15 VISUAL AMENITY

15.1 INTRODUCTION

This chapter provides responses to submissions received on the draft environmental impact statement (EIS) related to visual impacts of the Gas Field Component of the Queensland Curtis LNG (QCLNG) Project.

Where changes to the Project description have impacted visual amenity, these impacts, and measures to mitigate them, are described.

15.2 RESPONSES TO SUBMISSIONS

There were no submissions received on visual amenity of the Gas Field.

15.3 CHANGES TO PROJECT DESCRIPTION

Changes to the Project description are described in *Volume 2, Chapters 7* and *11*. The following changes in the Project description have resulted in a change to the assessment of visual impacts:

- change from a maximum of 10 reciprocating to a maximum of three centrifugal compressors at central processing plants (CPPs)
- substations at field compression stations (FCSs) and CPPs
- aboveground 33 kV power lines between FCSs and CPPs
- aboveground 132 kV power lines between CPPs and third-party substations
- water treatment plants (WTPs), including brine concentrators and reverse osmosis infrastructure
- flares at wells
- change in gathering line and trunkline easement widths

Where changes to the Project description are considered insignificant in relation to visual impacts, these have not been assessed in the supplementary EIS (sEIS).

15.3.1 Central Processing Plants

The draft EIS assumed a maximum of ten reciprocating compressors and five tri-ethylene glycol (TEG) units at each CPP. The sEIS assumes a maximum of three centrifugal compressors and three TEG units per CPP. The maximum number of structures giving rise to visual impacts at each CPP are:

- three air-cooled heat exchangers with fan and aftercooler, about 7 m high
- three TEG regeneration units and three TEG contactors, about 14 m high
- a flare, about 30 m high
- a substation

15.3.2 Power Lines and Substations

The draft EIS described all power to be sourced from gas-drive engines. Subsequent infrastructure design has resulted in a combination of options for power. The CPPs, FCSs and WTPs will be powered by:

- Electric-drive engines connected to the transmission grid in the south-east and central areas
- Gas-drive engines in the north-west area, with the option for electric-drive engines to be connected to the grid.

For the purposes of visual impact modelling, it has been assumed that all areas will be connected to the grid. This represents a conservative scenario with the maximum length of power lines and the maximum number of substations.

Figure 3.15.1 shows an example of 33kV power lines and *Figure 3.15.2* shows an example of 132kV power lines.

Figure 3.15.1 33 kV Power lines

Figure 3.15.2 132 kV Power lines

A substation will be constructed at each CPP, connected by aboveground 132 kV power lines to a third-party substation. The total length of aboveground 132 kV power lines, for which QGC Ltd is seeking approval, is approximately 40 km. This is comprised of approximately 15 km in the Bellevue block and 25 km between CPPs in the Ruby and Jordan blocks. Connections will also be required between third-party power suppliers and the Ruby and Woleebee Creek CPPs. All approvals for off-tenement power supply will be obtained by the relevant power distribution company.

A substation will be constructed at each FCS, connected through a combination of underground and aboveground 33 kV power lines to a substation at the nearest CPP. Underground power lines are the preferred option, although aboveground power lines will be used where practicable. The total length of 33 kV power lines is approximately 1,600 km. Multiple underground power lines will be located in the same easement as gas trunklines where power lines from multiple FCSs converge at a CPP. The total easement length is approximately 600 km, which has been conservatively assumed to be the total length of aboveground 33 kV power lines.

Substations at CPPs and FCSs will comprise transformers and switchyards approximately 6 m high.

15.3.3 Water Treatment Plants

The components of a WTP – including pre-treatment facilities, reverse-osmosis (RO) plant, brine concentrator, amendment and blending plant and chemical storage – are as described in the draft EIS.

Figure 3.15.3 shows an example of a WTP with a brine concentrator.

Figure 3.15.3 Water Treatment Plant with Brine Concentrator

For the purposes of assessing impacts on visual amenity from WTPs, it has been assumed there will be three WTPs with a combined capacity of 175 ML per day located in the north-west, central and south-east tenements.

The components of a WTP that may impact visual amenity are the:

- brine concentrator, approximately 30 m high
- reverse osmosis plant contained within a shed approximately 10-15 m high
- tanks and pipework

15.3.4 Flares at Wells

Figure 3.15.4 shows a typical separator and gas flare at a well.

Figure 3.15.4 Typical Gas Separator and Flare

The stack for well site flares will be between 2 m and 6 m high. There are a range of potential flaring scenarios occurring between twice a year and once every four years. Flaring events range between five minutes and six hours, except for flaring during pilot well testing and workover rig activities. Pilot well testing will occur as part of the exploration and appraisal program for the QCLNG Project (approximately 5 per cent or 300 wells) for six months. Pilot

wells are expected to flare approximately 95 mmscf (2.7 million m^3) of CSG per event. Flaring during workover rig activities occurs once every two years for a duration of approximately three days. Each workover flaring event will flare approximately 0.5 mmscf (14,150 m^3) per day.

Due to the duration and/or frequency of pilot well flaring and workover rig flaring, there may be visual impacts from these events.

15.3.5 Gathering Line and Trunkline Easements

The draft EIS described gathering line easements as being approximately 15 m wide. The sEIS describes easement widths with multiple gas and water gathering lines varying in widths of between 20 m and 30 m, depending on the number of gas and water lines. Easements with a single gas and water gathering line will be approximately 15 m wide. Approximately 75 per cent of easements will be 15 m wide, 15 per cent will be 15 m to 20 m wide and the remainder 20 m to 30 m wide.

Where required for safety or operational reasons, single gas and water easements may be up to 20 m wide.

The draft EIS described trunkline easements as being approximately 30 m wide. The sEIS describes easement widths for gas and water trunklines as between 20 m and 54 metres. Up to nine gas trunklines may be located in the same easement for distances up to 15 km. There may be a single water trunkline co-located in the same easement as gas trunklines. Approximately 70 per cent of trunkline easements will be less than 30 m, 25 per cent between 30 m and 40 m and the remainder greater than 40 m.

15.3.6 Borrow Pits

The draft EIS proposed that quarry material be sourced from appropriately licensed quarries. QGC now proposes to develop its own borrow pits where required. The exact number and location of borrow pits has not been determined and will depend on geotechnical investigations identifying suitable material. It is anticipated that each block will have a borrow pit of approximately 8 ha, of 2 m depth and 155,000 m^3 in order to meet the localised quarry material requirements of the Project.

15.4 METHODOLOGY FOR ASSESSING VISUAL IMPACTS

The description on the viewshed and methodology for assessing visual impacts is described in *Volume 3, Chapter 15* of the draft EIS and *Appendix 3.6*.

15.4.1 Impacts on Residents

The sEIS describes the methodology for assessing visual impacts on residents in the Gas Field.

There are approximately 2,000 occupied residential properties within the tenement area. The assessment of the visual impacts of the Gas Field infrastructure on residents is based on the following assumptions:

- An occupant of a residential dwelling will have a high degree of sensitivity to the change in their surrounding landscape.
- Viewer numbers for residential properties are not applicable, as the number of viewers is consistently low.
- Residents may be able to see Gas Field infrastructure as they move around their property. However, where there are multiple viewing locations, the most sensitive location is the one most used (e.g. a patio or outside entertainment areas) or that is most visually impacted (e.g. a view from a second-storey window).
- Landscaping may mitigate the visual impact at many residential locations. Landscaping may be inappropriate in some instances (e.g. where it screens a view or reduces solar access). The appropriateness of landscape mitigation can be assessed only on a case-by-case basis.

Based on the known extent of Gas Field infrastructure, there will be a number of residential properties within viewsheds of Gas Field infrastructure. Many of these residential properties will sit in forested areas or have forested areas between the residence and a particular Gas Field component, thereby screening or filtering views to the component. Gardens surrounding the houses on many other properties will also screen or filter views.

However, the visual impact assessment for residences assumes that the living areas are orientated towards the closest or most visually apparent piece of infrastructure and that there is no vegetation screening or filtering views. This is considered conservative.

An assessment can be made on a worst-case scenario based solely on distance parameters. Zones of visual influence for the Gas Field components are described below.

15.4.1.1 Major Infrastructure

For major infrastructure such as CPPs, FCSs and WTPs, the zones of visual influence for residential properties within the viewshed would be as follows:

- 0 to 0.5 km has a high level of visual impact
- 0.5 to 1 km has a medium level of visual impact
- 1 to 3.5 km has a low level of visual impact
- > 3.5 km is visually insignificant.

If 20 m to 30 m high infrastructure are located at least 1 km from the nearest residential property, the impact would be low. It is highly probable that, due to required noise separation distances (refer *Volume 3, Chapter 13*), QGC will

locate all major infrastructure such as CPPs, FCSs and WTPs at least 1 km from the nearest residence.

15.4.1.2 Wells and other Minor Infrastructure

For a 5 m high object, such as wellhead infrastructure, the zone of high visual impact would extend to only 30 m, with a medium level of visual impact being between 30 m and 60 m and a low level of visual impact being between 60 m and 500 m. Wells will be at least 200 m from the nearest residence and therefore have a low to negligible visual impact.

15.4.1.3 Power Lines

The maximum height of the 132 kV transmission poles is likely to be 41 m, however, the viewshed calculations were based on a height of 50 m. The viewshed and associated zones of visual influence for a transmission tower of this height are:

- 0 to 0.6 km has a high level of visual impact
- 0.6 to 1.2 km has a medium level of visual impact
- 1.2 to 6 km has a low level of visual impact
- > 6 km is visually insignificant.

From this calculation it is apparent that, if the 132 kV transmission lines are at least 1.2 km from the nearest residential property, their impact will be low. It is proposed to construct approximately 40 km of aboveground 132 kV power line, which would result in very few residents being able to see power lines from less than 1.2 km away.

The 33 kV transmission line would be lower in height and, basing the calculations on a height of 20 m, the viewshed and the associated zones of visual influence for a 33 kV line would be:

- 0 to 0.25 km has a high level of visual impact
- 0.25 to 0.5 km has a medium level of visual impact
- 0.5 to 2.3 km has a low level of visual impact
- > 2.3 km is visually insignificant.

From this calculation it is apparent that, if the 33 kV transmission lines are at least 0.5 km from the nearest residential property, their impact will be low.

15.4.1.4 Easements

Given a cleared easement defined by 20 m high vegetation, the viewshed would extend out to a distance of 2.3 km. For such a viewshed, the zones of visual influence within the viewshed would be as follows:

- 0 to 0.25 km has a high level of visual impact
- 0.25 to 0.5 km has a medium level of visual impact
- 0.5 to 2.3 km has a low level of visual impact
- > 2.3 km is visually insignificant.

An assessment of the visual impact of easements on the view from residential properties is more difficult than would be suggested by these calculations. If the easement is running through cleared farmland or through scattered vegetation, where the impact of clearing is not obvious, the visual impact would be low or negligible, irrespective of the separation distance between the easement and the residence. However, if an obvious corridor is created in what appears to be an intact area of forest, then these calculations could be applied and would suggest that if this clearance was more than 0.5 km from the residential property the visual impact would be low.

15.5 IMPACTS FROM CHANGES TO THE PROJECT DESCRIPTION

15.5.1 Central Processing Plants

Within and surrounding the QGC tenements there are taller and larger infrastructures than the proposed CPPs, such as the Condamine Power Station. A visual assessment of these third-party infrastructures shows they are absorbed into the surrounding landscape from publically accessible viewpoints through vegetation screening.

The overall dimensions of the visual components of a CPP, including a substation, have not changed materially from the draft EIS, and visual impacts were considered to be low. With appropriate screening, visual impacts from CPPs described in the sEIS are considered low.

15.5.2 Power Lines

There are many transmission lines already within the Project area that are an accepted part of the landscape. The transmission towers proposed for the Gas Field will be on poles, not lattice towers. Such poles are easily absorbed into the landscape, unlike lattice towers, which can be identified from a considerable distance. Even the taller poles proposed for the 132kV lines at a distance appear to be normal power lines, which to most viewers are virtually invisible in a rural landscape.

The main visual impact of a transmission line will be where vegetation is removed to construct the transmission line easement. QGC will, as far as reasonably practical, avoid vegetation clearing for transmission lines. Where underground transmission lines are used, they will be located in the same easement as pipelines, eliminating the need for additional vegetation clearing. Underground power lines are the preferred option, although aboveground power lines will be used where practicable.

Table 3.15.1 provides a qualitative assessment of the visual impacts of power lines and substation from various viewpoints, based on the extent of screening vegetation.

Table 3.15.1 Visual Impacts of Power Lines

Viewpoint	Vegetation/Distance	Impact
Highways	Little or none	Medium
Highways	Effective screen	Low to negligible
Roads and tracks	Little or none	Low
Roads and tracks	Effective screen	Low to negligible
Forested Areas	Effective screen	Low to negligible
Visitor/Community Centres[1]	Effective screen	Low to negligible
Residences (132 kV)	Little or no screening and > 0.6 km	Medium[2]
Residences (132 kV)	Little or no screening and > 1.2 km	Low to negligible
Residences (132 kV)	Effective screen	Low to negligible
Residences (33 kV)	Little or no screening and > 0.25 km	Medium[3]
Residences (33 kV)	Little or no screening and > 0.5 km	Low to negligible
Residences (33 kV)	Effective screen	Low to negligible

1 Only one community/ visitor centre assessed

2 Only about 40 km of 132 kV power lines, therefore very few residents exposed to medium visual impacts

3 Highly probable that 33 kV power lines will be located further than 250 m from the nearest resident

15.5.3 Water Treatment Plants

Table 3.15.2 provides a qualitative assessment of the visual impacts of WTPs, based on the extent of screening vegetation, from various viewpoints.

Table 3.15.2 Visual Impacts of Water Treatment Plants

Viewpoint	Vegetation	Impact
Highways	Little or none	Medium
Highways	Effective screen	Low to negligible
Roads and tracks	Little or none	Low
Roads and tracks	Effective screen	Low to negligible
Forested Areas	Effective screen	Low to negligible
Visitor / Community Centres[1]	Effective screen	Low to negligible
Residences	Little or no screening and > 1km[2]	Low
Residences	Effective screen	Low to negligible

1 Only one community/visitor centre assessed

2 Highly probable that WTPs will be greater than 1 km from the nearest resident

15.5.4 Flares at Wells

Small infrastructure such as flares at wells are likely to be screened from view in vegetated areas. Even when located in cleared landscapes, they are of such a scale that they cease to be visible elements within the landscape beyond a distance of more than 500 m.

Table 3.15.3 describes a qualitative assessment of the visual impacts of flares at wells, based on the extent of screening vegetation, from various viewpoints.

Table 3.15.3 Visual Impacts of Flares at Wells

Viewpoint	Vegetation	Impact
Highways	Little or none	Low
Highways	Effective screen	Negligible
Roads and tracks	Little or none	Low
Roads and tracks	Effective screen	Low to negligible
Forested Areas	Little or none	Low
Forested Areas	Effective screen	Negligible
Visitor/Community Centres[1]	Effective screen	Negligible
Residences	Little or no screening and > 60 m[2]	Low
Residences	Effective screen	Low to negligible

1 Only one community/visitor centre assessed

2 Highly probable that flares at wells will be greater than 60 m from the nearest resident

15.5.5 Gathering Line and Trunkline Easements

Where a pipeline runs parallel to the roads, once the route is rehabilitated the easement has the appearance of a widened road reserve and creates little visual impact.

Furthermore, when a pipeline crosses a road, generally at right angles, the visual impact in a vegetated or forest landscape is restricted to a view along an easement, which is not dissimilar to the view along minor roads or access tracks. Therefore, the visual impact in forested areas is low to negligible, while in cleared areas the pipeline becomes indistinguishable against the existing pasture and, as such, the visual impact is nil.

If the proposed easement is of a similar width to local roads, between 15 m and 30 m, then the visual impact would be low, as these would appear similar to many other roads that cross or intersect and have involved clearing of vegetation. However, if the easement width is greater than 30 m then this will create a large and unusual corridor across the road and the visual impact would be assessed as medium. There are no gathering line easements greater than 30 m and only 30 per cent (approximately 180 km) of trunkline easements greater than 30 m. Both gathering line and trunkline easements will be progressively rehabilitated (refer *Volume 2, Chapter 15*) to reduce the total easement footprint by approximately 55 per cent.

Where wider easements are necessary, there are two ways to reduce their impact:

- locate wider easements across cleared farmland, where they will remain inconspicuous, especially after landscape remediation
- avoid extended straight lengths at right angles to a viewpoint such as across a road.

Table 3.15.4 provides a qualitative assessment of the visual impacts of gathering line and trunkline easements, based on various width easements and extent of screening vegetation, from various viewpoints.

Table 3.15.4 Visual Impacts of Gathering Line and Trunkline Easements

Viewpoint	Easement Width / Vegetation	Impact
Highways	15 m to 30 m	Low
Highways	> 30m	Medium-High (depending upon linear extent of view)
Roads and tracks	15 m to 30m	Low to negligible
Roads and tracks	> 30m	Medium
Forested Areas	15 m to 30m	Low to negligible
Forested Areas	> 30m	Low
Visitor / Community Centres[1]	Effective screen	Low to negligible
Residences	Effective screening	Low to negligible
Residences	Little or no screening and > 0.5 km	Low
Residences	Little or no screening and > 0.25 km[2]	Medium

1 Only one community/visitor centre assessed

2 Highly probable that easements will be located further than 250 m from the nearest resident

15.5.6 Borrow Pits

Borrow pits are expected to be approximately 8 ha and 2 m deep. Topsoil will be stockpiled adjacent to the borrow pits. Stockpiles may act as visual barriers to activities where borrow pits are exposed to publically accessible viewpoints. Borrow pits are expected to have a low visual impact, particularly if screened by vegetation or stockpiles.

15.5.7 Summary of Impacts

The majority of Project infrastructure is assessed as having a negligible or low visual impact. Without mitigation, the following infrastructure may have a medium visual impact:

- power lines and WTPs from highways
- 132 kV power lines from residences between 600 m and 1,200m away
- 33 kV power lines from residences between 250 and 500 m away
- 30 m wide easements from highways, roads and tracks
- easements with little or no screening from residences between 250 and 500 m away.

QGC considers it highly unlikely that the above infrastructure will be located closer than the stated minimum distances above, and therefore does not consider that infrastructure will create a high visual impact at residences. Where infrastructure does encroach closer to residents than the above minimum distances, QGC will consider appropriate mitigation measures (refer to *Section 15.7*).

15.6 EXISTING INFRASTRUCTURE IN THE GAS FIELD

The visual impact of existing infrastructure in the Gas Field may be used as a basis for predicting the visual impact of proposed infrastructure for the QCLNG Project.

15.6.1 Existing Power Station

The Condamine Power Station is located adjacent to the Warrego Highway. The power station is taller than either the CPPs or FCSs, with the highest feature (the heat recovery steam generator exhaust/bypass stacks) at 34 m. *Figure 3.15.5* shows a view of the Condamine Power Station.

Figure 3.15.5 Condamine Power Station

The Condamine Power Station is a large structure found within the landscape of the viewshed. It is nestled among an area of retained vegetation that assists to filter views to the site from the surrounding landscape. This is demonstrated in *Figure 3.15.6*, which shows a view looking south towards the power station from the Warrego Highway and illustrates that vegetation is sufficient to screen it from view.

The Condamine Power Station is larger and, where visible, has a greater visual impact than any of the proposed structures associated with the QCLNG Gas Field.

Figure 3.15.6 View towards the Condamine Power Station from the Warrego Highway

15.6.2 Existing Easements

The Roma to Brisbane gas pipeline is within the Project area. *Figure 3.15.7* shows the view looking east along the pipeline easement where it crosses the Montrose Road, approximately 15 km west of the township of Kogan.

***Figure 3.15.7* Roma to Brisbane gas pipeline – within a heavily vegetated area**

At this location, existing vegetation within the forest to the east has been removed to allow for the construction and maintenance of the gas pipeline. The warning signage posted on the fenceline and access gate highlight the fact that there is a buried gas pipeline at this location. In the absence of such signage, the existing pipeline easement would be visually similar to a farm or forest access track, which is not uncommon in the surrounding area.

Figure 3.15.8 shows the view looking west from the same location, where the vegetation is both sparser and less dense than on the opposite side of the road.

Figure 3.15.8 **Roma to Brisbane Gas Pipeline – within less vegetated areas**

The pipeline easement is less noticeable than on the opposite side of the road. The gas pipeline is noticeable due to the warning signs posted along the fence bordering the road reserve.

15.7 MITIGATION MEASURES

Design measures to reduce the level of visual impact from roads (including highways and local roads) include the following:

- reduce clearing, especially at right angles to roads
- where it is necessary for a wide easement (> 30 m) to cross roads, limit extended lengths of clearance by locating a dogleg at either side of roads to limit long views along the cleared easement in heavily vegetated areas
- site infrastructure behind existing vegetation (or where there is limited existing vegetation) and establish landscape buffers between the easement and roads
- straight access roads from roads to infrastructure should be avoided. Use curved access roads or roads that contain a dogleg or are orientated towards an area that does not contain visible infrastructure.

In many instances the roads are already lined with mature bands of vegetation. In these areas the vegetation will easily screen views of the infrastructure, and therefore the visual impact of project infrastructure would be low to negligible. If infrastructure was visible from the highway then, given the number of viewers, the visual impact would be assessed as medium.

The landscapes along smaller roads and tracks in the Gas Field have in some cases been extensively cleared for agricultural practices. Being highly modified already, this landscape has low sensitivity to further visual change. Views from smaller roads and tracks include roads, fencelines and associated rural infrastructure such as sheds, silos, machinery and equipment. Viewer numbers for these roads are also less than those using highways.

Along smaller roads and tracks, vegetation will screen views of the infrastructure, and therefore the visual impact of Project infrastructure would be low to negligible. If infrastructure was visible from these roads then, given the low number of viewers, the visual impact would be assessed as low.

Visual impacts from clearing forested areas can be mitigated by reducing the footprint of cleared areas. QGC has proposed measures to mitigate the impacts on fauna and flora from vegetation clearing. These are described in *Volume 3, Chapter 7* of the draft EIS and sEIS and include minimisation of clearing and progressive rehabilitation of disturbed areas.

15.8 CONCLUSION

The sEIS considered visual impacts for:

- changes in the Project description
- residents from infrastructure described in the draft EIS and from changes to the Project description.

The majority of infrastructure will have a negligible or low visual impact. It is highly unlikely that any infrastructure will cause a high visual impact, due to:

- the distance between infrastructure and residents
- naturally occurring screening vegetation
- the size of potential infrastructure in the viewshed.

Where there may be a medium visual impact, QGC will identify appropriate mitigation measures.