

3. the proposed upgrade

This section gives an overview of the proposed upgrade.

It briefly outlines the process of identifying the route for the proposed upgrade, and provides an overview of the proposed upgrade, in terms of its alignment, the location and types of interchanges and local access and vehicular circulation arrangements.

DEVELOPMENT OF THE PROPOSED UPGRADE

The selection and preparation of the concept design for the proposed upgrade has involved a detailed process of planning and site investigations, since the intention to upgrade the Pacific Highway between Tintenbar and Ewingsdale to a two-lane dual carriageway was announced in 2004.

This process was described in detail in the *Route Options Development Report* and the *Preferred Route Report* (both by ARUP), which were previously publicly displayed. In summary, the process included preliminary investigations such as the identification of both constraints and evaluation criteria, which were agreed with the study team and led to the identification of initial highway upgrade route corridors. Assessment of route corridors against the evaluation criteria resulted in the determination of potentially feasible options. Evaluation criteria included a series of design principles developed to minimise visual and landscape impacts, ensuring that urban design, landscape and visual issues were considered early in and as an integral part of the route selection and development process. Further studies were then carried out, together with initial design work. This resulted in a number of refinements to the options, the review of which led to the determination of a short list of four options which were publicly displayed. Short listed options underwent a preliminary assessment process which resulted in the identification of the preferred route in September 2006.

Since its public display in late 2006, minor changes and amendments have been made to the preferred route, largely as a result of the need to review access arrangements, and as a response to engineering issues and to community and stakeholder feedback.

The preparation of this "Urban Design, Landscape and Visual Assessment" working paper, as part of the Environmental Assessment under Part 3A of the *Environmental Planning and Assessment Act 1979*, considers and builds on the results of the studies undertaken during the route selection process, as well as on the existing conditions.

OVERVIEW OF THE PROPOSED UPGRADE

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ROUTE ALIGNMENT

The Proposal would provide a four lane dual carriageway between Ross Lane and the Ewingsdale interchange which meets the RTA's highway design criteria for a 110 kilometres per hour design speed. The road reservation of the upgraded highway would vary in width, depending on the requirements for interchanges, cuttings, embankments and local access roads, with a minimum width of about 120 metres.

The upgraded highway would replace the existing two lane highway. It would significantly deviate from the existing highway alignment, the geometry of which is largely sub-standard, a fact which is reflected in the larger than average accident rate. However, the existing Pacific Highway would be retained as a local link road between Tintenbar and Ewingsdale, enabling local residents to make short trips without having to use the upgraded highway.

At the southern end of the study area, the proposed upgrade would tie in with the proposed Ballina bypass, at the Ross Lane interchange. At the northern end of the study area, the proposed highway upgrade would tie in with the existing four lane dual carriageway highway which commences at the Ewingsdale interchange.

Starting at the Ross Lane interchange, the upgraded highway would follow the top of the escarpment parallel to the existing highway, deviating slightly further west from it in the Knockrow area. The distance between the existing highway alignment and the upgraded highway would increase north of Martins Lane and the property 'Kilrush' (property 53), accommodating the Ivy Lane interchange west of the existing highway alignment. The upgraded highway would then follow a gently meandering alignment through the undulating agricultural landscape of the elevated plateau. Approximately three quarters of a kilometre south of Newrybar, the alignment would pass under the existing highway and continue its course through the elevated plateau, maintaining the integrity of the core of Newrybar Village. It would remain relatively close to the existing highway until the alignment reaches the Bangalow interchange. After the interchange, the upgrade would deviate significantly from the existing highway, cutting through the Tinderbox Creek Valley and adjoining valleys. It would partly climb the St Helena ridge before entering a tunnel which avoids the steepest section of the ridge line. The upgraded highway would emerge from the tunnel on the Ewingsdale spur, a long spur leading off the scenic escarpment. The upgrade would run parallel to the existing highway again, but on a lower vertical alignment.

INTERCHANGES

The proposed upgrade includes a number of modifications to the grade-separated interchanges at Bangalow, Ewingsdale and Ross Lane, as well as the construction of a new grade-separated interchange at Ivy Lane. Together, these interchanges would provide access between the local road system and the upgraded highway. The following provides an overview of the proposed interchange works. More detailed information on the proposed works is provided in the urban design, landscape and visual assessment section of this working paper, under the relevant precinct chapters.

- > Ross Lane interchange (Precinct One)
A northbound on-ramp and southbound off-ramp would be added to the interchange.
- > Ivy Lane interchange (Precinct Two)
A new interchange would be provided at Ivy Lane, consisting of a northbound on-load ramp and a southbound off-load ramp. An associated underpass would provide access to properties in this area.
- > Bangalow interchange (Precinct Three)
The existing interchange would be reconstructed, modifying the existing off-load ramp and constructing a new northbound off-load ramp for the upgraded highway, both of which would be connected to Bangalow Road via a roundabout and short link road. A new southbound on-load ramp onto the upgrade would also be provided.
- > Ewingsdale interchange (Precinct Five)
Modifications to the interchange would include the diversion of the existing highway alignment to connect the upgrade to the existing dual carriageway, replacing the existing southbound loop on-ramp with a direct on-ramp, and changes in the configuration of existing roundabouts.

LOCAL VEHICULAR ACCESS AND CIRCULATION

In order to minimise conflict between local traffic and regional traffic on the Pacific Highway, local vehicular access to the upgraded highway would be limited. The existing highway alignment would be retained and complemented with a series of local access roads, in order to provide an alternative local link between Tintenbar and Ewingsdale, and to maintain access to local properties.

The following is a brief overview of the proposed amendments to local access arrangements:

- > Ross Lane to Carney Place

A local access road would be provided on the western side of the upgraded highway, commencing at the existing highway alignment just south of the Ross Lane interchange.
 - > Carney Place to Macadamia Castle

A local access road would be provided on the western side of the upgraded highway, with a new intersection on the existing highway alignment approximately half way between Carney Place and Martins Lane.
 - > Ivy Lane

Access to properties off Ivy Lane would be provided via a short local access road on the western side of the upgraded highway and via the upgraded road infrastructure associated with the proposed Ivy Lane interchange.
 - > 'Yarrenbool Place'

Access to 'Yarrenbool Place' (property 89) and property 92 would be provided by two short access roads connecting to the existing highway on either side of a tributary to Emigrant Creek.
 - > Emigrant Creek

Around Emigrant Creek, the existing highway would be diverted to pass under a bridge constructed over the creek. Consequently, access roads and driveways off the existing highway would be upgraded and realigned.
 - > Watsons Lane

Access to properties off Watsons Lane would be maintained by the construction of an underpass.
 - > Broken Head Road and 'Claremont'

A bridge over the upgraded highway would be constructed in Broken Head Road. Access to the two severed portions of 'Claremont' (property 160 and 168) and to property 176 would be via two short access roads on either side of the bridge.
 - > 'Picadilly Park' and 'Arundel'

Access to 'Picadilly Park' (property 199), 'Arundel' (property 198), and properties 183, 186, 191 and 193 would be provided by a bridge over the upgraded highway and associated local access road on the eastern side of the upgrade. The two severed portions of 'Arundel' would be connected by a separate private underpass.
 - > Ballina Road to Bangalow Road

Access to properties on the eastern side of the upgraded highway would be provided via a local access road off Bangalow Road.
 - > Tinderbox Road

Tinderbox Road would be realigned to pass under the upgraded highway adjacent to Tinderbox Creek. There would be no changes to local access arrangements off this road.
 - > Plantation Drive, Ewingsdale

The upper reach of Plantation Drive would be realigned further east, maintaining access to property 371 on the St Helena ridge.
 - > 'Araluen' (property 394)

An access road would be provided off Myocum Road, replacing the existing access and underpass off the Old Pacific Highway.
- Access arrangements to other properties located along and off the existing highway alignment would not be affected by the proposed upgrade and would be retained in their current form, including access to
- properties east of the existing highway between Ross Lane and Emigrant Creek.
 - properties to the west of and along the existing highway between Emigrant Creek and the Bangalow bypass.
 - properties along the existing highway north of the Bangalow interchange.

4. landscape and visual impact assessment

This section is dedicated to the visual assessment of the proposed upgrade. It has been broken down according to several steps involved in the visual assessment:

> **Visual and Landscape Assessment Method**

Provides an overview of the method used. The assessment of the proposed upgrade has involved both a quantitative and qualitative assessment. In particular the quantitative assessment involved a number of steps and calculations that are explained in detail and in their relation to the qualitative assessment

> **Urban Design, Landscape and Visual Assessment Precincts**

Outlines the location and boundaries of the five precincts that the study area was divided into for the purposes of the visual assessment.

> **Potential Impacts common to all Precincts**

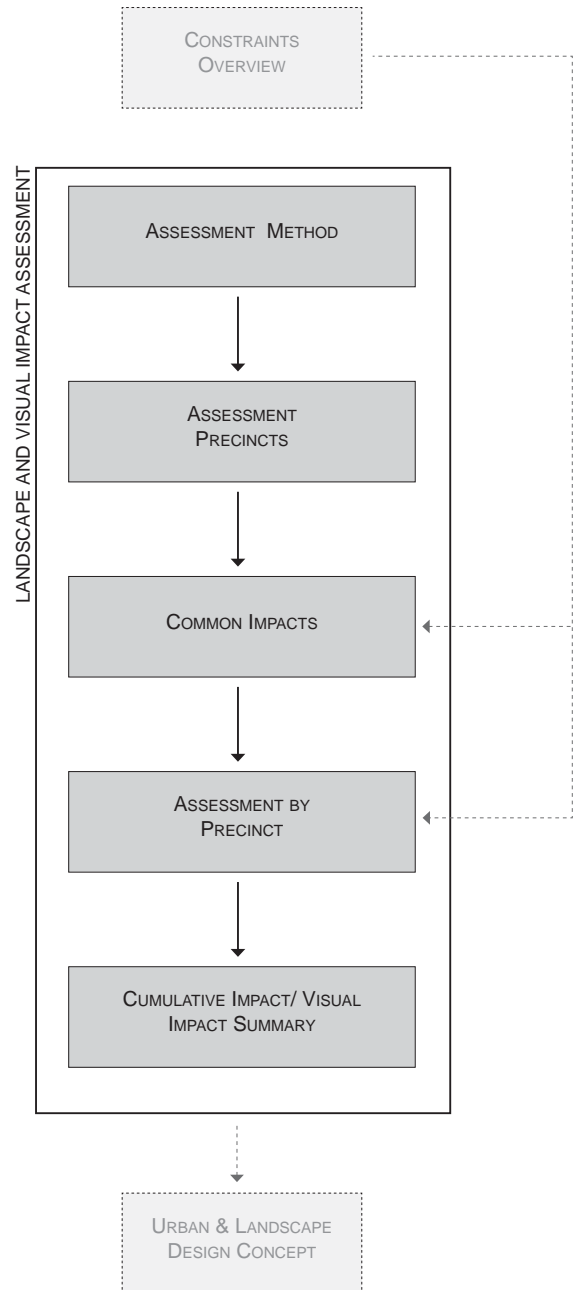
Provides a brief overview of visual issues associated with the upgrade across all precincts, the most important of which is the introduction of a major new infrastructure element into the rural landscape. Also briefly addressed temporary construction impacts.

> **Visual Assessment by Precinct**

Includes a description of the existing landscape and visual character of each precinct, an overview of the proposed upgrade accompanied by an annotated plan and the visual assessment of the proposed upgrade within each precinct. It involves a discussion of the likely visual effect of the works, the likely visual sensitivity of viewers and the resulting visual impact, based on the quantitative assessment.

> **Visual Impact Summary**

Summarises the visual effect, visual sensitivity and resulting visual impact for each precinct, based on the quantitative assessment. It is complemented by a discussion which considers the effect of the proposed upgrade on the specific visual quality of the landscape of the area, over and above its physical magnitude and in terms of the cumulative impact across all precincts.



VISUAL IMPACT

The visual impact of the proposed upgrade is determined by considering both the visual effect of the proposed works and the visual sensitivity of surrounding areas, as determined by surrounding land use areas from which the proposed upgrade would be visible and by the viewers likely to see it. The following diagram illustrates how various combinations of visual effect and visual sensitivity will produce high, moderate or low visual impact levels.

		VISUAL EFFECT LEVEL				
		High	High to Moderate	Moderate	Moderate to Low	Low
VISUAL SENSITIVITY LEVEL	High	High impact	High impact	High to Moderate	High to Moderate	Moderate impact
	High to Moderate	High impact	High to Moderate	High to Moderate	Moderate impact	Moderate impact
	Moderate	High to Moderate	High to Moderate	Moderate impact	Moderate impact	Moderate to Low
	Moderate to Low	High to Moderate	Moderate impact	Moderate impact	Moderate to Low	Moderate to Low
	Low	Moderate impact	Moderate impact	Moderate to Low	Moderate to Low	Low impact

*Illustration 21
Visual Impact Assessment*

For the purposes of this environmental assessment, existing site conditions and the likely visual effect and visual sensitivity of viewers have been described in a qualitative manner. This has been based on the authors' experience in the field of visual assessment and work on projects of a similar nature, as well as on widely adopted and accepted visual assessment methods. While these methods aim to provide a consistent and unbiased approach to visual assessment, the highly individualistic nature of visual perception still often leads to differing opinions with regards to the magnitude of the visual impact of a proposed development.

In order to address this issue and for reasons of consistency with the process that lead to the identification of the preferred route for the proposed upgrade, an attempt has been made at quantifying the visual assessment for the proposed upgrade. The method for doing so is described below, together with a general overview of the determination of the visual effect and the visual sensitivity.

VISUAL EFFECT

The visual effect is the expression of the visual interaction between a proposed development and the existing visual environment surrounding it. The visual effect can also be expressed as the level of visual contrast between the Highway upgrade and the visual setting within which it would be placed. It considers the relationship of factors such as form, line, colour and texture between a proposed development and the surrounding environment.

Generally speaking, a high visual effect would result where a development would be a major element and would contrast strongly with the existing landscape. Several factors might contribute to such an effect, such as poor or visually exposed siting of the development, poor integration into the landscape or a lack of screening such as provided by vegetation or topography. In situations where the existing environment is heavily modified by the proposed development, a high visual effect would also result.

A moderate visual effect would occur where a proposed upgrade is visible and contrasts with the landscape, but is integrated with it to some degree. For example, some form of visual screening or visual integration with the surrounding setting was provided through the way in which the development was positioned in relation to the surrounding landscape.

A low visual effect would occur if there was minimal visual contrast and a high level of integration of form, line, shape, pattern, colour or texture values between the development and the existing environment. Alternatively, it would be the case where a development results in only a low level of visual modification to the surrounding landscape and the existing visual setting.

The existing conditions of the surrounding environment itself will partly determine the degree of visual effect of a development. A description of the existing environment therefore forms an integral part of assessing the likely visual effect of a development. A level landscape with little vegetation cover will offer little opportunity to conceal a development. More

complex landscapes with varied topography and vegetation cover provide greater opportunities to site a development in a way which reduces its visual exposure. The potential exists to “nestle” a development into hills or behind ridges or take advantage of vegetation cover in surrounding properties, hiding the development from a range of viewpoints, rather than it being exposed all around. These factors were discussed in the “Constraints Overview” section of this working paper and are also described in more detail as part of the visual assessment in this section.

In order to arrive at a quantitative assessment of the visual effect of the proposed upgrade, the visual effect was considered to be an expression of the scale of the proposed infrastructure, combined with the degree of its exposure or visibility from surrounding areas, as determined by the local topography and vegetation cover. While this does not differentiate between different landscape types such as rural or urban areas, it is appropriate in providing a relative measure of the likely visual effect, based on the consistent rural landscape along the proposed upgrade.

Visual Effect	=	Scale of the Infrastructure	x	Visual Exposure
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Scale of the Infrastructure

The scale of the infrastructure of the proposed upgrade has been measured by considering the size of cuttings and fill embankments required along the route (vertical scale), as well as by the size of the road reservation required to accommodate the upgrade (horizontal scale).

Scale of the Infrastructure	=	Size of cuttings and embankments (vertical scale)	x	Size of the Road Corridor (horizontal scale)
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Cuttings and Embankment Sizes

The size of cuttings and embankments is a suitable indicator for the degree of change to the landscape, as they are representative of the degree to which the upgraded highway will “fit” into the existing landscape, which in turn will determine the visual effect of the proposed upgrade on the area.

Generally, the taller cuttings and embankments are, the greater their prominence and subsequent visual effect on the character of the landscape. In order to measure this effect, six categories of cuttings and embankment sizes have been defined and ranked, according to their height. Tallest cuttings

and embankments receive the highest ranking as they generally have the greatest visual effect. Because of their elevation above the natural landform, bridges have been treated as if they were fill embankments. Local road bridges over the upgraded highway were included in the calculations in the same way.

The ranges are as follows:

- 1) Insignificant cuttings and embankments: 0 to 0.5m tall.
- 2) Minor cuttings and embankments: 0.5m to 2m tall.
- 3) Noticeable cuttings and embankments: 2m to 5m tall.
- 4) Large cuttings and embankments: 5m to 10m tall.
- 5) Very large cuttings and embankments: 10m to 20m tall.
- 6) Major cuttings and embankments: greater than 20m tall.

Segments of route inside the tunnel would not be visible to viewers in the study area and these segments have been rated with a factor of 0. The effect of the tunnel portals in the quantitative assessment calculation is represented by the size of the cuttings leading up to the portal, with the actual tunnel opening being of comparatively minor scale.

The score for cuttings and embankments is derived by multiplying the length of route within each category (expressed as a percentage of the route length within the relevant precinct) with the ranking for that category, and then adding up the scores for all categories.

For example, 10 per cent of a precinct may consist of category one cuttings and embankments, 15 per cent of category two cuttings and embankments, 60 per cent of category three, 10 per cent of category four and 5 per cent of category five. The cuttings and embankment score for the precinct would be

$$0.1 \times 1 + 0.15 \times 2 + 0.6 \times 3 + 0.1 \times 4 + 0.05 \times 5 = 2.85$$

Road Reservation Area

The size of the road reservation is a reflection of the overall footprint required by the proposed upgrade, including interchanges, local access roads, and the area taken up by cuttings and fill embankments. It provides an indication of how much of the existing predominantly rural landscape is “lost”, as well as of the horizontal scale of the proposed upgrade, in particular with regard to the amount of hard pavement or engineered cuttings and embankments. The size of the road reservation and therefore the visual effect of the proposed upgrade would be greater where it would result in the co-location of several roadways in close proximity, as

a large amount of hard pavement would create a large contrast with the existing rural landscape.

The score for the corridor footprint is derived by dividing the area of road reservation (within a precinct) by the length of the upgraded highway corresponding to it. In order to arrive at a score compatible with other calculations, the figure was multiplied by 10.

For example, the size of the road reservation within a precinct may be 0.65 square kilometres, with a corresponding length of the proposed upgrade of 4.2 kilometres. The Corridor Footprint Score for the precinct would be:

$$(0.65 : 4.2) \times 10 = 1.01$$

Scale of the Infrastructure Score

Using the above example, the final score for the Scale of the Infrastructure would be:

$$2.85 \times 1.01 = 2.88$$

Visual Exposure

The degree or area from which the proposed upgrade can be seen from surrounding areas (the visual catchment) is determined largely by the interplay of local topography and vegetation cover. For the purposes of this environmental assessment, a "seen area" analysis was undertaken, using GIS systems to calculate visual catchments for each precinct, based on the local topography. Vegetated areas (including natural vegetation and agricultural plantations) would restrict views of the upgrade from those areas and were deducted from the "seen areas" to arrive at the "actual visual catchment" (refer to Illustration 22). While this method does not differentiate between different types of vegetation cover in the landscape and their respective visual quality, it nevertheless provides a suitable indication of the degree of exposure of the proposed upgrade. As discussed earlier, the visual quality of the landscape is generally high throughout the study area, and a differentiation into areas of differing landscape quality was not considered necessary within the quantitative assessment.

Finally, the "actual visual catchment" remains a conservative approximation of the areas from where the proposed upgrade may be able to be seen, as it does not consider the effect of vegetated areas in terms of blocking views to the proposed upgrade where they lie between the viewer and the upgrade. The area from where the proposed upgrade would be able to be seen is therefore likely to be smaller than the shaded area shown in Illustration 22.

As details are harder to discern and the development would take up a smaller portion of the view, the visual effect of the proposed upgrade would generally be smaller as the viewing distance increases. Rankings were therefore applied to the area identified as within the "actual visual catchment". Viewing distances within the closest proximity to the proposed



Illustration 22: Approximation of the "actual visual catchment" of the proposed upgrade, representing a conservative estimate with the area from where the proposed upgrade would be able to be seen likely to be smaller.

upgrade receive the highest ranking, where as background views receive a 0 ranking. The rankings are as follows:

- 0) Background: the upgrade is able to be seen from a distance greater than three kilometres.
- 1) Middleground: the upgrade is able to be seen from a distance between 600 metres and three kilometres
- 3) Foreground: the upgrade is able to be seen from a distance between 100 metres and 600 metres
- 5) Close proximity : the upgrade is able to be seen from within 100 metres of the centreline of the upgrade.

These distances were measured from the centre of the median of the proposed upgrade, taken to be indicative of the centre of the proposed road infrastructure.

The Visual Exposure score would be derived by multiplying the actual visual catchment area within each distance range with the relevant ranking factor. The results for all distance ranges would be added and then divided by the length of the upgraded highway within the Precinct.

For example, the length of the upgraded highway may be 4.2 kilometres within a precinct and have an actual visual catchment of 4.6 square kilometres, 1.8 square kilometres of which is located at a distance of three kilometres or more from the proposed upgrade, 1.3 square kilometres of which is located between 600 metres and three kilometres, 1.25 square kilometres of which is located between 600 metres and 300 metres, and 0.25 square kilometres is located within 100 metres of the proposed upgrade centreline. The Visual Exposure Score would be:

$$(1.8 \times 0 + 1.3 \times 1 + 1.25 \times 3 + 0.25 \times 5) : 4.2 = 3$$

Visual Effect Score

Using the above example, the final Visual Effect Score would be

$$2.88 \times 3 = 8.64$$

The Visual Effect Scores were ranked as follows:

Visual Effect Score	Visual Effect Ranking
0 - 3	Low
3 - 6	Low to moderate
6 - 9	Moderate
9 - 12	Moderate to high
> 12	High

Using the quantitative assessment method, the Visual Effect of the above example would be considered to be moderate.

VISUAL SENSITIVITY

Visual sensitivity is a measure of how critically a change to the existing landscape would be viewed from various areas and users. The visual sensitivity of a proposed development therefore depends on the type of viewers and surrounding land uses likely to see the proposed development, as well as on the visual characteristics of the existing environment. Tourists or people using recreational areas, for example, would use the surrounding landscape as part of their leisure experience and will view change to the landscape more critically than for example industrial or agricultural workers. Similarly, viewers are likely to be highly sensitive to development in natural or previously undeveloped areas and less sensitive to developments in areas which are already highly developed or widely considered to be of lesser scenic quality, such as industrialised areas.

In terms of the quantitative assessment, the visual sensitivity was considered to be an expression of the number of potential viewers in the area, combined with the distance between viewers and the proposed upgrade. Similar to the visual effect, this represents a relative measure of the visual sensitivity of viewers in the study area that does not take into consideration the particular values that viewers might assign to the landscape. These have been described in previous sections of this working paper. Since they will also influence the perception of the overall visual impact of the proposed upgrade, they also form part of a qualitative discussion in the "Visual Impact Summary" following the quantitative visual assessment.

Similar to the visual effect, the sensitivity of viewers within close proximity would be larger than that of viewers seeing the upgrade from a large distance. The same rankings have therefore been applied, assigning the highest ranking to viewers within the closest proximity, whereas background viewers have received a 0 ranking, due to the smaller portion of the view affected by the upgrade when seen from a larger distance. The rankings are as follows:

- 0) Background views: viewers seeing the proposed upgrade from a distance greater than three kilometres.
- 1) Middleground views: viewers seeing the proposed upgrade from a distance between 600 metres and three kilometres

- 3) Foreground views: viewers seeing the proposed upgrade from a distance between 100 metres and 600 metres
- 5) Close proximity views: viewers seeing the proposed upgrade from within 100m of the centreline of the upgrade.

As for the visual effect, distances were measured from the centre of the median of the proposed upgrade.

The visual sensitivity score would be derived by calculating the number of buildings (households) and the length of local road within each distance range. Household numbers were multiplied by 2.9, to arrive at an approximation of the actual number of viewers (based on the average number of people living in households in the area, according to 2006 Census data.) For townships (Newrybar, Bangalow), the number of lots within each distance range was counted, again multiplied by 2.9 to arrive at an approximation of actual viewer numbers.

Finally, the sum of road kilometre length and viewer numbers was multiplied by the relevant ranking factor, to arrive at a score for each distance range. The scores were divided by 100, in order to arrive at a score compatible with the figures for other calculations, then added up to arrive at the final visual sensitivity score for the precinct.

For example, with a precinct there may be 15 residential dwellings or lots and one kilometre of local roads within close proximity of the proposed upgrade, 63 residences and 1.8 kilometres of local roads within the foreground range, 43 residences and 6.1 kilometres of local road within the mid-ground range, and 51 residences and 8.2 local road kilometres in the background range. The Visual Sensitivity score would be

$$((15 \times 2.9 + 1) * 5 + (63 \times 2.9 + 1.8) * 3 + (43 \times 2.9 + 6.1) * 1 + (51 \times 2.9 + 8.2) * 0) : 100 = 9.07$$

Visual Sensitivity Score

Using the above example, the final Visual Sensitivity Score would be 9.07.

The Visual Sensitivity Scores were ranked as follows:

Visual Sensitivity Score	Visual Sensitivity Ranking
0 - 5	Low
5 - 10	Low to moderate
10 - 15	Moderate
15 - 20	Moderate to high
20 - 25	High

Using the quantitative assessment method, the Visual Sensitivity of the above example would be considered to be low to moderate.

VISUAL IMPACT SCORE

Based on the above examples, the visual effect of the proposed upgrade in a precinct would be moderate. The visual sensitivity of the precinct would also be moderate. The visual impact of the proposed upgrade within the precinct would therefore be considered to be moderate (refer to Illustration 21).

MITIGATION MEASURES

Mitigation measures are visual treatments that are recommended to mitigate the visual impacts of a proposed development. They include ways to lessen the visual effect of the proposed upgrade itself and identify treatments near critical view areas to reduce the visual impacts of a proposed development.

Mitigation measures will be addressed in the "Urban and Landscape Concept Design" section of this working paper.

URBAN DESIGN, LANDSCAPE AND VISUAL ASSESSMENT PRECINCTS

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The landscape and visual impact assessment identifies the potential impacts of the proposed upgrade on its setting. The motorists' experience of the highway journey is considered in the "Urban and Landscape Design" section of this Working Paper.

The landscape and visual impact assessment involves an analysis of the site in terms of the existing landscape and visual character of the study area surrounding the proposed upgrade, and an analysis of the visual prominence and visual effect of the proposed works. Based on this analysis, any potential impacts are identified and any necessary mitigation measures are recommended in the "Urban and Landscape Design Concept" section later in this working paper.

The visual impact of the proposed upgrade is determined by evaluating the visual effect of the proposed works, in the context of the visual sensitivity of viewers in the area, as described in the visual assessment method in section 1 of this report.

For the purposes of discussion of the proposed upgrade works, the study area along the route of the proposed upgrade has been broken down into five precincts (refer to Illustration 23). The precincts roughly correspond to visual catchments in the area and allow for a more detailed discussion of the visual character of each precinct, of the proposed works within it and of the sensitivity of viewers that would be able to see the proposed upgrade.

The five precincts are:

- 1 Knockrow (Ross Lane to Martins Lane)
- 2 Emigrant Creek (Martins Lane to Broken Head Road)
- 3 Bangalow (Broken Head Road to Byron Creek)
- 4 Tinderbox Creek Valley (Byron Creek to St Helena ridge)
- 5 Ewingsdale (St Helena ridge to Ewingsdale interchange)

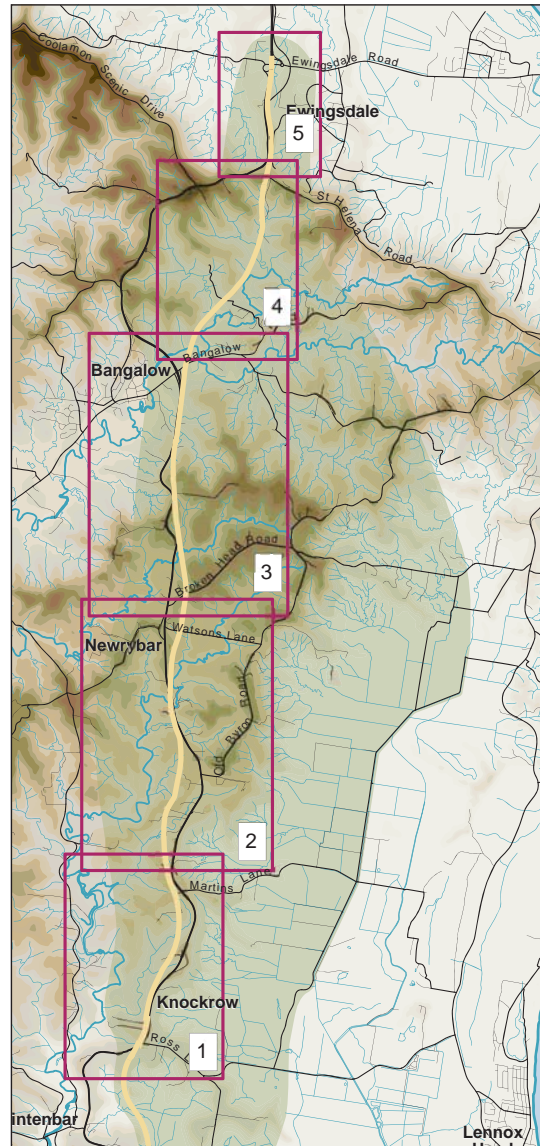


Illustration 23:
Key Plan - Visual and Landscape Impact Assessment Precincts

POTENTIAL IMPACTS COMMON TO ALL PRECINCTS

A NEW ELEMENT IN THE RURAL LANDSCAPE

The major visual change resulting from the proposed upgrade and affecting all precincts would be the introduction of the new dual carriageway highway into a highly scenic rural landscape. This landscape, while highly developed for agricultural purposes, has retained limited levels of development in general. In particular infrastructure development has been limited, with the majority of local roads retaining a low key rural road character. Local conditions, in particular the local topography, have determined the design of local roads. This is reflected in the gradients along those roads and the radii of curves in their alignment, which in turn influence the speed of travel and, to a degree, contribute to the poor safety record of the existing highway.

In addition to giving a major part of the landscape over to the development of a new roadway, the design approach for the upgraded highway in many respects is the reverse. Though the desire to fit the upgraded highway into the landscape was one of the criteria that informed the route selection process, meeting the design standards and requirements for a major national highway will invariably require adjustments to the landscape to accommodate the route .

As a result, significant modifications are required to the landscape as part of the proposed upgrade. In particular, cut and fill embankments would be an almost continual feature along the upgraded highway.

In addition, local land use and agricultural development has occurred in conjunction with the pattern of local roads and other local topographic features. The provision of an upgraded highway requires deviating from the existing highway alignment in order to achieve the desired design criteria. The proposed highway would therefore bisect the landscape along an alignment which does not correspond to the pattern of subdivision and development of the area. The wide and smooth hard pavement of the proposed highway and its engineered curves, cuttings and embankments would be in stark contrast with the highly textured agricultural landscape of the elevated plateau which has largely retained its natural landform. This would make the upgraded highway easily perceived as an imposition onto the existing landscape. It would be particularly reflected in the sometimes odd and ever-changing angles established between existing landscape features such as plantations and the upgraded highway.

As a major new highway, the proposed upgrade would also be highly prominent in the rural landscape. This would especially be the case in the southern half of the study area, and at its northern end where the upgraded highway would

follow an alignment of generous meanders in close proximity to the existing highway alignment, with the two alignments crossing or 'touching' in several locations. This creates a high level of interaction and visibility between the two roadways, which will characterise much of the study area. The design of the upgraded highway and of urban and landscape design elements in the study area will be of particular importance in this context, in order to achieve an outcome which recognises the importance of the relationship between the existing highway and the proposed upgrade. The design measures outlined in the "Urban and Landscape Concept" section later in this working paper aim to enhance the experience of road users on both routes, as well as to mitigate the potential impacts of the large increase in road infrastructure on viewers in surrounding areas.

TEMPORARY IMPACTS DURING CONSTRUCTION

Temporary impacts of construction works would be common to all precincts. They would include the generally short-term visual impacts of the construction works themselves, and the short to medium impacts in the period immediately following construction until landscape design measures grow and take effect in ameliorating some of the impacts of construction works on the landscape.

Short-term visual impacts during construction would include:

- > The location and/ or construction of temporary batching plants.
- > The prominence of construction machinery.
- > Frequent construction vehicle movements along the local road system.
- > Construction fencing.
- > Temporary erosion and sediment control measures such as sedimentation basins and fences.
- > The location of material stockpiling and construction yards in the study area.

Temporary impacts remaining for a period of time following construction completion include the visual impacts of bare cutting faces and fill embankments, until planting and revegetation works become established.

VISUAL ASSESSMENT - PRECINCT 1: KNOCKROW

ROSS LANE TO MARTINS LANE, CHAINAGE 134,750 TO 138,000

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EXISTING LANDSCAPE AND VISUAL CHARACTER

The landscape in the Knockrow precinct is highly scenic and diverse. Being located at the edge of the elevated plateau escarpment with views towards the Pacific Ocean in the east, it has a particularly expansive character. It is one of the relatively few sections along the Pacific Highway which permits ocean views. These are particularly spectacular south of Martins Lane when travelling south. In contrast, the western portion of the precinct sets the tone for the character of much of the landscape in remaining Precincts. This landscape is located on the undulating high plateau with its characteristic mix of strongly patterned agricultural landscapes and open pastures, complemented by rural residential housing and farmsteads located off the local access roads.



*Illustration 24:
Aerial Overview of the Knockrow precinct*



*Illustration 25 - 29:
Character Images of the Knockrow precinct: view towards the Pacific Ocean from the existing highway, the agricultural hinterland, view towards the Pacific Ocean from Martins Lane West, and Highway frontage and plantations in 'Clovelly Grove'*

THE PROPOSED UPGRADE

The proposed Tintenbar to Ewingsdale Pacific Highway upgrade would commence at the Ross Lane interchange which would be constructed as part of the proposed Ballina bypass Highway upgrade. It will be a grade-separated interchange featuring a northbound off-ramp and a southbound on-ramp. The existing Pacific Highway will be realigned with a bridge over the upgraded highway with a roundabout located on either side of the bridge terminating the on- and off-ramps. As part of the Tintenbar to Ewingsdale upgrade, a northbound on-ramp and a southbound off-ramp would be added to the interchange. The latter would connect to the existing highway approximately 1 kilometre north of Ross Lane. As a result of the proposed upgrade, the Ross Lane interchange would provide for vehicle movements in all directions.

North of the Ross Lane interchange, the upgraded highway would be located to the west of and closely aligned with the existing highway alignment, with the distance between the existing and upgraded highway slightly increasing in the northern half of the precinct. As a result, access from properties on the western side of the upgrade to the existing highway alignment would no longer be possible, affecting properties 5, 6, 7, 10, 13, 16, 22, 30, 32 and 36. A new, approximately 1.2 kilometre long local access road would be provided on the western side of the upgraded highway, commencing from the roundabout on the western side of the Ross Lane interchange and providing access to properties 5, 6, 7, 10, 13, 16 and 22.

Access to properties off Martins Lane West would also be no longer possible, affecting properties 39, 40, 48 and 52 in this precinct. A new local access road would be provided servicing these properties and others to the west of the upgraded highway in the Emigrant Creek precinct. The local access road would be connected via an underpass under the upgraded highway to a straight stretch of the existing highway alignment between Carney Place and Martins Lane East. The local access road would be about 2.4 kilometres long.

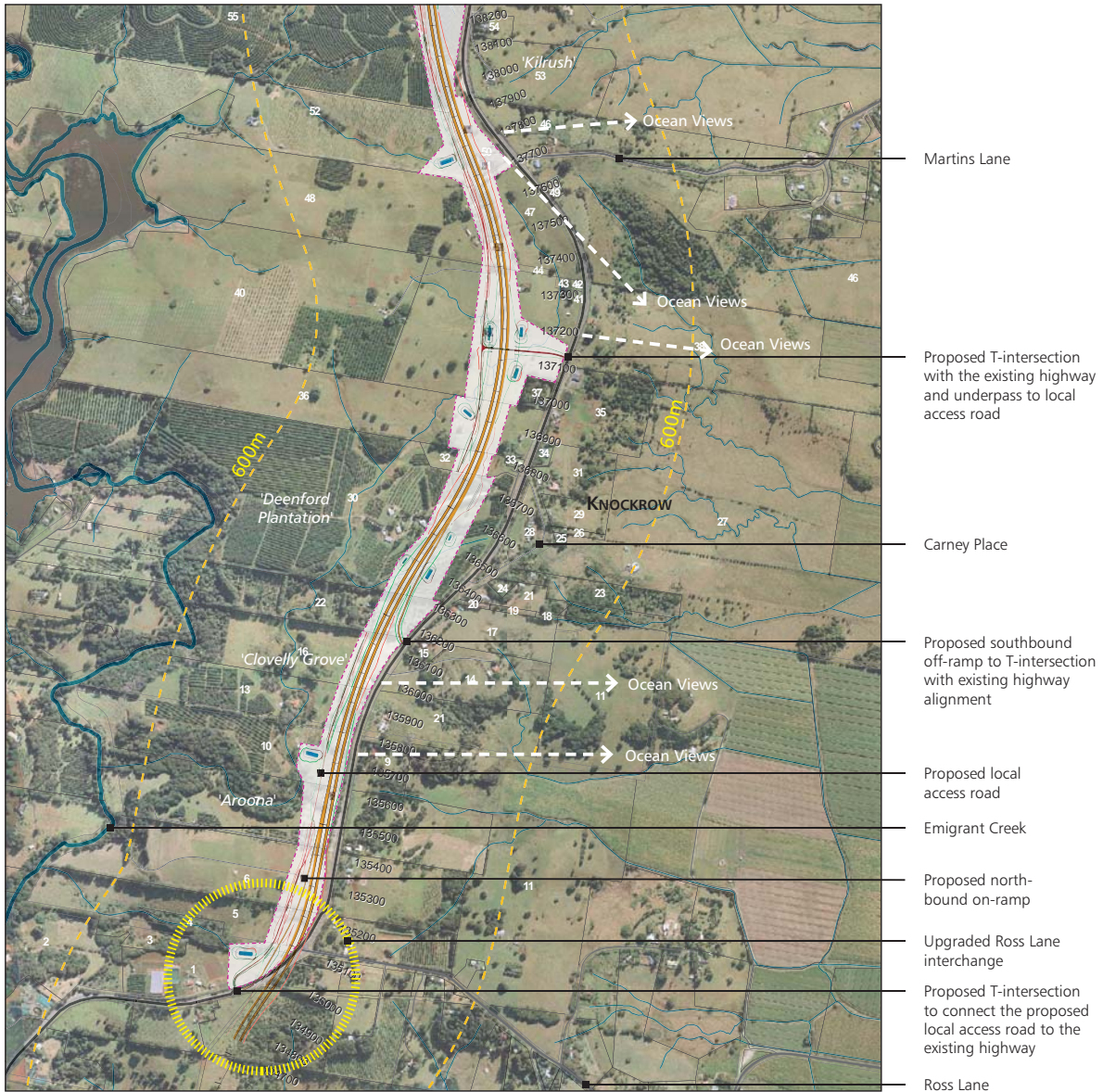


Illustration 30:
Overview of the proposed upgrade in precinct 1

Legend	
	Proposed upgraded highway: carriageways, on- and off-ramps
	Proposed new and modified local access roads
	Culverts under proposed upgrade/ local access road underpass
	Proposed structures: bridges, noise barrier or tunnel portal headwalls
	Proposed road corridor acquisition boundary
	Property ID number
	Extent of proposed fill embankments
	Extent of proposed cuttings
	Benching in cuttings and fill embankments
	Proposed sedimentation basin
	Existing Pacific Highway alignment
	Existing local roads and driveways
	600m offset: 'boundary' between areas with foreground and middleground views of the proposed upgrade

VISUAL ASSESSMENT

Visual Effect

The proposed upgrade would result in a notable increase in road infrastructure in this precinct, in particular in the area immediately north of the Ross Lane interchange where there would be a large number of parallel roadways, including the local access road, northbound on-ramp, the upgraded highway and the existing highway alignment. The provision of individual cuttings for some of these will assist in reducing the overall visual effect of the large number of roadways in close proximity to one another and associated expanse of pavement.

Further, while there would be a large amount of road infrastructure at the Ross Lane interchange, the majority of this would be in place prior to construction works for the upgraded highway, including the two roundabouts, and the changes to the existing highway alignment, crossing over the upgraded highway on a new bridge structure. The new local access roads on the western side of the upgrade further increase the amount of road infrastructure in the precinct.

Another area where the increase in road infrastructure would be highly visible would be in areas where both the new local access road and the upgraded highway would be located on fill embankments so that they would be relatively exposed to views from the existing highway alignment.

The intersection of the proposed local access road and the existing highway alignment approximately half way between Carney Place and Martins Lane would be a noticeable new element, but would be of relatively small scale.

The construction of the upgraded highway would further affect the visual character of the precinct through the severance of agricultural properties. Apart from the introduction of a new infrastructure element in the landscape, specific effects would be the loss of macadamia plantations in 'Deenford Plantations' (property 30) and in Martins Lane West (property 45), as well as the prominence of cuttings and fill embankments associated with the upgrade. These would be highly noticeable when seen from both affected properties and beyond, but especially in the area between Carney Place and Martins Lane West. This section of the upgraded highway would be located on large fill embankments through relatively open countryside. It would therefore be widely exposed to views, in particular from the existing highway alignment which in this area features only limited roadside vegetation. In other sections within the precinct, the upgraded highway

would be located in cuttings which would make it less visually prominent from the surrounding landscape. However, the cuttings themselves would have a potentially significant visual effect, especially large cuttings or where soil conditions and poor slope stability would require engineered stabilisation measures such as benching, retaining walls, rock netting or shotcreting.

In terms of effects on individual properties, local access driveways are currently small in scale. They are terminated by the existing highway alignment and property owners are able to enjoy views into the landscape beyond the existing Pacific Highway. As a result of the proposed upgrade and associated earthworks, the views along many access driveways would be blocked instead by fill embankments. This would affect the vistas along these driveways and the respective experience of affected property owners.

Another effect of the proposed upgrade would be the loss of property boundary plantations along the edge of the existing highway alignment, which currently make an important contribution to the landscape character of the precinct (refer to Illustration 29).

Scale of the Infrastructure

Size of Cuttings and Embankments

Cutting/ Embankment Height	Ranking	Length (m)	% within precinct	Score
0-0.5m	1	148	4.6	0.05
0.5-2m	2	565	17.4	0.35
2-5m	3	1,020	31.4	0.94
5-10m	4	1,109	34.1	1.37
10-20m	5	407	12.5	0.63
>20m	6	0	0	0
Total		3,250		3.33

Road Corridor Size

Corridor Size (km ²)	Length of Highway (km)	Score
0.414	3.25	1.27

Total Score for Scale of the Infrastructure

$$3.33 \times 1.27 = 4.23$$

Visual Exposure

Viewing Distance	Ranking	Actual Viewshed Area (km ²)	Score
Adjacent	5	0.39	0.60
Foreground	3	0.71	0.66
Middleground	1	3.52	1.08
Background	0	0.83	0
Total		5.46	
Total Visual Exposure Score			2.34

Total Visual Effect Score

$$4.23 \times 2.34 = 9.90$$

The quantitative assessment indicates that the visual effect of the proposed upgrade on this precinct would potentially be moderate to high due to earthworks required and the duplication of parallel road infrastructure required to maintain local road access, combined with the degree of visibility of the works.

Visual Sensitivity

The proposed upgrade would be visible from the existing highway alignment and from new local access roads. Viewers would include local residents and tourists both of which are likely to be highly sensitive to visual changes in the landscape. However, the quantitative assessment indicates that the overall number of potential viewers is limited by the comparatively few roads and buildings which would be within close proximity of the proposed upgrade. The visual sensitivity of this precinct is therefore likely to be low to moderate.

Viewing Distance	Ranking	Buildings (#)	Road lengths (km)	Score
Adjacent	5	20	0.32	2.92
Foreground	3	25	2.42	2.25
Middleground	1	49	7.94	1.50
Total Visual Sensitivity Score				6.66

Visual Impact

The quantitative assessment indicates that the visual impact of the proposed upgrade in this precinct would likely to be moderate due to the moderate to high visual effect and the low to moderate visual sensitivity of viewers in the precinct. The visual impact may be able to be decreased slightly through the implementation of mitigation measures outlined in the "Urban and Landscape Design Concept" section of this working paper.

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VISUAL ASSESSMENT - PRECINCT 2: EMIGRANT CREEK

MARTINS LANE TO BROKEN HEAD ROAD, CHAINAGE 138,000 TO 142,800

40



*Illustration 31:
Aerial Overview of the Emigrant Creek precinct*

EXISTING LANDSCAPE AND VISUAL CHARACTER

Similar to the first precinct, the character of the landscape in this precinct is highly scenic and visually diverse, being located on the elevated plateau and in close proximity to the top of the plateau escarpment. The landscape along both the upgraded highway and the existing highway alignment is characterised by the strongly patterned agricultural landscapes. Plantations are complemented by a limited amount of open pasture areas and rural residential housing and farmsteads located off the local access roads.

In the southern half of the precinct, there are open panoramic views towards the Pacific Ocean on the eastern side, where the existing highway alignment closely follows the top of the escarpment. In contrast, sections of the precinct north of Old Byron Road are set back from the top of the escarpment where views are limited to the short or middle distance by the interplay of topography and vegetation. The scenic qualities of this area are derived from the rich agricultural landscape alone. Around the Emigrant Creek crossing, views are particularly limited as the landscape is fairly contained within a series of valleys and enclosed by denser stands of vegetation along the creeks and watercourses. The Macadamia Castle is a major local landmark in the precinct, as well as an important tourist attraction.



*Illustration 32 - 36:
Character Images of the Emigrant Creek precinct: view towards the Pacific Ocean from the existing highway, the agricultural hinterland, patterned macadamia groves, the Macadamia Castle, and the enclosed landscape around the Emigrant Creek crossing*

THE PROPOSED UPGRADE

For about two thirds of the precinct, the proposed upgrade would be located to the west of the existing highway, before crossing over it north of Emigrant Creek. Most of the upgraded highway would be well set back from the existing highway alignment, with the exception of the area around the Emigrant Creek crossing where the existing highway and the upgraded highway would be closely aligned and parallel to one another.

In the vicinity of Emigrant Creek, the existing highway would be diverted for a length of about half a kilometre, to pass under the upgraded highway. The upgraded highway would pass over the realigned road and the creek at the same time, with a separate bridge provided for each carriageway. The bridge in the northbound carriageway would have a length of about 180 metres, and the bridge in the southbound carriageway would be about 165 metres long, requiring a minimum of four spans each.

Following the Emigrant Creek crossing, the upgraded highway would continue on the eastern side of the existing highway alignment, crossing Watsons Lane at right angles approximately 270 metres east of Newrybar Village. It would approach Broken Head Road after sweeping around in gentle curve on the eastern side of the Newrybar Public School. In order to reduce noise impacts on the school, a noise barrier would be provided on the western side of the upgraded highway and be approximately 400 metres long.

As part of the proposed upgrade, a grade-separated interchange would be provided at Ivy Lane, featuring of a southbound off-ramp and a northbound on-ramp. Both ramps would be connected to Ivy Lane via a roundabout. The two roundabouts would be linked by an extension of Ivy Lane under the upgraded highway. A local access road would commence at the western roundabout and provide access to properties currently serviced by Ivy Lane (property 73, 81, 82 and 85). The western properties severed by the upgraded highway in the southern part of the precinct (properties 55, 58, 60, 62 and 70) would be accessed via the local access road commencing between Carney Place and Martins Lane in precinct One.

In the vicinity of Emigrant Creek, changes to access arrangements would include two short access roads from the existing highway alignment to properties 89 ('Yarrenbool Place') and 92 on the western side of the upgraded highway. The access roads would be located on the south and north sides respectively of an unmade creek and dam. They would be bridged by twin bridges with a length of about 130 and 115 metres long for the north- and southbound carriageway

respectively. Indicative bridge layouts developed to demonstrate that functional requirements can be achieved indicate that a minimum of four spans would be required for each bridge. Access to property 101 would also be reconfigured, with a new local access road constructed off the realigned existing highway.

Watsons Lane would also be reconfigured to pass under the upgraded highway. The low clearance of the culvert under the upgrade would no longer permit heavy vehicles to use this route.

Though it would be wholly contained between the existing highway alignment and the proposed upgrade and a part of the property would need to be acquired, the built structure of the Macadamia Castle and its role as a tourist destination would not be directly affected by the proposal, from a visual point of view. Due to the intervening effects of existing vegetation at the rear of the Castle, the upgraded highway would not be visible from the site of this popular tourist attraction.

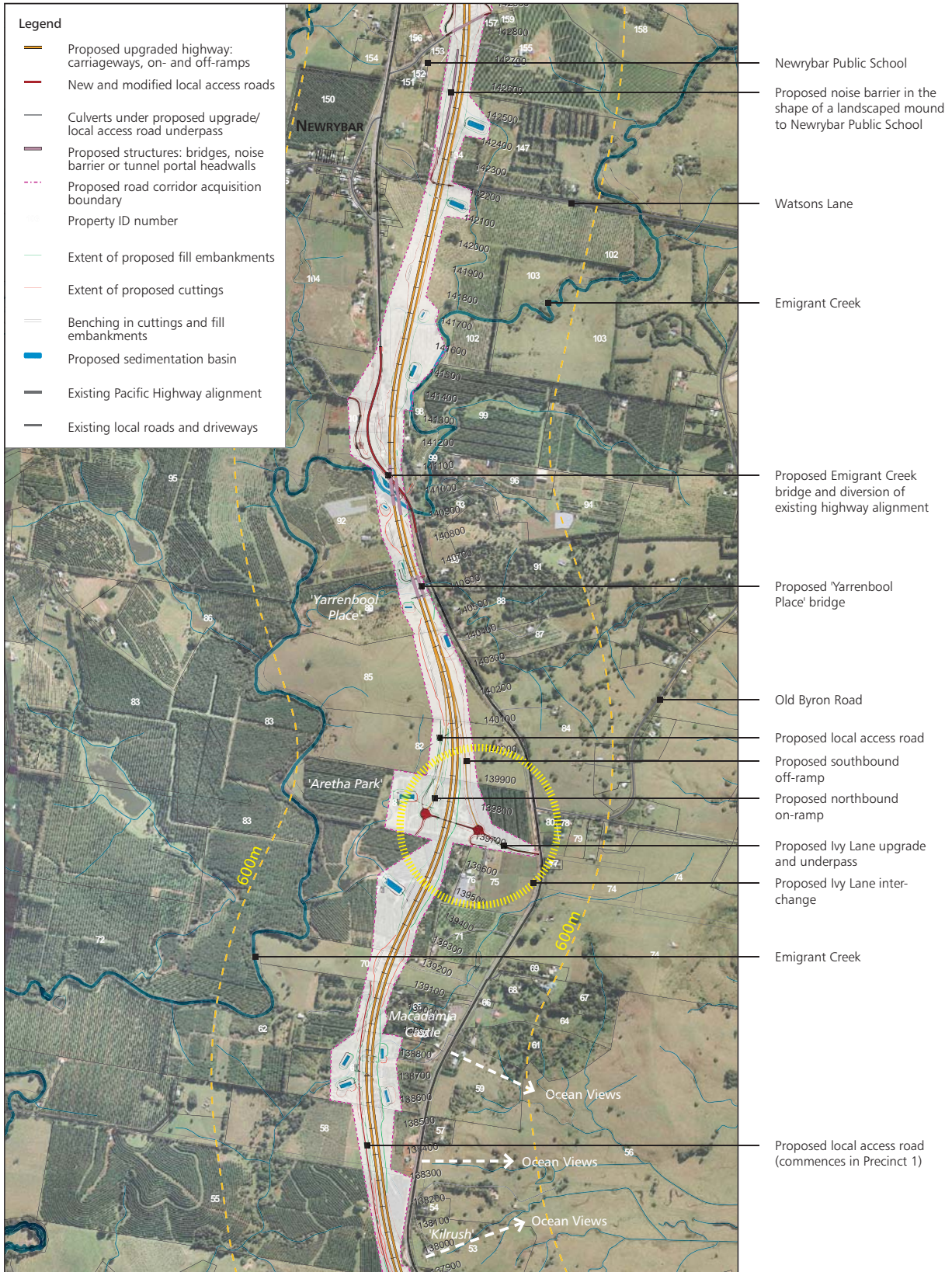


Illustration 37:
Overview of the proposed upgrade in Precinct 2

VISUAL ASSESSMENT

Visual Effect

Major visual changes specific to the precinct would be result from the construction of the creek crossings and associated works including the realignment of the existing highway near Emigrant Creek, the construction of the Ivy Lane interchange, the removal of vegetation, including agricultural plantations, and the large cuttings and fill embankments required to achieve a satisfactory vertical road alignment. Road infrastructure beyond the upgraded highway itself would be limited compared to other precincts, with this precinct requiring relatively few new or amended local access arrangements.

Works at Emigrant Creek would be of significant scale. They would include the realignment of the existing highway, including lowering of the alignment to allow the upgrade to pass over it, and the construction of fill embankments leading up to the creek crossing. The approximately 180 and 165 metres long twin bridges in the upgraded highway, spanning both the realigned existing highway and Emigrant Creek would be significant new structures. Further, a major cutting would be required on the southern approach to Emigrant Creek and would be clearly visible from the existing highway alignment. The overall visual effect of the Emigrant Creek crossing itself would be somewhat reduced by the location of the works in the Emigrant Creek Valley. While the valley is visually relatively well contained, much of the existing heavy vegetation cover is closely aligned with the existing highway and would need to be removed. While visibility of the Emigrant Creek crossing is currently limited as a result, following the proposed upgrade the crossing would be more widely exposed to views, in particular from the west, unless vegetation is reinstated in this area.

The twin underpasses and bridge over the Emigrant Creek tributary near 'Yarrenbool Place' would represent another highly noticeable visual change, being located immediately alongside the existing highway alignment.

The construction of the Ivy Lane interchange, associated roundabouts, underpass and local access roads on the western side of the upgraded highway would introduce a significant amount of road infrastructure in this part of the precinct, representing a notable visual change. With the exception of the off-ramp, these are all located on fill embankments, adding to the visual prominence of the infrastructure. However, the location of the interchange just offset from the

ridge line and the irregular pattern of vegetation in the area would conceal it to a degree, lessening its visual effect.

The construction of the proposed upgrade would result in a reduction in the area covered by macadamia plantations between Martins Lane and Old Byron Road, on the western side of the existing highway. This would be highly noticeable, as plantations currently about the existing highway alignment and provide a pleasant visual experience with their highly textured foliage and strict grid arrangement that provides a constantly changing pattern to the passing viewer (refer to Illustration 34). Following the proposed upgrade, plantations in this area would be confined to the western side of the upgraded highway. In addition to losing the experience of driving along the edge of the plantations, the plantations currently restrict views and their removal would expose the upgraded highway more widely to views from the existing highway alignment. In particular when approaching the Macadamia Castle from the south, both the upgraded highway and local access road would be highly visible as they cut through the rural landscape below the ridge line along which the existing highway is located (refer to Illustration 38).



Illustration 38:
The elevation and sweep of the existing highway alignment on the southern approach to the Macadamia Castle will make the proposed upgrade highly visible to motorists along this route.

North of Emigrant Creek, the upgraded highway would sever existing macadamia and coffee plantations. This would be noticeable from a number of locations within the precinct, including the existing highway and the proposed upgrade, from Old Byron Road, Watsons Lane and from within the affected properties themselves. The effect would be exaggerated by the changing angles created between the wide sweeping curves of the upgraded highway and the strong grid pattern of the plantations. The resulting conflicting geometries would make it obvious that the upgraded highway was imposed on the pre-existing agricultural landscape.

With regard to earthworks, the proposed upgrade in this precinct would traverse a series of valleys and ridge lines and as a result would require significant earthworks along much of the route to achieve a satisfactory vertical alignment. In particular, a number of large cuttings are required around the Macadamia Castle and the Ivy Lane interchange, near the Emigrant Creek crossing and north up to Watsons Lane. The construction of the noise barrier near Newrybar Public School in the shape of a landscaped earth mound would represent a further noticeable modification to the natural landscape. Provided the mound is successfully vegetated and well designed to integrate with the natural landform and the cutting under Broken Head Road, its visual effect may be able to be reduced over time and as vegetation matures.

The size of the cuttings and fill embankments together with the severing of properties throughout much of the precinct would result in a notable visual effect, in particular on the affected land holders. The proposed upgrade would feature prominently when seen from their properties. This would be exacerbated by the fact that additional trips would be needed to be made by these land holders who would need to use the new local access road and the existing highway alignment to travel between the severed halves of their properties.

Cuttings and fill embankments would also be noticeable from parts of the local road system.

Scale of the Infrastructure

Size of Cuttings and Embankments

Cutting/ Embankment Height	Ranking	Length (m)	% within precinct	Score
0-0.5m	1	145	3.0	0.03
0.5-2m	2	780	16.2	0.32
2-5m	3	1,328	27.7	0.83
5-10m	4	1,746	36.4	1.46
10-20m	5	800	16.7	0.83
>20m	6	0	0	0
Total		4,800		3.47

Road Corridor Size

Corridor Size (km ²)	Length of Highway (km)	Score
0.789	4.8	1.64

Total Score for Scale of the Infrastructure

$$3.47 \times 1.64 = 5.69$$

Visual Exposure

Viewing Distance	Ranking	Actual Viewshed Area (km ²)	Score
Adjacent	5	0.26	0.27
Foreground	3	1.26	0.79
Middleground	1	1.29	0.27
Background	0		0
Total		2.72	
Total Visual Exposure Score			1.33

Total Visual Effect Score

$$5.69 \times 1.33 = 7.57$$

The quantitative assessment indicates that the visual effect of the proposed upgrade on this precinct would potentially be moderate due to the visual effect associated with the road and creek crossings, the Ivy Lane interchange and the severing of the agricultural landscape. The relatively visually well contained nature of the precinct reduces the visual effect of

the proposed works by limiting areas from which they would be able to be seen.

Visual Sensitivity

The quantitative assessment indicates that the visual sensitivity of this precinct is likely to be moderate, as sections of the proposed upgrade within this precinct would be exposed to a potentially large number of viewers who would be able to see the upgraded highway from the existing highway alignment, local access roads, local residences and properties and possibly from Newrybar Public School. Limited glimpses may also be possible from the Harvest Café terrace in Newrybar, where a large number of people currently enjoy the outlook beyond the existing highway and into the agricultural landscape to the east. Viewers would include local residents, workers on rural properties and tourists. In particular the large number of local residents and tourists likely to be able to see the proposed upgrade are likely to be highly sensitive to visual changes in the landscape.

Viewing Distance	Ranking	Buildings (#)	Road lengths (km)	Score
Adjacent	5	17	1.05	2.52
Foreground	3	112	4.07	9.87
Middleground	1	54	4.45	1.61
Total Visual Sensitivity Score				13.99

Visual Impact

The quantitative assessment indicates that the visual impact of the proposed upgrade in this precinct would likely to be moderate due to the moderate visual effect and the moderate visual sensitivity of viewers in the precinct. The visual impact may be able to be decreased slightly through the implementation of mitigation measures outlined in the "Urban and Landscape Design Concept" section of this working paper.

VISUAL ASSESSMENT - PRECINCT 3: BANGALOW

BROKEN HEAD ROAD TO BYRON CREEK, CHAINAGE 142,800 TO 147,000

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*Illustration 39:
Aerial Overview of the Bangalow precinct*

EXISTING LANDSCAPE AND VISUAL CHARACTER

The character of the landscape in this precinct is characterised by its central location on the elevated plateau, well away from the edge of the escarpment. It differs from the previous two precincts insofar as it is influenced by the township of Bangalow and associated infrastructure including the Bangalow bypass and the Bangalow interchange. Outside of Bangalow, there is a population cluster along Broken Head Road.

The landscape is undulating and visually diverse, as a result of the interplay between topography and vegetation. Portions of the precinct around Lawlers Lane and near Broken Head Road feature strongly patterned agricultural plantations, while other areas are characterised by open pasture landscapes, including areas in the Byron Creek floodplain. The floodplain is fairly broad and contrasts in character with the more steeply sloping hills and ridges that dominate much of the elevated high plateau. Views around the floodplain are more open and the area is also relatively exposed to views from elevated areas, such as the parts of Bangalow township north of the railway line. In contrast, views within much of the remainder of the precinct are much more limited, as a result of the interplay between topography and vegetation.



*Illustration 40 - 45:
Character Images of the Bangalow precinct: plantations around Broken Head Road, the mix of open and vegetated landscape, 'Arundel', view from Bangalow Reservoir, significant roadside vegetation along the Bangalow bypass and view towards 'Arundel', the flat landscape around Byron Creek crossing*

THE PROPOSED UPGRADE

The upgraded highway would be located to the west of the existing highway alignment, sweeping through a large cutting underneath Broken Head Road before straightening in direction and heading towards the existing highway alignment which it meets at the southern end of the existing Bangalow bypass. Here, the northbound carriageway would merge onto the existing southbound carriageway of the Bangalow bypass. The northbound carriageway of the Bangalow bypass would be retained as an extension of the existing highway alignment, providing one lane in each direction. The southbound carriageway of the proposed upgrade would be constructed immediately to the east of the existing Bangalow bypass. At the height of the existing off-ramp, the upgrade would continue in a straight alignment, diverging from the Bangalow bypass, before sweeping in a north-easterly direction across the Byron Creek floodplain and towards the Tinderbox Creek Valley.

The proposed upgrade would involve major modifications to the existing Bangalow bypass and interchange. In addition to transforming the existing southbound carriageway into the northbound carriageway for the upgraded highway, the existing off-ramp would be removed and a new roundabout constructed on the northern carriageway of the existing bypass. The roundabout would serve to merge the separated carriageways of the Bangalow bypass onto two lanes and feed into a new link road onto Bangalow Road. A new off-load ramp from the upgraded highway would also connect to this roundabout. The existing southbound on-ramp would be relocated further east, connecting Bangalow Road with the upgraded highway. In order to protect outlying residential areas in Bangalow, such as the 'Clover Hill' estate from the acoustic impacts noise associated with the proposed upgrade, a noise barrier would be provided on the western side of the existing highway.

As a result of the proposed upgrade, properties to the east of the existing highway alignment and the Bangalow bypass would no longer retain direct access to the existing highway (properties 205 and 207). Instead, an approximately 1.2km long local access road would be constructed parallel to and on the eastern side of the upgraded highway. Access to properties 183, 186, 191, 193, 198 ('Arundel') and 199 ('Picadilly Park') further south would be provided via a bridge over the upgraded highway and a local access road. It would connect to the existing highway in approximately the same location as the existing property access road. A private underpass would link the two severed portions of 'Arundel'.

A second bridge over the upgraded highway would be constructed in Broken Head Road where the upgrade would be located in a deep cutting. Two new short roads would provide access to the severed property 'Claremont' (property 160), north of Broken Head Road.

Other major new infrastructure elements in the precinct would be the two sets of twin bridges which would be constructed over Skinners Creek and over Byron Creek and the railway line. The bridges at Skinners Creek would be about 190 metres long and are likely to require a minimum of five and four spans for the north- and southbound carriageway respectively. The length of the bridges over Byron Creek would be about 190 metres and 180 metres for the north- and southbound carriageway respectively, with each bridge likely to require five spans. A relatively short set of twin bridges of about 60 metres length would also be required over Bangalow Road. Initial design investigations have indicated that these bridges will require three separate spans.

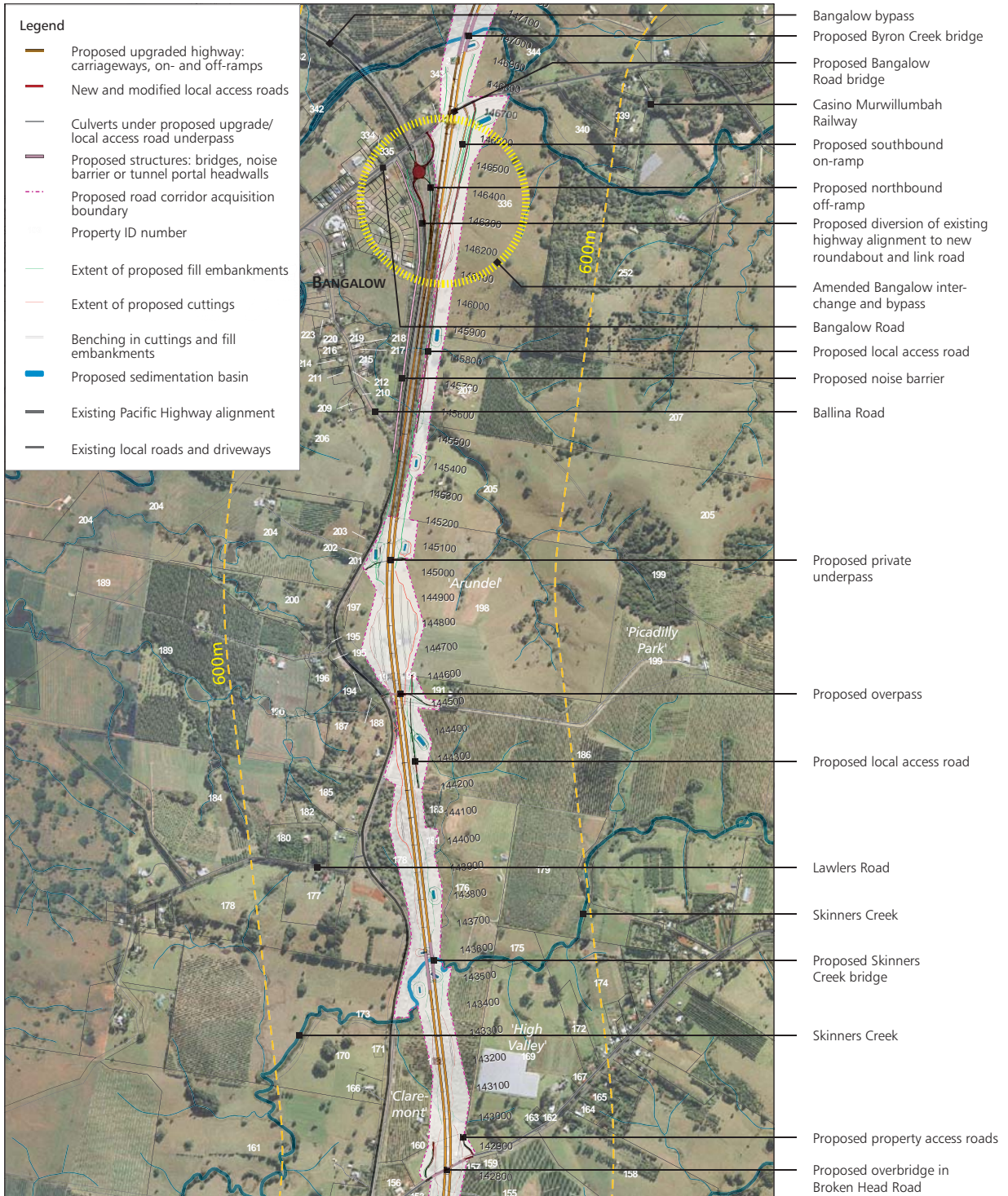


Illustration 46: Overview of the proposed upgrade in precinct 3

VISUAL ASSESSMENT

Visual Effect

The major visual changes in the Bangalow precinct would be associated with the significant amount of earthworks in the precinct, specifically the major cutting through 'Arundel' (property 198), the works around the existing Bangalow bypass, the crossing of Broken Head Road and the severing of agricultural plantations.

The proposed upgrade in this precinct would traverse a series of valleys and ridge lines, requiring significant earthworks along much of the route to achieve a satisfactory vertical alignment. In particular, large cuttings would be required near Broken Head Road and north through properties 160 and 168. A particularly large cutting would be required near 'Arundel', through properties 192, 193 and 198 and would also represent a significant visual change in the landscape, slicing through a natural hill top. Being set against the skyline, it is widely exposed to views, especially from the north. Areas from which the cutting would be able to be seen include elevated parts of the Bangalow township, such as areas from Rankin Drive or other areas north of the railway line, and parts of the St Helena ridge. In addition to the significant vertical size of these cuttings, cutting angles of repose would need to be relatively flat, therefore occupying a large footprint. Substantial fill embankments would also be required in the Byron Creek floodplain.

Similarly, the large cuttings near Broken Head Road and the bridge itself would result in notable visual changes that would be highly visible from Broken Head Road and the residences and other properties located along it.

The proposed works around the Bangalow interchange would be significant due to the large increase in road infrastructure, including the pavement surfaces of the four parallel roadways (the north- and southbound carriageway of the upgraded highway, the realigned existing highway on the current northbound carriageway of the Bangalow bypass and the proposed new local access road), on- and off-ramps, roundabout and additional bridges over Bangalow Road and Byron Creek.

Further increasing the degree of visual change in this area would be the removal of roadside vegetation lining the eastern side of the existing highway alignment and Bangalow bypass, in what would be the median strip of the upgraded highway. This vegetation is particularly dense and well established and its removal would alter the outlook from the

existing highway alignment, opening up views towards the east. These views would be largely dominated by the hard pavements associated with the upgraded highway and the new local access road. In addition to representing a highly noticeable loss, it would also expose the upgrade works and existing highway alignment to views from a larger area than is currently the case. The narrow distance between the different road- and carriageways limits the potential for landscaping or other measures that would provide visual separation or screening.

Visual effects around the Bangalow interchange would be further increased by the construction of a noise barrier on the western side of the existing highway, required to provide noise amelioration to residents of outlying residential areas in Bangalow, including the 'Clover Hill' estate. While the final form of the noise barrier has not been determined, it is likely to require the removal of significant established vegetation on the western side of the existing highway. The cumulative effect of these works would be the complete removal of vegetation along what is currently a densely vegetated road and visually pleasant road corridor (refer to Illustration 44).

The twin bridges over Byron Creek and the railway line would constitute a significant infrastructure element, with a length of up to 190 metres and a height of about 24 metres above the floodplain. The relatively open and exposed location of the bridge and associated large fill embankments in the floodplain of Byron Creek would exacerbate the visual effect, with little screening provided by either the landform or vegetation cover. In this naturally flat landscape, the large fill embankments in particular would be highly noticeable as a 'foreign' object in the landscape. The height of the bridge would also readily reveal the construction method of the bridge, including the numerous piles that are likely to be required. Initial design investigations have indicated that piles are likely to be staggered which will result in a more solid appearance of the two bridges when seen from surrounding areas. While the bridge over Bangalow Road would be significantly shorter, its visual effect would be similar as it is equally raised above the natural floodplain level, and readily exposed to viewers driving along Bangalow Road, which is important as one of the main entry and arrival points at the township.

A second instance of major twin bridges would need to be constructed over Skinners Creek and would be about 190 metres long. They would be almost parallel to the existing highway alignment and within close proximity to it. Its significant elevation above the natural valley floor, together with the earthworks associated with the structure, would make it a visually noticeable and therefore important infrastructure element in the precinct. Because of this, the detailed design

resolution of the bridge would have a significant bearing on its visual effect when seen from surrounding areas or the existing highway.

Another visual effect of the proposed upgrade results from the severing of a number agricultural crop areas on the eastern side of the existing highway alignment. Affected crops would include macadamia plantations in properties 73, 81, 102, 134, 147, 160, 168 ('Claremont') and 186 ('Picadilly Park'), as well as coffee plantations south of Broken Head Road (property 155). The visual effect of severed plantations, in particular of severed macadamia plantations, would be highly noticeable from the proposed upgrade, from Broken Head Road and from within the affected properties themselves. North of Broken Head Road where macadamia plantations are largely set out in fairly straight rows either perpendicular or parallel to existing roads, the visual effect of severed plantations would be exaggerated by the changing angles between the upgraded highway alignment and the strong grid pattern of the plantations. The resulting conflicting geometries would make it obvious that the upgraded highway was imposed on the pre-existing agricultural landscape.

Scale of the Infrastructure

Size of Cuttings and Embankments

Cutting/ Embankment Height	Ranking	Length (m)	% within precinct	Score
0-0.5m	1	1,077	25.6	0.26
0.5-2m	2	607	14.4	0.29
2-5m	3	879	20.9	0.63
5-10m	4	967	23.0	0.92
10-20m	5	709	16.9	0.84
>20m	6	139	3.3	0.20
Total		4,200		2.94

Road Corridor Size

Corridor Size (km ²)	Length of Highway (km)	Score
0.495	4.2	1.18

Total Score for Scale of the Infrastructure

$$2.94 \times 1.18 = 3.47$$

Visual Exposure

Viewing Distance	Ranking	Actual Viewshed Area (km ²)	Score
Adjacent	5	0.50	0.59
Foreground	3	1.24	0.88
Middleground	1	4.45	1.06
Background	0	0.20	0
Total		6.38	
Total Visual Exposure Score			2.54

Total Visual Effect Score

$$3.47 \times 2.54 = 8.81$$

The quantitative assessment indicates that the visual effect of the proposed upgrade on this precinct would potentially be moderate due to the high visual effect associated with the road and creek crossings and the severing of the agricultural landscape, combined with the high degree to which the works would be exposed to views from within and beyond the precinct.

Visual Sensitivity

The quantitative assessment indicates that the visual sensitivity of this precinct is likely to be high, as much of the proposed upgrade would be exposed to viewing by a potentially large number of local residents and tourists, both of which would be highly sensitive to changes in the landscape. The proposed upgrade would be highly visible from local roads such as the existing highway alignment (including the Bangalow bypass), the new local access road, Bangalow Road and Broken Head Road. A potentially large number of viewers would also be able to see the works associated with the upgraded highway from parts of Bangalow, in particular from areas in close proximity to the upgrade such as around Ballina Road, and from higher lying areas north of the railway line. Other potential viewers would include farm workers and local residents on properties east of the upgraded highway and along Broken Head Road.

Viewing Distance	Ranking	Buildings (#)	Road lengths (km)	Score
Adjacent	5	16	1.09	2.37
Foreground	3	129	2.42	11.30
Middleground	1	406	10.77	11.88
Total Visual Sensitivity Score				25.55

Visual Impact

The quantitative assessment indicates that the visual impact of the proposed upgrade in this precinct would likely to be moderate to high due to the moderate visual effect and the high visual sensitivity of viewers in the precinct. The visual impact may be able to be decreased slightly through the implementation of mitigation measures outlined in the "Urban and Landscape Design Concept" section of this working paper.

VISUAL ASSESSMENT - PRECINCT 4: TINDERBOX CREEK VALLEY

BYRON CREEK TO ST HELENA RIDGE, CHAINAGE 147,000 TO 150,200

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*Illustration 47:
Aerial Overview of the Tinderbox Creek Valley precinct*

EXISTING LANDSCAPE AND VISUAL CHARACTER

The landscape in this precinct is characterised by the undulating and open grassed hillsides of the valleys along Tinderbox Creek and its tributaries. The southern part of the precinct features the floodplains of Byron and Tinderbox creeks which are fairly broad compared to the more steeply undulating landscape of much of the elevated plateau and the Tinderbox Creek Valley. The predominant agricultural land use in this area is grazing, however, there are a limited number of macadamia plantations around the perimeter of the valleys. Open grazing paddocks are interspersed with individual trees or clumps of vegetation along the creeks. The precinct is visually highly contained, being surrounded by the steeper ridge lines along which the main local roads are located, including the existing highway alignment, St Helena Road and Bangalow Road. The St Helena ridge is particularly high and steep. As discussed earlier in this working paper, it forms the northern edge of the elevated plateau and is a part of the scenic escarpment identified and protected under the Byron Bay Local Environmental Plan.



*Illustration 48 - 53:
Character Images of the Tinderbox Creek Valley precinct: the Tinderbox Creek floodplain, view into the valley from Tinderbox Road, the piggery and rural yards off Tinderbox Road, view into the precinct from 'Byron View' (off St Helena Road), and views into the precinct from St Helena Road, above the proposed tunnel portal*

THE PROPOSED UPGRADE

After diverting from the existing Bangalow bypass alignment south of Byron Creek, the proposed upgrade would sweep in a north-easterly direction, between Tinderbox Creek and macadamia plantations in 'Jelbon Leigh' (property 349). It would then continue to closely follow the edge between the Tinderbox Creek floodplain and the foot of adjacent hills, before sweeping northwards towards the St Helena ridge along the valley floor of a northern tributary to Tinderbox Creek. About 140m south of St Helena Road, the upgraded highway would enter an approximately 340m long tunnel under the St Helena ridge. A separate tunnel would be provided for each carriageway. A major visual element associated with the tunnel would be the twin portals constructed in the side of the St Helena ridge. Construction of the portals is likely to involve an engineered head wall. In addition, major excavation works would be required in the side of the St Helena ridge, extending about 150 metres south of the tunnel portals and resulting in cuttings of major scale leading up to the portals. Due to the size and steepness of the cuttings, they are likely to require engineered stabilisation measures.

The proposed upgrade would further involve the construction of two major sets of twin bridges in the precinct, one over Byron Creek (discussed in precinct 4 above), and another over a tributary to Tinderbox Creek, just south of Tinderbox Road. The latter bridges would be approximately 145 metres long and elevated about 11 metres above the natural ground level. They are likely to require a minimum of three spans each.

The works around Tinderbox Creek would further involve the diversion of a short section of Tinderbox Road to pass under the upgraded highway alongside the Tinderbox Creek tributary.

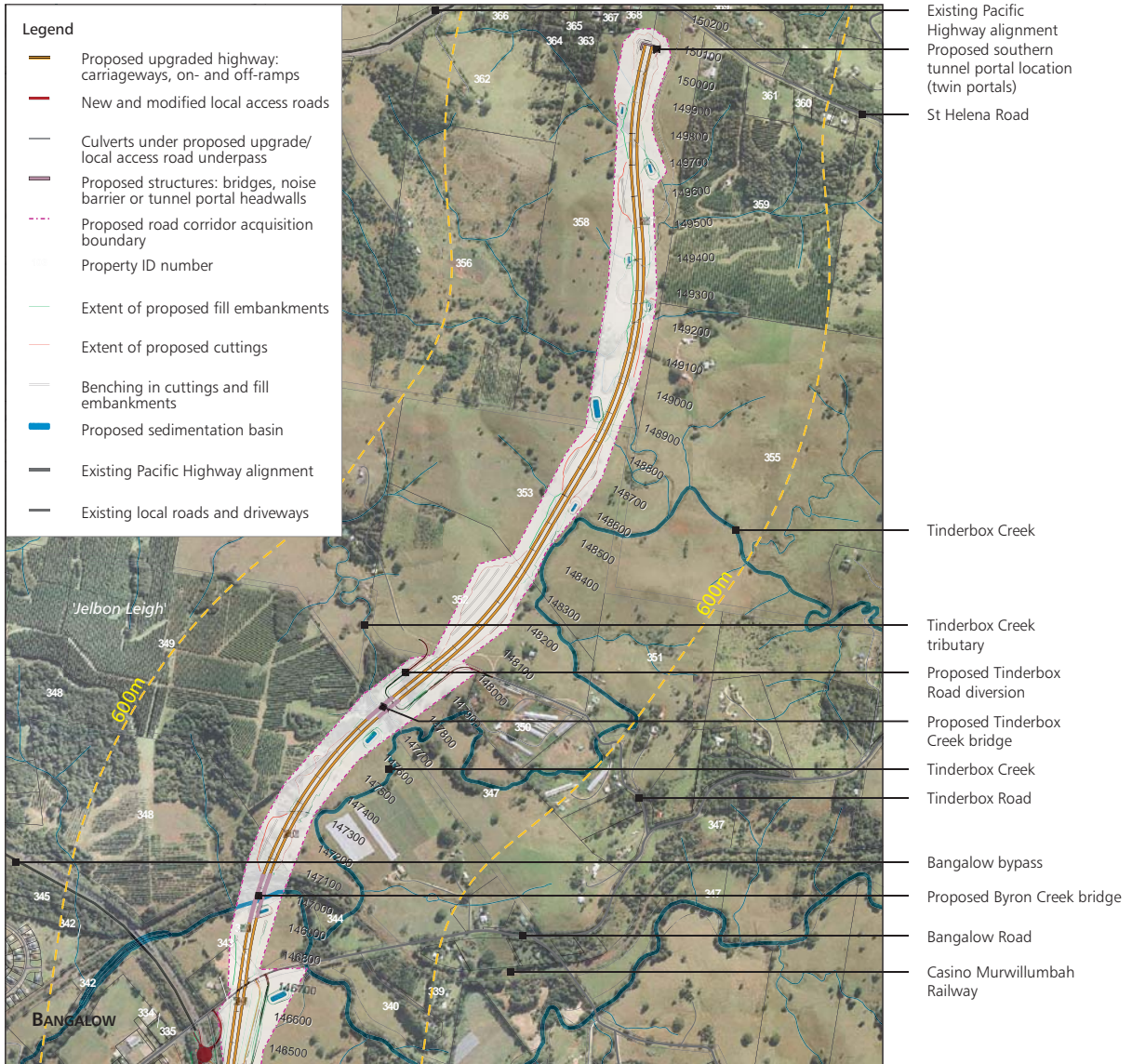


Illustration 54:
Overview of the proposed upgrade in precinct 4

VISUAL ASSESSMENT

Visual Effect

Major visual changes in the Tinderbox Creek Valley precinct result from the large size of cuttings, from the construction of the tunnel portals and the construction of the bridge over the Tinderbox Creek tributary and associated Tinderbox Road diversion.

Significant earthworks would be required for much of the precinct, with major cuttings needed north of Tinderbox Road and around the tunnel portal. The cutting on the tunnel approach would result in a major visual change to the character of the existing hillside, due to its significant height, the extent of excavation of the natural hillside, the steep nature of the cutting faces and the need for benching to improve stability. The steep cutting faces are likely to present challenges to revegetation, and are therefore likely to require 'hard' engineering stabilisation measures which would result in a stark contrast to the existing grazing landscape (refer to Illustration 53).

While the magnitude of cuttings associated with the portal construction provides an indication of the potential visual effect of the portal in quantitative terms, the actual visual effect on the surrounding landscape may be greater. It would be determined to a significant degree by the final design and detail treatment of the tunnel approach and portals. Recommendations on the design of the tunnel portals are provided in the "Urban and Landscape Design Concept Plan" section of this Working Paper.

In addition, the landscape of the precinct is fairly open and would readily expose the upgrade and associated works to viewers on surrounding properties and local ridge line roads.

While road infrastructure in this precinct would be minimal beyond the upgraded highway itself, the diversion of Tinderbox Road and the construction of the bridge over the Tinderbox Creek tributary would result in a notable visual change. While the design of the bridge has the potential to reduce the visual effect of the structure, its visibility would generally be limited to immediately surrounding areas, due to the landform and vegetation cover along the creeks in the vicinity of the proposed bridge and road diversion.

Scale of the Infrastructure

Size of Cuttings and Embankments

Cutting/ Embankment Height	Ranking	Length (m)	% within precinct	Score
0-0.5m	1	246	7.07	0.08
0.5-2m	2	594	18.6	0.37
2-5m	3	897	28.0	0.84
5-10m	4	701	21.9	0.88
10-20m	5	645	20.1	1.01
>20m	6	118	3.7	0.22
Total		3,200		3.17

Road Corridor Size

Corridor Size (km ²)	Length of Highway (km)	Score
0.429	3.2	1.34

Total Score for Scale of the Infrastructure

$$3.17 \times 1.34 = 4.25$$

Visual Exposure

Viewing Distance	Ranking	Actual Viewshed Area (km ²)	Score
Adjacent	5	0.463	0.70
Foreground	3	1.691	1.54
Middleground	1	2.868	0.87
Background	0	0.49	0.00
Total		5.51	
Total Visual Exposure Score			3.11

Total Visual Effect Score

$$4.25 \times 3.11 = 13.22$$

Overall, quantitative assessment indicates that the visual effect of the proposed upgrade on this precinct would potentially be high.

Visual Sensitivity

The proposed upgrade in this precinct would be able to be viewed mainly by Tinderbox Creek Valley residents and farm workers. In general farm workers may be less sensitive to visual changes than residents whose view from private properties would be affected. While the remote nature of the Tinderbox Creek Valley is likely to further increase the sensitivity to changes in the level of development, the overall number of viewers are comparatively low, due to the sparse level of settlement and associated road systems.

Tourists may also be able to obtain glimpses of the upgraded highway, when travelling along the ridgeline roads that surround the valley, in particular St Helena Road and Bangalow Road. However, most of these views would be fairly distant.

Therefore, the quantitative assessment indicates that the overall visual sensitivity of this precinct is likely to be low to moderate.

Viewing Distance	Ranking	Buildings (#)	Road lengths (km)	Score
Adjacent	5	0	0.35	0.02
Foreground	3	47	1.73	4.14
Middleground	1	37	3.97	1.11
Total Visual Sensitivity Score				5.27

Visual Impact

The quantitative assessment indicates that the visual impact of the proposed upgrade in this precinct would likely to be moderate to high due to the high visual effect and the low to moderate visual sensitivity of viewers in the precinct. The visual impact may be able to be decreased slightly through the implementation of mitigation measures outlined in the "Urban and Landscape Design Concept" section of this working paper.

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VISUAL ASSESSMENT - PRECINCT 5: EWINGSDALE

ST HELENA RIDGE TO EWINGSDALE INTERCHANGE, CHAINAGE 150,200 TO 152,250

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*Illustration 55:
Aerial Overview of the Ewingsdale precinct*

EXISTING LANDSCAPE AND VISUAL CHARACTER

The landscape in this precinct is characterised by the dramatic change in elevation between the coastal flats and the St Helena ridge. The St Helena ridge forms the northern edge of the elevated plateau and is particularly tall and steep. As discussed earlier, the visual importance of the ridge is reflected in its inclusion in the "Scenic Protection - Escarpment" zone in the Byron Bay Local Environmental Plan.

The St Helena ridge offers many spectacular lookout opportunities over the coastal landscape to the north. The most formal of these is the McLeods Shoot Lookout at the junction of the existing highway alignment and Coolamon Scenic Drive.

From the escarpment, the landscape quickly drops down towards the coastal lowlands. The exception is formed by the spur off the main ridge line that supports the existing highway, providing a relatively gradual descent. The western side of the spur is generally open and grassy permitting wide-ranging views, while the heavily treed village of Ewingsdale is located on the eastern side of the spur, screened from views from the existing highway alignment by a noise wall and mature vegetation.



*Illustration 56 - 62:
Character Images of the Ewingsdale precinct: the Ewingsdale spur from St Helena Road (above proposed portal), views towards the Pacific from the existing highway, view towards the highway from Woodford Lane, proposed portal location, Ewingsdale interchange from the north, and Ewingsdale spur from Coolamon Scenic Drive*

THE PROPOSED UPGRADE

The upgraded highway would emerge from the tunnel in the St Helena ridge below and to the eastern side of the existing highway. It would then descend the spur between the existing highway and Plantation Drive in Ewingsdale, prior to merging onto the existing dual carriageway at the Ewingsdale interchange. A section of the existing highway south of the interchange would need to be diverted to the west where it would be connected to a new roundabout at the end of Myocum Road. The southern reaches of Plantation Drive would also need to be realigned to a location further east.

A number of modifications to the Ewingsdale interchange would form part of the proposal. The existing southbound loop on-ramp would be replaced with a direct on-ramp and the southbound off-ramp would be modified to allow Woodford Lane to be connected to the existing roundabout in the future. The roundabout at the end of Myocum Road on the western side of the interchange would be able to accommodate the connection of a direct northbound on-ramp in the future, to replace the current loop on-ramp. A new access road into 'Araluen' (property 394) would be provided to the west of the diverted existing highway, also commencing at the Myocum Road roundabout. It would replace the existing access and underpass off the Old Pacific Highway.

Further modifications to the local road system as part of the proposed upgrade would include the realignment of the upper reaches of Plantation Drive, maintaining access to property 371 on the St Helena ridge while accommodating a large fill batter supporting the upgraded highway.

The existing noise wall between the existing highway and Ewingsdale would be replaced with a new noise barrier between the proposed upgrade and the settlement which would be in the shape of a landscaped earth mound east of the upgraded highway.

The major new element in this precinct would be the tunnel under the St Helena ridge, with a separate tunnel provided for each carriageway. The tunnel portal would be located in a prominent location in the side of the St Helena ridge, about 200 metres north of St Helena Road and to the east of the existing highway. The entrance to the tunnel would consist of twin portals most likely set into an engineered head wall and set within a large cutting excavated about 100 metres into the natural hillside in order to reduce the overall length of the tunnel. Due to the height and steepness of the cuttings leading up to and surrounding the portal, they are likely to require engineered stabilisation measures.

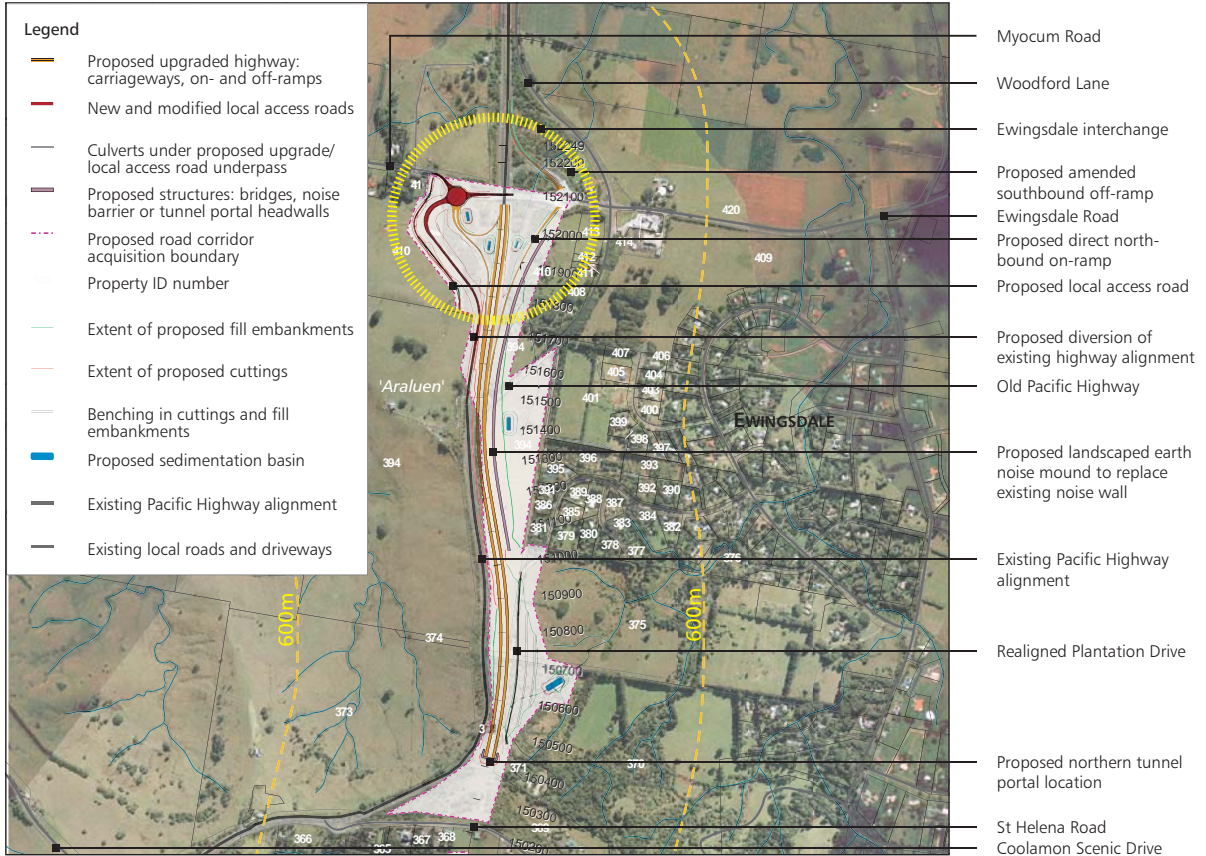


Illustration 63:
 Overview of the proposed upgrade in precinct 5

VISUAL ASSESSMENT

Visual Effect

Major visual changes specific to the fifth precinct result from the large increase in road infrastructure on the Ewingsdale spur, the associated large fill embankments and the construction of the tunnel portals and associated excavation works.

The construction of the upgraded highway adjacent to the alignment of the existing highway would approximately double the amount of road infrastructure on the Ewingsdale spur. Similarly, roadway infrastructure would increase noticeably around the Ewingsdale interchange, as a result of the diversion of the existing highway alignment and the provision of the additional access road. However, the scale of the infrastructure around the interchange is already significant, helping to reduce the degree to which the changes would be perceived as modifying the existing landscape.

The works on the Ewingsdale spur on the other hand would result in a more significant visual change, in particular the tunnel portals and associated cuttings, and the large fill embankments located along the eastern side of much of the upgraded highway. Construction of the latter would also require the removal of roadside vegetation on the eastern side of the existing highway which currently provides visual screening from Ewingsdale. A stand of vegetation immediately north of the tunnel portal would also need to be removed and the loss of vegetation on the prominent spur would be highly noticeable.

In addition, the cutting on the tunnel approach would represent a major visual change to the character of the St Helena ridge, due to its significant height, the steep nature of the cutting face and the need for benching and other stabilisation measures. The engineering works required around the tunnel portal would be in stark contrast to the existing vegetated landscape character. These works would also be highly visible, being exposed to views from the St Helena ridge and from the coastal lowlands below.

Scale of the Infrastructure

Size of Cuttings and Embankments

Cutting/ Embankment Height	Ranking	Length (m)	% within precinct	Score
0-0.5m	1	600	29.4	0.29
0.5-2m	2	412	20.2	0.40
2-5m	3	334	16.3	0.49
5-10m	4	298	14.6	0.58
10-20m	5	215	10.5	0.53
>20m	6	185	9.1	0.54
Total		2,050		2.30

Road Corridor Size

Corridor Size (km ²)	Length of Highway (km)	Score
0.384	2.05	1.87

Total Score for Scale of the Infrastructure

$$2.30 \times 1.87 = 4.30$$

Visual Exposure

Viewing Distance	Ranking	Actual Viewshed Area (km ²)	Score
Adjacent	5	0.241	0.59
Foreground	3	0.878	1.28
Middleground	1	1.027	0.50
Background	0		0
Total		2.15	
Total Visual Exposure Score			2.37

Total Visual Effect Score

$$2.37 \times 4.30 = 10.19$$

Overall, the quantitative assessment indicates that the visual effect of the proposed upgrade on this precinct would potentially be moderate to high.

Visual Sensitivity

The upgraded highway and associated works would be readily visible from sections of local roads including the existing highway alignment, St Helena Road, Myocum Road and Coolamon Scenic Drive, as well as from the upgraded highway itself. Potential viewers would include local residents and tourists. The works would also be visible from McLeods Shoot Lookout, a popular tourist destination and rest stop which offers spectacular panoramic views over the coastal lowlands, the Pacific Ocean and mountain ranges in the background. Cape Byron is the other major lookout and tourist destination in the area, however, its distance from the proposed upgrade is so large that it would be difficult to see the upgraded highway (also refer to Illustration 7).

The residential area of Ewingsdale is in relatively close proximity to the proposed upgrade, as reflected in the number of buildings in the middleground distance. However, overall building numbers in the precinct are comparatively low and views from Ewingsdale to the proposed upgrade are limited by the topography of the area as well as the existing vegetation cover.

The quantitative assessment indicates that the overall visual sensitivity of this precinct is therefore likely to be low to moderate.

Viewing Distance	Ranking	Buildings (#)	Road lengths (km)	Score
Adjacent	5	2	0.33	0.31
Foreground	3	52	1.37	4.57
Middleground	1	119	2.06	3.47
Total Visual Sensitivity Score				8.34

Visual Impact

The quantitative assessment indicates that the visual impact of the proposed upgrade in this precinct would likely to be moderate due to the moderate to high visual effect and the low to moderate visual sensitivity of viewers in the precinct. The visual impact may be able to be decreased slightly through the implementation of mitigation measures outlined in the "Urban and Landscape Design Concept" section of this working paper.

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VISUAL IMPACT SUMMARY

The visual impact assessment of the proposed upgrade described above represents an assessment based on five precincts and with a strong quantitative focus. The results of these assessments are summarised in the following table:

Precinct	Visual Effect	Visual Sensitivity	Visual Impact
1. Knockrow	High to moderate	Moderate to low	Moderate
2. Emigrant Creek	Moderate	Moderate	Moderate
3. Bangalow	Moderate	High	High to moderate
4. Tinderbox Creek Valley	High	Moderate to low	High to moderate
5. Ewingsdale	High to moderate	Moderate to low	Moderate

The predicted visual impacts for each precinct reflect the corresponding local conditions. They further reflect the scale of the road infrastructure within each precinct's setting and the extent of visibility from surrounding viewpoints. However, the quantitative precinct assessment does not reflect the cumulative effect of the visual impact on the study area as a whole.

Neither does the quantitative focus of the assessment fully reflect the likely visual impact of the proposed upgrade, in terms of its effects on the existing intricate landscape pattern, though it does provide a good indication of the physical magnitude of the proposed upgrade and of the number and kinds of viewers.

The assessment of the likely visual impact of the proposed upgrade however needs to go beyond physical magnitude to consider the proposal in terms of its effects on the visual quality of the landscape.

The scenic qualities of the landscape within and surrounding the study area are well recognised by residents and visitors alike. The growing popularity of the region as a place to live and to take a holiday is testament to the accepted beauty of the area's landscape and resulting lifestyle.

The combination of steep rolling topography and lush stands of vegetation encompassing areas of open and green paddocks creates an appealing natural setting. Layered over this setting is a relatively small scale pattern of rural development which conforms to the varied form of the natural features of the area. This layering of rural and natural elements produces

an intricate cultural landscape pattern where neither element dominates the other.

Settlements nestle into valleys and hillsides. Roads wind along ridge lines and around hills, through dense stands of vegetation and over watercourses. As a consequence, the landscape varies continuously and reveals changing characteristics to the traveller passing through the area.

The overall visual effect of the proposed upgrade on this kind of landscape is considered to be quite profound. The standard design requirements for a modern four lane dual carriageway motorway, with relatively gentle gradients and wide sweeping curves, introduces an entirely new form of infrastructure into the area. Where the existing road and rail infrastructure and pattern of subdivision respond to the constraints of the local topography and therefore become an integrated part of the overall composition of the landscape, the proposed upgrade will by necessity, override these constraints. As a result, the upgraded highway will become the dominant element cutting a relatively straight path through this varied landscape, overriding its existing patterns of development.

The upgrades highway would be a piece of infrastructure of a scale which will be perceived as visually dominant across the length of the majority of the study area. Although the long term benefits of landscape plantings will modify the visual effects of the proposed upgrade to a degree, the overall width and comparatively straight alignment will not enable it to integrate into the landscape as the existing roads have done. The steepness and geotechnical composition of many cuttings will further limit the potential for and likely success of benefits of landscape design treatments.

Based on the acknowledged scenic qualities of the region and the corresponding purpose for living in and travelling to the area, the visual sensitivity of the viewers, including both those travelling along the upgraded highway and those seeing it from surrounding areas, will be generally in the high to moderate range.

As a consequence the cumulative visual impact of the upgraded highway is likely to be of a high to moderate level. Over time the visual impacts of the upgraded highway will be partially mitigated by the treatments proposed along its length (refer to the "Urban and Landscape Design Concept" section of the working paper). However, the scale of the road in this landscape will remain a visually dominant feature. It will therefore substantially and irrevocably change the visual character of the areas through which it passes.

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