18 SUMMARY OF CUMULATIVE ENVIRONMENTAL IMPACTS

The Terms of Reference (TOR) for the Queensland Curtis LNG (QCLNG) Project require that the Environmental Impact Statement (EIS) provides a clear and concise summary of the cumulative impacts of the Project. This is in conjunction with a description of these cumulative impacts both in isolation and in combination with other known, existing or proposed project(s), where details of such proposed projects have been provided to QGC by the Department of Infrastructure and Planning (DIP) or are otherwise published.

Volume 1, Section 3.2.7 describes the approach used in this EIS to assess cumulative impacts. *Volume 1, Appendix 1.6* identifies and provides an overview of the proposed projects that were considered in the assessment of cumulative impacts.

This chapter summarises the potential cumulative impacts on a range of environmental values that are associated with the construction and operation of the Gas Field Component of the QCLNG Project. Other proposed projects and applicable components of the Project considered for the assessment of cumulative impacts for the Gas Field are shown in *Figure 3.18.1.*

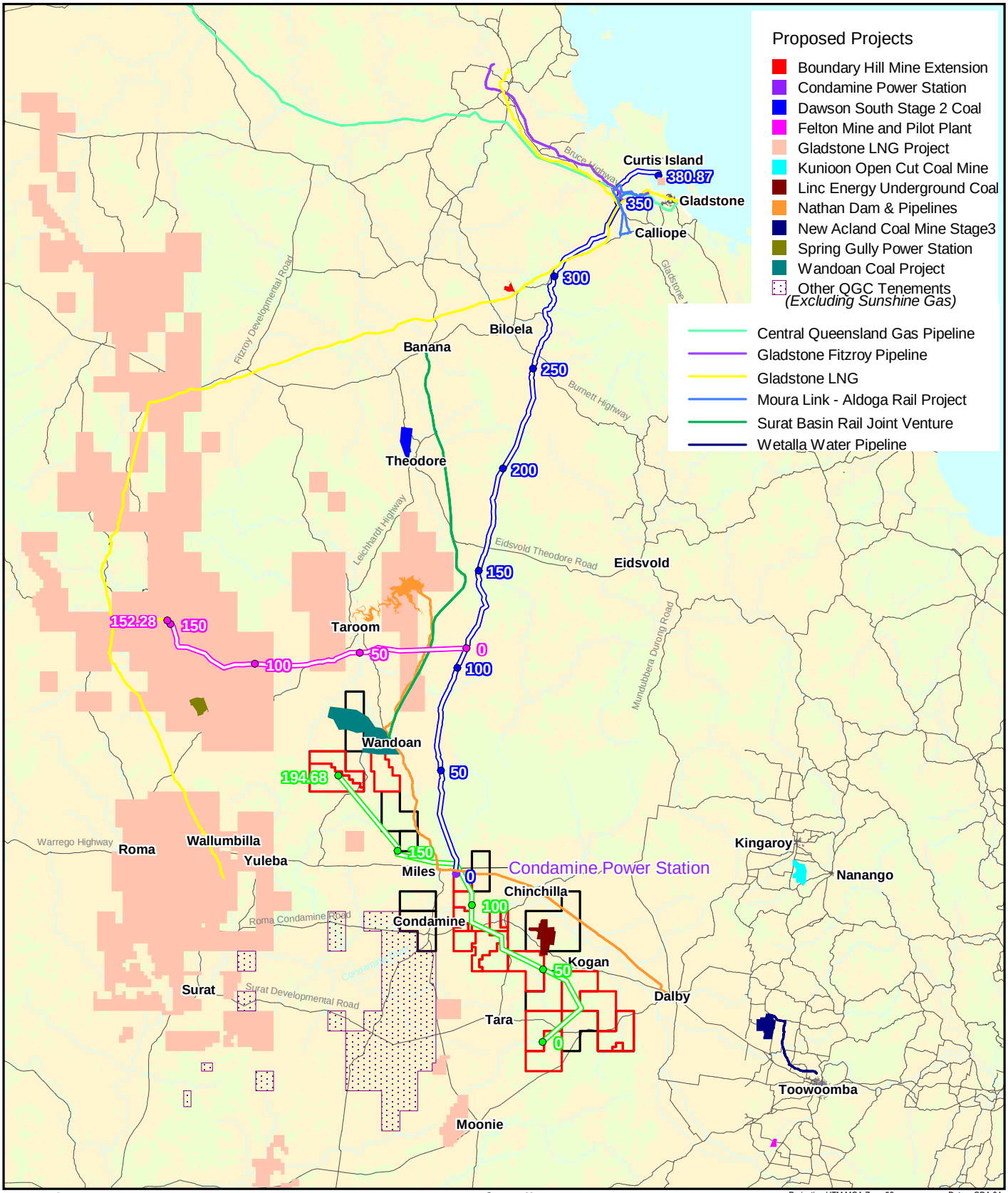
18.1 OUTCOMES OF THE CUMULATIVE IMPACT ASSESSMENT

Environmental values that may be affected by cumulative impacts are identified in *Table 3.18.1* for both the Construction and Operation phases of the Gas Field. Impacts on these environmental values may arise as a result of a geographic overlap with other project areas, scheduling overlap or utilisation of the same infrastructure, services and resources.

It is important to clarify that the matrix in *Table 3.18.1* is not a checklist showing which environmental values are affected by each of the proposed projects. Rather, shaded cells show the potential negative and positive impacts to environmental values as a result of the various proposed projects under construction or operating close to (or at a similar time as) the QCLNG Project.

The underlying assumption in *Table 3.18.1* is that the construction phase of these proposed projects and other components of the QCLNG Project all coincide. As such, it is a conservative evaluation of potentially negative cumulative impacts. It is likely that some projects will be delayed and others may be cancelled.

The nature and significance of potential cumulative impacts on the environmental values is discussed in the following sub-sections. For further discussion of the cumulative impacts associated with each environmental value, refer to the relevant chapters in this volume (*Chapters 4-17)*.



Legend:

- Export Pipeline & Kilometre Point
- Lateral Pipeline & Kilometre Point
- Upstream Infrastructure Corridor & Kilometre Point
- Gas Fields - PL & PLA
- Gas Fields - ATP

Source Note:
1:250,000 Topographic vector copyright Geoscience Australia

Projection UTM MGA Zone 56 Datum GDA 94

0 50 75 100

Kilometres

N

QUEENSLAND CURTIS LNG
A BG Group business

Project	Queensland Curtis LNG Project
Client	QGC - A BG Group business

Title: **Proposed Projects Considered for the Cumulative Impact Assessment of the Gas Field Component**

ERM
Environmental Resources Management Australia Pty Ltd

Drawn	Mipela	Volume 3	Figure 3.18.1
Approved	CD	File No:	QC02-T-MA-00072
Date	15.06.09	Revision	A

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Table 3.18.1 Identification and Assessment of the Significance of Cumulative Environmental Impacts for the Gas Field

Proposed Projects		Affected Environmental Values												
		Geology and Soils	Land Use and Infrastructure	Land Contamination	Terrestrial Ecology	Aquatic Ecology	Surface Water Resources	Groundwater Resources	Air	Noise and Vibration	Road Transport	Visual Amenity	Waste Management	Hazard and Risk
CSG Field and Pipeline														
Condamine Power Station	CON													
	OPS		■	■				■	■	■		■		■
Expansion of QGC CSG fields for domestic markets	CON	■	■	■	■	■	■	■	■	■	■	■	■	■
	OPS	■	■	■	■	■	■	■	■	■		■	■	■
Gladstone LNG Project: CSG Field (Santos)	CON	■	■	■	■	■	■	■	■		■		■	
	OPS	■	■	■	■	■	■	■	■		■		■	
New Acland Coal Mine: Stage 3 Expansion	CON	■	■	■	■	■	■	■	■		■		■	
	OPS	■	■	■	■	■	■	■	■		■		■	
Wandoan Coal Project	CON	■	■	■	■	■	■	■	■	■	■	■	■	■
	OPS	■	■	■	■	■	■	■	■	■	■	■	■	■
Linc Energy Underground Coal Gasification	CON	■	■	■	■	■	■	■	■	■	■	■	■	■
	OPS	■	■	■	■	■	■	■	■	■	■	■	■	■
Spring Gully Power Station	CON											■		■
	OPS			■		■	■	■	■					
Felton Mine and Dimethyl Ether Pilot Plant	CON										■			
	OPS			■					■					■
Kunioon Open Cut Coal Mine	CON	■	■	■	■	■	■	■			■		■	
	OPS	■	■	■	■	■	■	■	■		■		■	
Surat Basin Rail	CON	■	■	■	■	■	■		■	■	■		■	
	OPS			■										■
Nathan Dam Pipelines	CON	■	■	■	■	■	■		■	■	■		■	
	OPS					■	■							■
QCLNG Pipeline Component	CON	■	■		■				■		■	■	■	■
	OPS													

CON = Construction
OPS = Operations

18.1.1 Geology and Soils

The majority of other projects do not occur within 50 km of the Gas Field tenements, resulting in negligible to minor cumulative impacts on soils from these projects. However, major and moderate cumulative impacts on soils can be expected from the Wandoan Coal Project and the Linc Energy Underground Coal Gasification Project, respectively. Both these projects occur within and adjacent to the Gas Field tenements and are expected to have a greater direct impact on soils, through removal of topsoil, than the Gas Field activities and direct impacts on geological units.

The expansion of coal seam gas (CSG) fields for the domestic market, construction of the QCLNG Project Pipeline Component and construction of pipelines for the Nathan Dam are expected to have minor impacts on soils within and adjacent to the Gas Field. Cumulative impacts on soils will be localised, depending on the nature of other projects. Approximately 25,000 ha may experience moderate-to-major impact, mostly attributable to soil removal or disturbance by other mining projects.

Mitigation measures for QGC's impacts on soils are described in *Volume 3, Chapter 4*. Impacts on soils from other projects will be managed under the relevant environmental authorities for those projects.

18.1.2 Land Use and Infrastructure

The majority of other projects do not occur within 50 km of the Gas Field tenements, resulting in negligible to minor cumulative impacts on land use and infrastructure from these projects. However, major and moderate impacts on land use and infrastructure can be expected from the Wandoan Coal Project and the Linc Energy Underground Coal Gasification Project, respectively. Both these projects occur within and adjacent to the Gas Field tenements.

The expansion of CSG fields for the domestic market, construction of the Pipeline Component and construction of pipelines for the Nathan Dam are expected to have minor direct impacts on land use and infrastructure. The Gladstone LNG Project (Santos) gas fields will result in similar levels of disturbance to land use and infrastructure as the QCLNG Project. However, these impacts are expected to occur approximately 50 to 200 km west and north-west of the Project.

Within the Gas Field tenements, cumulative impacts on land use and infrastructure will be localised, depending on the nature of other projects. Approximately 20,000 ha may experience moderate to major impacts, such as removal of land from agricultural production. Elsewhere, cumulative impacts on land use and infrastructure are expected to be negligible to moderate due to the small size of other projects or their distance from the QCLNG Project.

Mitigation measures for QGC's impacts on land use and infrastructure are described in *Volume 3, Chapter 5*. QGC will work with the local community and community service organisations to minimise impacts on land use and infrastructure. Impacts from other projects will be managed under the relevant environmental authorities for those projects.

18.1.3 Land Contamination

The majority of other projects do not occur within 50 km of the Gas Field tenements, resulting in nil or negligible cumulative impacts on land contamination from these projects. However, moderate impacts on land contamination can be expected from the Wandoan Coal Project and Linc Energy Underground Coal Gasification Project, respectively. Both these projects occur within the Gas Field tenements.

The expansion of CSG fields for the domestic market is expected to result in minor cumulative impacts on land contamination. Cumulative impacts on land contamination will be localised, depending on the nature of other projects. Approximately 20,000 ha may experience moderate impact, with the majority of the impact attributable to other mining projects.

Mitigation measures for QGC's impacts on land contamination are described in *Volume 3, Chapter 6.* Impacts on land contamination from other projects will be managed under the relevant environmental authorities for those projects.

18.1.4 Terrestrial Ecology

Moderate cumulative impacts on terrestrial ecology are expected from the Wandoan Coal Project and the Gladstone LNG Project (Santos) gas fields.

The Wandoan Coal Project may directly impact approximately 20,000 ha of predominantly cropping and grazing land and 500 ha of Endangered Regional Ecosystems or of concern ecosystems in and surrounding the Gas Fields.

The Gladstone LNG Project (Santos) gas fields will result in similar levels of disturbance to terrestrial ecology as the QCLNG Project. This impact is likely to be on a variety of ecosystems, ranging from agricultural land to State Forest. However, these impacts are expected to occur approximately 50 to 200 km west and north-west of the Project.

Minor impacts on terrestrial ecology may come from the Linc Energy Underground Coal Gasification Project, construction of the Project Pipeline Component and the expansion of CSG fields for the domestic market. Other projects are expected to have a negligible cumulative impact on terrestrial ecology.

There are several Endangered, Vulnerable or Rare (EVR) flora species for which the potential cumulative impacts associated with the Gas Field would be likely to increase. These are *Micromyrtus patula and Philotheca sporadica*, both of which have highly restricted distributions with populations that may be concentrated within constrained project locations.

In particular, the known extent of *Micromyrtus patula* and *Philotheca sporadica* is limited to the area affected by a number of the proposed CSG Field developments. As such, it is proposed that well and other infrastructure sites be inspected before construction activities so that populations of such species can be identified and avoided. If other projects were to adopt similar

guidelines, impacts on these species should be minimal.

Queensland Herbarium records show substantial populations of other flora with limited distributions occur outside any proposed development area. Of the EVR fauna that occur within the Gas Field, none have distributions that are restricted to the area while several occur in refugial areas characterised by steep topography with sandstone cliffs and gorges, where development is unlikely (and has been restricted from development by QGC in this proposal).

In terms of fauna habitat in general, field assessments found that much of the Gas Field is in a degraded and depauperate condition. It is likely therefore, that EVR fauna, as well as other more common species, will have patchy distributions of localised populations that persist in some of the remaining suitable habitats. In this situation, it is not possible to predict cumulative impacts with any degree of certainty unless the details of other projects are known and further fauna surveys have been conducted in these other areas to assess the health of ecosystems and their biodiversity status.

Mitigation measures for QGC's impacts on terrestrial ecology are described in *Volume 3, Chapter 7.* QGC will try to minimise impacts on any REs identified as cumulatively impacted by other projects. Impacts on terrestrial ecology from other projects will be managed under the relevant environmental authorities for those projects.

18.1.5 Aquatic Ecology

Moderate cumulative impacts on aquatic (freshwater) ecology are expected from the Wandoan Coal Project while minor cumulative impacts may come from the expansion of CSG fields for the domestic market, the Linc Energy Underground Coal Gasification Project and the Gladstone LNG Project (Santos) gas fields. Other projects are expected to have a negligible cumulative impact.

The various projects that are expected to have some impact on aquatic ecology are those involving clearing and disturbance in the vicinity of aquatic habitats and in catchment areas. They will also contribute to changes in hydrological regimes, geomorphological processes and water quality, particularly where catchment and watercourse disturbance is not effectively managed. There is also the risk of introduction of aquatic weeds from a wider number of sources.

In contrast to terrestrial ecology, the aquatic (freshwater) ecology features and values are concentrated within the watercourse networks that drain large expanses of land over which the various projects occur. As such, there is a greater potential for the impacts from individual projects to accumulate and increasingly affect the aquatic (freshwater) ecology features and values.

EVR aquatic fauna that may suffer from such cumulative impacts include the Murray River Cod, which occurs in the Murray-Darling catchment, and the Fitzroy River Turtle, which occurs in the Dawson River catchment.

Appropriate mitigation and rehabilitation measures will help minimise these cumulative impacts while offsets have the potential to provide benefits.

As described in *Volume 3, Chapter 8*, the Gas Field Component of the Project is unlikely to have a significant impact on any freshwater aquatic features or values in its own right. However, all freshwater species are potentially affected by the cumulative impacts of the various projects.

Mitigation measures for QGC's impacts on aquatic (freshwater) ecology are described in *Volume 3, Chapter 8*. Impacts on aquatic ecology from other projects will be managed under the relevant environmental authorities for those projects.

18.1.6 Surface Water Resources

Moderate cumulative impacts on surface water are expected from the Wandoan Coal Project. Minor cumulative impacts on surface water may come from the expansion of CSG fields for the domestic market, the Linc Energy Underground Coal Gasification Project and the Gladstone LNG Project (Santos) gas fields.

The Wandoan Coal Project and the Gladstone LNG Project (Santos) will impact the Dawson–Fitzroy catchment while the majority of the QCLNG Project will impact the Condamine–Balonne catchment.

Other projects are expected to have a negligible cumulative impact on surface water resources.

Mitigation measures for QGCs' impacts on surface water are described in *Volume 3, Chapter 9*. Baseline data on surface water quality will be obtained and surface water quality will be regularly monitored in the future. This may assist in measuring the potential impact of QGC and other parties on surface water in the region. Impacts on surface water from other projects will be managed under the relevant environmental authorities for those projects.

18.1.7 Groundwater Resources

Major cumulative impacts on groundwater may be expected from the Gladstone LNG Project (Santos) gas fields and the Linc Energy Underground Coal Gasification Project. The Gladstone LNG project is likely to have a comparable impact on groundwater, in terms of volumes and quality, as the QCLNG Project. The impacts of Linc Energy's underground coal gasification on groundwater quality have not been established, but a conservative approach has been adopted in assessing the possible impact as major.

Moderate impacts on groundwater may result from the expansion of CSG fields for the domestic market as well as the Spring Gully Power station. Minor impacts on groundwater may result from the Condamine Power Station and the Wandoan Coal Project, although QGC may supply its own treated Associated Water to these projects, thus reducing the quantity of groundwater extracted.

Detailed information about the production of CSG for sale on the domestic market from tenures surrounding those of QGC is not available. The presence of adjacent CSG producers bordering on or in close proximity to the Gas Field Component of the QCLNG Project can be expected to result in moderate cumulative impacts as overlapping drawdown affects are additive. Impacts to existing bores will depend on their location in relation to the CSG activities. A program has been proposed within the tenements as well as at bores outside the Gas Field to monitor for any potential cumulative impacts.

Other projects are expected to have a negligible cumulative impact on groundwater.

Mitigation measures for QGC's impacts on groundwater are described in *Volume 3, Chapter 10* and management measures for Associated Water are described in *Volume 3, Chapter 11*. Baseline data on groundwater levels and quality will be obtained and regularly monitored in the future. This may assist in measuring the potential impact of QGC and other parties on groundwater in the region.

Impacts on groundwater from other projects will be managed under the relevant environmental authorities for those projects.

18.1.8 Air

Moderate cumulative impacts on air quality may result from the operation of the Spring Gully Power Station, Condamine Power Station, Wandoan Coal Project, Linc Energy Underground Coal Gasification Project and Gladstone LNG Project (Santos) gas fields.

The contribution of five existing power stations in the region to background levels of nitrogen dioxide (NO_2) was modelled (refer to *Volume 3, Chapter 12).* It was found that, including the QCLNG Project, the cumulative NO_2 levels were within the limits of air quality objectives. No background air quality data was available for other air pollutants. However, they are not expected to exceed air quality objectives due to the rural nature of the area.

It is not expected that the cumulative impact of Spring Gully Power Station or Gladstone LNG Project (Santos) gas fields to background air quality levels will result in exceedences of air quality objectives due to their distance (greater than 50 km) from the QCLNG Project.

The emissions from the Condamine Power Station, Wandoan Coal Project and Linc Energy Underground Coal Gasification Project are not expected to result in exceedences of air quality objectives, despite their proximity to the QCLNG Project. Due to the rural nature of the region, emissions from these

sources are not expected to add to background air quality levels to the extent they will be exceeded.

Should construction timing for the Wandoan Coal Project, Linc Energy Underground Coal Gasification Project and Pipeline Component coincide, dust generation may be significant, necessitating strict mitigation measures. Other projects are expected to have a negligible cumulative impact on air quality.

Mitigation measures for QGC's impacts on air are described in *Volume 3, Chapter 12.* QGC will measure air quality for a variety of values in and adjacent to the Gas Field. This will help to establish baseline air quality for a variety of pollutants in the region against which future cumulative impacts can be measured. Gas Field infrastructure may be located to reduce cumulative air impacts with other projects in or adjacent to the Gas Field. Impacts on air quality from other projects will be managed under the relevant environmental authorities for those projects.

18.1.9 Noise and Vibration

Cumulative impacts may be experienced from noise sources within approximately 10 km of a QCLNG Project field compression station (FCS).

Major cumulative noise impacts may be experienced through the potential close proximity of noise sources at the Wandoan Coal Project and Linc Energy Underground Coal Gasification Project or existing power stations.

Minor cumulative noise impacts may be experienced through the potential close proximity of noise sources at the Condamine Power Station and expansion of CSG fields for domestic markets. Other projects are expected to have nil or negligible cumulative impact on noise due to the distance between projects.

Detailed information about the production of CSG for sale on the domestic market from tenures surrounding those of QGC is not available. These projects may include infrastructure, with associated sound power levels, in close proximity to the QGC's tenements.

There are no significant vibration sources from the QCLNG Project. Cumulative vibration impacts may come from other nearby mining projects.

Mitigation measures for QGC's impacts on the acoustic environment are described in *Volume 3, Chapter 13*. QGC will measure noise levels at potential sensitive receptors in and adjacent to the Gas Field. This will help to establish baseline noise levels in the region against which future cumulative impacts can be measured.

Gas Field infrastructure may be located to reduce cumulative noise impacts with other projects located in or adjacent to the Gas Field. Impacts on noise levels from other projects will be managed under the relevant environmental authorities for those projects.

18.1.10 Road Transport

The preliminary road transport assessment for the Gas Field has been based on the assumption that all materials, plant, equipment and personnel movements will primarily be by road from Brisbane. This has provided a conservative estimate of the potential impacts on the road network, resulting in heavy impacts on the road pavement for a number of state- and local government-controlled roads.

Traffic generated by the construction of the Wandoan Coal Project, Linc Energy Underground Coal Gasification Project, Gladstone LNG Project (Santos) gas fields, QCLNG Project Pipeline Component and Nathan Dam pipelines project may result in moderate-to-major cumulative impacts to the road network, especially in the vicinity of the Gas Field. Impacts would be both in terms of pavement impacts and increased traffic volumes.

Other projects will have a negligible or minor cumulative impact on the road network, as they will:

- not use the same roads to the west of Toowoomba
- have limited demands on the road network
- use alternative routes to the QCLNG Project.

In *Volume 3, Chapter 14* a methodology for determining the actual impacts of the Gas Field on the road network has been proposed. This includes a review of the transport strategy during detailed design and again at the time of awarding transport contracts. QGC will then work closely with the Department of Transport and Main Roads (DTMR) to establish optimal transport routes and mitigation measures.

It is anticipated that successful negotiation of the management of road impacts with the relevant road authority (e.g. DTMR, regional councils) will form part of the conditions of approval for the Project.

18.1.11 Visual Amenity

There may be a moderate cumulative impact on visual amenity in the region of the Gas Field from the Wandoan Coal Project, Linc Energy Underground Coal Gasification Project and the Condamine Power Station. These Projects may occur within visual range of Gas Field infrastructure. Other projects are expected to have nil or negligible cumulative visual impact due to the distance between projects or the short duration of visual impacts.

Detailed information about the production of CSG for sale on the domestic market from tenures surrounding those of QGC is not available. The presence of adjacent CSG producers bordering on or in close proximity to the Proponent's Gas Field can be expected to result in minor cumulative impacts on visual amenity.

Mitigation measures for QGC's impacts on visual amenity are described in *Volume 3, Chapter 15*. Gas Field infrastructure will be located to minimise cumulative visual impacts. Impacts on visual amenity from other projects will be managed under the relevant environmental authorities for those projects.

18.1.12 Waste Management

The Wandoan Coal Project and Linc Energy Underground Coal Gasification Project may have a moderate cumulative impact on waste disposal facilities in the region. That cumulative impact may pose a risk to the potential capacity of waste management facilities. Other projects present a negligible-to-minor cumulative impact on waste management facilities, as they will use alternative facilities or produce only minor waste volumes.

Detailed information about the production of CSG for sale on the domestic market from tenures surrounding those of QGC is not available. The presence of adjacent CSG producers bordering on or in close proximity to the Gas Field can be expected to result in minor cumulative impacts on waste management.

The majority of waste by volume (other than Associated Water) is waste water, which will be treated and disposed of on-site. Associated Water management is described in *Volume 3, Chapter 11.*

Regional councils will be consulted about the volume of waste they can expect in future, and their ability to cope. Alternative waste disposal facilities will be utilised if necessary.

Mitigation measures for QGC's impacts on waste management are described in *Volume 3, Chapter 16*. Impacts on waste management from other projects will be managed under the relevant environmental authorities for those projects.

18.1.13 Hazard and Risk

Cumulative impacts from hazards are generally localised to the areas surrounding Gas Field infrastructure.

The Wandoan Coal Project, Linc Energy Underground Coal Gasification Project, Condamine Power Station, QCLNG Pipeline Component, Surat Basin Rail (if electric lines are used) and other local CSG producers may cause minor-to-moderate cumulative hazard impacts. This will depend on the proximity of infrastructure presenting the hazard and the probability of that hazard event interacting with other projects' infrastructure.

Mitigation measures for QGC's potential hazards are described in *Volume 3, Chapter 17*. Potential hazards will not be located where they might interact with other projects. Hazards from other projects will be managed under the relevant environmental authorities for those projects.

18.2 CONCLUSION

Cumulative impacts on the environment and public safety and amenity have been assessed, taking into consideration the projects that are currently underway or known to the assessment team. In relation to the cumulative impacts of the Gas Field Component and other infrastructure, the impact is generally negligible, but may be minor-to-moderate for some environmental values. A summary of the impacts outlined in this chapter is provided in *Table 3.18.2* below.

Table 3.18.2 Summary of Cumulative Impacts

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct
Impact duration	Short to long term
Impact extent	Local
Impact likelihood	High

Overall assessment of impact significance: negligible to moderate, depending on the environmental value impacted.