8 Other issues

This chapter provides an assessment of the other (non-key) environmental issues that may be associated with construction and operation of the project. The proposed impact mitigation and management measures for these issues are also identified. The other environmental issues associated with the project are:

- *Non-Aboriginal heritage.*
- *Land use and socio-economic impacts.*
- *Greenhouse gas emissions and climate change.*
- *Landscape character and visual impacts.*
- *Air quality.*
- *Hazards and risks.*
- *Waste management.*

8.1 Non-Aboriginal heritage

8.1.1 Existing environment

The Region

References to the Clarence River are made as early as 1799 by Flinders, who anchored his sloop in the river estuary and described Aboriginal huts on the riverbank (Flinders 1799). In the early 1800s, journeys through the Northern Rivers district by European and other settlers were generally limited to escaped convicts and wood-cutters seeking the pine and cedar forests. The Clarence River district was eventually opened up by the cedar cutters exploiting the dense `brush' along the river for its magnificent timbers. By 1845, much of the lower reaches of the river had been taken over by the cedar trade (Rich 1990).

Shortly after the first cedar getters settled in the area, a village grew in the area of the city of Grafton. Originally called “The Settlement”, the first sale of town blocks took place in 1851. In 1885 Governor Fitzroy renamed the town after his grandfather, the Duke of Grafton. It was proclaimed a city in 1885.

Timber-getters were soon followed by pastoralists prompted by the effects of drought to the south and within a few years the first exploration of the Clarence, or the ‘Big River' as it was known, led to the establishment of station properties in the Grafton area in the 1840s. Earliest occupation involved the establishment of large pastoral runs centred on naturally occurring grasslands held under licence and pasture lease for the rearing of livestock, initially sheep and later cattle. Grafton began to develop as a centre for timber-getting activities and a ship-building centre in the late 1830s and 1840s.

The gold rushes in the latter 1800s and the Robertson Land Acts from 1861 brought a dramatic increase in the non-indigenous population. The large leasehold pastoral runs were replaced by the closer settlement of small selectors, their holdings eventually impacting on even marginal country in the

upper tributary valleys.

Timber-getting continues today in parts of the valley and there are several state forests within the wider study area. The sugar and dairy industries also remain, along with beef and marine industries, while tourism is now a major employment base in the region.

Glenugie State Forest and the Glenugie Peak branch line

Glenugie State Forest was originally part of resumed land that was gazetted as Clarence Forest Reserve No 3 (also identified as FR 244A), which was notified on 2 June 1884. At this time, the reserve was exempted from the operation of ordinary timber licences. Notification may have been earlier, according to a notation on the map of the Parish of Lanitza, County of Clarence, of July 1886, which references notification on 15 September 1871.

The original area, together with additional land to its south, was identified as a State Forest (No 26), and dedicated on 10 December 1913. The area subsequently became Glenugie National Forest No.40 on 5 July 1940, while remaining identified as a State Forest.

Glenugie Peak (also referred to as Mt. Elaine) is the most prominent landscape feature within the State Forest and can be clearly seen from most vantage points in the district. It is a volcanic plug situated on the eastern fringe of the plain between Halfway Creek and Grafton. Basalt from its slopes was used in the construction of the rail bed of the main North Rail Line, the major trunk line from NSW to Brisbane, over 90 years ago.

In his report to the NSW Legislative Assembly of 1 September 1915, the Chief Engineer for Railway and Tramway Construction, NSW Department of Public Works, stated,

> *The Glenreagh to South Grafton, or ninth section [of the North Coast Railway], comprises a length of 27 ¾ miles, and is one of the easiest sections of the North Coast Railway. There is only one steel bridge over Sherwood Creek, and the earthworks are not heavy. The country passed through is of rather poor quality and the line for the present will terminate at South Grafton, a thriving town on the south bank of the Clarence River, and immediately opposite Grafton on the north bank. The principal difficulty met with on this section was to obtain a supply of ballast, there being no suitable stone along the line, and it was found necessary to put in a branch line to Glen Ugie Peak, a distance of over five miles, where an out-crop of basalt was obtained and broken with rotary crushers.*
>
> *Five stations, including South Grafton, [the others being Glenreagh, Kungala, Lanitza, and Braunstone – all of which have since closed] have been constructed, with water supplies at Glenreagh and South Grafton. The section is in a forward state and will be completed during this year (NSW Legislative Assembly Report of Public Works 1916:26).*

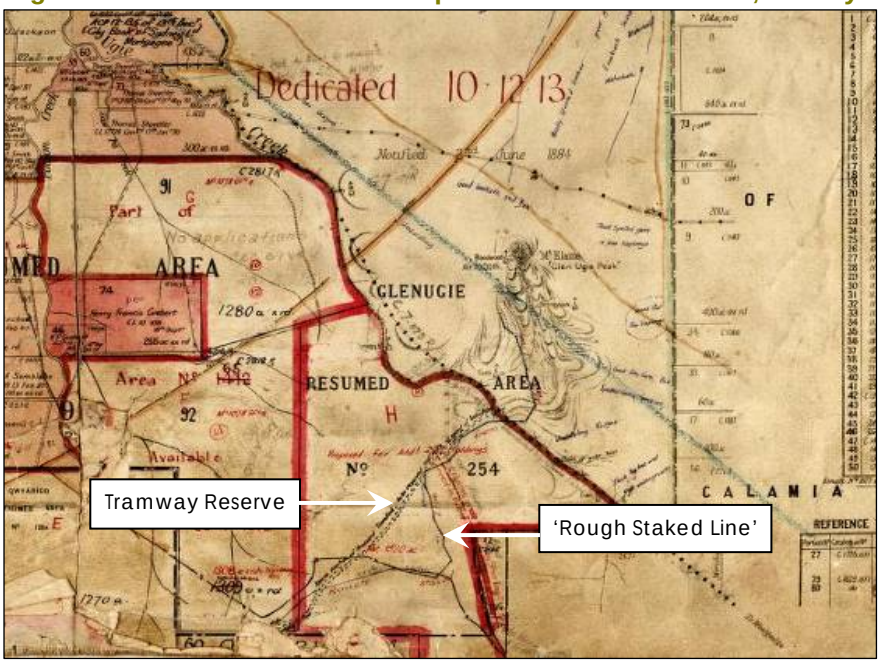
Parts of the embankment that carried the branch line/tramway to move the crushed basalt to the rail construction site are still evident, and much of the

former alignment has subsequently been utilised by vehicle tracks. The environmental impact statement for the Grafton Management Area) states that "the tramway can be discerned from the flattening of the ground for about three metres in width along its length. From its terminus, the tramway ran through a cutting for about 150 to 200 m, which is littered with the remains of a hopper truck, bits of metal, a wooden sleeper and several bolts" (Margules Groome Pöyry Pty Ltd 1994:118).

Indications of the tramway first appear on the 1909 map of the Parish of Lanitza, with its final alignment being shown most accurately on the 1925 Parish map (**Figure 8-1-1** and **Figure 8-1-2**). The remnant alignment may still be discerned from cadastral reserves and modern tracks shown on modern topographic mapping of the area. The branch line extended for 8.25 km from its junction with the North Coast Railway Line in the southwest to its terminus at the base of Glenugie Peak in the northeast. To minimise gradients, the tramway was constructed along the watershed ridgeline between Glenugie Creek in the north, and Dundoo Creek and the Coldstream River in the south and west.

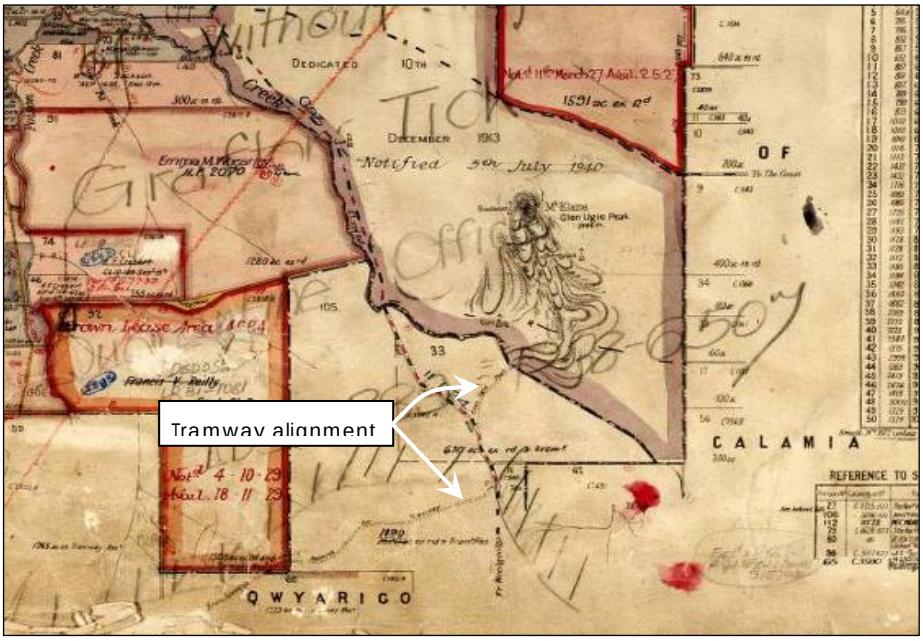
The existing Pacific Highway crosses a portion of the tramway alignment, between one kilometre and 300 m south of the current intersection with Franklins Road (as shown on the third edition (2005) Pillar Valley 1:25,000 topographic map). This section is approximately two thirds of the way along the tramway course between the North Coast Railway Line and Glenugie Peak. From the west, the alignment curved to the north and joined the Pacific Highway one kilometre to the south of Franklins Road. From this point, and prior to the straightening of the current highway, the former highway traversed a 600 m section of the alignment, from which point the tramway route diverged from the highway and followed the watershed, curving to the northeast. The modern forestry track, Lookout Road, traverses much of the former tramway alignment east of the highway, diverging at a point where the tramway ascended a north-south aligned spur providing access to the summit outcrops (**Figure 8-1-3**). A portion of the remnant alignment is still visible to the east of the current highway, just south of Lookout Road and will be impacted by construction of the project.

- **Figure 8-1-1 Extract from 1909 map of the Parish of Lanitza, County of Clarence**



Source: Department of Lands 105029, 3rd Edition, 25 August 1909.

- **Figure 8-1-2 Extract from 1925 map of the Parish of Lanitza, County of Clarence**



Source: Department of Lands 105028, 5th Edition, 10 March 1925.

Previously identified sites
Searches were made of the following statutory and non-statutory registers:

- The State Heritage Register (Heritage Branch, Department of Planning).
- State Heritage Inventory (Heritage Branch, Department of Planning).
- Section 170 Heritage and Conservation Registers (RTA, NSW State Rail, NSW Forest).
- The National Heritage List (Australian Heritage Council).
- The Commonwealth Heritage List (Australian Heritage Council).
- Grafton Local Environmental Plan 1998 Heritage Schedule.
- Register of the National Estate (Australian Heritage Council).
- Register of the National Trust of Australia (NSW).

There are no listed non-Aboriginal heritage items within the project corridor.

Predictive statement on non-Aboriginal heritage items in the project area
The types of places or items that may form part of the non-Aboriginal heritage context of the project area include:

- Below ground evidence, including building foundations, occupation deposits, features and artefacts.
- Above ground evidence, including buildings, works, industrial structures and relics that are intact or ruined.
- Areas of land that display evidence of human activity or occupation.
- Old roads, including old sections of the Pacific Highway.

Prior to site survey, unrecorded historic sites and features of heritage significance that could potentially occur within the project area include:

- Nineteenth-century structures, such as timber-getters huts, which may survive as standing buildings, ruins or archaeological deposits.
- Former timber mills and/or associated infrastructure, such as timber pole structures, remains of machinery, tracks and tramways, which may survive within Glenugie State Forest.
- Traces of industrial processing or extractive sites, such as quarries.
- Transport and access routes, such as bridle paths, stock routes, and highway alignments of varying forms and ages, which may survive as abandoned remnants adjacent to modern transport routes, or as alignments now followed by more modern or upgraded roads or tracks.
- Old fence lines, such as post and rail fencing, along road easement boundaries.

- **Figure 8-1-3 Parts of the remnant tramway alignment in the project area**

Above photograph shows tramway alignment crossing forest track and running in a northeast direction (facing northeast)

Above photograph taken facing northeast from forest track

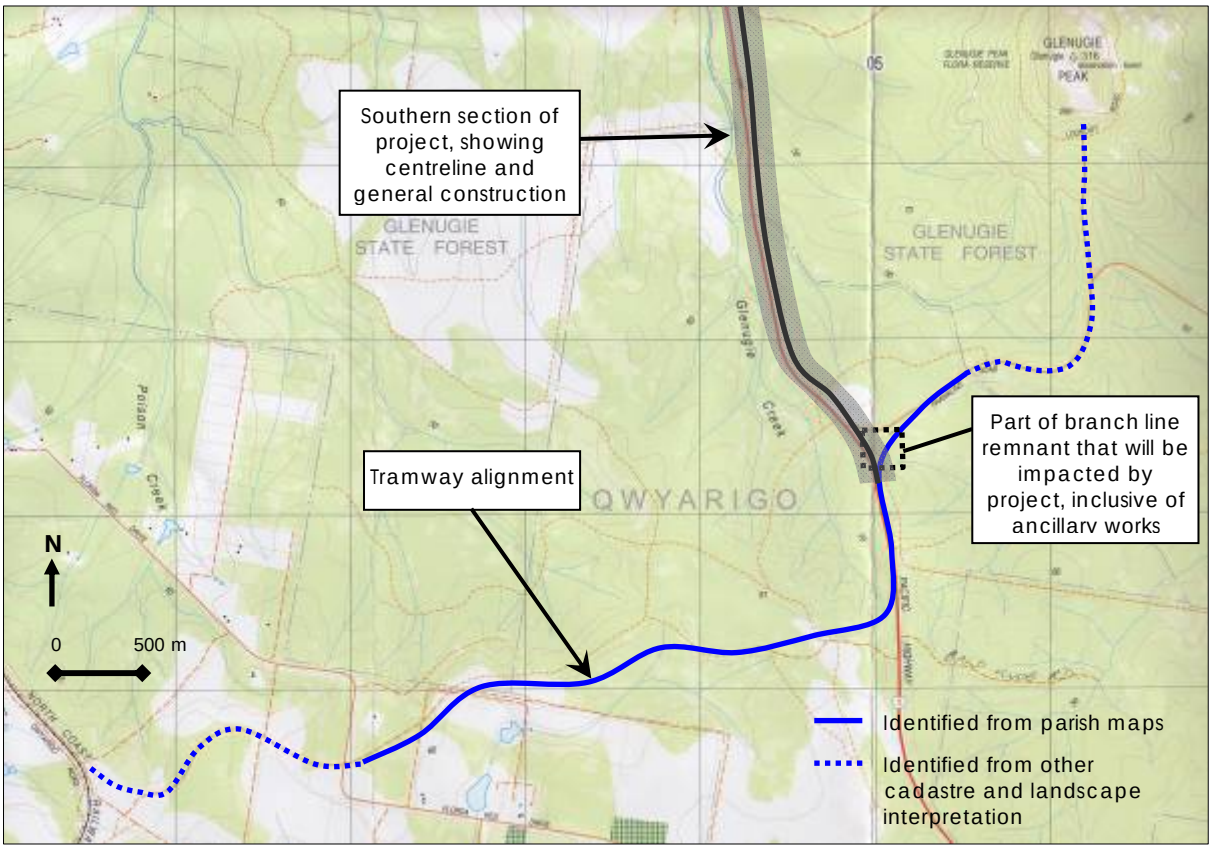
Non-Aboriginal heritage survey results

One non-Aboriginal heritage item was identified within the project area during the site survey. This was part of the remnant 1915 North Coast Railway branch line/ tramway alignment between the existing Pacific Highway and Franklins Road (**Figure 8-1-4**). The continuous blue line denotes the remnant tramway alignment identified from parish maps and the dotted blue line denotes the alignment identified from other cadastre and landscape interpretation.

The alignment is evident as a levelled, linear ground platform, approximately three metres in width, which in places is cut or benched to a minor degree

according to small scale changes in the local land surface (**Figure 8-1-3**). Shallow side embankments are evident in places. The alignment within the project area consists of a gradually curved section, 250 m in length, extending northeast of the highway to Franklins Road (from 505022.6697307 to 505090.6697467 (GDA). The construction of Franklins Road has removed traces of the tramway to the east of this point.

- **Figure 8-1-4 Section of remnant tramway alignment impacted by the project**



Source: Department of Lands, Pillar Valley, 9538-3N, 3rd Edition, 2005.

Heritage significance assessment of remnant 1915 branch line/tramway

Under NSW Heritage Council's heritage significance criteria, the remnant alignment meets criteria (a), (b), (e), (f) and (g), as follows:

Criterion (a) Through its identified construction date and remaining construction elements, the tramway alignment shows the necessary methods employed for the construction of the North Coast Rail line in the local area, and the importance of the local basalt resource of Glenugie Peak to the development of the early twentieth-century interstate (NSW – Queensland) rail network in that area. This site is therefore important in the course, or pattern, of the cultural history of the area.

Criterion (b) The tramway has a strong association with works of the Chief Engineer for Railway and Tramway Construction, NSW Department of Public Works, in 1915, and his and that department's role in the construction of the North Coast Rail line

in the local area and as such is of importance in the cultural history of the local area.

Criterion (c) Does not meet the threshold for this criteria

Criterion (d) Does not meet the threshold for this criteria

Criterion (e) The tramway alignment has potential to yield information, such as construction methods and techniques that will contribute to an understanding of the cultural history of the local area.

Criterion (f) Due to the need to obtain 'suitable stone' from an outcrop of basalt on Glenugie Peak for construction of the nearby section of the North Coast Rail line, the tramway alignment possesses uncommon aspects of the cultural history of the local area.

Criterion (g) The tramway alignment is important in demonstrating the principal characteristics of a class of NSW's cultural places, being, the construction of subsidiary branch lines/ tramways during mainline rail development throughout NSW.

The remnant branch line/tramway alignment has been assessed as an item of ***local*** heritage significance.

A 250 m section of the locally significant 1915 branch line/tramway from the North Coast Railway to Glenugie Peak has been recorded within the project area. The only visible element of this heritage item within the project zone is the modified earthen embankments. This is considered a contributory component to the overall heritage significance of the item.

This part of the remnant tramway alignment has been altered and modified over time. There is no evidence of tramway construction materials or physical items associated with its use (such as wooden sleepers, metal objects or the remains of hopper trucks) at that location. A previously described portion of this tramway, including "*The remains of a hopper truck, bits of metal, a wooden sleeper and several bolts*", noted in the Grafton Management Area EIS (State Forests, 1994) is not included in this section of the remnant tramway (Margules Groome Pöyry Pty Ltd 1994:118).

8.1.2 Potential impacts of the project

One non-Aboriginal heritage item would be directly impacted by the project. This is the former 1915 North Coast Railway branch line/tramway located between the existing Pacific Highway and Franklins Road. Construction of the Glenugie upgrade project would remove a 250 m section of the surviving total eight kilometre tramway alignment. This section is a contributory component to the overall *local* heritage significance as assessed under the Heritage Council of NSW's criteria. This is considered acceptable knowing that this portion of the tramline does not have good integrity, and the majority of the heritage item remains outside the project impact zone.

8.1.3 Impact mitigation and management measures

Impact mitigation and management measures include:

- Carrying out a photographic archival record of an appropriate portion of the remnant historic branch line/tramway alignment within the project area in accordance with the Heritage Council of NSW guidelines prior to any disturbance.
- Archaeological monitoring and recording of any intact tramway remains, if they exist.
- Developing a protocol to deal with any previously unexpected non-Aboriginal relics revealed within the project area.
- A non-Aboriginal heritage component will be included in the pre-construction and on-going induction programs provided to all construction and in-field personnel.

8.2 Land use and socio-economic impacts

8.2.1 Existing environment

Socio-economic profile

The economy of the Clarence Valley area is generally based on agriculture, tourism and transport. The size of the regional economy was valued at $1.5 billion (Gross Regional Product) in June 2006 (CVC 2008). Timber production across the Clarence Valley was valued at $27.5 million in 2002. Beef cattle, dairying and general farming also remain important contributors to the Clarence Valley's economic base. The current value of the stock throughput at the Grafton Regional Livestock Selling Centre is estimated at $30 million, however there has been a gradual decline in the numbers of livestock being sold due to general market trends in the beef cattle industry, which include increased costs of production (including transport costs) and changes in land use to other forms of primary production (CVC 2008). Tourism in the mid north coast region has good potential for further growth due to the large areas of coast and rural hinterland (CVC 2008). Tourism is currently valued at about $226 million, with approximately 1,718 jobs created in the region from tourism.

Grafton is an important retail, services and employment centre in the region. While Grafton has 35 per cent of the Clarence Valley population, it contains 60 per cent of the retail establishments and provides 75 per cent of the employment in the retail field (CVC 2008). The public service and local government sector is also a major employer.

Grafton is also a transport hub, being serviced by the Pacific and Gwydir Highways, the Summerland Way, North Coast Railway and Grafton Airport. It is increasing in attractiveness as a location for the warehousing and distribution industry. This is mainly because of the upgrading of the Pacific Highway and also factors such as proximity to the fast-growing south-east Queensland and mid-north coast of NSW, lower costs of land acquisition and building rental than locations such as Sydney, Brisbane or the Gold Coast. In addition, numerous transports companies have been established in Grafton to provide services between Sydney and Brisbane along the Pacific Highway. These

include Jim Pearson Transport, Cromack Transport and Herb Blanchard Haulage.

The Mid North Coast Regional Strategy (DoP 2009a) defines Grafton as one of the major regional centres where the most efficient use can be made of existing and new infrastructure. It also provides further opportunities for housing and commercial development. Economic growth opportunities in the study area are likely to be led more by tourism and increased settlement (both retirees and working-age) rather than by production. There are large influxes of visitors to Grafton during major events, including July Racing Carnival, Jacaranda Festival and numerous sporting events.

The Pacific Highway is the main route to, from and within the Clarence Valley, and therefore its importance to the local economy is substantial. At a local level it provides access to employment, retail, commercial and entertainment opportunities and is used for local freight transport. At a regional level, it provides for the movement of freight associated with both local production (eg sugar and timber) and to service local retail (eg deliveries to supermarkets and other stores). It is the primary means of access for tourists to the Clarence Valley. At an intra and inter-state level, it also creates income through highway related businesses such as service stations, motels, vehicle repairs and employment in the transport industry.

The principle economic activity along the Glenugie section of the Pacific Highway is forestry operations. Supply for the major mills at Grafton, Glenreagh and Koolkhan is mainly derived from the State Forests (Clarence Valley Council 2008). Timber production in 2002 across the Clarence Valley was valued at $27.5 million (Northern NSW Forestry Services 2002).

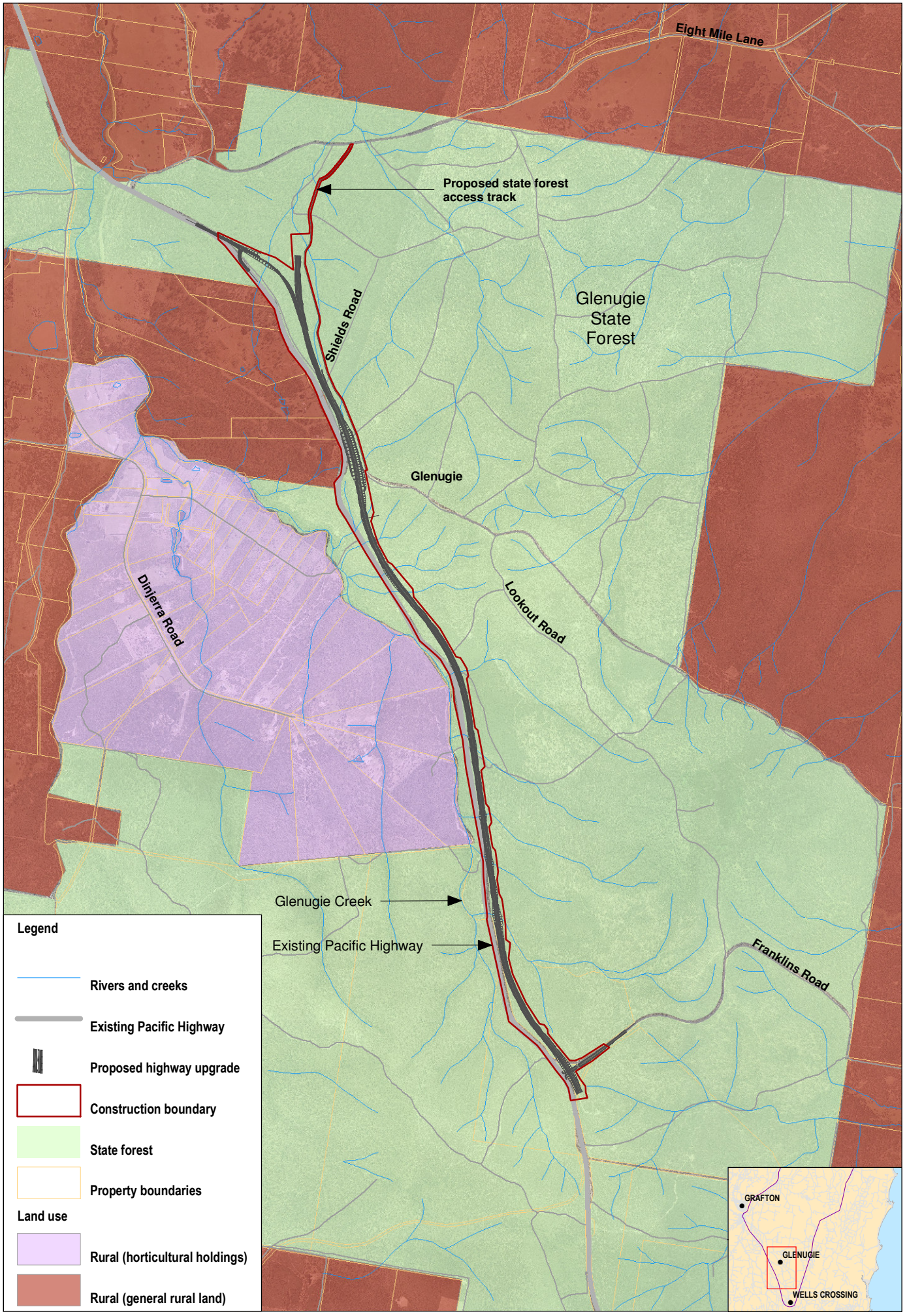
Community profile

The Clarence Valley local government area (LGA) has a population of 48,564 people according to the 2006 Census (ABS 2006). This represents a population increase of 2.17 per cent since the 2001 Census.

The median age of persons in the LGA is 44 with 6.8 per cent persons born overseas. The percentage of people of Indigenous origin (4.8 per cent in 2006) is high compared to the NSW average (2.1 per cent in 2006). Additionally, 92.6 per cent of the Clarence Valley population were born in Australia compared to the NSW average of 85.8 per cent. The unemployment rate for the Clarence Valley is 9.9 per cent which is high in comparison to the overall NSW unemployment rate of 5.9 per cent.

Land use

The project is located in the Clarence Valley LGA. The existing land use in the study area is shown in **Figure 8-2-1**. Forestry is the main economic activity in the direct vicinity of the project, as it is located within Glenugie State Forest.



Data Sources
Topodata: Streetworks, LPI 2008
Aerial: 2007

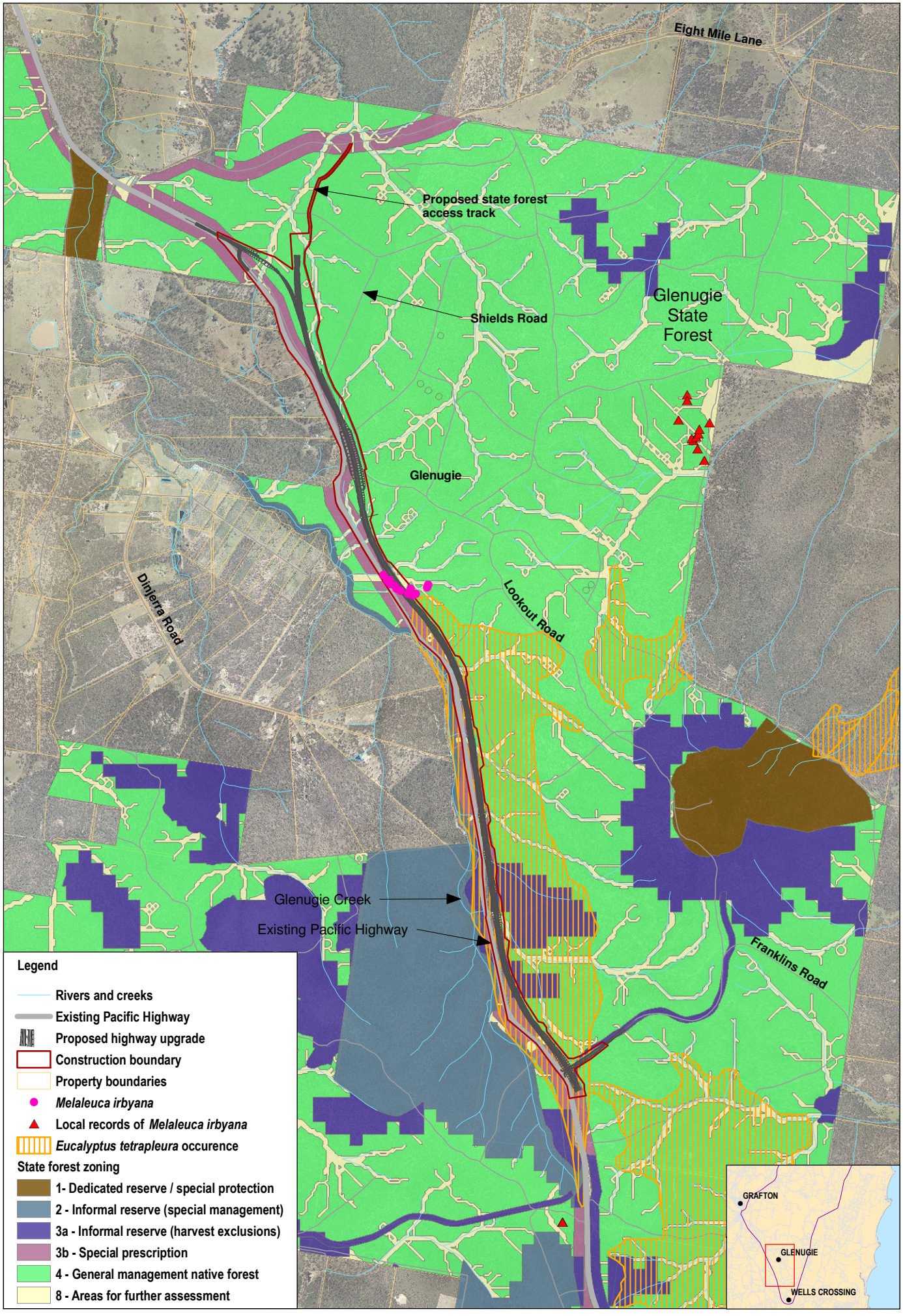
Figure 8-2-1: Existing land use

0 1
A4 1:40,000 Kilometres

Glenugie State Forest has a total area of about 4,940 hectares. Forest management zones have been adopted by Forests NSW to assist in the management of the forest estate. Forest management zones specify the land uses that can be carried out in the forests. These are described in **Table 8-2-1** and shown in **Figure 8-2-2**. Parts of the Glenugie State Forest are also gazetted as 'National Forest' under the *Forestry Act* 1916.

- **Table 8-2-1 Forest management zone classification**

Forest management zone	Management
1 - Dedicated Reserve/Special Protection	Management to maximise protection of very high natural and cultural conservation values. Not available for timber harvesting.
2 - Informal Reserve (Special Management)	Specific management and protection of natural and cultural conservation values where it is not possible or practical to include them in zone 1. Not available for timber harvesting.
3a - Informal Reserve (Harvest Exclusion)	Management for conservation of identified values and/or ecosystems and their natural processes. Areas where harvesting is excluded but other management and productions activities not permitted in zone 1 or 2 may be appropriate (e.g. grazing or mineral exploration).
3b - Special Prescription	Management for conservation of identified values and/or ecosystems and their natural processes. The zone is available for timber harvesting but minimised in design and implementation to maintain or enhance the values that the area is zoned to protect.
4 - General Management Native Forest	Management of native forests for timber production utilising the full range of silvicultural options as appropriate; and conservation of broad area habitat and environmental values which are not dependent on the structure of the forest. Available for timber harvesting.
5 - Hardwood planted forest estate	Management of hardwood plantations to maximise sustainable timber production on a continuing cyclical basis.
6 - Softwood planted forest estate	Management of softwood plantations to maximise sustainable timber production on a continuing cyclical basis.
7- Non forestry use	Management of cleared (non-forested) areas, such as those used for special developments.
8 - Land for further assessment	An interim zoning of areas where field investigation is required to determine final Forest Management Zone classification.



Data Sources
Topodata: Streetworks, LPI 2008
Aerial: 2007

Figure 8-2-2: State forest management zones

0 1
A4 1:40,000 Kilometres

Scattered rural and rural residential developments occur north-west, west and south-east of the project, outside the project corridor. The project is located on land zoned 1(f) Rural (Forests) under the *Ulmarra Local Environmental Plan* 1992 and adjoins land zoned 1(a) General Rural to the west. These land uses are shown on **Figure 8-2-1**. Beef cattle grazing and dairying are the predominant uses of agricultural land in the vicinity of the project. Land to the west of the project is also used for secondary agricultural purposes which includes horticultural activities and orchards or greenhouses. Active quarry areas are located further to the east of the project, in the hilly areas to the south of Pillar Valley. There are no shop-front businesses along the existing highway in the section traversed by the project.

The *Mid North Coast Regional Strategy* (DoP 2009a) and the Mid North Coast Farmland Mapping Proposal (DoP 2009b) does not identify any regionally significant farmland, proposed urban areas or proposed employment lands within the study area. There is a Telstra mobile phone tower within Glenugie State Forest about 100 m to the east of the project. An optical fibre cable runs through the study area about 100 m from the project from this tower to Eight Mile Lane to the north.

8.2.2 Potential impacts of the project

The following potential land use and socio-economic issues have been identified for the project:

- Construction stage impacts.
- Acquisition.
- Economic productivity and job creation.
- Changes to the character and amenity of the local area.
- Land connectivity and contiguity.
- Planned development.

Construction stage impacts

The main impacts that may occur during the construction phase of the project relate to traffic impacts and establishment of construction compounds and ancillary facilities. Potential locations for ancillary construction facilities are detailed in Chapter 4 and shown in **Figure 4-1**. The establishment of these facilities would temporarily affect the land use of the chosen sites, although these impacts would be short term and are not considered significant. Site compounds and batch plants would be removed following the completion of the construction works for the project. The potential construction traffic impacts arising from the project would be mainly due to the increases in traffic volumes due to construction worker vehicles, the haulage of materials associated with construction, and disruptions to traffic flow due to construction works.

During the construction period, there is likely to be short-term boost to the local and regional economy from employment and spending in the region. Construction supplies and construction workers would be sourced from the local region, where possible.

Acquisition

The project does not require acquisition of any private property. The project would require the acquisition of about 100 hectares of Glenugie State Forest, which is about two per cent of the total forest area. About 80 hectares of the affected area is classified as National Forest. Not all of the acquired area of State Forest would be cleared, with some areas retained within the road reserve. The amount of clearing required has been estimated at 85 hectares.

The project would affect forest management zones 3a, 3b, 4 and 8 (**Table 8-2-2**). Other management zones would not be directly impacted. The area of acquisition for the construction of the project is based on the highest potential acquisition requirements, being for the motorway style upgrade, so that all property ultimately required for the project is accounted for. The likely initial staging may require less land acquisition. Acquisition of land in Glenugie State Forest would be carried out in accordance with the *Forestry Act* 1916.

- **Table 8-2-2 Area of each forest management zone affected by the project**

Forest management zone	Description	Total area (ha)	Area affected (ha)*	Proportion affected
1 (Dedicated Reserve/ Special Protection)	Management to maximise protection of very high natural and cultural conservation values. Not available for timber harvesting.	128.8	0	0%
2 (Informal Reserve (Special Management))	Specific management and protection of natural and cultural conservation values where it is not possible or practical to include them in zone 1. Not available for timber harvesting.	449.87	0	0%
3a (Informal Reserve (Harvest Exclusions))	Management for conservation of identified values and/or ecosystems and their natural processes. Areas where harvesting is excluded but other management and productions activities not permitted in zone 1 or 2 may be appropriate (e.g. grazing or mineral exploration).	635.21	7.01	1%

Forest management zone	Description	Total area (ha)	Area affected (ha)*	Proportion affected
3b (Special Prescription)	Management for conservation of identified values and/or ecosystems and their natural processes. The zone is available for timber harvesting but minimised in design and implementation to maintain or enhance the values that the area is zoned to protect	147.91	46.60	32%
4 (General Management Native Forest)	Management of native forests for timber production utilising the full range of silvicultural options as appropriate; and conservation of broad area habitat and environmental values which are not dependent on the structure of the forest. Available for timber harvesting	3054.05	35.96	1%
5 (Hardwood Plantations)	Management of hardwood plantations to maximise sustainable timber production on a continuing cyclical basis	0	0	0%
6 (Softwood Plantations)	Management of softwood plantations to maximise sustainable timber production on a continuing cyclical basis	0	0	0%
7 (Non Forestry Use)	Management of cleared (non forested) areas, such as those used for special developments such as infrastructure	1.94	0	0%

Forest management zone	Description	Total area (ha)	Area affected (ha)*	Proportion affected
8 (Areas for Further Assessment)	An interim zoning of areas where field investigation is required to determine final Forest Management Zone classification. Field investigation will be undertaken as part of pre-harvest planning. Management will be for protection under the same requirements as zone 3a until field investigation has taken place.	518.67	12.51	2%
Total		**4936.45**	**102.08**	**2%**

* Values calculated from GIS.

Economic productivity and job creation

The area of Glenugie State Forest affected by the project is about 100 hectares, which equates to around two per cent of the total forest area. Not all this land would be cleared, but would be located in the road reserve. The area between the existing highway and the project would be used, as required, for temporary construction facilities and sediment detention basins as shown in **Figure 4-1**. The key productivity issues for State Forest lands are:

- Loss of forest that contributes to the economy of the area through timber harvesting.
- Impacts on recreation and conservation values.

There would be a loss of some areas of productive State Forest land and areas within the forest that are currently identified as buffer zones for visual amenity purposes. Given the small area of State Forest impacted by the project, overall visual amenity will not be adversely affected. There may be some social impacts associated with the loss of forests for the community who may value the forests for intrinsic reasons such as the natural beauty of the forest, however, this will be minor. The loss of some areas of the Glenugie State Forest is unlikely to significantly impact tourism in the area.

The general harvesting zone reflects the economic output of the Glenugie State Forest within the study area. Impacts would include reduction in the area of land available for forestry operations and some fragmentation and removal of productive areas., Based on the small proportion of Glenugie State Forest land affected by the project, it is not anticipated that there would be a significant impact on timber production activities or the viability of forestry businesses. The project would provide access to the state forest for forest management purposes.

No businesses front the existing highway in the project area and the project

would not result in loss of passing trade. The efficiency of transporting local produce would not be compromised by the project. The project would result in reduced travel times and transport costs. Businesses that trade within the wider region are likely to benefit from improved accessibility and travel times.

Construction of the project would require the import of some materials. Locally sourced materials would be used where possible to limit haulage distances and minimise heavy vehicle use of the road network.

The project will have a beneficial impact on employment during construction. It is expected that up to 230 people would be employed on the construction site. It is likely that some of the construction jobs and materials would be locally sourced.

The social and economic benefits from the workforce would filter into Grafton, Woolgoolga and Coffs Harbour through the local economy. This would include localised economic stimulus from the workforce purchasing local goods, services and accommodation as well as more regional economic benefits through the provision of specialised goods and services.

Local amenity

There would be minimal change, and mostly beneficial impacts on the amenity of the surrounding areas as a result of operation of the project. The visual amenity of the local area for nearby residents would improve as the upgrade would be located further away than the existing highway and would not be visible at any residences. Noise modelling indicates that noise levels for the relatively small number of residents adjacent to the project would fall below the project specific noise level criterion.

During the construction stage, there is potential for an increase in noise and vibration, traffic, air quality and visual amenity impacts. Air quality impacts would be minor and would include emissions of dust during excavation. Visual amenity impacts during construction would be negligible, as construction works would not be readily visible from any nearby residents. The potential for construction noise impacts would be minimised with the implementation of feasible and reasonable measures as detailed in Section 7.6.1. No significant impact is expected on local amenity.

Land connectivity and contiguity

Where the existing highway is retained as a local access road, it would provide for access by cyclists, pedestrians and local traffic. As the project is located near to the existing highway, no sections of the community would be isolated. Access and proximity of residents to the centres of Grafton, Woolgoolga and Coffs Harbour would remain unchanged.

Access is provided to Glenugie State Forest for forestry management activities.

Planned development

Land use change in the vicinity of the project is influenced by strategic planning initiatives and statutory controls from local and state government,.

The project would assist in improving infrastructure that supports future local and regional economic development. The project has been developed with consideration of existing strategic planning documents including:

- Mid North Coast Regional Strategy 2006-2031.
- Mid North Coast Farmland Mapping Proposal 2009.
- Clarence Valley Settlement Strategy 1999.

The project would not hinder or prohibit the achievement of the strategic goals or objectives outlined in these documents.

The likely future use of the Glenugie State Forest is expected to be consistent with the forest management zones.

A search of the Clarence Valley Council development application (DA) register and the Department of Planning's Major Projects was undertaken as part of this environmental assessment. There are no projects that would be impacted, or would be impacted by the project.

8.2.3 Impact mitigation and management measures

The following mitigation measures are proposed:

- Land acquisition or exchange would be in accordance with the provisions of the *Forestry Act* 1916.
- Harvestable timber would be removed from within the footprint of the project prior to commencement of construction.
- In consultation with the Department of Primary Industries, access to and within State Forest land would be provided for forestry purposes.
- Traffic connectivity would be maintained during construction.
- Advance notification would be given to property owners and occupants on the construction schedule, construction works and access arrangements.
- Existing public utilities would be protected as required.
- Retention of the existing highway as a local access and service road on the western side of the project.

8.3 Greenhouse gas emissions and climate change

8.3.1 Existing environment

Greenhouse gases are gases found in the atmosphere that absorb outgoing heat energy from the earth. The absorption of the energy warms the air, enabling life to survive, and is known as the greenhouse effect. Human activities, such as the combustion of carbon-based fuels, increase the amount of greenhouse gases in the atmosphere, which leads to greater absorption of heat and increases in atmospheric temperature, known as the enhanced greenhouse effect.

One of the main indictors for the enhanced greenhouse effect is the

atmospheric concentration of carbon dioxide (CO_2). Since 1860, the atmospheric concentration of CO_2 has risen from 280 parts per million (ppm) to 370 ppm and, at the same time, the average global temperature has increased by nearly one degree celsius. Projections show that if this trend continues, global temperatures could rise between one and four degrees by the end of the 21st century, compared to 1990 levels (WBCSD 2004). These projections suggest that there will be more hot days, bushfires, droughts and increased intensity of storm events.

The major climate change issue for the project is the potential for intensification of the hydrological cycle. Increasing temperatures lead to additional water vapour in the atmosphere. Intensification of the hydrological cycle means the climate becomes more variable and the frequency and intensity of storm events is likely to increase in the long-term.

The *Preliminary Environmental Assessment* for the project (RTA 2009b) identified the potential for occasional short duration, high intensity flood events as climate change is predicted to increase flood intensities in the Mid North Coast region. This has implications for the design life requirements of drainage infrastructure, as the drainage capacity required to manage storm events increases with rainfall intensity.

Carbon dioxide is only one of a number of greenhouse gases. The Kyoto Protocol identifies the main greenhouse gases as:

- Carbon dioxide (CO_2).
- Methane (CH_4).
- Nitrous oxide (N_2O).
- Hydrofluorocarbons (HFCs).
- Perfluorocarbons (PFCs).
- Sulphur hexafluoride (SF_6).

In assessing the greenhouse impact from various gases it is typical to report the collective impact as carbon dioxide equivalents ($CO_{2\text{-}e}$). '$CO_{2\text{-}e}$' is a metric measure used to compare the emissions from various greenhouse gases based upon their global warming potential. For example, the global warming potential for CH_4 is 21 and for N_2O is 310 (DCC 2008a). This means that emissions of 1 tonne (t) of CH_4 and N_2O is, respectively, equivalent to emissions of 21 and 310 t of CO_2, in terms of global warming potential.

CO_2 and N_2O are formed and released during combustion of gaseous, liquid and solid fuels. These will be the most significant gases for the project, being released when fuel is burnt in diesel engines during the construction phase.

Australia publishes national greenhouse gas inventories each year. The inventories are prepared according to international guidelines established by the Intergovernmental Panel on Climate Change and Kyoto accounting provisions. In 2006, Australia's net greenhouse gas emissions using the Kyoto accounting provisions were 576 million tonnes (Mt) of $CO_{2\text{-}e}$. The energy sector, which includes transport, was the largest source of greenhouse gas

emissions, accounting for 70 per cent (401 Mt CO_{2-e}) of the total (DCC 2008b).

8.3.2 Potential impacts of the project

Construction

A detailed construction plan would be completed for the project by the construction contractor. Greenhouse gas emissions from construction are largely a function of energy consumed by construction plant. The major energy consuming activities include clearing earthworks, material transport, pavement, bridge and culvert construction, demolition and lighting as detailed in Chapter 4. Clearing of vegetation will also release greenhouse gases. On average Australian forests sequester 64 tonnes of carbon per hectare (BRS 2005), with a ton of carbon equating to 3.67 tonnes of CO_2. The amount of vegetation to be cleared for the project has been estimated at 85 hectares, which would equate to 19,965 tonnes of CO_2 being released into the atmosphere.

Preliminary estimates of fuel consumption have been made for earthworks and concrete batching. The preliminary fuel usage for construction of the project is estimated at 8.7 million litres for earthworks and 15 million litres for activities relating to concrete batching.

Based on the initial estimates of fuel use for energy intensive construction activities, greenhouse gas emissions are summarised in **Table 8-3-1**. A more accurate estimate of greenhouse gas emissions from the construction activities would also be carried out following the development of a detailed construction schedule.

Table 8-3-1 Construction greenhouse gas emissions

Activity	Fuel usage (kL)	Energy content (GJ/kL)	Emission factor (kg CO_{2-e}/GJ)	Total emissions (tonnes CO_{2-e})
Earthworks	8,700	38.6	69.5	23,339
Concrete batching	15,000	38.6	69.5	40,241
Vegetation removal	-	-	-	25,850
Total	**23,700**	**-**	**-**	**127160**

Note: Calculations assume all fuel for construction is diesel.

In addition to emissions arising from the project construction, climate change has the potential to impact construction activities, due to the potential for more severe weather events and associated increase in stormwater flows. This could result increased soil erosion and sedimentation risks. This is discussed further in Section 7.2.

Climate change predictions would be factored into the design life phase of the project including provision for increasing frequency of high intensity storm events and the additional demands placed on drainage infrastructure to cope under such scenarios. This is particularly relevant for the mid north coast due to the significant population growth expected for the region and the

additional strain this will impose on transportation and drainage infrastructure. The current population of 330,600 is expected to grow by an additional 94,000 residents by 2031 (DoP 2009a). During construction, environmental controls would be implemented to ensure soil erosion associated with open cut earthworks is controlled and minimised, and that storm water discharge is configured to minimise scour under high intensity rainfall scenarios, thus preventing erosion and sedimentation of adjoining waterways.

Operation

Greenhouse gas emissions from the operation of roads vary according to a number of factors. These can include road surface, road gradient, fuel composition, vehicle types, traffic volume and congestion. The Department of Climate Change has historically published emission factors for vehicles, based on the vehicle size and distance travelled (AGO 2006). These factors were subsequently updated to be based on fuel consumption (DCC 2008b).

In the absence of fuel usage data for the operational scenarios, an estimate of the total $CO_{2\text{-}e}$ emissions has been made using the 2006 emission factors for fuel consumption, the daily traffic data, and the 2008 Department of Climate Change fuel consumption emission factors (**Table 8-3-2**). It was assumed that the emissions relate to seven kilometres of roadway.

- **Table 8-3-2 $CO_{2\text{-}e}$ emission estimates for the project**

Scenario	AADT	Annual VKT		Fuel consumed (kL)*		Total $CO_{2\text{-}e}$ emission (t)
		Petrol (L)	Diesel (L)	Petrol (0.113 L/km)	Diesel (0.285 L/km)	
2009 Existing highway	8193	15755978	5175995	1780	1475	8218
2012 Existing highway	8905	17126748	5626307	1935	1603	8933
2012 Project in place	8762	16850253	5537358	1904	1578	8790
2022 Existing highway	11488	22093505	7257936	2497	2069	11524
2022 Project in place	11281	21808992	7013509	2464	1999	11259

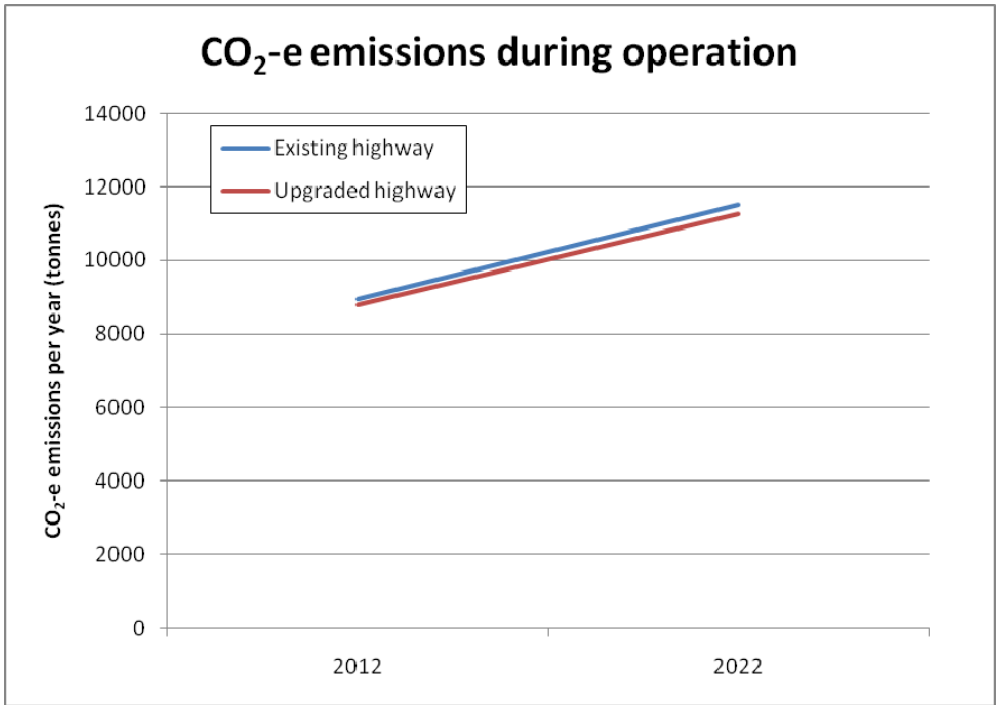
* AGO, 2006. ** DCC (2008a)

The estimates show slightly lower $CO_{2\text{-}e}$ emissions for the project compared with the base case (**Table 8-2-3** and **Figure 8-3-1**). This can be attributed to improvements in traffic flow and fuel economy. The combination of a more direct alignment, reduced gradient and improved curvature of the route will result in faster travelling times, smoother driving, and improved fuel economy. Congestion along the route will also be greatly reduced resulting in further

reductions in fuel consumption and greenhouse gas emissions.

The figures presented in **Table 8-2-3** and **Figure 8-3-1** do not include consideration of potential induced traffic.

- **Figure 8-3-1 CO_2 emissions during operation of the project**



8.3.3 Impact mitigation and management measures

The impact mitigation and management measures that would be implemented include the following:

- Assessing energy (fuel/electrical) efficiency when selecting equipment.
- Regular maintenance of equipment to retain fuel efficiency.
- Using biofuels where practicable (for example, biodiesel, ethanol, or blends such as E10 and B80) to reduce greenhouse gas emissions from construction plant and equipment.
- Minimising vegetation clearing and maximising re-vegetation.
- Planning and coordinating activities to minimise the number of flights, delivery or trips with empty loads.
- Using recycled materials in place of new materials when practicable.
- Substituting low greenhouse-intensity materials where appropriate, subject to engineering constraints.