ATTACHMENT 2

ARROW LNG PLANT

Matters of National Environmental Significance Update

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ARROW LNG PLANT

MATTERS OF NATIONAL ENVIRONMENTAL SIGNIFICANCE UPDATE

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FEBRUARY 2013

Arrow CSG (Australia) Pty Ltd

Arrow LNG Plant

Matters of National Environmental Significance Update

Referral No. EPBC 2009/5007 - LNG plant and ancillary infrastructure

February 2013

CR 7033_16_v3

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1. INTRODUCTION

1.1 Background and Purpose

Arrow CSG (Australia) Pty Ltd (Arrow Energy) is seeking approval to construct, operate and decommission the Arrow LNG Plant, located on Curtis Island, near Gladstone, Queensland.

Approval is required under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act). The EPBC Act provides for the protection of the environment, especially matters of national environmental significance (MNES). Under the act, actions likely to have a significant impact on MNES require assessment and approval under the EPBC Act.

Two referrals were made to the then Australian Government Department of Environment, Water, Heritage and the Arts (DEWHA):

- EPBC 2009/5007 – to develop a liquefied natural gas facility on the southern end of Curtis Island, opposite Gladstone, Queensland.
- EPBC 2009/5008 – to develop a high pressure gas pipeline and associated infrastructure from either the Gladstone City Gate or a new facility, to Curtis Island, Queensland.

On 21 August 2009, it was determined that the proposed actions described by referrals EPBC 2009/5007 and EPBC 2009/5008 were both likely to have a significant impact on the following MNES:

- World Heritage properties.
- National Heritage places.
- Listed threatened species and communities.
- Listed migratory species.

An environmental impact statement (EIS) for the project was subsequently prepared and was published for public comment in April 2012. The EIS included an attachment specifically addressing MNES that addressed both controlled actions.

This report – an attachment to the Supplementary Report to the Environmental Impact Statement (SREIS) – supplements the MNES attachment to the EIS and specifically addresses the controlled action EPBC 2009/5007 (development of the LNG plant on Curtis Island).

The EPBC Act Policy Statement 1.1 ‘Significant Impact Guidelines: Matters of National Environmental Significance’ (DEWHA, 2009) provides the framework for the assessment of potential impacts upon MNES from the Arrow LNG Plant.

A separate report within Attachment 2 to the SREIS provides similar supplementary information for controlled action EPBC 2009/5008. The report is less extensive, due to the narrower scope of project infrastructure and operations it covers, with more focus on the immediate footprint of disturbance associated with the high pressure gas pipeline and associated infrastructure. Inevitably, both reports cover common issues, for example with regard to assessment of impacts to World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area (GBRWHA). The footprint of infrastructure for referral number EPBC 2009/5008 is largely outside

the GBRWHA, apart from the tunnel, which is subterranean below Port Curtis, and a small area of pipeline from the reception shaft on Curtis Island to the LNG plant.

The purpose of this supplementary MNES attachment for EPBC 2009/5007 is to:

- Assess the change in potential impact (between the EIS and the SREIS) to MNES as a result of the changes in project design during front end engineering design (FEED), other design modifications and further information. MNES for which there is no change in impact, are not carried forward to this assessment, and are addressed in Table 2.2.
- Address the issues raised by the Australian Government Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC) in their submission on the EIS.
- Address other issues raised in submissions on the EIS relating to MNES.

This MNES attachment refers substantially to the additional information and revised assessments compiled from further technical studies completed for the SREIS and presented in various chapters in Part A of the SREIS.

Matters relating to terrestrial ecology are addressed in the SREIS in Chapter 18, Terrestrial Ecology, which is based upon the technical study conducted by 3D Environmental and EcoSmart Ecology (Appendix 11, Terrestrial Ecology Supplementary EIS Study).

Matters relating to shorebird species are addressed in the SREIS in Chapter 19, Shorebirds, which is based upon the technical study carried out by Ecosure (Appendix 12, Arrow LNG Plant Interim Shorebird Technical Study).

Matters relating to marine ecology are addressed in the SREIS in Chapter 15, Marine Ecology, which is based upon the technical study carried out by Coffey Environments (Appendix 8, Technical Study of Marine Ecology (Port Curtis)).

Matters relating specifically to the impacts of project lighting on marine turtles are addressed separately in Chapter 16, Turtles and Lighting, which is based upon the technical study carried out by Pendoley Environmental (Appendix 9, Marine Ecology (Turtles) Technical Study).

Matters relating to estuarine ecology of the Calliope River are addressed in the SREIS in Chapter 17, Estuarine Ecology (Calliope River), which is based upon the technical study carried out by Coffey Environments (Appendix 10, Technical Study of Estuarine Ecology (Calliope River)).

1.2 Changes in Project Design

Chapter 4, of the SREIS, Project Description: LNG Plant (Table 4.1) provides an overview of the project description changes for the proposed Arrow LNG Plant. These changes, as relevant to EPBC 2009/5007, are summarised below:

- Boatshed Point is confirmed as the location for the materials offloading facility (MOF), with minor design changes.
- Pioneer MOF options on Curtis Island are identified.
- Pioneer mainland launch site options are identified for personnel, equipment and materials.

- Construction cut and fill volumes have changed. Estimated cut and fill volumes presented in the EIS were 4,700,000 m^3 and 4,200,000 m^3 respectively. Revised estimates from FEED are 5,820,000 m^3 of cut and 3,140,000 m^3 of fill.
- The areas of reclamation required at Hamilton Point in North China Bay have increased, and a new reclamation area identified west of Boatshed Point to dispose of excess spoil and provide temporary laydown.
- The operational flare is no longer proposed.
- Power supply for the LNG plant is defined. The all electrical option has been discontinued and the all mechanical drive (also known as power island mode) has been retained as the base case in the event the preferred mechanical and electrical option is not feasible.
- Other minor configuration changes have been made to accommodate power and water supply infrastructure.

The layout of the LNG plant (Figure 1.1) remains substantially unchanged from that presented in the EIS. Design optimisation has resulted in changes to the location of ancillary infrastructure (Figure 1.2).

1.3 DSEWPaC Submission on the Arrow LNG Plant EIS

In May 2012, DSEWPaC, which administers the EPBC Act, made a submission on the MNES attachment to the EIS to Arrow Energy via the Queensland Coordinator-General. Some of the general issues raised in the submission related to:

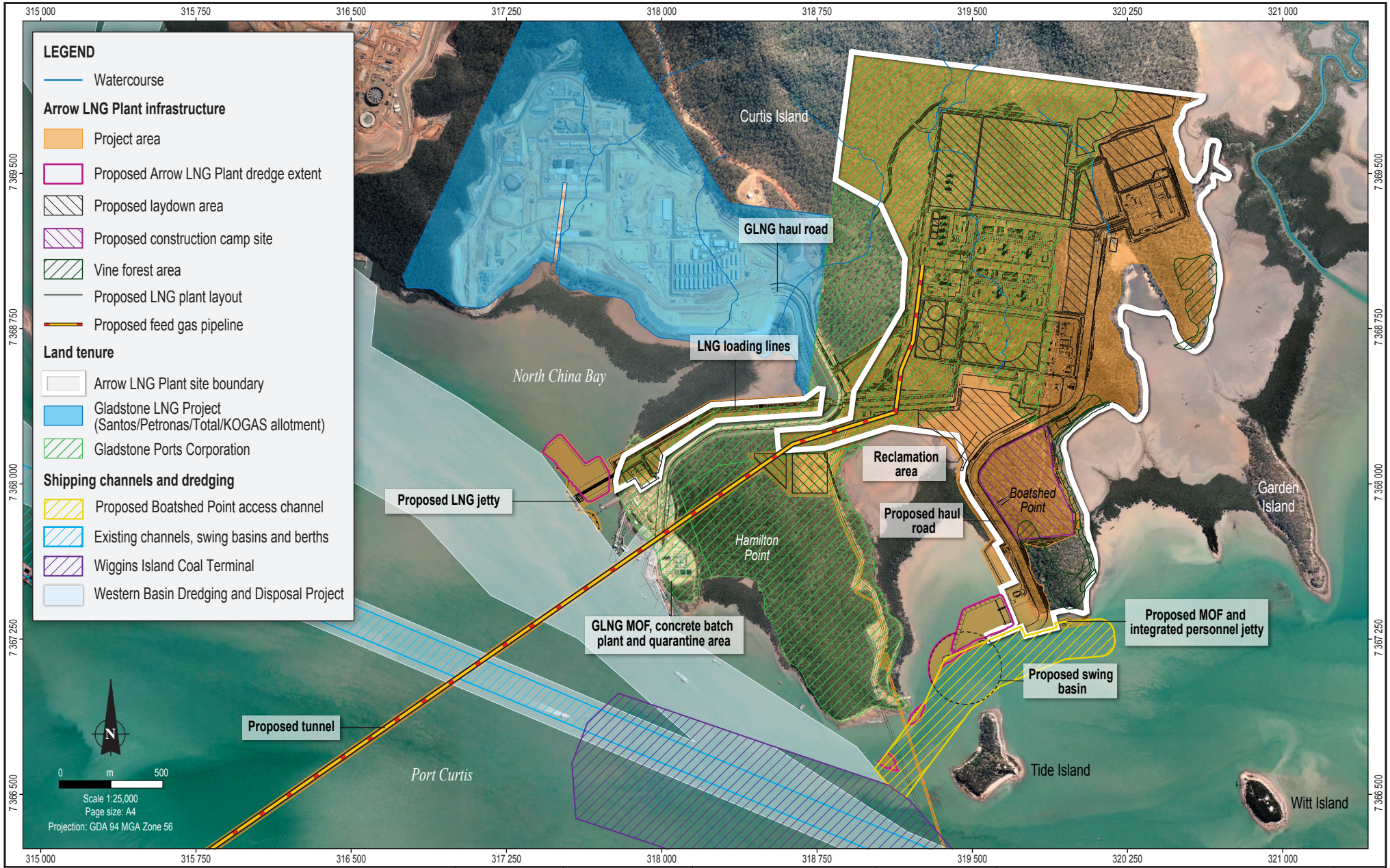
- Species survey methods.
- Specific issues relating to impacts on species.
- Assessment of significance of residual impacts.
- Mitigation measures and management plans.
- Offset requirements.
- Cumulative and indirect impacts.
- Accessibility of information within the EIS.

The comments provided by DSEWPaC are provided in Appendix A of this attachment, along with cross references to the corresponding section of the EIS, the SREIS, and/or this attachment where each comment is addressed. Further details of the responses to the department's submission on the EIS are provided in Part B of the SREIS. Part B also presents information about the public exhibition period and the process for lodgement of submissions on the EIS, and statistics on the number and variety of submissions received during the EIS review period.

1.4 Issues Relating to MNES Raised in Public Submissions

A small number of submissions relating to MNES were received during the public comment period on the EIS. These submissions related to:

- Management of the Great Barrier Reef.
- Potential impacts upon dolphin species.
- Vegetation clearance.



Source:
Place names and roads from DME. Watercourses from Alluvium
Study area, proposed auxiliary facilities, marine infrastructure and vine forest areas from Arrow Energy.
Western Basin Dredging Master Plan and Disposal Project from Gladstone Ports Corporation.
Study area and proposed feed gas pipeline from Coffey Environments.
Imagery from Nearmap (captured 7 August 2012).

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Date: 10.12.2012
MXD: 7033CB_16_GIS001_v1_11
File Name: 7033_MNES1_F01.01_GIS_GL

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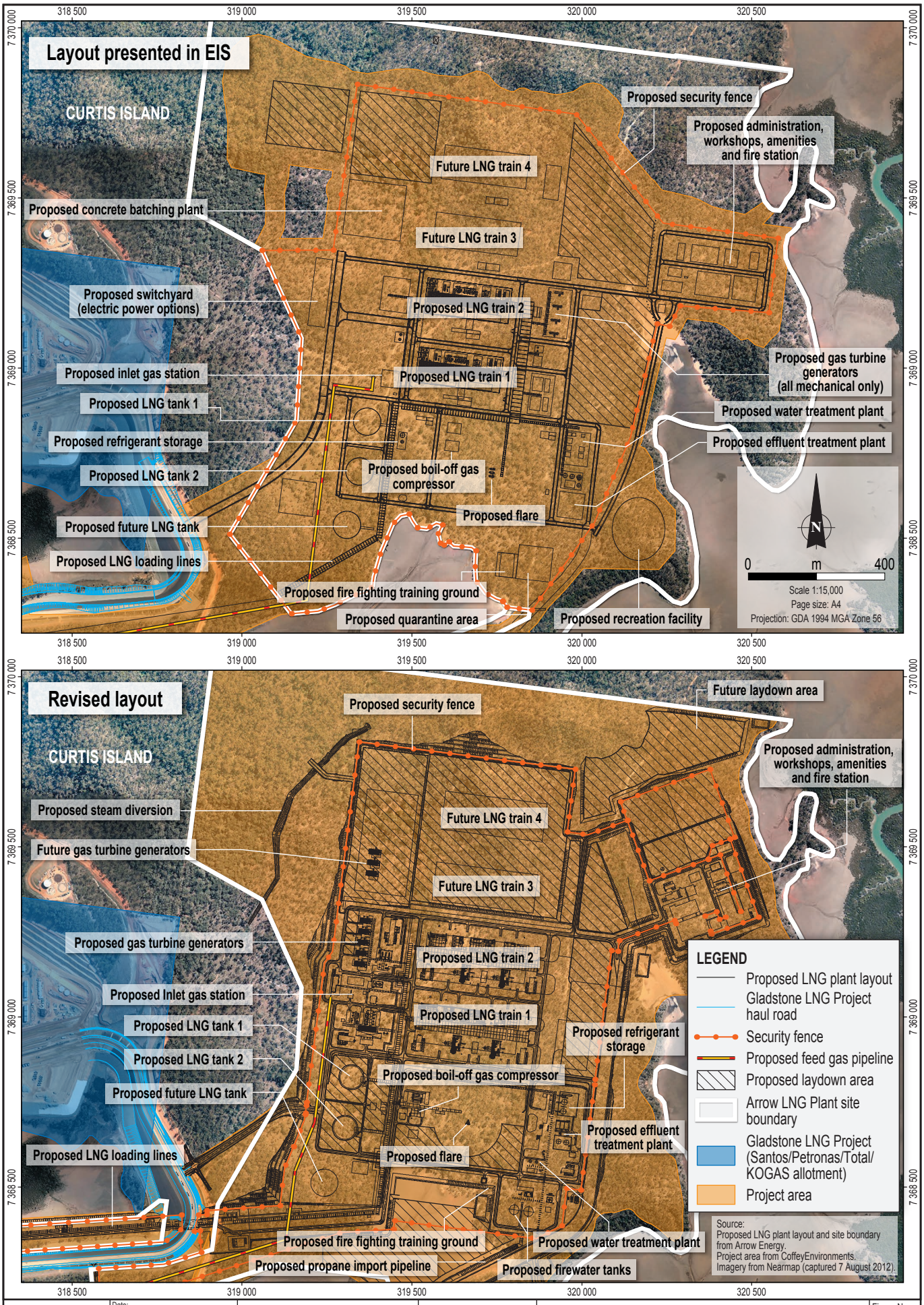
LNG plant and ancillary infrastructure

Figure No: 1.1



coffey environments	Date: 10.12.2012 MXD: 7033CC_16_GIS023_v1_2 File Name: 7033_MNES1_F01.02__GIS_HB	Arrow Energy Arrow LNG Plant	arrow energy go further	LNG plant layout	Figure No: 1.2

The public submissions relating to MNES are provided in Appendix B of this attachment, along with cross references to the corresponding section of the EIS, the SREIS, and/or this attachment where each comment is addressed. Further details of the responses to public submissions on the EIS are provided in Part B of the SREIS. Part B also presents information about the public exhibition period and the process for lodgement of submissions on the EIS, and statistics on the number and variety of submissions received during the EIS review period.

1.5 MNES Project Commitments

The project commitments included as Attachment 8 of the EIS have been reviewed to address changes to the project layout and submissions to the EIS, and where necessary have been revised. New commitments developed during the studies completed for the SREIS to address the management of MNES are provided in Appendix C and in the relevant sections of this attachment as they pertain to specific MNES. Commitments provided in Appendix 1 of the MNES attachment to the EIS are still applicable.

2. WORLD HERITAGE AND NATIONAL HERITAGE VALUES

This section addresses the following MNES:

- World Heritage properties.
- National Heritage places.

2.1 Assessment

The Great Barrier Reef World Heritage Area (GBRWHA), which is also listed on the National Heritage List, is the only World or National Heritage property or place with the potential to be impacted by the project. The GBRWHA is the world's largest World Heritage property and is listed for its outstanding natural heritage values; the specific qualifying values are outlined in Table 2.1.

The qualifying values of the GBRWHA are assessed against significant impact criteria detailed in the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009).

The change in the potential impact as a result of the changes in project design, or as a result of further information being obtained, is outlined in Table 2.2 for the World Heritage and National Heritage values of the Great Barrier Reef.

The values of the Great Barrier Reef recognised on the Natural Heritage List, have been derived from the World Heritage Listing, and potential significant impacts on World Heritage values discussed in both the MNES attachment to the EIS and the MNES attachment to the SREIS, apply to National Heritage values.

Table 2.1 World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area

World Heritage criterion		Associated National Heritage criteria	World Heritage values of the Great Barrier Reef – specific aspects	Relevant significant impact criteria*
vii	Contain superlative natural phenomena or areas of exceptional natural beauty and aesthetic importance.	Events, processes. Aesthetics characteristics.	• Natural beauty above and below the water. • Complex string of reefal structures. • Vast mosaic patterns of reefs, islands and coral cays. • Whitsunday Islands provide a magnificent vista of green vegetated islands and spectacular sandy beaches spread over azure waters. • Vast mangrove forests in Hinchinbrook Channel. • Rugged vegetated mountains and lush rainforest gullies that are periodically cloud-covered on Hinchinbrook Island. • Globally important breeding colonies of seabirds and marine turtles on many of the cays. • Raine Island is the world's largest green turtle breeding area. • On some continental islands, large aggregations of over-wintering butterflies periodically occur. • Spectacular coral assemblages of hard and soft corals. • Thousands of species of reef fish provide a myriad of brilliant colours, shapes and sizes. • Internationally renowned Cod Hole near Lizard Island. • Annual coral spawning. • Migrating whales. • Nesting turtles. • Significant spawning aggregations of many fish species.	Geology or landscape values. Biological and ecological values. Wilderness, natural beauty or rare or unique environmental values.

Table 2.1 World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area (cont'd)

World Heritage criterion		Associated National Heritage criteria	World Heritage values of the Great Barrier Reef – specific aspects	Relevant significant impact criteria*
viii	Be outstanding examples representing major stages of earth's history, including the record of life, significant on-going geological. processes in the development of landforms, or significant geomorphic or physiographic features.	Events, processes. Research. Principal characteristics of a class of places.	• Outstanding example of an ecosystem that has evolved over millennia. • Exposed and flooded by at least four glacial and interglacial cycles, and over the past 15,000 years reefs have grown on the continental shelf. • During interglacial periods, rising sea levels caused the formation of continental islands, coral cays and new phases of coral growth. • Environmental history can be seen in cores of old massive corals. • World's largest coral reef ecosystem, ranging from inshore fringing reefs to mid-shelf reefs, and exposed outer reefs, including examples of all stages of reef development. • Processes of geological and geomorphological evolution are well represented, linking continental islands, coral cays and reefs. • Varied seascapes and landscapes moulded by changing climates and sea levels, and the erosive power of wind and water, over long time periods. • Continental slope and deep oceanic waters and abyssal plains.	Geology or landscape values. Wilderness, natural beauty or rare or unique environmental values.

Table 2.1 World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area (cont'd)

World Heritage criterion		Associated National Heritage criteria	World Heritage values of the Great Barrier Reef – specific aspects	Relevant significant impact criteria*
ix	Be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals.	Events, processes. Research. Principal characteristics of a class of places.	• Globally significant diversity of reef and island morphologies reflects ongoing geomorphic, oceanographic and environmental processes. • The complex cross-shelf, longshore and vertical connectivity is influenced by dynamic oceanic currents and ongoing ecological processes such as upwellings, larval dispersal and migration. • Ongoing erosion and accretion of coral reefs, sand banks and coral cays combine with similar processes along the coast and around continental islands. • Extensive beds of *Halimeda* algae represent active calcification and accretion over thousands of years. • Evidence exists for the evolution of hard corals and other fauna. • Globally significant marine faunal groups include over 4,000 species of molluscs, over 1,500 species of fish, plus a great diversity of sponges, anemones, marine worms, crustaceans, and many others. • Establishment of vegetation on the cays and continental islands exemplifies the important role of birds, such as the pied imperial pigeon, in processes such as seed dispersal and plant colonisation. • Human interaction illustrated by numerous shell deposits (middens) and fish traps, plus the application of story places and marine totems.	Biological and ecological values. Wilderness, natural beauty or rare or unique environmental values.

Table 2.1 World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area (cont'd)

World Heritage criterion		Associated National Heritage criteria	World Heritage values of the Great Barrier Reef – specific aspects	Relevant significant impact criteria*
x	Contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of outstanding universal value from the point of view of science or conservation.	Events, processes. Rarity. Research. Principal characteristics of a class of places.	• One of the richest and most complex natural ecosystems on earth, and one of the most significant for biodiversity conservation. • Supports tens of thousands of marine and terrestrial species, many of which are of global conservation significance. • The world's most complex expanse of coral reefs. • Contains some 400 species of corals in 60 genera. • Large ecologically important inter-reefal areas. • The shallower marine areas support half the world's diversity of mangroves and many seagrass species. • The waters also provide major feeding grounds for one of the world's largest populations of the threatened dugong. • At least 30 species of whales and dolphins occur here, and it is a significant area for humpback whale calving. • Six of the world's seven species of marine turtle occur in the GBRWHA. • As well as the world's largest green turtle breeding site at Raine Island, the GBRWHA also includes many regionally important marine turtle rookeries. • Some 242 species of birds have been recorded in the GBRWHA. • Twenty-two seabird species breed on cays and some continental islands, and some of these breeding sites are globally significant. • The continental islands support thousands of plant species, while the coral cays also have their own distinct flora and fauna.	Geology or landscape values. Biological and ecological values. Wilderness, natural beauty or rare or unique environmental values.

* Note that the significant impact category of 'Historic heritage values' is not relevant to the GBRWHA, as the GBRWHA is not listed as a World Heritage property for its cultural heritage values.

Table 2.2 Change in potential impact to World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area

Relevant significant impact category*	Significant impact criteria	Project component with the potential to cause impact	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and change in potential impact
Geology or landscape values	• Damage, modify, alter or obscure important geological formations in a World Heritage property.	Construction of terrestrial and marine project infrastructure.	No significant impact. Geological formations will not be adversely affected.	No. No change to the potential impact.
	The Geology, Landform and Soils assessment in the EIS (Chapter 11) concluded that the study area is characterised by folded, steeply dipping, well-jointed, variable strength, variably weathered sedimentary sequences of mudstone and siltstone outcrops. No important features were identified in the project area, and impacts to geological formations on Curtis Island are limited to a localised area of the industrial precinct. Therefore, no significant impacts were identified on important geological formations in a World Heritage property. No further assessment was required in the SREIS as changes to project design were not significant in relation to geology, landform and soils.			
	• Damage, modify, alter or obscure landforms or landscape features, for example, by excavation or infilling of the land surface in a World Heritage property.	Construction of terrestrial project infrastructure.	No significant impact. Impacts to landscape features will be localised and confined within the designated industry precinct on Curtis Island.	No. No change to the potential impact.
	The geology, landform and soils assessment in the EIS (Chapter 11) concluded that the Gladstone urban region is characterised by large scale artificial alteration associated with rapid recent industrial development. Levelling during the construction of various developments and roads has significantly altered the former natural landscape, with disturbance, alteration and removal of soils and landforms, as well as large areas of reclaimed land. The study area does not contain landform sites listed on the Australian Heritage Register. No further assessment was required in the SREIS as changes to project design were not significant in relation to geology, landform and soils.			

Table 2.2 Change in potential impact to World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area (cont'd)

Relevant significant impact category*	Significant impact criteria	Project component with the potential to cause impact	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and change in potential impact
Geology or landscape values (cont'd)	• Modify, alter or inhibit landscape processes, for example, by accelerating or increasing susceptibility to erosion, or stabilising mobile landforms, such as sand dunes, in a World Heritage property.	Construction of terrestrial project infrastructure.	No significant impact. Erosion and sediment control measures will be implemented, which will prevent the modification, alteration or inhibition of landscape progresses.	No. No change to the potential impact.
	The geology, landform and soils assessment in the EIS (Chapter 11) concluded that the large scale earthworks will result in major topographic and landscape system changes, including major localised disruption or removal of landform and soils. Although the project design avoids most steep slopes or will remove them through earthworks, the large scale earthworks on Curtis Island could cause slope instability, particularly where steep hills are partially removed, and along the side slopes of the Boatshed Point haul road. The project was designed to limit the amount of excavation required on Curtis Island as far as is practicable to reduce the topographic impact. General mitigation measures were developed in accordance with the industry standard management guidelines (International Erosion Control Association Best Practice Erosion and Sediment Control Manual (IECA, 2008), Australian Pipeline Industry Association Code of Environmental Practice for Onshore Pipelines (APIA, 2009)). Successful implementation of erosion control plans and rehabilitation plans will reduce the magnitude of impact. Successful rehabilitation of the LNG plant site will produce a stable, safe, non-polluting landform with self sustaining soil fertility; and it will reduce the long term significance of impacts. Therefore, no significant impacts were identified on landscape processes in a World Heritage property, as impacts are localised within an industrial precinct and will be managed by erosion control plans and rehabilitation plans. No further assessment was required in the SREIS as changes to project design were not significant in relation to geology, landform and soils.			

Table 2.2 Change in potential impact to World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area (cont'd)

Relevant significant impact category*	Significant impact criteria	Project component with the potential to cause impact	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and change in potential impact
Geology or landscape values (cont'd)	• Divert, impound or channelise a river, wetland or other water body in a World Heritage property.	Construction of terrestrial project infrastructure.	No significant impact. No rivers, wetlands or other waterbodies will be impounded.	No. No change to the potential impact.
	The Surface Water, Hydrology and Water Quality assessment in the EIS (Chapter 13) concluded that several ephemeral waterways will be infilled during construction of the LNG plant on Curtis Island, with subsequent stream diversions needed to control overland flow from three of the subcatchments within the area. Advice from DERM stated that the drainage features in the project area on Curtis Island are not watercourses as defined by the Water Act 2000. No freshwater wetlands are present within the project area. There is no connectivity to any higher order streams, wetlands or lakes. Therefore, no significant impact were identified on rivers, wetlands or other waterbodies in a World Heritage property, as impacts are limited to the removal of an ephemeral system of limited aquatic habitat value. No further assessment was required in the SREIS as changes to project design were not significant in relation to surface water, hydrology and water quality.			

Table 2.2 Change in potential impact to World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area (cont'd)

Relevant significant impact category*	Significant impact criteria	Project component with the potential to cause impact	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and change in potential impact
Geology or landscape values (cont'd)	• Substantially increase concentrations of suspended sediment, nutrients, heavy metals, hydrocarbons, or other pollutants or substances in a river, wetland or water body in a World Heritage property.	Construction of terrestrial project infrastructure. Operation of the LNG plant. Capital dredging in Port Curtis. Maintenance dredging in Port Curtis. Shipping movements.	No significant impact. Erosion and sediment control measures will be implemented in terrestrial parts of the project area. Dredging activities in Port Curtis will cause increases in suspended sediments. This increase will be short-term and localised.	Yes: • Hydrodynamic and coastal processes. • Water quality. • Marine ecology. • Estuarine ecology. No change to the potential impact.
	The Surface Water, Hydrology and Water Quality assessment (Chapter 13) and Marine Water Quality and Sediment assessment (Chapter 16) in the EIS, concluded that with implementation of erosion and sediment control measures in terrestrial environments, and implementation of spill prevention and response plans, there will be no substantial increase in concentrations of suspended sediment, nutrients, heavy metals, hydrocarbons, or other pollutants or substances in a river, wetland or water body in a World Heritage property. Stormwater will be managed across all project sites during construction and operation and will assist in controlling the runoff of sediment and other pollutants. No further assessment of surface water, hydrology and water quality was required in the SREIS as changes to project design were not significant in relation to this discipline. Additional marine water quality data was available for Port Curtis to that presented in the EIS and this additional information informed the design of the water quality sampling program undertaken for the SREIS. Impacts to water quality due to increased dredge volumes remained spatially the same as those reported in the EIS. Changes to the project description had a negligible influence on the significance of the predicted impacts to marine water quality in the study area. The predicted impacts and the management measures presented in the EIS remained valid. Therefore, impacts on marine water quality remain as assessed in the EIS, with no significant impact on water quality in Port Curtis likely.			

Table 2.2 Change in potential impact to World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area (cont'd)

Relevant significant impact category*	Significant impact criteria	Project component with the potential to cause impact	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and change in potential impact
Biological and ecological values.	• Reduce the diversity or modify the composition of plant and animal species in all or part of a World Heritage property.	Construction of terrestrial project infrastructure. Capital dredging in Port Curtis. Maintenance dredging in Port Curtis. Shipping movements.	No significant impact. While the project does involve vegetation clearance that provides habitat for fauna, and marine fauna may be affected by localised impacts from dredging activities, an increased risk of boat strike and localised construction noise (e.g., marine pile driving), this will not reduce the diversity or modify the composition of plant and animal species in the GBRWHA. EPBC listed threatened and migratory species for which the project is declared a controlled action are address in sections 3 and 4 of this attachment.	Yes: • Hydrodynamics and coastal processes. • Water quality. • Terrestrial ecology (species and ecological communities) • Shorebirds • Marine ecology. • Estuarine ecology (Calliope River). • Turtles and lighting. • Shipping. No change to potential impact.
	Further assessment of terrestrial ecology values and marine ecology values has been undertaken in studies completed for the SREIS (Chapters 15 – 19). The findings of these assessments concluded that there will be no significant impacts on MNES species or communities from the Arrow LNG Plant, with the exception of water mouse. The findings of these assessments relating to MNES are discussed in further detail in Section 3 of this attachment.			

Table 2.2 Change in potential impact to World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area (cont'd)

Relevant significant impact category*	Significant impact criteria	Project component with the potential to cause impact	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and change in potential impact
Biological and ecological values.	• Fragment, isolate or substantially damage habitat important for the conservation of biological diversity in a World Heritage property.	Construction of terrestrial project infrastructure. Capital dredging in Port Curtis. Maintenance dredging in Port Curtis.	No significant impact. The project will not interact with any habitat that is important for the conservation of biological diversity, and will therefore not fragment, isolate or substantially damage this important habitat. EPBC listed threatened ecological communities, and the habitats for EPBC listed threatened and migratory species (including marine species), are addressed in sections 3 and 4 of this attachment.	As above. No change to the potential impact within the World Heritage Area boundary. Potential impact to the water mouse (*Xeromys myoides*) due to disturbance of mangrove habitat at Boatshed Point and fragmentation of the sub-population west of Boatshed Point (see Section 3 of this attachment).
	Further assessment of terrestrial ecology values and marine ecology values has been undertaken in studies completed for the SREIS (Chapters 15 – 19). The findings of these assessments concluded that there will be no significant impacts on MNES species or communities from the Arrow LNG Plant, with the exception of water mouse. The findings of these assessments relating to MNES are discussed in further detail in Section 3 of this attachment.			
	• Cause a long-term reduction in rare, endemic or unique plant or animal populations or species in a World Heritage property.	Construction of terrestrial project infrastructure. Capital dredging in Port Curtis. Maintenance dredging in Port Curtis. Shipping movements.	No significant impact. While the project does involve interaction with fauna and/or fauna habitat (through vegetation clearance, dredging, vessel strike), this interaction will not cause a long-term reduction in any rare, endemic or unique plant or animal populations or species.	As above. No change to the potential impact. Sub-population of water mouse west of Boatshed Point may be further fragmented by the project but is unlikely to significantly impact the population of Curtis Island or Port Curtis (see Section 3 discussion).
	Further assessment of terrestrial ecology values and marine ecology values has been undertaken in studies completed for the SREIS (Chapters 15 – 19). The findings of these assessments concluded that there will be no significant impacts on MNES species or communities from the Arrow LNG Plant, with the exception of water mouse. The findings of these assessments relating to MNES are discussed in further detail in Section 3 of this attachment.			

Table 2.2 Change in potential impact to World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area (cont'd)

Relevant significant impact category*	Significant impact criteria	Project component with the potential to cause impact	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and change in potential impact
Biological and ecological values.	• Fragment, isolate or substantially damage habitat for rare, endemic or unique animal populations or species in a World Heritage property.	Construction of terrestrial project infrastructure. Capital dredging in Port Curtis. Maintenance dredging in Port Curtis.	No significant impact. As above, the project will involve some interaction with fauna and/or fauna habitat, however this is unlikely to fragment, isolate or substantially damage habitat for rare, endemic or unique animal species.	As above. No change to the potential impact.
	Further assessment of terrestrial ecology values and marine ecology values has been undertaken in studies completed for the SREIS (Chapters 15 – 19). The findings of these assessments concluded that there will be no significant impacts on MNES species or communities from the Arrow LNG Plant, with the exception of water mouse. The findings of these assessments relating to MNES are discussed in further detail in Section 3 of this attachment.			
Wilderness, natural beauty or rare or unique environmental values.	• Involve construction of buildings, roads, or other structures, vegetation clearance, or other actions with substantial, long-term or permanent impacts on relevant values.	Construction of terrestrial project infrastructure.	No significant impact. Impacts to visual amenity will be localised and largely confined within the designated industry precinct on Curtis Island.	No. No change to the potential impact.
	The geology, landform and soils assessment in the EIS (Chapter 11) concluded that the Gladstone urban region is characterised by large scale artificial alteration associated with rapid recent industrial development. Levelling during the construction of various developments and roads has significantly altered the former natural landscape, with disturbance, alteration and removal of soils and landforms, as well as large areas of reclaimed land. The study area does not contain landform sites listed on the Australian Heritage Register. The project was designed to limit the amount of excavation required on Curtis Island as far as is practicable to reduce the topographic impact. General mitigation measures were developed in accordance with the industry standard management guidelines (International Erosion Control Association Best Practice Erosion and Sediment Control Manual (IECA, 2008), Australian Pipeline Industry Association Code of Environmental Practice for Onshore Pipelines (APIA, 2009)). Therefore. no significant impacts were identifiedon landforms or landscape features in a World Heritage Property, as impacts are localised within an industrial precinct in a significantly disturbed landscape of the Gladstone urban region. No further assessment was required in the SREIS as changes to project design were not significant in relation to geology, landform and soils.			

Table 2.2 Change in potential impact to World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area (cont'd)

Relevant significant impact category*	Significant impact criteria	Project component with the potential to cause impact	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and change in potential impact
Wilderness, natural beauty or rare or unique environmental values.	• Introduce noise, odours, pollutants or other intrusive elements with substantial, long-term or permanent impacts on relevant values.	Construction of terrestrial project infrastructure. Operation of the LNG plant.	No significant impact. While the project will cause localised increases in noise levels and the release of some pollutants to the atmosphere, this will not be of a sufficient scale to be considered substantial, or of sufficient duration to be considered long-term or permanent.	No. No change to the potential impact.
	The air quality assessment (Chapter 21) and noise and vibration assessment (Chapter 22) in the EIS concluded that project construction and operation activities will comply with air and noise criteria assuming implementation of the identified mitigation measures. Compliance with these criteria will ensure protection of environmental values within the study area and all sensitive receptor areas. Further assessment of impacts on air quality and from noise and vibration was undertaken in the SREIS due to changes in project design and layout. The findings of the supplementary noise and vibration impact assessment indicate that construction noise levels are generally consistent with those reported in the EIS (Section 11.4.4 of SREIS). With the application of additional feasible acoustic treatment and management measures the project noise criteria can be achieved at all noise sensitive receptors. Arrow Energy will manage project related noise generated during operation to comply with the project noise criteria at all assessment locations. The results of the supplementary air quality assessment are consistent with those of the air quality impact assessment completed for the EIS (Section 8.6 of SREIS). The predicted impacts and the management measures presented in the EIS remain valid. There is no change to the worst-case scenario in terms of impacts of the project on air quality. The Arrow LNG Plant will be designed to comply with the air quality assessment criteria, which are based upon all relevant air quality standards and objectives. Compliance with these criteria will ensure protection of environmental values within the air quality impact assessment study area and all sensitive receptor areas.			

* Note that the significant impact category of 'Historic heritage values' is not relevant to the GBRWHA, as the GBRWHA is not listed as a World Heritage property for its cultural heritage values.

2.2 Discussion

The specialist technical studies undertaken for the SREIS identified changes to the potential project impacts to the World Heritage and National Heritage values of the Great Barrier Reef. These potential impacts all relate to marine ecology or terrestrial ecology through either direct disturbance or impacts upon habitat. The results of these studies included:

- *Hydrodynamic and coastal processes.* Further hydrodynamic modelling identified minor changes to current velocities within the vicinity of Boatshed Point and launch site 1. These changes will have a negligible influence on coastal processes in the study area as they occur over a small area within a large well-mixed dynamic environment. Impacts to other coastal processes remain as assessed in the EIS. Detailed remodelling was carried out to determine the extent of changes to extreme low tide levels in the Calliope River following the dredging of the bar at the river mouth. Intertidal banks between the river mouth and a point near the Gladstone Power Station may be exposed by up to an additional 0.5 m on the lowest low tide (less than the 0.8 m predicted in the EIS).

  Preliminary modelling was also carried out to understand the potential maintenance dredging requirements at Boatshed Point and within the Calliope River. Sediment deposition in the Calliope River will be largely outside the dredged areas and at relatively small annual rates in navigable areas. Overall net sand transport within the river will not be affected by project activities. At the Boatshed Point MOF, the maximum rate of siltation is predicted to be up to 0.14 m/month in the manoeuvring basin and up to 0.2 m/month near the roll-on, roll-off berth. The extent, volume and frequency of maintenance dredging are not expected to be any greater than for capital dredging. Overall, the changes to the project description have a negligible influence on the predicted impacts to coastal processes and the hydrodynamic environment in the study area.

  Therefore, there will be no significant impact on World Heritage and National Heritage values of the Great Barrier Reef as a result of changes to hydrodynamics and coastal processes.

- *Water quality.* Further data on existing water quality was obtained in the vicinity of projects sites. All water quality results were consistent with results from other recent monitoring studies carried out in Port Curtis and fit within long term ranges reported by the Department of Environment, Heritage and Planning. Impacts to water quality, due to increased dredge volumes, will be spatially the same as those reported in the EIS but will occur over a longer period. Impacts associated with maintenance dredging are consistent with those presented in the EIS. Impacts to water quality from increased volumes of hydrostatic test water discharge are not significant as water quality criteria will be met close to the point of discharge and will be limited of duration. Overall, project changes will have a negligible influence on the significance of the predicted impacts to marine water quality in the study area. The predicted impacts and the management measures presented in the EIS remain valid.

  A submission comment was received from DSEWPaC relating to the potential discharge of wastewater from the effluent treatment plant.

  The MNES attachment to the EIS describes that wastewater from the effluent treatment plant at Boatshed Point will only be discharged to Port Curtis under extreme circumstances. In the unlikely event that wastewater is discharged, it will be compliant with the ANZECC/ARMCANZ (2000) guidelines and water quality criteria will be satisfied at the edge of the mixing zone boundary (10 m from the discharge location).

Gladstone Regional Council (GRC) has installed two sewer mains under Port Curtis to service the LNG plants on Curtis Island. Pipelines for category A (sewer) and category B (trade waste) waste have been installed by HDD from RG Tanna Coal Terminal to Hamilton Point. The sewer mains are expected to have a capacity of 864 m^3 per day, which will be sufficient to meet peak construction demands for both the LNG plant and construction camp. As a consequence, FEED considered disposal of effluent via the sewer mains in lieu of an effluent treatment facility.

While disposal of wastewater via the GRC sewer mains is preferred, Arrow Energy will retain the option to develop an effluent treatment plant in the event the sewer mains are unavailable (e.g., they reach capacity). Consequently, an effluent treatment plant remains a wastewater treatment and disposal option for the proposed LNG plant.

The area that could be affected by any discharge, if it does occur, is shown in Figure 2.1; it does not include any seagrass habitat for marine megafauna (the nearest seagrass is approximately 500 m from Boatshed Point and the outfall), or any other sensitive heritage value. Modelled indicates that any discharge, if it occurred, would reach background levels only 17 m from the discharge point, which is negligible with respect to the scale of Figure 2.1.

Given the low likelihood of a wastewater discharge occurring, and that water quality criteria will be satisfied in the event of any discharge, and the lack of any sensitive areas (such as seagrass habitat for dugongs), any impacts that arise will be extremely localised and minor in nature. There is a very low likelihood of a wastewater discharge occurring that has a significant impact on the heritage values of the GBRWHA.

Therefore, there will be no significant impact on World Heritage and National Heritage values of the Great Barrier Reef as a result of changes to marine water quality.

- *Marine ecology.* This technical study identified changes in the areas of marine habitats directly affected by changes to the project design. Revised disturbance areas have decreased for mangroves (down from 5.8 ha to 4.7 ha (base case clearance, clearance for alternative case is 5.1 ha)), saltpan vegetation (from 58.2 ha to 55.01 ha) and reef and rock substrates (0.4 ha to 0.14 ha). Areas of disturbance have increased slightly for benthic (subtidal) zones and intertidal mudflats (5.31 ha to 5.64 ha). Removal or indirect loss of seagrass beds is not expected (as concluded in the EIS).
- *Estuarine ecology.* This study focussed on the impact on the hydrology and ecology of the Calliope River resulting from dredging of a 3.02 km long access channel required to support the construction and operation of the proposed launch site 1. The study determined that there would be an increased area of intertidal zone and an increased duration of exposure of the lower tidal mudflats along the Calliope River. These changes will provide extended foraging opportunities for shorebirds such as waders, at the expense of some reduced foraging opportunities for resident crustaceans and fishes. However, given the slight increase in duration of exposure (less than four per cent of the time), any impacts are most likely to be undetectable. No mangroves along the Calliope River are expected to be impacted by the predicted changes in tidal pattern either during the existing (pre-dredging) or new (post-dredging) conditions.

Source:
Proposed LNG plant layout, dredging, access channel extent, auxiliary facilities and associated marine infrastructure from Arrow Energy.
Project area and nominal location of ocean outfall from Coffey Environments.
Seagrass from DEEDI (2002)
Imagery from Nearmap (captured 7 August 2012).

coffey environments

Date: 10.12.2012
MXD: 7033CC_16_GIS125_v1_1
File Name: 7033_MNES1_F02.01_GIS_VS

Arrow Energy

Arrow LNG Plant

arrow energy go further

Area potentially impacted by treated effluent discharge

Figure No: 2.1

- *Turtles and lighting.* The detailed study of the potential impacts of LNG plant lighting on marine turtle hatchlings and adults found that the residual impacts of project lighting on turtles using beaches on Curtis and Facing islands will be reduced to a minimum with the implementation of a detailed lighting mitigation plan. Light from the plant will increase the extent of horizon illumination at some locations on Facing Island and Curtis Island beaches which will add to the existing artificial illumination in Port Curtis. This includes an increase in the amount of glow seen on turtle nesting beaches, which could increase the degree of misorientation and disorientation in hatchlings. The proposed flaring strategy will effectively minimise the impact of flaring on marine turtles in the Port Curtis region.
- *Terrestrial ecology.* Issues pertaining to terrestrial ecology are discussed in Section 3.1 and Section 3.2 of this attachment.

As outlined in Table 2.2, the assessment of the potential impacts of the project concludes that the project is unlikely to have a significant impact to the World Heritage and National Heritage values of the GBRWHA. The project will cause the loss of terrestrial vegetation and fauna habitat, disturb marine fauna habitat and adversely affect visual amenity. However, the implementation of the management and mitigation measures outlined in both the EIS and SREIS will reduce these impacts to below a level of significance. Mitigation measures pertaining to World Heritage and National Heritage values of the GBRWHA remain as presented in Section 6.1 of the MNES Attachment to the EIS (and are shown in Appendix C to this attachment). New commitments resulting from additional studies undertaken for the SREIS, relating to MNES species and communities are presented in Section 3 of this attachment.

As the impacts will be below the level of significance, offsets for MNES will not be required to compensate for a residual significant impact. Section 5 of this attachment provides discussion on offsets considerations for all MNES for which the project is declared a controlled action that may be subject to a significant level of impact.

2.2.1 Findings of the UNESCO World Heritage Committee

A submission was received from a member of the public relating to the recommendations of the UNESCO World Heritage Committee for the management of the GBRWHA.

In June 2012, the UNESCO World Heritage Committee released a ‘State of Conservation’ report for some World Heritage properties, including the GBRWHA. This report included a number of findings regarding the management of the GBRWHA. The report made the following findings (UNESCO WHC, 2012):

> The World Heritage Committee…
>
> Notes with great concern the potentially significant impact on the property’s Outstanding Universal Value resulting from the unprecedented scale of coastal development currently being proposed within and affecting the property, and further requests the State Party to not permit any new port development or associated infrastructure outside of the existing and long-established major port areas within or adjoining the property, and to ensure that development is not permitted if it would impact individually or cumulatively on the Outstanding Universal Value of the property…
>
> [and]
>
> Requests moreover the State Party [Australian Government] to undertake an independent review of the management arrangements for Gladstone Harbour, that will result in the optimization of port

development and operation in Gladstone Harbour and on Curtis Island, consistent with the highest internationally recognized standards for best practice commensurate with iconic World Heritage status

The project is proposed to be constructed and operated within a long-established major port area (Port Curtis), within the Gladstone State Development Area, which is established specifically for the development of large-scale, heavy industry. The commissioning of the independent review of the management arrangements for Port Curtis is the responsibility of the Australian Government, and is out of Arrow Energy's control; Arrow Energy can only operate within the statutory framework established by the various levels of government. Accordingly, no aspect of the project that is within Arrow Energy's control is inconsistent with the findings of the UNESCO World Heritage Committee.

2.2.2 Cumulative Impacts to Heritage Values

The Arrow Energy LNG Plant is one of four LNG projects that are currently under construction, or that will be constructed, within the Gladstone State Development Area of Curtis Island. There are also multiple dredging projects either underway, or that will be undertaken, within Port Curtis. This includes Stage 2 of the Western Basin Dredging and Disposal (WBDD) project, which is the only other dredging project that will be undertaken concurrently with the dredging associated with the project. Curtis Island and Port Curtis are included within the GBRWHA.

Cumulative impacts of relevance to the Arrow LNG Plant fall into three key categories:

- Marine environment.
- Terrestrial environment.
- Landscape and visual.

Section 6.5 of the MNES Attachment to the EIS, discusses the potential cumulative impacts that may occur as a result of the multiple projects. Cumulative impacts to World Heritage and National Heritage values of the GBRWHA remain as presented in the EIS.

3. THREATENED ECOLOGICAL COMMUNITIES AND SPECIES

This section addresses the MNES of EPBC Act listed threatened ecological communities and species.

Additional desktop and field survey information on terrestrial threatened ecological communities and species, to inform the SREIS, was provided by 3D Environmental and EcoSmart Ecology in the Terrestrial Ecology Supplementary EIS Study. The survey and assessment methodology is detailed in Section 4 of the Supplementary EIS Study and complies with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009).

Additional desktop and field survey information on threatened marine species, to inform the SREIS, was provided by Coffey Environments Australia in the Technical Study of Port Curtis Marine Ecology. The survey and assessment methodology is detailed in Section 4 of the Supplementary EIS Study and complies with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009).

Further discussion and details of the revised assessment of threatened terrestrial and marine ecological communities and species are included in Chapter 18, Terrestrial Ecology, of the SREIS, Section 18.6, Floristic Assessment and Section 18.7, Fauna Assessment and Chapter 15, Marine Ecology of the SREIS.

3.1 Change in Potential Impact to Threatened Ecological Communities

The EPBC Protected Matters Searches, literature review and field surveys for the EIS identified four threatened ecological communities as being present or potentially present in and adjacent to the project area, based on their likelihood of occurrence according to distribution.

3.1.1 Assessment

Field surveys for the EIS confirmed the presence of one threatened ecological community listed under the EPBC Act. This was the 'critically endangered' 'Littoral Rainforest and Coastal Vine Thickets of Eastern Australia'. Within the study area this community was represented by small pockets of low microphyll-notophyll vine forest, including a small pocket of vine forest situated on a small Holocene sand dune on the eastern side of Hamilton Point. This community was outside of the project area and would not be subject to clearance or fragmentation, and management measures were recommended to avoid and mitigate indirect impacts such as weed infestation.

The following three ecological communities were also identified in the EIS as potentially occurring within the region but unlikely to occur in the project area and were subsequently not located during terrestrial ecology field surveys for either the EIS. Additional desktop study and field survey undertaken for the SREIS confirmed that these communities are unlikely to be present in the project area:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) (endangered).

- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (endangered).
- Weeping Myall Woodlands (endangered).

A search of the EPBC database for the project area buffered to 50 km was undertaken for the SREIS to validate findings of the EIS.

The ecological community 'Coolibah – Black Box Woodlands of the Darling Riverine Plains and Brigalow Belt South Bioregions' (endangered) was identified during the search of the EPBC database as potentially occurring in the project area. This community was not located during field surveys, and habitat was not suitable. Identification is most likely due to an expansion of the search buffer associated with the protected matters search. Therefore, the MNES assessment for the project is not affected by the listing of this ecological community:

In addition, the 'Lowland Rainforest of Subtropical Australia' ecological community was listed under the EPBC Act as 'critically endangered' in November 2011, following the completion of the EIS report. A review of certified regional ecosystem (RE) mapping (DERM, 2009), undertaken by 3D Environmental for the SREIS, suggests that the component REs (12.3.1, 12.5.13, 12.8.3, 12.8.4, 12.8.13, 12.11.1, 12.11.10, 12.12.1, 12.12.16) of the community are not present in the study area. This finding was confirmed during terrestrial ecology field surveys carried out for the SREIS.

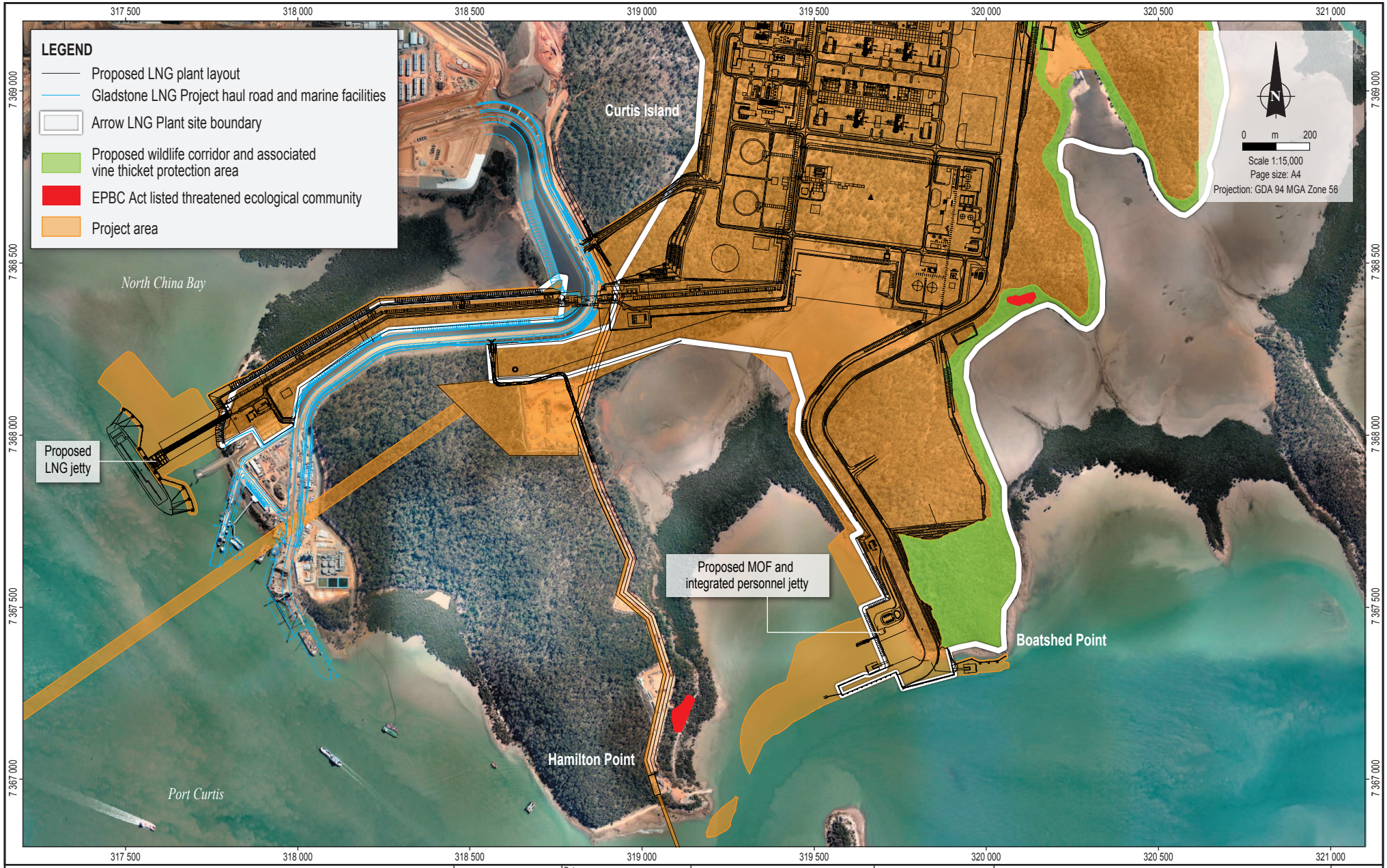
The EPBC listing came into effect after the Australian Government Environment Minister decided the project was a controlled action. Therefore, the MNES assessment for project is not affected by the listing of this ecological community.

3.1.2 Discussion

During field floristic surveys carried out for the SREIS, an amendment to existing vegetation mapping was identified regarding two small patches of vine thicket near the LNG plant site, to the northeast of Boatshed Point, at the eastern end of a beach ridge, separated by a narrow pinch (Figure 3.1). These two new patches of littoral vine thicket are consistent, in both landform and floristic structure, with a small patch of 'Littoral Rainforest and Coastal Vine Thickets of Eastern Australia' identified in the EIS at Hamilton Point. The two new patches have a combined total area of 0.41 ha.

The extent of the threatened ecological community, 'Littoral Rainforest and Coastal Vine Thickets of Eastern Australia' in the project area has changed in extent. The potential impact to the ecological community is discussed in this section.

The change in the potential impact as a result of the changes in project design, or as a result of further information being obtained, is outlined in Table 3.1.



Source:
EPBC Act listed threatened ecological communities from Ecosure and 3D Environmental.
Project area and proposed wildlife corridor from Coffey Environments.
Imagery from Nearmap (captured 7 August 2012).

coffey environments

Date: 10.12.2012
MXD: 7033CC_16_GIS051_v1_1
File Name: 7033_MNES1_03.01_GIS_GL

Arrow Energy

Arrow LNG Plant

arrow energy go further

Littoral rainforest and coastal vine thickets of eastern Australia (critically endangered) communities on Curtis Island

Figure No: **3.1**

Table 3.1 Change in potential impact to threatened ecological communities

Threatened ecological community	EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in significance of potential impact
Littoral Rainforests and Coastal Vine Thickets of South-Eastern Australia	Critically endangered	Present on the eastern side of Hamilton Point on Curtis Island.	No. The extent of the community will not be cleared or fragmented as a result of the project. Habitat and abiotic factors within the community will not be altered, and no burning or harvesting will take place.	Yes. The ecological community was confirmed on Curtis Island on the eastern side of Hamilton Point A further occurrence was also identified on a broad beach ridge to the northeast of Boatshed Point. There are two small patches of vine thicket at the eastern end of the beach ridge.	No. Discussed in Section 3.1.2.

Since the publication of the EIS, the haul road option on Hamilton Point has been discontinued. A horizontal directional drill (HDD) pad and easement for a high voltage line to the Arrow Energy LNG plant from the mainland runs up the eastern margin of Hamilton Point adjacent to existing services lines for Gladstone Area Water Board (GAWB). The GAWB service lines are immediately adjacent to the EPBC Act listed community. The Arrow Energy high voltage line is located on the western side of the GAWB service lines, approximately 25 m away from the area of coastal vine thicket.

The location of the beach ridge, along with the associated patches of littoral vine thicket northeast of Boatshed Point is shown on Figure 3.1.

The patches of critically endangered littoral vine thicket (corresponding to RE 12.2.2) northeast of Boatshed Point, and the community on Hamilton Point will not be cleared as they are avoided by the site layout. Although infrastructure avoids these areas, the community to the northeast of Boatshed Point and the community on Hamilton Point could be vulnerable to increased edge effects such as weed ingress, trampling from increased personnel movement and potentially increased fire frequency.

The proposed activities will not directly impact the habitat although have potential to cause degradation, particularly through facilitated weed invasion. These habitats represent an extremely small proportion of this ecological community's national extent (<0.01 %).

Commitments in relation to weed control (C17.09, C17.10 and C17.12, and vegetation clearing (C17.27 and C17.28) in the EIS remain unchanged and are shown in Appendix C to this attachment. Commitment C17.23 from the EIS has been amended to take into account the newly surveyed community on the northeast of Boatshed Point and now reads:

- Clearly mark no-go zones, where required, including the semi-evergreen vine thicket (*Cupaniopsis*) fenced area on Boatshed Point, and the critically endangered EPBC Act listed vine thicket communities on the eastern margin of Hamilton Point, and northeast of Boatshed Point. Signage will be erected around the margins of the communities to indicate restricted access (C17.23A).

Environmental management plans for the project will need to consider this community so that procedures for protection (weed control, fire management etc) and monitoring (habitat condition) are established prior to construction. New commitments to address this issue are as follows:

- Protect the EPBC Act listed community northeast of Boatshed Point and employ low impact methods of weed control within and adjacent to EPBC Act listed communities (C17.40).
- Establish a management buffer of suitable width and of contiguous natural vegetation, around the EPBC Act listed community northeast of Boatshed Point to minimise the potential for edge effects and limit the potential for weed invasion. The buffer will be defined in the Wildlife Corridor Management Plan to be developed prior to construction (C17.41).
- Implement fire control measures to prevent wildfire incursion into the EPBC Act listed communities. This may include construction of firebreaks or asset protection burning outside of the community and its associated buffer (C17.42).
- Detail the need to protect EPBC Act listed communities and explain mitigation measures that are to be implemented in workforce inductions (C17.43).

Measures to limit impacts on these communities will be addressed in environmental management plans to be developed, to ensure procedures for protection (weed control, fire management etc) and monitoring (habitat condition) are established prior to construction. Therefore, the project is not expected to have a direct or significant impact on the threatened ecological community.

3.2 Change in Potential Impact to Threatened Species (Terrestrial)

3.2.1 Species or Habitats Schedules Revision

Koala

On 2 May 2012, koala populations in Queensland, New South Wales and the Australian Capital Territory were listed as vulnerable under the EPBC Act. In order to list the Queensland/New South Wales/Australian Capital Territory koala population separately, the Minister had to nominate it under Section 517(1) of the EPBC Act as a separate species to the rest of the koala population. This was based on advice from the Threatened Species Scientific Committee (TSSC) to DSEWPaC (TSSC, 2012).

All new developments within koala habitat in Queensland, New South Wales or the Australian Capital Territory will now need to consider whether the development is likely to have a significant impact upon the koala, using the existing EPBC Act significant impact criteria for vulnerable species. Referral guidelines for the koala have been released and outline criteria for assessing ‘critical habitat’, ‘important populations’ and significant impacts. As this listing came after the Australian Government Environment Minister decided the project was a controlled action, the MNES assessment for the project is not affected by the listing.

The koala does not constitute one of the controlling provisions for the project. However, potential impacts to the terrestrial faunal values of the species and its potential habitat within the project area are addressed in the EIS.

To date, work necessary to comply with these criteria has not been undertaken or documented. Additional wet season field surveys are proposed for early 2013 and will include site assessment of potential mainland koala habitat in the project area. Potential essential habitat for koala has been identified on the mainland in the vicinity of TWAF 8. There are no records of the species at these sites. Current evidence suggests the species is rare in the local area, and absent from Curtis Island. It is questionable that the vegetation to be cleared is regularly inhabited by koala and impacts are unlikely to affect the abundance or distribution of the species.

Cupaniopsis Species

The EIS (Chapter 17, Terrestrial Ecology, Section 17.3.2) noted that the unidentified species of *Cupaniopsis,* recorded from an area of semi-evergreen vine forest at the southern extent of Boatshed Point, shares similar characteristics to the vulnerable wedge-leaf tuckeroo (*Cupaniopsis shirleyana*). All prior records of *Cupaniopsis shirleyana* within a 100 km buffer surrounding the project area have been re-assigned by the Queensland Herbarium to an undescribed taxon (*Cupaniopsis*), which, at the date of assessment, had not been assigned a hispid name. *Cupaniopsis shirleyana*, being restricted to the area between Gympie and Brisbane, is outside the scope of the project study area. The MNES assessment for the project is not affected by the undescribed taxon of *Cupaniopsis*.

3.2.2 Assessment

The change in the potential impact as a result of the changes in project design, or as a result of further information being obtained, is outlined in Table 3.2 for all threatened species, listed under the EPBC Act as either critically endangered, endangered or vulnerable, and identified in the EIS as having a moderate (including ‘low to moderate’) or higher likelihood of occurrence within the study area.

Desktop work undertaken for the supplementary terrestrial ecology study facilitated the development of species dossiers on threatened species (flora and fauna) likely to be present within the project area. The dossiers present a detailed analysis of the ecology of each species in question and how this relates to the activities of the Arrow LNG Plant. This includes status, species ecology, distribution and breeding, threats and occurrence in the region including any identified important populations or critical habitat.

The dossiers are structured to accord with the “Department of Environment’s significant impact guidelines 1.1 – Matters of national environmental significance”, particularly in relation to the definition of important populations and critical habitat. The dossiers are contained in Appendix 11, Terrestrial Ecology Supplementary EIS Study.

Any species that appears in database searches or the referrals (EPBC 2009/5007 and EPBC 2009/5008) for the project, that were considered unlikely to be present in the project area based on being out of range or the lack of suitable habitat present, were discounted and dossiers for these species were not produced. A summary of these species and the reasons for their omission from further study is presented in Appendix 11, Terrestrial Ecology Supplementary EIS Study and in Appendix D of this attachment. Species remaining as potentially present within the project area

are assessed in Chapter 18, Terrestrial Ecology to the SREIS, in Section 18.6.4 (flora) and Section 18.7.1 (fauna) respectively, and are discussed below.

Flora

A review of database searches undertaken for the EIS concluded that all potentially occurring species that have a conservation status under the EPBC Act or the *Nature Conservation (Wildlife) Regulation* were adequately accounted. No species were assessed as being likely to be present in the project area.

Site assessments validated the findings of the desktop review, and no conservation listed species were found. The value of habitats for conservation listed species was generally low, often due to the presence of an extensive range of exotic weed species. Where habitat was suitable (e.g., vine thicket areas) extensive supplementary searches were undertaken, but failed to locate any conservation listed species.

Impacts upon conservation listed flora species are unchanged from those assessed in the EIS, as the supplementary study validated the assessment that no conservation listed species were likely to be present in the project area. The Arrow LNG Plant will not have a significant impact on EPBC Act listed flora species.

Fauna

Database searches identified a number of species that were potentially present within the vicinity of the Arrow LNG Plant based on the expanded 50 km search area. Further refinement of the search results based on known range, likelihood of occurrence and habitat preferences identified that a large number of these species were unlikely to be present with the Arrow LNG Plant project area (Table 11 of Appendix 11, Terrestrial Ecology Supplementary EIS Study).

Of these discounted species, many were identified as potentially occurring within the Arrow LNG Plant study area in the EIS and associated MNES attachment. The Terrestrial Ecology Supplementary EIS Study (Appendix 11) sets out the detailed rationale behind their omission from detailed assessment in this study. Species include yellow chat (Dawson) (*Epthianura crocea macgregori*), yakka skink (*Egernia rugosa*) and collared delma (*Delma torquata*). The omission was largely based around further detail of the species range in the area, and understanding of habitat suitability (or rather lack of) in the Arrow LNG Plant project area.

Species of conservation significance under the EPBC Act identified as possibly occurring within the Arrow LNG Plant project area are presented in Table 3.2 and each species has a detailed dossier presented in Appendix 11, Terrestrial Ecology Supplementary EIS Study.

Table 3.2 Change in potential impact to threatened species (terrestrial)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in potential impact
Common name	**Scientific name**					
Mammals						
Water mouse	*Xeromys myoides*	Vulnerable	High	No. While a total of approximately 5 ha of mangrove habitat, on the mainland and Curtis Island, for the species will be cleared, this will not significantly contribute to the loss and fragmentation of habitat.	Yes. The presence of individuals was confirmed on Curtis Island, in the vicinity of Boatshed Point. This species was not captured in targeted trapping, although active searches located an active nest hollow in mangroves to the east of Boatshed Point, and an abandoned hollow and footprints in mangroves to the west of Boatshed Point. Habitat at mainland sites was assessed as sub-optimal.	Yes. Discussed in Section 3.2.2.

Table 3.2 Change in potential impact to threatened species (terrestrial) (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in potential impact
Common name	**Scientific name**					
Mammals (cont'd)						
Grey-headed flying-fox	*Pteropus poliocephalus*	Vulnerable	High	No. Recorded north of the study area just south of Graham Creek, and likely to be present in study area within similar habitat both on Curtis Island and the mainland, but on transitory basis. Impacts on species not likely to be significant, as no colonies, breeding camps or roosts were identified and potential foraging habitat cleared is a small proportion of that available in the wider region.	Yes. Moderate likelihood of assessment. A large temporary camp known from Calliope area, records of grey-headed flying foxes from both Curtis Island and in proximity to mainland sites but likely to relate to transitory individuals.	No. No flying-fox camps are known to occur within the project area footprint. The species is highly mobile, but may be affected by loss of foraging resources from the project area. Similar habitat occurs throughout much of Curtis Island and in large expanses of forest that occur on the mainland, so substantial foraging habitat remains within the local area. Due to the comparative abundance of similar resources within the local area, the loss of foraging trees associated with the development are not expected to significantly affect the local population.

Table 3.2 Change in potential impact to threatened species (terrestrial) (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in potential impact
Common name	**Scientific name**					
Birds						
Squatter pigeon	*Geophaps scripta scripta*	Vulnerable	High	No. Noted adjacent to study area on mainland, on numerous occasions during Arrow LNG Plant field surveys. Suitable habitat present within study area on mainland, especially around TWAF 8. Impacts on species not likely to be significant, as no critical habitat has been identified and foraging habitat cleared is a small proportion of that available in the wider region.	Yes. Expected (mainland only) to occur. The species is regularly recorded on the mainland including in the vicinity of TWAF 8, favouring open woodlands and low grassy habitats. It is widely distributed with no particular sites or habitat favoured or important populations identified.	No. Habitat loss through direct clearing (32 ha of probable habitat at TWAF 8 in alternative case) is minor in relation to surrounding abundant suitable habitat (in the vicinity of TWAF 8), and it is unlikely impacts on the species will be significant. Edge effects (e.g., weed infestation) could occur at this site but would be managed through weed control and implantation of the pest management plan. Increased abundance of predatory species such as feral cats and foxes at TWAF 8, increasing mortality and reducing reproductive success. The squatter pigeon is highly mobile and it is likely that individuals move over a broad area on the mainland, although it is likely to be absent from Curtis Island. Clearing on the mainland will affect only a minor portion of sub-optimal habitat.

Table 3.2 Change in potential impact to threatened species (terrestrial) (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in potential impact
Common name	**Scientific name**					
Reptiles						
Brigalow scaly-foot	*Paradelma orientalis*	Vulnerable	Moderate	No. Suitable habitat present, and found in similar habitat 12 km to southeast of study area on Boyne Island. Impacts on brigalow scaly-foot from the Arrow LNG Plant are not significant, as no individuals were identified and potential foraging habitat cleared is a small proportion of that available in the wider region.	Yes. Low likelihood of presence, as although potential habitat occurs on Curtis Island (dry sclerophyll forest with native ground cover) it is unlikely that resident populations are present based on closest records (away from Boyne Island) and lack of findings in survey work on Curtis Island.	No. Habitat loss through direct clearing (240 ha of possible habitat) is minor in relation to surrounding available suitable habitat on Curtis Island. No probable habitat was identified, and actual loss of habitat is dependent on the existence of resident populations. Impacts prior to mitigation are considered unlikely and the growing body of evidence suggests that a resident population is unlikely and the species does not occur outside of Boyne Island in the local area. Loss of vegetation is irreversible, but of low magnitude in context of surrounding values. Further survey effort will be conducted in early 2013 (wet season) to better understand the potential presence of the species within the project area. Surveys are expected to further support the evidence that the species is unlikely to be present on Curtis Island. Extensive fieldwork undertaken for other LNG projects on Curtis Island did not locate this species.

3.2.3 Discussion

Table 3.1 shows that the project is unlikely to have a significant impact on grey-headed flying-fox, squatter pigeon or brigalow scaly-foot (as assessed in the EIS). Commitments relating to terrestrial ecology will reduce the impacts on these species, if they are located in pre-clearance surveys (as shown in Appendix 1 of the MNES attachment to the EIS). New and revised commitments pertaining to terrestrial ecology that would benefit these species are as follows:

- Develop trench management procedures to prevent access of fauna into trenches. These procedures will include measures such as trench breakers and covers. In addition, inspection procedures will be established in order to remove trapped fauna, create protection and refuge areas for wildlife trapped in the trench and develop methods to assist trapped fauna left in the trench. (C17.36A)
- Clearly delineate clearing boundaries prior to clearing commencing to avoid unnecessary vegetation loss (C17.44).
- Where practical, stock-pile cleared vegetation in ‘wind-rows’ around the edge of retained vegetation. In addition to providing shelter, this will also provide some physical barrier reducing edge impact severity and the risk of weed spread (C17.45).
- Minimise the duration trenches are open, ensure daily trench inspections are undertaken by suitably qualified spotter/catchers and ensure that the length of open trench does not exceed that which can be inspected by the available spotter/catchers in any one daily period (C17.46).

The only MNES species where significant impacts are anticipated as a result of the Arrow LNG Plant is water mouse. These impacts are discussed below.

The water mouse (*Xeromys myoides*), listed as vulnerable under the EPBC Act, is known to occur in central Queensland within fringing mangroves and saltpan habitat, associated with regional ecosystems 12.1.3 and 12.1.2. The species was identified in the EIS as having potentially suitable habitat occurring in fringing mangroves in the intertidal zone along the mainland coastline and the southern section of Curtis Island.

The species was identified at the Australia Pacific LNG site on Curtis Island. No individuals or nest mounds were recorded in field surveys undertaken for the Arrow LNG Plant EIS.

Additional desktop review was undertaken for the SREIS to further assess potential water mouse habitat. Mainland sites appear to have little habitat value for the species due to heavy disturbance, smaller extent and isolation. The Curtis Island mangroves were assessed to be suitable habitat for the species, being relatively undisturbed, with large hollows and abundant prey in the vicinity of the project site.

During field surveys for the SREIS, the presence of water mouse was confirmed on Curtis Island, to the eastern side of Boatshed Point, where an active nesting hollow and feeding signs were discovered, though no specimens were directly identified. To the west of Boatshed Point an abandoned nesting hollow and footprints were found (see Figure 3.2).

Source:
Place names from DME. Watercourses from Alluvium.
Water mouse activity from 3D Environmental/EcoSmart Ecology.
Project area from Coffey Environments.
Imagery from Nearmap (captured 7 August 2012).

coffey environments

Date: 05.12.2012
MXD: 7033CC_16_GIS125_v1_1
File Name: 7033_MNES1_F03.02_GIS_GL

Arrow Energy

Arrow LNG Plant

arrow energy go further

Location of water mouse activity

Figure No: 3.2

Under the Australian Government's 'significant impact guidelines' for the species (policy statement 3.20), any population that has evidence of recent activity is considered important. Therefore the sub-populations located to the east and west of Boatshed Point are important, as defined under the guidelines.

Following the publication of the EIS, the project description, including layout of the LNG plant, has been revised such that the total area of mangroves to be cleared for the project (including mainland and Curtis Island sites) is approximately 4.7 ha for base case, or 5.1 ha for alternative case, which is not substantially different from the EIS, and less than 1% of mangrove habitat around Port Curtis.

The limited extent of clearing of the mangroves and adjoining habitat on Curtis Island is unlikely to significantly impact the water mouse. Loss of habitat is minimal compared to areas of retained habitat, and no nesting structures were recorded in surveyed areas to be cleared. Although project activities generally avoid mangrove areas, small areas of mangrove will be cleared at launch site 1, the LNG jetty at North China Bay and west of Boatshed Point.

On Curtis Island, clearance in North China Bay of 1.7 ha of mangrove to construct the LNG jetty (both cases) will take place in the context of an already extensively disturbed site. Shoreline habitats are already altered with reduced natural cover, increased lighting, and increased personnel and vehicle movements.

To the west of Boatshed Point, a corridor of 0.8 ha of mangrove will be cleared (both cases) to construct a haul road along the western shore of Boatshed Point. The small area of mangrove to be cleared is at the southeastern edge of a more extensive area of mangrove in this embayment. Any water mouse present are expected to be displaced into the retained area of mangrove away from disturbed areas. Signs of water mouse presence were noted in fieldwork and it is likely that a population occurs in this area.

Small areas of mangrove will be cleared at Red Rover Road for the potential laydown and staging area (0.6 ha in alternative case) and TWAF 7 (0.2 ha in base case). This clearance is not of mangrove habitat assessed as being suitable for water mouse.

Construction of infrastructure has the potential to create movement barriers, and modification of shoreline habitat between areas of habitat has the potential to affect movement and therefore increase isolation of local sub-populations. Passage of the population west of Boatshed Point south to and from North China Bay is doubtful due to construction activities of other LNG proponents at this site. Construction of infrastructure on the western side of Boatshed Point for the Arrow LNG Plant (the MOF) is likely to create a movement barrier for water mouse moving either to the east or west and other areas of mangrove habitat.

The population west of Boatshed Point is already separated from more extensive areas of mangrove by rocky headlands to the west and east, although some movement across these headlands is likely to take place.

The Arrow Energy LNG plant will contribute to the additional fragmentation and increased edge effects, of one small area of known habitat within a broader length of coastline that has already experienced substantial disturbance.

As movement from the west and north is already inhibited by construction for other LNG plants around North China Bay and the west coast of Curtis Island, the barrier of movement to and from the east for the western Boatshed Point sub-population is the most significant project related impact. The Curtis Island water mouse population is likely to be formed by a chain of sub-populations in the bays between headlands on south Curtis Island, with some movement between these sub-populations likely, although the rate of movement is unknown. Fragmentation of the population to the west of Boatshed Point is already taking place to the west, and the effect of further fragmentation to the east is unknown without knowledge of the genetic diversity of these sub-populations, movement between the sub-populations and the size of the sub-populations. Any movement taking place to the east from this sub-population needs to take place across sub-optimal rocky habitat, but nevertheless the construction of the MOF will likely inhibit movement further than is naturally the case at this site. If permanent, the loss of connectivity for the western Boatshed Point sub-population could reduce the population viability, although large extents of mangroves will be retained in this area.

The Arrow LNG Plant will contribute to the isolation of one small patch of known habitat to the west of Boatshed Point. In the context of overall cumulative impact, the potential loss of this local population is not likely to be significant in the context of the wider population on Curtis Island and around Port Curtis.

In the long term, a decommissioning plan will be developed for the Arrow LNG Plant. This plan will consider options for removal of the MOF at Boatshed Point, which would facilitate passage to and from the bay to the west of Boatshed Point.

Project lighting could impact on water mouse by increasing predation pressure, altering foraging and disposal patterns, reducing prey abundance and leading to abandonment of nesting hollows. Increased predator abundance (particularly pest fauna) may occur as a result of project activities. Changes in natural hydrology, modified water levels and salinity in tidal waterways may affect water mouse and their prey.

The cumulative impact of other LNG developments already under construction on Curtis Island is likely to reduce connectivity between larger, less disturbed areas of habitat to the north (i.e., Graham Creek) from habitats in the south (e.g., Endfield Creek). This impact reduces the value of this locality as significant water mouse habitat, leading to the likely isolation of any local populations occurring along the southwest coast.

Approximately 5.1 ha of mangrove habitat will be cleared for the Arrow LNG Plant, which is 24% of the total clearance within Port Curtis for all projects assessed. Total clearance in Port Curtis forms 0.04% of the total extent of the RE within the bioregion.

In the context of cumulative impacts, due to the broader extent of suitable habitat in region, any localised reduction in the occupancy of the species at the Boatshed Point location is not considered significant and will not threaten survival of the species.

Table 3.3 summarises the revised assessment of water mouse under MNES referral guidelines

Table 3.3 Assessment of water mouse under MNES referral guidelines

Criteria	Evaluation
'Important population'	Yes, under the Significant impact guidelines for the vulnerable water mouse *Xeromys myoides* (DEWHA 2009) and important population is one that shows evidence of recent activity. Recent activity was observed during our surveys.
Criteria 1: lead to a long-term decrease in the size of an important population.	Clearing is unlikely to lead to a decrease in population size. The long-term viability of the sub-population to the west of Boatshed Point is unclear due to isolation. The loss of this sub-population would reduce the size of the broader Curtis Island population. The long-term viability of other sub-populations along the southwest shoreline of Curtis Island from other LNG developments remains unclear.
Criteria 2: reduce the area of occupancy of an important population	Should isolation lead to the loss of the sub-population to the west of Boatshed Point, the area of occupancy of this species will be reduced although in the context of overall cumulative impact, the potential loss of this local population is not likely to be significant in the context of the wider population on Curtis Island and around Port Curtis. Other areas of extensive habitat within Port Curtis, which are likely to be occupied, will not be affected. Other areas of extensive habitat within Port Curtis, which are likely to be occupied, will not be affected.
Criteria 3: fragment an existing important population	Yes, development on Boatshed Point is likely to isolate movement of west of Boatshed Point sub-population to the east. Existing approvals and operations at Hamilton Point have already impacted possible northward passage along the west coast of Curtis Island.
Criteria 4: adversely affect habitat critical to the survival of the species	It is unlikely that the sub-population to the west of Boatshed Point is critical to the survival of the species. In the context of overall cumulative impact, the potential loss of this local population is not likely to be significant in the context of the wider population on Curtis Island and around Port Curtis. Other areas of extensive habitat within Port Curtis, which are likely to be occupied, will not be affected.
Criteria 5: disrupt the breeding cycle of an important population	Unlikely. While lighting has some potential to affect breeding, light pollution in mangroves is diluted rapidly. Further, light management practices will be implemented to reduce this impact.
Criteria 6: modify, destroy, remove or isolate or decrease habitat leading to the decline of the species	It is possible that isolation could lead to the loss of the sub-population in habitat to the west of Boatshed Point. While this could lead to a small decline of the species in the Port Curtis area, impacts do not affect the species across its broader range and other areas of extensive habitat within Port Curtis, which are likely to be occupied, will not be affected.
Criteria 7: result in the establishment of an invasive species	No, predators such as foxes, cats and dogs are already established. Mitigation measures will be implemented to reduce the risk of development actions leading to an increase in predator abundance.
Criteria 8: introduce a disease	No. Disease has not been identified as a main threat to water mouse. The pest management plan (Appendix 10 to the EIS) and quarantine management plan to be developed for the project will detail the measures to prevent the introduction and spread of disease.
Criteria 9: interfere with the recovery of the species	No. The project will not result in threatening processes identified in the recovery plan for the species. A quarantine management plan and control of invasive weeds and pest fauna will support measures to reduce the decline in the species.

Arrow Energy has proposed a series of mitigating measures, for incorporation into pre-construction management plans to address potential impacts to the water mouse. These measures are to lessen any potential impacts due to habitat loss and degradation, reduction of movement and dispersal potential, lighting, introduced predators and alteration of water quality. Commitments additional to those presented in the EIS are as follows:

Consider measures to minimise light emitted from the LNG plant during the detailed design of the LNG plant including:

- Assess the necessity and choice of lighting in the plant area:
  - Use low-pressure sodium (LPS) lights as a first-choice light source and high-pressure sodium (HPS) lights where LPS is not practical.
  - Replace short-wavelength light with long-wavelength light and exclude short-wavelength light with the use of filters.
  - Avoid using halogen, metal halide or fluorescent lights (white lights) where possible, and only use white lights in contained areas where colour rendition is required.
  - Minimise the number and wattage of lights, and recess lighting into structures where possible.
- Use timers and motion-activated light switches.
- Use reflective materials to delineate equipment or pathways and use embedded lighting for roads.
- Position doors and windows on the sides of buildings facing away from marine turtle nesting beaches and install and use window coverings to reduce light emissions.
- Maintain elevated horizons (such as topographic features, vegetation or barriers) to screen rookery beaches from light sources (C17.47).
- Design infrastructure to reduce impacts on shoreline habitat, where possible, and reduce the risk of unnecessary clearing by demarcating disturbance areas (C17.49).
- Reduce lighting wherever possible, in locations where movement between water mouse foraging and nesting habitats (e.g., between mangroves and the supralittoral zone) occurs (C17.50).

The terrestrial ecology technical study that informs the SREIS states that a detailed water mouse management plan will be developed. The plan will detail procedures during construction and operation of the Arrow LNG Plant, specifically including shoreline management and rehabilitation following decommissioning. Timelines and responsibility for completing the work will be included, and the plan will be developed and approved by a suitably qualified ecologist with a working knowledge of the species.

The revised conclusion to the SREIS is that the residual impacts on the species are not significant, although impacts on the sub-population west of Boatshed Point will be significant. Offsets for the species under the EPBC Act are not considered necessary, as no areas of critical habitat will be cleared for the project. It is not possible to satisfactorily offset against impacts from fragmentation, although any offset of mangrove and saltpan vegetation habitat that Arrow Energy

will undertake under state vegetation offsets legislation is expected to have benefits for security of potential water mouse habitats elsewhere.

3.3 Change in Potential Impact to Threatened Species (Marine)

3.3.1 Assessment

Changes in potential impacts as a result of the changes in project design, or as a result of additional information being obtained, are outlined in Table 3.4 for all marine threatened species, listed under the EPBC Act as either critically endangered, endangered or vulnerable, and identified in the EIS as having a moderate (including 'low to moderate') or higher likelihood of occurrence within the study area.

Six marine turtle species were identified in database searches as possibly occurring in the project area, and were further assessed following a desktop review and field surveys conducted for the EIS.

The Arrow LNG Plant Marine Ecology (Turtles) Technical Study: Curtis Island Baseline Light Monitoring (Appendix 9) investigated the potential for light (glow and glare) from the LNG plant and the associated flare stack (flaring) to impact on nearby marine turtle rookeries (i.e., loggerhead, flatback and green turtle populations) at Curtis and Facing islands.

Further discussion and details of the revised assessment of marine threatened species is included in Chapter 15, Marine Ecology of the SREIS.

Table 3.4 Change in potential impact to threatened species (marine)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in potential impact?
Common name	**Scientific name**					
Loggerhead turtle	*Caretta caretta*	Endangered (also listed as migratory)	High	No. No nesting sites located within the study area. Nearest breeding site is approximately 60 km away at Deepwater National Park. Potential foraging habitat is a small proportion of that available in the wider region.	Yes, further investigations were conducted to identify likely impacts on loggerhead turtles at nearby turtle nesting beaches to flaring, glow and glare from LNG plant lighting. Changes to marine infrastructure and marine ferry movements prompted further investigation into the significance of impacts of vessel strikes and underwater noise (pile driving) There is no change to likelihood of occurrence.	No. Lighting Yes (improvement) Vessel strikes Yes (improvement). Underwater noise – pile driving. Discussed in Section 3.3.2.
Leatherback turtle	*Dermochelys coriacea*	Endangered (also listed as migratory)	Moderate	No. Potential foraging habitat is a small proportion of that available in the wider region.	Changes to marine infrastructure and marine ferry movements prompted further investigation into the significance of impacts of vessel strikes and underwater noise (pile driving) There is no change to likelihood of occurrence.	Yes (improvement) Vessel strikes Yes (improvement). Underwater noise – pile driving. Discussed in Section 3.3.2.

Table 3.4 Change in potential impact to threatened species (marine) (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in potential impact?
Common name	**Scientific name**					
Olive Ridley turtle	*Lepidochelys olivacea*	Endangered (also listed as migratory)	Moderate	No. Species does not nest within the region.	Changes to marine infrastructure and marine ferry movements prompted further investigation into the significance of impacts of vessel strikes and underwater noise (pile driving) There is no change to likelihood of occurrence.	Yes (improvement) Vessel strikes Yes (improvement). Underwater noise – pile driving. Discussed in Section 3.3.2.
Flatback turtle	*Natator depressus*	Vulnerable (also listed as migratory)	High	No. Closest breeding population is at Connor Bluff on the eastern coast of Curtis Island. Disturbance of marine habitat by the project contributes a small proportion of the overall cumulative direct and indirect impact of development in Port Curtis.	Yes, further investigations were conducted to identify likely impacts on flatback turtles at nearby turtle nesting beaches to flaring, glow and glare from LNG plant lighting. Changes to marine infrastructure and marine ferry movements prompted further investigation into the significance of impacts of vessel strikes and underwater noise (pile driving) There is no change to likelihood of occurrence.	No. Lighting Yes (improvement) Vessel strikes Yes (improvement). Underwater noise – pile driving. Discussed in Section 3.3.2.

Table 3.4 Change in potential impact to threatened species (marine) (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in potential impact?
Common name	**Scientific name**					
Green turtle	*Chelonia mydas*	Vulnerable (also listed as migratory)	High	No. Closest sporadic breeding population is on the eastern coast of Curtis Island. Potential foraging habitat is a small proportion of that available in the wider region.	Yes, further investigations were conducted to identify likely impacts on green turtles at nearby turtle nesting beaches to flaring, glow and glare from LNG plant lighting. Changes to marine infrastructure and marine ferry movements prompted further investigation into the significance of impacts of vessel strikes and underwater noise (pile driving) There is no change to likelihood of occurrence.	No. Lighting Yes (improvement) Vessel strikes Yes (improvement). Underwater noise – pile driving. Discussed in Section 3.3.2.
Hawksbill turtle	*Eretmochelys imbricata*	Vulnerable (also listed as migratory)	Moderate	No. Potential foraging habitat is a small proportion of that available in the wider region.	Changes to marine infrastructure and marine ferry movements prompted further investigation into the significance of impacts of vessel strikes and underwater noise (pile driving) There is no change to likelihood of occurrence.	Yes (improvement) Vessel strikes Yes (improvement). Underwater noise – pile driving. Discussed in Section 3.3.2.

3.3.2 Discussion

Marine Fauna

The Arrow LNG Plant Marine Ecology (Turtles) Technical Study: Curtis Island Baseline Light Monitoring (Appendix 9 of the SREIS) provides supplementary information and an assessment on the potential for light from the LNG plant and the associated flare stack to impact on nearby marine turtle rookeries at Curtis and Facing islands.

The technical study notes that the short duration of both scheduled flaring (two to three days every six years) and unscheduled (train trips) flaring (up to two hours and possibly four times per year) are unlikely to have a detectable impact on the regional marine turtle flatback population. Regional beaches may be exposed to flaring events during the nesting season. A low number of hatchlings will potentially be exposed to the flare light due to the low density of marine turtle nesting on regional beaches, and the intermittent nature of flaring together with the relatively short duration of flaring.

The technical study concludes that with appropriate management the residual impact of LNG plant lighting can be reduced to an absolute minimum, reducing the sky glow and long term visibility of the LNG plant during the operations phase, thereby reducing residual impacts to nesting turtles and hatchlings.

The EIS concluded that there was risk of a moderate significant impact to the loggerhead, flatback and green turtles due to potential vessel strikes, and there was a risk of a moderate significant impact to the loggerhead and green turtles due to underwater noise.

The revised assessment of impacts on marine fauna (included in the marine ecology technical report for the SREIS, Appendix 6) due to vessel strikes and noise, concluded that changes to project layout, operation and mitigation measures results in improvements to the level of impacts assessed in the EIS. In particular, due to a reduced frequency of high speed people-moving ferry movements, from 1140 per month (EIS) to 480 per month, and by adopting mitigating measures, such as soft start up piling and evaluating the use of bubble curtain noise attenuation, residual impacts were assessed as being of minor significance.

Attachment 4 of the EIS, addressing MNES, and Attachment 8 of the EIS include project recommendations and commitments that aim to avoid, minimise and mitigate impacts, including potential vessel strikes and noise, on marine fauna. New commitments developed during the SREIS pertaining to marine ecology are as follows:

- Establish a system for the recording of opportunistic observation of marine megafauna (turtles, saltwater crocodiles, dugong and cetaceans) spotted during marine operations such as dredging, pile driving and marine transport including where these activities occur within the Calliope River. (C19.12)
- Evaluate the use of bubble curtains for each method of piling, and deploy where they are demonstrated to be effective in aiding the rapid attenuation of underwater noise and deterring marine fauna from approaching, or remaining at, pile driving sites. (C19.13).

Consider measures to minimise light emitted from the LNG plant during the detailed design of the LNG plant including:

- Assess the necessity and choice of lighting in the plant area:
  - Use low-pressure sodium (LPS) lights as a first-choice light source and high-pressure sodium (HPS) lights where LPS is not practical.
  - Replace short-wavelength light with long-wavelength light and exclude short-wavelength light with the use of filters.
  - Avoid using halogen, metal halide or fluorescent lights (white lights) where possible, and only use white lights in contained areas where colour rendition is required.
  - Minimise the number and wattage of lights, and recess lighting into structures where possible.
- Use timers and motion-activated light switches.
- Use reflective materials to delineate equipment or pathways and use embedded lighting for roads.
- Position doors and windows on the sides of buildings facing away from marine turtle nesting beaches and install and use window coverings to reduce light emissions.
- Maintain elevated horizons (such as topographic features, vegetation or barriers) to screen rookery beaches from light sources (C17.47).
- A light mitigation plan for construction and operation will be developed and will include specific light management and reduction measures and a commitment to routine light audits (C19.14).
- Arrow Energy will participate in monitoring programs established to assess the impact of current and future industrial lighting in the Gladstone region on hatchlings emerging on the beaches of Curtis and Facing islands (C19.15).

4. MIGRATORY SPECIES

This section addresses the MNES of listed migratory species.

Additional desktop and field survey information on migratory shorebird species, to inform the SREIS, was provided in the Arrow LNG Plant Interim Shorebirds Technical Study prepared for Arrow CSG (Australia) Pty Ltd and Coffey Environments Australia Pty Ltd by Ecosure (Appendix 12). This study presents preliminary results and impact assessment based on a literature review and data from two of five proposed surveys, noting that a final report is planned for April 2013, at the completion of field surveys. The survey and assessment methodology is detailed in Section 4 of the Technical Study and complies with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009), and the EPBC Act Policy Statement 3.21 'Significant Impact Guidelines for 36 Migratory Shorebird Species' (Australian Government 2009).

In addition, the Terrestrial Ecology Supplementary EIS Study (3D Environmental and EcoSmart Ecology, 2012) presented in Appendix 11 of the SREIS acknowledges field recordings of several migratory bird species (e.g., eastern curlew, rainbow bee-eater and white-bellied sea-eagle) and the suitability of terrestrial habitats to support migratory species, though migratory and shorebird species are not the target of this report.

4.1 Shorebird Assessment

The change in the potential impact as a result of the changes in project design, or as a result of further information being obtained, on shorebirds and marine fauna species is outlined below.

No additional information has been provided concerning potential impacts to migratory birds that are not shorebirds (other wetland species or terrestrial species) so the conclusions of the EIS on these issues are unchanged. The EIS concluded that the project was not likely to significantly impact listed migratory bird species that are not shorebirds. These species are addressed briefly in Appendix E to this attachment.

Further discussion and details of the revised assessment of migratory shorebird and marine species is included in Chapter 19, Terrestrial Ecology - Shorebirds and Chapter 15, Marine Ecology of the SREIS.

4.2 Discussion

Shorebirds in Port Curtis

The interim shorebirds technical study provides further information for the SREIS, from desktop and field survey, regarding the presence of EPBC listed migratory species, the suitability of potential habitats for foraging and roosting, and the significance of potential project impacts to migratory shorebirds generally.

The revised assessment of shorebird habitats, to determine if the project would have a 'significant impact', was undertaken in accordance with the EPBC Act Policy Statement 3.21 – Significant

Impact Guidelines for 36 Migratory Shorebird Species, focussing on 21 known or potential roosting and/or foraging sites.

In accordance with the EPBC Act migratory shorebirds assessment guidelines, four factors were combined to determine the magnitude of the impact on habitat within the referral area, combined with an analysis of the habitat's sensitivity to re-evaluation the significance of impact: habitat loss, habitat degradation, disturbance and direct mortality. For the purpose of the evaluation, shorebird habitat has been classified for its use by shorebirds as: potential foraging, important roosting, secondary foraging, and potential roosting and foraging. This evaluation appears as Table 20 of the supplementary shorebirds technical study.

A network of nationally important shorebird sites occurs within the Curtis Coast region, from the Fitzroy Estuary in the north to Rodds Peninsula in the south. Shorebirds have been studied sporadically in recent years in this area, firstly by QWSG counts, and also by Driscoll (1997), but more recently by shorebird studies commissioned for other LNG projects and for the Western Basin Dredging and Disposal Project.

Driscoll (1997) identified that the Curtis Coast supported internationally significant populations of Australian pied oystercatcher, eastern curlew and grey-tailed tattler. Further study by Sandpiper Ecological Surveys (for Gladstone Ports Corporation (GPC)) on the Western Basin Dredging Project Shorebirds Monitoring Program in 2011 and 2012 (Gladstone Ports Corporation, 2011 and 2012) found the Curtis Coast as a whole supported internationally significant populations (greater than 1% of the flyway population) of seven species. These species were lesser sandplover, eastern curlew, whimbrel, terek sandpiper, grey-tailed tattler, red-necked stint and Australian pied oystercatcher.

Within the Curtis Coast, the extensive sandflats of both the Fitzroy Estuary and North Curtis Island were identified as being sites of particular importance with largest numbers of shorebirds recorded in these areas consistently on the surveys.

Within Port Curtis, there is a large degree of variability in the quality of shorebird habitat. Large areas support extensive important foraging habitat and corresponding important roost sites. Areas of key shorebird foraging and roosting habitat were identified in the Curtis Coast Regional Coastal Management Plan (EPA, 2003). Key roosting habitat was identified at Clinton ash ponds and at Flying Fox creek (1 km to the southeast of the mainland tunnel launch site) and key foraging habitat at Targinie wetlands adjacent to the mainland tunnel launch site, as discussed within the EIS (Figure 3 of Attachment 4, Matters of National Environmental Significance)

Further shorebird studies undertaken for the Western Basin Shorebirds Monitoring Program and other LNG proponents indicate that the area of Port Curtis known as the lower port (east and south from the mouth of the Calliope River) typically holds larger numbers of shorebirds than the upper port. Generally shorebird populations within Port Curtis are dominated by large shorebirds and species that forage primarily on crustaceans. Smaller wader species such as the *Calidris* sandpipers that forage for prey in soft sediments are present in much smaller numbers.

The spring/neep tide surveys for the QCLNG pipeline crossing (Sandpiper Ecological Surveys, 2011) found that over 75% of the shorebirds present in Port Curtis were in the area around the Southend flats and Facing Island. The lower port contains larger areas of intertidal habitat, a greater substrate diversity and higher tidal range, which results in increased foraging resources for shorebirds in this area.

The most significant roosting area was identified at Southend claypan with smaller roosts on Facing Island. At low tide, birds disperse onto the Pelican Banks, and intertidal areas along the western shoreline of Facing Island.

Other significant roosts are present on Facing Island and on Kangaroo Island at the southern end of the Narrows. At low tide, birds disperse from the latter roost and move onto the Passage Island mudflats up the Narrows, or onto the Fishermans Landing mudflats and the mudflats adjacent to the mainland tunnel launch site.

The supplementary shorebirds technical study provides further assessment of two sites within the project area considered to be of potential importance to shorebirds as roosting and foraging sites, the 'Targinie Wetlands' (identified as 'site 11'), which is a shallow mudflat immediately to the seaward side of mangroves fringing the mainland tunnel launch site (see MNES attachment for referral number EPBC 2009/5008); and the 'Clinton ash ponds' (identified as 'sites 5 and 6'), which is an artificial ash pond adjacent to a possible alignment for the access road servicing launch site 1.

Survey sites for the shorebird surveys are shown on Figure 4.1.

The shorebirds technical study acknowledges that the Clinton ash ponds has been identified as a roosting site for a variety of shorebird species. Despite being artificial and subject to a history of disturbance, in the September 2012 survey the site supported numbers in the range for a 'nationally important' habitat, particularly for the eastern curlew (*Numenius madagascariensis*). However, there is some evidence that this area may no longer support sufficient numbers of shorebirds to be considered important roosting habitat, perhaps due to a decline in prey availability and an increase in anthropogenic disturbance at this site.

Impacts from the Arrow LNG Plant (Referral Number EPBC 2009/5007)

No direct loss of previously determined important shorebird habitat will occur as a result of the project. Clinton ash ponds will not be cleared for project infrastructure. Indirect impacts on important shorebird foraging habitat are discussed in the MNES attachment for referral number EPBC 2009/5008.

Some (2.8 ha) of secondary foraging habitat will be lost due to construction of project infrastructure. Approximately 4 ha of potential foraging and roosting habitat (if the alignment of the access road to launch site 1 follows the route that passes site 7) will be lost due to construction of project infrastructure. Approximately 15 ha of potential roosting habitat will be removed for construction of the Arrow LNG Plant, on the west side of Boatshed Point (site 1). The claypan on the east side will not be cleared (site 13). The loss of these areas of secondary habitat is minimal in the context of Port Curtis, and the generally low value of the habitat.

Areas of shorebird habitat could be degraded and disturbed by project activities, leading to reduced availability of invertebrate food for shorebirds in intertidal areas. Management plans will be developed to address potential threats such as acid sulfate soils, pollution runoff, erosion and sedimentation and weed incursion. With implementation of the measures contained in such plans, there should be minimal residual impact on important shorebird foraging habitat.

coffey environments	Date: 06.12.2012 MXT: 7033CC_16_GIS074_v1_1 File Name: 7033_MNES1_F04.01_GIS_GL	Arrow Energy Arrow LNG Plant	arrow energy go further	Shorebird survey site locations	Figure No: 4.1

Potentially important roosting habitat could be disturbed and indirectly impacted from increased vehicle and personnel movement in the vicinity leading to noise and dust generation. These impacts would only occur if one of the options for an access track to launch site 1 is chosen that passes the adjacent Clinton ash ponds.

Any shorebirds using Clinton ash ponds are likely to be habituated to high levels of disturbance. Numbers of shorebirds using this site have dropped in recent years and it is likely this is due at least in part to this increased disturbance, as well as a reduction in the quality of roosting habitat available (site recently covered in mulch to suppress dust).

This area will most likely be remediated (filled in with capping material to encapsulate the fly ash) as part of fly ash disposal and reclamation, associated with the NRG power plant station activities. This reclamation process is an ongoing activity at Clinton ash ponds.

The common practice in this area is to fill (for the purposes of fly ash disposal and reclamation) the designated ash pond areas, dewater and remediate with a 300 mm clay cap to ensure the fly ash does not dry out and become airborne. Although this reclamation may be post the upgrade of the haul road past the ash ponds to launch site 1, reclamation is an ongoing activity in this area with frequent vehicle and personnel movements in and around the ash ponds.

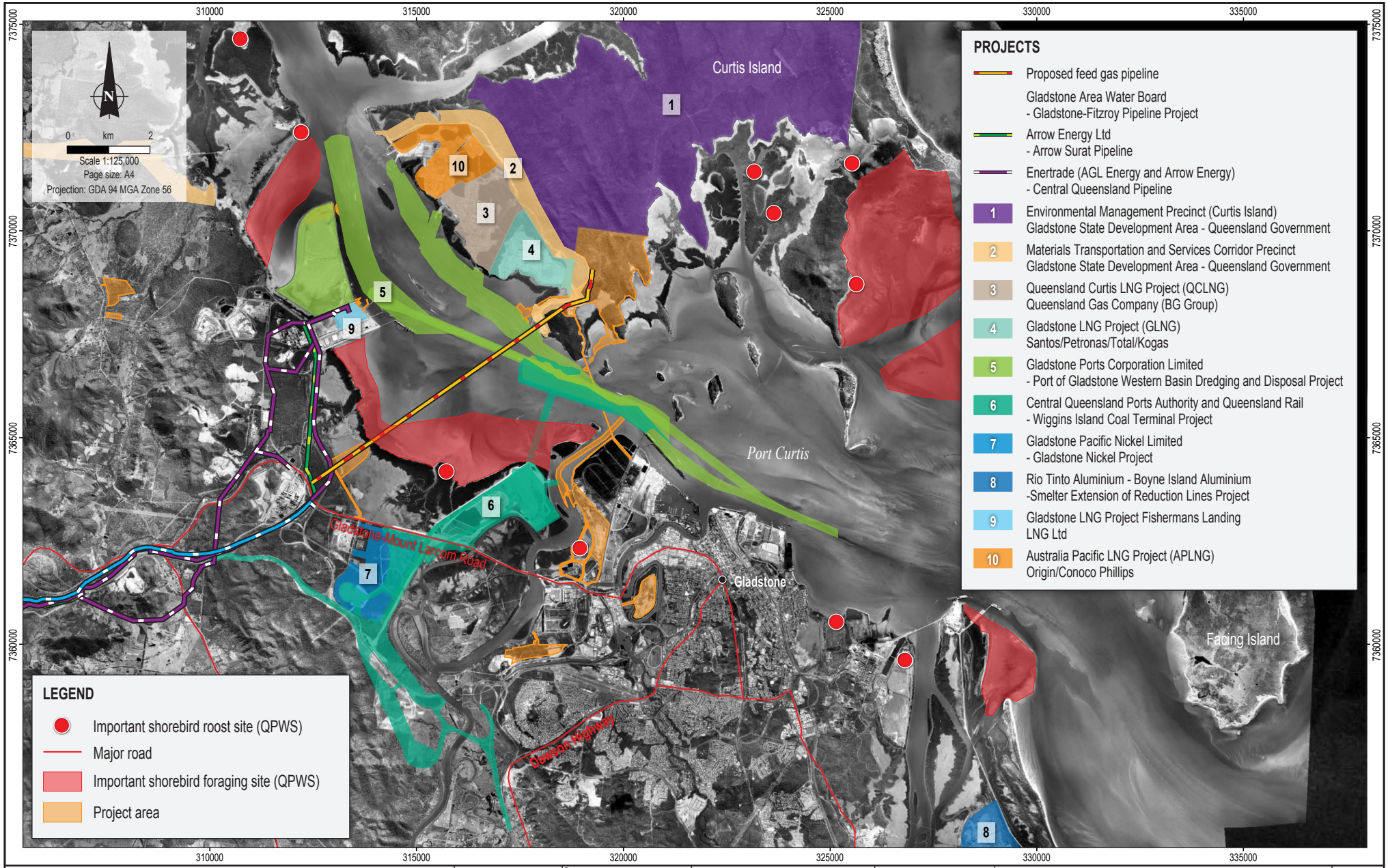
There is a potential for bird strike into structures for the Arrow LNG Plant, but this is considered to be a negligible risk with a low likelihood of taking place.

At this time, areas of identified potential shorebird habitat are not expected to provide habitat for sufficient numbers or diversity of shorebirds to meet important habitat criteria. Surveys planned for these areas after rain during the peak shorebird season (over a number of visits) will confirm this assessment. Some of these sites are located adjacent to areas of project infrastructure (Arrow Energy LNG plant). The presence of large highly visible structures, with high levels of vehicular and personnel movement, and light spill onto adjacent areas may render potential habitat immediately adjacent to these facilities unfavourable.

Figure 4.2 shows projects that were considered in the cumulative impacts assessment presented in the EIS, and their distribution in Port Curtis in relation to important shorebird habitats. The majority of infrastructure development is taking place within the upper port which is already heavily industrialised. The lower port, which includes areas such as Southend mudflats, Facing Island and Pelican Banks, all important shorebird sites, is largely unaffected by direct impacts. Further afield, significant shorebird sites around the Fitzroy Estuary and North Curtis will also be retained.

Indirect cumulative impacts from increased infrastructure on habitats in Port Curtis such as pollution, runoff, and sedimentation will be managed through relevant construction and environmental management plans prepared for each project.

Arrow Energy will develop a shorebird management and monitoring plan for approval prior to construction commencing. The plan will take account of similar programs developed for other similar projects being undertaken within the study area and surrounds. The plan will include the mitigation measures identified in Table 19.7 in Chapter 19, Shorebirds, of the SREIS. An outline of this plan is presented in Attachment 5, Other Management Plans.



Source:
Important shorebird areas in Port Curtis from Curtis Coast Regional Coastal Management Plan, QPWS.
Place names and roads from DME.
Project area from Coffey Environments.
Imagery from Nearmap (captured 7 August 2012).
NOTE: For projects' source information please refer to report reference notes.

coffey environments

Date: 07.12.2012
MXD: 7033CC_16_GIS076_v1_1
File Name: 7033_MNES1_04.02_GIS_VS

Arrow Energy

Arrow LNG Plant

arrow energy go further

Important shorebird habitats in and near Port Curtis in relation to major projects

Figure No: **4.2**

Attachment 4 of the EIS, addressing MNES provides a range of project recommendations and commitments that aim to avoid, minimise and mitigate impacts on migratory shorebirds and shorebird habitats, and these are replicated in Appendix C of this attachment.

Further to the project commitments made in the EIS, additional commitments have been proposed in the SRIES to mitigate project impacts to shorebirds. These are listed in Section 6.5.2 of the interim shorebirds technical study for the SREIS (Appendix 12). These measures are intended be integrated into a shorebird management and monitoring plan (an outline of which is presented in Attachment 5, Other Management Plans to the SREIS) for approval prior to construction commencing, integrated with current similar projects being undertaken within the study area and surrounds. The plan will include the following mitigation measures applicable to all types of shorebird habitat in and adjacent to the project area:

- Shield/direct the light source onto work areas where practical, and avoid light spill on to habitat areas (such as mangroves and Clinton ash ponds) where practical (C17.16).

Consider measures to minimise light emitted from the LNG plant during the detailed design of the LNG plant including:

- Assess the necessity and choice of lighting in the plant area:
  - Use low-pressure sodium (LPS) lights as a first-choice light source and high-pressure sodium (HPS) lights where LPS is not practical.
  - Replace short-wavelength light with long-wavelength light and exclude short-wavelength light with the use of filters.
  - Avoid using halogen, metal halide or fluorescent lights (white lights) where possible, and only use white lights in contained areas where colour rendition is required.
  - Minimise the number and wattage of lights, and recess lighting into structures where possible.
- Use timers and motion-activated light switches.
- Use reflective materials to delineate equipment or pathways and use embedded lighting for roads.
- Position doors and windows on the sides of buildings facing away from marine turtle nesting beaches and install and use window coverings to reduce light emissions.
- Maintain elevated horizons (such as topographic features, vegetation or barriers) to screen rookery beaches from light sources (C17.47).
- Review the need for an ongoing program to monitor the shorebird population at project sites following the completion of survey work in 2013 (C17.51).
- Develop measures to minimise disturbance around important shorebird habitat, during construction and operation. Measures could include exclusion zones or screens as recommended in Rohweder *et al*. (2011) (C17.52).

Commitment number C17.47 was developed for the technical study assessing the impact on turtles from light from the Arrow LNG Plant (Appendix 9, Marine Ecology (Turtles) Technical Study

– Curtis Island Baseline Light Monitoring 2012). Aspects of the commitment are also of benefit to minimising impacts of lighting on shorebird habitat.

4.3 Migratory Marine Fauna Assessment

Changes in potential impacts as a result of the changes in project design, or as a result of additional information being obtained, are outlined in Table 4.1 for all marine migratory species, listed under the EPBC Act as either critically endangered, endangered or vulnerable, and identified in the EIS as having a moderate (including 'low to moderate') or higher likelihood of occurrence within the study area.

Two cetacean species, the Indo-Pacific humpback dolphin and the Australian snubfin dolphin, and one marine mammal, the dugong, are migratory species listed under the EPBC Act and are known to be present in the study area. Six marine turtle species, listed as both threatened and migratory are discussed in Section 3.3.2 of this attachment. Saltwater crocodile are discussed in Appendix E of this attachment.

Further discussion and details of the revised assessment of marine migratory species is included in Chapter 15, Marine Ecology of the SREIS.

Table 4.1 Change in potential impact to threatened species (marine migratory species)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in potential impact?
Common name	**Scientific name**					
Australian snubfin dolphin	*Orcaella heinsohni*	Migratory	High	No. No areas of seagrass lost and no key areas of habitat affected.	Yes. Changes to marine infrastructure and ferry movements prompted further investigation into significance of impacts of vessel strikes and underwater noise (pile driving). There is no change to likelihood of occurrence. Minor significance residual impacts due to risk of vessel strike; underwater noise (pile driving).	Yes, minor impact from noise (improvement from moderate) due to establishment of bubble curtains as a management measure to attenuate noise, coupled with existing management measures outlined in the EIS. Direct impacts from vessel strikes on marine megafauna (dugong, cetaceans and marine turtles) were all reduced from moderate to minor due to the commitment of existing and additional management measures. Managing vessel speeds through speed restrictions remains the foremost mitigation measure. Discussed in Section 4.5.
Indo-Pacific humpback dolphin	*Sousa chinensis*	Migratory	High	No. No areas of seagrass lost and no key areas of habitat affected.	Yes. Changes to marine infrastructure and ferry movements prompted further investigation into significance of impacts of vessel strikes and underwater noise (pile driving). There is no change to likelihood of occurrence. Minor significance residual impacts due to risk of vessel strike; underwater noise (pile driving).	Yes, minor impact from noise (improvement from moderate) due to establishment of bubble curtains as a management measure to attenuate noise, coupled with existing management measures outlined in the EIS. Direct impacts from vessel strikes on marine megafauna (dugong, cetaceans and marine turtles) were all reduced from moderate to minor due to the commitment of existing and additional management measures. Managing vessel speeds through speed restrictions remains the foremost mitigation measure. Discussed in Section 4.5.

Table 4.1 Change in potential impact to threatened species (marine migratory species) (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in potential impact?
Common name	**Scientific name**					
Dugong	*Dugong dugon*	Migratory	High	No. No areas of seagrass lost and no key areas of habitat affected.	Yes. Changes to marine infrastructure and marine ferry movements prompted further investigation into the significance of impacts of vessel strikes and underwater noise (pile driving). There is no change to likelihood of occurrence. Minor significance residual impacts – due to risk of potential vessel strike; underwater noise (pile driving).	Yes, minor impact from noise (improvement from moderate) due to the establishment of bubble curtains as a management measure to attenuate noise in the water column, coupled with the existing management measures outlined in the EIS. Direct impacts from vessel strikes on marine megafauna (dugong, cetaceans and marine turtles) were all reduced from moderate to minor due to the commitment of existing and additional management measures. Managing vessel speeds through speed restrictions remains the foremost mitigation measure. Discussed in Section 4.5.

4.4 Discussion

The EIS concluded that the significance of impact to the Australian snubfin dolphin, Indo-Pacific humpback dolphin and dugong due to potential vessel strike and pile driving were both moderate.

The marine ecology technical report for the SREIS (Appendix 8) conducted a revised assessment taking into account changes to ferry movements and additional information on the use of Port Curtis by these species. Potential impacts to cetaceans and dugong due to vessel strikes and pile driving improved from that reported in the EIS. Vessel strike impacts improved from moderate to minor significance due to a reduction in fast cat ferry movement frequencies from 1140 per month (EIS) to 480 per month and with implementation of management measures included in the EIS. Pile driving impacts improved from moderate to minor significance with application of management measures such as soft start procedures and evaluating the use of bubble curtains to mitigate underwater noise.

Attachment 7 of the SREIS includes commitments that aim to avoid, minimise and mitigate impacts, including potential vessel strikes and pile driving impacts on marine fauna. Additional commitments to mitigate potential impacts to migratory marine species are discussed below.

4.5 Mitigation Measures – Marine Fauna

Further to the project commitments made in the EIS, additional commitments have been proposed in the SRIES to mitigate project impacts to marine fauna. These are listed in Chapter 15, Marine Ecology (Section 15.6.2) and Chapter 16, Turtles and Lighting (Section 16.6) of the SREIS. These include:

- Establish a system for the recording of opportunistic observation of marine megafauna (turtles, saltwater crocodiles, dugong and cetaceans) spotted during marine operations such as dredging, pile driving and marine transport including where these activities occur within the Calliope River. (C19.12)
- Evaluate the use of bubble curtains for each method of piling, and deploy where they are demonstrated to be effective in aiding the rapid attenuation of underwater noise and deterring marine fauna from approaching, or remaining at, pile driving sites. (C19.13).

Consider measures to minimise light emitted from the LNG plant during the detailed design of the LNG plant including:

- Assess the necessity and choice of lighting in the plant area:
  - Use low-pressure sodium (LPS) lights as a first-choice light source and high-pressure sodium (HPS) lights where LPS is not practical.
  - Replace short-wavelength light with long-wavelength light and exclude short-wavelength light with the use of filters.
  - Avoid using halogen, metal halide or fluorescent lights (white lights) where possible, and only use white lights in contained areas where colour rendition is required.
  - Minimise the number and wattage of lights, and recess lighting into structures where possible.

- Use timers and motion-activated light switches.
- Use reflective materials to delineate equipment or pathways and use embedded lighting for roads.
- Position doors and windows on the sides of buildings facing away from marine turtle nesting beaches and install and use window coverings to reduce light emissions.
- Maintain elevated horizons (such as topographic features, vegetation or barriers) to screen rookery beaches from light sources (C17.47).
- A light mitigation plan for construction and operation will be developed and will include specific light management and reduction measures and a commitment to routine light audits (C19.14).
- Arrow Energy will participate in monitoring programs established to assess the impact of current and future industrial lighting in the Gladstone region on hatchlings emerging on the beaches of Curtis and Facing islands (C19.15).

5. OFFSETS

This section summarises the offsets requirements, where required, deriving from the revised assessment provided by this report for the MNES for which the project was declared a controlled action under the EPBC Act.

The Australian Government's EPBC Act Environmental Offsets Policy (DSEWPaC 2012) provides the framework for the provision of offsets for MNES that are subject to significant impacts as a result of the project construction and operation.

The Environmental Offsets Assessment Guide (Australian Government, 2012), which accompanies the policy, has been developed to give effect to the requirements of the policy, using a balance sheet approach to measure impacts and offsets. The guide applies where the impacted protected matter is a threatened species or ecological community.

The EPBC Act Environmental Offsets Policy applies to any new referrals or variations to approval conditions from 2 October 2012. It also applies to any projects currently under assessment for which a decision has not yet been made and therefore will apply to the Arrow LNG Plant.

Any offsets under the policy, must be new and additional to what is already required – an area already set aside for conservation or that is unable to be developed is unlikely to be acceptable. Offsets are only to be proposed after all reasonable avoidance and mitigation measures have been presented. Offsets are therefore designed to compensate for the residual impact of a project, after the implementation of avoidance and mitigation measures.

The same offset can be used to satisfy both state/territory and Commonwealth environmental impact assessment processes for the one project. Offset requirements at a state level are unchanged since the Arrow LNG Plant EIS was finalised, and governed by the Queensland Government Environmental Offsets Policy, June 2008 (EPA, 2008). This policy is currently under review (as of November 2012). However, the State Government has since released the Ecological Equivalence Methodology Guideline (DERM, 2011). The guideline is intended to inform requirements for ecological offset required under the Policy for Vegetation Management Offsets and Queensland Biodiversity Offsets Policy.

5.1 World Heritage and National Heritage Values

As summarised in Section 2.2.3, the revised assessment of the potential impacts of the project concludes that the project is unlikely to have a significant impact to the World Heritage and National Heritage values of the GBRWHA.

While the project will cause the loss of terrestrial vegetation and fauna habitat, will disturb marine fauna habitat and will adversely affect visual amenity, the implementation of the management and mitigation measures outlined in both the EIS and SREIS will reduce the level of each of these impacts below a level of significance. As the impacts will be below the level of significance, offsets for MNES will not be required to compensate for a residual significant impact.

5.2 Threatened Ecological Communities and Species

Threatened Ecological Communities

Field surveys carried out for the SREIS confirmed the presence of the critically endangered ecological community 'Littoral Rainforests and Coastal Vine Thickets of South-Eastern Australia', which is representative of the endangered RE 12.2.2, in the vicinity of Boatshed Point on Curtis Island. The revised footprint area does not include the newly defined areas of littoral vine thicket community. Management and mitigation measures and commitments have been proposed to minimise and mitigate the risks of indirect impacts, including edge effects such as weed infestations and fire. Therefore, the project is not expected to have a direct or significant impact on threatened communities and no offsets for MNES are required.

Threatened Species

As discussed in Section 3.2.3, the presence of the water mouse (*Xeromys myoides*), listed as vulnerable under the EPBC Act was observed in the vicinity of Boatshed Point. Approximately 0.8 ha and 1.8 ha of RE 12.1.3 mangrove habitat, potentially suitable for the species, is designated be cleared west of Boatshed Point and along the north margin of Hamilton Point within North China Bay respectively. This area is less than one per cent of the available suitable habitat for the species in the study area.

Under the Australian Government's 'significant impact guidelines' for the species (policy statement 3.20), any population that has evidence of recent activity is considered important. Therefore the sub-populations located to the east and west of Boatshed Point are important, as defined under the guidelines.

The limited extent of clearing of the mangroves and adjoining habitat due to the project is unlikely to significantly impact water mouse. However, modification of shoreline habitat between areas of habitat has the potential to affect movement, and therefore increase isolation of local populations.

The Arrow LNG Plant will contribute to the isolation of one small patch of known habitat to the west of Boatshed Point. In the context of overall cumulative impact, the potential loss of this local population is not likely to be significant in the context of the wider population on Curtis Island and around Port Curtis.

Offsets for the species under the EPBC Act are not considered necessary, as no areas of critical habitat will be cleared for the project. It is not possible to satisfactorily offset against impacts from fragmentation, although any offset of mangrove and saltpan vegetation habitat that Arrow Energy will undertake under the Queensland Government Environmental Offsets Policy is likely to have benefits for security of potential water mouse habitats elsewhere.

The cumulative impact of other LNG developments already under construction on Curtis Island is likely to reduce connectivity between larger, less disturbed areas of habitat to the north (i.e., Graham Creek) from habitats in the south (e.g., Endfield Creek). This reduces the value of this locality as significant water mouse habitat, leading to the likely isolation of any local populations occurring along the southwest coast.

The project will contribute to the additional fragmentation of one small area of known habitat within a broader length of coastline that has already experienced substantial disturbance.

Therefore, in the context of cumulative impact, the potential loss of the west of Boatshed Point sub-population does not represent a significant impact.

The EIS concluded that by adopting recommended mitigation measures, such as storm water and pest management, this clearing would not contribute to the loss, fragmentation or degradation of habitat. Further mitigation measures are recommended in the terrestrial ecology technical study for the SREIS to lessen any potential impacts due to habitat loss and degradation, reduction of movement and dispersal potential, lighting, introduced predators and alteration of water quality.

The revised conclusion of the SREIS is that the residual impacts on the water mouse are not significant and no offsets for MNES are required. Nonetheless, offsets may be required under the Queensland Government Environmental Offsets Policy for the clearing of mangroves (i.e., marine plants), which are expected to provide direct benefit for the species.

The conclusions of the EIS regarding threatened marine fauna have changed; there is now a (reduced) risk of minor significance of impact to the endangered loggerhead turtle, and vulnerable flatback and green turtles due to potential vessel strikes, and a (reduced) risk of minor significance of impact to the loggerhead and green turtles due to underwater noise. The EIS and SREIS provide management measures and commitments that aim to avoid and minimise impacts to threatened marine fauna species and no additional offsets for MNES are required.

5.3 Migratory Species

Shorebirds

Information provided for the SREIS regarding migratory species suggests that the Clinton ash ponds (adjacent to the proposed launch site 1 on the mainland) may be a significant roosting site for migratory birds, notably the eastern curlew. The remaining shorebird surveys planned for late 2012 and early 2013 will assist in confirming the importance of the site and therefore the significance of potential impacts to species utilising this site.

Offsets may be required under the Queensland Government Environmental Offsets Policy for the clearing of mangroves and saltpan vegetation (i.e., marine plants), which are expected to provide direct benefit for migratory shorebirds.

Marine Fauna

The conclusions of the EIS regarding threatened and migratory marine fauna have changed; there is a (reduced) risk of minor significance of impact to the endangered loggerhead turtle, and vulnerable flatback and green turtles due to potential vessel strikes, and that there is a (reduced) risk of minor significance of impact to the loggerhead and green turtles due to underwater noise; and that there is a (reduced) risk of minor significance of direct impact to the migratory Australian snubfin dolphin, Indo-Pacific humpback dolphin and dugong due to potential vessel strikes.

The EIS and SREIS provide management measures and commitments that aim to avoid and minimise impacts to migratory marine fauna. These measures should be considered in context with the range of measures being implemented or proposed to address the cumulative potential impacts to marine values presented by all developments occurring in Port Curtis.

5.4 Offsets Strategy and Strategic Management Plan

Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (Attachment 6 of the SREIS), consistent with its Environmental Offset Strategy. This plan:

- Describes measures taken to avoid and minimise impacts.
- Identifies Arrow Energy's likely offset requirements.
- Presents evidence that there are opportunities to achieve the required offsets.
- Sets out Arrow Energy's preferred approach to the provision of environmental offsets.

The Draft Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.

Arrow Energy's principles for offset management have been developed to align with offset principles from both Commonwealth and state policies. Offsets will:

- Meet the requirements of current government policy.
- Only be used once the hierarchy to minimise impact (avoid, minimise, mitigate) has been followed.
- Contribute to managing and protecting biodiversity.
- Be implemented strategically and economically.

6. CONCLUSION

This MNES attachment to the SREIS provides updated information and a revised assessment of potentially significant impacts to the MNES for which the Arrow Energy LNG Plant was determined to be a controlled action under the EPBC Act (referral number EPBC 2009/5007).

The revised assessment addresses issues where any new desktop or field survey information, or change to the project design or layout since the publication of the EIS, has led to an increase in the significance of potential impacts to MNES. This attachment also addresses matters raised in the DSEWPaC submission to the EIS and other public submissions to the EIS relating on MNES.

Further information has informed the assessment of impacts on the World Heritage and National Heritage values of the GBRWHA, and EPBC-listed threatened ecological communities, threatened species and migratory species (including shorebirds habitats). Key findings are discussed in this section.

The revised assessment concludes that the project is unlikely to have a significant impact to the World Heritage and National Heritage values of the GBRWHA. While the project will cause the loss of terrestrial vegetation and fauna habitat, will disturb marine fauna habitat and will adversely affect visual amenity, the implementation of the management and mitigation measures outlined in both the EIS and SREIS will reduce the level of each of these impacts to below a level of significance.

Two small areas of the critically endangered ecological community ‘Littoral Rainforest and Coastal Vine Thickets of Eastern Australia’ were confirmed in the vicinity of Boatshed Point and Hamilton Point. Management measures and commitments have been proposed to avoid disturbance to the community and minimise and mitigate the risks of indirect impacts, including edge effects such as weed infestations and fire.

Water mouse was confirmed as present in the vicinity of Boatshed Point. The limited clearing of the mangroves is unlikely to significantly impact water mouse. The project will reduce connectivity between adjacent undisturbed areas, which may affect movement of the species. In the context of overall cumulative impact of this highly disturbed stretch of the Curtis Island shoreline, the potential loss of this local population does not represent a significant impact.

No migratory shorebird habitat defined as ‘important’ under EPBC guidelines will be cleared for the project, however there is potential for disturbance and habitat degradation to potentially important roosting habitat at the Clinton ash ponds (noting that this site is artificial and highly disturbed).

The SREIS concluded that the project was not likely to significantly impact listed migratory bird species that are not shorebirds or not marine birds. Therefore, the conclusions of the EIS on this matter are unchanged.

The conclusions of the EIS regarding threatened and migratory marine fauna have changed: there is a risk of minor significance of impact to the endangered loggerhead turtle, and vulnerable flatback and green turtles due to potential vessel strikes, and a risk of minor significance of impact to the loggerhead and green turtles due to underwater noise; and a risk of minor significance of

direct impact to the migratory Australian snubfin dolphin, Indo-Pacific humpback dolphin and dugong due to potential vessel strikes.

The EIS and SREIS include management measures and commitments to avoid and minimise impacts to threatened and/or migratory marine fauna. These measures should be considered in context with the range of measures being implemented or proposed to address the cumulative potential impacts to marine values presented by all developments occurring in Port Curtis.

Further fieldwork proposed for the 2012/13 wet season aims in part to clarify the importance of several terrestrial fauna and shorebird habitats and validate the assessment of the significance of potential impacts in order to inform the environmental management plans for the project.

Notwithstanding that no offsets for MNES are considered necessary for the project, offsets may be required under the Queensland Government Environmental Offsets Policy for the clearing of mangroves and saltpan vegetation (i.e., marine plants), which are expected to provide direct benefit for the water mouse and migratory shorebirds.

Appendix A

Cross-Check Table Against DSEWPaC Feedback

Table A.1 Cross-check table against DSEWPaC feedback

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
1 (see: 2)	General comments	While we understand that a number of our comments below can be addressed by information, studies and reports already provided in the draft EIS, the matters of national environmental significance (MNES) chapter must be a standalone chapter that exclusively and fully addresses MNES listed as controlling provisions for these projects. Cross-referencing to other parts of the EIS can be provided in the MNES chapter, but important information (such as rationale for determinations of non-significance, assessment of cumulative impacts on MNES, key mitigation measures and offsets for MNES) must be provided in the MNES chapter. We note that cross-references to other parts of the draft EIS must be to a specific part of the EIS document that specifically provides information on EPBC matters (for example information on listed threatened ecological communities and not State REs).	**1)** Attachment 4 (MNES) **2)** Attachment 2 (MNES)	The MNES attachment (EIS Attachment 4) references information in the EIS to provide background, context and detailed information about survey methods. The MNES attachment included in the SREIS (Attachment 2) addresses changes to the assessment of MNES as a result of project changes, additional information and issues raised in submissions.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
2 (see: 1)	General comments	Because of the size and complexity of the EIS including its attachments it is important that the MNES chapter contains all important and relevant information to an assessment of impacts on matters of national environmental significance, and that cross-references are to specific parts of the EIS.	**1)** Attachment 4 (MNES) **2)** Attachment 2 (MNES)	The EIS MNES Attachment 4 was revised to address DSEWPaC's earlier comments on the detail presented in the chapter. Key information on the rationale for the determinations of non-significance and assessment of cumulative impacts on MNES are presented in the EIS Attachment 4 along with key mitigation measures. The MNES Attachment 4, although comprehensive, relies on information in the EIS to provide background, context and detailed information about survey methods etc.
3 (see: 12, 30, 46)		We require information on the survey methodology used, including any limitations of the methodology and data collected for each matter of MNES, as well as a justification for the survey methodology and survey sites employed. We require the EIS to demonstrate how all survey methodology follows relevant Commonwealth survey guidelines that were available at the time of surveying (e.g., the Survey Guidelines for Australia's Threatened Birds (DSEWPaC)). Based on the information provided in the draft EIS it is our view that further survey work will need to be undertaken (including targeted surveys where appropriate) unless justification can be provided for current survey effort or any risks accounted for in avoidance, mitigation and management. It appears that not all sites were surveyed and surveys were not undertaken in optimal conditions (for e.g., the only wet season terrestrial season survey was cancelled after 3 days and only one dry season fauna survey was undertaken with limitations in the data collected).	**1)** Attachment 4 (MNES) Sections 3.1 and 6.4.1 (Migratory Shorebirds) Chapter 17 and Appendix 9 (Terrestrial Ecology) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) **2)** Refer to chapters below and corresponding technical studies Chapter 15 Marine Ecology Chapter 16 Turtles and Lighting Chapter 17 Estuarine Ecology (Calliope River) Chapter 18 Terrestrial Ecology Chapter 19 Shorebirds **3)** Sections 3 and 4	Additional field survey work has been undertaken in 2012 relating to MNES and is summarised in chapters 15 to 19 of the SREIS. SREIS Attachment 2 (MNES) summarises the survey and assessment methodology described in the supporting technical studies, particularly; terrestrial ecology, shorebirds, marine ecology, and estuarine ecology. The MNES Attachment confirms that the survey methodology complies with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009). The significance assessment approach adopted for the EIS and SREIS is underpinned by management measures that are effective and proven, based on industry standards where relevant. All mitigation measures have been reviewed by Arrow Energy to ensure they can be implemented and will be effective in managing identified impacts.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
4 (see: 17 & 47)	General comments	We require more detail around indirect impacts, and management and mitigation from these impacts (e.g., activation of acid sulphate soils), particularly in the context of impacts on MNES (e.g., water mouse). The department also notes that although the proposed action may only result in the loss of 67 ha of marine habitat, the indirect impact and cumulative impact is likely to represent a greater impact (e.g., impacts including boat strike, behavioural disturbance and habitat displacement from shipping). The draft EIS should account for indirect impacts when discussing impacts and coming to a conclusion on impacts to MNES.	**1)** EIS Section 17.4 Attachment 4 (MNES) Sections 6.3 and 6.4 **2)** Section 3.2.2 Appendix 11 Terrestrial Ecology Technical Study (Sections 4.2.2 and 5.2.10 – water mouse) **3)** Section 3.2.3, Table 3.2	Technical studies informing the SREIS chapters (Terrestrial Ecology; Shorebirds; Marine Ecology; Calliope River Estuarine Ecology) all assess potential indirect impacts. For example, EIS Appendix 4, Acid Sulfate Soil Impact Assessment, provides a comprehensive assessment of acid sulfate soils expected to be encountered and proposes measures to effectively manage the soils during disturbance, handling and disposal. The study concludes that "…ASS disturbances in the Gladstone area have not and are not likely to cause significant environmental harm as disturbances are managed or planned to be managed in accordance with SPP 2/02 and its attendant guidelines and reference documents. Further information on ASS in the project area has been obtained from a geotechnical investigation being carried out in project areas. The program has included analysis for ASS/PASS. Preliminary results of this investigation for marine sediments at the dredge sites are included in SREIS Chapter 12, Sediment Characterisation. This information and the final results of the investigation will inform the development of the ASS management plan.
5		Please provide further information and justification as to the reason for a separate gas pipeline to the mainland, rather than using the Northern Infrastructure Corridor Sub-Precinct of the GSDA. Please discuss in respect of impacts on matters of national environmental significance, noting that the bundled pipeline across the Northern Infrastructure Corridor has already been approved and a number of impacts to MNES have already addressed in previous approvals.	**1)** Section 5.3.4	EIS Chapter 5, Section 5.3.4 provides the rationale for a separate gas pipeline to the mainland, rather than using the Northern Infrastructure Corridor Sub-Precinct of the GSDA. The reasons include proximity to the Arrow Surat Gas Pipeline, misalignment with the construction schedules of the other projects, avoidance of significant environmental and cultural heritage management issues, and avoidance of conflicts with future infrastructure.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
6	General comments	The sources of information relied upon must be clearly referenced and discussed in the MNES chapter. We require information on the scientific reliability of surveys, investigations and conclusions drawn, including the degree of certainty or statistical confidence for both impacts and mitigation measures. This is a requirement of Section 7 of Schedule 4 of the Environment Protection and Biodiversity Conservation Regulations 2000.	**1)** Attachment 4 (MNES) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) Chapter 17 and Appendix 9 (Terrestrial Ecology) **2)** Various technical studies **3)** Section 2, Table 2.1 Technical studies referenced in SREIS MNES Attachment (Section 2)	Appendices (specialist technical reports) to the EIS and SREIS provide detailed information on the survey methods undertaken for each technical study.
7 (see: 27, 34, 42, 48)		The magnitude of proposed offsets must account for the risk associated with any uncertainty of impacts.	**1)** Attachment 4 (MNES) Section 7.2 **2)** Attachment 6 (Offsets) **3)** Sections 3.2.2 and 3.2.3, Table 3.2 Section 5	SREIS Attachment 6 provides an approach for proposed offsets, to be created in consultation with both the Queensland Department of Environments and Heritage Protection (EHP) and the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC).

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
8	LNG Shipping, Table 2.1, page 2-5	We require the indicative frequency for all vessel types (e.g., indicative frequency for the Cutter section dredging vessel, Support vessel, Backhoe dredging barge and Backhoe dredger support tugs). While we note that this information may be provided in the Dredge Management Plan, we require an indication of the frequency and scope of shipping associated with dredging to be provided in the MNES chapter (e.g., 1, 10 or 100 trips every day). We recommend that this information is provided in table 2.1 along with other indicative frequencies for vessels.	**1)** Sections 19.4.5, 19.5.2, and 19.5.3, Table 19.9 Chapter 29 **2)** Sections 6.1, 7.1.1, 7.2.1, 15.2.1, 15.5.2 and 15.6.2 Appendix 13 Transport and Traffic technical study (Section 5.4.1 and Table 5)	Technical studies informing the SREIS have assessed revised projections of vessel movements with respect to marine logistics and transport. Estimated vessel movements during construction and operations are described in SREIS Chapter 7, Project Description: Logistics (Section 7.1.1 and Section 7.2.1 respectively). Additional details on ferry movements are included in the Transport and Traffic Technical Study completed for the SREIS, Appendix12, Chapter 5, Section 5.5. Section 15.6.2 of Chapter 15 Marine Ecology addresses the impacts of vessel movements on marine fauna.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
9	5.1.1 Great Barrier Reef World Heritage Area	This section provides a useful summary of the values of the Great Barrier Reef World and National Heritage places, however we require some more detail around: • Vegetation communities, habitat type, habitat use (including justification for habitat type and use (e.g., why certain habitat is deemed not to be present) within the Great Barrier Reef World and National Heritage area within, and in proximity to, the project area. It would be useful to have maps showing important habitat for key species (such as seagrass for dugongs) and other values within proximity of the proposed action; • What World and National Heritage values (and associated species and habitat), if any, are within the area of the 10m salinity discharge.	**1)** Attachment 4 (MNES) Chapter 17 and Appendix 9 (Terrestrial Ecology) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) **3)** Sections 2.1, 2.2 and 3.1, Tables 2.2 and 3.1	SREIS Attachment 2 (MNES), Section 2.1 (Table 2.1) assesses project activities, including vegetation clearance, against Great Barrier Reef World Heritage and National Heritage values. Important habitats for marine species are shown in Figures 19.1 of the EIS (Chapter 19). Updated information on turtle nesting sites is provided in SREIS Chapter 16, and shown in Figure 16.1. Important shorebird habitats within Point Curtis are shown in of Chapter 19 (Shorebirds) of the SREIS (Figure 19.2). SREIS Attachment 2 (MNES), Chapter 2, Section 2.2.1 identifies the area potentially impacted by wastewater discharge. Arrow Energy's preferred option is to use the two sewer mains servicing Curtis Island from the mainland to dispose of effluent. The treatment plant on Curtis Island is being maintained as a project option. Should this option be pursued, no sensitive areas (such as seagrass) are located close to the discharge location and any discharge will comply with applicable water quality criteria. Impacts are predicted to be extremely localised and will not have a significant impact on the heritage values of the GBRWHA (Section 2.2 of MNES attachment to the SREIS).

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
10 (see: 29)	Fauna within Port Curtis, page 5-13	The draft EIS states that no individual syngnathid fish were recorded in the area, however no video recording or diving was performed during the field studies. We require an explanation as to why there is unlikely to be a significant impact on syngnathid fish (both in terms of World and National Heritage place and in respect of syngnathid fish listed as threatened species under the EPBC Act), when no appropriate surveying has been undertaken.	**1)** Attachment 4 (MNES) **2)** Section 5.1.2	Visibility is limited in the project areas and precluded any meaningful video or diving (e.g., for seahorses). Replicate gill and cast net and beach seine sampled mainly juveniles of many species but no seahorse species. Their presence is inferred from the EPBC Protected Matters search, but it is difficult to prove that they are not in a particular area. As no seagrass or key areas for these species will be removed, impacts were assessed as not significant.
11 (see: 20, 31, 39)	6.1 GBRWHA and Port Curtis National Heritage Place	This section provides a reasonable summary of the expected impacts on the Great Barrier Reef World and National Heritage values, and appears to identify and address impacts that may affect heritage values and provide a set of mitigation measures based primarily on relevant legislation and accepted industry standard. However, the draft EIS also identifies a number of impacts that cannot be fully mitigated and which will result in residual impacts on the Great Barrier Reef World and National Heritage values, in particular those associated with terrestrial and marine habitat loss, dredging and dredge and tunnel spoil disposal, and loss of scenic amenity. Further information around offsetting (compensating for) these impacts is required.	**1)** Attachment 4 (MNES), Sections 5.1, 6.1 and 7 **2)** Chapter 16, and Section 19.6 **3)** Section 2.1, Tables 2.1 and 2.2, Section 5	Further assessment of impacts on Great Barrier Reef World Heritage Area (GBRWHA) and Natural Heritage values is provided in SREIS Attachment 2, MNES, Section 2 and is based on additional technical studies completed for the SREIS. Table 2.2 of Attachment 2, correlates specific project components and potential impacts to the Great Barrier Reef World Heritage and Natural Heritage values. The potential direct and indirect impacts of dredging on marine fauna and habitats is addressed in SREIS Chapter16 (Marine Ecology) and Chapter 17 (Estuarine Ecology – Calliope River) and associated technical studies. SREIS Chapter 18, Section 18.6 provides a revised floristic assessment of terrestrial vegetation. Section 18.6.2 addresses EPBC listed threatened ecological communities and s.18.6.4 addresses EPBC listed flora species. Chapter 18, Table 18.3 tabulates the revised areas of regulated vegetation to be cleared within the project area. This information is summarised in SREIS Attachment 2 sections 3.1.2 and 3.2.2, and Tables 3.1 and 3.2.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
11 (see: 20, 31, 39) (cont'd)	6.1 GBRWHA and Port Curtis National Heritage Place			The MNES Attachments to the EIS and the SREIS include commitments to address potential impacts to EPBC listed species. Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (Attachment 6 of the SREIS), consistent with its Environmental Offset Strategy. This plan: • Describes measures taken to avoid and minimise impacts. • Identifies Arrow Energy's likely offset requirements. • Presents evidence that there are opportunities to achieve the required offsets. • Sets out Arrow Energy's preferred approach to the provision of environmental offsets. The Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.
12 (see: 3, 30, 46)		• Methodologies used, including what targeted surveys have been undertaken (if any), survey methodology and how this complies with relevant Commonwealth guidelines and policies (for e.g., we require more information around methodologies used for assessment of impacts on Dugongs)	**1)** Attachment 4 (MNES) Section 3 Sections 19.4 and 19.5 Appendix 12 Marine and Estuarine Ecology Impact Assessment Report Sections 5.4 and 5.5 **2)** Appendix 8 Technical Study of Marine Ecology (Port Curtis) Appendix 11 Terrestrial Ecology Supplementary EIS Study Appendix 12 Interim Shorebird Technical Study	The report prepared by Central Queensland University sets out the survey methods used to inform the assessment of impacts including on MNES. Information on use of the area by dugong was sourced from the routine monitoring undertaken by experts over several years and documents referred to in the report. Additional surveys were undertaken for the SREIS more recently in August 2012. In addition, observations recorded in February to April 2011 and June 2011 during vessel and aerial surveys completed for the Western Basin Dredging and Disposal Project EIS were considered.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
		The department also requires more detail around:		
13 (see 23)	6.1 GBRWHA and Port Curtis National Heritage Place	• Information about what specific components of the project elements will impact on each World or National Heritage value	**3)** Sections 2.1 and 2.2, Tables 2.1 and 2.2	Table 2.2 of Attachment 2, correlates specific project components and potential impacts to the Great Barrier Reef World Heritage and Natural Heritage values.
14 (see 22)		• Dredging operation and impacts from dredge and tunnel spoil disposal (we note that there will be additional impacts to those assessed under the WBDD Project that must be assessed as part of that proposed action, and options for disposal must be confirmed)	**1)** Chapters 15 and 16 and Appendix 8 (Coastal Processes and Marine Water Quality) **2)** Chapter 6, 12, 13 and 14 Appendix 7 Coastal Processes and Marine Water Quality	The hydrodynamic modelling and subsequent impact assessment (Chapters 15 and 16 and EIS Appendix 8) provide a detailed assessment of the impacts of dredging in relation to the cumulative impacts of dredging in Port Curtis. Further modelling was undertaken to verify the predicted impacts following the receipt of more detailed information on dredge footprints and volumes from FEED – presented in SREIS coastal processes Chapter 14 and associated specialist technical study (SREIS Appendix 10). Arrow Energy has reviewed the dredge spoil disposal requirements for the project, including a range of feasible options in the vicinity of the dredge sites (in addition to the Western Basin Reclamation Area). The proposed sites for disposal of dredge spoil from each of Arrow Energy's dredge locations are identified in SREIS Chapter 6, Project Description: Dredging, within Section 6.3. All options for dredge disposal have the required approvals. Management of these sites, including of decant water, will be carried out in accordance with the approval conditions for each site. The dredge management plan for the Arrow LNG Plant will consider the locations and timing of all dredging activities in Port Curtis (project and non-project).

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
15	6.1 GBRWHA and Port Curtis National Heritage Place	• Aesthetic impacts (the findings in chapter 23 should be summarised in the MNES chapter)	**1)** Chapter 23 and Appendix 17 (Landscape and Visual) **3)** Sections 2.1 and 2.2, Tables 2.1 and 2.2	No significant impacts were identified on landforms or landscape features in a World Heritage property, as impacts are localised within an industrial precinct in a significantly disturbed landscape of the Gladstone urban region. A range of measures have been developed and commitments made to reduce the visual impact of the Arrow Energy LNG plant on Curtis Island. In particular, the headland of Boatshed Point will be protected from excavation and clearing to preserve areas of vegetation and topography that help screen lower parts of the LNG plant and the construction camp. Vegetation in a 20 m wide wildlife corridor along the eastern boundary of the LNG plant site will also be retained to screen the site from the east. The design of the plant also minimises cutting into the high ground of the Curtis Island hogsback ridge system that will assist in maintaining a vegetated backdrop and visually absorbing the built form of the development. Several measures were also developed to address the visual impact of project lighting, including minimising night time working, shielding/directing lighting on to work areas and the use of passive lighting (e.g., reflectors). These measures are discussed in detail in EIS Chapter 23, Section 23.5 and listed in Table 23.14.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
16 (see: 25, 26)	6.1 GBRWHA and Port Curtis National Heritage Place	• Quantification of impacts (both direct and indirect), including hectares to be impacted and percentage impacted compared to overall available habitat and habitat available regionally (where possible)	**1)** Attachment 4 (MNES), Section 6.5 Appendix 12 Marine and Estuarine Ecology, Section 6.1 **2)** Chapters 15-17, Section 18.6 **3)** Sections 3.1, 3.2 and 3.3	Updated area of disturbance is provided in SREIS Section 18.6. SREIS Chapter 18 (Terrestrial Ecology, Section 18.6) provides a revised floristic assessment of terrestrial vegetation. Section 18.6.2 addresses EPBC listed threatened ecological communities and Section 18.6.4 addresses EPBC listed flora species. Sections 18.6 tabulates revised areas of regulated vegetation to be cleared within the project area. This information is summarised in SREIS Attachment 2 sections 3.1.2 and 3.2.2, Tables 3.1 and 3.2. The potential direct and indirect impacts of dredging on marine fauna and habitats is addressed in SREIS Chapter 16 (Marine Ecology) and Chapter 17 (Estuarine Ecology – Calliope River) and associated technical studies. SREIS Section 18.8 calculates the area of disturbance, by RE, relative to cumulative total clearing expected for all Curtis Island LNG proposals.
17 (see: 4, 47)		• Assessment of cumulative impacts on World and National Heritage values	**1)** Attachment 4 (MNES), Sections 6.1 and 6.5, Appendix 12 Marine and Estuarine Ecology, Section 9 **2)** Section 18.8 **3)** Section 2.2 and Table 2.3	The cumulative impacts of vegetation clearing are presented in the EIS Section 32.3.7, Table 32.2 and Attachment 4 (MNES), Table 6.4 and are updated in SREIS Chapter 18 (Terrestrial Ecology, Section 18.8).
18		• Mitigation measures and their effectiveness in reducing impacts	**1)** Attachment 4 (MNES) Attachment 6 (EMP) Attachment 8 (Commitments) **2)** Attachment 3 (EMP Update), Attachment 7 (Commitments Update) **3)** Appendix C	The significance assessment approach adopted for the EIS and SREIS is underpinned by management measures that are effective and proven, based on industry standards where relevant. All mitigation measures have been reviewed by Arrow Energy to ensure they can be implemented and will be effective in managing identified impacts.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
19	6.1 GBRWHA and Port Curtis National Heritage Place	• Evidence based analysis for all conclusions, particularly for conclusions of non-significance.	**1)** Attachment 4 (MNES) Chapter 17 and Appendix 9 (Terrestrial Ecology) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) **2)** See technical studies pertaining to MNES, i.e., terrestrial ecology, shorebirds, marine and estuarine ecology, coastal processes, marine water quality	Additional field survey work has been undertaken in 2012 relating to MNES and is summarised in SREIS chapters 15 to 19. SREIS Attachment 2 (MNES) summarises the survey and assessment methodology described in the supporting technical studies, particularly; terrestrial ecology, shorebirds, marine ecology, and estuarine ecology. The MNES Attachment confirms that the survey methodology complies with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009). The significance assessment approach adopted for the EIS and SREIS is underpinned by management measures that are effective and proven, based on industry standards where relevant. All mitigation measures have been reviewed by Arrow Energy to ensure they can be implemented and will be effective in managing identified impacts.
20 (see: 11, 31, 39)		• Assessment of residual impacts (including quantification of residual impacts) after proposed mitigation methods (for e.g., in the draft EIS it is stated that 'some impacts will be unavoidable', but no information is provided on what these impacts are and on which values they impact).	**1)** Attachment 4 (MNES) Sections 5.1, 6.1 and 7. **2)** Sections 18.6, 18.7 and 19.6 **3)** Sections 3.1. 3.2, 3.3, 4.1 and 4.5	The residual impacts presented are those remaining after application of mitigation measures, as described in each impact assessment and the associated supporting study. Some impacts are avoidable e.g., by going to another location or using different technology; those that are "unavoidable" by such means have to be reduced. This is simply the pre-amble to the assessments that follows in the text, and the areas of habitat unavoidably lost after minimisation are given for each of the habitats and impacting activities in tables in each chapter.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
21 (see: 32, 40, 49)	6.1 GBRWHA and Port Curtis National Heritage Place	• Detail around any proposed management plans.	**1)** Attachment 4 (MNES) Attachment 6 (EMP) Attachment 8 (Commitments) **2)** Attachment 3 (EMP Update) Attachment 5 (Other Management Plans) Attachment 7 (Commitments)	SREIS Attachment 3 provides the revised environmental management plan, and Attachment 7 provides the commitments update. The SREIS Attachment 5 also presents a suite of additional 'other' management plans for: shorebirds, (wildlife) species, the Curtis Island wildlife corridor and pre-clearance surveys.
22 (see 14)		We note that the draft EIS states that dredging will be integrated with dredging undertaken for the WBDD project. We require more detail around when dredging will be undertaken (e.g., at the same time as dredging for WBDD or afterward) and cumulative impacts associated with dredging.	**1)** Chapters 15 and 16 and Appendix 8 (Coastal Processes and Marine Water Quality) **2)** Chapters 6, 12, 13 and 14	The modelling of impacts of dredging on coastal processes and water quality carried out for the EIS included the WBDD project and other relevant developments in Port Curtis in the base case. The modelling results were used in the assessment of cumulative impacts for coastal processes, water quality and marine and estuarine ecology (chapters 15, 16 and 19 of the EIS). The conclusions of these studies has been reviewed for the SREIS in light of changes to project dredging activities and considered in the further update of the MNES attachment of the SREIS. The dredge management plan for the Arrow LNG Plant will consider the locations and timing of all dredging activities in Port Curtis (project and non-project).
23 (see 13)		The 'Summary of Potential Impact' on World and National Heritage values must be clear and make a conclusion on significance of impacts (for e.g., statements such as 'Potential Impacts on the values of the GBRWHA will be further considered in the further development of the design of the project' are not adequate). In accordance with previous comments, the EIS must provide a full and comprehensive assessment of impacts.	**3)** Sections 2.1 and 2.2, Tables 2.1 and 2.2	See SREIS MNES Attachment 2 (i.e., this report), section 2.1 and associated tables Table 2.1 and Table 2.2.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
24	6.1.1 Geology or Landscape Values, page 6-6	The draft EIS states that 'lighting during construction will have a significant impact on landscape and visual receptors'. Discuss and provide a more detailed rationale for the conclusion that there will be no residual significant impact given that the draft EIS states that lighting will have a significant impact on landscape and visual receptors.	**1)** Attachment 4 (MNES), Section 6.3.3 Sections 6.5.2, 23.4.2 and 23.8. Chapter 32. **2)** Appendix 9 (Marine Ecology (Turtles) Technical Study – Curtis Island Baseline Light Monitoring 2012) **3)** Section 3.3, Table 3.4	EIS Chapter 23 (Landscape and Visual, Section 23.4.2) provides an assessment of 15 sensitive visual receptors / viewpoints. The assessment identified impacts, mainly due to lighting, of varying degrees of significance depending on the viewpoint. Commitments to avoid, mitigate and manage visual impacts are also included in EIS Chapter 23, Section 23.8. The cumulative impact assessment (EIS Chapter 23 and Attachment 4 (MNES) Section 6.5.2) considered impacts on landscape and visual amenity and of lighting from the increased number of developments planned and under construction in the Gladstone region. Lighting from the Arrow LNG plant during construction will be set in the context of three other LNG plants either under construction or operational on Curtis Island. Against this industrialised background, the additional cumulative impacts of lighting from the Arrow LNG plant will be minimal. Commitments to avoid, mitigate and manage visual impacts are included in EIS Chapter 23, Section 23.8. The SREIS provides additional assessment of potential lighting impacts to turtles (Chapter 16, Turtles and Lighting). The technical study informing the SREIS concludes that with appropriate management, the residual impact of LNG plant lighting can be reduced to an absolute minimum, reducing the sky glow and long term visibility of the LNG plant during the production phase, thereby reducing residual impacts to nesting turtles and hatchlings. Additional commitments have been included in the SREIS to manage light from the LNG plant site, during both construction and operations.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
25 (see: 16, 26)	6.1.2 Biological or Ecological Values	We require quantification of the total amount of vegetation to be cleared by the construction of project infrastructure (page 6-8). Further detail around mitigation measures is required (e.g., what are the "appropriate mitigation measures will be implemented" - page 6-9) In respect of reduction or loss of terrestrial species or populations, more detail is required around hydrological impacts or pollution and stringing and laying of pipelines (page 6-11). Any mitigation measures should be discussed.	**1)** Attachment 4 (MNES) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) Chapter 17 and Appendix 9 (Terrestrial Ecology) **2)** Section 18.6 **3)** Section 3.1	SREIS Chapter 18 (Terrestrial Ecology, Section 18.6) provides a revised assessment of terrestrial vegetation. Section 18.6.2 addresses EPBC listed threatened ecological communities and Section 18.6.4 addresses EPBC listed flora species. Section 18.6 presents a table of the revised areas of regulated vegetation to be cleared within the Arrow LNG Plant project area. This information is summarised in SREIS Attachment 2 (MNES), Section 3.1. EPBC Act listed vegetation communities and RE mapping are shown on figures in Chapter 18. Table 2.2 of SREIS Attachment 2 (MNES) correlates specific project activities to potential impacts to the World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area. Revised and additional management measures (commitments) identified during the supplementary technical studies to address impact on terrestrial ecology are included in Section 18.10 of the SREIS. The cumulative impacts of vegetation clearing are presented in the EIS Chapter 32 (Cumulative Impacts, Section 32.3.7, Table 32.2) and Attachment 4 (MNES), Table 6.4 and are updated in SREIS Chapter 18 (Terrestrial Ecology, Section 18.8).

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
26 (see: 16, 25)	6.1.3 Wilderness, Natural Beauty or Rare or Unique Environment Values	Vegetation clearance should also be discussed in the context of wilderness, natural beauty or rare or unique environment values.	**1)** Section 32.3.7 Attachment 4. **2)** Sections 3.1.2 and 3.2.2, Sections 18.6, 18.8 and 18.10 **3)** Section 2.2 (Tables 2.1 to 2.3)	SREIS Chapter 18 (Terrestrial Ecology, Section 18.6) provides a revised assessment of terrestrial vegetation. Section 18.6.2 addresses EPBC listed threatened ecological communities and Section 18.6.4 addresses EPBC listed flora species. Chapter 18, Table 18.3 tabulates the revised areas of regulated vegetation to be cleared within the Arrow LNG Plant project area. This information is summarised in SREIS Attachment 2 (MNES), sections 3.1.2 and 3.2.2, and tables 3.1 and 3.2. EPBC Act listed vegetation communities updated field validated regional ecosystem mapping are shown in Chapter 18. Table 2.2 of SREIS Attachment 2 (MNES) correlates specific project activities to potential impacts to the World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area. Revised and additional management measures (commitments) identified during the supplementary technical studies to address impact on terrestrial ecology are included in Section 18.10 of the SREIS. The cumulative impacts of vegetation clearing are presented in EIS Chapter 32 (Cumulative Impacts, Section 32.3.7, Table 32.2) and Attachment 4 (MNES), Table 6.4 and are updated in SREIS Chapter 18 (Terrestrial Ecology, Section 18.8). SREIS MNES Attachment 2, Section 2 presents disturbances in context with World Heritage and Natural Heritage values.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
27 (see: 7, 34, 42, 48)	6.1.5 Summary of Potential Impact	Please clarify what is proposed to be offset and why (the proposed offset suggests that there is likely to be a significant impact on the Great Barrier Reef World and National Heritage values). The offsets plan, or at a minimum, more detail around the plan, is required. The draft EIS states "Potential impacts on the values of the GBRWHA will be further considered in the further development of the design of the project" (page 6-16). We expect information on all impacts to be provided and quantified in the assessment phase.	**1)** Attachment 4 (MNES), Section 7.2 **2)** Attachment 6 (Offsets) **3)** Section 5 (Offsets)	Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (SREIS Attachment 6), consistent with its Environmental Offset Strategy. This plan: • Describes measures taken to avoid and minimise impacts. • Identifies Arrow Energy's likely offset requirements. • Presents evidence that there are opportunities to achieve the required offsets. • Sets out Arrow Energy's preferred approach to the provision of environmental offsets. The Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
		More detail is required around:		
28	6.3 Protected species	• Whether each species is vulnerable, endangered or critically endangered (noting that the significance threshold differs with each listing criteria) and please include the scientific names for all species.	**1)** Attachment 4 (MNES), Section 5.3, Table 5.2, Section 5.4, Table 5.3 **2)** Chapters 18 and 19, and associated technical studies **3)** Sections 3 and 4, Tables 3.2 and 4.1	The rationale for species considered not likely to be impacted by the proposed action is presented in SREIS Attachment 2, MNES, Appendix D based on detailed information provided in the technical studies. This took into account the species status and the impact this had on the significance threshold. The status of each species is detailed within the EIS MNES Attachment and the supporting technical studies and is included in the SREIS. Scientific names were included for all species and are also included in the SREIS. Conservation-listed species records are shown on Figure 4 in EIS Attachment 4 (MNES), in relation to the project area. Figures 5 and 6 show Regional Ecosystems in relation to the project area. Many species (particularly migratory species) potentially present in the study area are generalist species. It is not possible to isolate a particular habitat type of importance to those species. No important populations were identified of any conservation-listed species in the EIS.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
29 (see: 10)	6.3 Protected species	• An assessment of impacts on all listed threatened species and communities likely to occur, or be impacted by, the proposed action (for e.g., an assessment of impacts should be provided for syngnathid fish listed under the EPBC Act).	**1)** Attachment 4 (MNES) Section 5.1.2	Further assessment of EPBC listed threatened species is provided in SREIS Attachment 2, MNES, Chapter 3 and draws on details provided by the technical studies completed for the SREIS for terrestrial ecology, shorebirds and marine ecology. These studies included detailed discussion on the desktop and field survey methodologies; and impact assessment methodology, including conclusions regarding the magnitude and significance of residual (post-mitigation) impacts; mitigation and management commitments; and offsets. Appendix D of SREIS Attachment 2 (MNES) tabulates the revised assessment of threatened species where no change to potential impact is predicted. The rationale for species considered not likely to be impacted by the proposed action is based on detailed information provided in the technical studies. This took into account the species status and the impact this had on the significance threshold.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
30 (see: 3, 12, 46)	6.3 Protected species	• Detail around methodologies used. This should include a discussion around what broad scale and targeted surveys have been undertaken (and for what species), survey methodology, survey success and how surveys comply with relevant Commonwealth guidelines and policies. Surveys and methodology used are important to demonstrate that populations do not occur (particularly for endangered or critically endangered species).	**1)** Attachment 4 (MNES) Sections 3.1 and 6.4.1 Chapter 17 and Appendix 9 (Terrestrial Ecology) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) **2)** See technical studies pertaining to MNES, i.e., terrestrial ecology, turtles shorebirds, marine and estuarine ecology, coastal processes, marine water quality	Additional field survey work has been undertaken in 2012 relating to MNES and is summarised in SREIS chapters 15 to 19. The MNES Attachment confirms that the survey methodology complies with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009). The significance assessment approach adopted for the EIS and SREIS is underpinned by management measures that are effective and proven, based on industry standards where relevant. All mitigation measures have been reviewed by Arrow Energy to ensure they can be implemented and will be effective in managing identified impacts. Additional terrestrial ecology field surveys are proposed for the 2012/13 wet season targeting species that are more readily detectable in the warmer wet season months.
31 (see: 11, 20, 39)		• Some species, where impacts need to be mitigated, would benefit from a discussion and assessment of the level of residual impact.	**1)** Attachment 4 (MNES) Sections 5.1, 6.1 and 7 **2)** Sections 18.6, 18.7 and 19.6 **3)** Sections 3 and 4, Tables 3.2 and 4.1	The residual impacts given are those remaining after application of mitigation measures, as described in each impact assessment and the associated supporting study. The SREIS Attachment 2, MNES, Table 3.2 identifies the changes in potential impact to threatened species, notably the water mouse (*Xeromys myoides*). This species was detected in the vicinity of Boatshed Point on Curtis Island. SREIS Chapter 18 (Terrestrial Ecology) shows records of EVNT species in relation to the project area.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
32 (see: 21, 40,49)	6.3 Protected species	• Proposed mitigation measures including detail around any proposed management plans.	**1)** Attachment 4 (MNES), Section 7 Attachment 6 (EMP) Attachment 8 (Commitments) **2)** Attachment 3 (EMP Update), Attachment 7 (Commitments Update)	SRIES Attachment 4 provides the updated environmental management plan, and Attachment 7 provides an update on the commitments that were included in the EIS. The MNES attachments to the EIS and the SREIS include commitments to address potential impacts to EPBC listed species. Arrow Energy will develop management plans to address ecological issues prior to construction. SREIS Attachment 5 (Other Management Plans) provides details of the species management plan, pre-clearance survey procedure, wildlife corridor management plan and shorebirds management plan.
33 (see: 41)		• More detail around pre-clearance surveys to demonstrate that avoidance and mitigation measures will be effective when species or habitat is identified. The timing of pre-clearance surveys is crucial and should take into account breeding/feeding seasons of certain species, in particular migratory shorebird species present in higher numbers during the summer months. There is also no indication about what 'appropriate mitigate measures' will be implemented when species are found in pre-clearance surveys.	**1)** Attachment 4 (MNES), Sections 6.3 and 6.4 **2)** Appendix 11, Terrestrial Ecology Technical Report, Sections 4.1, 6.3, 9 and 10	The SREIS Attachment 5 (Other Management Plans) presents a suite of additional 'other' management plans covering pre-clearance surveys, plans for pre-clearance, shorebirds, wildlife species and the Curtis Island wildlife corridor. Section 4.1 of the Terrestrial Ecology Technical Report, notes that the timing of pre-clearance surveys should take into account breeding and feeding seasons of certain species. The pre-clearance framework also acknowledges the standard DSEWPaC development approval condition that: "Prior to the commencement of construction, DSEWPaC is likely to require a separate management plan for each species, ecological community or other MNES found during the verification surveys to manage the impacts of project construction and operation."

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
34 (see: 7, 27, 42, 48)	6.3 Protected species	• Proposed offsets (what is proposed to be offset, how the offset will be implemented/managed & what is it actually proposing to 'offset') – this can be provided in the offsets section of the MNES chapter.	**1)** Attachment 4 (MNES), Section 7.2 **2)** Attachment 6 (Offsets) **3)** Section 5 (Offsets)	Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (SREIS Attachment 6), consistent with its Environmental Offset Strategy. This plan: • Describes measures taken to avoid and minimise impacts. • Identifies Arrow Energy's likely offset requirements. • Presents evidence that there are opportunities to achieve the required offsets. • Sets out Arrow Energy's preferred approach to the provision of environmental offsets. The Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.
35		We note that the above matters have been addressed or mostly addressed in relation to several species in discussion with the department prior to publication.	-	Noted
36		Please note that for all listed threatened, migratory or marine species that are believed not likely to be impacted by the action, but for which suitable habitat is present and could be impacted by the action, we require sufficient, logically presented information to clearly demonstrate that a likely impact on the species will not occur.	**1)** Attachment 4 (MNES); Chapter 17 and Appendix 9 (Terrestrial Ecology) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) **2)** See technical studies pertaining to MNES **3)** Tables 3.2 and 4.1	The EIS MNES Attachment was revised to address DSEWPaC's earlier comments on the detail presented in the document. Information on the rationale for the determinations of non-significance and assessment of cumulative impacts on MNES are presented along with mitigation measures. Each specialist technical study for both the EIS and SREIS explains in detail the survey and assessment methodologies, in particular how it is required to comply with EPBC Act Guideline 1.1.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
37	6.3 Protected species	Use of diagrams and illustrations to show proximity of species and habitat to project elements would be useful. Statements such as 'the species could potentially occur within patches of forest occurring in the study area' need clarification and should be shown in diagrams. It would also be useful if these diagrams showed potential habitat, known habitat, habitat type (foraging, breeding etc.) and recorded sightings within proximity of the proposed action.	**1)** Attachment 4 (MNES), Figures 4, 5 and 6 **2)** Section 18.7 **3)** Figures in SREIS MNES attachment	Conservation-listed species records are shown on Figure 4 in EIS Attachment 4, MNES, in relation to the project area. Figures 5 and 6 show Regional Ecosystems in relation to the project area. Many species (particularly migratory species) potentially present in the study area are generalist species. It is not possible to isolate a particular habitat type of importance to those species. No important populations were identified of any conservation-listed species in the EIS. Additional figures are provided in the SREIS (e.g., see Chapter 18 (Terrestrial Ecology, Section 18.7).
		The description of EPBC Act listed migratory species is thorough and generally meets the department's requirements. However, more detail is required around:		

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
38	6.4 Migratory species	• Detail around methodologies used, including what surveys have been undertaken, survey methodology and how this complies with relevant Commonwealth guidelines and policies.	**1)** Attachment 4, Sections 3 and 6.4 **2)** Section 19.4 **3)** Section 4	Further assessment of migratory species is provided in the SREIS in MNES Attachment 2, Chapter 4 and draws on details provided by the SREIS technical studies for terrestrial ecology, shorebirds and marine ecology. Detailed discussion is provided on the desktop and field survey methodologies; and impact assessment methodology, including conclusions on the magnitude and significance of residual (post-mitigation) impacts; mitigation and management commitments; and offsets. The assessment of impacts was undertaken in accordance with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009) and the draft Background Paper to EPBC Act Policy Statement 3.21 – Significant Impact Guidelines for 36 Migratory Shorebird Species (DEWHA, 2009). The SREIS MNES Attachment 2, Section 4 identifies changes in potential impacts to migratory species, notably the eastern curlew (due to potential indirect disturbance to the Clinton Ash Ponds site). Appendix E of SREIS Attachment 2 (MNES) tabulates the revised assessment of migratory species. No change to potential impacts is predicted. Additional migratory shorebird and terrestrial ecology field surveys are proposed for the 2012/13 wet season, in part to validate the assessment of sites such as Clinton Ash Ponds. SREIS Chapter 15 (Marine Ecology, Section 15.4.2) details the results of scientific literature reviews undertaken for EPBC listed marine fauna, in particular the snubfin and Indo-Pacific humpback dolphins.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
39 (see: 11, 20, 31)	6.4 Migratory species	• Some species, where impacts need to be mitigated, would benefit from a discussion and assessment of the level of residual impact.	**1)** Attachment 4 (MNES), Section 6.4 **2)** Appendix 11 Terrestrial Ecology Supplementary EIS Study, Section 5.3 **3)** Section 4	The residual impacts given are those after application of mitigation measures, as described in each impact assessment chapter. Further assessment of migratory species is provided in SREIS MNES Attachment 2, Chapter 4 and draws on details provided by the SREIS technical studies for terrestrial ecology, shorebirds and marine ecology. Detailed discussion is provided on the desktop and field survey methodologies; and impact assessment methodology, including conclusions on the magnitude and significance of residual (post-mitigation) impacts; mitigation and management commitments; and offsets
40 (see: 21, 32, 49)		• Proposed mitigation measures including detail around any proposed management plans.	**1)** Attachment 4 (MNES), Section 7 Attachment 6 (EMP) Attachment 8 (Commitments) **2)** Attachment 3 (EMP Update), Attachment 7 (Commitments)	The MNES attachments to the EIS and the SREIS include commitments to address potential impacts to migratory species. Arrow Energy will develop management plans to address ecological issues prior to construction. Outlines of the species management plan, pre-clearance survey procedure, wildlife corridor management plan and shorebirds management plan are provided in SREIS Attachment 5.
41 (see: 33)		• More detail around pre-clearance surveys to demonstrate that avoidance and mitigation measures will be effective when species or habitat is identified. The timing of pre-clearance surveys is crucial and should take into account breeding/feeding seasons of certain species, in particular migratory shorebird species present in higher numbers during the summer months. There is also no indication about what 'appropriate mitigate measures' will be implemented when species are found in pre-clearance surveys.	**2)** Attachment 3 (EMP Update), Attachment 5 (Other Management Plans) Attachment 7 (Commitments Update)	The SREIS Attachment 5 (Other Management Plans) presents a suite of additional 'other' management plans covering pre-clearance surveys, plans for pre-clearance, shorebirds, wildlife species and the Curtis Island wildlife corridor. The pre-clearance framework also acknowledges the standard DSEWPaC development approval condition that: "Prior to the commencement of construction, DSEWPaC is likely to require a separate management plan for each species, ecological community or other MNES found during the verification surveys to manage the impacts of project construction and operation."

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
42 (see 7, 27, 34, 48)	6.4 Migratory species	• Any proposed offsets (what is proposed to be offset, how the offset will be implemented/managed & what is it actually proposing to 'offset').	**1)** Attachment 4 (MNES), Section 7.2 **2)** Attachment 6 (Offsets) **3)** Section 5 (Offsets)	Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (SREIS Attachment 6), consistent with its Environmental Offset Strategy. This plan: • Describes measures taken to avoid and minimise impacts. • Identifies Arrow Energy's likely offset requirements. • Presents evidence that there are opportunities to achieve the required offsets. • Sets out Arrow Energy's preferred approach to the provision of environmental offsets. The Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.
43		Use of diagrams and illustrations to show proximity of migratory species and habitat to project elements (for e.g., will the MOF2 impact the White-bellied Sea Eagle nest found during surveys). Maps showing potential habitat, known habitat and recorded sightings within proximity of the proposed action would be useful. These maps should highlight habitat components important for each relevant species.	**1)** Attachment 4 (MNES), Figures 1 - 6 **2)** Section 18.7 **3)** Figures in SREIS MNES attachment	The white-bellied sea eagle nest is shown on Figure 4 of the EIS MNES Attachment 4. This species forages widely in Port Curtis, and there are regular sightings around the port. The Hamilton Point MOF is not taken forward to the SREIS as a project option and there will be no project infrastructure in the vicinity of this nest. Migratory shorebird habitat is shown on Figure 3 of the EIS MNES Attachment 4 (both foraging areas and roost sites). An updated figure is provided in the SREIS in Chapter 19. SREIS shorebirds specialist technical study, Figure 3 and Appendix 1 describe the shorebird habitats in the project area.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
44	6.4 Migratory species	Internal advice suggests that shorebird roosting sites and significant foraging habitat for migratory shorebirds is present within the project footprint. Migratory shorebird surveys undertaken in January-March 2011 as part of the Ecosystem Research and Monitoring Program (ERMP) approval condition of the Port of Gladstone Western Basin Dredging and Disposal project indicate intertidal areas within the area of the proposed action as feeding habitat for migratory shorebirds. The proposed tunnel launch site and tunnel spoil disposal area were also identified as shorebird foraging areas, and two roost sites were identified in close proximity to the proposed launch site 1 and access road at the mouth of the Calliope River. Please clarify whether shorebird roosting sites and significant habitat for migratory shorebirds is present within the project site in the context of this information and other available information, and provide a justification for your conclusion (Page 6-88).	**1)** Attachment 4 (MNES), Figure 3 **2)** Chapter 19 and Appendix 12 (Interim Shorebirds Technical Study) **3)** Section 4.2	The Interim Shorebirds Technical Study report (SREIS Appendix 11) identifies the location the two roost sites and provides details for 21 habitat sites, including launch site 1 (Figure 3). The findings of the study are summarised in SREIS Chapter 19, Shorebirds. The MNES Attachment (SREIS Attachment 2) draws in the technical study in the discussion of MNES (chapters 2 to 5).
45		The results of other surveys conducted under the Ecosystem Research and Monitoring Program should also be considered in the context of marine fauna distribution, abundance and habitat use of the region as it may assist with mitigation measures.	**2)** Chapter 19 and Appendix 12 (Interim Shorebirds Technical Study) **3)** Section 4.2	Further marine ecology desktop studies and field surveys were carried out for the SREIS, as described in Chapter 4 of the SREIS Marine Ecology technical study and Chapter 4 of the SREIS Estuarine Ecology (Calliope River) technical study.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
46 (see: 3, 12, 30)	Significant Impact Criteria – Dolphins (page 6-104)	More information needs to be provided around impacts to the Snubfin dolphin and Indo Pacific humpback dolphin. It appears that surveys have not been undertaken for these species, and internal advice confirms that habitat occurring for these species close to and at the proposal site could be considered important habitat for the species. We require quantification and further discussion of impacts on these species, including more detailed information around proposed mitigation and management measures.	**1)** Attachment 4 (MNES), Section 3 Attachment 8 (Commitments) Chapter 19 (Sections 19.4 and 19.5) and Appendix 12 (Marine and Estuarine Ecology) (Sections 5.4 and 5.5) **2)** Chapter 15. Appendix 8, Technical Study of Marine Ecology (Port Curtis), Sections 4.1.2, 5 and 6.1. **3)** Sections 4.4 and 4.5	The existing environment and environmental values of marine fauna are discussed in EIS Chapter 19 (Marine and Estuarine Ecology, Section 19.3.3). Potential impacts on marine fauna are discussed in Section 19.4.2, and measures to avoid, mitigate and manage potential impacts on marine fauna are discussed in Section 19.5.2. Updated information on the potential impacts to marine fauna from project activities are provided in the SREIS Chapter 15, Marine Ecology. Information on the potential impacts of lighting on marine turtles is provided in SREIS Chapter 16, Turtles and Lighting. Both chapters contain additional management measures to address the impacts identified. The dredge management plan will be developed and approved prior to dredging activities commencing. The plan will include clear procedures for managing potential impacts to marine fauna for the project incorporating the commitments set out in the EIS and SREIS.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
46 (see: 3, 12, 30) (cont'd)	Significant Impact Criteria – Dolphins (page 6-104)	The following additional information should be provided: • A more detailed discussion and mapping that describes the known locations and habitat availability of this species to the north and south of the proposal • Additional detail on the ecology of the species including distribution, habitat use, diet, life history, social structure and behaviour; • Additional detail on the impacts of the proposal including a quantitative analysis of habitat lost and degraded and ongoing impacts of the various activities associated with the proposal; • A discussion of cumulative impacts for both species; • A calculation of Potential Biological Removal for both species and the implications of project impacts and cumulative impacts in relation to this; and • Detail on how offsets will address the impacts of the proposal on both species.	**1)** Attachment 4 (MNES), Section 3 Attachment 8 (Commitments) Chapter 19 (Sections 19.4 and 19.5) and Appendix 12 (Marine and Estuarine Ecology) (Sections 5.4 and 5.5) **2)** Chapter 15. Appendix 8, Technical Study of Marine Ecology (Port Curtis), Sections 4.1.2, 5 and 6.1. **3)** Sections 4.4 and 4.5	• SREIS Appendix 8 Marine Ecology technical report provides detailed discussion on the observed locations, ecology and occurrence of the dolphins within the study area, and the revised assessment of potential impacts. • SREIS Appendix 8 Marine Ecology technical report, sections 4.1.2, 5.2 and 6.1, addresses impacts to dolphins and marine habitats. S.4.1.2 explains the revised field and desktop survey methodology, and impact assessment methodology, as required to address DSWEPaC and DEHP EIS submissions This includes locations, dates and methods for aerial and vessel surveys. S.5.2 presents the results of additional survey effort for the SREIS, as well as the revised assessment of direct and indirect impacts. Accordingly, additional mitigation measures have been developed to manage potential impacts of project activities on marine fauna. • Revised dredge plume modelling undertaken for the SREIS (see Chapter 14 Coastal Processes and technical study Appendix 7) show no significant impact to dolphin habitats as a result of marine disturbances (dredging and offshore structures). • Section 5.2.1 of the SREIS Appendix 8, Marine Ecology technical report provides result from Gladstone Ports Corporation of that use abundance estimates of marine wildlife to determine the Potential Biological Removal. • The conclusion of the revised assessment (for the SREIS, i.e., see section 5.3 of this report) is that, following implementation of management and mitigation measures, there is a reduced risk of minor significance of direct impact to the migratory Australian snubfin dolphin, Indo-Pacific humpback dolphin and dugong due to potential vessel strikes, and that therefore, no specific offsets for these species is required.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
47 (see 4, 17)	6.5 Cumulative impacts	Note the comments above in respect to cumulative impacts, in particular on the Great Barrier Reef World and National Heritage values.	**1)** Attachment 4 (MNES), Sections 6.1 and 6.5, Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) (Section 9) **2)** Chapter 22 Appendix 8, Technical Study of Marine Ecology (Port Curtis), Section 4.2.1 **3)** Section 2.2 and Table 2.2	Table 2.2 of SREIS MNES Attachment 2 describes the impacts on World Heritage values updated from the EIS. A number of values of the world heritage area (coral reefs, breeding seabirds etc) are not of relevance as the project is not situated near any of these areas. Impacts on landscape values, biological values and wilderness values have largely been demonstrated to be negligible and confined to the boundaries of the designated industrial precinct of the GSDA on Curtis Island. Of those values that are of relevance to the Arrow LNG Plant pertaining to the world heritage area, the technical studies and chapters of the EIS and SREIS considered cumulative impacts as an intrinsic part of the assessment and the results of which are presented in relevant chapters of the EIS and SREIS, particularly those relating to terrestrial and marine ecology. Updated area of disturbance – presenting the LNG Plant Project proportionate cumulative contribution to impacts - is provided in SREIS Ch.18.6 (terrestrial ecology, floristic assessment). SREIS MNES Attachment 2, section 2 presents disturbances in context with World Heritage and Natural Heritage values.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
48 (see: 7, 27, 42, 34)	7.2 Environmental offsets	Although the draft EIS states that offsets will be provided, we require information on what offset is proposed, what the offset compensates for, and how the offset complies with relevant Commonwealth guidelines and policies (recognising that details will be developed and refined during assessment). We also require the offset strategy to specifically address MNES. Note that a consultation draft of the most recent EPBC Draft Environmental Offsets Policy is available (http://www.environment.gov.au/epbc/publications/consultation-draft-environmental-offsets-policy.html) and should be used as a guide for developing the offsets strategy (and referenced appropriately in the EIS). The magnitude of proposed offsets must account for the risk associated with any uncertainty of impacts. Please note that it is the department's preference for any offset strategy to align with offsets required for the three previously approved LNG plants on Curtis Island to ensure the best possible environmental outcomes.	**1)** Attachment 4 (MNES), Section 7.2 **2)** Attachment 6 (Offsets) **3)** Section 5 (Offsets)	Offsets are discussed in SREIS Attachment 2 (MNES), Chapter 5 with reference to the Australian Government's EPBC Act Environmental Offsets Policy, October 2012. The MNES Attachment (Attachment 2) of the SREIS, chapters 2, 3 and 4 provide the rational for consideration of offsets for the World Heritage and National Heritage values, and EPBC listed threatened ecological communities and species and migratory species for which the project is declared a controlled action. Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (Attachment 6 of the SREIS), consistent with its Environmental Offset Strategy. This plan: • Describes measures taken to avoid and minimise impacts. • Identifies Arrow Energy's likely offset requirements. • Presents evidence that there are opportunities to achieve the required offsets. • Sets out Arrow Energy's preferred approach to the provision of environmental offsets. The Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
49 (see: 32)	Appendix 1	Note that mitigation measures that are to be relied upon to reduce the level of significance of impact must use commitment language and must not use terminology such as 'may' or 'should'. If using the term 'where practical' other mitigation measures must be provided to ensure the level of impact will be appropriately mitigated.	**1)** Attachment 4 (MNES), Section 7 Attachment 6 (EMP) Attachment 8 (Commitments) **2)** Attachment 3 (EMP Update), Attachment 7 (Commitments Update) **3)** Appendix C (Commitments Update)	The mitigation measures presented in the EIS and MNES Attachment 4 are presented as commitments. SREIS Attachment 2, Appendix C provides the project commitments relating to the protection and management of MNES. The framework for approvals is provided in EIS Chapter 2, and Attachment 1, and has been updated for the SREIS (Attachment 1, Approvals Update).
50		Where available, we require the statutory or policy basis for the mitigation measure, and the expected cost of the mitigation measure, to be provided. Please also provide the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program. This information is required under Section 4.01 of Schedule 4 of the *Environment Protection and Biodiversity Conservation Regulations 2000*.	**1)** Attachment 1 (Legislation and Approvals) Attachment 6 (EMP) **2)** Attachment 1 (Revised - Legislation and Approvals) Attachment 3 (Revised - EMP) Attachment 7 (Commitments Update) **3)** Appendix C (Commitments Update)	SREIS Attachment 1, Legislation Update, provides discussion on the legislative and approvals framework for the project. The cost of mitigation will be determined through a competitive tendering process for the construction of the Arrow LNG Plant. Consequently, it is not possible to provide insight into that actual cost of mitigation. It is important to note that all mitigation measures have been reviewed by the FEED team to ensure they can be implemented.
51	9. Environmental Records	We require more information about the circumstances around the two penalty infringement notices noted in the draft EIS.	**1)** Chapter 1	EIS Chapter 1 discusses the penalty infringement notices (PINs).

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
52	10. Conclusions	The conclusion on significance of impacts to MNES to be clear and include a discussion around: • level of impact; • mitigation measures; • residual impact; and • proposed offsets for any impact that cannot be mitigated.	**1)** Attachment 4 (MNES) Attachment 6 (EMP) Attachment 8 (Commitments) Chapter 17 and Appendix 9 (Terrestrial Ecology) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) **2)** See technical studies pertaining to MNES, i.e., terrestrial ecology, turtles shorebirds, marine and estuarine ecology, coastal processes, marine water quality **3)** MNES attachment	SREIS Attachment 2, MNES, Section 6 provides revised conclusions concerning MNES.

Note: fully detailed responses to all public and advisory agency submissions to the EIS are included as Part B of the SREIS.

Appendix B

Cross-Check Table Against Issues Relating to MNES Raised in Public Submissions

Table B.1 Cross-check table against issues relating to MNES raised in public submissions

Issue	Description	Section where addressed		
		EIS	SREIS	SREIS MNES Attachment
GBRWHA issues	Recommendations from the UNESCO World Heritage Committee meeting on the management of the GBRWHA (June 2012) should be applied and incorporated into the supplementary EIS. The EIS process should be suspended until receipt of these recommendations.	-	-	Section 2.2.2, and Tables 2.1, 2.2 and 2.3
Dolphins – distribution, impacts and mitigation	Further research is recommended on the distribution and extent of relevant species (Irrawaddy dolphin, Snub-fin and Indo-Pacific humpback dolphin). Provide further detail on the impacts to these species in Port Curtis in the MNES attachment including on habitat loss, cumulative impacts and proposed mitigation measures (including offsets).	Chapter 19 Attachment 4 (MNES)	Port Curtis marine Ecology Tech Report: Sections 4.1.2, 5 and 6.1	Section 2.2.2, and Tables 2.1, 2.2 and 2.3 Section 4.2 and Table 4.1
Vegetation clearance - areas and mitigation	Provide a map and details of the areas of vegetation proposed to be cleared including for MNES vegetation. Vegetation clearance should be discussed in the context of wilderness, natural beauty or rare and unique environmental values. Provide details of the vegetation management plan, including its purpose and the proposed mitigation measures.	Section17.4.3 Sections 17.5 and 17.8	Section 18.6	Sections 3.1.2 and 3.2.2; Tables 2.2, 3.1 and 3.2

Note: fully detailed responses to all public and advisory agency submissions to the EIS are included as Part B of the SREIS.

Appendix C

New and Revised Commitments Relating to Management of Impacts to MNES

New and revised commitments to manage the project impacts to MNES, additional to, or superseding where appropriate those presented in Appendix 1, Table A1 of the Arrow LNG Plant EIS, are set out in Table C.1.

Table C.1 New and Revised Commitments Relating to Management of Impacts to MNES

No.	Commitment
C17.03 A	An area of semi-evergreen vine thicket community (containing the *Cupaniopsis* vegetation community) will be retained by the project on Boatshed Point. This area will be demarcated prior to the commencement of construction and workers and machinery will be prohibited from accessing the area. The boundary of the semi-evergreen vine thicket community to be retained will be fenced off with a 20-m buffer between the semi-evergreen vine thicket community (including the *Cupaniopsis* vegetation community) and the fence and area of disturbance. The retained vine thicket area is designed to protect a viable semi-evergreen vine thicket vegetation community and a viable population of *Cupaniopsis* sp. indet. on Boatshed Point. Do not develop within the fenced area of the retained semi-evergreen vine thicket community. Establish roles and responsibilities for the management of the retained semi-evergreen vine thicket community.
C17.16 A	• Shield/direct the light source onto work areas where practical, and avoid light spill on to habitat areas (such as mangroves and Clinton ash ponds) where practical.
C17.23 A	Clearly mark no go zones, where required, including the semi-evergreen vine thicket (*Cupaniopsis*) fenced area on Boatshed Point and the critically endangered EPBC Act listed vine thicket communities on the eastern margin of Hamilton Point and northeast of Boatshed Point. Signage will be erected around the margins of the communities to indicate restricted access.
C17.36 A	Develop trench management procedures to prevent access of fauna into trenches. These procedures will include measures such as trench breakers and covers. In addition, inspection procedures will be established in order to remove trapped fauna, create protection and refuge areas for wildlife trapped in the trench and develop methods to assist trapped fauna left in the trench.
C17.40	Protect the EPBC Act listed community northeast of Boatshed Point and employ low impact methods of weed control within and adjacent to EPBC Act listed communities.
C17.41	Establish a management buffer of suitable width and of contiguous natural vegetation, around the EPBC Act listed community northeast of Boatshed Point to minimise the potential for edge effects and limit the potential for weed invasion. The buffer will be defined in the Wildlife Corridor Management Plan to be developed prior to construction.
C17.42	Implement fire control measures to prevent wildfire incursion into the EPBC Act listed communities. This may include construction of firebreaks or asset protection burning outside of the community and its associated buffer.
C17.43	The need to protect EPBC Act listed communities and explanation of the mitigation measures that are to be implemented, to be detailed in workforce inductions.
C17.44	Clearly delineate clearing boundaries to avoid unnecessary vegetation loss.
C17.45	Where practical, stock-pile cleared vegetation in ‘wind-rows’ around the edge of retained vegetation. In addition to providing shelter, this will also provide some physical barrier reducing edge impact severity and the risk of weed spread.
C17.46	Minimise the duration trenches are open, ensure daily trench inspections are undertaken by suitably qualified spotter/catchers and ensure that the length of open trench does not exceed that which can be inspected by the available spotter/catchers in any one daily period.

Table C.1 New and Revised Commitments Relating to Management of Impacts to MNES (cont'd)

No.	Commitment
C17.47	Consider measures to minimise light emitted from the LNG plant during the detailed design of the LNG plant including: • Assess the necessity and choice of lighting in the plant area: – Use low-pressure sodium (LPS) lights as a first-choice light source and high-pressure sodium (HPS) lights where LPS is not practical. – Replace short-wavelength light with long-wavelength light and exclude short-wavelength light with the use of filters. – Avoid using halogen, metal halide or fluorescent lights (white lights) where possible, and only use white lights in contained areas where colour rendition is required. – Minimise the number and wattage of lights, and recess lighting into structures where possible. • Use timers and motion-activated light switches. • Use reflective materials to delineate equipment or pathways and use embedded lighting for roads. • Position doors and windows on the sides of buildings facing away from marine turtle nesting beaches and install and use window coverings to reduce light emissions. • Maintain elevated horizons (such as topographic features, vegetation or barriers) to screen rookery beaches from light sources.
C17.48	If koalas are found during wet season surveys to be undertaken in early 2013 or pre-clearance surveys, develop and implement appropriate mitigations in the species management plan, which could include fauna spotter/catchers, limiting vehicle speed limits and habitat rehabilitation.
C17.49	Design infrastructure to reduce impacts on shoreline habitat, where possible, and reduce the risk of unnecessary clearing by demarcating disturbance areas.
C17.50	Reduce lighting wherever possible, in locations where movement between water mouse foraging and nesting habitats (e.g., between mangroves and the supralittoral zone) occurs.
C17.51	Review the need for an ongoing program to monitor the shorebird population at project sites following the completion of survey work in 2013.
C17.52	Develop measures to minimise disturbance around important shorebird habitat, during construction and operation. Measures could include exclusion zones or screens as recommended in Rohweder et al., (2011).
C19.12	Establish a system for the recording of opportunistic observation of marine megafauna (turtles, saltwater crocodiles, dugong and cetaceans) spotted during marine operations such as dredging, pile driving and marine transport including where these activities occur within the Calliope River.
C19.13	Evaluate the use of bubble curtains for each method of piling, and deploy where they are demonstrated to be effective in aiding the rapid attenuation of underwater noise and deterring marine fauna from approaching, or remaining at, pile driving sites.
C19.14	A light mitigation plan for construction and operation will be developed and will include specific light management and reduction measures and a commitment to routine light audits.
C19.15	Arrow Energy will participate in monitoring programs established to assess the impact of current and future industrial lighting in the Gladstone region on hatchlings emerging on the beaches of Curtis and Facing islands

Commitments C17.05 and C17.26 from the EIS have been removed as the Hamilton Point MOF is no longer considered as an option.

Appendix D

Revised Assessment of Threatened Species Where No Change to Potential Impact is Predicted

Table D.1 Revised assessment of threatened species where no change to potential impact is predicted and species not likely to occur within project area

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Revised likelihood of occurrence (SREIS)	Change in potential impact
Common name	**Scientific name**						
Birds							
Australian painted snipe	*Rostratula australis*	Vulnerable (also listed as migratory and marine)	Low to moderate	No. Species has not been identified from within the study area. No suitable freshwater habitat to be removed for the project.	No Paucity of records indicates the species is not common within the local area or region. No suitable habitat within project area of disturbance.	No change.	No change to the potential impact Identified as 'rarely, if ever, inhabiting Port Curtis'.
Black-breasted button-quail	*Turnix melanogaster*	Vulnerable	Low to moderate	No. No areas identified as habitat critical to the survival of the species identified. No important populations in vicinity of the project area.	No Records occur along Boyne Island, however there are no records known from Curtis Island and little suitable habitat is present within the project area. Marginal habitat in project area.	Low	No change. No records known from Curtis Island and little suitable habitat is present within the project area.
Red goshawk	*Erythrotriorchis radiatus*	Vulnerable	Low to moderate No historical records of the species and no individuals observed during EIS surveys.	No. Sub-optimal habitat to be cleared for the project is small in comparison to the potential foraging habitat available in the wider region.	No Habitat for this species within the project area is marginal.	Low	No change. Very few known records suggest it is not a regular inhabitant of the area.

Table D.1 Revised assessment of threatened species where no change to potential impact is predicted and species not likely to occur within project area (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Revised likelihood of occurrence (SREIS)	Change in potential impact
Common name	**Scientific name**						
Birds (cont'd)							
Yellow chat (Dawson subspecies)	*Epthianura crocea macgregori*	Critically endangered	Moderate	No. No optimal habitat has been identified within the study area. Populations are not known from within the study area.	No Although records of the species occur on Curtis Island, the species resides in the northeast corner of the island and is not know from the project area. No suitable habitat.	Low	No change. Not know from the project area. No suitable habitat.
Mammals							
Northern quoll	*Dasyurus hallucatus*	Endangered	Moderate	No. No records of the species within suitable habitat within the study area. Large areas of more suitable habitat are present to the north of the LNG plant on Curtis Island, and adjacent to TWAF 8 in Targinie State Forest.	No. No records occur within proximity to the project area. Habitat for the species is marginal.	Low	No change. No records of the species within suitable habitat within the study area.

Table D.1 Revised assessment of threatened species where no change to potential impact is predicted and species not likely to occur within project area (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Revised likelihood of occurrence (SREIS)	Change in potential impact
Common name	**Scientific name**						
Reptiles							
Collared delma	*Delma torquata*	Vulnerable	Moderate	No. No critical habitat for the species has been identified within the study areas, no important populations are present, and potential foraging habitat clearing is a small proportion of that available in the wider region.	No. No known nearby records suggest the species does not inhabit the area.	Low	No change. Species unlikely to inhabit the area.
Yakka skink	*Egernia rugosa*	Vulnerable	Moderate	No. No critical habitat for the species has been identified within the study areas, no important populations are present, and potential foraging habitat clearing is a small proportion of that available in the wider region.	No. No known nearby records suggest the species does not inhabit the area. No suitable habitat in project area.	Low	No change. Species unlikely to inhabit the area.

Table D.1 Revised assessment of threatened species where no change to potential impact is predicted and species not likely to occur within project area (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Revised likelihood of occurrence (SREIS)	Change in potential impact
Common name	**Scientific name**						
Plants							
Wedge-leaf tuckeroo	*Cupaniopsis shirleyana*	Vulnerable	Low to moderate	No. No important habitat has been identified in the project area, and the species was not identified in field surveys.	Semi-evergreen vine thicket habitat is present in the project area. All prior records of *Cupaniopsis shirleyana* within 100 km buffer surrounding project area have been re-assigned to an undescribed taxon (Cupaniopsis) that at date of assessment had not been assigned a hispid name. *Cupaniopsis shirleyana,* being restricted to the area between Gympie and Brisbane, has no further relevance to the project and reference has been removed from the SREIS.	Very Low	No change. Reference to *Cupaniopsis shirleyana* has been removed from the SREIS.
Cycad	*Cycas megacarpa*	Endangered	Low to moderate	No. No important habitat has been identified in the project area, and the species was not identified in field surveys.	Numerous Herbrecs records within 100 km buffer with nearest record 4.2 km west of TWAF 8 on the western slope of Mount Larcom. Mostly associated with granite and acid volcanic soils.	Low	No change. Species was not identified in field surveys.

Table D.1 Revised assessment of threatened species where no change to potential impact is predicted and species not likely to occur within project area (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Revised likelihood of occurrence (SREIS)	Change in potential impact
Common name	**Scientific name**						
Plants (cont'd)							
Mount Larcom silkpod	*Parsonsia larcomensis*	Vulnerable	Low to moderate	No. No individuals were identified in the project area, and habitat proposed to be cleared is not optimal habitat for the species.	Herbarium records 3 km west of TWAF 8 on Mount Larcom as well as 6 km north of TWAF 8 in non-remnant paddock (possible unreliable co-ordinates).	Low	No change. Species was not identified in field surveys.
Quassia	*Samadera bidwillii*	Vulnerable	Low to moderate	No. No important habitat has been identified in the project area, and the species was not identified in field surveys.	Five records in study area. Nearest record 4 km west of mainland tunnel launch site - Upper western slopes of Mount Larcom.	Very low	No change. Species was not identified in field surveys.

Appendix E

Revised Assessment of Migratory Species Where No Change to Potential Impact is Predicted

Table E.1 Revised assessment of migratory species where no change to potential impact is predicted and species not likely to occur within project area

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Change in potential impact
Common name	**Scientific name**					
Birds						
Other migratory wetland birds						
Caspian tern	*Hydroprogne caspia*	Migratory	Recorded	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	Yes	No change
Cattle egret	*Ardea ibis*	Migratory	High (common)	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Eastern osprey	*Pandion haliaetus*	Migratory	Recorded	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Eastern reef egret	*Egretta sacra*	Migratory	High	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Great egret	*Ardea alba*	Migratory	Recorded (common)	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	Yes	No change

Table E.1 Revised assessment of migratory species where no change to potential impact is predicted and species not likely to occur within project area (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Change in potential impact
Common name	**Scientific name**					
Birds (cont'd)						
Other migratory wetland birds (cont'd)						
Little tern	*Sterna albifrons*	Migratory, marine	Moderate to high	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	No	No change
White-bellied sea-eagle	*Haliaeetus leucogaster*	Migratory	Recorded	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	Yes	No change
Terrestrial migratory birds (cont'd)						
Barn swallow	*Hirundo rustica*	Migratory (terrestrial)	Moderate	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Black-faced monarch	*Monarcha melanopsis*	Migratory (terrestrial)	Moderate	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Fork-tailed swift	*Apus pacificus*	Migratory (terrestrial)	Recorded	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change

Table E.1 Revised assessment of migratory species where no change to potential impact is predicted and species not likely to occur within project area (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Change in potential impact
Common name	**Scientific name**					
Birds (cont'd)						
Terrestrial migratory birds (cont'd)						
Rainbow bee-eater	*Merops ornatus*	Migratory (terrestrial)	Recorded	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Rufous fantail	*Rhipidura rufifrons*	Migratory (terrestrial)	Recorded	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Satin flycatcher	*Myiagra cyanoleuca*	Migratory (terrestrial)	Recorded	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Spectacled monarch	*Monarcha trivirgatus*	Migratory (terrestrial)	High	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change
White-throated needletail	*Hirundapus caudacutus*	Migratory (terrestrial)	Recorded	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Marine fauna						
Saltwater crocodile	*Crocodylus porosus*	Migratory	Moderate	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change

Arrow CSG (Australia) Pty Ltd

Arrow LNG Plant

Matters of National Environmental Significance Update

Referral No. EPBC 2009/5008 - Feed gas pipeline

February 2013

CR 7033_16_v3

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Appendices

1. INTRODUCTION

1.1 Background and Purpose

Arrow CSG (Australia) Pty Ltd (Arrow Energy) is seeking approval to construct, operate and decommission the Arrow LNG Plant, located on Curtis Island, near Gladstone, Queensland.

Approval is required under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act). The EPBC Act provides for the protection of the environment, especially matters of national environmental significance (MNES). Under the act, actions likely to have a significant impact on MNES require assessment and approval under the EPBC Act.

Two referrals were made to the then Australian Government Department of Environment, Water, Heritage and the Arts (DEWHA):

- EPBC 2009/5007 – to develop a liquefied natural gas facility on the southern end of Curtis Island, opposite Gladstone, Queensland.
- EPBC 2009/5008 – to develop a high pressure gas pipeline and associated infrastructure from either the Gladstone City Gate or a new facility, to Curtis Island, Queensland.

On 21 August 2009, it was determined that the proposed actions described by referrals EPBC 2009/5007 and EPBC 2009/5008 were both likely to have a significant impact on the following MNES:

- World Heritage properties.
- National Heritage places.
- Listed threatened species and communities.
- Listed migratory species.

An environmental impact statement (EIS) for the project was subsequently prepared and was published for public comment in April 2012. The EIS included an attachment specifically addressing MNES that addressed both controlled actions.

This report – an attachment to the Supplementary Report to the Environmental Impact Statement (SREIS) – supplements the MNES attachment to the EIS and specifically addresses the referral number EPBC 2009/5008 (development of a high pressure gas pipeline to Curtis Island).

The EPBC Act Policy Statement 1.1 ‘Significant Impact Guidelines: Matters of National Environmental Significance’ (DEWHA, 2009) provides the framework for the assessment of potential impacts upon MNES from the Arrow LNG Plant.

A separate report within Attachment 2 of the SREIS provides similar supplementary information for referral number EPBC 2009/5007 that, due to its broader scope of project infrastructure and operations, provides a more extensive revised assessment of potential impacts, particularly concerning marine and estuarine (Calliope River) ecology, terrestrial ecology (ecological communities, flora and fauna species, and shorebird species and habitats). Inevitably, both reports contain common issues, for example with regard to assessment of impacts to World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area.

The purpose of this supplementary MNES attachment for EPBC 2009/5008 is to:

- Provide an assessment of the change in potential impact (between the EIS and the SREIS) to MNES as a result of the changes in project design during front end engineering design (FEED), and/or as a result of further information being obtained. MNES for which there is no change in impact, are not carried forward to this assessment, but are addressed in Table 2.2.
- Address the issues raised by the Australian Government Department of Sustainability, Environment, Water Population and Communities (DSEWPaC) in feedback on the MNES attachment to the EIS.
- Address other issues raised in submissions on the EIS relating to MNES.

This MNES attachment refers substantially to the additional information and revised assessments compiled as chapters of the SREIS, which in turn are informed by a series of technical studies prepared to address changes in the project design, information gaps in the EIS and responses to submissions on the EIS. In particular:

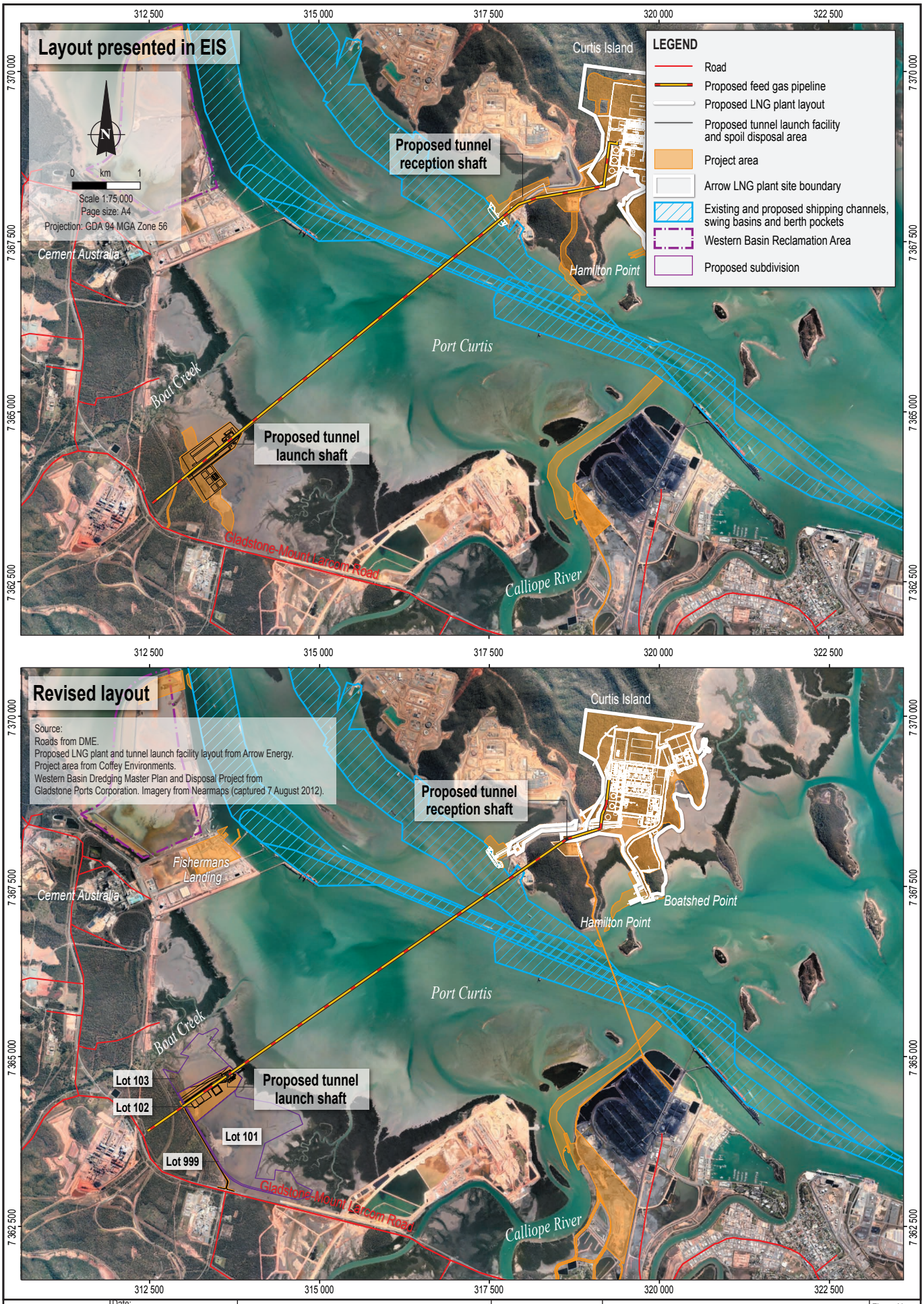
Matters relating to terrestrial ecology are addressed in the SREIS Chapter 18, Terrestrial Ecology, which is based upon the technical study conducted by 3D Environmental and EcoSmart Ecology, which is attached as Appendix 11, Terrestrial Ecology Supplementary EIS Study.

Matters relating to shorebird species are addressed in the SREIS Chapter 19, Shorebirds, which is based upon the technical study carried out by Ecosure, which is attached as Appendix 12, Arrow LNG Plant Interim Shorebird Technical Study.

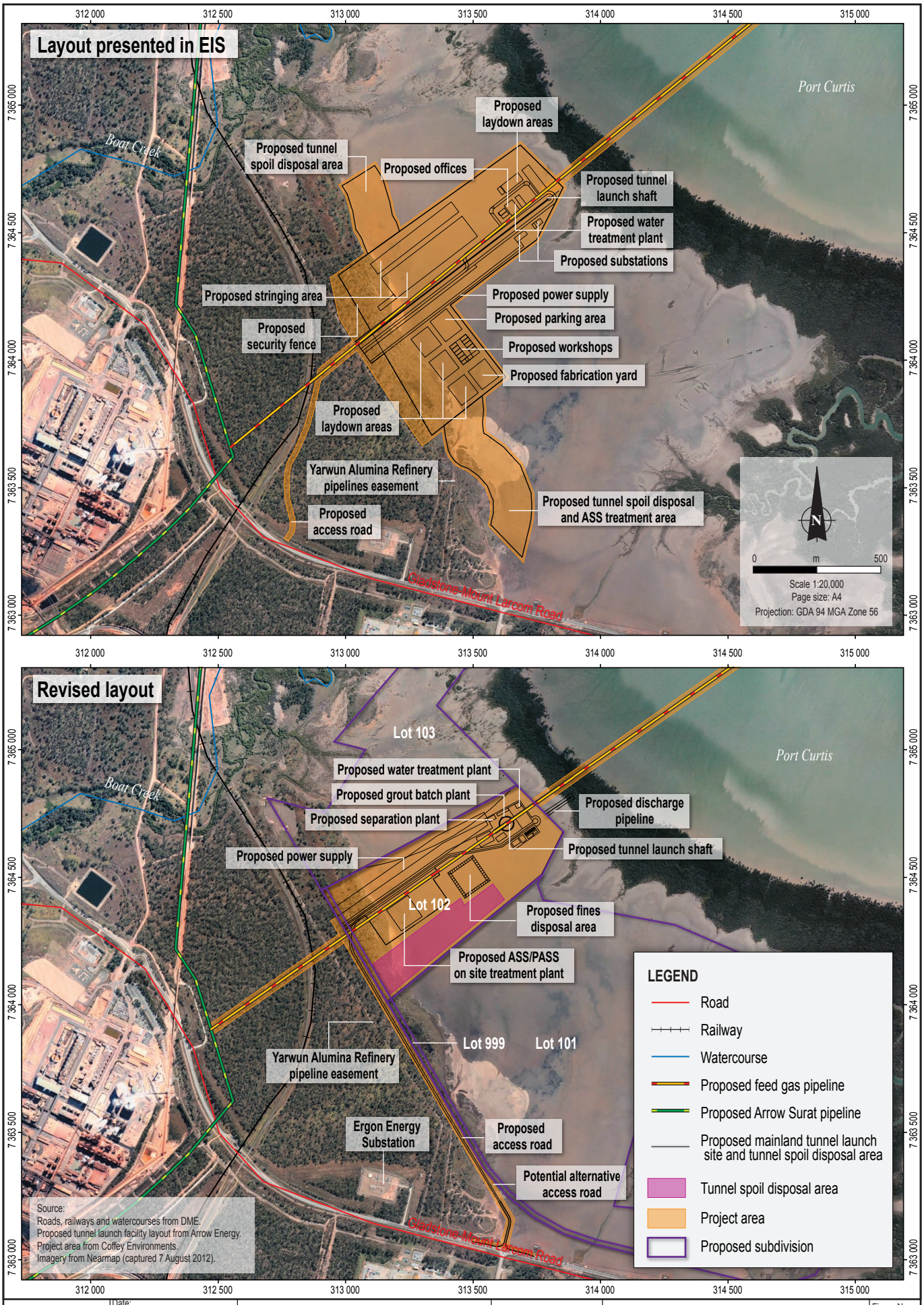
1.2 Changes in Project Design

An overview of the projectdescription changes for the proposed Arrow LNG Plant is described in Chapter 5, Project Description Feed Gas Pipeline of the SREIS. The changes in project description of relevance to referral number EPBC 2009/5008, consist of the following:

- The tunnel has been extended and realigned to avoid the GLNG MOF and haul road. The tunnel reception shaft is now located approximately 700 m east of the original site, south of the GLNG haul road and on the eastern side of the low hills of Hamilton Point. The feed gas pipeline now runs south of the haul road to the LNG plant site, crossing the LNG loading lines inside the LNG plant site. West of the LNG plant site, the tunnel reception shaft and feed gas pipeline are located in the Curtis Island Corridor Sub-Precinct of the Gladstone State Development Area (Figure 1.1).
- The mainland tunnel launch site, located on the intertidal mudflats south of Boat Creek, was originally proposed as an irregular-shaped, 50-ha site, approximately 900 m long by 700 m wide at the edge of the mudflats, narrowing to 350 m near the tunnel launch shaft to encompass the tunnel launch shaft pad and tunnel spoil disposal areas. A 35-ha site, approximately 900 m long by 450 m wide at the edge of the mudflats, narrowing to 300 m wide near the tunnel launch shaft, is now proposed (Figure 1.2).



coffey environments	Date: 10.12.2012 MXT: 7033CC_16_GIS029_v1_4 File Name: 7033_MNES2_F01.01_GIS_VS	Arrow Energy Arrow LNG Plant	arrow energy go further	Proposed feed gas pipeline alignment	Figure No: 1.1



coffey environments	Date: 10.12.2012 MXT: 7033CC_16_GIS030_v1_2 File Name: 7033_MNES2_F01.02_GIS_VS	Arrow Energy Arrow LNG Plant	arrow energy go further	Conceptual layout of tunnel launch site	Figure No: 1.2

1.3 DSEWPaC Submission on the Arrow LNG Plant EIS

In May 2012, DSEWPaC, which administers the EPBC Act, made a submission on the MNES attachment to the EIS to Arrow Energy via the Queensland Coordinator-General. Some of the general issues raised in the comments related to:

- Species survey methods.
- Specific issues relating to impacts upon species.
- Assessment of significance of residual impacts.
- Mitigation measures and management plans.
- Offset requirements.
- Cumulative and indirect impacts.
- Accessibility of information within the EIS.

The comments provided by DSEWPaC are provided in Appendix A of this attachment, along with cross references to the corresponding section of the EIS, the SREIS, and/or this attachment where each comment is addressed. Further details of the responses to DSEWPaC's submission on the EIS are provided in Part B of the SREIS. Part B presents information about the public exhibition period and the process for lodgement of submissions on the EIS, and statistics on the number and variety of submissions received during the EIS review period.

1.4 Issues Relating to MNES Raised in Public Submissions

A small number of submissions relating to MNES were received during the public comment period on the EIS. These submissions related to:

- Management of the Great Barrier Reef.
- Potential impacts upon dolphin species.
- Vegetation clearance.

The public submissions relating to MNES are provided in Appendix B of this attachment, along with cross references to the corresponding section of the EIS, the SREIS, and/or this attachment where each comment is addressed. Further details of the responses to public submissions on the EIS are provided in Part B of the SREIS. Part B also presents information about the public exhibition period and the process for lodgement of submissions on the EIS, and statistics on the number and variety of submissions received during the EIS review period.

1.5 Project Commitments Relating to MNES

The project commitments included as Attachment 8 of the EIS have been reviewed to address changes to the project layout and submissions to the EIS, and where necessary have been revised. New commitments developed during the studies completed for the SREIS to address the management of MNES are provided in Appendix C and in the relevant sections of this attachment as they pertain to specific MNES. Commitments provided in Appendix 1 of the MNES attachment to the EIS are still applicable.

2. WORLD HERITAGE AND NATIONAL HERITAGE VALUES

This section addresses the following MNES:

- World Heritage properties.
- National Heritage places.

2.1 Assessment

The Great Barrier Reef World Heritage Area (GBRWHA), which is also listed on the National Heritage List, is the only World or National Heritage property or place with the potential to be impacted by the project. The GBRWHA is the world's largest World Heritage property and is listed for its outstanding natural heritage values; the specific qualifying values are outlined in Table 2.1 of the MNES attachment for referral number EPBC 2009/5007.

The qualifying values of the GBRWHA were assessed against significant impact criteria detailed in the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009) in the attachment relating to referral number EPBC 2009/5008 in the EIS (Attachment 4).

Impacts remain as assessed in the MNES attachment to the EIS, and changes to the project description pertaining to referral number EPBC 2009/5008 are of negligible significance. The change in the potential impact on the GBRWHA for referral number EPBC 2009/5007 as a result of the changes in project design, or as a result of further information being obtained, is outlined in Table 2.2 of the MNES attachment for that referral.

The mainland tunnel launch site and the feed gas pipeline on the mainland are not within the boundaries of the GBRWHA. Therefore the only infrastructure within the GBRWHA relating to referral number EPBC 2009/5008, is a short section of feed gas pipeline running from the tunnel reception shaft site on Hamilton Point to the LNG plant site. The footprint of this infrastructure is minimal in comparison to clearance for the Arrow Energy LNG plant itself and associated infrastructure on Curtis Island, therefore impacts from the feed gas pipeline on values of the GBRWHA remain as assessed in the EIS and insignificant in the context of the industrial precinct on Curtis Island and the Arrow Energy LNG plant itself.

3. THREATENED ECOLOGICAL COMMUNITIES AND SPECIES

This section addresses the MNES of EPBC Act listed threatened ecological communities and species.

Additional desktop and field survey information on terrestrial threatened ecological communities and species, to inform the SREIS, was provided by 3D Environmental and EcoSmart Ecology in the Terrestrial Ecology Supplementary EIS Study. The survey and assessment methodology is detailed in Section 4 of the Supplementary EIS Study and complies with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009).

Additional desktop and field survey information on threatened marine species, to inform the SREIS, was provided by Coffey Environments Australia in the Technical Study of Port Curtis Marine Ecology. The survey and assessment methodology is detailed in Section 4 of the Supplementary EIS Study and complies with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009).

Further discussion and details of the revised assessment of threatened terrestrial and marine ecological communities and species are included in Chapter 18, Terrestrial Ecology, of the SREIS, Section 18.6, Floristic Assessment and Section 18.7, Fauna Assessment and Chapter 15, Marine Ecology of the SREIS.

3.1 Change in Potential Impact to Threatened Ecological Communities

The EPBC Protected Matters Searches, literature review and field surveys for the EIS identified four threatened ecological communities as being present or potentially present in and adjacent to the project area, based on their likelihood of occurrence according to distribution.

3.1.1 Assessment

Field surveys for the EIS confirmed the presence of one threatened ecological community listed under the EPBC Act. This was the 'critically endangered' 'Littoral Rainforest and Coastal Vine Thickets of Eastern Australia'. Within the study area this community was represented by small pockets of low microphyll-notophyll vine forest, including a small pocket of vine forest situated on a small Holocene sand dune on the eastern side of Hamilton Point. This community was outside of the project area and would not be subject to clearance or fragmentation, and management measures were recommended to avoid and mitigate indirect impacts such as weed infestation.

The following three ecological communities were also identified in the EIS as potentially occurring within the region but unlikely to occur in the project area and were subsequently not located during terrestrial ecology field surveys for either the EIS. Additional desktop study and field survey undertaken for the SREIS confirmed that these communities are unlikely to be present in the project area:

- Brigalow (*Acacia harpophylla* dominant and co-dominant) (endangered).

- Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar Bioregions (endangered).
- Weeping Myall Woodlands (endangered).

A search of the EPBC database for the project area buffered to 50 km was undertaken for the SREIS to validate findings of the EIS.

The ecological community 'Coolibah – Black Box Woodlands of the Darling Riverine Plains and Brigalow Belt South Bioregions' (endangered) was identified during the search of the EPBC database as potentially occurring in the project area. This community was not located during field surveys, and habitat was not suitable. Identification is most likely due to an expansion of the search buffer associated with the protected matters search. Therefore MNES assessment for the project is not affected by the listing of this ecological community:

In addition, the 'Lowland Rainforest of Subtropical Australia' ecological community was listed under the EPBC Act as 'critically endangered' in November 2011, following the completion of the EIS report. A review of certified regional ecosystem (RE) mapping (DERM, 2009), undertaken by 3D Environmental for the SREIS, suggests that the component REs (12.3.1, 12.5.13, 12.8.3, 12.8.4, 12.8.13, 12.11.1, 12.11.10, 12.12.1, 12.12.16) of the community are not present in the study area. This was confirmed during terrestrial ecology field surveys carried out for the SREIS.

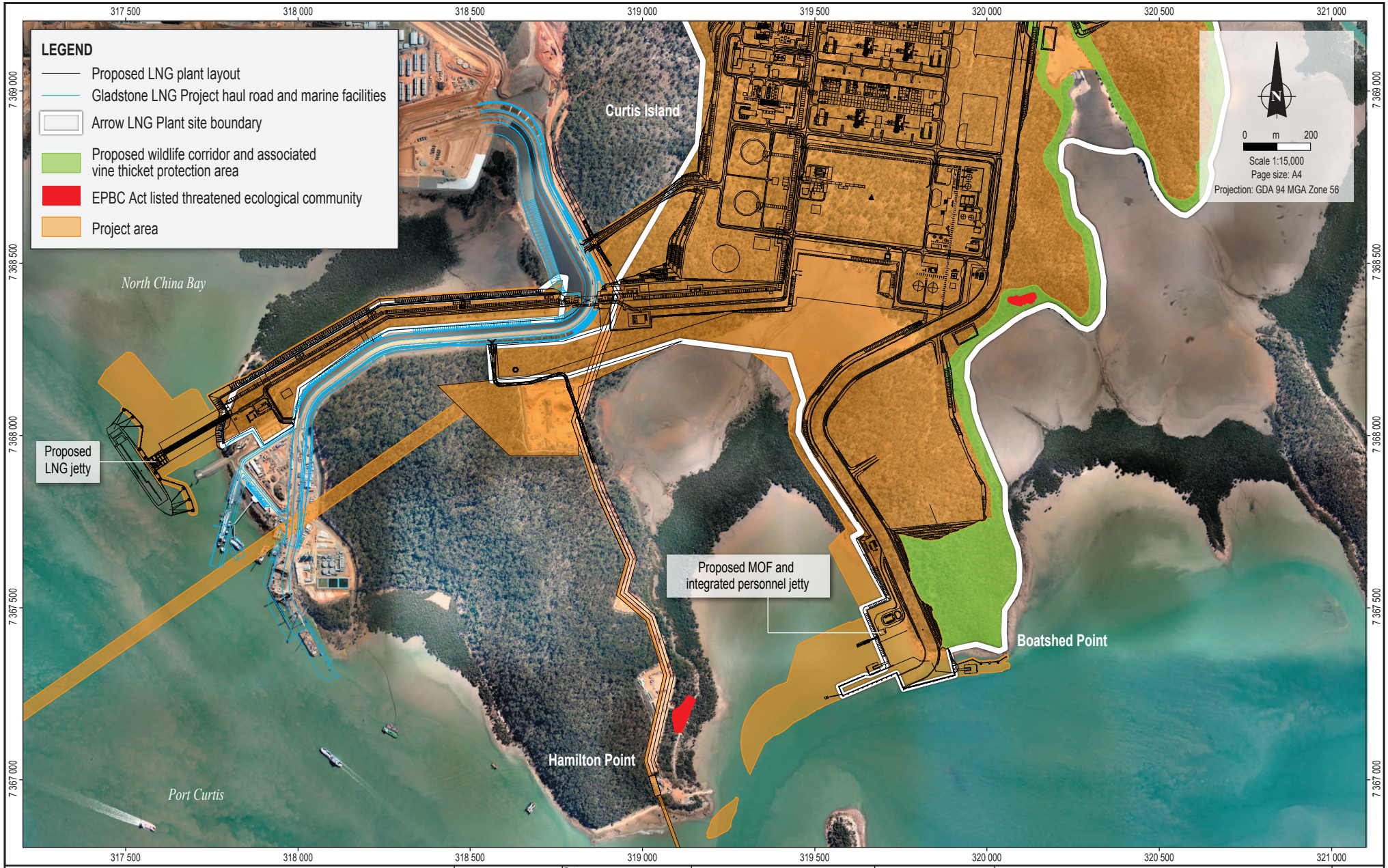
The EPBC listing came into effect after the Australian Government Environment Minister decided the project was a controlled action. Therefore, the MNES assessment for the project is not affected by the listing of this ecological community.

3.1.2 Discussion

During field floristic surveys carried out for the SREIS, an inconsistency in existing vegetation mapping was identified regarding two small patches of vine thicket near the LNG plant site, to the northeast of Boatshed Point, at the eastern end of a beach ridge, separated by a narrow pinch (Figure 3.1). These two new patches of littoral vine thicket are consistent, in both landform and floristic structure, with a small patch of 'Littoral Rainforest and Coastal Vine thickets of Eastern Australia' identified in the EIS at Hamilton Point. The two new patches have a combined total area of 0.41 ha.

These areas of threatened ecological community, 'Littoral Rainforest and Coastal Vine Thickets of Eastern Australia', are located adjacent to project infrastructure associated with referral number EPBC 2009/5007. There were no areas of the community within proximity to infrastructure relating to referral number EPBC 2009/5008, and the community is unlikely to be located within or adjacent to the project area for this referral as the project area has been extensively mapped in terms of regulated vegetation.

Therefore, the construction and operation of project infrastructure relating to referral number EPBC 2009/5008, is not expected to have a direct or significant impact on the threatened ecological community.



Source:
EPBC Act listed threatened ecological communities from Ecosure and 3D Environmental.
Project area and proposed wildlife corridor from Coffey Environments.
Imagery from Nearmap (captured 7 August 2012).

coffey environments

Date: 10.12.2012
MXD: 7033CC_16_GIS051_v1_1
File Name: 7033_MNES2_03.01_GIS_GL

Arrow Energy

Arrow LNG Plant

arrow energy go further

Littoral rainforest and coastal vine thickets of eastern Australia (critically endangered) communities on Curtis Island

Figure No: **3.1**

3.2 Change in Potential Impact to Threatened Species

3.2.1 Species or Habitats Schedules Revision

Koala

On 2 May 2012, koala populations in Queensland, New South Wales and the Australian Capital Territory were listed as vulnerable under the EPBC Act. In order to list the Queensland/New South Wales/Australian Capital Territory koala population separately, the Minister had to nominate it under Section 517(1) of the EPBC Act as a separate species to the rest of the koala population. This was based on advice from the Threatened Species Scientific Committee (TSSC) to DSEWPaC (TSSC, 2012).

All new developments within koala habitat in Queensland, New South Wales or the Australian Capital Territory will now need to consider whether the development is likely to have a significant impact upon the koala, using the existing EPBC Act significant impact criteria for vulnerable species. Referral guidelines for the koala have been released and outline criteria for assessing 'critical habitat', 'important populations' and significant impacts. As this listing came after the Australian Government Environment Minister decided the project was a controlled action, the MNES assessment for the project is not affected by the listing.

The koala does not constitute one of the controlling provisions for the project. However, potential impacts to the terrestrial faunal values of the species and its potential habitat within the project area are addressed in the EIS.

To date, work necessary to comply with these criteria has not been undertaken or documented, however, additional wet season field surveys proposed for early 2013 will include site assessment of potential mainland koala habitat in the project area. Essential habitat for koala has been identified on the mainland in the vicinity of the tunnel launch site, however there are no records of the species at this site. Current evidence suggests the species is rare in the local area, and absent from Curtis Island. The closest record on the mainland is 15 km to the north of the project area. It is questionable that the vegetation to be cleared for the Arrow LNG Plant is regularly inhabited by koala and impacts are unlikely to affect the abundance or distribution of the species.

3.2.2 Assessment

The change in the potential impact as a result of the changes in project design, or as a result of further information being obtained, is outlined in Table 3.1 for all threatened species, listed under the EPBC Act as either critically endangered, endangered or vulnerable, and identified in the EIS as having a moderate (including 'low to moderate') or higher likelihood of occurrence within the study area.

Desktop work undertaken for the supplementary terrestrial ecology study facilitated the development of species dossiers on conservation listed species (flora and fauna) likely to be present within the project area. The dossiers present a detailed analysis of the ecology of each species in question and how this relates to the activities of the Arrow LNG Plant. This includes status, species ecology, distribution and breeding, threats and occurrence in the region including any identified important populations or critical habitat.

The dossiers are structured to accord with the “Department of Environment’s significant impact guidelines 1.1 – Matters of national environmental significance”, particularly in relation to the definition of important populations and critical habitat.

Any species that appears in database searches or the referrals (EPBC 2009/5007 and EPBC 2009/5008) for the project, that were considered unlikely to be present in the project area based on being out of range or the lack of suitable habitat present, were discounted and dossiers for these species not produced. A summary of these species and the reasons for their omission from further study is presented in Appendix 11, Terrestrial Ecology Supplementary EIS Study and in Appendix D of this attachment. Species remaining as potentially present within the project area are assessed in Chapter 18, Terrestrial Ecology to the SREIS, in Section 18.6.4 (flora) and Section 18.7.1 (fauna) respectively, and are discussed below.

Flora

A review of database searches undertaken for the EIS concluded that all potentially occurring species that have a conservation status under the EPBC Act or the *Nature Conservation (Wildlife) Regulation*, were adequately accounted. No species were assessed as being likely to be present in the project area.

Site assessments validated the findings of the desktop review, and no conservation listed species were found. The value of habitats for conservation listed species was generally low, often due to the presence of an extensive range of exotic weed species. Where habitat was suitable (e.g., vine thicket areas) extensive supplementary searches were undertaken, but failed to locate any conservation listed species.

Impacts upon conservation listed flora species are unchanged from those assessed in the EIS, as the supplementary study validated the assessment that no conservation listed species were likely to be present in the project area. Therefore the Arrow LNG Plant feed gas pipeline is not anticipated to have a significant impact on EPBC Act listed flora species.

Fauna

Database searches identified a number of species that were potentially present within the vicinity of the Arrow LNG Plant based on the expanded 50 km search area. Further refinement of the search results based on known range, likelihood of occurrence and habitat preferences identified that a large number of these species were unlikely to be present with the Arrow LNG Plant project area (Table 11 of Appendix 11, Terrestrial Ecology Supplementary EIS Study).

Of these discounted species, many were identified as potentially occurring within the Arrow LNG Plant study area in the EIS and associated MNES attachment. The Terrestrial Ecology Supplementary EIS Study (Appendix 11) sets out the detailed rationale behind their omission from detailed assessment in this study. Species include yellow chat (Dawson) (*Epthianura crocea macgregori*), yakka skink (*Egernia rugosa*) and collared delma (*Delma torquata*). The omission was largely based around further detail of the species range in the area, and understanding of habitat suitability (or rather lack of) in the Arrow LNG Plant project area.

Species of conservation significance under the EPBC Act identified as possibly occurring within the Arrow LNG Plant project area are presented in Table 3.1 and each species has a detailed dossier presented in Appendix 11, Terrestrial Ecology Supplementary EIS Study.

As the pipeline is to be constructed under the bed of Port Curtis, any potential impacts upon marine MNES below the low water mark, from the crossing are eliminated and therefore are not discussed further within this attachment. They are discussed further within the MNES document relating to referral number EPBC 2009/5007. Potential impacts upon Port Curtis from work above the low water mark adjacent to the harbour, such as accidental spills, will be mitigated by implementing appropriate materials handling procedures and spill prevention and response plans.

The construction of approximately 2.1 km of pipeline from the reception shaft on Hamilton Point to the LNG plant will require the transport of materials across Port Curtis to Curtis Island. However, the impact of the few vessel transfers required for this materials transport, and the daily vessel movement of the pipeline construction crew will be minimal in comparison to existing and planned vessel movements in Port Curtis, and all project vessels will comply with maritime law and project standards to reduce the impacts of these transfers.

Table 3.1 Change in potential impact to threatened species

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in potential impact
Common name	**Scientific name**					
Mammals						
Water mouse	*Xeromys myoides*	Vulnerable	High	No. While a total of approximately 5 ha of mangrove habitat, on the mainland and Curtis Island, for the species will be cleared, this will not significantly contribute to the loss and fragmentation of habitat.	Yes. The presence of individuals was confirmed on Curtis Island, in the vicinity of Boatshed Point. This species was not captured in targeted trapping, although active searches located an active nest hollow in mangroves to the east of Boatshed Point, and an abandoned hollow and footprints in mangroves to the west of Boatshed Point. Habitat at mainland sites was assessed as sub-optimal.	No. Project activities generally avoid mangrove habitats and direct impacts on these habitats. There is no loss of mangrove as a result of referral number EPBC 2009/5008. Indirect impacts such as changes in natural hydrology, light and mobilisation of acid sulfate soils may occur. Arrow Energy will comply with applicable water quality guidelines and develop and implement stormwater and acid sulfate soils management plans (sections12.5 and 13.5 of EIS). Discussed in Section 3.2.2.

Table 3.1 Change in potential impact to threatened species (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in potential impact
Common name	**Scientific name**					
Mammals (cont'd)						
Grey-headed flying-fox	*Pteropus poliocephalus*	Vulnerable	High	No. Recorded north of the study area just south of Graham Creek, and likely to be present in study area within similar habitat both on Curtis Island and the mainland, but on transitory basis. Impacts on species not likely to be significant, as no colonies, breeding camps or roosts were identified and potential foraging habitat cleared is a small proportion of that available in the wider region.	Yes. Moderate likelihood of assessment. A large temporary camp known from Calliope area, records of grey-headed flying foxes from both Curtis Island and in proximity to mainland sites but likely to relate to transitory individuals.	No. No flying-fox camps are known to occur within the project area footprint. The species is highly mobile, but may be affected by loss of foraging resources from the project area. Similar habitat occurs throughout much of Curtis Island and in large expanses of forest that occur on the mainland, so substantial foraging habitat remains within the local area. Due to the comparative abundance of similar resources within the local area, the loss of foraging trees associated with the development are not expected to significantly affect the local population.

Table 3.1 Change in potential impact to threatened species (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in potential impact
Common name	**Scientific name**					
Birds						
Squatter pigeon	*Geophaps scripta scripta*	Vulnerable	High	No. Noted adjacent to study area on mainland, on numerous occasions during Arrow LNG Plant field surveys. Other studies have recorded this species within the study area around the mainland tunnel launch shaft and tunnel spoil disposal site. Suitable habitat present within study area on mainland, especially around the mainland tunnel launch site. Impacts on species not likely to be significant, as no critical habitat has been identified and foraging habitat cleared is a small proportion of that available in the wider region.	Yes. Expected (mainland only) to occur. The species is regularly recorded on the mainland including in the vicinity of the mainland tunnel launch site, favouring open woodlands and low grassy habitats. It is widely distributed with no particular sites or habitat favoured or important populations identified.	No. Habitat loss through direct clearing (10 ha of probable habitat in woodland along the feed gas pipeline alignment inland of the mainland tunnel launch site) is minor in relation to surrounding abundant suitable habitat (in the vicinity of the mainland tunnel launch site), and it is unlikely impacts on the species will be significant. Edge effects (e.g., weed infestation) could occur at this site but would be managed through weed control and implantation of the pest management plan. Increased abundance of predatory species such as feral cats and foxes at mainland tunnel launch site, increasing mortality and reducing reproductive success. The squatter pigeon is highly mobile and it is likely that individuals move over a broad area on the mainland, although it is likely to be absent from Curtis Island. Clearing on the mainland will affect only a minor portion of sub-optimal habitat.

Table 3.1 Change in potential impact to threatened species (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS) and revised likelihood of occurrence?	Change in potential impact
Reptiles						
Brigalow scaly-foot	*Paradelma orientalis*	Vulnerable	Moderate	No. Suitable habitat present, and found in similar habitat 12 km to southeast of study area on Boyne Island. Impacts on brigalow scaly-foot from the Arrow LNG Plant are not significant, as no individuals were identified and potential foraging habitat cleared is a small proportion of that available in the wider region.	Yes. Low likelihood of presence, as although potential habitat occurs on Curtis Island (dry sclerophyll forest with native ground cover) it is unlikely that resident populations are present based on closest records (away from Boyne Island) and lack of findings in survey work on Curtis Island.	No. Habitat loss through direct clearing is minor in relation to surrounding available suitable habitat on Curtis Island. No probable habitat was identified, and actual loss of habitat is dependent on the existence of resident populations. Impacts prior to mitigation are considered unlikely and the growing body of evidence suggests that a resident population is unlikely and the species does not occur outside of Boyne Island in the local area. Loss of vegetation is irreversible, but of low magnitude in context of surrounding values. Further survey effort will be conducted in early 2013 (wet season) to better understand the potential presence of the species within the project area. Surveys are expected to further support the evidence that the species is unlikely to be present on Curtis Island. Extensive fieldwork undertaken for other LNG projects on Curtis Island did not locate this species.

3.2.3 Discussion

Table 3.1 shows that the project is not likely to have a significant impact on grey-headed flying fox, squatter pigeon or brigalow scaly-foot as assessed in the EIS. Commitments relating to terrestrial ecology will reduce the impacts on these species, if they are located in pre-clearance surveys (as shown in Appendix 1 of the MNES attachment to the EIS). New and revised commitments pertaining to terrestrial ecology that would benefit these species are as follows:

- Develop trench management procedures to prevent access of fauna into trenches. These procedures will include measures such as trench breakers and covers. In addition, inspection procedures will be established in order to remove trapped fauna, create protection and refuge areas for wildlife trapped in the trench and develop methods to assist trapped fauna left in the trench. (C17.36A)
- Clearly delineate clearing boundaries to avoid unnecessary vegetation loss (C17.44).
- Where practical, stock-pile cleared vegetation in 'wind-rows' around the edge of retained vegetation. In addition to providing shelter, this will also provide some physical barrier reducing edge impact severity and the risk of weed spread (C17.45).
- Minimise the duration trenches are open, ensure daily trench inspections are undertaken by suitably qualified spotter/catchers and ensure that the length of open trench does not exceed that which can be inspected by the available spotter/catchers in any one daily period (C17.46).

The only MNES species where significant impacts are anticipated as a result of the Arrow LNG Plant is water mouse (*Xeromys myoides*). These impacts are discussed below.

The water mouse, listed as vulnerable under the EPBC Act, is known to occur in central Queensland within fringing mangroves and saltpan habitat, associated with regional ecosystems RE 12.1.3 and RE 12.1.2. The species was identified in the EIS as having potentially suitable habitat occurring in fringing mangroves in the intertidal zone along the mainland coastline and the southern section of Curtis Island.

Project activities generally avoid mangrove habitats and direct impacts on these habitats. There is no loss of mangrove as a result of referral number EPBC 2009/5008.

Surveys for the proposed new Gladstone coal terminal (GHD, 2012), trapped two individuals in fringing mangroves approximately 1 km to the southeast of the mainland tunnel launch site. Mangrove and intertidal vegetation surrounding the study area were considered to have high habitat potential for water mouse. However, the mainland tunnel launch site does not require the removal of fringing mangroves or areas of intertidal vegetation. Areas of RE 12.1.2 to be cleared at this site are largely bare.

Indirect impacts such as changes in natural hydrology, light and mobilisation of acid sulfate soils may occur. Arrow Energy will comply with applicable water quality guidelines and develop and implement stormwater and acid sulfate soils management plans (sections12.5 and 13.5 of EIS). Commitments remain as proposed in the EIS for this species to minimise indirect impacts at the mainland tunnel launch site. Therefore, the impacts of the construction and operation of infrastructure relating to referral number EPBC 2009/5008 on protected species are considered to be negligible and as assessed within the MNES attachment for the EIS.

4. MIGRATORY SPECIES

This section addresses the MNES of listed migratory species.

Additional desktop and field survey information on migratory shorebird species, to inform the SREIS, was provided in the Arrow LNG Plant Interim Shorebirds Technical Study prepared for Arrow CSG (Australia) Pty Ltd and Coffey Environments Australia Pty Ltd by Ecosure (Appendix 12). This study presents preliminary results and impact assessment based on a literature review and data from two of five proposed surveys, noting that a final report is planned for April 2013, at the completion of field surveys. The survey and assessment methodology is detailed in Section 4 of the Technical Study and complies with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009), and the EPBC Act Policy Statement 3.21 'Significant Impact Guidelines for 36 Migratory Shorebird Species' (Australian Government 2009).

In addition, the Terrestrial Ecology Supplementary EIS Study (3D Environmental and EcoSmart Ecology 2012) acknowledges field recordings of several migratory bird species (e.g., eastern curlew, rainbow bee-eater and white-bellied sea-eagle) and the suitability of terrestrial habitats to support migratory species, though migratory and shorebird species are not the target of this report.

As the pipeline is to be constructed under the bed of Port Curtis, any potential impacts upon marine MNES below the low water mark, from the crossing are eliminated and therefore are not discussed further within this attachment. They are discussed further within the MNES document relating to referral number 2009/5007. Potential impacts upon Port Curtis from work above the low water mark adjacent to the harbour, such as accidental spills, will be mitigated by implementing appropriate materials handling procedures and spill prevention and response plans.

The construction of approximately 2.1 km of pipeline from the reception shaft on Hamilton Point to the LNG plant will require the transport of materials across Port Curtis to Curtis Island. However, the impact of the few vessel transfers required for this materials transport, and the daily vessel movement of the pipeline construction crew will be minimal in comparison to existing and planned vessel movements in Port Curtis, and all project vessels will comply with maritime law and project standards to reduce the impacts of these transfers.

4.1 Assessment

The change in the potential impact as a result of the changes in project design, or as a result of further information being obtained, on shorebirds and marine fauna species is outlined below.

No additional information has been provided concerning potential impacts to migratory birds that are not shorebirds (other wetland species or terrestrial species) so the conclusions of the EIS on these issues are unchanged. The EIS concluded that the project was not likely to significantly impact listed migratory bird species that are not shorebirds. These species are addressed briefly in Appendix E to this attachment.

Further discussion and details of the revised assessment of migratory shorebird and marine species is included in Chapter 19, Terrestrial Ecology - Shorebirds and Chapter 15, Marine Ecology of the SREIS.

4.2 Discussion

Shorebirds in Port Curtis

The interim shorebirds technical study provides further information for the SREIS, from desktop and field survey, regarding the presence of EPBC listed migratory species, the suitability of potential habitats for foraging and roosting, and the significance of potential project impacts on migratory shorebirds generally.

The revised assessment of shorebird habitats, to determine if the project would have a 'significant impact', was undertaken in accordance with the EPBC Act Policy Statement 3.21 – Significant Impact Guidelines for 36 Migratory Shorebird Species, focussing on 21 known or potential roosting and/or foraging sites.

In accordance with the EPBC Act migratory shorebirds assessment guidelines, four factors were combined to determine the magnitude of the impact on habitat within the referral area, combined with an analysis of the habitat's sensitivity to re-evaluation the significance of impact: habitat loss, habitat degradation, disturbance and direct mortality. For the purpose of the evaluation, shorebird habitat has been classified for its use by shorebirds as: potential foraging, important roosting, secondary foraging, and potential roosting and foraging. This evaluation appears as Table 20 of the supplementary shorebirds technical study.

A network of nationally important shorebird sites occurs within the Curtis Coast region, from the Fitzroy Estuary in the north to Rodds Peninsula in the south. Shorebirds have been studied sporadically in recent years in this area, firstly by QWSG counts, and also by Driscoll (1997), but more recently by shorebird studies commissioned for other LNG projects and for the Western Basin Dredging and Disposal Project.

Driscoll (1997) identified that the Curtis Coast supported internationally significant populations of Australian pied oystercatcher, eastern curlew and grey-tailed tattler. Further study by Sandpiper Ecological Surveys (for Gladstone Ports Corporation (GPC)) on the Western Basin Dredging Project Shorebirds Monitoring Program in 2011 and 2012 (Gladstone Ports Corporation, 2011 and 2012) found the Curtis Coast as a whole supported internationally significant populations (greater than 1% of the flyway population) of seven species. These species were lesser sandplover, eastern curlew, whimbrel, terek sandpiper, grey-tailed tattler, red-necked stint and Australian pied oystercatcher.

Within the Curtis Coast, the extensive sandflats of both the Fitzroy Estuary and North Curtis Island were identified as being sites of particular importance with largest numbers of shorebirds recorded in these areas consistently on the surveys.

Within Port Curtis, there is a large degree of variability in the quality of shorebird habitat. Large areas support extensive important foraging habitat and corresponding important roost sites. Areas of key shorebird foraging and roosting habitat were identified in the Curtis Coast Regional Coastal Management Plan (EPA, 2003). Key roosting habitat was identified at Clinton ash ponds and at Flying Fox creek (1 km to the southeast of the mainland tunnel launch site) and key foraging

habitat at Targinie wetlands adjacent to the mainland tunnel launch site, as discussed within the EIS (Figure 3 of Attachment 4 Matters of National Environmental Significance).

Further shorebird studies undertaken for the Western Basin Shorebirds Monitoring Program and other LNG proponents indicate that the area of Port Curtis known as the lower port (east and south from the mouth of the Calliope River) typically holds larger numbers of shorebirds than the upper port. Generally shorebird populations within Port Curtis are dominated by large shorebirds and species that forage primarily on crustaceans. Smaller wader species such as the *Calidris* sandpipers that forage for prey in soft sediments are present in much smaller numbers.

The spring/neep tide surveys for the QCLNG pipeline crossing (Sandpiper Ecological Surveys, 2011) found that over 75% of the shorebirds present in Port Curtis were in the area around the Southend flats and Facing Island. The lower port contains larger areas of intertidal habitat, a greater substrate diversity and higher tidal range, which results in increased foraging resources for shorebirds in this area.

The most significant roosting area was identified at Southend claypan with smaller roosts on Facing Island. At low tide, birds disperse onto the Pelican Banks, and intertidal areas along the western shoreline of Facing Island.

Other significant roosts are present on Facing Island and on Kangaroo Island at the southern end of the Narrows. At low tide, birds disperse from the latter roost and move onto the Passage Island mudflats up the Narrows, or onto the Fishermans Landing mudflats and the mudflats adjacent to the mainland tunnel launch site.

The supplementary shorebirds technical study provides further assessment of two sites within the project area considered to be of potential importance to shorebirds as roosting and foraging sites, the ‘Targinie Wetlands’ (identified as ‘site 11’), which is a shallow mudflat immediately to the seaward side of mangroves fringing the mainland tunnel launch site; and the ‘Clinton ash ponds’ (identified as ‘sites 5 and 6’), which is an artificial ash pond adjacent to a possible alignment for the access road servicing launch site 1 (see MNES attachment for referral number EPBC 2009/5007).

Survey sites for the shorebird surveys are shown on Figure 4.1.

Impacts from the Arrow LNG Plant (Referral Number EPBC 2009/5008)

No direct loss of previously determined important shorebird habitat will occur as a result of the project. Targinie wetlands will not be cleared for project infrastructure. Indirect impacts on important shorebird roosting habitat are discussed in the MNES attachment for referral number EPBC 2009/5007.

Impacts remain broadly as assessed in the MNES attachment to the EIS. There will be negligible impact to the roost site at Flying Fox Creek, approximately 1 km to the southeast of the mainland tunnel launch site. The Targinie Wetlands site is unlikely to be disturbed by the construction and operation of the adjacent mainland tunnel launch site, as there will be no disturbance to the fringing mangroves that buffers the mudflats from the project infrastructure.

coffey environments	Date: 06.12.2012 MXT: 7033CC_16_GIS074_v1_1 File Name: 7033_MNES2_F04.01_GIS_GL	Arrow Energy Arrow LNG Plant	arrow energy go further	Shorebird survey site locations	Figure No: 4.1

The mainland tunnel launch site and tunnel spoil disposal area is identified as ‘site 9’, and is described as claypan with surrounding mangrove (RE 12.1.3), with saltpan vegetation including grassland, herbland and sedgeland on marine clay plains, representative of RE 12.1.2. The site is potential roosting habitat.

Approximately 35 ha of RE 12.1.2, will be cleared due to construction of the mainland tunnel launch site, although areas of RE 12.1.2 to be cleared at this site are largely bare saltpan.

Large areas of more suitable habitat are retained close to the mangroves, especially to the north around Boat Creek around the mainland tunnel launch site. It should be noted though, that proposed new Gladstone Coal Terminal is located on the lot to the south of the Arrow Energy mainland tunnel launch site, and infrastructure for this site is likely to be constructed on the area of saltpan to the south of the Arrow Energy site. The impacts on the roost site at Flying Fox Creek and Targinie wetlands have not yet been assessed.

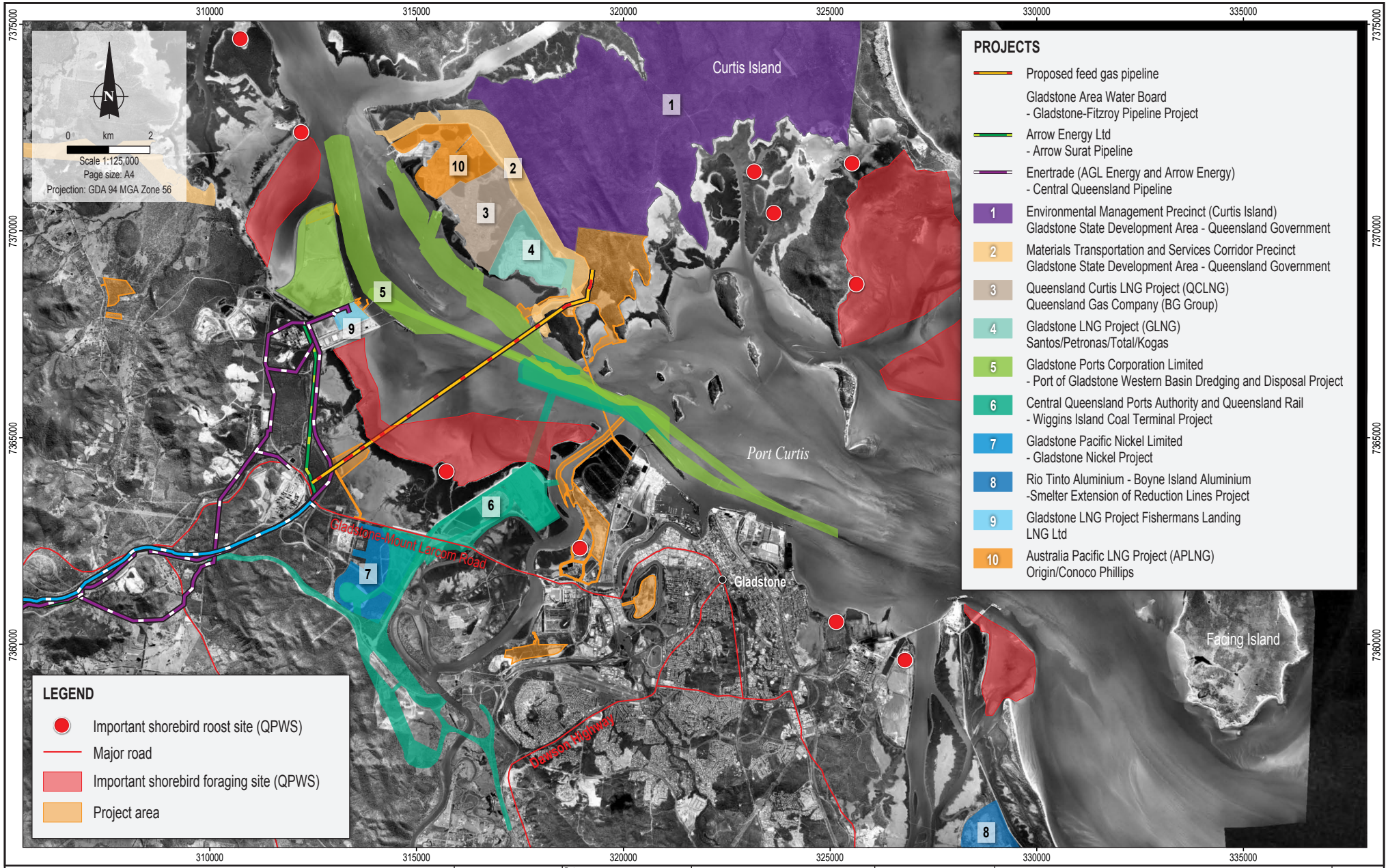
The revised assessment concludes that the significance of impact to this site is unknown at this stage due to unknown quality of the habitat. Further information will be gathered during wet season (peak period) surveys. If this area is important, even only periodically, then there is a high potential impact. Given size of these areas and proximity to areas recently regularly surveyed as part of the approval process for other LNG plants, it seems unlikely that these areas would support sufficient numbers of birds to be considered important habitat, however it cannot be ruled out at this stage.

Areas of shorebird habitat could be degraded and disturbed by project activities, leading to reduced availability of invertebrate food for shorebirds in intertidal areas. Management plans will be developed to address potential threats such as acid sulfate soils, pollution runoff, erosion and sedimentation and weed incursion. With implementation of the measures contained in such plans, minimal residual impact is predicted on important shorebird foraging habitat.

There is potential for bird strike into structures for the Arrow LNG Plant, but this is considered to be a negligible risk with a low likelihood of taking place.

At this time, areas of identified potential shorebird habitat are not expected to provide habitat for sufficient numbers or diversity of shorebirds to meet important habitat criteria. Surveys planned for these areas after rain during the peak shorebird season (over a number of visits) will confirm this assessment. One such site is the mainland tunnel launch site. The presence of large highly visible structures, with high levels of vehicular and personnel movement, and light spill onto adjacent areas may render potential habitat immediately adjacent to this facility unfavourable although it is unlikely Targinie wetlands will be effected.

Figure 4.2 shows projects that were considered in the cumulative impacts assessment presented in the EIS, and their distribution in Port Curtis in relation to important shorebird habitats. The majority of infrastructure development is taking place within the upper port which is already heavily industrialised. The lower port, which includes areas such as Southend mudflats, Facing Island and Pelican Banks, all important shorebird sites, is largely unaffected by direct impacts. Further afield, significant shorebird sites around the Fitzroy Estuary and North Curtis will also be retained.



Source:
Important shorebird areas in Port Curtis from Curtis Coast Regional Coastal Management Plan, QPWS.
Place names and roads from DME.
Project area from Coffey Environments.
Imagery from Nearmap (captured 7 August 2012).
NOTE: For projects' source information please refer to report reference notes.

coffey environments

Date: 07.12.2012
MXD: 7033CC_16_GIS076_v1_1
File Name: 7033_MNES2_04.02_GIS_VS

Arrow Energy

Arrow LNG Plant

arrow energy go further

Important shorebird habitats in and near Port Curtis in relation to major projects

Figure No: 4.2

Indirect cumulative impacts from increased infrastructure on habitats in Port Curtis such as pollution, runoff, and sedimentation will be managed through relevant construction and environmental management plans prepared for each project.

Arrow Energy will develop a shorebird management and monitoring plan for approval prior to construction commencing. The plan will take account of similar programs developed for other similar projects being undertaken within the study area and surrounds. The plan will include the mitigation measures identified below. An outline of this plan is presented in Attachment 5, Other Management Plans.

Mitigation Measures – Migratory Shorebirds

Attachment 4 of the EIS, addressing MNES provides a range of project recommendations and commitments that aim to avoid, minimise and mitigate impacts on migratory shorebirds and shorebird habitats, and these are replicated in Appendix C of this attachment.

Further to the project commitments made in the EIS, additional commitments have been proposed in the SREIS to mitigate project impacts to shorebirds. These are listed in Section 6.5.2 of the interim shorebirds technical study for the SREIS. These measures are intended be integrated into a shorebird management and monitoring plan (an outline of which is presented in Attachment 5 Other Management Plans to the SREIS) for approval prior to construction commencing, integrated with current similar projects being undertaken within the study area and surrounds. Commitments additional to those presented in the EIS are as follows:

Consider measures to minimise light emitted from the LNG plant during the detailed design of the LNG plant including:

- Assess the necessity and choice of lighting in the plant area:
  - Use low-pressure sodium (LPS) lights as a first-choice light source and high-pressure sodium (HPS) lights where LPS is not practical.
  - Replace short-wavelength light with long-wavelength light and exclude short-wavelength light with the use of filters.
  - Avoid using halogen, metal halide or fluorescent lights (white lights) where possible, and only use white lights in contained areas where colour rendition is required.
  - Minimise the number and wattage of lights, and recess lighting into structures where possible.
- Use timers and motion-activated light switches.
- Use reflective materials to delineate equipment or pathways and use embedded lighting for roads.
- Position doors and windows on the sides of buildings facing away from marine turtle nesting beaches and install and use window coverings to reduce light emissions.
- Maintain elevated horizons (such as topographic features, vegetation or barriers) to screen rookery beaches from light sources (C17.47).
- Review the need for an ongoing program to monitor the shorebird population at project sites following the completion of survey work in 2013 (C17.51).

- Develop measures to minimise disturbance around important shorebird habitat, during construction and operation. Measures could include exclusion zones or screens as recommended in Rohweder *et al*. (2011) (C17.52).

Commitment number C17.47 was developed for the technical study assessing the impact on turtles from light from the Arrow LNG Plant (Appendix 9, Marine Ecology (Turtles) Technical Study – Curtis Island Baseline Light Monitoring 2012). Aspects of the commitment are also of benefit to minimising impacts of lighting on shorebird habitat.

5. OFFSETS

This section summarises the offsets requirements, where required, deriving from the revised assessment provided by this report for the MNES for which the project was declared a controlled action under the EPBC Act.

The Australian Government's EPBC Act Environmental Offsets Policy (DSEWPaC 2012) provides the framework for the provision of offsets for MNES that are subject to significant impacts as a result of the project construction and operation.

The Environmental Offsets Assessment Guide (Australian Government, 2012), which accompanies the policy, has been developed to give effect to the requirements of the policy, using a balance sheet approach to measure impacts and offsets. The guide applies where the impacted protected matter is a threatened species or ecological community.

The EPBC Act Environmental Offsets Policy applies to any new referrals or variations to approval conditions from 2 October 2012. It also applies to any projects currently under assessment for which a decision has not yet been made and therefore will apply to the Arrow LNG Plant.

Any offsets under the policy, must be new and additional to what is already required – an area already set aside for conservation or that is unable to be developed is unlikely to be acceptable. Offsets are only to be proposed after all reasonable avoidance and mitigation measures have been presented. Offsets are therefore designed to compensate for the residual impact of a project, after the implementation of avoidance and mitigation measures.

The same offset can be used to satisfy both state/territory and Commonwealth environmental impact assessment processes for the one project. Offset requirements at a state level are unchanged since the Arrow LNG Plant EIS was finalised, and governed by the Queensland Government Environmental Offsets Policy, June 2008 (EPA, 2008). This policy is currently under review (as of November 2012). However, the State Government has since released the Ecological Equivalence Methodology Guideline (DERM, 2011). The guideline is intended to inform requirements for ecological offset required under the Policy for Vegetation Management Offsets and Queensland Biodiversity Offsets Policy.

5.1 World Heritage and National Heritage Values

As summarised in Section 2.1, the revised assessment of the potential impacts of the project concludes that the project is unlikely to have a significant impact to the World Heritage and National Heritage values of the GBRWHA.

While the project will cause the loss of terrestrial vegetation and fauna habitat, will disturb marine fauna habitat and will adversely affect visual amenity, the implementation of the management and mitigation measures outlined in both the EIS and SREIS will reduce the level of each of these impacts below a level of significance. As the impacts will be below the level of significance, offsets for MNES will not be required to compensate for a residual significant impact.

5.2 Threatened Ecological Communities and Species

Threatened Ecological Communities

Field surveys carried out for the SREIS confirmed the presence of the critically endangered ecological community 'Littoral Rainforests and Coastal Vine Thickets of Eastern Australia', which is representative of the endangered RE 12.2.2, in the vicinity of Boatshed Point on Curtis Island. There were no areas of the community within proximity to infrastructure relating to referral number EPBC 2009/5008, and the community is unlikely to be located within or adjacent to the project area for this referral as the project area has been extensively mapped in terms of regulated vegetation. Therefore, the project is not expected to have a direct or significant impact on threatened communities and no offsets for MNES are required.

Threatened Species

As discussed in Section 3.2.3, the water mouse, listed as vulnerable under the EPBC Act, is known to occur in central Queensland within fringing mangroves and saltpan habitat, associated with regional ecosystems RE 12.1.3 and RE 12.1.2. The species was identified in the EIS as having potentially suitable habitat occurring in fringing mangroves in the intertidal zone along the mainland coastline and the southern section of Curtis Island.

Project activities generally avoid mangrove habitats and direct impacts on these habitats. There is no loss of mangrove as a result of referral number EPBC 2009/5008.

Surveys for the proposed new Gladstone coal terminal (GHD, 2012) trapped two individuals in fringing mangroves approximately 1 km to the southeast of the mainland tunnel launch site. Mangrove and intertidal vegetation surrounding the study area were considered to have high habitat potential for water mouse. However, the mainland tunnel launch site does not require the removal of fringing mangroves or areas of intertidal vegetation. Areas of RE 12.1.2 to be cleared at this site are largely bare.

Indirect impacts such as changes in natural hydrology, light and mobilisation of acid sulfate soils may occur. Arrow Energy will comply with applicable water quality guidelines and develop and implement stormwater and acid sulfate soils management plans (sections12.5 and 13.5 of EIS). Commitments remain as proposed in the EIS for this species to minimise indirect impacts at the mainland tunnel launch site.

Therefore, the impacts of the construction and operation of infrastructure relating to referral number EPBC 2009/5008 are considered to be negligible and as assessed within the MNES attachment for the EIS. No offsets are required for this species.

5.3 Migratory Species

Shorebirds

As summarised in Section 4.2, information provided for the SREIS regarding migratory species suggests that the Targinie wetlands, which is adjacent to the proposed mainland tunnel launch site, may be a significant foraging site for migratory birds. The remaining surveys later in 2012 and early 2013 of the shorebird surveys being undertaken, will assist in ascertaining the importance of the site and therefore the significance of potential impacts to species utilising this site. It is unlikely that project activities at the mainland tunnel launch site will have a significant

impact on Targinie wetlands as the mangrove belt separating the two sites will shield Targinie wetlands from construction and operation disturbance. Standard project controls will prevent impacts from runoff, sedimentation etc affecting the habitat quality of this site.

Offsets may be required under the Queensland Government Environmental Offsets Policy for the clearing of mangroves and saltpan vegetation (i.e., marine plants), which are expected to provide direct benefit for migratory shorebirds.

5.4 Offsets Strategy and Strategic Management Plan

Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (Attachment 6 of the SREIS), consistent with its Environmental Offset Strategy. This plan:

- Describes measures taken to avoid and minimise impacts.
- Identifies Arrow Energy's likely offset requirements.
- Presents evidence that there are opportunities to achieve the required offsets.
- Sets out Arrow Energy's preferred approach to the provision of environmental offsets.

The Draft Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.

Arrow Energy's principles for offset management have been developed to align with offset principles from both Commonwealth and state policies. Offsets will:

- Meet the requirements of current government policy.
- Only be used once the hierarchy to minimise impact (avoid, minimise, mitigate) has been followed.
- Contribute to managing and protecting biodiversity.
- Be implemented strategically and economically.

6. CONCLUSION

This MNES attachment to the SREIS provides updated information and a revised assessment of potentially significant impacts to the MNES for which the high pressure gas pipeline and associated infrastructure feeding the Arrow Energy LNG plant was determined to be a controlled action under the EPBC Act (referral number EPBC 2009/5008).

The revised assessment particularly addresses issues where any new desktop or field survey information, or change to the project design or layout since the publication of the EIS, has resulted in an upward change in the significance of potential impacts to MNES. This attachment also addresses matters raised in the DSEWPaC submission to the EIS and other public submissions to the EIS relating on MNES.

The revised assessment concludes that the project is unlikely to have a significant impact to the World Heritage and National Heritage values of the GBRWHA. While the project will cause the loss of terrestrial vegetation and fauna habitat, and will adversely affect visual amenity, the implementation of the management and mitigation measures outlined in both the EIS and SREIS will reduce the level of each of these impacts to below a level of significance.

Two small areas of the critically endangered ecological community ‘Littoral Rainforest and Coastal Vine Thickets of Eastern Australia’ were confirmed in the vicinity of Boatshed Point. These communities are not close to infrastructure for referral number EPBC 2009/5008 and will not be impacted by this referral.

Activities for referral number EPBC 2009/5008 will not significantly impact protected species as assessed within the MNES attachment for the EIS. Water mouse activity was recorded around Boatshed Point in additional field surveys in 2012, but this area is not adjacent to infrastructure for referral number EPBC 2009/5008, and project activities avoid mangrove habitats and direct impacts on these habitats. There is no loss of mangrove as a result of referral number EPBC 2009/5008.

No migratory shorebird habitat defined as ‘important’ under EPBC guidelines will be cleared for the project. However, the construction of the mainland tunnel launch site will disturb approximately 35 ha of saltpan vegetation, associated with RE 12.1.2, identified as a potential roosting habitat.

The SREIS concluded that the project was not likely to significantly impact listed migratory bird species that are not shorebirds. Therefore the conclusions of the EIS are unchanged.

Further fieldwork proposed for the 2012/13 wet season aims in part to clarify the importance of several terrestrial fauna and shorebird habitats and validate the assessment of the significance of potential impacts in order to inform the environmental management plans for the project.

Notwithstanding that no offsets for MNES are considered necessary for the project, offsets may be required under the Queensland Government Environmental Offsets Policy for the clearing of mangroves and saltpan vegetation (i.e., marine plants), which are expected to provide direct benefit for the water mouse and migratory shorebirds.

Appendix A

Cross-Check Table Against DSEWPaC Feedback

Table A.1 Cross-check table against DSEWPaC feedback

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
1 (see: 2)	General comments	While we understand that a number of our comments below can be addressed by information, studies and reports already provided in the draft EIS, the matters of national environmental significance (MNES) chapter must be a standalone chapter that exclusively and fully addresses MNES listed as controlling provisions for these projects. Cross-referencing to other parts of the EIS can be provided in the MNES chapter, but important information (such as rationale for determinations of non-significance, assessment of cumulative impacts on MNES, key mitigation measures and offsets for MNES) must be provided in the MNES chapter. We note that cross-references to other parts of the draft EIS must be to a specific part of the EIS document that specifically provides information on EPBC matters (for example information on listed threatened ecological communities and not State REs).	**1)** Attachment 4 (MNES) **2)** Attachment 2 (MNES)	The MNES attachment (EIS Attachment 4) references information in the EIS to provide background, context and detailed information about survey methods. The MNES attachment included in the SREIS (Attachment 2) addresses changes to the assessment of MNES as a result of project changes, additional information and issues raised in submissions.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
2 (see: 1)	General comments	Because of the size and complexity of the EIS including its attachments it is important that the MNES chapter contains all important and relevant information to an assessment of impacts on matters of national environmental significance, and that cross-references are to specific parts of the EIS.	**1)** Attachment 4 (MNES) **2)** Attachment 2 (MNES)	The EIS MNES Attachment 4 was revised to address DSEWPaC's earlier comments on the detail presented in the chapter. Key information on the rationale for the determinations of non-significance and assessment of cumulative impacts on MNES are presented in the EIS Attachment 4 along with key mitigation measures. The MNES Attachment 4, although comprehensive, relies on information in the EIS to provide background, context and detailed information about survey methods etc.
3 (see: 12, 30, 46)		We require information on the survey methodology used, including any limitations of the methodology and data collected for each matter of MNES, as well as a justification for the survey methodology and survey sites employed. We require the EIS to demonstrate how all survey methodology follows relevant Commonwealth survey guidelines that were available at the time of surveying (e.g., the Survey Guidelines for Australia's Threatened Birds (DSEWPaC)). Based on the information provided in the draft EIS it is our view that further survey work will need to be undertaken (including targeted surveys where appropriate) unless justification can be provided for current survey effort or any risks accounted for in avoidance, mitigation and management. It appears that not all sites were surveyed and surveys were not undertaken in optimal conditions (for e.g., the only wet season terrestrial season survey was cancelled after 3 days and only one dry season fauna survey was undertaken with limitations in the data collected).	**1)** Attachment 4 (MNES) Sections 3.1 and 6.4.1 (Migratory Shorebirds) Chapter 17 and Appendix 9 (Terrestrial Ecology) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) **2)** Refer to chapters below and corresponding technical studies Chapter 15 Marine Ecology Chapter 16 Turtles and Lighting Chapter 17 Estuarine Ecology (Calliope River) Chapter 18 Terrestrial Ecology Chapter 19 Shorebirds **3)** Sections 3 and 4	Additional field survey work has been undertaken in 2012 relating to MNES and is summarised in chapters 15 to 19 of the SREIS. SREIS Attachment 2 (MNES) summarises the survey and assessment methodology described in the supporting technical studies, particularly; terrestrial ecology, shorebirds, marine ecology, and estuarine ecology. The MNES Attachment confirms that the survey methodology complies with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009). The significance assessment approach adopted for the EIS and SREIS is underpinned by management measures that are effective and proven, based on industry standards where relevant. All mitigation measures have been reviewed by Arrow Energy to ensure they can be implemented and will be effective in managing identified impacts.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
4 (see: 17 & 47)	General comments	We require more detail around indirect impacts, and management and mitigation from these impacts (e.g., activation of acid sulphate soils), particularly in the context of impacts on MNES (e.g., water mouse). The department also notes that although the proposed action may only result in the loss of 67 ha of marine habitat, the indirect impact and cumulative impact is likely to represent a greater impact (e.g., impacts including boat strike, behavioural disturbance and habitat displacement from shipping). The draft EIS should account for indirect impacts when discussing impacts and coming to a conclusion on impacts to MNES.	**1)** EIS Section 17.4 Attachment 4 (MNES) Sections 6.3 and 6.4 **2)** Section 3.2.2 Appendix 11 Terrestrial Ecology Technical Study (Sections 4.2.2 and 5.2.10 – water mouse) **3)** Section 3.2.3, Table 3.2	Technical studies informing the SREIS chapters (Terrestrial Ecology; Shorebirds; Marine Ecology; Calliope River Estuarine Ecology) all assess potential indirect impacts. For example, EIS Appendix 4, Acid Sulfate Soil Impact Assessment, provides a comprehensive assessment of acid sulfate soils expected to be encountered and proposes measures to effectively manage the soils during disturbance, handling and disposal. The study concludes that "…ASS disturbances in the Gladstone area have not and are not likely to cause significant environmental harm as disturbances are managed or planned to be managed in accordance with SPP 2/02 and its attendant guidelines and reference documents. Further information on ASS in the project area has been obtained from a geotechnical investigation being carried out in project areas. The program has included analysis for ASS/PASS. Preliminary results of this investigation for marine sediments at the dredge sites are included in SREIS Chapter 12, Sediment Characterisation. This information and the final results of the investigation will inform the development of the ASS management plan.
5		Please provide further information and justification as to the reason for a separate gas pipeline to the mainland, rather than using the Northern Infrastructure Corridor Sub-Precinct of the GSDA. Please discuss in respect of impacts on matters of national environmental significance, noting that the bundled pipeline across the Northern Infrastructure Corridor has already been approved and a number of impacts to MNES have already addressed in previous approvals.	**1)** Section 5.3.4	EIS Chapter 5, Section 5.3.4 provides the rationale for a separate gas pipeline to the mainland, rather than using the Northern Infrastructure Corridor Sub-Precinct of the GSDA. The reasons include proximity to the Arrow Surat Gas Pipeline, misalignment with the construction schedules of the other projects, avoidance of significant environmental and cultural heritage management issues, and avoidance of conflicts with future infrastructure.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
6	General comments	The sources of information relied upon must be clearly referenced and discussed in the MNES chapter. We require information on the scientific reliability of surveys, investigations and conclusions drawn, including the degree of certainty or statistical confidence for both impacts and mitigation measures. This is a requirement of Section 7 of Schedule 4 of the Environment Protection and Biodiversity Conservation Regulations 2000.	**1)** Attachment 4 (MNES) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) Chapter 17 and Appendix 9 (Terrestrial Ecology) **2)** Various technical studies **3)** Section 2, Table 2.1 Technical studies referenced in SREIS MNES Attachment (Section 2)	Appendices (specialist technical reports) to the EIS and SREIS provide detailed information on the survey methods undertaken for each technical study.
7 (see: 27, 34, 42, 48)		The magnitude of proposed offsets must account for the risk associated with any uncertainty of impacts.	**1)** Attachment 4 (MNES) Section 7.2 **2)** Attachment 6 (Offsets) **3)** Sections 3.2.2 and 3.2.3, Table 3.2 Section 5	SREIS Attachment 6 provides an approach for proposed offsets, to be created in consultation with both the Queensland Department of Environments and Heritage Protection (EHP) and the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC).

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
8	LNG Shipping, Table 2.1, page 2-5	We require the indicative frequency for all vessel types (e.g., indicative frequency for the Cutter section dredging vessel, Support vessel, Backhoe dredging barge and Backhoe dredger support tugs). While we note that this information may be provided in the Dredge Management Plan, we require an indication of the frequency and scope of shipping associated with dredging to be provided in the MNES chapter (e.g., 1, 10 or 100 trips every day). We recommend that this information is provided in table 2.1 along with other indicative frequencies for vessels.	**1)** Sections 19.4.5, 19.5.2, and 19.5.3, Table 19.9 Chapter 29 **2)** Sections 6.1, 7.1.1, 7.2.1, 15.2.1, 15.5.2 and 15.6.2 Appendix 13 Transport and Traffic technical study (Section 5.4.1 and Table 5)	Technical studies informing the SREIS have assessed revised projections of vessel movements with respect to marine logistics and transport. Estimated vessel movements during construction and operations are described in SREIS Chapter 7, Project Description: Logistics (Section 7.1.1 and Section 7.2.1 respectively). Additional details on ferry movements are included in the Transport and Traffic Technical Study completed for the SREIS, Appendix12, Chapter 5, Section 5.5. Section 15.6.2 of Chapter 15 Marine Ecology addresses the impacts of vessel movements on marine fauna.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
9	5.1.1 Great Barrier Reef World Heritage Area	This section provides a useful summary of the values of the Great Barrier Reef World and National Heritage places, however we require some more detail around: • Vegetation communities, habitat type, habitat use (including justification for habitat type and use (e.g., why certain habitat is deemed not to be present) within the Great Barrier Reef World and National Heritage area within, and in proximity to, the project area. It would be useful to have maps showing important habitat for key species (such as seagrass for dugongs) and other values within proximity of the proposed action. • What World and National Heritage values (and associated species and habitat), if any, are within the area of the 10m salinity discharge.	**1)** Attachment 4 (MNES) Chapter 17 and Appendix 9 (Terrestrial Ecology) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) **3)** Sections 2.1, 2.2 and 3.1, Tables 2.2 and 3.1	SREIS Attachment 2 (MNES), Section 2.1 (Table 2.1) assesses project activities, including vegetation clearance, against Great Barrier Reef World Heritage and National Heritage values. Important habitats for marine species are shown in Figures 19.1 of the EIS (Chapter 19). Updated information on turtle nesting sites is provided in SREIS Chapter 16, and shown in Figure 16.1. Important shorebird habitats within Point Curtis are shown in of Chapter 19 (Shorebirds) of the SREIS (Figure 19.2). SREIS Attachment 2 (MNES), Chapter 2, Section 2.2.1 identifies the area potentially impacted by wastewater discharge. Arrow Energy's preferred option is to use the two sewer mains servicing Curtis Island from the mainland to dispose of effluent. The treatment plant on Curtis Island is being maintained as a project option. Should this option be pursued, no sensitive areas (such as seagrass) are located close to the discharge location and any discharge will comply with applicable water quality criteria. Impacts are predicted to be extremely localised and will not have a significant impact on the heritage values of the GBRWHA (Section 2.2 of MNES attachment to the SREIS).

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
10 (see: 29)	Fauna within Port Curtis, page 5-13	The draft EIS states that no individual syngnathid fish were recorded in the area, however no video recording or diving was performed during the field studies. We require an explanation as to why there is unlikely to be a significant impact on syngnathid fish (both in terms of World and National Heritage place and in respect of syngnathid fish listed as threatened species under the EPBC Act), when no appropriate surveying has been undertaken.	**1)** Attachment 4 (MNES) **2)** Section 5.1.2	Visibility is limited in the project areas and precluded any meaningful video or diving (e.g., for seahorses). Replicate gill and cast net and beach seine sampled mainly juveniles of many species but no seahorse species. Their presence is inferred from the EPBC Protected Matters search, but it is difficult to prove that they are not in a particular area. As no seagrass or key areas for these species will be removed, impacts were assessed as not significant.
11 (see: 20, 31, 39)	6.1 GBRWHA and Port Curtis National Heritage Place	This section provides a reasonable summary of the expected impacts on the Great Barrier Reef World and National Heritage values, and appears to identify and address impacts that may affect heritage values and provide a set of mitigation measures based primarily on relevant legislation and accepted industry standard. However, the draft EIS also identifies a number of impacts that cannot be fully mitigated and which will result in residual impacts on the Great Barrier Reef World and National Heritage values, in particular those associated with terrestrial and marine habitat loss, dredging and dredge and tunnel spoil disposal, and loss of scenic amenity. Further information around offsetting (compensating for) these impacts is required.	**1)** Attachment 4 (MNES), Sections 5.1, 6.1 and 7 **2)** Chapter 16, and Section 19.6 **3)** Section 2.1, Tables 2.1 and 2.2, Section 5	Further assessment of impacts on Great Barrier Reef World Heritage Area (GBRWHA) and Natural Heritage values is provided in SREIS Attachment 2, MNES, Section 2 and is based on additional technical studies completed for the SREIS. Table 2.2 of Attachment 2, correlates specific project components and potential impacts to the Great Barrier Reef World Heritage and Natural Heritage values. The potential direct and indirect impacts of dredging on marine fauna and habitats is addressed in SREIS Chapter16 (Marine Ecology) and Chapter 17 (Estuarine Ecology – Calliope River) and associated technical studies. SREIS Chapter 18, Section 18.6 provides a revised floristic assessment of terrestrial vegetation. Section 18.6.2 addresses EPBC listed threatened ecological communities and s.18.6.4 addresses EPBC listed flora species. Chapter 18, Table 18.3 tabulates the revised areas of regulated vegetation to be cleared within the project area. This information is summarised in SREIS Attachment 2 sections 3.1.2 and 3.2.2, and Tables 3.1 and 3.2.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
11 (see: 20, 31, 39) (cont'd)	6.1 GBRWHA and Port Curtis National Heritage Place			The MNES Attachments to the EIS and the SREIS include commitments to address potential impacts to EPBC listed species. Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (Attachment 6 of the SREIS), consistent with its Environmental Offset Strategy. This plan: • Describes measures taken to avoid and minimise impacts. • Identifies Arrow Energy's likely offset requirements. • Presents evidence that there are opportunities to achieve the required offsets. • Sets out Arrow Energy's preferred approach to the provision of environmental offsets. The Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.
12 (see: 3, 30, 46)		• Methodologies used, including what targeted surveys have been undertaken (if any), survey methodology and how this complies with relevant Commonwealth guidelines and policies (for e.g., we require more information around methodologies used for assessment of impacts on dugongs).	**1)** Attachment 4 (MNES) Section 3 Sections 19.4 and 19.5 Appendix 12 Marine and Estuarine Ecology Impact Assessment Report Sections 5.4 and 5.5 **2)** Appendix 8 Technical Study of Marine Ecology (Port Curtis) Appendix 11 Terrestrial Ecology Supplementary EIS Study Appendix 12 Interim Shorebird Technical Study	The report prepared by Central Queensland University sets out the survey methods used to inform the assessment of impacts including on MNES. Information on use of the area by dugong was sourced from the routine monitoring undertaken by experts over several years and documents referred to in the report. Additional surveys were undertaken for the SREIS more recently in August 2012. In addition, observations recorded in February to April 2011 and June 2011 during vessel and aerial surveys completed for the Western Basin Dredging and Disposal Project EIS were considered.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
		The department also requires more detail around:		
13 (see 23)	6.1 GBRWHA and Port Curtis National Heritage Place	• Information about what specific components of the project elements will impact on each World or National Heritage value	**3)** Sections 2.1 and 2.2, Tables 2.1 and 2.2	Table 2.2 of Attachment 2, correlates specific project components and potential impacts to the Great Barrier Reef World Heritage and Natural Heritage values.
14 (see 22)		• Dredging operation and impacts from dredge and tunnel spoil disposal (we note that there will be additional impacts to those assessed under the WBDD Project that must be assessed as part of that proposed action, and options for disposal must be confirmed)	**1)** Chapters 15 and 16 and Appendix 8 (Coastal Processes and Marine Water Quality) **2)** Chapter 6, 12, 13 and 14 Appendix 7 Coastal Processes and Marine Water Quality	The hydrodynamic modelling and subsequent impact assessment (Chapters 15 and 16 and EIS Appendix 8) provide a detailed assessment of the impacts of dredging in relation to the cumulative impacts of dredging in Port Curtis. Further modelling was undertaken to verify the predicted impacts following the receipt of more detailed information on dredge footprints and volumes from FEED – presented in SREIS coastal processes Chapter 14 and associated specialist technical study (SREIS Appendix 10). Arrow Energy has reviewed the dredge spoil disposal requirements for the project, including a range of feasible options in the vicinity of the dredge sites (in addition to the Western Basin Reclamation Area). The proposed sites for disposal of dredge spoil from each of Arrow Energy's dredge locations are identified in SREIS Chapter 6, Project Description: Dredging, within Section 6.3. All options for dredge disposal have the required approvals. Management of these sites, including of decant water, will be carried out in accordance with the approval conditions for each site. The dredge management plan for the Arrow LNG Plant will consider the locations and timing of all dredging activities in Port Curtis (project and non-project).

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
15	6.1 GBRWHA and Port Curtis National Heritage Place	• Aesthetic impacts (the findings in chapter 23 should be summarised in the MNES chapter)	**1)** Chapter 23 and Appendix 17 (Landscape and Visual) **3)** Sections 2.1 and 2.2, Tables 2.1 and 2.2	No significant impacts were identified on landforms or landscape features in a World Heritage property, as impacts are localised within an industrial precinct in a significantly disturbed landscape of the Gladstone urban region. A range of measures have been developed and commitments made to reduce the visual impact of the Arrow Energy LNG plant on Curtis Island. In particular, the headland of Boatshed Point will be protected from excavation and clearing to preserve areas of vegetation and topography that help screen lower parts of the LNG plant and the construction camp. Vegetation in a 20 m wide wildlife corridor along the eastern boundary of the LNG plant site will also be retained to screen the site from the east. The design of the plant also minimises cutting into the high ground of the Curtis Island hogsback ridge system that will assist in maintaining a vegetated backdrop and visually absorbing the built form of the development. Several measures were also developed to address the visual impact of project lighting, including minimising night time working, shielding/directing lighting on to work areas and the use of passive lighting (e.g., reflectors). These measures are discussed in detail in EIS Chapter 23, Section 23.5 and listed in Table 23.14.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
16 (see: 25, 26)	6.1 GBRWHA and Port Curtis National Heritage Place	• Quantification of impacts (both direct and indirect), including hectares to be impacted and percentage impacted compared to overall available habitat and habitat available regionally (where possible)	**1)** Attachment 4 (MNES), Section 6.5 Appendix 12 Marine and Estuarine Ecology, Section 6.1 **2)** Chapters 15-17, Section 18.6 **3)** Sections 3.1, 3.2 and 3.3	Updated area of disturbance is provided in SREIS Section 18.6. SREIS Chapter 18 (Terrestrial Ecology, Section 18.6) provides a revised floristic assessment of terrestrial vegetation. Section 18.6.2 addresses EPBC listed threatened ecological communities and Section 18.6.4 addresses EPBC listed flora species. Sections 18.6 tabulates revised areas of regulated vegetation to be cleared within the project area. This information is summarised in SREIS Attachment 2 sections 3.1.2 and 3.2.2, Tables 3.1 and 3.2. The potential direct and indirect impacts of dredging on marine fauna and habitats is addressed in SREIS Chapter 16 (Marine Ecology) and Chapter 17 (Estuarine Ecology – Calliope River) and associated technical studies. SREIS Section 18.8 calculates the area of disturbance, by RE, relative to cumulative total clearing expected for all Curtis Island LNG proposals.
17 (see: 4, 47)		• Assessment of cumulative impacts on World and National Heritage values	**1)** Attachment 4 (MNES), Sections 6.1 and 6.5, Appendix 12 Marine and Estuarine Ecology, Section 9 **2)** Section 18.8 **3)** Section 2.2 and Table 2.3	The cumulative impacts of vegetation clearing are presented in the EIS Section 32.3.7, Table 32.2 and Attachment 4 (MNES), Table 6.4 and are updated in SREIS Chapter 18 (Terrestrial Ecology, Section 18.8).
18		• Mitigation measures and their effectiveness in reducing impacts	**1)** Attachment 4 (MNES) Attachment 6 (EMP) Attachment 8 (Commitments) **2)** Attachment 3 (EMP Update), Attachment 7 (Commitments Update) **3)** Appendix C	The significance assessment approach adopted for the EIS and SREIS is underpinned by management measures that are effective and proven, based on industry standards where relevant. All mitigation measures have been reviewed by Arrow Energy to ensure they can be implemented and will be effective in managing identified impacts.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
19	6.1 GBRWHA and Port Curtis National Heritage Place	• Evidence based analysis for all conclusions, particularly for conclusions of non-significance.	**1)** Attachment 4 (MNES) Chapter 17 and Appendix 9 (Terrestrial Ecology) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) **2)** See technical studies pertaining to MNES, i.e., terrestrial ecology, shorebirds, marine and estuarine ecology, coastal processes, marine water quality	Additional field survey work has been undertaken in 2012 relating to MNES and is summarised in SREIS chapters 15 to 19. SREIS Attachment 2 (MNES) summarises the survey and assessment methodology described in the supporting technical studies, particularly; terrestrial ecology, shorebirds, marine ecology, and estuarine ecology. The MNES Attachment confirms that the survey methodology complies with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009). The significance assessment approach adopted for the EIS and SREIS is underpinned by management measures that are effective and proven, based on industry standards where relevant. All mitigation measures have been reviewed by Arrow Energy to ensure they can be implemented and will be effective in managing identified impacts.
20 (see: 11, 31, 39)		• Assessment of residual impacts (including quantification of residual impacts) after proposed mitigation methods (for e.g., in the draft EIS it is stated that 'some impacts will be unavoidable', but no information is provided on what these impacts are and on which values they impact).	**1)** Attachment 4 (MNES) Sections 5.1, 6.1 and 7. **2)** Sections 18.6, 18.7 and 19.6 **3)** Sections 3.1. 3.2, 3.3, 4.1 and 4.5	The residual impacts presented are those remaining after application of mitigation measures, as described in each impact assessment and the associated supporting study. Some impacts are avoidable e.g., by going to another location or using different technology; those that are "unavoidable" by such means have to be reduced. This is simply the pre-amble to the assessments that follows in the text, and the areas of habitat unavoidably lost after minimisation are given for each of the habitats and impacting activities in tables in each chapter.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
21 (see: 32, 40, 49)	6.1 GBRWHA and Port Curtis National Heritage Place	• Detail around any proposed management plans.	**1)** Attachment 4 (MNES) Attachment 6 (EMP) Attachment 8 (Commitments) **2)** Attachment 3 (EMP Update) Attachment 5 (Other Management Plans) Attachment 7 (Commitments)	SREIS Attachment 3 provides the revised environmental management plan, and Attachment 7 provides the commitments update. The SREIS Attachment 5 also presents a suite of additional 'other' management plans for: shorebirds, (wildlife) species, the Curtis Island wildlife corridor and pre-clearance surveys.
22 (see 14)		We note that the draft EIS states that dredging will be integrated with dredging undertaken for the WBDD project. We require more detail around when dredging will be undertaken (e.g., at the same time as dredging for WBDD or afterward) and cumulative impacts associated with dredging.	**1)** Chapters 15 and 16 and Appendix 8 (Coastal Processes and Marine Water Quality) **2)** Chapters 6, 12, 13 and 14	The modelling of impacts of dredging on coastal processes and water quality carried out for the EIS included the WBDD project and other relevant developments in Port Curtis in the base case. The modelling results were used in the assessment of cumulative impacts for coastal processes, water quality and marine and estuarine ecology (chapters 15, 16 and 19 of the EIS). The conclusions of these studies has been reviewed for the SREIS in light of changes to project dredging activities and considered in the further update of the MNES attachment of the SREIS. The dredge management plan for the Arrow LNG Plant will consider the locations and timing of all dredging activities in Port Curtis (project and non-project).
23 (see 13)		The 'Summary of Potential Impact' on World and National Heritage values must be clear and make a conclusion on significance of impacts (for e.g., statements such as 'Potential Impacts on the values of the GBRWHA will be further considered in the further development of the design of the project' are not adequate). In accordance with previous comments, the EIS must provide a full and comprehensive assessment of impacts.	**3)** Sections 2.1 and 2.2, Tables 2.1 and 2.2	See SREIS MNES Attachment 2 (i.e., this report), section 2.1 and associated tables Table 2.1 and Table 2.2.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
24	6.1.1 Geology or Landscape Values, page 6-6	The draft EIS states that 'lighting during construction will have a significant impact on landscape and visual receptors'. Discuss and provide a more detailed rationale for the conclusion that there will be no residual significant impact given that the draft EIS states that lighting will have a significant impact on landscape and visual receptors.	**1)** Attachment 4 (MNES), Section 6.3.3 Sections 6.5.2, 23.4.2 and 23.8. Chapter 32. **2)** Appendix 9 (Marine Ecology (Turtles) Technical Study – Curtis Island Baseline Light Monitoring 2012) **3)** Section 3.3, Table 3.4	EIS Chapter 23 (Landscape and Visual, Section 23.4.2) provides an assessment of 15 sensitive visual receptors / viewpoints. The assessment identified impacts, mainly due to lighting, of varying degrees of significance depending on the viewpoint. Commitments to avoid, mitigate and manage visual impacts are also included in EIS Chapter 23, Section 23.8. The cumulative impact assessment (EIS Chapter 23 and Attachment 4 (MNES) Section 6.5.2) considered impacts on landscape and visual amenity and of lighting from the increased number of developments planned and under construction in the Gladstone region. Lighting from the Arrow LNG plant during construction will be set in the context of three other LNG plants either under construction or operational on Curtis Island. Against this industrialised background, the additional cumulative impacts of lighting from the Arrow LNG plant will be minimal. Commitments to avoid, mitigate and manage visual impacts are included in EIS Chapter 23, Section 23.8. The SREIS provides additional assessment of potential lighting impacts to turtles (Chapter 16, Turtles and Lighting). The technical study informing the SREIS concludes that with appropriate management, the residual impact of LNG plant lighting can be reduced to an absolute minimum, reducing the sky glow and long term visibility of the LNG plant during the production phase, thereby reducing residual impacts to nesting turtles and hatchlings. Additional commitments have been included in the SREIS to manage light from the LNG plant site, during both construction and operations.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
25 (see: 16, 26)	6.1.2 Biological or Ecological Values	We require quantification of the total amount of vegetation to be cleared by the construction of project infrastructure (page 6-8). Further detail around mitigation measures is required (e.g., what are the "appropriate mitigation measures will be implemented" - page 6-9) In respect of reduction or loss of terrestrial species or populations, more detail is required around hydrological impacts or pollution and stringing and laying of pipelines (page 6-11). Any mitigation measures should be discussed.	**1)** Attachment 4 (MNES) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) Chapter 17 and Appendix 9 (Terrestrial Ecology) **2)** Section 18.6 **3)** Section 3.1	SREIS Chapter 18 (Terrestrial Ecology, Section 18.6) provides a revised assessment of terrestrial vegetation. Section 18.6.2 addresses EPBC listed threatened ecological communities and Section 18.6.4 addresses EPBC listed flora species. Section 18.6 presents a table of the revised areas of regulated vegetation to be cleared within the Arrow LNG Plant project area. This information is summarised in SREIS Attachment 2 (MNES), Section 3.1. EPBC Act listed vegetation communities and RE mapping are shown on figures in Chapter 18. Table 2.2 of SREIS Attachment 2 (MNES) correlates specific project activities to potential impacts to the World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area. Revised and additional management measures (commitments) identified during the supplementary technical studies to address impact on terrestrial ecology are included in Section 18.10 of the SREIS. The cumulative impacts of vegetation clearing are presented in the EIS Chapter 32 (Cumulative Impacts, Section 32.3.7, Table 32.2) and Attachment 4 (MNES), Table 6.4 and are updated in SREIS Chapter 18 (Terrestrial Ecology, Section 18.8).

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
26 (see: 16, 25)	6.1.3 Wilderness, Natural Beauty or Rare or Unique Environment Values	Vegetation clearance should also be discussed in the context of wilderness, natural beauty or rare or unique environment values.	**1)** Section 32.3.7 Attachment 4. **2)** Sections 3.1.2 and 3.2.2, Sections 18.6, 18.8 and 18.10 **3)** Section 2.2 (Tables 2.1 to 2.3)	SREIS Chapter 18 (Terrestrial Ecology, Section 18.6) provides a revised assessment of terrestrial vegetation. Section 18.6.2 addresses EPBC listed threatened ecological communities and Section 18.6.4 addresses EPBC listed flora species. Chapter 18, Table 18.3 tabulates the revised areas of regulated vegetation to be cleared within the Arrow LNG Plant project area. This information is summarised in SREIS Attachment 2 (MNES), sections 3.1.2 and 3.2.2, and tables 3.1 and 3.2. EPBC Act listed vegetation communities updated field validated regional ecosystem mapping are shown in Chapter 18. Table 2.2 of SREIS Attachment 2 (MNES) correlates specific project activities to potential impacts to the World Heritage and National Heritage values of the Great Barrier Reef World Heritage Area. Revised and additional management measures (commitments) identified during the supplementary technical studies to address impact on terrestrial ecology are included in Section 18.10 of the SREIS. The cumulative impacts of vegetation clearing are presented in EIS Chapter 32 (Cumulative Impacts, Section 32.3.7, Table 32.2) and Attachment 4 (MNES), Table 6.4 and are updated in SREIS Chapter 18 (Terrestrial Ecology, Section 18.8). SREIS MNES Attachment 2, Section 2 presents disturbances in context with World Heritage and Natural Heritage values.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
27 (see: 7, 34, 42, 48)	6.1.5 Summary of Potential Impact	Please clarify what is proposed to be offset and why (the proposed offset suggests that there is likely to be a significant impact on the Great Barrier Reef World and National Heritage values). The offsets plan, or at a minimum, more detail around the plan, is required. The draft EIS states "Potential impacts on the values of the GBRWHA will be further considered in the further development of the design of the project" (page 6-16). We expect information on all impacts to be provided and quantified in the assessment phase.	**1)** Attachment 4 (MNES), Section 7.2 **2)** Attachment 6 (Offsets) **3)** Section 5 (Offsets)	Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (SREIS Attachment 6), consistent with its Environmental Offset Strategy. This plan: • Describes measures taken to avoid and minimise impacts. • Identifies Arrow Energy's likely offset requirements. • Presents evidence that there are opportunities to achieve the required offsets. • Sets out Arrow Energy's preferred approach to the provision of environmental offsets. The Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
		More detail is required around:		
28	6.3 Protected species	• Whether each species is vulnerable, endangered or critically endangered (noting that the significance threshold differs with each listing criteria) and please include the scientific names for all species.	**1)** Attachment 4 (MNES), Section 5.3, Table 5.2, Section 5.4, Table 5.3 **2)** Chapters 18 and 19, and associated technical studies **3)** Sections 3 and 4, Tables 3.2 and 4.1	The rationale for species considered not likely to be impacted by the proposed action is presented in SREIS Attachment 2, MNES, Appendix D based on detailed information provided in the technical studies. This took into account the species status and the impact this had on the significance threshold. The status of each species is detailed within the EIS MNES Attachment and the supporting technical studies and is included in the SREIS. Scientific names were included for all species and are also included in the SREIS. Conservation-listed species records are shown on Figure 4 in EIS Attachment 4 (MNES), in relation to the project area. Figures 5 and 6 show Regional Ecosystems in relation to the project area. Many species (particularly migratory species) potentially present in the study area are generalist species. It is not possible to isolate a particular habitat type of importance to those species. No important populations were identified of any conservation-listed species in the EIS.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
29 (see: 10)	6.3 Protected species	• An assessment of impacts on all listed threatened species and communities likely to occur, or be impacted by, the proposed action (for e.g., an assessment of impacts should be provided for syngnathid fish listed under the EPBC Act).	**1)** Attachment 4 (MNES) Section 5.1.2	Further assessment of EPBC listed threatened species is provided in SREIS Attachment 2, MNES, Chapter 3 and draws on details provided by the technical studies completed for the SREIS for terrestrial ecology, shorebirds and marine ecology. These studies included detailed discussion on the desktop and field survey methodologies; and impact assessment methodology, including conclusions regarding the magnitude and significance of residual (post-mitigation) impacts; mitigation and management commitments; and offsets. Appendix D of SREIS Attachment 2 (MNES) tabulates the revised assessment of threatened species where no change to potential impact is predicted. The rationale for species considered not likely to be impacted by the proposed action is based on detailed information provided in the technical studies. This took into account the species status and the impact this had on the significance threshold.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
30 (see: 3, 12, 46)	6.3 Protected species	• Detail around methodologies used. This should include a discussion around what broad scale and targeted surveys have been undertaken (and for what species), survey methodology, survey success and how surveys comply with relevant Commonwealth guidelines and policies. Surveys and methodology used are important to demonstrate that populations do not occur (particularly for endangered or critically endangered species).	**1)** Attachment 4 (MNES) Sections 3.1 and 6.4.1 Chapter 17 and Appendix 9 (Terrestrial Ecology) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) **2)** See technical studies pertaining to MNES, i.e., terrestrial ecology, turtles shorebirds, marine and estuarine ecology, coastal processes, marine water quality	Additional field survey work has been undertaken in 2012 relating to MNES and is summarised in SREIS chapters 15 to 19. The MNES Attachment confirms that the survey methodology complies with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009). The significance assessment approach adopted for the EIS and SREIS is underpinned by management measures that are effective and proven, based on industry standards where relevant. All mitigation measures have been reviewed by Arrow Energy to ensure they can be implemented and will be effective in managing identified impacts. Additional terrestrial ecology field surveys are proposed for the 2012/13 wet season targeting species that are more readily detectable in the warmer wet season months.
31 (see: 11, 20, 39)		• Some species, where impacts need to be mitigated, would benefit from a discussion and assessment of the level of residual impact.	**1)** Attachment 4 (MNES) Sections 5.1, 6.1 and 7 **2)** Sections 18.6, 18.7 and 19.6 **3)** Sections 3 and 4, Tables 3.2 and 4.1	The residual impacts given are those remaining after application of mitigation measures, as described in each impact assessment and the associated supporting study. The SREIS Attachment 2, MNES, Table 3.2 identifies the changes in potential impact to threatened species, notably the water mouse (*Xeromys myoides*). This species was detected in the vicinity of Boatshed Point on Curtis Island. SREIS Chapter 18 (Terrestrial Ecology) shows records of EVNT species in relation to the project area.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
32 (see: 21, 40,49)	6.3 Protected species	• Proposed mitigation measures including detail around any proposed management plans.	**1)** Attachment 4 (MNES), Section 7 Attachment 6 (EMP) Attachment 8 (Commitments) **2)** Attachment 3 (EMP Update), Attachment 7 (Commitments Update)	SRIES Attachment 4 provides the updated environmental management plan, and Attachment 7 provides an update on the commitments that were included in the EIS. The MNES attachments to the EIS and the SREIS include commitments to address potential impacts to EPBC listed species. Arrow Energy will develop management plans to address ecological issues prior to construction. SREIS Attachment 5 (Other Management Plans) provides outlines of the species management plan, pre-clearance survey procedure, wildlife corridor management plan and shorebirds management plan.
33 (see: 41)		• More detail around pre-clearance surveys to demonstrate that avoidance and mitigation measures will be effective when species or habitat is identified. The timing of pre-clearance surveys is crucial and should take into account breeding/feeding seasons of certain species, in particular migratory shorebird species present in higher numbers during the summer months. There is also no indication about what 'appropriate mitigate measures' will be implemented when species are found in pre-clearance surveys.	**1)** Attachment 4 (MNES), Sections 6.3 and 6.4 **2)** Appendix 11, Terrestrial Ecology Technical Report, Sections 4.1, 6.3, 9 and 10	The SREIS Attachment 5 (Other Management Plans) presents a suite of additional 'other' management plans covering pre-clearance surveys, plans for pre-clearance, shorebirds, wildlife species and the Curtis Island wildlife corridor. Section 4.1 of the Terrestrial Ecology Technical Report, notes that the timing of pre-clearance surveys should take into account breeding and feeding seasons of certain species. The pre-clearance framework also acknowledges the standard DSEWPaC development approval condition that: "Prior to the commencement of construction, DSEWPaC is likely to require a separate management plan for each species, ecological community or other MNES found during the verification surveys to manage the impacts of project construction and operation."

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
34 (see: 7, 27, 42, 48)	6.3 Protected species	• Proposed offsets (what is proposed to be offset, how the offset will be implemented/managed & what is it actually proposing to 'offset') – this can be provided in the offsets section of the MNES chapter.	**1)** Attachment 4 (MNES), Section 7.2 **2)** Attachment 6 (Offsets) **3)** Section 5 (Offsets)	Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (SREIS Attachment 6), consistent with its Environmental Offset Strategy. This plan: • Describes measures taken to avoid and minimise impacts. • Identifies Arrow Energy's likely offset requirements. • Presents evidence that there are opportunities to achieve the required offsets. • Sets out Arrow Energy's preferred approach to the provision of environmental offsets. The Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.
35		We note that the above matters have been addressed or mostly addressed in relation to several species in discussion with the department prior to publication.	-	Noted
36		Please note that for all listed threatened, migratory or marine species that are believed not likely to be impacted by the action, but for which suitable habitat is present and could be impacted by the action, we require sufficient, logically presented information to clearly demonstrate that a likely impact on the species will not occur.	**1)** Attachment 4 (MNES); Chapter 17 and Appendix 9 (Terrestrial Ecology) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) **2)** See technical studies pertaining to MNES **3)** Tables 3.2 and 4.1	The EIS MNES Attachment was revised to address DSEWPaC's earlier comments on the detail presented in the document. Information on the rationale for the determinations of non-significance and assessment of cumulative impacts on MNES are presented along with mitigation measures. Each specialist technical study for both the EIS and SREIS explains in detail the survey and assessment methodologies, in particular how it is required to comply with EPBC Act Guideline 1.1.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
37	6.3 Protected species	Use of diagrams and illustrations to show proximity of species and habitat to project elements would be useful. Statements such as 'the species could potentially occur within patches of forest occurring in the study area' need clarification and should be shown in diagrams. It would also be useful if these diagrams showed potential habitat, known habitat, habitat type (foraging, breeding etc.) and recorded sightings within proximity of the proposed action.	**1)** Attachment 4 (MNES), Figures 4, 5 and 6 **2)** Section 18.7 **3)** Figures in SREIS MNES attachment	Conservation-listed species records are shown on Figure 4 in EIS Attachment 4, MNES, in relation to the project area. Figures 5 and 6 show Regional Ecosystems in relation to the project area. Many species (particularly migratory species) potentially present in the study area are generalist species. It is not possible to isolate a particular habitat type of importance to those species. No important populations were identified of any conservation-listed species in the EIS. Additional figures are provided in the SREIS (e.g., see Chapter 18 (Terrestrial Ecology, Section 18.7).
		The description of EPBC Act listed migratory species is thorough and generally meets the department's requirements. However, more detail is required around:		

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
38	6.4 Migratory species	• Detail around methodologies used, including what surveys have been undertaken, survey methodology and how this complies with relevant Commonwealth guidelines and policies.	**1)** Attachment 4, Sections 3 and 6.4 **2)** Section 19.4 **3)** Section 4	Further assessment of migratory species is provided in the SREIS in MNES Attachment 2, Chapter 4 and draws on details provided by the SREIS technical studies for terrestrial ecology, shorebirds and marine ecology. Detailed discussion is provided on the desktop and field survey methodologies; and impact assessment methodology, including conclusions on the magnitude and significance of residual (post-mitigation) impacts; mitigation and management commitments; and offsets. The assessment of impacts was undertaken in accordance with the EPBC Act Policy Statement 1.1 'Significant Impact Guidelines: Matters of National Environmental Significance' (DEWHA, 2009) and the draft Background Paper to EPBC Act Policy Statement 3.21 – Significant Impact Guidelines for 36 Migratory Shorebird Species (DEWHA, 2009). The SREIS MNES Attachment 2, Section 4 identifies changes in potential impacts to migratory species, notably the eastern curlew (due to potential indirect disturbance to the Clinton Ash Ponds site). Appendix E of SREIS Attachment 2 (MNES) tabulates the revised assessment of migratory species. No change to potential impacts is predicted. Additional migratory shorebird and terrestrial ecology field surveys are proposed for the 2012/13 wet season, in part to validate the assessment of sites such as Clinton Ash Ponds. SREIS Chapter 15 (Marine Ecology, Section 15.4.2) details the results of scientific literature reviews undertaken for EPBC listed marine fauna, in particular the snubfin and Indo-Pacific humpback dolphins.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
39 (see: 11, 20, 31)	6.4 Migratory species	• Some species, where impacts need to be mitigated, would benefit from a discussion and assessment of the level of residual impact.	**1)** Attachment 4 (MNES), Section 6.4 **2)** Appendix 11 Terrestrial Ecology Supplementary EIS Study, Section 5.3 **3)** Section 4	The residual impacts given are those after application of mitigation measures, as described in each impact assessment chapter. Further assessment of migratory species is provided in SREIS MNES Attachment 2, Chapter 4 and draws on details provided by the SREIS technical studies for terrestrial ecology, shorebirds and marine ecology. Detailed discussion is provided on the desktop and field survey methodologies; and impact assessment methodology, including conclusions on the magnitude and significance of residual (post-mitigation) impacts; mitigation and management commitments; and offsets
40 (see: 21, 32, 49)		• Proposed mitigation measures including detail around any proposed management plans.	**1)** Attachment 4 (MNES), Section 7 Attachment 6 (EMP) Attachment 8 (Commitments) **2)** Attachment 3 (EMP Update), Attachment 7 (Commitments)	The MNES attachments to the EIS and the SREIS include commitments to address potential impacts to migratory species. Arrow Energy will develop management plans to address ecological issues prior to construction. Outlines of the species management plan, pre-clearance survey procedure, wildlife corridor management plan and shorebirds management plan are provided in SREIS Attachment 5.
41 (see: 33)		• More detail around pre-clearance surveys to demonstrate that avoidance and mitigation measures will be effective when species or habitat is identified. The timing of pre-clearance surveys is crucial and should take into account breeding/feeding seasons of certain species, in particular migratory shorebird species present in higher numbers during the summer months. There is also no indication about what 'appropriate mitigate measures' will be implemented when species are found in pre-clearance surveys.	**2)** Attachment 3 (EMP Update), Attachment 5 (Other Management Plans) Attachment 7 (Commitments Update)	The SREIS Attachment 5 (Other Management Plans) presents a suite of additional 'other' management plans covering pre-clearance surveys, plans for pre-clearance, shorebirds, wildlife species and the Curtis Island wildlife corridor. The pre-clearance framework also acknowledges the standard DSEWPaC development approval condition that: "Prior to the commencement of construction, DSEWPaC is likely to require a separate management plan for each species, ecological community or other MNES found during the verification surveys to manage the impacts of project construction and operation."

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
42 (see 7, 27, 34, 48)	6.4 Migratory species	• Any proposed offsets (what is proposed to be offset, how the offset will be implemented/managed & what is it actually proposing to 'offset').	**1)** Attachment 4 (MNES), Section 7.2 **2)** Attachment 6 (Offsets) **3)** Section 5 (Offsets)	Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (SREIS Attachment 6), consistent with its Environmental Offset Strategy. This plan: • Describes measures taken to avoid and minimise impacts. • Identifies Arrow Energy's likely offset requirements. • Presents evidence that there are opportunities to achieve the required offsets. • Sets out Arrow Energy's preferred approach to the provision of environmental offsets. The Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.
43		Use of diagrams and illustrations to show proximity of migratory species and habitat to project elements (for e.g., will the MOF2 impact the White-bellied Sea Eagle nest found during surveys). Maps showing potential habitat, known habitat and recorded sightings within proximity of the proposed action would be useful. These maps should highlight habitat components important for each relevant species.	**1)** Attachment 4 (MNES), Figures 1 - 6 **2)** Section 18.7 **3)** Figures in SREIS MNES attachment	The white-bellied sea eagle nest is shown on Figure 4 of the EIS MNES Attachment 4. This species forages widely in Port Curtis, and there are regular sightings around the port. The Hamilton Point MOF is not taken forward to the SREIS as a project option and there will be no project infrastructure in the vicinity of this nest. Migratory shorebird habitat is shown on Figure 3 of the EIS MNES Attachment 4 (both foraging areas and roost sites). An updated figure is provided in the SREIS in Chapter 19. SREIS shorebirds specialist technical study, Figure 3 and Appendix 1 describe the shorebird habitats in the project area.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
44	6.4 Migratory species	Internal advice suggests that shorebird roosting sites and significant foraging habitat for migratory shorebirds is present within the project footprint. Migratory shorebird surveys undertaken in January-March 2011 as part of the Ecosystem Research and Monitoring Program (ERMP) approval condition of the Port of Gladstone Western Basin Dredging and Disposal project indicate intertidal areas within the area of the proposed action as feeding habitat for migratory shorebirds. The proposed tunnel launch site and tunnel spoil disposal area were also identified as shorebird foraging areas, and two roost sites were identified in close proximity to the proposed launch site 1 and access road at the mouth of the Calliope River. Please clarify whether shorebird roosting sites and significant habitat for migratory shorebirds is present within the project site in the context of this information and other available information, and provide a justification for your conclusion (Page 6-88).	**1)** Attachment 4 (MNES), Figure 3 **2)** Chapter 19 and Appendix 12 (Interim Shorebirds Technical Study) **3)** Section 4.2	The Interim Shorebirds Technical Study report (SREIS Appendix 11) identifies the location the two roost sites and provides details for 21 habitat sites, including launch site 1 (Figure 3). The findings of the study are summarised in SREIS Chapter 19, Shorebirds. The MNES Attachment (SREIS Attachment 2) draws in the technical study in the discussion of MNES (chapters 2 to 5).
45		The results of other surveys conducted under the Ecosystem Research and Monitoring Program should also be considered in the context of marine fauna distribution, abundance and habitat use of the region as it may assist with mitigation measures.	**2)** Chapter 19 and Appendix 12 (Interim Shorebirds Technical Study) **3)** Section 4.2	Further marine ecology desktop studies and field surveys were carried out for the SREIS, as described in Chapter 4 of the SREIS Marine Ecology technical study and Chapter 4 of the SREIS Estuarine Ecology (Calliope River) technical study.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
46 (see: 3, 12, 30)	Significant Impact Criteria – Dolphins (page 6-104)	More information needs to be provided around impacts to the Snubfin dolphin and Indo Pacific humpback dolphin. It appears that surveys have not been undertaken for these species, and internal advice confirms that habitat occurring for these species close to and at the proposal site could be considered important habitat for the species. We require quantification and further discussion of impacts on these species, including more detailed information around proposed mitigation and management measures.	**1)** Attachment 4 (MNES), Section 3 Attachment 8 (Commitments) Chapter 19 (Sections 19.4 and 19.5) and Appendix 12 (Marine and Estuarine Ecology) (Sections 5.4 and 5.5) **2)** Chapter 15. Appendix 8, Technical Study of Marine Ecology (Port Curtis), Sections 4.1.2, 5 and 6.1. **3)** Sections 4.4 and 4.5	The existing environment and environmental values of marine fauna are discussed in EIS Chapter 19 (Marine and Estuarine Ecology, Section 19.3.3). Potential impacts on marine fauna are discussed in Section 19.4.2, and measures to avoid, mitigate and manage potential impacts on marine fauna are discussed in Section 19.5.2. Updated information on the potential impacts to marine fauna from project activities are provided in the SREIS Chapter 15, Marine Ecology. Information on the potential impacts of lighting on marine turtles is provided in SREIS Chapter 16, Turtles and Lighting. Both chapters contain additional management measures to address the impacts identified. The dredge management plan will be developed and approved prior to dredging activities commencing. The plan will include clear procedures for managing potential impacts to marine fauna for the project incorporating the commitments set out in the EIS and SREIS.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
46 (see: 3, 12, 30) (cont'd)	Significant Impact Criteria – Dolphins (page 6-104)	The following additional information should be provided: • A more detailed discussion and mapping that describes the known locations and habitat availability of this species to the north and south of the proposal • Additional detail on the ecology of the species including distribution, habitat use, diet, life history, social structure and behaviour; • Additional detail on the impacts of the proposal including a quantitative analysis of habitat lost and degraded and ongoing impacts of the various activities associated with the proposal; • A discussion of cumulative impacts for both species; • A calculation of Potential Biological Removal for both species and the implications of project impacts and cumulative impacts in relation to this; and • Detail on how offsets will address the impacts of the proposal on both species.	**1)** Attachment 4 (MNES), Section 3 Attachment 8 (Commitments) Chapter 19 (Sections 19.4 and 19.5) and Appendix 12 (Marine and Estuarine Ecology) (Sections 5.4 and 5.5) **2)** Chapter 15. Appendix 8, Technical Study of Marine Ecology (Port Curtis), Sections 4.1.2, 5 and 6.1. **3)** Sections 4.4 and 4.5	• SREIS Appendix 8 Marine Ecology technical report provides detailed discussion on the observed locations, ecology and occurrence of the dolphins within the study area, and the revised assessment of potential impacts. • SREIS Appendix 8 Marine Ecology technical report, sections 4.1.2, 5.2 and 6.1, addresses impacts to dolphins and marine habitats. S.4.1.2 explains the revised field and desktop survey methodology, and impact assessment methodology, as required to address DSWEPaC and DEHP EIS submissions This includes locations, dates and methods for aerial and vessel surveys. S.5.2 presents the results of additional survey effort for the SREIS, as well as the revised assessment of direct and indirect impacts. Accordingly, additional mitigation measures have been developed to manage potential impacts of project activities on marine fauna. • Revised dredge plume modelling undertaken for the SREIS (see Chapter 14 Coastal Processes and technical study Appendix 7) show no significant impact to dolphin habitats as a result of marine disturbances (dredging and offshore structures). • Section 5.2.1 of the SREIS Appendix 8, Marine Ecology technical report provides result from Gladstone Ports Corporation of that use abundance estimates of marine wildlife to determine the Potential Biological Removal. • The conclusion of the revised assessment (for the SREIS, i.e., see section 5.3 of this report) is that, following implementation of management and mitigation measures, there is a reduced risk of minor significance of direct impact to the migratory Australian snubfin dolphin, Indo-Pacific humpback dolphin and dugong due to potential vessel strikes, and that therefore, no specific offsets for these species is required.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
47 (see 4, 17)	6.5 Cumulative impacts	Note the comments above in respect to cumulative impacts, in particular on the Great Barrier Reef World and National Heritage values.	**1)** Attachment 4 (MNES), Sections 6.1 and 6.5, Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) (Section 9) **2)** Chapter 22 Appendix 8, Technical Study of Marine Ecology (Port Curtis), Section 4.2.1 **3)** Section 2.2 and Table 2.2	Table 2.2 of SREIS MNES Attachment 2 describes the impacts on World Heritage values updated from the EIS. A number of values of the world heritage area (coral reefs, breeding seabirds etc) are not of relevance as the project is not situated near any of these areas. Impacts on landscape values, biological values and wilderness values have largely been demonstrated to be negligible and confined to the boundaries of the designated industrial precinct of the GSDA on Curtis Island. Of those values that are of relevance to the Arrow LNG Plant pertaining to the world heritage area, the technical studies and chapters of the EIS and SREIS considered cumulative impacts as an intrinsic part of the assessment and the results of which are presented in relevant chapters of the EIS and SREIS, particularly those relating to terrestrial and marine ecology. Updated area of disturbance – presenting the LNG Plant Project proportionate cumulative contribution to impacts - is provided in SREIS Ch.18.6 (terrestrial ecology, floristic assessment). SREIS MNES Attachment 2, section 2 presents disturbances in context with World Heritage and Natural Heritage values.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
48 (see: 7, 27, 42, 34)	7.2 Environmental offsets	Although the draft EIS states that offsets will be provided, we require information on what offset is proposed, what the offset compensates for, and how the offset complies with relevant Commonwealth guidelines and policies (recognising that details will be developed and refined during assessment). We also require the offset strategy to specifically address MNES. Note that a consultation draft of the most recent EPBC Draft Environmental Offsets Policy is available (http://www.environment.gov.au/epbc/publications/consultation-draft-environmental-offsets-policy.html) and should be used as a guide for developing the offsets strategy (and referenced appropriately in the EIS). The magnitude of proposed offsets must account for the risk associated with any uncertainty of impacts. Please note that it is the department's preference for any offset strategy to align with offsets required for the three previously approved LNG plants on Curtis Island to ensure the best possible environmental outcomes.	**1)** Attachment 4 (MNES), Section 7.2 **2)** Attachment 6 (Offsets) **3)** Section 5 (Offsets)	Offsets are discussed in SREIS Attachment 2 (MNES), Chapter 5 with reference to the Australian Government's EPBC Act Environmental Offsets Policy, October 2012. The MNES Attachment (Attachment 2) of the SREIS, chapters 2, 3 and 4 provide the rational for consideration of offsets for the World Heritage and National Heritage values, and EPBC listed threatened ecological communities and species and migratory species for which the project is declared a controlled action. Arrow Energy has developed a Draft Environmental Offset Strategic Management Plan (Attachment 6 of the SREIS), consistent with its Environmental Offset Strategy. This plan: • Describes measures taken to avoid and minimise impacts. • Identifies Arrow Energy's likely offset requirements. • Presents evidence that there are opportunities to achieve the required offsets. • Sets out Arrow Energy's preferred approach to the provision of environmental offsets. The Environmental Offsets Strategic Management Plan presents the results of GIS analysis involving the sequential application of filters to identify suitable patches/tracts of target regional ecosystems, to facilitate identification of potential offset sites.

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
49 (see: 32)	Appendix 1	Note that mitigation measures that are to be relied upon to reduce the level of significance of impact must use commitment language and must not use terminology such as 'may' or 'should'. If using the term 'where practical' other mitigation measures must be provided to ensure the level of impact will be appropriately mitigated.	**1)** Attachment 4 (MNES), Section 7 Attachment 6 (EMP) Attachment 8 (Commitments) **2)** Attachment 3 (EMP Update), Attachment 7 (Commitments Update) **3)** Appendix C (Commitments Update)	The mitigation measures presented in the EIS and MNES Attachment 4 are presented as commitments. SREIS Attachment 2, Appendix C provides the project commitments relating to the protection and management of MNES. The framework for approvals is provided in EIS Chapter 2, and Attachment 1, and has been updated for the SREIS (Attachment 1, Approvals Update).
50		Where available, we require the statutory or policy basis for the mitigation measure, and the expected cost of the mitigation measure, to be provided. Please also provide the name of the agency responsible for endorsing or approving each mitigation measure or monitoring program. This information is required under Section 4.01 of Schedule 4 of the *Environment Protection and Biodiversity Conservation Regulations 2000*.	**1)** Attachment 1 (Legislation and Approvals) Attachment 6 (EMP) **2)** Attachment 1 (Revised - Legislation and Approvals) Attachment 3 (Revised - EMP) Attachment 7 (Commitments Update) **3)** Appendix C (Commitments Update)	SREIS Attachment 1, Legislation Update, provides discussion on the legislative and approvals framework for the project. The cost of mitigation will be determined through a competitive tendering process for the construction of the Arrow LNG Plant. Consequently, it is not possible to provide insight into that actual cost of mitigation. It is important to note that all mitigation measures have been reviewed by the FEED team to ensure they can be implemented.
51	9. Environmental Records	We require more information about the circumstances around the two penalty infringement notices noted in the draft EIS.	**1)** Chapter 1	EIS Chapter 1 discusses the penalty infringement notices (PINs).

Table A.1 Cross-check table against DSEWPaC feedback (cont'd)

No.	EIS MNES Attachment reference	DSEWPaC Comment	Section where addressed: 1) EIS; 2) SREIS; & 3) SREIS MNES Attachment 2 (i.e., this report)	Explanatory Notes
52	10. Conclusions	The conclusion on significance of impacts to MNES to be clear and include a discussion around: • level of impact; • mitigation measures; • residual impact; and • proposed offsets for any impact that cannot be mitigated.	**1)** Attachment 4 (MNES) Attachment 6 (EMP) Attachment 8 (Commitments) Chapter 17 and Appendix 9 (Terrestrial Ecology) Chapter 19 and Appendix 12 (Marine and Estuarine Ecology) **2)** See technical studies pertaining to MNES, i.e., terrestrial ecology, turtles shorebirds, marine and estuarine ecology, coastal processes, marine water quality **3)** MNES attachment	SREIS Attachment 2, MNES, Section 6 provides revised conclusions concerning MNES.

Note: fully detailed responses to all public and advisory agency submissions to the EIS are included as Part B of the SREIS.

Appendix B

Cross-Check Table Against Issues Relating to MNES Raised in Public Submissions

Table B.1 Cross-check table against issues relating to MNES raised in public submissions

Issue	Description	Section where addressed		
		EIS	**SREIS**	**SREIS MNES Attachment**
GBRWHA issues	Recommendations from the UNESCO World Heritage Committee meeting on the management of the GBRWHA (June 2012) should be applied and incorporated into the supplementary EIS. The EIS process should be suspended until receipt of these recommendations.	-	-	Section 2.2.2, and Tables 2.1, 2.2 and 2.3
Dolphins – distribution, impacts and mitigation	Further research is recommended on the distribution and extent of relevant species (Irrawaddy dolphin, Snub-fin and Indo-Pacific humpback dolphin). Provide further detail on the impacts to these species in Port Curtis in the MNES attachment including on habitat loss, cumulative impacts and proposed mitigation measures (including offsets).	Chapter 19 Attachment 4 (MNES)	Port Curtis marine Ecology Technical Report: Sections 4.1.2, 5 and 6.1	Section 2.2.2, and Tables 2.1, 2.2 and 2.3 Section 4.2 and Table 4.1
Vegetation clearance - areas and mitigation	Provide a map and details of the areas of vegetation proposed to be cleared including for MNES vegetation. Vegetation clearance should be discussed in the context of wilderness, natural beauty or rare and unique environmental values. Provide details of the vegetation management plan, including its purpose and the proposed mitigation measures.	Section17.4.3 Sections 17.5 and 17.8	Section 18.6	Sections 3.1.2 and 3.2.2 Tables 2.2, 3.1 and 3.2

Note: fully detailed responses to all public and advisory agency submissions to the EIS are included as Part B of the SREIS.

Appendix C

New and Revised Commitments Relating to Management of Impacts to MNES

New and revised commitments to manage the project impacts to MNES, additional to, or superseding where appropriate those presented in Appendix 1, Table A1 of the Arrow LNG Plant EIS, are set out in Table C.1.

Table C.1 New and Revised Commitments Relating to Management of Impacts to MNES

No.	Commitment
C17.23A	Clearly mark no go zones, where required, including the semi-evergreen vine thicket (*Cupaniopsis*) fenced area on Boatshed Point and the critically endangered EPBC Act listed vine thicket communities on the eastern margin of Hamilton Point and northeast of Boatshed Point. Signage will be erected around the margins of the communities to indicate restricted access.
C17.36A	Develop trench management procedures to prevent access of fauna into trenches. These procedures will include measures such as trench breakers and covers. In addition, inspection procedures will be established in order to remove trapped fauna, create protection and refuge areas for wildlife trapped in the trench and develop methods to assist trapped fauna left in the trench.
C17.40	Protect the EPBC Act listed community northeast of Boatshed Point and employ low impact methods of weed control within and adjacent to EPBC Act listed communities.
C17.41	Establish a management buffer of suitable width and of contiguous natural vegetation, around the EPBC Act listed community northeast of Boatshed Point to minimise the potential for edge effects and limit the potential for weed invasion. The buffer will be defined in the Wildlife Corridor Management Plan to be developed prior to construction.
C17.42	Implement fire control measures to prevent wildfire incursion into the EPBC Act listed communities. This may include construction of firebreaks or asset protection burning outside of the community and its associated buffer.
C17.43	The need to protect EPBC Act listed communities and explanation of the mitigation measures that are to be implemented to be detailed in workforce inductions.
C17.44	Clearly delineate clearing boundaries to avoid unnecessary vegetation loss.
C17.45	Where practical, stock-pile cleared vegetation in 'wind-rows' around the edge of retained vegetation. In addition to providing shelter, this will also provide some physical barrier reducing edge impact severity and the risk of weed spread.
C17.46	Minimise the duration trenches are open, ensure daily trench inspections are undertaken by suitably qualified spotter/catchers and ensure that the length of open trench does not exceed that which can be inspected by the available spotter/catchers in any one daily period.
C17.47	Consider measures to minimise light emitted from the LNG plant during the detailed design of the LNG plant including: • Assess the necessity and choice of lighting in the plant area: – Use low-pressure sodium (LPS) lights as a first-choice light source and high-pressure sodium (HPS) lights where LPS is not practical. – Replace short-wavelength light with long-wavelength light and exclude short-wavelength light with the use of filters. – Avoid using halogen, metal halide or fluorescent lights (white lights) where possible, and only use white lights in contained areas where colour rendition is required. – Minimise the number and wattage of lights, and recess lighting into structures where possible. • Use timers and motion-activated light switches. • Use reflective materials to delineate equipment or pathways and use embedded lighting for roads. • Position doors and windows on the sides of buildings facing away from marine turtle nesting beaches and install and use window coverings to reduce light emissions. • Maintain elevated horizons (such as topographic features, vegetation or barriers) to screen rookery beaches from light sources.

Table C.1 New and Revised Commitments Relating to Management of Impacts to MNES (cont'd)

No.	Commitment
C17.48	If koalas are found during wet season surveys to be undertaken in early 2013 or pre-clearance surveys, develop and implement appropriate mitigations in the species management plan, which could include fauna spotter/catchers, limiting vehicle speed limits and habitat rehabilitation.
C17.49	Design infrastructure to reduce impacts on shoreline habitat, where possible, and reduce the risk of unnecessary clearing by demarcating disturbance areas.
C17.50	Reduce lighting wherever possible, in locations where movement between water mouse foraging and nesting habitats (e.g., between mangroves and the supralittoral zone) occurs.
C17.51	Review the need for an ongoing program to monitor the shorebird population at project sites following the completion of survey work in 2013.
C17.52	Develop measures to minimise disturbance around important shorebird habitat, during construction and operation. Measures could include exclusion zones or screens as recommended in Rohweder et al., (2011).

Attachment D

Revised Assessment of Threatened Species Where No Change to Potential Impact is Predicted

Table D.1 Revised assessment of threatened species where no change to potential impact is predicted

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Revised likelihood of occurrence (SREIS)	Change in potential impact
Common name	**Scientific name**						
Birds							
Australian painted snipe	*Rostratula australis*	Vulnerable (also listed as migratory and marine)	Low to moderate	No. Species has not been identified from within the study area. No suitable freshwater habitat to be removed for the project.	No Paucity of records indicates the species is not common within the local area or region. No suitable habitat within project area of disturbance.	No change.	No change to the potential impact. Identified as 'rarely, if ever, inhabiting Port Curtis'.
Black-breasted button-quail	*Turnix melanogaster*	Vulnerable	Low to moderate	No. No areas identified as habitat critical to the survival of the species identified. No important populations in vicinity of the project area.	No Records occur along Boyne Island, however there are no records known from Curtis Island and little suitable habitat is present within the project area. Marginal habitat in project area.	Low	No change. No records known from Curtis Island and little suitable habitat is present within the project area.
Red goshawk	*Erythrotriorchis radiatus*	Vulnerable	Low to moderate No historical records of the species and no individuals observed during EIS surveys.	No. Sub-optimal habitat to be cleared for the project is small in comparison to the potential foraging habitat available in the wider region.	No Habitat for this species within the project area is marginal.	Low	No change. Very few known records suggest it is not a regular inhabitant of the area.

Table D.1 Revised assessment of threatened species where no change to potential impact is predicted (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Revised likelihood of occurrence (SREIS)	Change in potential impact
Common name	**Scientific name**						
Birds (cont'd)							
Yellow chat (Dawson subspecies)	*Epthianura crocea macgregori*	Critically endangered	Moderate	No. No optimal habitat has been identified within the study area. Populations are not known from within the study area.	No Although records of the species occur on Curtis Island, the species resides in the northeast corner of the island and is not know from the project area. No suitable habitat.	Low	No change. Not known from the project area. No suitable habitat.
Mammals							
Northern quoll	*Dasyurus hallucatus*	Endangered	Moderate	No. No records of the species within suitable habitat within the study area. Large areas of more suitable habitat are present to the north of the LNG plant on Curtis Island, and adjacent to TWAF 8 in Targinie State Forest.	No. No records occur within proximity to the project area. Habitat for the species is marginal.	Low	No change. No records of the species within suitable habitat within the study area.

Table D.1 Revised assessment of threatened species where no change to potential impact is predicted (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Revised likelihood of occurrence (SREIS)	Change in potential impact
Common name	**Scientific name**						
Reptiles							
Collared delma	*Delma torquata*	Vulnerable	Moderate	No. No critical habitat for the species has been identified within the study areas, no important populations are present, and potential foraging habitat clearing is a small proportion of that available in the wider region.	No. No known nearby records suggest the species does not inhabit the area.	Low	No change. Species unlikely to inhabit the area.
Yakka skink	*Egernia rugosa*	Vulnerable	Moderate	No. No critical habitat for the species has been identified within the study areas, no important populations are present, and potential foraging habitat clearing is a small proportion of that available in the wider region.	No. No known nearby records suggest the species does not inhabit the area. No suitable habitat in project area.	Low	No change. Species unlikely to inhabit the area.

Table D.1 Revised assessment of threatened species where no change to potential impact is predicted (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Revised likelihood of occurrence (SREIS)	Change in potential impact
Common name	**Scientific name**						
Plants							
Wedge-leaf tuckeroo	*Cupaniopsis shirleyana*	Vulnerable	Low to moderate	No. No important habitat has been identified in the project area, and the species was not identified in field surveys.	Semi-evergreen vine thicket habitat is present in the project area. All prior records of *Cupaniopsis shirleyana* within 100 km buffer surrounding project area have been re-assigned to an undescribed taxon (Cupaniopsis), which at date of assessment had not been assigned a hispid name. *Cupaniopsis shirleyana,* being restricted to the area between Gympie and Brisbane, has no further relevance to the project and reference has been removed from the SREIS.	Very Low	No change. Reference to *Cupaniopsis shirleyana* has been removed from the SREIS.
Cycad	*Cycas megacarpa*	Endangered	Low to moderate	No. No important habitat has been identified in the project area, and the species was not identified in field surveys.	Numerous Herbrecs records within 100 km buffer with nearest record 4.2 km west of TWAF 8 on the western slope of Mount Larcom. Mostly associated with granite and acid volcanic soils.	Low	No change. Species was not identified in field surveys.

Table D.1 Revised assessment of threatened species where no change to potential impact is predicted (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Revised likelihood of occurrence (SREIS)	Change in potential impact
Common name	**Scientific name**						
Plants (cont'd)							
Mount Larcom silkpod	*Parsonsia larcomensis*	Vulnerable	Low to moderate	No. No individuals were identified in the project area, and habitat proposed to be cleared is not optimal habitat for the species.	Herbarium records 3 km west of TWAF 8 on Mount Larcom as well as 6 km north of TWAF 8 in non-remnant paddock (possible unreliable co-ordinates).	Low	No change. Species was not identified in field surveys.
Quassia	*Samadera bidwillii*	Vulnerable	Low to moderate	No. No important habitat has been identified in the project area, and the species was not identified in field surveys.	Five records in study area. Nearest record 4 km west of mainland tunnel launch site - Upper western slopes of Mount Larcom.	Very low	No change. Species was not identified in field surveys.

Attachment E

Revised Assessment of Migratory Species Where No Change to Potential Impact is Predicted

Table E.1 Revised assessment of migratory species where no change to potential impact is predicted

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Change in potential impact
Common name	**Scientific name**					
Other migratory wetland birds						
Caspian tern	*Hydroprogne caspia*	Migratory	Recorded	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	Yes	No change
Cattle egret	*Ardea ibis*	Migratory	High (common)	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Eastern osprey	*Pandion haliaetus*	Migratory	Recorded	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Eastern reef egret	*Egretta sacra*	Migratory	High	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Great egret	*Ardea alba*	Migratory	Recorded (common)	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	Yes	No change

Table E.1 Revised assessment of migratory species where no change to potential impact is predicted (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Change in potential impact
Common name	**Scientific name**					
Other migratory wetland birds (cont'd)						
Little tern	*Sterna albifrons*	Migratory, marine	Moderate to high	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	No	No change
White-bellied sea-eagle	*Haliaeetus leucogaster*	Migratory	Recorded	No. No important habitat or populations have been identified in the project area, Potential feeding habitat to be cleared is a small proportion of that available in the wider region.	Yes	No change
Terrestrial migratory birds						
Barn swallow	*Hirundo rustica*	Migratory (terrestrial)	Moderate	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Black-faced monarch	*Monarcha melanopsis*	Migratory (terrestrial)	Moderate	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Fork-tailed swift	*Apus pacificus*	Migratory (terrestrial)	Recorded	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Rainbow bee-eater	*Merops ornatus*	Migratory (terrestrial)	Recorded	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change

Table E.1 Revised assessment of migratory species where no change to potential impact is predicted (cont'd)

Species		EPBC Act status	Likelihood of occurrence (EIS)	Potentially significantly impacted? (EIS)	Further information obtained (SREIS)	Change in potential impact
Common name	**Scientific name**					
Terrestrial migratory birds (cont'd)						
Rufous fantail	*Rhipidura rufifrons*	Migratory (terrestrial)	Recorded	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Satin flycatcher	*Myiagra cyanoleuca*	Migratory (terrestrial)	Recorded	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change
Spectacled monarch	*Monarcha trivirgatus*	Migratory (terrestrial)	High	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change
White-throated needletail	*Hirundapus caudacutus*	Migratory (terrestrial)	Recorded	No. No important habitat or populations have been identified in the project area, Potential foraging habitat to be cleared is a small proportion of that available in the wider region.	No	No change