited overtaking opportunities, numerous junctions with rural roads and private uncontrolled accesses. The existing alignment has a posted speed limit of 80 km/h in some locations and 100 km/h where the alignment allows it.

There are three climbing lanes associated with the existing alignment, one southbound and two northbound. The southbound climbing lane extends for approximately one kilometre from just south of Belinda Street to the area known as the Gerringong Bends, at approximate chainage 5800. Chainage refers to the distance heading south along the proposal from the start of the proposal at Mount Pleasant and is measured in metres.

The first of the northbound climbing lanes extends for approximately 800 m, from chainage 6800, approximately 800 m east of Toolijooa Road to the Gerringong Bends at chainage 6000. The second climbs Mount Pleasant from approximate chainage 2000 in the vicinity of the Fem Street interchange and continues as the second lane beyond the proposal extending through the Kiama Bends.

Crash analysis shows the existing highway has a fatality rate of 2.56 per 100 million vehicle kilometres (MVKM), almost four times the NSW average, highlighting the poor safety record of the highway in this area. If the highway is not upgraded, the potential for crashes is likely to increase with increased traffic volumes especially at major intersections along the route, such as Fern Street and Belinda Street in Gerringong (refer to Section 6.6).

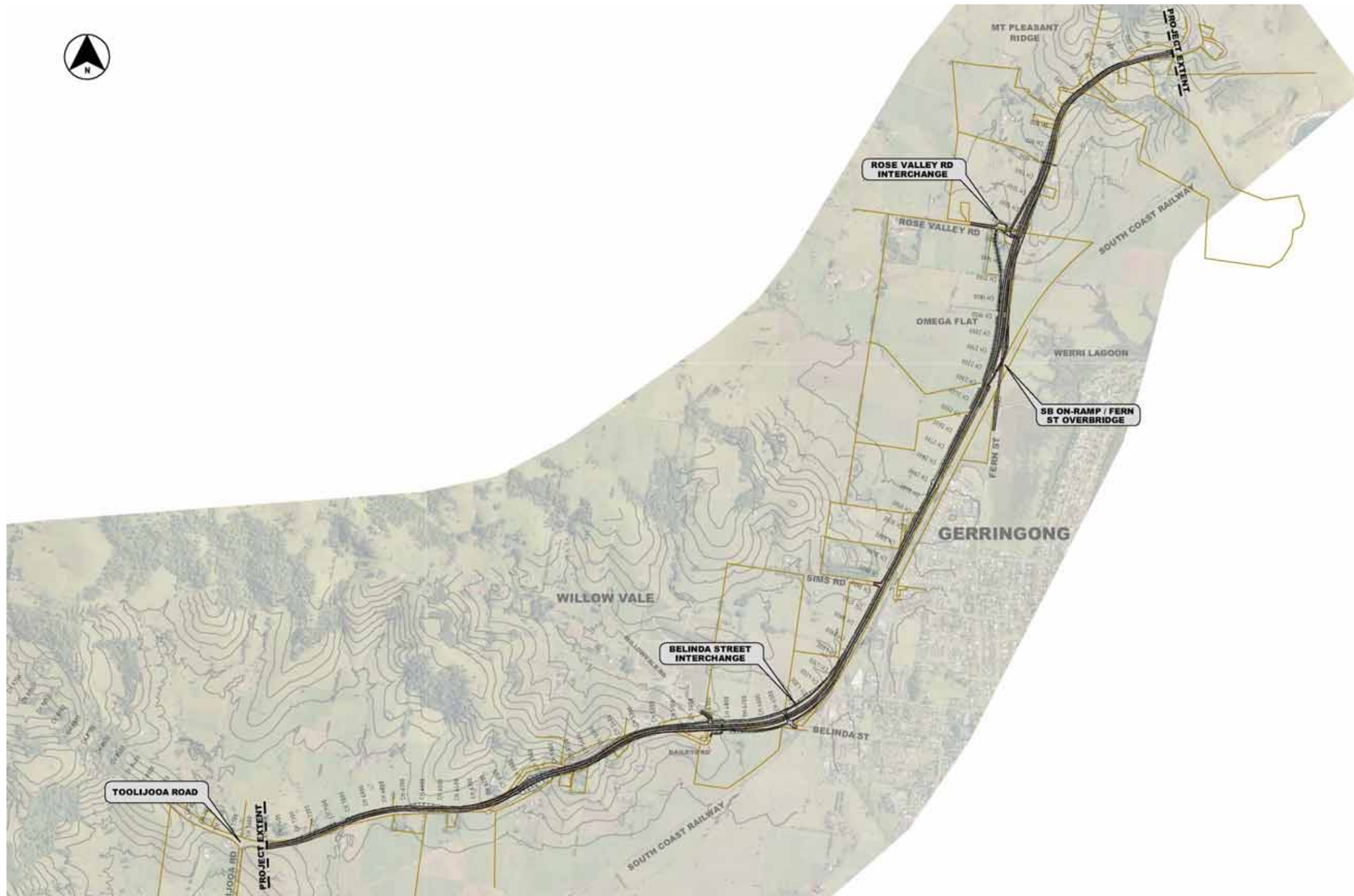
There are two existing access points for the town of Gerringong associated with the current highway, one at the northern end of the town at Fern Street and the other at the southern end of the town at Belinda Street.

The existing northern access point at Fern Street incorporates the less than desirable existing level crossing over the South Coast Railway Line. This level crossing has been identified as number 20 in the NSW Government's top 300 priority list for safety treatment under its Level Crossing Safety Improvement Program, coordinated by the Level Crossing Strategy Council (LCSC).

At-grade intersections at Fern Street and Belinda Street connect Gerringong to the highway. The Belinda Street intersection features a sub-standard seagull configuration and an adjacent service station on Belinda Street. Rose Valley Road, Sims Road, Baileys Road, and Willowvale Road all connect to the highway with at-grade 'all movements' junctions.

The existing highway is susceptible to flooding where it crosses Omega Flat at the northern extremity of Gerringong. Inadequate cross-drainage also contributes to localised flooding at other locations.

Figure 3.1: Concept design for Gerringong upgrade



3.2 Design parameters

The proposal would provide a minimum four lane divided carriageway with a posted speed of 100 km/h. A median incorporating a barrier (a combination of wire rope and concrete barrier) would provide separation of opposing traffic.

Climbing lanes would be provided where steep grades would result in a loss of truck speed to 40 km/h and fall in level of service to LoS D 20 years after construction.

Generally local road and private property connections would continue to be at-grade with left-in-left-out movements provided, and the incorporation of the median and barrier would prevent right turns across opposing traffic flows. The prevention of right turns across opposing traffic provides a significant safety benefit and is required for the proposal to meet the proposal objectives.

Access to Gerringong would be provided by grade-separated movements at both the northern and southern ends of town. The existing level crossing at Fern Street would be replaced by an overbridge as part of the proposal.

The proposal would achieve a 1 in 100 year flood immunity for through movements on the highway and allows for future widening to three lanes in each direction.

Components of the proposal are designed to be consistent with the RTA's Road Design Guide 1998.

3.2.1 Design criteria

Table 3.1 shows the design criteria applied to the proposal. The criteria shown below are expanded within the Concept Design Report.

Table 3.1: Design criteria

Criteria	Requirement
Highway alignment and cross section	
Design speed	Horizontal 110 km/h Vertical 100 km/h
Minimum "K" value ^a	Crest 66 Sag 33.4
Stopping sight distance	Reaction time 2.5 seconds Horizontal 210 m Vertical 175 m
Horizontal radius	On line upgrade minimum 600 m Off line construction minimum 750 m
Upgrade lanes (in each direction) Ramps	2 ^b 1
Climbing lanes	Loss of truck speed to 40 km/h and LoS D 20 years after construction
Grade	Desirable maximum six per cent ^c Absolute maximum eight per cent Minimum in cutting 0.5 per cent
Lane width (including interchange ramps and auxiliary lanes)	3.5 m

Criteria	Requirement
Highway alignment and cross section	
Shoulder width	Nearside (outside) 2.5 m Offside (median) minimum one metre
Median width ^d – No right turn bay	With wire rope barrier five metres With Type F concrete barrier 2.6 m
Median width ^d – Right turn bay treatment required	Six metres
Clearance to boundary	Minimum six metres
Flood immunity	1 in 100 for new structures. A minimum of 1 in 20 if an existing structure can be utilised subject to structural capacity adequate for new design life.
Batters Fill < 1.5 m high Fill > 1.5 m high Cut 2:1 or flatter Cut steeper than 2:1	4:1 2:1 Seven metres maximum between benches 10 m maximum between benches
Design vehicle highway	25 m B-double 12.5 m single unit truck (emergency vehicle u-turn bays) 19 m semi-trailer (access u-turn bays)
Design vehicle local road	19 m semi-trailer (unless designated)
Design vehicle – property access	19 m semi-trailer (farm residence and paddock access by negotiation with the land owner)
Bridges	
Outside shoulder	Two metres to three metres (to match approach shoulder width)
Median shoulder	Minimum one metre
Vertical clearance – over highway	5.3 m
Vertical clearance – over regional and local road	4.6 m
Vertical clearance – over railway (future DC electric)	5.9 m

Notes:

- The K value is a geometric design term used to determine the length of vertical curvature along a road between two varying grades.
- Provision for future widening on the outside. Climbing lanes to occupy ultimate third lane.
- No criteria regarding maximum length of grade applies.
- Measured edgeline to edgeline.

3.2.2 Engineering constraints

Major public utilities

Major public utilities in this area that would interact with proposal are shown in Figure 3.2 and include the Eastern Gas Pipeline, the South Coast Railway Line, fibre optic cables, Sydney Water Corporation water main and effluent reuse scheme, and high voltage overhead power lines.

The most significant gas asset in the study area is the Eastern Gas Pipeline, owned and operated by Jemena. The pipeline is a 450 mm diameter 15 MPa main buried at a depth between 900 mm and 1200 mm and runs from northern Victoria to western Sydney. The pipeline crosses the existing highway to the west of the Belinda Street intersection. Interference with this significant piece of infrastructure would be avoided by aligning the upgraded highway and any interchange ramps above existing ground level.

The South Coast Railway Line runs parallel to the proposal from Fern Street to Belinda Street. The rail line crosses Fern Street with a signalised level crossing in close proximity to the junction of Fern Street and the existing highway. The proposal would span the rail line with a bridge – eliminating the need for the level crossing. The bridge would allow for a future duplication of the currently single line track. Allowance would also be made for future electrification of the line.

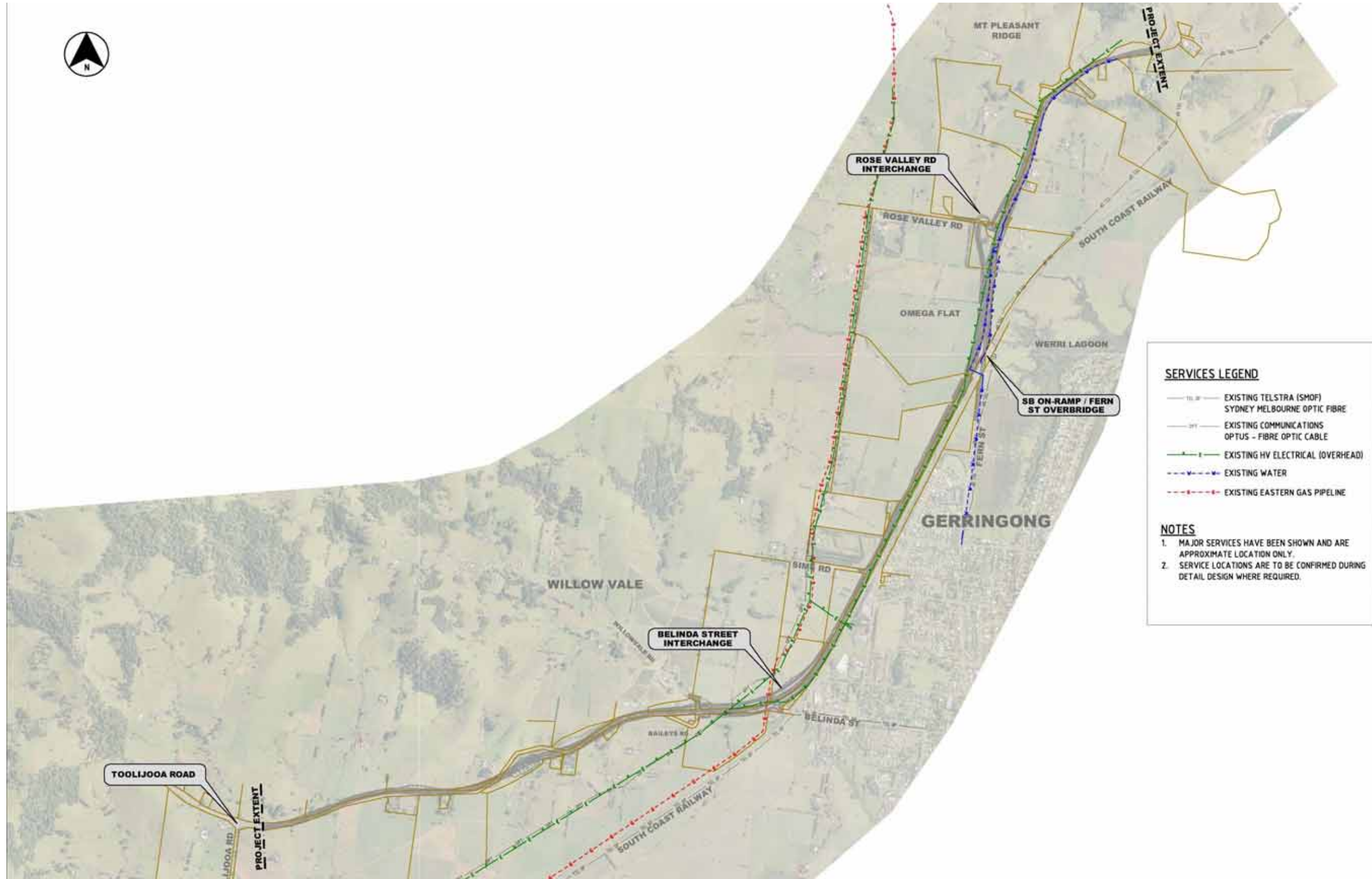
A buried Sydney-Melbourne fibre optic cable owned and operated by Optus follows a similar alignment to the Eastern Gas Pipeline. The proposal interacts with the cable in the vicinity of Crooked River requiring adjustment to the cable where it would be crossed by the proposal.

A second Sydney-Melbourne fibre optic cable owned and operated by Telstra is generally aligned with the western side of the railway line entering Gerringong. The cable tracks the eastern side of Fern Street through Gerringong and re-joins the eastern side of the railway in the vicinity of Belinda Street. The proposal interacts with this cable in the vicinity of the Fern Street bridge and the cable would require adjustment at this location. Drainage amplification works near the junction of Belinda Street and Rowllins Road would also interfere with the cable located along the northern side of Belinda Street.

A Sydney Water 375 mm diameter main follows the eastern side of the existing highway from Mount Pleasant to Rose Valley Road. At Rose Valley Road the main splits into two – a branch crosses the existing highway and follows the western side of the existing highway before crossing back in the vicinity of Fern Street. A new section of main continues along the eastern side of the existing highway to Fern Street. The main continues to follow the eastern side of Fern Street into Gerringong and on to Gerroa.

It is intended that the existing Sydney Water main be protected in the shoulder of the upgraded highway to Omega Lane – a length of approximately 450 m. Relocation would be required over approximately 600 m to accommodate the Rose Valley Road interchange. Relocation or protection would also be required over 300 m to accommodate the southbound on ramp. The development of the southern approach to the Fern Street bridge would also require localised adjustment to the main.

Figure 3.2: Major public utilities



The sewerage network in Gerringong and Gerroa culminates at the Gerringong Gerroa Wastewater Treatment Plant south of Crooked River. Advanced tertiary treated effluent is pumped to Sydney Water owned grazing land between the railway line and the existing Princes Highway where it is used to irrigate pasture. The effluent re-use irrigation scheme covers a substantial area on the southern side of the highway in the vicinity of the Gerringong Bends to Toolijooa Road. The scheme is operated by Veolia Water. The proposal requires a strip acquisition of the irrigated grazing land but does not interfere with the operation of the irrigation scheme or the sewerage network.

Integral Energy own and operate two overhead electricity power lines serving the Gerringong substation on Rowllins Road in Gerringong. Both feeders interact with the proposal at different locations and would require relocation.

Ground conditions

Ground conditions are discussed in detail in Section 6.1 and in the Concept Design Report.

The ground conditions over the length of the proposal generally comprise latite overlain by tuffaceous sandstone and residual soils. In isolated pockets the soils are alluvial or estuarine with compressible and sometimes acid sulfate properties. The proposal would generally require earth fill to be placed in areas of alluvial or estuarine soils and cuttings in areas of residual soils and rock.

An approximately four metre high embankment would be required to provide 1 in 100 flood immunity across Omega Flat. The deep (up to 10 m) compressible estuarine deposits and potential acid sulfate soils in this low lying area would need to be pre-loaded to prevent uneven settlement. Pre-loading refers to the early construction of an embankment over an area of soft soils to enable consolidation and settlement prior to construction. Consolidation in this area is likely to take up to 12 months before the road surface can be constructed on the embankment.

The approximately eight metre high embankment spanning the Belinda Street underpass would be located in an area of shallow alluvial soils over residual soils.

An existing borehole exists at the toe of the existing embankment on the western end of the Gerringong Bends which would need to be intercepted and piped to the new embankment interface.

An approximate three metre high embankment would be required to span a low lying area near chainage 7000, between the Gerringong Bends and Toolijooa Road. Alluvial deposits in this low lying area are likely to be compressible and require pre-loading.

Flooding and drainage

In the low lying areas of Omega Flat, immediately north of Gerringong, the existing highway is prone to occasional flooding. Pursuant to design requirements the upgrade is required to be 1 in 100 flood immune. The level of the existing highway would need to be raised in some areas and reconstruction and/or widening of existing transverse drainage structures would be necessary.

3.2.3 Major design features

The major design features of the proposal can be discussed in four theoretical sections along the alignment.

Mount Pleasant to Rose Valley Road

From Mount Pleasant to Rose Valley Road the proposal is essentially a widening of the existing alignment to accommodate an additional lane in each direction. In this section the alignment maintains the existing eight per cent grade and the opposing traffic flows would be separated by a concrete barrier. A third climbing lane would be provided for northbound traffic.

Rose Valley Road to Fern Street

At Rose Valley Road the four lanes of the proposal deviate to the western side of the existing highway and remain wholly to the western side across Omega Flat before rejoining the existing highway south of the Fern Street junction.

A single grade-separated all-movements interchange at Rose Valley Road would service Rose Valley Road and Fern Street and forms a northern gateway to Gerringong and coastal communities to the south. The interchange would incorporate a bus stop and u-turn facility. The bus facility would be integrated with the landscape to lessen its potential urban design impact by placing the through lanes in cutting and spanning the cutting with an overbridge.

Between Fern Street and Rose Valley Road the existing highway is reconfigured to a two-way service road, which is an extension of Fern Street with a bridge spanning the railway line and replacing the existing level crossing. The two-way service road would also provide a connection to a southbound on ramp allowing traffic from Rose Valley Road to access the highway heading south.

Across Omega Flat the proposal would be flood immune for a calculated 1 in 100 year flood return. A series of low profile bridges are proposed to span the defined waterways of Omega Flat. The service road and existing Fern Street would continue to flood in less significant flood events as currently experienced. All-movements access to Gerringong and coastal communities would be provided via the proposed southern interchange at Belinda Street in times of flood.

Fern Street to Belinda Street

Between Fern Street and Belinda Street the proposal would require the widening of the existing highway to the west. The proposal would improve the currently undulating vertical alignment of this section and introduce a series of cuttings and embankments.

Sims Road would connect to the highway in a cutting with a left-in-left-out junction and right turns out would be prohibited with the inclusion of the central median barrier. Southbound access to the highway from Sims Road would be provided via the Rose Valley Road interchange and the southbound on ramp at Fern Street.

A single grade-separated all-movements interchange at Belinda Street would service Belinda Street and Willowvale Road and form a southern gateway to Gerringong. The highway would be elevated on embankment in the vicinity of Belinda Street and Willowvale Road, which would provide opportunity for Crooked River, Baileys Road, and Belinda Street to pass under. A proposed two-way service road would connect Belinda Street to Willowvale Road on the northern side of the main four lane alignment.

Flooding issues at the existing Belinda Street rail underpass and the junction of Belinda Street with Rowllins Road would be addressed as part of the proposal through a combination of amplification of the local road drainage infrastructure and the downstream railway drainage infrastructure in consultation with RailCorp and Kiama Municipal Council. The interchange would provide 1 in 100 flood free access for Gerringong at times when the Fern Street access is closed due to flooding.

Belinda Street to Toolijooa Road

West of Willowvale Road the proposal would traverse a ridge spur in a section known as the Gerringong Bends. The southbound on ramp from Belinda Street would continue as a climbing lane over this spur. The existing cutting through the spur would need to be deepened to improve the vertical geometry at this location.

Following the Gerringong Bends the proposal would require the widening of the existing highway to the north. A temporary 'tie-in' would connect the upgraded alignment to the existing alignment immediately east of Toolijooa Road. The temporary tie-in would be configured such that traffic would be appropriately transitioned between the upgraded and existing alignment for the period following the completion of the proposal and future upgrade of the highway south of the proposal.

The potential traffic and transport issues associated with the proposal and the interaction with future upgrades south of the proposal is discussed in Section 3.3.5, Section 6.6 and Appendix I detailed traffic assessment.

Emergency access provisions

Emergency vehicle u-turn facilities would be provided between grade-separated interchanges. The wire rope median barrier would be discontinued and a permanent gap would be provided. In the case of a significant traffic incident blocking all lanes, emergency u-turn facilities could be used to direct traffic under emergency services control. Signposting would denote that the facility is for use by emergency vehicles, RTA vehicles and the NRMA only. A lay-by with emergency telephone would be incorporated with these facilities.

Emergency cross over facilities were considered to enable contra-flow arrangements to be put in place by emergency services in the case of a significant traffic incident blocking one direction of flow. However the only suitable locations with sufficient stopping sight distance for such facilities did not provide for contra-flow along a sufficient length of highway and so no facilities have been provided in this proposal.

Pedestrian and cyclist provision

Currently provision for pedestrians and cyclists is limited to within the Gerringong urban area. Cyclist provision in the proposal would be allowed for in the 2.5 m shoulder.

The proposal would also incorporate a combined pedestrian and cyclist pathway between Sims Road and the Belinda Street interchange. This provision has been included following community feedback and the requirement to maintain easy access to Gerringong following the introduction of the restricted left-in-left-out access at Sims Road and the wire rope barrier in the median.

Provision for future widening

The proposal has considered to the potential need to widen the Princes Highway in the future to three lanes in each direction over the length of the proposal. The concept design recognises that widening may be required in the future to improve capacity and provide for this allowance if it is economical and practical to do so. The proposal has undertaken property acquisition and the setting of corridor boundaries to provide future widening.

Where it is considered economical and practical to do so, significant structures have been designed to accommodate future widening needs. Specifically this applies to the cutting and bridge structure at the Rose Valley Road interchange, the embankment across Omega Flat and the cutting at the Gerringong Bends south of Willowvale Road. On ramps and off ramps at interchanges would be configured to allow for the introduction of a third lane on the outside of the carriageway.

Noise attenuation

The provision of noise attenuation is discussed in detail in Section 6.7. The noise assessment undertaken for the proposal recommends that noise attenuation be considered to reduce road traffic noise levels at the residential properties located immediately to the east of the railway line adjacent to the Princes Highway between Fern Street and Belinda Street. Noise attenuation would be considered during detailed design.

3.3 Construction activities

3.3.1 Work methodology

The construction of the proposal would comprise activities associated with major road works. The works would be undertaken by a contractor(s) selected after a competitive tendering process. The work methodology would be finalised during detailed design and an indicative list of work activities is provided below:

- Installation of temporary erosion, sedimentation and drainage controls.
- Installation of temporary fencing for 'no go zones'.
- Establishment of stockpile and compound sites.
- Adjustment of utilities as required.
- Removal of vegetation and grubbing.
- Establishment of clear zones within cut and fill sections.
- Surface preparation by graders, dozers, scrapers and other equipment.
- Compaction of the resultant surface using compaction equipment.
- Recycling of suitable excavated material and incorporation of unsuitable material in earthworks.
- Cut earthworks to be transported and placed as compacted fill.
- Importation of gravel materials.
- Installation of roadside drainage structures including culvert extensions.
- Construction of roadside batters.
- Construction of roadside gutters and berms.
- Progressively rehabilitate / stabilise disturbed areas.
- Application of flexible asphalt pavement by pavers and rollers.
- Landscaping of proposal site.

- Installation of line marking, signs and guide posts.
- Site clean-up and disposal of all surplus waste materials.

The proposal can be constructed in two broad stages:

- The northbound lanes and associated earthworks and median can be constructed with two-way traffic remaining on the existing highway.
- The southbound lanes and associated earthworks can be constructed with two-way traffic shifted to the completed northbound lanes.

Exceptions to this broad strategy are Rose Valley Road and Belinda Street interchanges and the Gerringong Bends. This is because the complex construction activities at these locations may require several stages. A possible staging strategy is discussed in greater detail with consideration of traffic management during construction in Section 3.3.5.

3.3.2 Plant and equipment

Plant and equipment required for the construction of the proposal would be typical of that required for major roads works. The works are anticipated to include the following:

- Front end loaders.
- Rollers / vibrating compactors.
- Excavation plant.
- Concrete supply agitator trucks.
- Back hoes.
- Cranes.
- Asphaltic paving machines.
- Jack hammers.
- Concrete vibrators.
- Rock breakers.
- Dump trucks.
- Road sweepers.
- Bulldozers.
- Trucks delivering construction materials.
- Water tankers.
- Low loader transporters.
- Graders.
- Light commercial and passenger vehicles.
- Trenching machines.
- Chain saws.
- Stump grinder.
- Line marking vehicles.
- Milling machine.
- Trucks transporting excavated material from the site or within the site and to deliver material onto the site.

3.3.3 Earthworks

Cuttings

Mount Pleasant to Rose Valley Road interchange

Shallow cuttings in latite on approach to Rose Valley Road interchange would have a similar appearance to existing cuttings. This rock is likely to require blasting or rock hammer to remove. Although the volume extracted would be relatively small, the rock would be suitable for use as scour protection.

Rose Valley Road interchange

The interchange requires the highway to be cut in 'slot' over a short length. The slot requires excavation up to 10 m deep in material varying from gravelly clay to highly weathered latite and sandstone. The proposed configuration would require a vertical cut face.

The rock material at this location is not likely to require blasting. The excavated gravelly clay and highly weathered latite would be suitable for use as general fill only. The sandstone layer may provide limited select material.

Near Sims Road junction

The proposed cutting in this vicinity would be in the order of 5.5 m deep with a batter slope at a near 45 degree angle. The highly weathered latite at this location would not require blasting and would be suitable for general fill only.

Gerringong Bends

The proposal would require an existing cutting to be deepened at this location. It is proposed to introduce another bench and face to the northern side of the existing cutting. The additional face would be cut at a similar slope to the existing faces slightly steeper than a 45 degree angle. The vesicular latite is prone to weathering and the additional face would require erosion protection. It is proposed to adopt shotcrete to be consistent with the treatment adopted for the remainder of the cutting on the northern side of the highway. The use of shotcrete would be consistent with RTA's Shotcrete Design Guidelines.

The massive vesicular latite on the northern cut face would require blasting to remove. This material's susceptibility to weathering makes it unsuitable for use as scour protection but it is likely to be suitable as general fill. The residual and extremely weathered soils ripped from the southern side of the cutting are likely to be suitable for use as general fill.

Chainage 6600

A relatively short seven metre deep cut would be required in the vicinity of chainage 6600, approximately one kilometre east of Toolijooa Road. The slightly weathered sandstone at this location would require blasting and is likely to be suitable for use as select material.

Embankments

Omega Flat

An approximate four metre high embankment would be required to provide 1 in 100 flood immunity across Omega Flat. The up to 10 m deep compressible estuarine deposits in this low lying area would require pre-loading to prevent differential settlement of the embankment. The incorporation of wick drains would accelerate settlement prior to construction of the embankment. Wick drains are closely-spaced artificial vertical drainage paths consisting of a plastic core, which functions as a free-draining water channel, encased by a geotextile filter through which pore water can flow, decreasing consolidation time.

Should there be a future need to increase the capacity of the highway from four to six lanes, and to avoid future construction difficulties and reduce the risk of differential settlement, the embankment would be constructed to a six lane width but accommodate four lanes only.

Pre-loading would not be required where the existing highway alignment is re-constructed to become the southbound lanes of the proposal. In these areas it is assumed that the existing highway embankment has consolidated the underlying soils.

Belinda Street interchange

The approximately eight metre high embankment spanning the Belinda Street underpass is located in an area of shallow alluvial soils over residual soils. The approximately two metre deep alluvial soils would need to be removed prior to the construction of the embankment. The consolidation of soft soils would not be required.

Gerringong Bends

The existing embankment on the western end of the Gerringong Bends would require major widening. The existing embankment was widened in the mid 1990s. If the highway is to be widened from four to six lanes in the future the embankment would be constructed to suit the six lanes but accommodate only four to avoid further incremental widening in the future. The height of the road surface would be increased by one to two metres from existing.

Chainage 7000

An approximately three metre high embankment would be required to span a low lying area between the Gerringong Bends and Toolijooa Road. Alluvial deposits in this low lying area are likely to be compressible and require pre-loading. Deposits in this area are not as compressible as those in Omega Flat and it is unlikely that wick drains would be required to accelerate consolidation.

Quantities

The achievement of an earthworks balance is desirable as the movement of earthworks within the proposal and the need to import or export material has an influence on the potential environmental impact and cost of the proposal. At concept design stage it is desirable to attempt to balance cut and fill volumes by adjusting the vertical alignment if necessary. Consideration is also given to the suitability of the material sourced from within the proposal for use as select material, concrete or asphalt constituents, or erosion protection.

The overall estimate for earthworks indicates that a cut/fill balance is achievable for the proposal. The total cut volume is estimated as 450,000 cubic metres. The total fill volume is estimated as 360,000 cubic metres. The 90,000 cubic metres excess in cut volume provides an allowance for unsuitable material of 25,000 cubic metres, material for the select material zone of 60,000 cubic metres and material for preloading of soft soil areas of 5,000 cubic metres.

These volumes do not consider the range of bulking factors that would apply to the various material types.

A detailed assessment of earthworks quantities, material suitability, bulking factors and mass haul would be undertaken in the detailed design phase. If a cut/fill balance is not possible following further assessment, consideration would be given to incorporating any excess spoil into the design, for example through landscaping. If this is not feasible, consideration would be given to stockpiling the excess for use in the construction of future proposals.

3.3.4 Source and quantity of materials

Construction of the proposal would require the following materials, which would be sourced from local licensed facilities:

- General fill.
- Pipe bedding.
- Select fill.
- Sub-base.
- Concrete.
- Base course.
- Sealing aggregate.
- Asphalt.

3.3.5 Traffic management and access

The highway would be kept open to traffic throughout construction and an appropriate speed limit would be maintained during construction depending on the type and scale of works being undertaken.

A possible construction staging and traffic management strategy is shown in Table 3.2.

Table 3.2: Construction staging and traffic management strategy

Mount Pleasant to Rose Valley Road interchange	
Stage 1	<ul style="list-style-type: none"> Two-way traffic to remain on the existing highway with construction of the northbound lanes from chainage 350 – 1150.
Stage 2	<ul style="list-style-type: none"> Two-way traffic transferred to the northbound lanes – including the existing northbound lanes from chainage 0 – 650. Requires southbound traffic to be merged to a single lane and switched to the northbound lanes prior to chainage 0. Construct southbound lanes from chainage 0 – 1150.
Rose Valley Road interchange	
Stage 1	<ul style="list-style-type: none"> Two-way traffic to remain on the existing highway. Construct all western-side ramps, bus interchange, and adjustments to Rose Valley Road. A temporary sidetrack is required to allow the northbound traffic stream to be taken via the off and on ramps in Stage 2. Construct southbound off ramp and tie to existing highway ready to take the southbound traffic stream in Stage 2.
Stage 2	<ul style="list-style-type: none"> Southbound traffic transferred to the southbound off ramp. Northbound traffic transferred to the northbound off ramp and northbound on ramp with temporary connecting track. Construct Rose Valley Road over-bridge and full upgrade cross-section from chainage 1150 – 1600.
Rose Valley Road interchange to Fern Street	
Stage 1	<ul style="list-style-type: none"> Two-way traffic to remain on the existing highway. Construct full upgrade cross-section to the western side of the existing highway from chainage 1600 – 2100.
Stage 2	<ul style="list-style-type: none"> Two-way traffic transferred to the completed northbound lanes. Southbound traffic on switch from existing highway in vicinity of chainage 1750. No access available to and from Fern Street. All grade-separated movements to and from Gerringong available at the Belinda Street interchange. Construct southbound on ramp and Fern Street bridge.
Fern Street to Belinda Street interchange	
Stage 1	<ul style="list-style-type: none"> Two-way traffic to remain on the existing highway. Construct northbound lanes to the western side of the existing highway from chainage 2100 – 4000.
Stage 2	<ul style="list-style-type: none"> Two-way traffic transferred to the completed northbound lanes. Construct southbound lanes from chainage 2200 – 4000.

Belinda Street interchange	
Stage 1	<ul style="list-style-type: none"> • Two-way traffic to remain on the existing highway. • Construct all western-side ramps and adjustments to Willowvale Road. • Construct the Belinda Street connection and tie to existing highway. • Construct sections of the southbound off ramp and southbound on ramp and tie to existing highway.
Stage 2	<ul style="list-style-type: none"> • Southbound traffic transferred to the southbound off ramp via switch at approximately chainage 4025. • Northbound traffic transferred to the northbound off ramp and northbound on ramp. • Connection to Belinda Street via two-way Belinda Street underpass. • Construct full upgrade cross section, including Belinda Street under-bridges, from chainage 4100 – 4750. • Construct northbound lanes, including bridge over Crooked River, from chainage 4750 – 5100.
Belinda Street interchange to tie-in at Toolijooa Road	
Stage 1	<ul style="list-style-type: none"> • Two-way traffic to remain on the existing highway. • Construct southbound lanes adjacent to existing highway from chainage 5200 – 6050. • Construct northbound lanes and on ramp from future Toolijooa Road interchange from chainage 5850 – 7650. • Construct a temporary u-turn facility at Toolijooa Road.
Stage 2	<ul style="list-style-type: none"> • Two-way traffic transferred to the southbound lanes between chainage 5300 – 6000. • Traffic switch at chainage 6000 with two-way traffic transferred to the completed northbound lanes. • Construct northbound lanes from chainage 5300 – 6000. • Construct southbound lanes from chainage 6025 – 7500. Southbound lanes to terminate at chainage 7500. • Once traffic has been shifted to the completed southbound lanes a temporary switch would connect the southbound lanes to the existing highway. Northbound traffic would remain on the northbound on ramp until construction of the next downstream highway upgrade proposal was completed.

The potential for conflict between highway traffic and construction traffic is high, and delays may be frequent. In order to manage these conditions, phased construction and temporary traffic facilities would be implemented to reduce delay to road users while maintaining high levels of safety for motorists, residents and the construction workforce.

Construction impacts of the Gerringong upgrade would include an increase in heavy vehicle activity on the Princes Highway and local routes due to on/off road earthworks haulage. Traffic control details are limited at this stage in the proposal due to the uncertainty associated with the ultimate contractor's work methods. The construction sequencing and any temporary works identified would be based on minimising user delay whilst providing sufficient flexibility for the contractor to efficiently plan the construction of the Gerringong upgrade.

A traffic management plan (TMP) would be developed by the construction contractor prior to the commencement of works. The TMP would outline guidelines, general requirements and procedures to be used when existing traffic arrangements are impacted; identify the traffic management requirements of the proposal; and describe the general approach and procedures to be adopted when producing specific traffic control plans.

Construction methods and staging would be designed to minimise road closures, subject to other proposal constraints and allow staged construction so that disruption to the existing traffic is maintained within acceptable levels. Traffic diversions or stages would include lane and shoulder closures on either the existing, temporary or new pavements. Road occupancy licences would be obtained for each type of construction work involving closures.

Provision of traffic management measures during the closure of Fern Street, such as temporary traffic lights, would help to improve the performance of the off ramp approaches. Provision of temporary traffic management measures would also be considered during periods of blasting if required.

Vehicular access for properties adjacent to the Princes Highway would be left-in-left-out during construction and operation of the proposal and specific provisions for pedestrians and cyclists would only be considered where they currently exist, and where they would interact with the construction zone, for example, at local roads such as Fern Street and Belinda Street.

Provision would be made to maintain access to all residences, local roads and commercial properties during construction.

A temporary 'tie-in' connects the upgraded alignment to the existing alignment immediately east of Toolijooa Road at the southern proposal extent, which would be configured to allow appropriate transition of traffic between the upgraded and existing alignment.

During the construction of the proposal, it is estimated that some traffic would divert away from the Princes Highway to avoid the ongoing construction work.

Following completion of the proposal and subsequently as more of the upgrade works to the south are completed in the future, it is expected that traffic would quickly return to the Princes Highway to take advantage of travel time, comfort and safety benefits provided by the proposal.

3.3.6 Workforce and working hours

The workforce would comprise of RTA staff, contractor staff and sub-contracting crews (an average of approximately 30 staff ongoing for the construction period). Construction would be predominantly undertaken during the following hours:

- Monday – Friday: 7am to 6pm
- Saturday: 8am to 1pm
- Sunday and Public Holidays: No work.

However, it is anticipated that some work would be required outside of these hours. This would be to minimise disruptions to local businesses, reduce the overall construction time and to provide for special delivery of plant and materials to site.

Work undertaken outside of the above working hours would be in accordance with the DECCW Interim Construction Noise Guideline (DECC 2009) and the procedure contained in the RTA's Environmental Noise Management Manual 2001, 'Practice Note vii – Roadworks Outside of Normal Working Hours' (refer to Section 6.7 for more information).

Wherever possible, the amount of work that would be required to be undertaken during holiday periods, public holidays and weekends would be minimised.

3.4 Ancillary facilities

Ancillary facilities are required for two purposes:

- To support or facilitate the construction of the proposal – such as batching plants or site compounds.
- To divert traffic or services around various construction stages.

The required location of compounds, batch plants and stockpile sites is dependent on the work packages identified by the construction contractor. Work packages are differentiated according to the location, the nature of the work and the timing of the activity. Cleared or otherwise disturbed land would be leased from adjacent land holders for ancillary facilities where possible.

Site compounds

The establishment of administration and construction compounds would form part of the site establishment works. Site compound establishment would include the erection of site fencing and clearing and levelling the site. Hard stand areas would be constructed and temporary offices and storage sheds would be erected. Temporary utility connections to these sites would be established.

Compounds would comprise prefabricated sheds or purpose built temporary buildings for the proposal. It may be possible to utilise an existing dwelling to be acquired by the proposal if the dwelling is located such that it is not affected by the earthworks for the majority of the proposal duration.

Two types of compound would be required for the proposal:

- Administration compounds are the centre for works coordination and communication and provide for employee and visitor parking and would include toilet amenities.
- Construction compounds 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 incorporated in the works.

The location and layout of site compounds would be designed with consideration for the natural and built environment and the location of near and sensitive receivers. Impacts include the noise, vibration, and dust generated by traffic and site activities. Traffic management and noise and vibration sub-plans would be established, implemented, and monitored throughout the course of the proposal.

On-site batching plants

The scale of the proposal is such that temporary concrete and asphalt batching plants may be required on-site. Concrete batching plants may be required to service the construction of bridges. Asphalt batching plants would be required for construction of temporary and permanent pavement.

All batching plants would be required to comply with relevant environmental and licensing requirements, including dust collection equipment, hours of operation and management of waste materials.

Casting yards

Concrete elements would be either cast in situ, pre-cast off-site, or cast on-site. The following concrete elements are required:

- Pits, pipes, culverts and headwalls for drainage works.
- Barriers, noise walls and other road furniture.
- Bridge girders, piles and abutments.

If required, casting yards can be accommodated within the concrete batch plant sites.

Stockpiling sites

Stockpiles would be required for the temporary storage of materials delivered to the construction site or generated from within the construction site. Materials would include the constituents of concrete and asphalt, and stripped topsoil for use in final landscaping work.

There would also be a requirement for long-term operational road maintenance stockpile sites as part of the proposal. The design and exact location of these sites would be developed during detailed design.

Site selection criteria

Proposed selection criteria for establishment of ancillary facilities including site compounds, on-site batching plants and temporary and long-term stockpile sites would be as follows:

- Sites are to be located on residues of land purchased for the road works where such residues are available and suitable.
- Sites are to have sufficient area to permit the storage of topsoil and the movement of scrapers.
- Wherever practicable, sites are to be separated from creeks or watercourses by at least 50 m conditional upon the provision of adequate erosion and sedimentation controls. Where 50 m separation is not possible they would be sited subject to investigation of appropriate controls.
- Sites are to have low conservation significance for flora and fauna.
- Sites are not to be of Aboriginal or non-Aboriginal heritage significance.
- Sites are to be already cleared of native vegetation.
- Sites are not to be located within 200 m of, or drain directly to, SEPP 14 wetlands.
- Batching plant sites are to be located so as to facilitate effective transport of concrete and asphalt to the worksites and to allow efficient access for constituent materials.
- Batching plant sites are to be relatively level and have sufficient area to permit effective operation, preferably at least one hectare.
- Wherever possible, sites are to be separated from the nearest residence by at least 200 m unless it can be demonstrated that there would be no adverse noise, visual and air quality impacts.

- Batching plant sites must be above the 20 ARI flood level unless a contingency plan to manage flooding issues is prepared and implemented.
- Sites are to be selected so that the operation of the plant minimises impact on the land use of adjacent properties current at the time the plant is established.
- Concrete batching sites are to have at least town water and power supply. Asphalt batching plants are to have at least power supply.
- Concrete batching sites are to have a 'first flush' capability to minimise the risk of alkaline water runoff.
- Where practicable, operational road maintenance stockpile sites would be stabilised through revegetation.
- Stockpiles would not be established on slopes greater than 2h:1v.
- Stockpile sites would be managed in accordance with the RTA's Stockpile Site Management Procedure (RTA, 2001).

Side tracks

Where the new works interact with the existing road network, there would be a need to incorporate traffic diversions to enable 'off-line' construction of the permanent works. Side tracks would be constructed with asphalt pavement and temporary line marking and traffic control devices to maintain existing road network functionality during construction.

Temporary traffic facilities

It is important that construction vehicles accessing the site and compounds minimise disruption to traffic on adjacent roads. Where substantial volumes of traffic are generated by site activities, temporary traffic facilities may be needed to ensure safe and efficient entry and egress of construction vehicles. These facilities could include right-turn bays, traffic signals and roundabouts on the existing road network and would be identified during the detailed design phase and configured by the construction contractor as part of their work package planning.

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. Utilities would be installed in their new permanent alignment when this suites construction staging.

The construction contractor would carry out a detailed survey and identify all utilities affected prior to the commencement of construction. Modifications to the affected utilities would be in accordance with the design and construction methods approved by the relevant service authorities. Potential impacts on services would be minimised as far as practicable.

Haulage roads

Where possible, it is proposed to utilise the proposal alignment for mass haulage of materials. Once the alignment is cleared of vegetation a haulage route would be established to link borrow sites, construction compounds and concrete batching plants. Where the new alignment utilises the existing road corridor, a haulage route would need to be accommodated separate from highway traffic and within the construction footprint.

Sedimentation basins

Sedimentation basins and upgraded stormwater diversion and temporary cross drainage would be required at the time that the proposal alignment is cleared of vegetation. Sedimentation basins would be excavated at low-lying areas adjacent to the formation. Stormwater diversion and cross drains would be installed to convey off-site waters through the worksite. They would be representative of the sensitivity of the identified receiving environment and may be incorporated as a permanent part of the drainage works.

3.5 Public utility adjustment

The proposal interacts with the Optus Sydney-Melbourne fibre optic cable in the vicinity of the Crooked River bridge. Adjustment to the cable would be required where it is crossed by the proposal.

The proposal interacts with the Telstra Sydney-Melbourne fibre optic cable in the vicinity of the Fern Street bridge and would require adjustment at this location. Drainage amplification works near the junction of Belinda Street and Rowllins Road would also interfere with the cable tracking on the northern side of Belinda Street.

Relocation of approximately 600 m of the new section of Sydney Water 375 mm diameter water main would be required in the vicinity of the Rose Valley Road interchange as it follows the eastern side of the existing highway to Fern Street. Relocation or protection would also be required over 300 m to accommodate the southbound on ramp at Fern Street. The development of the southern approach to the Fern Street bridge would also require localised adjustment to the Sydney Water main.

Two existing Integral Energy overhead power lines interact with the proposal at different locations on the eastern and western sides of the existing highway between Rose Valley Road and Belinda Street and would require relocation.

3.6 Property acquisition

Based on preliminary adjusted road boundaries, the proposal would require the acquisition of approximately 99,3400m² (99.34 hectare) of private land including.

- Full acquisitions (three properties) - 743,050m² (74.305 hectare)
- Partial acquisitions (31 properties) - 250,350m² (25.035 hectare)

The preliminary adjusted road boundaries would be subject to confirmation following concept design finalisation addressing any design modifications required following the display of the REF and feedback gathered during the submissions period.

All property acquisition, whether partial or full acquisition would be undertaken in accordance with RTA's Land Acquisition Policy and the *Land Acquisition (Just Terms Compensation) Act 1991*.