Technical Appendix E2

Visual Assessment Report

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FINAL REPORT

GORGON

Technical Appendix
Visual Assessment Report

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FINAL REPORT

GORGON

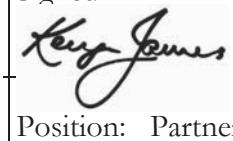
Technical Appendix
Visual Assessment Report

0013438 RPT1 Revision b

For and on behalf of Environmental Resources Management Australia

Approved by: Keryn James

Signed:



Position: Partner

Date : 3 May 2005

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Executive Summary

Visual Assessment

Aims

The Gorgon Joint Venture Project Development Team aims to reduce the visual impacts of the proposed works by considering the landscape character of the development area in the design, construction, rehabilitation, operation and ongoing maintenance of all facilities and associated infrastructure.

The proposed Gorgon Development comprises the following components:

1. Sub-sea gathering infrastructure at the Gorgon gas fields.
2. 70 km long feed gas pipeline to bring gas/well stream fluids to Barrow Island from the Gorgon gas field. Onshore Barrow Island there are currently two options, one landing at Flacourt Bay and the second at North White's Beach.
3. Gas processing plant & port facilities on the east coast of Barrow Island.
4. 80 km long domestic gas (DOMGAS) infrastructure piping gas from Barrow Island to the mainland.
5. On the mainland the DOMGAS pipeline corridor remains underground along side an existing gas easement. This alignment crosses through Mardie Station (Stock Grazing Property) to join the Dampier-Bunbury Natural Gas Pipeline at Compressor Station One (CS1).

Existing Environment

The Development area has been divided into offshore and onshore components. The onshore component will generally relate to Barrow Island, whereas the mainland (Mardie Station) underground component will mostly be referred to in construction and mitigation measures outlined in the main report.

Offshore

The sub-sea gas-gathering system will be located on the sea floor at the Gorgon gas fields 70 kilometres west of Barrow Island. The feed gas pipeline both from the sub-sea gas-gathering system to Barrow Island and the 80km long domestic feed gas pipeline from Barrow Island to the mainland does not have any visual impact implications above the waterline.

Onshore Barrow Island

The landscape of Barrow Island is arid and rugged accommodating spectacular views of low grey green vegetation interspersed with ochre red termite mounds. On the coastline weathered rocky headland contrast with white secluded sandy beaches and aqua-blue water.

Landscape form consists of limestone uplands, dry creek beds, red inland sands, white coastal dunes, beaches, clay and salt flats and intertidal flats.

Due to the arid climate vegetation covers is low, generally sparse and up to 90% of species are related to three types of spinifex, *Triodia wiseana, Triodia angusta* and *Triodia epactica*.

Existing oil extraction infrastructure, such as wells and associated pumping equipment are intermixed throughout the central region of the island with the tallest structure being the communication tower (120m high) situated on the highest central upland point (65m above sea level).

In 1910 Barrow Island was pronounced a Class A Nature Reserve with the unique status of attaining no introduced species, flora or fauna.

For the purpose of the visual assessment the landform on the island can be broadly divided into five landscape units defined on the basis of dominant plant species, associated landform, soils, underlying geology and vegetation unit surveys.

These five landscape units are:

- West Coastal Complex;
- East Coastal Complex;
- Valley Slopes and Escarpments;
- Limestone Ridges; and
- Creek or Seasonal Drainage lines.

These units are described in Chapter 2.4 'Baseline Landscape Character'.

Onshore Mainland DOMGAS Pipeline

The mainland landscape, upon leaving the coastal mangrove zone, is described as a non-vegetated salt plain. Following the proposed/existing easement east, low hummocks of grassland/spinifex become dispersed through the red soil salt flats. These vegetated hummocks join to provide a flat open sparsely vegetated shrub and grassland, as it approaches CS1.

The landscape can be described as being moderately disturbed with evidence of local soil erosion, cleared vegetation evident along existing pipeline easement, disturbed soil/rock due to stock grazing. There is evidence of introduced vegetation species within this landscape.

The Mainland can be described as having the following 4 landscape units:

- Coastal Mangrove Zone
- Red/Grey Non-vegetated Salt Flats
- Vegetated Hummocks within Salt Flats
- Low Lying Shrub and Grasslands

These units are further described in Chapter 2.4 'Baseline Landscape Character'.

Potential Visual Impacts and Visual Mitigation

Methodology

The assessment process commenced at the very broad scale in order to gain an understanding of the landscape setting in which the project was located. It then focussed in greater detail on the position of the components and their relationship within their immediate setting.

The landscape on Barrow Island was initially divided into 5 units as listed above to discuss **baseline landscape character**. Within each of these units, change resulting from the infrastructure can be accommodated to varying degrees without significantly altering the setting. This was determined as **Landscape Absorptive Capability** and is assessed in broad terms within the **Baseline Landscape Character** study. This process assists in the understanding of the visual interaction occurring between the project infrastructure and the setting as a precursor to the more detailed analysis.

At the more detailed level, due to the deficiency of human receptors which is applied in the process of measuring **Visual Amenity**, the seen value of a landscape character, the assessment concentrated on evaluating **Visual Effect**, the degree to which the project infrastructure changed the appearance of the landscape as a result of development. Through qualitative and quantitative assessment tools these values were then considered in determining the relative levels of **Visual Impact** (the measure of visual effect in the landscape) during and immediately after construction.

Various **Visual Impact Mitigation** measures were then recommended to assist in obtaining a greater visual integration of the infrastructure into the setting, thereby reducing its visibility or visual effect.

The assessment methodology is discussed in detail within Appendix A. The remainder of the chapter is summary of the assessment findings.

Areas of Visual Amenity

Offshore

The amenity of this visual setting is considered to be nil due to the gas collecting and transporting infrastructure situated below sea level.

Onshore Barrow Island

Visual Amenity is described as 'the value of a landscape in terms of what is seen' (GLVIA 2002). Therefore it was concluded that due to the deficiency of human receptors within this landscape visual amenity is perceived as low to very low.

Onshore Mainland DOMGAS Pipeline

Due to the lack of human receptors within close proximity to the proposed DOMGAS pipeline location (all 220,000ha of the station is used for stock grazing purposes), visual amenity is also perceived as low to very low.

Visual Absorption Capability

Visual Absorption Capability is a measure of the relative ability of a landscape character type to absorb visual change. A landscape with a high absorptive capability is able to absorb more visual change than one with a low capability. The Visual Absorption Capabilities of the landscape units in the Development area are listed in Table 1 below.

Table 1. Visual Absorptive Capability of Landscape Units in the proposed Barrow Island Development Area

Landscape Character Units	Visual Absorption Capability
West Coast Complex	Low
East Coast Complex	Moderate
Valley Slopes and Escarpments	Low to Moderate
Limestone Ridges	Low
Creek or Seasonal Drainage lines	Moderate

Onshore Mainland - Mardie Station

As with Barrow Island the landscape character of the mainland is predominantly open & flat with sparse covering vegetation, therefore the visual absorption capability of this landscape would be considered as low.

Visual Effect

The visual effect is the degree of change/contrast that occurs in the appearance of the landscape as a result of the development.

Onshore Barrow Island Pipeline(s)

The degree of visual effect involved with the pipeline will generally be associated with how the landscape absorbs a linear form within a natural setting. This has most consequence when the corridor parts from an established road easement.

Much regard will be given to construction in particular, the clearance of vegetation and disturbance of the ground surface. Long term visual effects will be negligible, as the alignment design option, rehabilitation and construction management will be carried out in an effective manner.

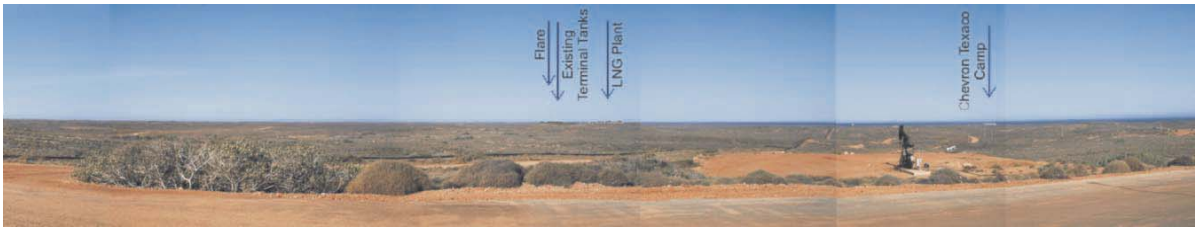
LNG Plant and Port Facilities

The visual effect of the LNG plant, port facilities and temporary construction camp will depend on the viewer's position within the infrastructure viewshed. If the Plant is viewed beyond the surrounding ridgeline, beyond that which surrounds the drainage line flat (LNG Plant site) the visual effect will range from slight to negligible.

This is due to the screening and integration of Plant mass with the undulating terrain and the softening of distance when high points in the terrain do allow

views to the LNG Plant and port facilities (refer Figure 1 below illustrating modelled view from Base Castle, highest viewing point in the central uplands).

Figure 1. Viewing simulation of LNG Plant at completion of construction from Base Castle Communication Tower.



Where the LNG Plant, port facilities and construction camp is viewed within the drainage line flat or upon the nearby surrounding ridgeline (within the 5km viewshed) the visual effect will be moderate to substantial as the structure contrasts with the immediate landscape.

Figure 2. Viewing simulation looking north on ridgeline from Chevron Camp, approximately 4km from LNG Plant and port facilities site.

Onshore Mainland DOMGAS Pipeline

The DOMGAS pipeline will be located underground, in close proximity to the existing Apache pipeline. As the pipeline infrastructure will not be viewed, regard will be given to the construction easement in particular, the clearance of vegetation and disturbance of the ground surface. Apart from a wider clearance easement, long term visual effects will be negligible, as rehabilitation and construction management will be carried out in an effective manner.

Figure 3. View of existing onshore mainland pipeline corridor, viewing east towards Compressor Station 1.

Visibility of Components

Offshore

The offshore facilities gas collecting facility will not be visible from the ocean's surface or from land.

Onshore Barrow Island Pipeline(s)

The pipeline routes will not be regularly visible until seen from within the road easement or from a road vantage point. The pipeline infrastructure will be most visible on the upland 'Limestone Ridges' landscape unit. Furthermore the pipe infrastructure will be substantially visible when vegetation is sparse in between the shared road corridor or when the pipeline route intersects with the road.

LNG Plant & Port Facilities

The LNG Plant will be moderately visible from within the central eastern area of the island and offshore while approaching the central island mass from the east. Visibility of the plant from the central upland area of Barrow Island will be negligible with views mostly screened by undulating topography and intervening ridgelines.

The viewshed analysis in Figure 4. below, illustrates where the comprehensive height (calculated at 20m above respective ground level) of the proposed LNG Plant will be seen. The flare height is approximately 150m tall and due to its thin structure in contrast to the Plant structure the visual impact is considered negligible (refer chapter 4.6.4 Flare and Illumination).

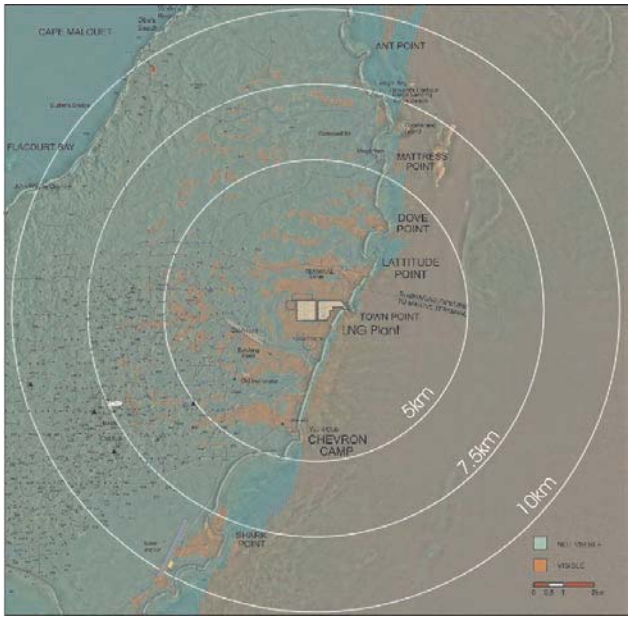


Figure 4. Showing Viewshed of Gorgon LNG Plant

Seven (7) computer generated images from 7 viewpoints in chapter 4 illustrate varying views of the LNG Plant from various distances and viewshed vantage points. These illustrate what components will be seen from person's (workers) from within the viewshed.

Once operational, visibility of the pipeline infrastructure will be nil.

Assessment Results - Visual Impact

Detailed findings are included in Chapter 4 of the Report. The following provides a summary of key results.

Onshore Barrow Island Pipeline(s)

The visual impact of the gas pipeline options will be negligible to moderate. Areas of substantial impact will occur in a small number of locations where vegetation is sparse along the central upland 'Limestone Ridges'.

LNG Plant and Port Facilities

The visual impact of the proposed LNG plant and port facilities will be moderate to substantial for views within 5km of the central eastern section of Barrow Island. The anticipated impacts from key viewing locations are summarised in Table 2 and noted in detail in Chapter 4. 6.

Table 2. Indicative Areas of Visual Impact

Viewing Location	Impact*
View 1 – Chevron Camp	Moderate
View 2 – Town Point	Substantial to Severe
View 3 – Communication Tower, Base Castle	Negligible
View 4 – Ocean View at 5km	Moderate to Substantial
View 5 – Road Junction, Old Airport	Substantial
View 6 – New Airport	Negligible to None
View 6 – Ridgeline West of Terminal Tanks	Substantial **Criteria definitions in Methodology Appendices A 1.5*

Within the 5km viewing area the LNG plant will be in stark contrast to the low vegetated nature of the landscape. Given the arid conditions and the lack of substantial indigenous vegetation that may be able to be used to screen the LNG Plant, the impact level would not significantly reduce over time.

Onshore Mainland DOMGAS Pipeline

During construction, the visual impact will be negligible, as there are no human receptors except the construction workers. The visual impacts of completed pipeline corridor will be negligible to none, as rehabilitation and construction management will be carried out in an effective manner.

Visual Impact Mitigation

The landscape of the project area is one of great significance and fragility and already a portion of the Barrow Island has viewed man-made development from a low to moderate extent.

Given the relative scarcity of vegetation of any physical stature due to the environmental conditions of the project area, amelioration methods that rely on the growth of vegetation to hide the visual effects of the LNG plant will be ineffective and therefore inappropriate.

Therefore, where practicable, the components of the proposed pipeline easements and LNG plant will be located to make use of existing infrastructure and topography to minimise visual disturbance and optimise visual blending and screening where possible.

The visual effect of the reinstated pipeline both on Barrow Island/Mainland and the benching works that occur around the LNG Plant pad will depend upon the degree to which it is noticeable due to a contrast occurring between disturbed areas and the surrounding natural ground surface. This may result from observable differences in the colour of the backfilled material or a change in texture and size of the naturally occurring soil or rock on the ground plane.

The dominant colour of the weathered and oxidised surface rock is a light (sun bleached) cream to pink in colour. However, when the rock is fractured or the surface disturbed the colours become deeper and the underlying rust red-ochre earth becomes a dominant contrast. Therefore, it is very important that different soil profiles are stored separately and replaced in the same locations and that excavated rock is reburied where practicable.

Given the difficulty of achieving effective rehabilitation, planning and management should focus on minimising the area of disturbance to vegetation. Experience gained from other revegetated pipelines and benched platforms within the area have demonstrated that the harsh conditions will make revegetation with the same pre-development species difficult.

To assist with this process, revegetation will commence immediately following reinstatement, using direct topsoil placement that matches that of the particular location rather than the broader area. This topsoil contains a local seed pool and from experience is the most effective way of achieving germination. Impact Mitigation and Rehabilitation methods are explained in detail within Chapter 4.4 of this report. In addition, ongoing research into collecting propagation material from the plant site prior to construction to allow stocks of appropriate revegetation species to be grown is to be further investigated.

Environmental Management Objectives:

- To reduce visual impacts to an acceptable level.

- To consider the landscape character in the design, construction, rehabilitation, operation and ongoing maintenance of all facilities and associated infrastructure.

Environmental Management Strategies:

Onshore Pipeline(s) inluding mainland DOMGAS easement

- The extent of vegetation clearing will be minimised.
- Disturbance of soil and rock outcrops will be minimised.
- Construction easement width will be minimised and disturbance to areas outside the easement will be avoided.
- Soil and rock will be replaced to match the existing layers/profiles.
- Revegetation will commence immediately with local direct topsoil replacement or a species mix matching that of the exact location rather than the broader area.
- Infrastructure/easements will be designed and managed to minimise visual impact.

LNG Plant & Port Facilities

- The extent of vegetation clearing will be minimised.
- Propagation material for revegetation will be collected from both the Camp site and LNG Plant site prior to construction.
- Where practicable, the LNG plant components will be located and benched so that they optimise the advantage of the low-lying area and surrounding ridge lines.
- Surface and sub surface material will be stockpiled separately and will be utilised in areas exposed such as terraces, unused roads and as appropriate. Topsoil is not to be stockpiled higher than 1m, and used as soon as practicable.
- Soil and rock will be replaced to match the existing layers/profiles.
- Where practicable, rehabilitation of site benching and unused construction roads/areas will commence immediately with direct topsoil placement that matches that of the exact location rather than broader area.
- Infrastructure surfaces, Port Facilities will be of a colour that minimises visual impact where practicable (non-contrasting colours to vegetation and ocean).

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1 Introduction

Aims

The Gorgon Joint Venture Project Development Team aims to reduce the visual impacts of the proposed works by considering the landscape character of the development area in the design, construction, rehabilitation, operation and ongoing maintenance of all facilities and associated infrastructure.

Objectives

The objectives of the Visual Assessment Report are:

- to assess the visual impacts of the proposed LNG plant and associated infrastructure, from view points within the view shed of the development on and around Barrow Island,

- to assess the impact of the proposed, pipeline(s) and associated infrastructure on the landscape character of the localities through which it runs, and

- to determine a landscape strategy which would help to mitigate significant impacts and to integrate the proposed LNG plant and pipeline(s) into the landscape.

Issues To Be Addressed

Landscape impacts are assessed separately from visual impacts, whereas the receptors of landscape impacts are essentially the elements that comprise the physical environment, such as vegetation, watercourses and built form, the receptors of visual impact are the human users of the physical environment.

As described in the Guidelines for Landscape and Visual Impact Assessment, Spon Press 2nd Edition (GLVIA 2003).

'*The sensitivity of visual receptors and views are dependent on:*

the location and context of the view;

the expectations and occupation or activity of the receptor;

the importance of the view, which may be determined with respect to its popularity or numbers of people affected…'

The Guidelines further state that,

'…the least sensitive receptors are likely to be people at their place of work, or engaged in similar activities… …In this process more weight is usually given to changes in the view or visual amenity.' (GLVIA 2003)

The assessment of the change to, or impact on, the visual amenity of an area involves consideration of two separate but closely interlinked factors:

'Views' are defined as 'what can be seen from an identified location'. However, to interpret views, it is necessary to understand the context of the view.

'Landscape' refers to the context of a view, comprising not only physical appearance, but also population and such factors as built elements, 'naturalness' and scenic beauty. It can be described only up to a point, because the value ascribed to a landscape will vary from person to person and their specific relationship to the land.

Due to Barrow Island's stringent quarantine conditions and isolation to public activity the landscape relationship to human receptors is significantly unique. Workers associated with the oil and gas projects are the only person's to view the development.

Therefore this visual assessment will focus on the visual changes to the landscape in response to the LNG Plant/Port facilities and Pipeline corridor(s) pre-development and construction.

Factors to be considered in assessing the visual impacts of a development are:

- vegetation cover,
- topography,
- degree of existing human modification to the 'natural' landscape and dominance of man-made elements and,
- the proposed developments viewshed (relating to view spread and distance) and specific human vantage points within this viewshed.

The assessment of landscape and visual impacts was undertaken using the following assumptions:

- The parameters of human vision provide some guide in measuring relative visual impacts of the above ground components (ie. LNG Plant and pipeline easement).
- As distance increases, visual impacts are reduced.
- Topography and vegetation can help screen, filter views.
- Perception of beauty and what is visually intrusive can vary.

The visual assessment report is based on interpretation of quantitative assessment (which is based on measurable parameters), and a qualitative assessment, which is based on accurately visualising the proposed works within the existing landscape, and assessing the landscapes ability to absorb that impact.

Methodology

The landscape assessment has been undertaken in accordance with the methodology recommended by the UK Institutes of Landscape and Environmental Management and Assessment. This methodology is consistent with the preparation of Environmental Impact Assessments in accordance with EU Directives and can be applied to the Barrow Island context.

The visual assessment will discuss changes that the proposed development will make to the existing landscape, these being visible from surrounding viewshed locations. The methodology is set out in detail in Appendix A. however in summary the visual assessment is based on the following:

- Determine existing visual Baseline Landscape Character Units and regulatory special values that may apply to this area;

- Within the above description discern the Visual Absorptive Capability of the Baseline Landscape Character Units in the Development - Visual Absorption Capability is a measure of the relative ability of a landscape to absorb visual change. A landscape with a high absorptive capability is able to absorb more visual change than one with a low capability;

- Determine the extent of the viewshed/visual catchment;

- Locate viewpoints within the viewshed where the visual effect (changes to the landscape) can be best described;

- Quantitatively assess the potential visual impact by comparing measurements of viewing size and distance to determine view angles, which relate to the parameters of human vision;

- Qualitatively assess the visual impact by utilising computer simulations to accurately describe and simulate the change to the landscape from identified viewpoints; and,

- Recommend mitigation measures to ameliorate visual impact.

Infrastructure Components

The following components form the Gorgon Gas project.

Offshore Gas Fields

The sub-sea gas-gathering system will be located on the sea floor at the Gorgon gas fields 70 kilometres west of Barrow Island and does not have any visual impact implications above the waterline.

Onshore Gas Pipelines and Corridors

The onshore pipeline will transport gas from the western shore crossing location and head in an easterly direction following closely to an existing road easement, then onto the LNG Plant site. An outgoing gas pipeline will transport gas from the LNG Plant across the eastern shoreline towards the mainland for domestic gas purposes (DOMGAS) and along a 4km jetty to a ship gas loading facilities.

LNG Plant & Port Facilities

The LNG Plant will include a number of structures located above ground associated with the processing and storage of gas. It is expected that the gas plant *(internal infrastructure)* will have a total infrastructure area of approximately 300ha**.** This will include:

- Storage tanks,
- Towers, Pumps and Compressors,
- Offices, workshop and stores,
- Flare and utility systems,
- Racks and Pumps,
- On site turning bays and provisions for vehicle parking.

The Port Facilities include:

- A Material Offloading Facility (MOF) A jetty that extends approximately1km in length directly east of the LNG Plant, and
- A ship gas loading jetty, a smaller thin structure that extends diagonally approximately another 3km from the end of the MOF.

Proposed LNG Plant & Port Facilities detail shown in Chapter 3 Figure 3.4.

Onshore Mainland DOMGAS Pipeline

A sub-sea pipeline from Barrow Island LNG Plant will transport compressed domestic gas to the Western Australian mainland for use in the industrial and domestic gas markets. The pipeline will join existing gas pipeline alignments before crossing the mainland West Coast south of Dampier and will continue east to Compressor Station One.

With regard to the following Visual Impact Assessment report the gas pipeline components on the mainland will be situated underground therefore this pipeline easement will only be referred to in regard to general construction and visual mitigation measures outlined to lesson temporary and long term visual impact.

2 Baseline Landscape Character

2.1 Introduction

The assessment of baseline landscape characteristics discusses the following:-

- A regional assessment to identify landscape character units with similar environmental and geological characteristics, discussing their ability to absorb the impacts associated with the pipeline easement(s) and associated infrastructure;

- Describe the proposed route alignment, and the location and surrounding landscape for proposed shore crossing(s) and proposed onshore pipeline corridor(s);

- Describe the landscape characteristics surrounding the location under consideration for an onshore LNG Plant;

- Identify surrounding viewpoints from where visual changes to the landscape will be noticeable from human vantage points and can be best described.

Project Alignment Plan

The plan (Figure 2.1) on the following page illustrates the proposed options for the alternative shore crossing(s), above ground gas pipeline corridors and LNG Gas Plant location. This plan provides a context for further assessment of the regional landscape character types, local landscape characteristics and surrounding viewpoints associated with:

Island Shore Crossing(s)

- North White's Beach
- Flacourt Bay

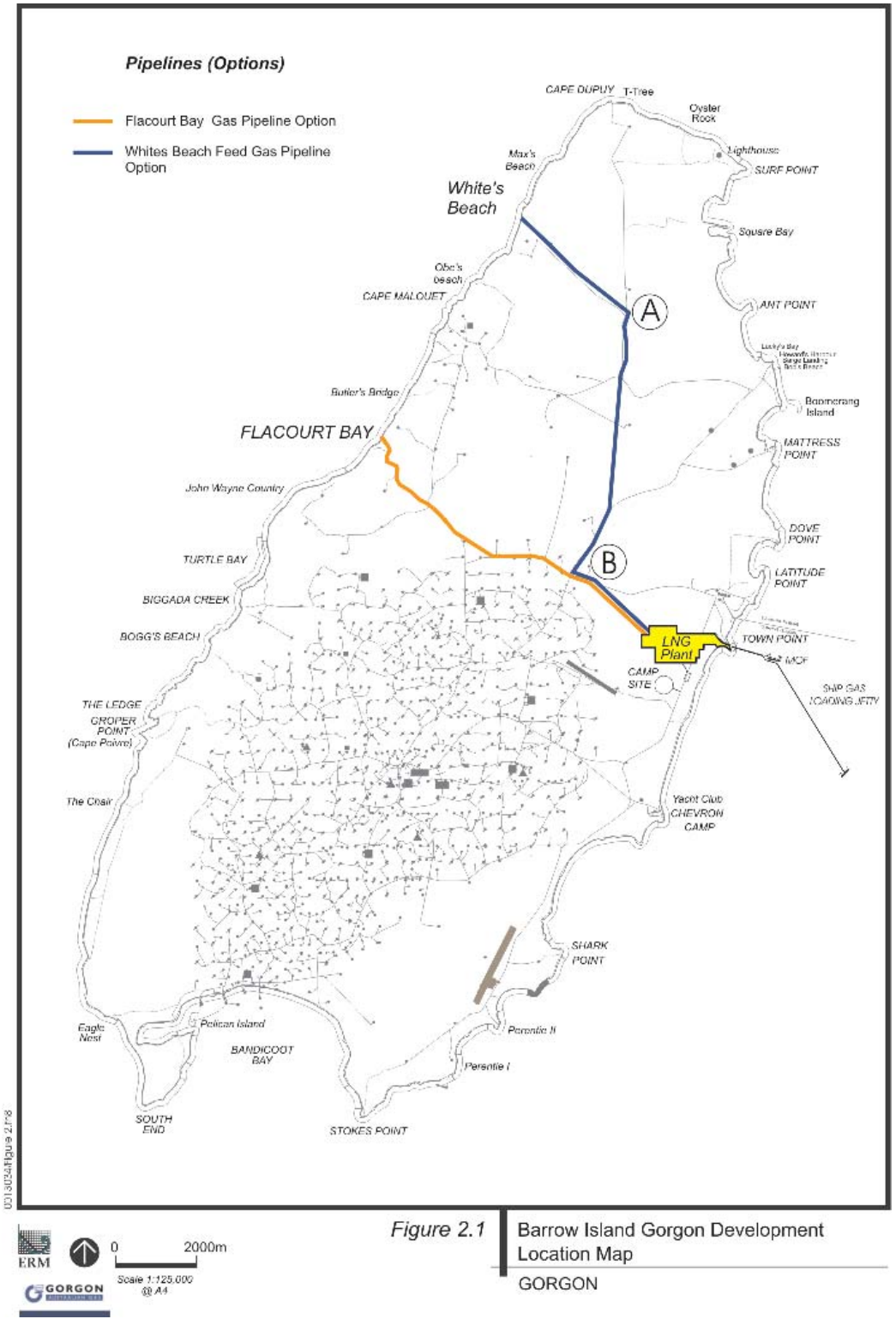
Island Onshore Gas Pipeline Route with possible connections from

- North White's Beach
- Flacourt Bay

Proposed LNG Plant site and Port Facilities

- Mid east point on Island directly west of Town Point.

Figure 2.1 – Barrow Island Gorgon Development Location Map



Onshore Mainland DOMGAS Pipeline

Gas pipeline aligns with existing gas services offshore and crosses the shoreline South of Dampier aligned with existing gas pipeline easements. The pipeline then continues underground to Compressor Station One.

Regional Baseline Landscape Characteristics

Barrow Island Landscape Overview

Barrow Island is elongated oval in shape, 25km in length and 10km in width with total area of about 234km squared. The highest area on the island is 65 metres above sea level. Generally the island can be said to slope toward the sea on the eastern side from higher erosional cliffs and deeply eroded gullies to the west.

An overview of Barrow Islands landscape consists of limestone uplands, dry creek beds, red sands, white dunes, beaches, clay and salt flats and intertidal flats.

The area of the island can increase up to 20% at low tide as a result of shallow offshore conditions and a mean spring tidal range of 2.5m.

Vegetation is low and sometimes sparse due to the arid climate and plant types vary on the island depending on the landform, soil depths and proximity to the sea. Up to 90% of vegetation on Barrow Island are related to three species of spinifex, *Triodia wiseana, Triodia angusta* and *Triodia epactica*.

Oil extraction infrastructure can be sporadically viewed throughout the island with the tallest structure being the communication tower (120m high) situated on the highest central point. The largest visually intrusive man-made structures are the oil terminal tanks situated on the central eastern coastline. These are 5 approximately 25m high by 60m wide bulk oil collection tanks have inturn a relatively low view shed which is contained to the central eastern part of the Island due to Barrow Islands rolling limestone ridges and central upland topography.

More frequently viewed are the less intrusive well heads that are dotted around the central and south central areas of Barrow Island.

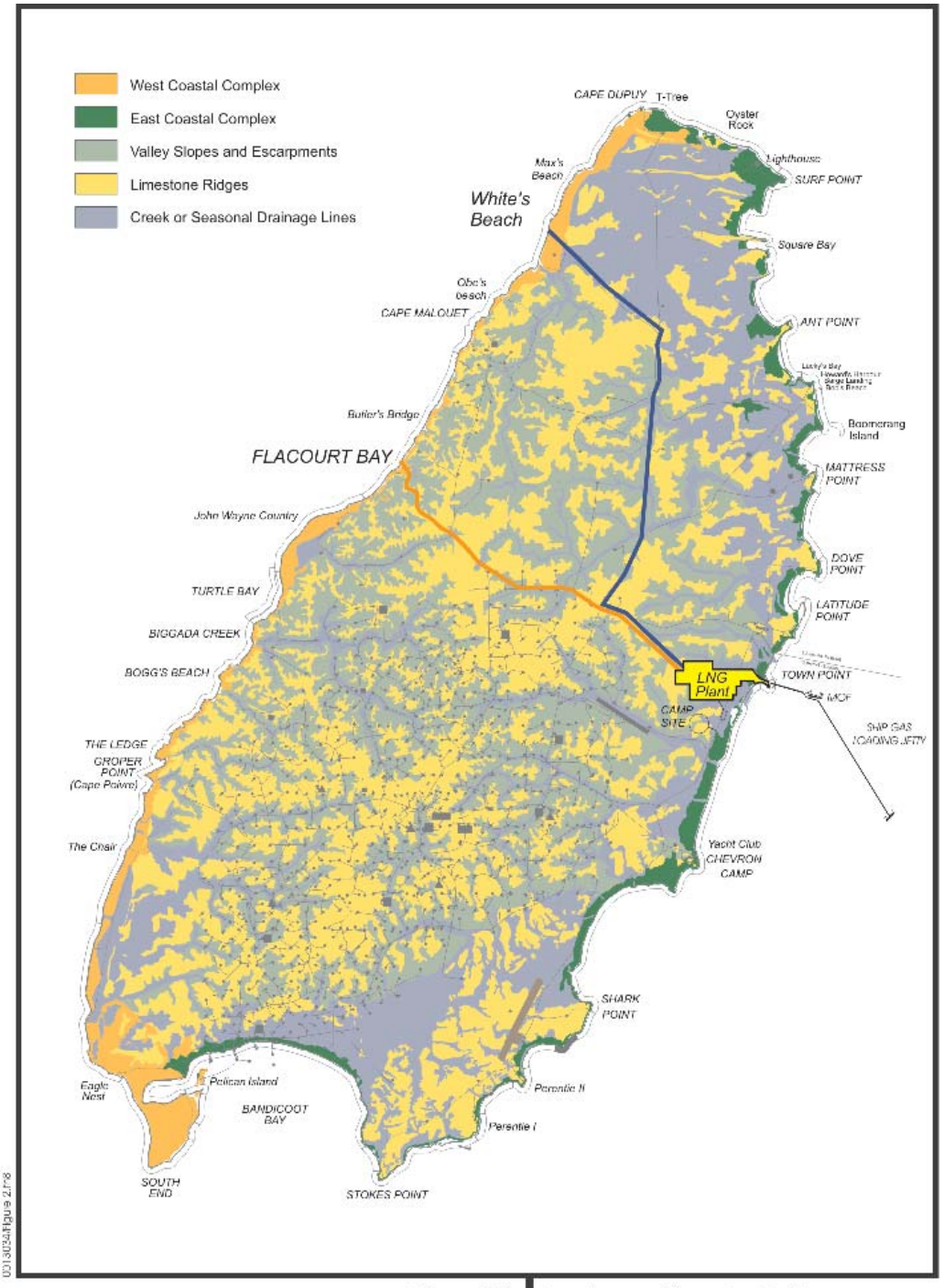
Termite mounds, another common vertical element, are spread across much of the Island's landscape. They can sit up to 2m above the vegetation and are ochre red in contrast to the grey green of the spinifex type vegetation.

Four landscape units for Barrow Island have been defined on the basis of dominant plant species, associated landform and soils as a result of flora surveys by Buckley(1983), Trugden(1989) EM Mattiske and Associates (1993;97) and recently expanded by Astron Environmental (1992).

For the purpose of the visual assessment the coastal unit has been further broken down into two separate units due to contrasting visual differences of the West and East Coast to make five landscape These five landscape units are:

- West Coastal Complex;
- East Coastal Complex;
- Valley Slopes and Escarpments;
- Limestone Ridges;
- Creek or Seasonal Drainage lines.

Figure 2.2 below identifies the location of the various landscape character units within the Island Study area.



Baseline Landscape Character Units

This section describes the visual landscape character types within the regional study area. Units are based on areas with similar visual characteristics in terms of their ability to absorb visual change. Often the character units relate to areas with similar environmental, flora and geological features. For the purpose of this Visual Assessment within Barrow Island there have been 5 Landscape Character Units defined and on the Mainland (Mardie Station) there are 4.

Onshore Barrow Island Landscape Character Units

Unit 1 – West Coast Complex

The western ocean coastline absorbs the wind and wave action associated with the open Indian Ocean. The coastline topography varies from rocky weathered steep sheer cliffs to less steep traversable inclines. Typically the existing sandy beaches are narrow and fit between the weathered rocky headlands.

This coastline is a significant feature of Barrow and the western area is highly rated in terms of world significance and accordingly is regarded as sensitive to potential visual disturbance.

Figure 2.3 - View northerly direction of rugged cliffs located along western coastline north of Flacourt Bay towards Butler's Bridge

Except for low priority tracks leading to individual beach's there is no man-made influences viewed in this Landscape Character Unit together with this pristine natural setting this landscape Character is seen to have a low potential to absorb visual change.

Plants in Unit 1 are sparse and cling to the limestone outcrops. The vegetation is described as Low Mixed Shrubland with dominant species of *Frankenia pauciflora* & *Hedyotis crouchiana*.

Figure 2.4 - View southerly direction of western coastline across Flacourt Bay towards John Wayne Country and sheltered reef coral of Turtle Beach beyond

Unit 2 – East Coast Complex

In contrast, Barrow Island's eastern coastline is somewhat more protected and a slight land gradient meets the ocean. Vegetated sand dunes and large tidal flats occur more readily and the 2.5m tidal variance is quite noticeable along this coastline.

Figure 2.5 - View in southerly direction from Town Point with a receding tide.

Figure 2.6 – Same view in southerly direction from Town Point showing high tide.

Vegetation types that occur along this coastline are dominated by the more hardier *Triodia angusta.*

Figure 2.7 – View in northerly direction from Town Point showing oil Terminal Tanks on left and centre right Apache oil rig monopods visible on the ocean horizon.

Existing man-made infrastructure is situated and viewed readily along this coastline (ie. Barge docking infrastructure, 5 large oil terminal yanks, new and old Airports, Well Infrastructure and the Chevron Camp site).

Due to man-made visual disturbance and low-lying nature of the landscape its ability to absorb further development becomes moderate.

Unit 3 – Valley Slopes and Escarpments

Steeper formed valleys and escarpments tend to occur on the western side of the Island that leave exposed limestone ridges, escarpments and relatively deep valleys.

Typical vegetation on the valley slopes and escarpments is described as open low shrubland with dominant species of *Triodia wiseana* with mixed emergent lower growing shrub species such as *Acacia bivenosa/Petalostylis labicheiodes* and *Petalostylis trichodemoides* situated on the southern escarpments.

The hilly terrain within this unit provides views from the elevated areas, however this characteristic may also assist to absorb visual disturbances due to intervening ridgelines therefore the absorptive capability of this landscape unit is considered as being low to moderate.

Figure 2.8 - View easterly towards central uplands showing vegetation on the limestone ridges

Unit 4 – Limestone Ridges

This landscape unit type occurs generally throughout the central north-south upland plateaus of the Island. The terrain ranges from steeper slopes in the west to and flatter more gentle undulations as the ridges continue east.

Typical vegetation on the limestone ridges includes the sensitive Hummock Grassland of *Triodia wiseana* with low mixed shrubs including *Acacia gregorii*.

Figure 2.9 - View easterly from the central uplands towards terminal tanks proposed LNG plant showing vegetation, power poles, and road easement. East-west gas pipeline is proposed to run through this area along side road easement.

This landscape unit has limited capacity to absorb visual impacts especially if low screening vegetation is damaged or removed.

A large proportion of the proposed pipeline corridor is located in this landscape character unit.

Figure 2.10 - View westerly from terminal tanks towards the central uplands showing main oil distributor pipe. Views along the pipe easement are in contrast to views adjacent the pipeline easement where low vegetation can screen pipeline views.

Unit 5 – Creek or Seasonal Drainage Lines

This landscape unit occurs generally in the broad valleys and flats of limestone ridges and is located slightly in from the coastal fringes. This landscape has deeper alluvial soil structure and in conjointly a denser, taller vegetation character. The vegetation in this unit type is described as Mixed Hummock Grassland of *Triodia angusta* with pockets of dense shrubs along major creek lines.

Figure 2.11 - View easterly in the vicinity of the proposed LNG Plant showing taller vegetation communities within the drainage line landscape.

Out of the earlier landscape character units discussed this has the greatest capacity to absorb visual impacts due to the following factors:

- Low-lying topography in an undulating landscape may assist in lessoning a structures potential view shed;
- Vegetation height will potentially be the greatest in this landscape unit making it easier to absorb above ground pipe infrastructure.
- Due to greater soil depth and vegetation type rehabilitation has the best opportunity to be achieved.
- The local vegetation community has a greater capacity for rehabilitation using the 'Direst Topsoil Placement' procedure.
- The proposed LNG Plant is located within this Landscape unit.

Onshore Mainland Landscape Character Units

Unit 1 – Coastal Mangrove Zone

Unlike the western exposed shoreline of Barrow Island, the mainland shoreline has a low-lying approach. Adjacent the shoreline a wide spreading zone of Mangroves inhabit the shallow coastal waters.

Figure 2.13. illustrates rehabilitation technique (fenced structure) used to shelter and encourage new Mangrove growth. This break in the Mangrove stand has occurred due to the existing gas easement.

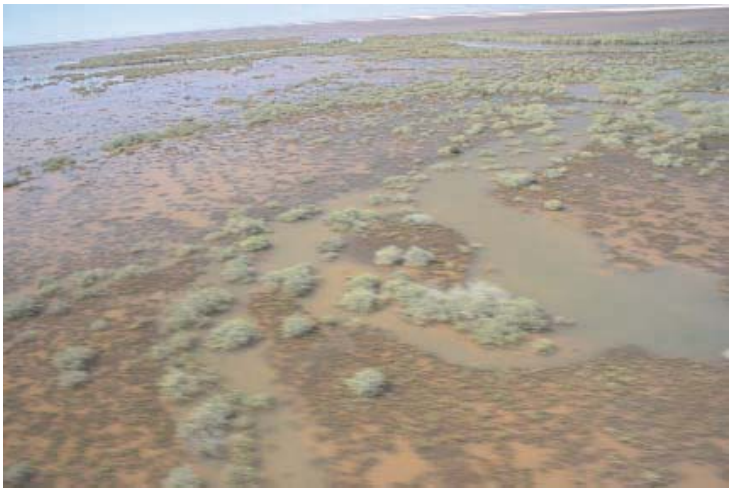


Figure 2.12 – Aerial view east towards shoreline showing extent of mangrove zone.

Figure 2.13 - View west showing existing pipeline easement through the shoreline vegetation and rehabilitation works involved with mangrove re-establishment.

Unit 2 – Red/Grey Non–vegetated Salt Flats

These salt flats are tidal and occur directly adjacent the shoreline and traverse east into the mainland to eventually dissolve into the slightly higher lying shrub and grasslands.

While this landscape has no capacity to absorb above ground structure in contrast it has a great capacity to disguise ground disturbance due to the moving tidal sands and sediment.

Figure 2.14 – Aerial view showing expanse of non-vegetated salt flats adjacent and west of shoreline.

Unit 3 – Vegetated Hummocks within Salt Flats

Increasingly as you move east from the shoreline vegetated hummocks are dispersed within the salt flats. These hummocks are vegetated with low sparse grassland/spinifex vegetation. This hummock landscape unit has limited capacity to absorb visual impacts especially if low screening vegetation is damaged or removed.

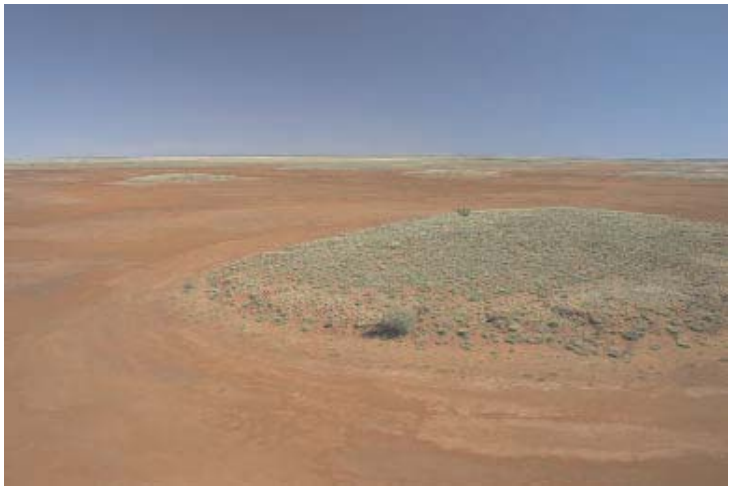


Figure 2.15 – Aerial view of vegetated hummocks within the salt flats.

Figure 2.16 – Aerial viewing west near Compressor Station One. This view shows existing pipeline easement within the low lying shrub and grassland landscape.

Unit 4 – Low Lying Shrub and Grasslands

As the pipeling easement moves east towards Compressor Station One, the vegetated hummocks join to develop a low lying shrub and grassland plain.

This landscape unit has limited capacity to absorb visual impacts especially if low screening vegetation is damaged or removed and the underlying red soil is exposed.

On the mainland a large proportion of the proposed pipeline corridor is located in this landscape character unit.

Baseline Landscape Character – Shore Crossing Options

This section describes the visual landscape character within the Barrow Island proposed Gorgon components local study area.

North White's Beach - Option

The proposed pipeline shore crossing at this site enters at right angles to the coastline. Steep cliffs with limestone rocky headlands occur to the south and north of the corridor. To the east, the grade reduces as the land approaches a sandy beach.

Fig 2.17 Viewing north across the headlands of White's Beach

Apart from the coastal fringe and limestone headlands the area east leading into the shoreline could be described as a 'Valley Slope and Escarpments' landscape unit.

Fig 2.18 Viewing westerly down a slight grade into White's Beach showing typical landform leading to shore line.

From this point in the landscape, with exception an existing red dirt track that falls in and out of view as it winds its way through the undulating limestone ridges, no man-made structures or 'unnatural' disturbances can be viewed.

Vegetation in this unit type is described as open low shrubland with dominant species of *Triodia wiseana* .

Also mixed emergent lower growing shrub species such as *Acacia bivenosa/Petalostylis labicheiodes* as shown in Figure 2.18 previous page.

Flacourt Bay - Option

The proposed shore crossing would also enter at right angles to the shoreline. High steep sided headlands occur to the south and north of the beach corridor as shown in Figure 2.19 below.

Figure 2.19 Viewing southerly across Flacourt Bay.

To the east, the grade reduces through a windy, relatively narrow, steep sided valley and as indicated in earlier Figure 2.8, the land drainage line snakes its way to an open sandy beach.

Views into the bay remain 'natural' with no man-made visual disturbance.

The sandy beach line is larger at Flacourt Bay, however as noted before, the dominant landscape snaking from the east into the shore line can be described as a 'Valley Slope and Escarpments' landscape unit with the common species being *Triodia wiseana.*

Baseline Landscape Character – Pipeline Corridor Options

North White's Beach Gas Pipeline Option – Barrow Island

An overview of North White's Beach Gas pipeline option indicates that after the shore crossing the corridor continues south east to meet the north-south T-Tree Road & Howards Harbour Barge Landing Service roads. The pipeline then continues due south to meet up with the main east-west road. At this point the pipeline would join the Flacourt Bay proposed route and continue due east to the LNG Plant. The overall distance from shore crossing to LNG Plant Site is approximately 10.5km.

In more detail, upon leaving the beach line, the pipeline corridor climbs a gentle drainage line and valley slope for approximately 600m to ascend to the western

upland area. From this point until meeting up with the major east west road, the landscape character that the pipeline corridor runs through is gently undulating as it dips into thickly vegetated creek and seasonal drainage lines and rises over the sparsely vegetated stony limestone ridges as shown below in Figure 2.20.

Ascending from the western beach complex the pipeline corridor runs approximately 3km to meet up with the north-south road that gives access the north Island T-Tree area (Indicted as point A on Figure 2.1 Location Map). The North White's Beach pipeline option then changes course to continue due south along this road.

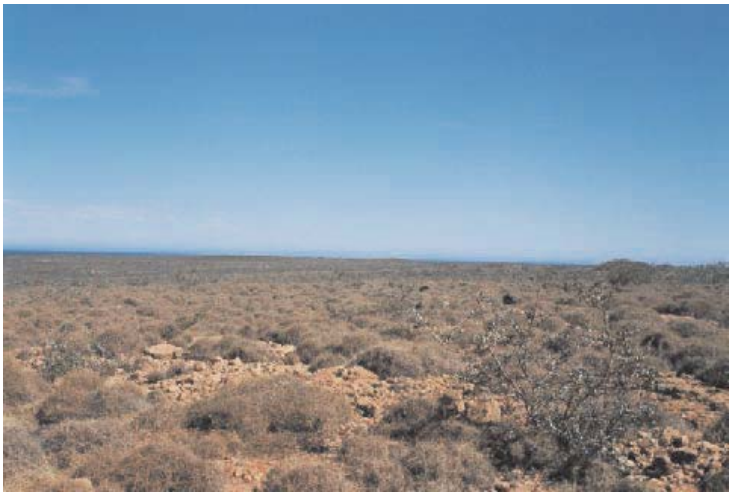


Figure 2.20 Showing typical limestone ridge landscape.

This feeder pipeline corridor option follows adjacent to this road for approximately 1.7km upon where the road and pipeline corridor divert. The road detours east to service Howards Harbour and the barge landing.

For 3.2km the easement crosses south over natural ground, apart from any road easement, until it joins the Howards Landing service road again on its southern approach.

From this point the easement runs adjacent with the road another 1.8km until meeting up with the major east-west access road that links with Town Point, The Terminal Tanks and the LNG Gas Plant site (Indicated as point B on Figure 2.1 Location Map).

Not until approaching this east-west road to Town Point has the pipeline corridor shared other main existing infrastructure easements. Whereas in this area there are a number of existing oil pipe and power easements snaking there way through the landscape often visually obstructed by slightly undulating land or existing vegetation. It is not until the viewer is aligned with one of these easements that a clear view of the infrastructure corridor is apparent as seen in Figure 2.22.

Flacourt Bay Gas Pipeline Corridor – Barrow Island

Flacourt Bay is due west of the LNG Plant Site and is the option with the least travel distance being approximately 9km from coast to LNG Plant.

An overview of this pipeline option indicates that following the shore crossing the gas pipeline corridor continues west mostly adjacent the east/west road to terminate at the LNG Plant Site.

In more detail, upon leaving a wide beach line, the easement climbs approximately 500m up a gentle sloped drainage line, which then narrows into a winding valley for approximately 2km to ascend to the limestone uplands as indicated in Figure 2.21 below.

Fig 2.21 Viewing west from shore line into Flacourt Bay Showing drainage line and winding valley beyond.

As discussed earlier in the Barrow Islands Landscape Overview, valleys and ridgelines tend to be more defined on the western coastline. Views from within the valleys are restricted whereas once ascending upon the ridgeline it is possible to view west across the headlands to the Indian Ocean, also down through tight winding valleys with glimpses of sandy beaches and the shore line beyond.

Continuing along the pipeline corridor oil well heads appear irregularly as you approach the central uplands. The well structures meld into the landscape and only at a reasonable close distance, approximately 1-1.5km, possibly a little further with the sun angle behind the viewer, can this structure be visually discerned from the surrounding landscape. Oil well infrastructure stands out as a small black vertical T-shape when viewed on a ridgeline with a blue sky background. Scattered oil, power and water pipeline infrastructure intersects the ground plane in the upland area. Assuming a pipeline easement is viewed from a vehicle on a service road these low infrastructure easements are visually prominent in the following instances:

- when a long lineal intrusion contrasts the natural landscape visual norm.

- when the pipeline is aligned with the road and there is a break in vegetation easement between the alignments or the vegetation becomes particularly low and sparse;

- when the pipeline angle is misaligned with the viewer on relatively flat ground the visual obtrusion becomes greater the further you can see along the easement. This is mostly experienced when the pipe easement crosses the road as seen in Figure 2.22 below;

Fig 2.22 Viewing south showing typical pipeline and power easement at junction of north south and east west roads

Fig 2.23 Viewing east along the east west road showing proposed pipeline corridor and existing power easement in a typical 'Limestone Ridges' landscape unit.

The roadside vegetation on the uplands becomes increasingly sparse on the limestone ridges this allows filtered views to the aligned corridor as the viewer travels along the east west road.

The alignment continues in a westerly direction adjacent to the east west road where the landscape unit type of the upland 'Limestone Ridges' are typical from this point on until terminating at the seasonal drainage flat of the LNG Plant site.

The rolling topography in the west becomes more gradual as it moves east from the uplands and wide views to Barrow Islands central east lands and coastline open up as the landscape levels towards the eastern coast and terminates at the lowland level of the LNG Plant Site.

Baseline Landscape Character – LNG Plant Site & Port Facilities

The LNG Plant Site & Port Facilities are located on the central eastern coastal flank of Barrow Island approximately 1km west of Town Point and 3.5km north of the Chevron Camp. The proposed plant will be located on the land sloping away to the right of the image below and will be visible from this location.

From the existing Chevron Camp looking north as indicated in Figure 2.24 below, the LNG Plant Site sits within a 'Creek or Existing Drainage Line' landscape unit. Limestone ridges to the north, south and west border the broad low-lying flat, with the land sloping gently down to the shoreline bordering to the east.

The landscape continues to be characterised by gently undulating topography. Expansive views across the landscape can be gained from the fringing ridgeline, however your views are limited within the drainage line flat.

Fig 2.24 Viewing north from Chevron Camp towards proposed LNG Plant Site The view shows a large open flat bordered by the Chevron Camp ridgeline and the Terminal Tank ridgeline to the north.

Vegetation on this flat is relatively tall (1-1.5m) and there is a dense cover of spinifex, *Triodia pungens*.

Man made structures that are shared within this view shed are the five large Terminal Tanks to the north, the Communication Tower to the south west and the Chevron Camp accommodation buildings, nestled into the ridge due south.

3 Visual Assessment

3.1 Statements, Policy And Planning Guidelines

Environment Protection and Biodiversity Conservation Act (EPBC Act)

Barrow Island is classified under EPBC Act since 1910 as a Class A Nature Reserve.

In relation to visual amenity The Environmental Protection Authority (EPA) issued a statement on the principal of locating a gas processing complex on Barrow Island. Visual significance is not specifically mentioned, although concern was raised for,

' …adequate attention be given to plant design, appropriate stack heights, avoidance of building effects…'

It should be noted that these recommendations have been incorporated into the amelioration measures recommended for the proposed gas plant and pipeline locations.

Visual Assessment Objectives

This part of the report assesses the visual impact of the:-

- onshore components of the 2 gas pipeline options:
  - North White's Beach
  - and Flacourt Bay
- mainland onshore components of gas pipeline
- LNG Plant, Port Facilities and temporary construction camp site

The proposed methodology for this visual assessment is set out in Appendix A.

The objectives of this report are to:

- Describe how the proposed development would alter the landscape character of the immediate area;
- Examine the visual impacts associated with the pipeline and associate infrastructure from adjacent road easements and road vantage points;
- Examine the visual impact of the LNG Plant from identified viewpoints;
- Assess the visual impacts during the phases of construction and completion and present visual optimisation and impact mitigation recommendations.

Assumptions

Assumptions are made when assessing visual impact. These include:

- The parameters of human vision provide some guide in measuring relative visual impacts.
- Natural landscape characteristics (ie. topography, vegetation cover) and degrees of disturbance (man-made built form) influence the capacity to absorb visual changes.
- As distance increases, visual impacts are reduced, to a point where the visual impact is insignificant. This physical distance can be calculated and defines the extent of the view shed for a particular development.
- Vegetation can screen or filter views (in relation to pipeline easements).
- Topography can screen views.
- Perception of beauty and what is visually intrusive can vary.

Visual Impact Mitigation

Visual impact can be lessoned through vegetative and topographic screening, maximising the separation distance to viewpoints and by selecting environments that are capable of absorbing visual changes in the context of surrounding viewpoints. For pipeline easements the strategic alignment of the route is the most important consideration in minimising visual impacts.

Strategic mitigation measures include:

- Alignment of the route to minimise adverse visual impacts associated with easement clearance;
- Minimal visibility of the easements and associated infrastructure from surrounding viewpoints;
- Selection of the most appropriate infrastructure sites for particular circumstances.

On occasions it is not possible to avoid sensitive viewpoints and it is necessary to balance visual impacts with other conflicting issues such as ecological impacts and cost. On such occasions it is necessary to consider tactical methods of mitigation to reduce visual impact. Tactical mitigation measures are applied at visually critical points in order to reduce visual impact to the practical minimum and include:

- adjusting the route alignment and positioning of infrastructure;
- blending infrastructure colour, materiality to match surrounding landscape character;

- vegetation retention;

- rehabilitation.

Tactical mitigation measures provide a degree of amelioration but rarely provide immediate relief from visual impacts and may not always be appropriate or practical. For example, screen planting can be effective in many landscape characters, however given the height and density of existing vegetation and the unique character of this natural Reserve, the introduction of screening species for the large infrastructure becomes inappropriate.

These limitations reinforce the point that infrastructure integration and route selection for pipeline easements are the most important factor in minimising landscape and visual impact.

Tactical mitigation measures available to further ameliorate impacts are discussed below.

Adjusting the Alignment

Minor modifications of the final alignment may make a major difference to the visual impact of the surrounding landscape. These need to be examined on a case by case basis but are generally readily achieved subject to technical suitability.

Colour Integration

The use of sympathetic colours, which blend with the surrounding landscape or are neutral (not contrasting) can assist to visually merge the infrastructure components with the surrounding landscape particularly when viewed from a distance. Colour also can be appropriated in the design and construction of the port facilities.

Vegetation Retention

The retention of vegetation as close as possible to the pipeline easements and LNG Plant site works will reduce exposure of the visually contrasting red soils and rock associated with this area.

Rehabilitation

Rehabilitation should reflect the landscape characteristics of surrounding areas. The removal and replacement of soil, rock and indigenous planting is to be implemented as follows;

Vegetation

- Before removing vegetation from an area that is to be substantially cleared, ensure local seed collection viability and stockpiling techniques have been explored and implemented if required (at present seed viability in the Pilbara region is as little as 1%).

- Vegetation removed is to be buried in appropriate landfill areas.

- Topsoil, not more than 100-50mm (200mm max.) from top of soil profile, at Barrow Island has been known to contain a viable seed pool and if direct

topsoil placement (without storage stockpiling) from one local area to another is practised there is the highest probability for regenerating vegetation cover.

- If stockpiling of topsoil is to occur and maintain seed viability it has to be stockpiled at a depth of 1.5m, not more than 2m high and ripped monthly for aeration. Stockpiles stored longer than a few years will cease to have viable seed stock.

- When roadways are being rehabilitated one technique used with satisfactory results is called 'equalisation' ripping, the dragging of topsoil containing seed from both sides of the road in a staggered pattern. As well as transporting seed this treatment allows a less uniform disturbance line in the natural landscape setting and in consideration of the soil profile.

Soil Profile

Visual disturbance in the Barrow Island natural setting is most noticeable when the soil profile is altered or new cap rock is brought to the surface. Topsoil has a different colouring and texture to hidden subsoils and rocks. With this in mind when excavation occurs it is important to maintain topsoil and subsoil layers in separate stockpiles and for these to be replaced in their respective soil profiles.

The soil profile on gorgon apart form the sandy coastal fringes generally consists of the following levels:

1. Topsoil (to 200mm, mostly shallow);
2. Granuled Subsoil (approx 200mm to 1m);
3. Limestone Gravel (approx. 1m to 2m); and
4. Cap Rock (at approx 2m).

This profile is a general across the Barrow Island Landscape. There are many instances especially in the Limestone ridges where the cap rock is exposed. However newly exposed rock has a different hue to existing weathered rock.

Ripping

- When ripping or equalising for road revegetation the prevention of bringing up submerged rocks can be avoided by only shallow ripping to150mm, no greater than 200mm depth. This is to be monitored on site.

Note: The implementations of specific tactical mitigation measures are discussed in association with the assessment of individual viewpoints.

Visual Impact Assessment – Shoreline Crossings

North White's Beach

The options of directional drilling or digging in of the pipeline through the narrow beach foredune achieves a none to negligible visual impact shore crossing.

An access road passes a few hundred metres adjacent on the ridgeline east of North White's Beach as seen in Figure 3.1 below. A track would need to be developed to allow construction equipment access down a moderate gradient to the site.

Fig 3.1 Aerial viewing east towards White's Beach showing proposed pipeline corridor and existing road running adjacent to shoreline.

The temporary disruption to the landscape at this location will be visible from vantage points within the surrounding western coastal ridgeline, however this coastal crossing has a viewshed of less than 0.5km.

Reinstatement of sand, soil, exposed rock and vegetation, as soon as practicable will prevent long-term visual impacts. Refer to chapter 3.4 on Visual Mitigation and rehabilitation for recommended reinstatement procedures.

Flacourt Bay

Again, the options of directional drilling or digging in the pipeline through the wide 100m beach have also been discussed to achieve an undersurface, none to negligible visual impact.

The existing road terminates on a ridgeline to the south of Flacourt Bay as seen in Figure 3.2 following page. A track would have to be developed down a steep sided valley to allow construction equipment access to the site.

The temporary disruption to the landscape at this location will be highly visible from vantage points within the surrounding western coast headlands, however this coastal crossing has a viewshed of less than 1km when approached from land.

Suitable reinstatement of sand, soil, exposed rock and vegetation, as soon as practicable will prevent long-term visual impacts. Refer to chapter 3.4 on Visual Mitigation and rehabilitation for recommended reinstatement procedures.

Fig 3.2 Aerial viewing east towards Flacourt Bay showing proposed pipeline corridor and existing road terminating on ridgeline south of beach.

Visual Impact Assessment – Onshore Pipeline Corridors

The majority of the land traversed by the pipeline corridors will follow close to existing road or other pipeline easements. Visual impacts associated with all options are very similar. This is based on visual intrusion of pipeline and for the construction works phase.

Apart from the coastline crossing's all proposed easements pass through gently undulating landscape that has mostly sparse vegetation coverage of low spinifex.

It is therefore possible to align the gas pipeline close to the adjacent road easement and existing pipeline corridors to ensure that there is little vegetation removal required for construction.

It could be argued that a pipe easement adjacent to the road and low in the drivers/passengers visual horizon has a far less visual impact than an alignment that is seen cutting through and contrasting with the open natural setting.

Some visual impacts will be of a temporary nature with vegetation clearing for construction access. Refer to chapter 3.4 on Visual Mitigation and Rehabilitation for recommended reinstatement procedures.

The local visual characteristics, development impacts and mitigation recommendations are summarised for each of the landscape character units within Table 3.1 - Visual Assessment Overview of Onshore Pipeline Options.

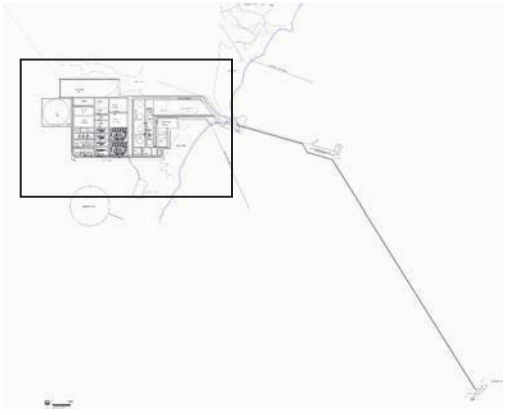
Table 3.1 - Visual Assessment Overview of Barrow Island Onshore Pipeline Corridors.

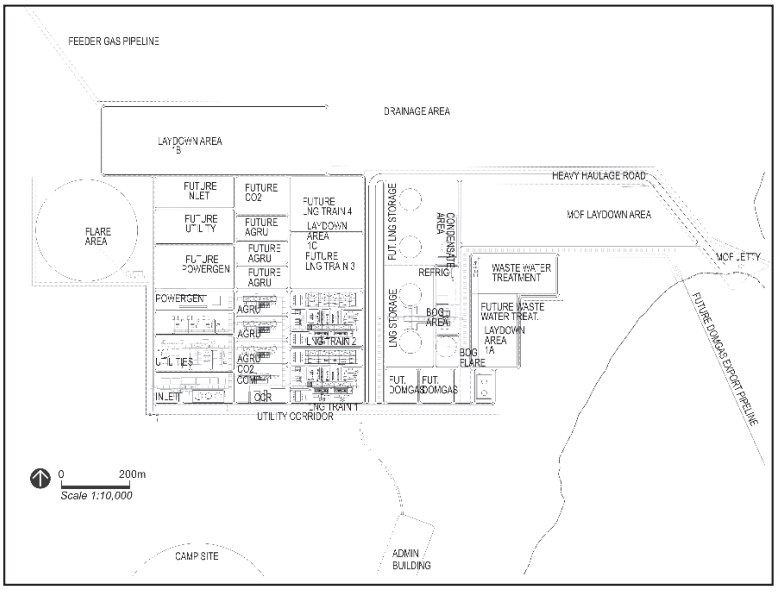
LANDSCAPE UNITS	LOCAL LANDSCAPE CHARACTERISTICS	POTENTIAL VISUAL IMPACTS	MITIGATION MEASURES AND RECOMMENDATIONS
UNIT 1 West Coastal Complex Western Shoreline crossing	Coastal cliffs Sandy beaches with high rocky headlands Open sandy beach line Gentle to medium slopes behind sandy beach line	Negligible to nil* visual impact on shoreline crossing moderate* visual impact from beyond beach line Disturbance of soil profile, possible exposure of rock on sandy beach and behind shoreline Possible views to pipeline from higher vantage points (rocky headlands)	Directional drilling to minimise damage to the foreshore Rectification of works sites and access roads with vegetation rehabilitation, sand, soils and rock profile to match existing Align pipeline easement to take advantage of topography with screening from vantage point views when climbing escarpment within the valleys
UNIT 3 Valley Slopes and Escarpments Most prominent between West Coast and Central Limestone Ridges	Low shrubland with dominant species of *Triodia wiseana* with mixed emergent lower growing shrub species such as *Acacia bivenosa/Petalostylis labicheiodes* and *Petalostylis trichodemoides* situated on the southern escarpments	Slight* visual impact Ground disturbance and vegetation clearance during the construction of access roads and pipeline easement Permanent pipeline easement with vegetation removal within the easement. Possible screening of easement from ridgelines and in contrast overlooking of pipeline easement into valleys Low to Moderate visual impact from adjacent roads	Rectification of works sites and access roads with soil and rock profile to match existing. Align pipeline easement to take advantage of topography with screening vantage point views when pipeline is not adjacent to road easement Align pipeline easement as close to and adjacent to road easement as practicable Reinstate local vegetation with local direct topsoil placement.
UNIT 4 Limestone Ridges Landscape Character Type most dominant in central development area	The terrain ranges from steeper slopes in the west to flatter more gentle undulations as the ridges continue east Typical vegetation on the limestone ridges include the sensitive Hummock Grassland of *Triodia wiseana* with low mixed shrubs including *Acacia gregorii* Planting is sparse and has limited rehabilitation capacity	Moderate* visual impact Ground disturbance and vegetation clearance during the construction of access roads and pipeline easement Permanent pipeline easement with vegetation removal within the easement Little screening from adjacent road easement	Align pipeline easement as close to and adjacent to road easement as practicable Rectification of works sites and access roads with soil and rock profile to match existing. Reinstate indigenous vegetation with local direct topsoil placement. Retain as much vegetation as practicable

LANDSCAPE UNITS	LOCAL LANDSCAPE CHARACTERISTICS	POTENTIAL VISUAL IMPACTS	MITIGATION MEASURES AND RECOMMENDATIONS
UNIT 5 Creek or Seasonal Drainage Lines Landscape Character Type that occupies the open valleys between the limestone ridges with large open flats situated on the east side of Barrow Island	The vegetation in this unit type is described as Mixed Hummock Grassland of *Triodia angusta* with pockets of dense shrubs along major creek lines. Low-lying topography in an undulating landscape Vegetation height will potentially be the greatest in this landscape unit making it easier to absorb above ground pipe infrastructure.	Negligible* visual impact Ground disturbance and vegetation clearance during the construction of access roads and pipeline easement Permanent pipeline easement with vegetation removal within the easement Due to soil depth and vegetation type rehabilitation has a greater opportunity to be achieved. **Criteria definitions in Methodology Appendices*	Rectification of works sites and access roads with soil profile to match existing. Align pipeline easement as close to and adjacent to road easement as practicable Reinstate indigenous vegetation with local direct topsoil placement.

LNG Plant Layout & Port Faciliy Layout

Figure 3.3 below illustrates the proposed LNG Plant that is to be located at Barrow Island. The elements listed are common for all plants, however their configuration varies relative to site constraints.





The major visual components of the gas plant are:

- The LNG Trains which are made up of columns, pipes and steel platforms, and has a mass height of approximately 20m above ground level; and

- The bulk Compressor and Storage tanks. Each tank is approximately 20m high and 20 metres in diameter. Therefore the comprehensive height of the LNG Plant can be ascertained at 20m above bench level (approximately 38.5m AHD).

The Emergency flare height at 150m high contrasts with the other Plant structures. This structure is tall and thin and although has potentially a wide viewshed it can be argued to have a negotiable visual impact on the surrounding landscape. (Refer Cha. 3.5.4 – Flare & Illumination).

Although the development area on whole will be approximately 300 hectares the LNG Plant is not constructed or viewed as a single mass. The Plant will be viewed

as a mixture of steel structural elements of varying size, width and height combining to give the development an "airy" feeling.

In general the development has been sited in a low-lying are to minimise visual impact within the surrounding landscape.

The Port facilities consist of a larger Materials Offloading Ramp (MOF) approximately 1km in length and a lighter structured offshore ship gas loading jetty of approximately 3km in length. While these facilities will protrude for a substantial distance from the eastern coast these forms will tend to blend into the seascape due to their low lying and light structured nature.

Appropriate measures will be taken to neutralise the colouring of these port facilities to blend with the seascape while night lighting will be minimal and will not have a high visual impact in this coastal area.

LNG Plant Viewshed

The viewshed for the LNG Plant site has been calculated assuming radii's of 5km, 7.5km and 10km.

A viewshed diagram (Figure 3.4 below) has been created using Global Positioning System (GPS) combined with 3D topographic information (ArcView) to determine their visibility from surrounding areas.

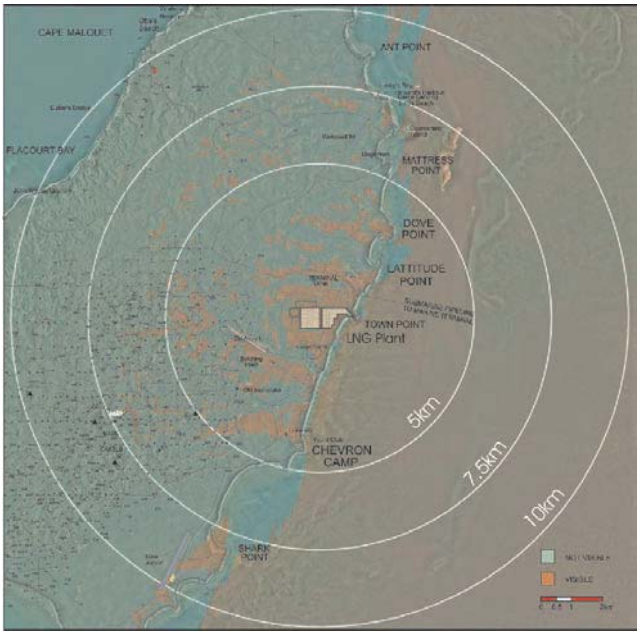


Figure 3.4 - Viewshed of LNG Plant site

The heights of the various infrastructure components have been identified to determine the extent of the viewshed. The viewshed analysis shown in Figure 3.4 above considers structures, which range in height from 10m to 20m and form the comprehensive bulk of the development. It is recommended that Individual stacks and flares may protrude above the comprehensive LNG Plant structure height but their impact is insignificant due to their narrow construction width.

The viewshed quantitative assessment also recognises that the emergency flare exceeds 150m in height, however given its narrow columnar appearance, the disturbance to the field of view is insignificant especially when viewed at a distance. The visual impacts are further tested as part of the qualitative assessment and simulations.

The topography of the LNG Plant Site immediate surrounds is low-lying, flat to gently undulating. This is reflected in the viewshed analysis with the plant being visible from a significant area within the central eastern segment of the Island. The LNG Plant would be visible from the ocean approaching from the east.
Viewpoints

The viewpoints identified in the Figure 3.5 below are located within the LNG Plant viewshed. These viewpoints have been selected to illustrate both typical and worst case visual impacts of the proposed development.

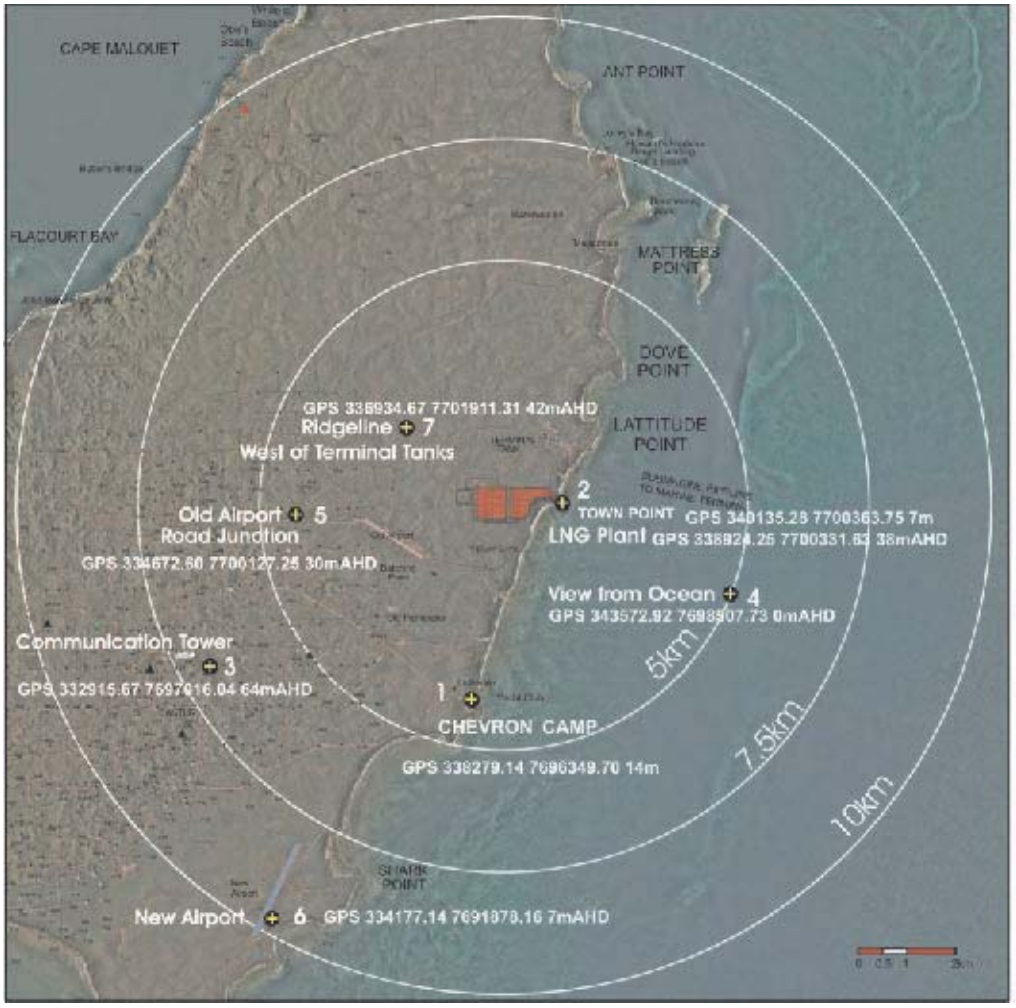


Figure 3.5 – Chosen Viewpoints around the LNG Plant site

Viewpoint 1 – Chevron Camp

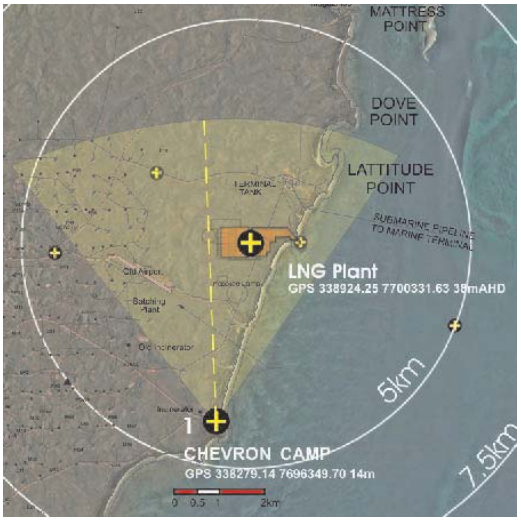


Figure 3.6 – Viewpoint 1

The view is looking north from the Chevron Camp carpark on the southern ridgeline overlooking the drainage line and broad flat. This viewpoint is located due south of the Terminal Tanks and Town Point, approximately 4.3km from the proposed LNG Plant.

Figure 3.7 – Simulation of LNG Plant & Port Facilities at completion of works from Viewpoint 1 – Chevron Camp

This viewpoint was chosen to show the common viewing point for the Chevron Camp workers and as a good overview of the LNG Plant, Port Facilities (MOF) within its landscape character.

The LNG Plant is moderately visible from this viewpoint and continues a low built skyline from the existing terminal tanks as seen situated on the right of the LNG Plant model.

From this distance the flare structure and low lying port facilities become of negligible visual impact and has very little effect on the overall scene.

Viewpoint 2 – Town Point

The view is looking west from Town Point. This viewpoint is located south east approximately 1.8km of the Terminal Tanks and approximately 1.2km due east from the centre of the proposed LNG Plant.

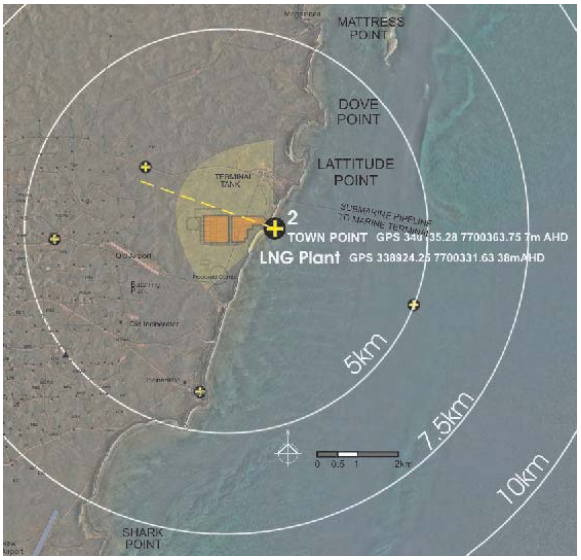


Figure 3.8 – Viewpoint 2

Figure 3.9 – Simulation of LNG Plant at completion of works from Viewpoint 2 – Town Point

This viewpoint was chosen to illustrate an immediate view of the development and to contrast the existing terminal tanks shown on the far right of photo.

The LNG Plant is substantially visible from this close viewpoint and adds to the built skyline of the existing terminal tanks.

This model simulation also shows proposed earth benching that contrasts the natural landscape this is before vegetation rehabilitation of the bench slopes.

Viewpoint 3 – Communication Tower, Base Castle

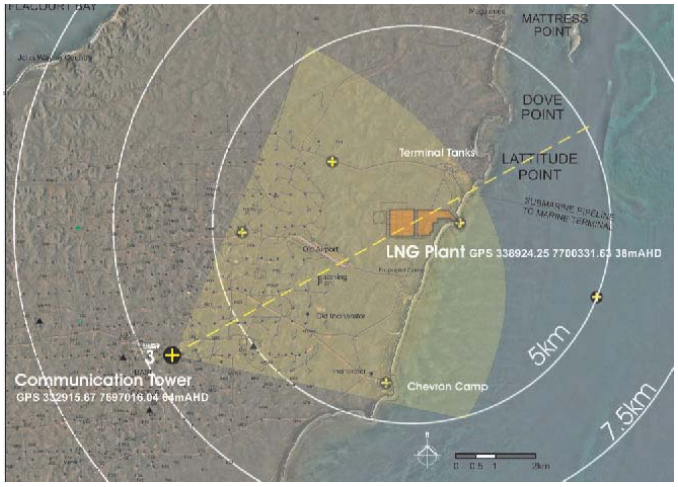


Figure 3.10 – Viewpoint 3

The view is looking north east from the Communication Tower, at 63m the highest central point on Barrow Island. This viewpoint is located 5.2km due west of the Chevron Camp site and approximately 6.8km south west of the proposed LNG Plant.

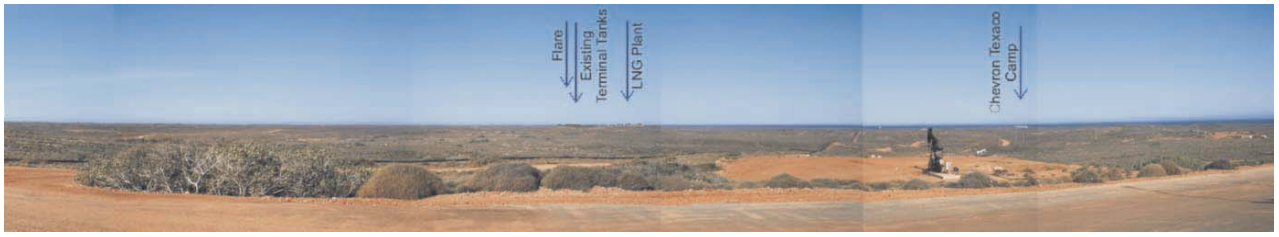


Figure 3.11 – Simulation of LNG Plant at completion of works from Viewpoint 3 – Communication Tower, Base Castle

This viewpoint was chosen to illustrate views from the highest central point in the island (63m AHD). From this view the Plant site is partially hidden due to a ridgeline and its position on a low-lying flat.

The LNG Plant has negligible visual impact and the view indicates how the LNG Plant at this distance melds into the landscape.

The flare structure at this point becomes less discernible and has virtually no visual impact to the broader scene.

Viewpoint 4 – Ocean View at 5km East of LNG Plant

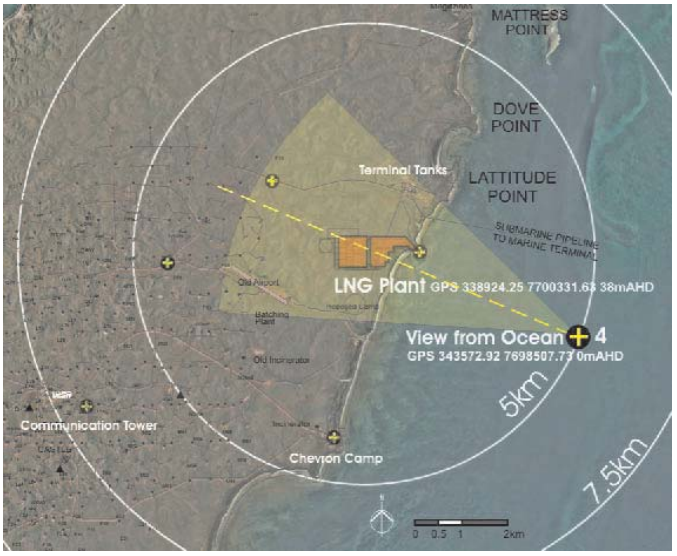


Figure 3.12 – Viewpoint 4

The view is looking west from 5km east of the proposed LNG Plant.

This viewpoint was chosen to account for the view while approaching the development site within a water vessel.

Figure 3.13 – Simulation of LNG Plant at completion of works from Viewpoint 4 – Ocean View at 5km east of LNG Plant. View at left of figure shows extent of Ship Gas Loading facility.

From this viewpoint the LNG Plant has a moderate to substantial visual impact and the view indicates how the LNG Plant and Port Facilities form a recognisable new element within the landscape.

Viewpoint 5 – Road Junction near Old Airport

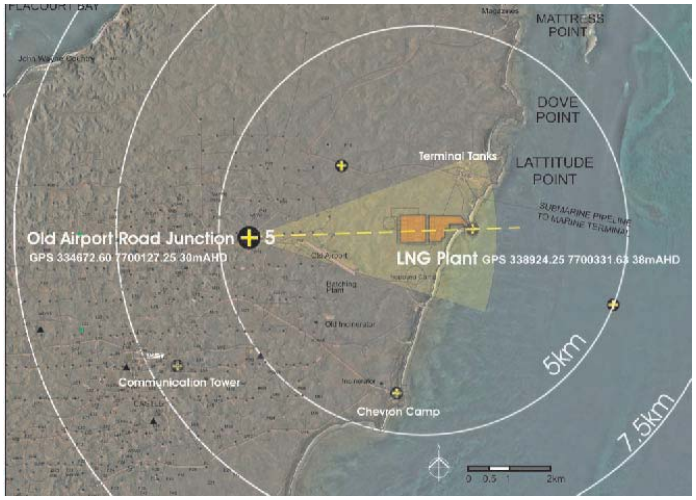


Figure 3.14 – Viewpoint 5

This view is looking due east from a major road junction 1.5km west of the old Airport and 4.9km due west of the Proposed LNG Plant site.

Figure 3.15 – Simulation of LNG Plant at completion of works from Viewpoint 5 – Road Junction, Old Airport

This viewpoint was chosen to illustrate one of the few visible views beyond the development sites low-lying, drainage flat landscape. The junction is situated in a shallow east west valley that aligns, when looking east, with the proposed Plant site.

From this viewpoint the Plant bulk is partially hidden due to a ridgeline however the development dominates the skyline and is seen to have a substantial change to the natural landscape.

Viewpoint 6 – Passenger Terminal, New Airport

This viewpoint was chosen to illustrate the only ground view passengers would

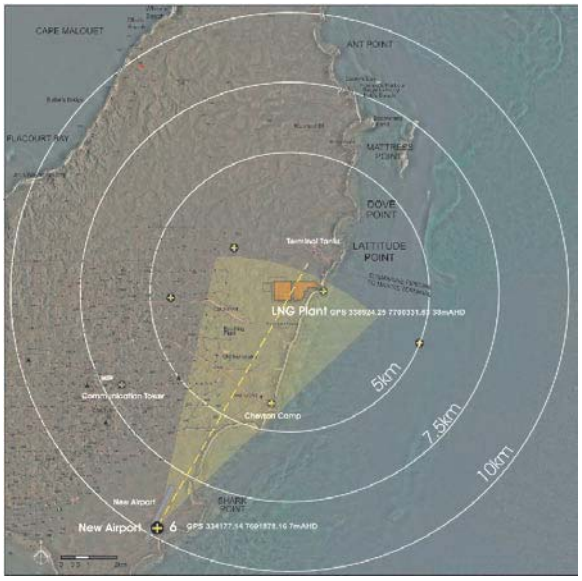


Figure 3.16 – Viewpoint 5

Figure 3.17 – This view is looking north north-east from the New Airport passenger terminal at Barrow Island 9.7km south west of the of the Proposed LNG Plant site.

have of the development site. From this viewpoint the bulk of the development sits behind the helicopter hanger and the flare is the only structure that can be faintly seen. The bulk of the plant sits below a ridgeline and structures that sit above form, from this distance, part of the landform.

The visual impact of the development from the New Airport passenger terminal would be described as negligible to none.

Viewpoint 7 – Ridgeline West of Terminal Tanks

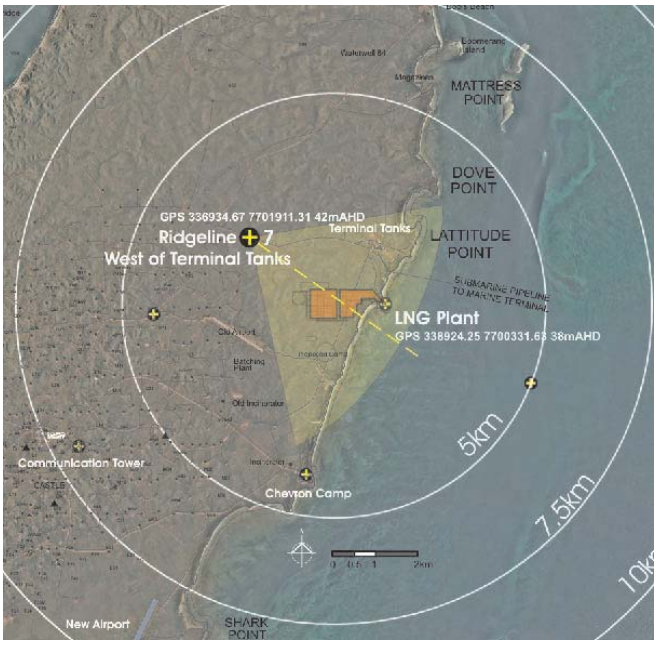


Figure 3.18 – Viewpoint 7

This view is looking south east from a main road that leads west from the existing Terminal Tanks. This view is from the highest point of the ridgeline that surrounds the development site. It is situated 3km west of the Terminal Tanks and 2.5km north west of the development site.

Figure 3.19 – Simulation of LNG Plant at completion of works from Viewpoint 7 – Ridgeline West of Terminal Tanks

This viewpoint was chosen to illustrate a worse case scenario of the highest and closest point that a worker will view the entire development.

From this viewpoint the Plant bulk is totally exposed and the development will dominate the landscape and skyline. Within this broad flat and surrounding ridgeline the development is seen to have a substantial change to the natural landscape.

Flare and Illumination

Foreground active activity is more prominent.

Bench marking 5 – 9km integrate with the landscape

The emergency flare stack of the gas plant is 150 metres in height and has an internal diameter of 0.5m. It is proposed for emergency discharges only, which will be of short duration and infrequent occurrence. The emergency flare will normally operate a pilot flame only, automatically igniting when required for pressure relief. If an emergency situation arises and the flare needs to be used the flame of the flare will extend approximately 30-40 metres above the top of the stack.

The flare will be visible from long distances. However due to the relative infrequency (due to the design of the plants shutdown system) of the purge, the visual impacts are not considered significant.

The lighting of this facility would be designed to ensure that light levels are minimal required for safety and plant operations. Plant and Port Facility lighting will be visible from adjacent ridgelines and roads' where vegetation and topography does not screen or filter views.

Quantitative Assessment – LNG Plant Site

The following Table 3.2 following page show the distances to the proposed gas plant from nominated viewpoints. Also measured are the developments horizontal and vertical line of sight angles (vertical bulk height of 20m). Further described is the likely visibility of the ancillary lighting at night.

Table 3.2 - Distances and viewing angles from identified viewpoints to Centre of Proposed LNG Plant **Note: LNG Plant Site Centre GPS 338924.24 – 7700331.63 38m AHD**

VIEWPOINTS	Distance to gas plant	Horizontal angle of view	Potential impact	Vertical angle of view	Potential impact	Night time Lighting
1. Chevron Camp GPS 338279.14 – 7696349.70 14m AHD	4033m	14°	Potentially noticeable	0.3°	Insignificant	Noticeable glow
Town Point GPS 340135.28 – 7700363.75 7m AHD	1100m	40°	Potentially visually dominant	1.5°	Potentially noticeable	Glow in foreground
Coms. Tower GPS 332915.67 – 7697016.04 64m AHD	6862m	6°	Potentially visually dominant	0.24°	Insignificant	Dull glow in distance
Ocean View GPS 343572.92 – 7698507.73 2m AHD	4993m	10°	Potentially visually dominant	0.5°	Potentially noticeable	Noticeable glow
Old Airport GPS 334672.60 – 7700127.25 30m AHD	4256m	26°	Potentially noticeable	0.11°	Insignificant	Noticeable glow
New Airport GPS 334177.14 – 7691878.16 7m AHD	9695m	5°	Insignificant Disregarding view screened by helicopter hanger	0.02°	Insignificant Disregarding view screened by helicopter hanger	Dull glow in distance
Ridgeline GPS 336934.67 – 7701911.31 7m AHD	2540m	40°	Potentially visually dominant	0.5°	Potentially noticeable	Glow in foreground

The quantitative assessment recognises that isolated structures within the gas plant exceed 20m, however their dimensions are such that their narrow columnar appearance will not provide a significant visual impact when viewed at a distance providing the remaining structure is hidden from view. The visual impacts are further tested as part of the qualitative assessment and simulations.

4 Conclusion

4.1 Pipeline Corridor - Shoreline Crossings

The **Visual Impact** of the alternative shoreline crossings at 'North White's Beach' and 'Flacourt Bay' are considered as none to negligible due to their underground construction and works temporary nature.

Reinstatement of sand, soil, exposed rock and vegetation, as soon as practicable will prevent long-term visual impacts. Refer to chapter 3.4 on Visual Mitigation and rehabilitation for recommended reinstatement procedures.

Onshore Pipeline Corridor(s)

The construction and form of the proposed pipeline easements for Barrow Island will have similar visual implications for all landscape character units with the exception of the underground shoreline crossings. The visual impacts can be summarised as follows:

- When viewed, a long lineal form that will contrast with natural environment;
- Visual gaps in landscape from removal of vegetation and soil;
- Colour change in soil profile disturbance; and
- Additional access roads.

Achieving the following will reduce visual impact for all the proposed pipeline easements on Barrow Island and the Mainland:

- Limiting the removal of vegetation within the pipeline easement;
- Limiting duration of disturbance;
- Replacing disturbed areas as soon as practicable with local direct topsoil replacement;
- Replacing disturbed soil and rock back to existing soil profile;
- Limiting construction access roads;
- Aligning pipeline corridors adjacent and as close to existing road easements as practicable; and
- When a pipeline corridor is not adjacent to road easement designing the pipeline to fit into the topography of the landscape where practicable.

LNG Plant Site

The siting of the LNG Plant has the potential to significantly alter the landscape character without appropriate siting and mitigation treatment applied.

The visual assessment recognises that the regional landscape character surrounding the proposed LNG Plant has the greatest **Landscape Absorptive Capability** ability to incorporate the visual impact of this type of infrastructure.

The **Visual Amenity** of the proposed LNG Plant site adjacent Town Point would be considered negligible to human visual perception and significance.

However, according to the viewers position within the LNG Plant's viewshed the **Visual Impact** ranges from negligible to substantial as the development bulk height is screened from most of Barrow Island by surrounding ridgelines and its tactical positioning within a low-lying landscape.

Visual Impact Mitigation

Given the lack of substantial indigenous vegetation and inappropriate within this landscape character to use exotic species, the visual impact level of the LNG Plant or ancillary and other lighting would not significantly reduce over time.

It is important that the lower infrastructure to 20m (including the temporary construction camp) is coloured not to contrast surrounding spinifex vegetation where practicable and benching slopes (unused roads, benches) are revegetated to blend effectively into the landscape. The extent of vegetation removed is to be minimised and rehabilitation by direct soil placement is to take place as soon as practicable.

Figure 4.1 – Proposed aerial view simulation of LNG Plant at completion of works. View shows LNG Plant & extent of Port Facilities. Chevron Camp can be viewed on the lower right hand corner of the simulation.

5 Appendices

5.1 Methodology

Quantitative Assessment

An analysis of the parameters of human vision makes it possible to establish guidelines for defining the viewshed within which potential visual impacts associated with a development may occur. Within this viewshed it is possible to identify specific locations with potential views to the infrastructure or easement clearing associated with the gas pipeline.

The visual impact of a development can be quantified by reference to the degree of influence on a person's field of vision. The diagrams on the following pages illustrate the typical parameters of human vision. These provide a basis for assessing and interpreting the impact of a development by comparing the extent to which the development would intrude into the central field of vision.

These parameters also allow a comparative analysis of the visual impacts relative to other elements within the landscape such as tall trees.

It should be noted that the quantitative assessment determines the relative scale of a development from a viewpoint. The quantitative assessment assumes that distance is the only modifier of visual impact, and if considered in isolation, does not allow for local landscape characteristics, which may influence the visibility of a development. As such the quantitative assessment should be interpreted in association with the qualitative assessment.

Horizontal Line of Sight

The central field of vision for most people covers an angle of between 50° degrees to 60°. Within this angle, both eyes observe an object simultaneously. This creates a central field of greater magnitude than that possible by each eye separately. This central field of vision is termed the 'binocular field' and within this field images are sharp, depth of perception occurs and colour discrimination is possible.

The visual impact of a development will vary according to the proportion in which a development impacts on the central field of vision. Being evaluation on this measurable parameter allows the rating of potential impact.

These physical parameters are illustrated in Figure A1.1

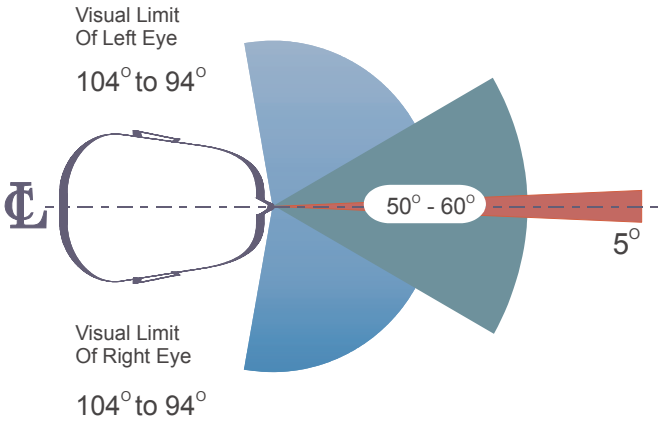


Figure A1.1 Horizontal Field of View

Table A1.1 below list assumptions, which determine whether the impact of a development is:

- Insignificant;
- Potentially noticeable; or
- Potentially visually dominant.

Once potential visual impacts are rated one may direct remedial action to those viewpoints that are most impacted.

Horizontal Field of View	***Impact***
<5° of view	Insignificant The development will take up less than 5 percent of the central field of view. The development, unless particularly conspicuous against the background, will not intrude significantly into the view. The extent of the vertical angle will also affect the visual impact.
5° – 30° of view	Potentially noticeable The development may be noticeable and its degree of visual intrusion will depend greatly on its ability to blend in with its surroundings.
>30° of view	Potentially visually dominant Developments that fill more than 30 percent of the central field of vision will always be noticed and only sympathetic treatments will mitigate visual effects.

Table A1.1 Impact within the horizontal field of view

Vertical Line of Sight

A similar analysis can be undertaken based upon the vertical line of sight for human vision.

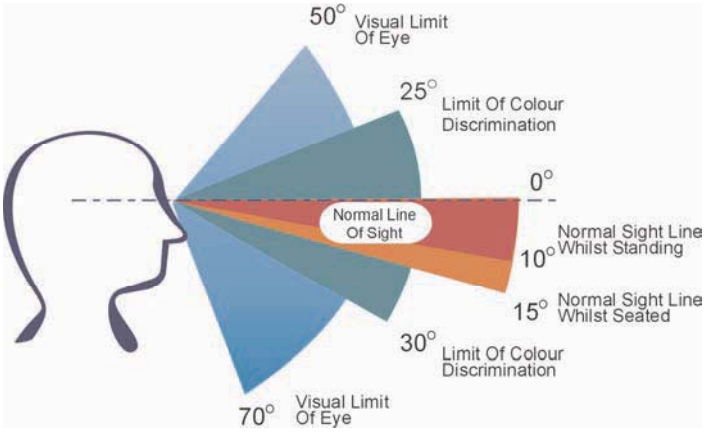


Figure A1.2 Vertical Line of Sight

As can be seen in Figure A1.2, the typical line of sight is considered to be horizontal or 0°. A person's natural or normal line of sight is below the horizontal. It varies slightly from person to person and depends on whether they are standing or sitting. If standing, the normal line of sight is approximately 10° below the horizontal and if sitting, approximately 15°

This situation is similar when looking across a disturbed landscape. Objects, which take up a small proportion of the vertical field of view, are visible when one focuses on them directly. However, they are not dominant, nor do they create a significant change to the existing environment when short objects are placed within a landscape.

Table A1.2 Shows the relationship between the impact and the proportion that the development occupies within the vertical line of sight.

Vertical Line of Sight	Impact
$<0.5^{O}$ of vertical angle	Insignificant A thin line in the landscape.
0.5^{O} – 2.5^{O} of vertical angle	Potentially noticeable The degree of visual intrusion will depend on the development's ability to blend in with the surroundings.
$>2.5^{O}$ of vertical angle	Visually evident Usually visible, however the degree of visual intrusion will depend of the width of the object and its placement within the landscape.

Table A1.2 Impact within the Vertical Line of Sight

Qualitative Assessment

The qualitative analysis is achieved by observation, description of existing conditions (supported by simulations, photographs, sketches etc.) and interpretation of the changes to the landscape associated with the proposed development

Computer Simulations

Computer imagery makes it possible to accurately simulate the visual changes associated with the proposed development. The visual modelling process enables people to observe the typical changes to the landscape associated with the construction of the proposed gas pipeline from particular viewpoints at the completion of construction and once mitigation measures such as trees have established.

- Photographs were taken from the selected viewpoints towards the proposed corridor, using a 50mm lens to most accurately simulate the human eye. GIS Co-ordinates (satellite positioning) were recorded to determine the location at which the photographs were taken;

- 3-D models were constructed of the infrastructure to accurately represent their form in terms of height and construction;

- A 3-D, wire frame model of the terrain was then created from digital contour information. The 3-D models of the infrastructure were accurately positioned within this terrain model, again using GIS Co-ordinates to determine their location and height;

- Cameras were created within the 3-D model to simulate the camera used on site. The simulated camera view was then overlayed onto the original photos;

- The visual modelling software then rendered the proposed alignment over the scanned site photo to demonstrate how the infrastructure would appear along the corridor;

- Photo-montaging techniques were utilised to modify the final view to represent proposed view in its' altered condition

The accuracy of simulations is dependent on the available base information and may be subject to change during the development of the project.

In the first instance, the digital wire frame simulation is overlaid on the photograph to demonstrate the accuracy of the modelling process. By relating the 3-D contours with the terrain and landscape features within the photograph, it is possible to accurately position the infrastructure in the landscape. The pipeline alignment and infrastructure are clearly identified in yellow so that they clearly stand out from the landscape.

The final visual simulation is intended to accurately reflect the colours and form of the gas plant or associated infrastructure and easement clearing.

Interpretation

The existing landscape character plays an important role in determining the impact of a proposed development. The background setting and surrounding natural/built environment can help to absorb changes brought about by developments such as linear infrastructure developments. Alternatively, a development may contrast significantly with the existing environment making its integration more difficult.

There are four major elements of landscape character, which affect the extent to which the proposed developments impact on a landscape. These are:

- Vegetation cover;
- Topography;
- Degree of human modification to 'the natural' landscape and dominance of man made elements; and
- Distance

Vegetation Cover

The height and density of vegetation can contribute to the visual quality of the landscape. However the removal of vegetation to accommodate infrastructure in the Barrow Island Landscape presents a significant change to the landscape character by exposing the contrasting red soils and in some cases contrasting unexposed rock that is deeper in colour to the sun bleached extracted rock. The visual impact is relative to the significance of the viewpoints.

Topography

Topography can play an important role in determining the visibility of a development within the landscape, depending on elevation of viewpoints and their relationship with the proposed development, and surrounding vegetation and structures.

Flat Landscapes

Changes in the vertical field of view may not be apparent within flat landscapes if foreground vegetation screens views. If views are not screened, vertical development above the scale of the surrounding landscape becomes very apparent from longerdistances.

Undulating Landscapes

Landscapes with topographical variations have greater capacity to partially screen views to a development, however, this is largely dependent on the viewing location. At lower elevations topography may help to screen foreground views, whereas at higher elevations views may be exposed.

Degree of Human Modification

The potential impact of the proposed pipeline easement and associated infrastructure is less when man modifies the surrounding landscape. Viewers

perceive the first change to a natural landscape with greater sensitivity than subsequent changes.

Distance

As distance increases, the impacts associated with development decrease due to the relative reduction in scale. As the scale of a development reduces, the capacity for screening is increased.

Sensitive Viewpoints

The location and frequency of viewing are important considerations when assessing visual impact. As the Barrow Island Visual Assessment is unique due to the lack of sensitive human receptors visual impact within the context of this study, will be assessed from a number of viewpoints that are considered important to represent the potential changes in the landscape character. These viewpoints are from:

- the Chevron Camp site;
- Town Point;
- The base of the Communication Tower highest land point located centrally on the Island;
- from 5km offshore looking towards the LNG Plant site;
- A main road junction directly west of the development site;
- The new Airport, in regard to passengers passing through; and
- Worst case scenario of highest closest point to view whole of construction (Ridgeline directly west of Terminal Tanks.

Major, Secondary Roads and Access Tracks

In regard to the Barrow Island, workers alone will be viewing changes to the landscape from roads. Roads themselves are part of man-modified landscapes.

Generally, the visual impact of easement clearing and infrastructure construction on motorists varies according to distance and surrounding landscape character. In vegetated areas, changes to the landscape resulting from easement clearing or construction works may be seen for only a short period in the context of a journey. Therefore vegetated areas easement clearing is preferable at right angles to existing roads, as the view along the easement may be visible for only a very short period.

When easement clearing occurs adjacent to the road edge, the change to the landscape character is more apparent for longer periods to the motorist.

However in the Barrow Island context, as stated earlier, this structure will be inspected and viewed by gas and oil workers, a pipeline easement that becomes part of the road easement would be in this scenario viewed in favour of an easement cutting through the natural landscape.

Easement clearing can be viewed at a further distance on Barrow Island due to the to low and sparse vegetation habit and as noted with the existing seismic lines.

Visual Impact Definitions

Table A1.3 explains the visual impact definitions used within this study.

Visual Impact	Definition
None	No part of the development, or work or activity associate with it, is discernible.
Negligible	Only a very small part of the proposals is discernible and/or they are at such a distance that they are scarcely appreciated, Consequently they have very little effect on the scene.
Slight	The proposals constitute only a minor component of the wider view, which might be missed by the casual observer or receptor. Awareness of the proposals would not have a marked effect on the overall quality of the scene.
Moderate	The proposal may form a visible and recognisable new element within the overall scene and may be readily noticed by the observer or receptor.
Substantial	The proposals form a significant and immediately apparent part of the scene that affects and changes its overall character.
Severe	The proposals become the dominant feature of the scene to which other elements become subordinate and they significantly affect and change its character.

Table A1.3 Visual Impact Definitions

Note: That these definitions can apply to either existing or proposed situation and that visual impacts need not be necessary detrimental. For example, a proposed prominent group of trees might have a 'substantial' impact, however the effect on the landscape and views would be beneficial.

Landscape Visual Assessment - Glossary

Analysis	(Landscape) The process of breaking the landscape down into its component parts to understand how it is made up.
Assessment	(Landscape) An umbrella term for description, classification and analysis for landscape.
Enhancement	Landscape improvement through restoration, reconstruction or creation.
Environment	Our physical surroundings including air, water and land.
Landform	Combinations of slope and elevation that produce the shape landform of the land.
Landscape	Human perception of the land conditioned by knowledge and identity with a place.
L. absorptive capacity	The degree to which a particular landscape character type or area is able to accommodate change without unacceptable adverse affects on its character. Capacity is likely to vary according to the type and nature of change being proposed.
Landscape character	The distinct and recognisable pattern of elements that occur consistently in a particular type of landscape, and how this is perceived by people. It reflects particular combinations of geology, landform, soils, vegetation, land use and human settlement. It creates the particular sense of place of different areas of the landscape.
L. character type	A landscape type will have broadly similar patterns of geology, landform, sols, vegetation, land use , settlement and field pattern discernible in maps and field survey records.
Landscape effects	Change in the elements, characteristics, character and qualities of the landscape as a result of development. These effects can be positive or negative.
Landscape perception	The psychology of seeing and possibly attaching value and/or meaning to landscape.
Landscape sensitivity	The extent to which a landscape can accept change of a particular type and scale without unacceptable adverse effects on its character.
Landscape value	The relative value or importance attached to a landscape which expresses national or local consensus, because of its quality, special qualities

	including perceptual aspects such as scenic beauty, tranquillity or wildness, cultural associations other conservation issues.
Receptor	Special interest of viewer group that will experience the landscape effect.
Sense of place	The essential character or spirit of an area. The *genius loci* meaning the spirit of a place.
Visual amenity	The value of the landscape character, a particular area in terms of what is seen.
Visual effect	Change in appearance of the landscape as a result of development. This can be positive(ie. beneficial, improvement) or negative (ie. adverse or a detraction).
Visual impact	The measure of visual effect in the landscape being quantitative or qualitatively assessed.
Visual Mitigation	Measure, including any process, activity or design to avoid, reduce remedy or compensate for adverse landscape and visual effects of a development project.
Viewshed	Extent of potential visibility to or from a specific area or feature.
Methodology	The specific approach and techniques used for a given study.

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