7 TERRESTRIAL ECOLOGY

7.1 INTRODUCTION

This chapter of the supplementary environmental impact statement (sEIS) for the proposed Queensland Curtis LNG (QCLNG) Project provides responses to terrestrial ecology-related submissions received on the draft EIS of August 2009, where they pertain to the LNG Component of the Project. This chapter also presents additional information gathered on terrestrial ecology, and provides an assessment and discussion of new or altered impacts as a result of amendments to the Project description since the publishing of the draft EIS. Key amendments to the Project description for the QCLNG Project, as pertaining to the LNG Component of the Project, relate to the following:

- A shift in the footprint of the LNG Plant within the LNG Facility boundary, approximately 100 m to 150 m further inland and to the east (see *Volume 2, Chapter 9* of this sEIS for the revised site layout).
- Relocation of the product loading jetty further south.
- Construction of a Construction Dock south of the jetty.
- Removal of the Mainland Road/Bridge Approach and Curtis Island Road from the project scope.

These amendments to the Project description for the LNG Facility are discussed in detail in *Volume 2, Chapters 9* and *13* of this sEIS.

Additional engineering information is also available on the pipeline crossing over The Narrows. A description of the proposed route and construction methodology for The Narrows pipeline is discussed in *Volume 2, Chapter 12* of this sEIS. Impacts associated with the marine environment are described in *Volume 5, Chapter 8.* Terrestrial impacts associated with the mainland section of the pipeline crossing over The Narrows (including the Philipies Landing, Marshland and Creek Sections) and the Curtis Island Section (i.e. Sections 1,2, 3 and 5 as described in *Volume 2, Chapter 12*) are discussed in this chapter. Although other parts of the Export pipeline route alignment have been amended since the draft EIS, The Narrows pipeline crossing has not changed significantly.

7.2 RESPONSES TO SUBMISSIONS

Table 5.7.1 provides a summary of the comments received on terrestrial ecology for the LNG Component.

Table 5.7.1 Summary of LNG Component terrestrial ecology submissions on the draft EIS

Summary of Submission	Response	Submitter Number
Endangered Regional Ecosystem 12.3.3 should be left intact and alternatives to clearing 37 ha on the LNG Facility site need to be considered. Offsetting is not a solution.	The changes to the LNG Plant layout and removal of the Curtis Island road from the scope require a smaller portion of RE 12.3.3 to be cleared – approximately 32.7 ha on Curtis Island (subject to ongoing refinement of LNG Facility design). While the Facility footprint has been developed to reduce the amount cleared so far as practicable, clearance is unavoidable in order to construct the facility. QGC has made a commitment to retaining RE 12.3.3 vegetation wherever practicable. As there is still some loss of this vegetation type associated with the project, offsets have been investigated. As no RE 12.3.3 is available for offsetting on Curtis Island, a suitable area will be identified on the mainland. This is discussed further in the Project Draft Vegetation and Biodiversity Offset Strategy (see *Appendix 2.3* of this sEIS).	24
The proposed road route traverses RE 12.3.3, containing a dense area of hollow-bearing trees – the road should be rerouted.	The proposed Curtis Island road is no longer within the scope of the QCLNG Project. QGC has made a commitment to retain hollow-bearing trees wherever possible.	24
Prevent access to the beach and mangroves during LNG Facility construction and operation.	Owing to the location of the proposed Facility and the need for marine infrastructure, access to limited areas of intertidal habitat will be required, resulting in some loss of mangroves. QGC is in discussions with DEEDI regarding suitable offsets for marine plants. Access to beach and mangrove areas by construction or operations workforce outside work activity duties will not be allowed.	24
Disturbance to beaches and intertidal sand and mud flats should be rehabilitated to pre-pipeline conditions.	Sections of the pipeline right of way traversing intertidal areas and mud flats, such as on either side of The Narrows crossing, will be allowed to re-establish with marine vegetation (mangroves) once the pipeline is constructed. These environments will return to natural conditions over time.	24
Monitor the impacts of the LNG Facility on species use of the area.	Additional threatened and migratory bird surveys were undertaken, in part to determine the need for additional monitoring. As the intertidal area adjacent to the plant has been established as not being significant for roosting or foraging (there are more suitable sites on Curtis Island), no future monitoring is planned. For the Powerful Owl, annual monitoring (during the breeding season) may be undertaken during the construction phase, to record the presence and behaviour of the identified breeding pair potentially affected by the project.	24

Summary of Submission	Response	Submitter Number
Any offset areas need to be adjacent or near the LNG Facility to provide suitable habitat for bird species such as the Powerful Owl and Black Cockatoo.	As foraging and nesting areas for these birds are strongly correlated with vegetation types, any offset provision for vegetation (such as RE 12.3.3) is likely to provide a suitable offset for bird habitat. However, the suitability of the identified RE 12.3.3 offset on the mainland would need to be confirmed as Powerful Owl habitat. QGC has made a commitment to investigate suitable offset sites for the Powerful Owl.	24
The LNG facility will lead to habitat loss. Every effort must be made to minimise vegetation clearing and fragmentation	QGC has made a commitment to limit vegetation clearing wherever practicable. Potential habitat fragmentation on Curtis Island has been reduced through the discontinuance of the Curtis Island road from the scope – this is discussed further in *Section 7.4.2.1* of this Chapter.	24
Species vulnerability to cumulative effects from multiple LNG facilities on Curtis Island needs to be assessed.	Please see *Section 7.7* of this Chapter.	24
The sEIS should recognise the state-significant biodiversity conservation value of the export facility site on Curtis Island as determined by the DERM *Biodiversity Planning Assessment for South East Queensland Bioregion*. The potential impacts identified and the mitigations measures proposed should be revised considering this value.	The vegetation within the study area is acknowledged to be of state conservation significance for the following values: • Habitat for threatened fauna listed under the *Nature Conservation Act 1992 (Qld)* • Endangered RE 12.3.3 • Of-Concern RE 12.3.11 and RE 12.11.14 The study area does contain attributes that are considered significant under the *Biodiversity Planning Assessment for South East Queensland Bioregion,* that is, the vegetation is isolated from mainland disturbance and forms part of contiguous habitat Curtis Island. However, there were few observations of species of state significance within the study area. Furthermore, the uncontrolled presence and impacts of domestic and feral animals within the study area counteracts the beneficial attributes of the island location. In summary, the vegetation of the study area is considered significant in that it provides habitat for threatened species and contains remnants of three regional ecosystems which are considered Endangered or Of Concern under Queensland legislation. With the exception of these values, the vegetation is considered to be degraded due to introduced species and altered fire regimes. The significance of impacts to threatened species and vegetation therefore remains as stated in the draft EIS.	32

Summary of Submission	Response	Submitter Number
Minimise the impact on possum and glider populations by adjusting the location of the LNG Plant or installing nest boxes.	The Project will aim to reduce the impact on possums and gliders by implementing a number of mitigation measures, as discussed in the draft EIS and in the Environmental Management Plan (EMP) in *Volume 11* of this sEIS. Specific measures will include: • Hollow-bearing trees will be retained wherever possible. • Nest boxes will be installed in retained vegetation at the site. • A Revegetation and Rehabilitation Plan will be implemented to assist in providing additional habitat for possums and gliders. • The implementation of a feral animal eradication plan at the site will help provide a more secure habitat.	32
A commitment should be made to offset the loss of feeding habitat for the Powerful Owl, either on Curtis Island or the mainland or both, as part of the Project offset strategy.	QGC has made a commitment to offset for Powerful Owl feeding habitat and will investigate suitable offset areas, which are strongly correlated with certain vegetation types. As suitable offset sites for vegetation impacts on Curtis Island are difficult to find on the island due to the large proportion of the island that already contains mature remnant vegetation, it is likely that offset sites will be proposed on the mainland. However, QGC has made a significant funding contribution to the Environmental Management Precinct on Curtis Island with the purpose of facilitating improved environmental outcomes for this area and the island in general.	32
Pipelines should be at least 1.2m underground to allow for the rehabilitation of the shrubby understorey over the pipeline and allow for habitat to remain for small, ground-dwelling fauna species. Rehabilitation efforts should include restoration of the shrubby understorey where this exists in the vegetation community.	All pipelines associated with the QCLNG Project will be built to the Australian Standard AS2885. As required by this standard, all pipelines will be buried to a minimum depth of 750 mm below the natural surface. Subject to easement requirements, trees and shrubs will be allowed to regenerate on the right of way with the exception of a 10 m wide cleared corridor, which is required for pipeline protection and for access purposes. To encourage regrowth of shrubby understorey species (where this exists in the vegetation community) and to discourage weed infestations, vegetation wastes from clearing activities will, wherever practicable, be spread over the easement.	32

Summary of Submission	Response	Submitter Number
The sEIS should address potential changes in fauna composition associated with the introduction of more adaptable and aggressive species (such as crows, butcher birds, magpies etc) which can change the local endemic faunal composition.	Construction of Project infrastructure will require clearing of vegetation that will result in habitat alteration. One of the effects of such clearing is the potential change in the fauna composition. Some bird species (such as Noisy Miners, crows, magpies and butcher birds) are found to prefer heavily disturbed and degraded patches of forest where the understorey has been grazed[1]. In fragmented remnants, these more adaptable birds also display very aggressive behaviour and actively exclude other smaller bird species[2.] As a result, the faunal composition of areas subject to clearing can potentially be altered. Birds such as Noisy Miners, crows and magpies are already established in abundance in all areas visited during the fauna surveys.	32
The sEIS should address: 1. management of fauna mortality on access roads 2. the loss of access and corridors for fauna by the project 3. the use of fencing materials so as to reduce injury to fauna 4. options for avoiding, or minimising and offsetting impacts on fauna habitat through rehabilitation and restoration of habitat values.	1. The proposed Curtis Island road is no longer within the scope of the QCLNG Project. While the site will be fenced, any road kills on site internal roads will be recorded and mitigation measures implemented where required. Mitigation measures may include reduced speed limits, signage and restriction of traffic to daylight hours, where practicable. 2. Vegetation clearing has the potential to create a barrier to wildlife movement. Some small mammals and birds may be deterred from crossing cleared zones, and suffer greater predation. Small, ground-dwelling animals, which are generally less mobile, such as fossorial (digging and burrowing) reptiles and amphibians can be more sensitive to barrier effects, while highly mobile species (birds and bats) are less likely to be affected. In almost all cases, the relatively narrow clearances required for roads and pipelines will create only minor barriers. 3. Fencing around construction and operation areas will keep animals from re-entering the site. 4. Mitigation measures to address impacts on fauna have been discussed in *Volume 5, Chapter 7* of the draft EIS and in the EMPs. Rehabilitation activities after the cessation of project activity, aimed at restoring habitat values, include the following: • the breaking up of hardened surfaces, and restoration of natural surfaces and contours • reseeding with local native flora, where appropriate	32

1 Grey et al. 1997, 1998

2 Grey et al. 1997, 1998 and Maron, 2009

Summary of Submission	Response	Submitter Number
	• the respreading of vegetative material over cleared areas • regular monitoring of regeneration on a monthly basis for six months and then biannually for a further two years.	
There must be an overall study undertaken to look at the cumulative impacts of the proposed LNG facilities and plans by Gladstone Ports Corporation on Endangered and Of-Concern vegetation on Curtis Island.	It is beyond the scope of the QCLNG study to consider the strategic development of the Gladstone region.	6
Consider the cumulative effects of multiple LNG facilities on endangered migratory birds in terms of heat generated by the facilities and impacts on nesting, feeding and roosting sites.	No heat sources associated with the QCLNG Project are directed at roost sites or located directly adjacent to foraging areas of migratory birds. Impacts to migratory bird activity are thus not anticipated. Please see *Section 7.*7 of this Chapter for additional description of cumulative effects on migratory birds.	6
Development of an LNG industry on Curtis Island will accelerate environmental degradation of a relatively intact ecosystem which contains regionally significant remnant vegetation and which supports a number of EPBC listed species.	Although Curtis Island does contain RE vegetation and provides foraging and nesting habitat to protected bird species, it is not in a pristine condition owing to the impact of feral and domestic animals and an altered fire regime. Additionally, the siting of the proposed QCLNG LNG Plant has considered ways to reduce impact on RE vegetation and important bird habitats. QGC has also made a commitment to limiting the removal of RE 12.3.3 wherever practicable. Findings from recent ecological studies have indicated that the site is not a significant foraging site for *Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth) (EPBC) listed migratory birds.	30
The EIS fails to evaluate the cumulative impacts of the three proposed LNG facilities regarding clearing of vegetation. This could be easily achieved by using the Regional Ecosystem Mapping and Geographic Information Systems (GIS).	See *Section 7.7.1.*	25

7.3 ADDITIONAL INPUT TO THE TERRESTRIAL ECOLOGY BASELINE

The amendments to the LNG Component project description, as outlined in *Section 7.1,* have not required additional terrestrial ecology baseline information to be gathered, as the study area remains the same as that presented in the draft EIS. However, in response to the findings and recommendations of the draft EIS and the potential for impacts on threatened or migratory species at the LNG Facility, additional bird surveys were commissioned to further gauge species presence and distribution at the LNG Facility site. The following EPBC listed migratory species were targeted during the surveys:

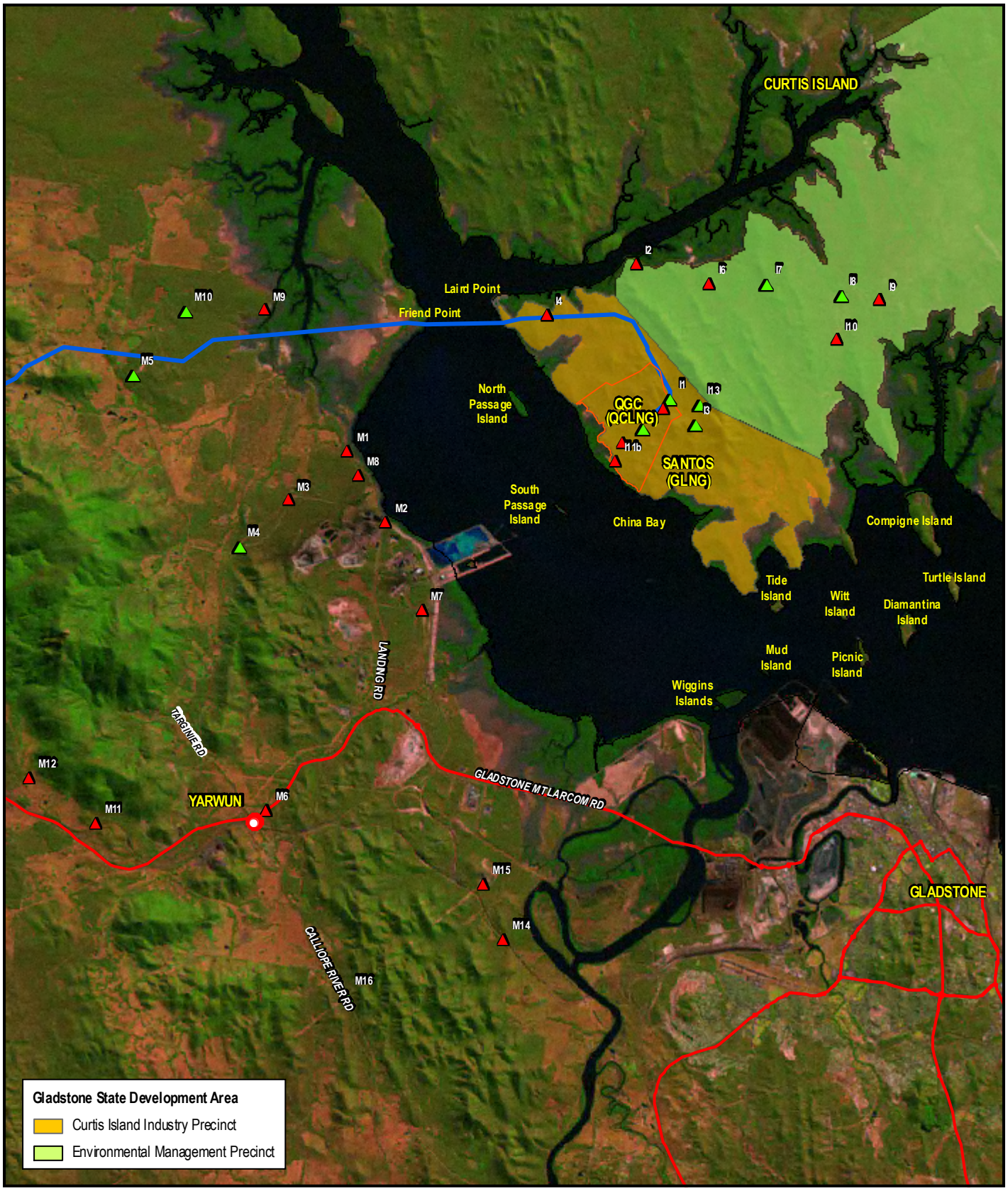
- Bar-tailed Godwit *Limosa lapponica*
- Eastern Curlew *Numenius madagascariensis*
- Whimbrel *Numenius phaeopus*
- Common Greenshank *Tringa nebularia*
- Red-necked Stint *Calidris ruficollis*.

The draft EIS also identified the presence of at least one pair of Powerful Owls (listed as Vulnerable under the *Nature Conservation Act 1992* (Qld) whose home range includes the area proposed for the LNG Facility. Further surveys of this species were therefore undertaken to identify possible roosting and nesting locations within the site and the surrounding area.)

The bird surveys were undertaken by Wildsearch Environmental Services and Sandpiper Ecological Surveys, who undertook the previous surveys for the Project. The fieldwork was undertaken between 14-25 September 2009. A larger study area, including Curtis Island and the mainland, was investigated compared to previous surveys, to assess the cumulative impact of other developments; to place the subject site in a local context; and to identify potential reference sites should monitoring be required. While survey effort was concentrated on the LNG Facility site, sampling within the broader study area was undertaken to place the site in a local context. Full details of the survey methodology and findings are located in sEIS *Appendix 5.2.*

7.3.1 Powerful Owl Survey Results

Field survey methods for the Powerful Owl included nocturnal call broadcasts, dusk censuses and contextual surveys. Owing to access restrictions (permission from the land-holder), the Curtis Island portion of the survey area was limited within the boundaries of the Curtis Island Industry Precinct but excluded the Santos GLNG site – see *Figure 5.7.1*.



Legend

- Proposed QCLNG Site Boundary
- Santos (GLNG) Site Boundary
- Proposed Export Pipeline
- Main Roads

Powerful Owl Survey Sites

Presence

- Yes
- No

Source Note:

StreetPro Australia - Pitney Bowes MapInfo
Indicative LOT Boundaries: SP225924 (Preliminary)
Sandpiper Ecological Surveys and
Wildsearch Environmental Services, September 2009.

Projection: UTM MGA Zone 56 Datum: GDA 94

0 0.75 1.5 3 km

N

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A BG Group business

Project	Queensland Curtis LNG Project
Client	QGC - A BG Group business
Title	Powerful Owl Survey Area

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Drawn	JB	sEIS Volume 5	Figure S5.7.1
Approved	SO	File No:	0086165b_SUP_GIS001_S5.7.1
Date	10.12.09	Revision	0

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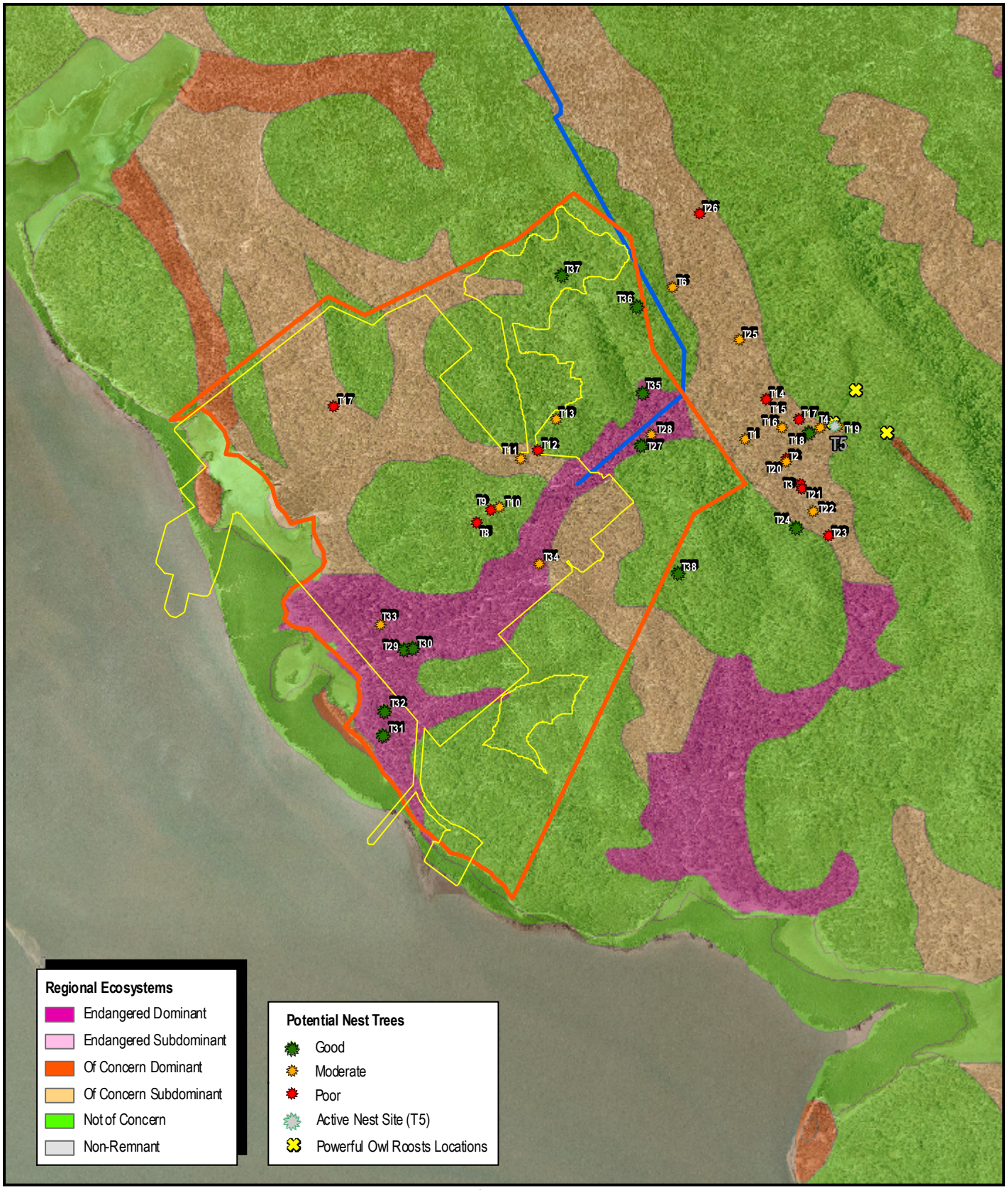
The survey identified 38 potential nest trees within the LNG Facility site that could be utilised by Powerful Owl. Of these, 18 were stags, 12 were Lemon-scented Gum (*Corymbia citriodora*) and eight were Queensland Blue Gum. Eleven of these potential nest trees were categorised as having "good" suitability as a nest tree (see *Figure 5.7.2*).

The majority of potential nest trees were on the lower slopes or flatter areas of the site, while a high number of trees were found in the valley immediately to the east of the site. Large entry hollows and hollows in Lemon-scented Gum trees were uncommon. Old growth Queensland Blue Gums were rare within the development site; however, large hollows were a notable feature in those trees that were identified.

The findings of the survey were similar to previous surveys of the site in that only one breeding pair of Powerful Owl was confirmed as having a roost site close to the LNG Facility. The location of the roost sites are outside of the LNG Facility boundary, to the east.

In addition to these roosts, a dead stag, outside the LNG Facility site, appeared to be an active nest. This is indicated on *Figure 5.7.2*.

Observations from the nocturnal call broadcasts and dusk censuses suggest that the breeding pair has a relatively extensive home range that may be larger than 1,000 ha.



Legend

- Proposed QCLNG Site Boundary
- Proposed Export Pipeline
- Boundary of Cleared Area

Source Note:

Aerial photo -Department of Infrastructure and planning for QCLNG Project
Sandpiper Ecological Surveys and Wildsearch Environmental Services, September 2009.

Disclamer: Positional Accuracy of RE Data mapped at a scale of 1:100,000 is 100 metres.
Survey and Mapping of 2003 Remnant Vegetation Communities and Regional Ecosystems of Queensland, Version 5.0, EPA (Dec 2005), Certified Regional Ecosystem Map Amendments under the Vegetation Management Act (1999), EPA, 20/08/2008.
Field Assessments undertaken by Unidela s reported in "Revised Regional Ecosystem Mapping"

Projection: UTM MGA Zone 56 Datum: GDA 94

0 125 250 500 m

N

QUEENSLAND CURTIS LNG
A BG Group business

Project	Queensland Curtis LNG Project	Title	Location of Powerful Owl Potential Nest Trees and Roost Sites
Client	QGC - A BG Group business		
Drawn	JB	sEIS Volume 5	Figure S5.7.2
Approved	SO	File No:	0086165b_SUP_GIS002_S5.7.2
Date	10.12.09	Revision	0

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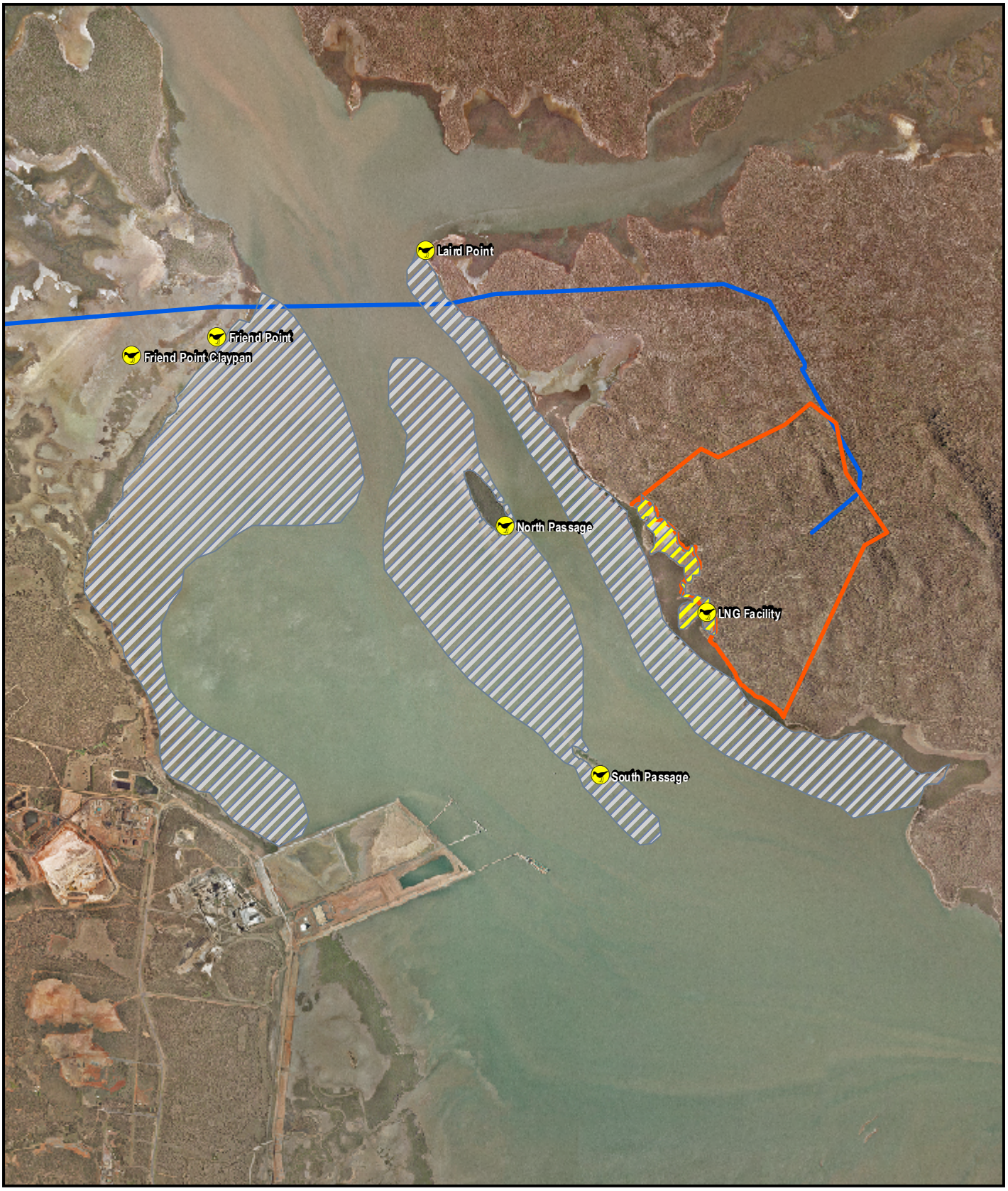
7.3.2 Migratory Species Survey Results

Shorebird surveys involved sampling during a spring and a neap tide cycle, and included locations at Friend Point, Laird Point and the LNG Facility site. Several roosts in the vicinity of the proposed LNG Facility site were sampled, the locations of which were determined from previous surveys, EPA maps of shorebird roosts and Shorebird 2020 roost mapping. Foraging surveys were conducted at low tide at intertidal mud flats immediately adjacent to the proposed LNG Facility site and on the mainland south of Friend Point. A map of foraging and roosting sites is provided in *Figure 5.7.3*. Twelve species of shorebird were recorded during the survey, including four resident and eight migratory species. Two threatened species (Beach Stone-Curlew and Eastern Curlew) listed in the *Nature Conservation Act 1992* (Qld) and eight migratory species listed in the *EPBC Act* were recorded (see sEIS *Appendix 5.2, Table A5* for a complete list of species and numbers of individuals recorded). One species that had not been recorded in the study area during previous surveys, Curlew Sandpiper, was recorded in September 2009. Curlew Sandpiper is listed as a migratory species in the *EPBC Act*. Data collected during the field surveys show that the LNG Facility site and immediately adjacent intertidal habitat support a very small proportion of the migratory shorebird population in the Curtis Coast Region (0.001%), Port Curtis (0.003%) and the nearby section of Port Curtis (0.01%).

While the proposed LNG Facility may render the claypan habitat unsuitable for shorebirds, this would affect a very small number (i.e. between three and six) of individuals. Despite the presence of a construction dock and loading wharfs, substantial areas of the adjoining intertidal habitat will continue to be available to shorebirds at low tide. Shorebirds are likely to continue to use this habitat, albeit in lower numbers. Lights from the wharfs may also benefit some individuals that forage near the site at night.



Legend

- Proposed QCLNG Site Boundary
- Proposed Export Pipeline
- Shorebird Roosts Locations
- Low Tide Foraging Areas
- High Tide Claypan Roost Area

Source Note:
Aerial photo -Department of Infrastructure and planning for QCLNG Project
Sandpiper Ecological Surveys and Wildsearch Environmental Services, September 2009.

Projection: UTM MGA Zone 56 Datum: GDA 94

0 250 500 1,000 m

N

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

Title: **Location of Shorebird Roosting and Foraging Areas**

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Drawn	JB	sEIS Volume 5	Figure S5.7.3
Approved	SO	File No:	0086165b_SUP_GIS003_S5.7.3
Date	10.12.09	Revision	0

7.4 UPDATE OF TERRESTRIAL ECOLOGY IMPACTS

An evaluation of impacts resulting from the Project changes and additional survey information is presented in the following sections.

7.4.1 Vegetation

7.4.1.1 Clearing of Regional Ecosystem (RE) vegetation

LNG Facility

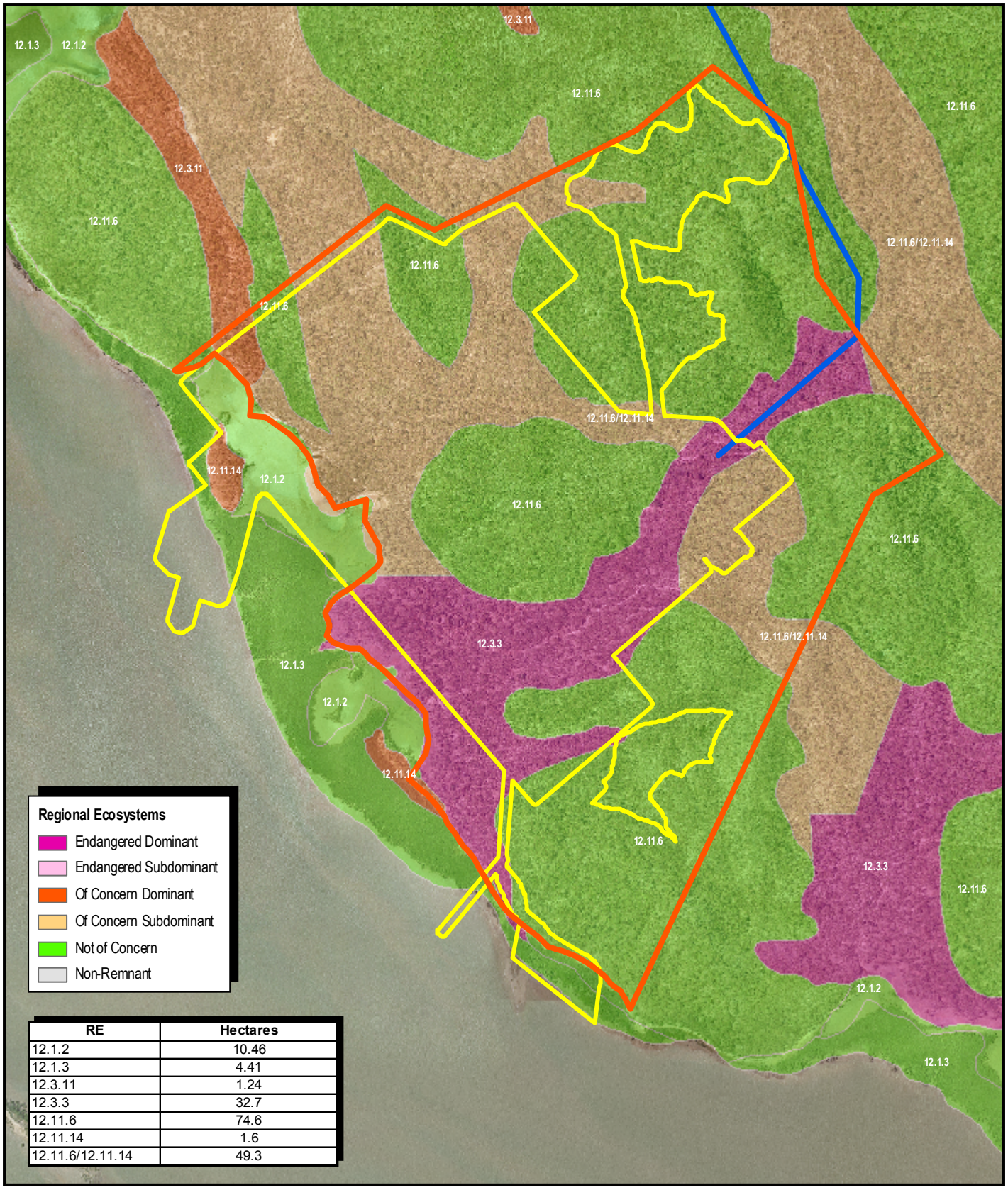
As stated in *Volume 5, Chapter 7* of the draft EIS, the establishment of the LNG Facility, pipeline corridor and Curtis Island road would have required clearing of approximately 39.6 ha of Endangered RE 12.3.3 vegetation (Blue Gum open woodland on alluvial plains).

As a result of the shift in the LNG Plant further east, minor changes in the configuration of the plant infrastructure, and removal of the Curtis Island road from the Project scope, the proposed plant layout (including spoil disposal areas) and pipeline right of way will result in a reduction of RE 12.3.3 to be cleared to approximately 36 ha. This is illustrated in *Figure 5.7.4*.

RE 12.3.3 vegetation is also associated with the presence of a number of hollow-bearing trees (HBTs) on Curtis Island. These provide important habitat for birds such as the Powerful Owl and arboreal species, such as the possum and sugar glider, which the Powerful Owl preys on. Removal of HBTs will therefore have a potential impact on these species. This is discussed further in *Section 7.4.2.2*.

Clearing of Not of Concern RE 12.1.3 (Mangroves) at the LNG Facility site is described in *Volume 5, Chapter 8* of this sEIS.

For RE 12.1.2 (Samphire Forbland Saltpan vegetation), the anticipated area to be cleared at the LNG Facility site has increased from 3.9 ha (0.2 per cent of the total amount of this RE type within 10 km of the study area – poor condition, sparsely vegetated) to approximately 10 ha (0.5 per cent of the total amount of this RE type within 10 km of the study area) as a result of an increase in the utilisation of the plant area (a sediment pond is planned in an area not identified for clearing in the draft EIS).



RE	Hectares
12.1.2	10.46
12.1.3	4.41
12.3.11	1.24
12.3.3	32.7
12.11.6	74.6
12.11.14	1.6
12.11.6/12.11.14	49.3

Legend

- Proposed QCLNG Site Boundary
- Proposed Export Pipeline
- Boundary of Cleared Area

Source Note:

Aerial photo -Department of Infrastructure and planning for QCLNG Project

Projection: UTM MGA Zone 56 Datum: GDA 94

0 125 250 500 m

Disclamer: Positional Accuracy of RE Data mapped at a scale of 1:100,000 is 100 metres. Survey and Mapping of 2003 Remnant Vegetation Communities and Regional Ecosystems of Queensland, Version 5.0, EPA (Dec 2005), Certified Regional Ecosystem Map Amendments under the Vegetation Management Act (1999), EPA, 20/08/2008. Field Assessments undertaken by Unidel as reported in "Revised Regional Ecosystem Mapping"

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QUEENSLAND CURTIS LNG
A BG Group business

Project: Queensland Curtis LNG Project

Client: QGC - A BG Group business

Title: **Regional Ecosystem Vegetation to be Cleared at the LNG Facility**

ERM
Environmental Resources Management Australia Pty Ltd

Drawn	JB	sEIS Volume 5	Figure S5.7.4
Approved	SO	File No:	0086165b_SUP_GIS004_S5.7.4
Date	19.01.10	Revision	0

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On the mainland, saltpan (RE 11.1.2) and mangrove (RE 11.1.4) habitats near Friend Point would potentially have been significantly affected by the Mainland Road and Bridge Approach through the clearing of approximately 10 ha and 3 ha of these vegetation communities respectively. The removal of this infrastructure from the Project scope potentially means a smaller intertidal area will be affected and fewer mangroves would need to be cleared.

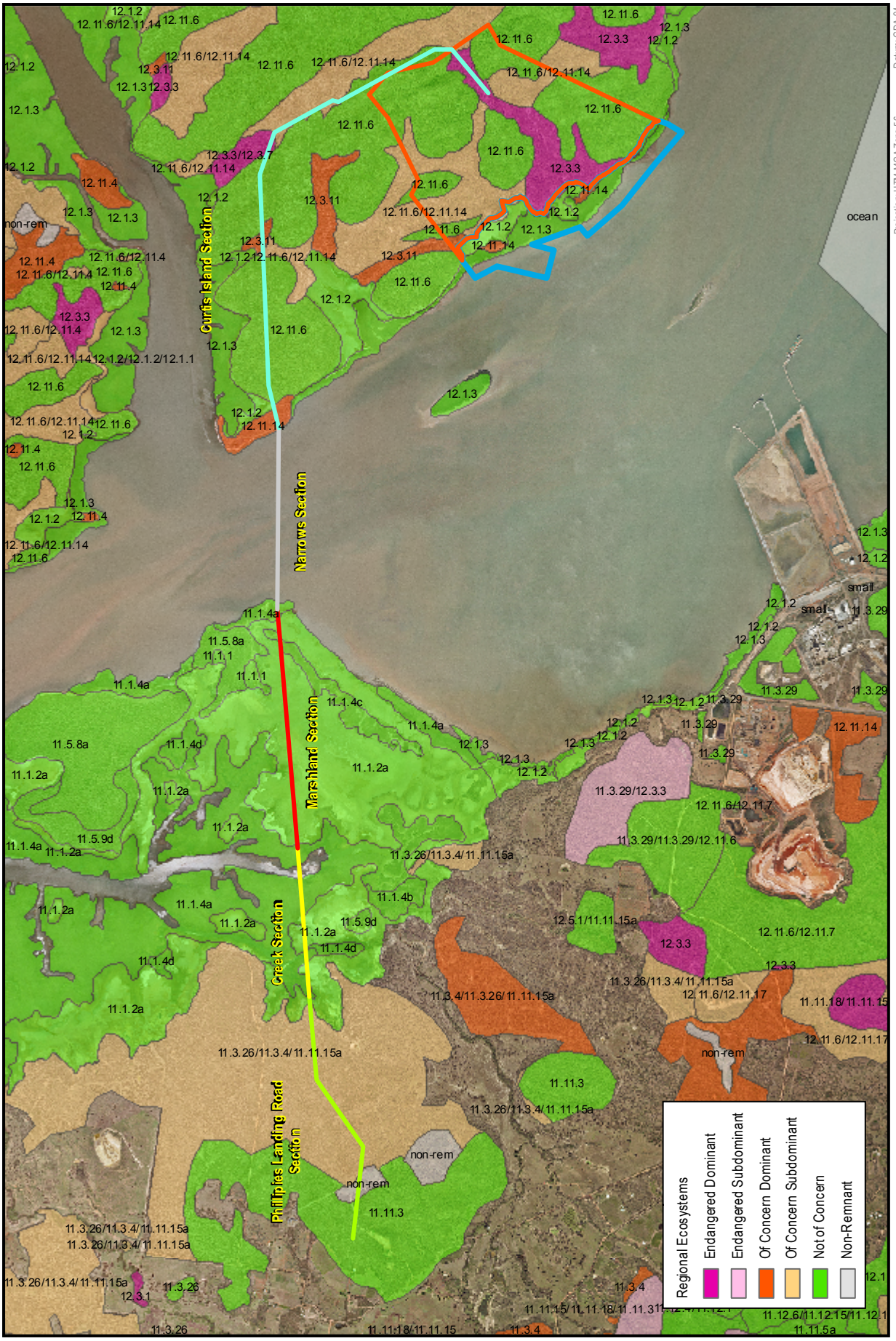
The overall impact on RE vegetation as a result of the LNG Facility changes and removal of the Mainland Road/Bridge and Curtis Island road is therefore a reduction in clearing by approximately 15 ha from that described in the draft EIS.

The Narrows Pipeline

The pipeline crossing of The Narrows will require the clearing of RE vegetation on the mainland and on Curtis Island. The Philipies Landing Section will potentially require the clearing of approximately 10 ha of Of Concern RE 11.11.15/11.3.26/11.3.4. The Curtis Island Section of the pipeline may require clearing of approximately 3 ha of Endangered RE 12.3.3, approximately 3 ha of Of Concern RE 12.11.6/12.11.14 and approximately 1 ha each of Of Concern RE's 12.3.11 and 12.11.14 (see *Figure 5.7.5).* These areas have been calculated assuming a conservative 60 m wide pipeline right of way.

The exact areas to be cleared will depend on the methodology adopted for the pipeline construction, by the yet to be appointed construction contractor, as trenching and Horizontal Directional Drilling (HDD) methods have different laydown area requirements and different rights of way widths (see *Volume 2, Chapter 12*).

Although clearing of RE vegetation will be avoided or reduced wherever practicable, some clearing of the abovementioned vegetation will be unavoidable. However, the greater proportion of direct impacts of the pipeline will be temporary, as the 60 m corridor will be rehabilitated following construction, other than a 10 m wide strip directly above the pipeline required for access and maintenance.



Projection: UTM MGA Zone 56 Datum: GDA 94

0 250 500 1,000 m

N

Source Note:
Aerial Photo - Department of Infrastructure and Planning for QCLNG Project
Disclaimer: Positional Accuracy of RE Data mapped at a scale of 1:100,000 is 100 metres.
Survey and Mapping of 2003 Remnant Vegetation Communities and Regional Ecosystems of Queensland, Version 5.0, EPA (Dec 2005), Certified Regional Ecosystem Map Amendments under the Vegetation Management Act (1999), EPA, 20/08/2008.
Field Assessments undertaken by Unidel as reported in "Revised Regional Ecosystem Mapping"

Section 1 : Phillipies Landing Road Section (approx 2.5 km)
Section 2 : Creek Section (approx 1.3 km)
Section 3 : Marshland Section (approx 2.1 km)
Section 4 : Narrows Section (approx 1.8 km)
Section 5 : Curtis Island Section (approx 4.5 km)

Legend
Proposed QCLNG Site Boundary
Indicative Wet Lease Area

QUEENSLAND CURTIS LNG
A BG Group business

ERM
Environmental Resources Management Australia Pty Ltd

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

Title: **Regional Ecosystem Vegetation Traversed by the Pipeline Crossing over The Narrows**

Drawn	KP	sEIS Volume 5	Figure S5.7.5
Approved	SO	File No:	0086165b_SUP_GIS046_S5.7.5
Date	19.01.10	Revision	0

7.4.2 Fauna

7.4.2.1 Habitat loss, Disturbance and Fragmentation

As discussed in the draft EIS, permanent linear infrastructure such as the Mainland Road/Bridge Approach and the Curtis Island Road, have the potential to cause:

- creation of edge effects
- habitat fragmentation
- creation of dispersal barriers
- direct habitat loss
- increased disturbance from traffic and human activity
- disruption to tidal movement (mainland)
- increased risk of vehicle strike.

Habitats permanently lost to the Mainland Road/Bridge and Curtis Island road would include intertidal and saltpan habitats at Friend Point and Laird Point, which are used by migratory bird species for nesting and roosting. The removal of this infrastructure from the scope allows a greater opportunity for these sites to be preserved.

The proposed Export Pipeline across The Narrows to Curtis Island and the LNG Facility is also associated with the types of impacts described above. However, these impacts would be less severe than that from surface infrastructure because the pipeline would be buried, does not pose a permanent barrier to fauna, is not associated with bird strikes, and intertidal vegetation (mangroves) in the pipeline right of way would be able to re-establish over time.

Removal of the Curtis Island road from the Project scope also avoids the fragmentation of woodland habitat, especially as narrow strips of vegetation may have been retained between the pipeline and road corridors. As stated in the draft EIS, this would have limited habitat value for threatened species and could have favoured the establishment of exotic and edge-tolerant species. Eliminating the road from the scope will also reduce the number of HBTs to be removed, and avoids the clearing of Endangered RE 12.3.3 vegetation south of the LNG Facility.

The removal of the road infrastructure from the Project scope also reduces impacts on reptilian and amphibian fauna, both on the mainland and on Curtis Island, through a reduction in habitat loss, fragmentation effects and potential road mortalities.

There are some disturbance impacts (noise, night lighting and dust) on fauna associated with the 24-hour site-preparation activities at the LNG Facility (involving vegetation clearing and bulk earthworks). Similar to the 24-hour tank slipforming activities described in the draft EIS, these site preparation activities will be temporary (lasting at least three months) and will be undertaken once fauna pre-clearance surveys have been completed. This is expected to reduce impacts to fauna at the site to as low as reasonably possible. Measures to deal with fauna that may be attracted to the site owing to night lighting are described in the Vegetation Clearing Strategy, attached in sEIS *Appendix 11.1.*

7.4.2.2 Birds

During the bird surveys undertaken for the EIS, four species listed on the *Nature Conservation Act 1992* (Qld) were recorded, including the Squatter Pigeon, Powerful Owl, Beach Stone-Curlew (all listed as Vulnerable); and Eastern Curlew (listed as Rare). The Squatter Pigeon is also listed as Vulnerable in the *EPBC Act*. Twenty-eight migratory species, listed in the *EPBC Act,* were also recorded at Project areas for the LNG Component.

Impacts on Squatter Pigeon and Beach Stone-Curlew would decrease slightly as a result of removal of the Mainland Road and Bridge Approach from the Project scope, which would have led to habitat loss, disturbance and the potential for vehicle strikes. As discussed in the draft EIS, the proposed mainland road route would render the neap tide roost unsuitable for Eastern Curlews and would reduce the suitability of the nearby spring tide roost.

For migratory bird species utilising the shoreline adjacent to the proposed LNG Facility as a foraging area, impacts identified in the draft EIS remain largely unchanged. The realignment of the LNG Plant footprint reduces the area of intertidal zone affected by infrastructure and may therefore provide greater opportunities for migratory species to continue using this shoreline area, although disturbance and loss of habitat will still occur. However, the LNG Facility shoreline area is not considered an important habitat as only a small number of birds use it, and there are other more suitable sites on Curtis Island (at South End and Laird Point) that can be utilised for this purpose. As discussed in *Section 7.4.2.1,* impacts on migratory bird roost sites will still be affected by the pipeline crossing over The Narrows, but this will be to a lesser extent with the removal of the Mainland Road and Bridge Approach from the Project scope.

Similarly, the potential impacts on Powerful Owl remain largely unchanged to those described in the draft EIS. However, these impacts directly affect only one confirmed pair of Powerful Owls, and it is expected that the mitigation measures proposed in *Section 7.5* will reduce the impact on these individuals. The changes to the LNG Plant layout do not result in major changes, positive or negative, on the Powerful Owl. Removal of the Curtis Island road from the scope will have a positive result as it results in the removal of fewer HBTs and there is less chance of direct impact on Powerful Owl roosting sites and the

confirmed nest site, to the east of the LNG Facility. Furthermore, the removal of the Mainland Road and Bridge Approach from the scope will have a positive effect as Powerful Owls do utilise that habitat for foraging and nesting.

Although the pipeline right of way may require the removal of some HBT's, the route is located approximately 400 m from the existing Powerful Owl roost and nest site to the east of the LNG facility, hence the impact of the pipeline on these birds is not significant.

Overall, the changes to the LNG Facility project description and removal of the Mainland Road and Bridge Approach and Curtis Island road from the Project will result in a small reduction in impacts to threatened and migratory bird species and their associated habitats, to those identified in the draft EIS.

7.4.3 Impact Summary

The table below summarises the impact on terrestrial ecology associated with the LNG Facility and Pipeline but excluding the Mainland Road/Bridge corridor and Curtis Island road. While the changes to the Project result in reduced impacts, the overall Project impact remains unchanged.

Impact assessment criteria	Assessment outcome
Impact assessment	Negative
Impact type	Direct and cumulative
Impact duration	Permanent for loss of Endangered RE and Powerful Owl foraging area.
Impact extent	Local
Impact likelihood	Highly likely

As such, the overall assessment of impact significance of the LNG Facility for terrestrial ecology remains moderate to major, for permanent impacts to Endangered RE and impacts to Powerful Owl habitat.

The additional information and the Project changes have not, however, changed the principal conclusions presented in the draft EIS regarding the terrestrial ecology impacts of the LNG Component of the Project.

7.5 MITIGATION

This section outlines mitigation measures that are additional to those outlined in *Volume 5, Chapter 7* and *Volume 11* of the draft EIS, hence they should be read together for a complete suite of mitigation and management measures for terrestrial ecology impacts. Mitigation measures described in the draft EIS for the bridge and roads are no longer applicable, as this infrastructure is no longer within the scope of the Project.

Additional mitigation measures for terrestrial ecology impacts of the LNG Component of the Project include:

- QGC, through its involvement in the Curtis Island Environmental Management Precinct, will seek to protect Powerful Owl roost and nest sites to the east of the site. All workers on site will also be informed that this is a no-go area.
- Installation of nest boxes for arboreal species in non-cleared areas on-site and along the pipeline right of way.
- Intertidal vegetation (mangroves) cleared for the pipeline right of way will be allowed to re-establish, while maintaining a 10 m cleared corridor for maintenance access.Vehicle access through saltmarsh habitat will be restricted to designated access tracks to limit disturbance.Pipeline plant and equipment laydown areas will be sited to limit the clearing of Regional Ecosystem vegetation so far as practical, and to avoid mud flat, mangrove or saltmarsh communities. The exact positioning of laydown areas will follow consultation with an ecologist.

Additional commitments made by QGC include:

- HBTs will be inspected for wildlife before being felled.
- QGC will offset the loss of Powerful Owl foraging habitat on Curtis Island with suitable habitat on the mainland.

Specific mitigation measures have been written into management plans or strategies. Drafts are presented in this sEIS as:

- Vegetation Clearing Strategy (sEIS *Appendix 11.1*).
- Weed and Pest Management Plan (sEIS *Appendix 11.2*).
- Spoil Rehabilitation and Revegetation Plan (sEIS *Appendix 11.3*).

7.6 OFFSETS

The Terms of Reference for the QCLNG Project identified requirements for QGC to consider the provision of vegetation and biodiversity offsets (including marine offsets) for any unavoidable impacts associated with the Project. It is an anticipated condition of approval that where construction or operation of the Project will have an unavoidable impact on biodiversity and Ecological Communities listed as Threatened under the Commonwealth *EPBC Act*, as well as endangered and of concern Regional Ecosystems (REs) and Essential Habitat identified under the *Vegetation Management Act 1999 (Qld)* (*VM Act*), or EVR species listed under the *EPBC Act* or *Nature Conservation Act*, a vegetation and biodiversity offset will be required.

A Project-wide Draft Vegetation and Biodiversity Offset Strategy *(Appendix 2.3)* has been developed, the aim of which is to outline the predicted unavoidable impacts in relation to anticipated Government offset

expectations and detail the offsetting principles and methodology to which QGC proposes to commit for the Project.

The objectives of the QCLNG Project offsets will be to:

- Provide suitable offsets for unavoidable loss of environmental values.
- Provide offsets that are targeted to the protected matters that are being affected.
- Achieve long-term and certain conservation outcomes that are cost-effective.
- Deliver real conservation outcomes.
- Provide offsets that, as a minimum, will be commensurate with the magnitude of the unavoidable impacts of the development, and ideally deliver outcomes that are 'like for like'.
- Locate offsets within the same general area as the development activity, wherever practicable.
- Deliver long-lasting offsets in a timely manner.
- Monitor, audit and implement corrective actions, as required.

Individual, site-based offset commitments will be made when proposed individual offset initiatives are developed and presented to the relevant approvals Agencies in relation to each area where vegetation is cleared or is proposed to be cleared. Due to the Project timeframes, these commitments will, by necessity, need to be made after the initial Government approval of the Project. Therefore, the Project Draft Vegetation and Biodiversity Offset Strategy is intended to provide stakeholders with adequate confidence that the proposed offset methodology will deliver the appropriate offsets to adequately compensate for unavoidable impacts likely to be associated with the Project.

It is stressed that offsets will only ever be considered as a last resort mitigation measure. Avoidance and/or on-site mitigation measures for any disturbance to native vegetation will always be preferred.

For the terrestrial environment of Curtis Island, the strategy provides information on potential offsets for endangered vegetation (RE 12.3.3) and protected fauna (Powerful Owl). Potential offsets for the marine environment (such as mangroves and sea grasses) are addressed in the Marine Ecology chapter of this sEIS (*sEIS Volume 5, Chapter 8*).

Suitable offset sites for vegetation impacts on Curtis Island are difficult to find on the Island due to the large proportion of the island that already contains mature remnant vegetation. For this reason, offset sites will be proposed on the mainland. However, QGC has made a significant funding contribution to the Environmental Management Precinct on Curtis Island with the purpose of facilitating improved environmental outcomes for this area and the island in general.

7.7 CUMULATIVE IMPACTS

For the consideration of cumulative effects of other LNG operators on Curtis Island, the Gladstone LNG Facility, immediately to the south of the proposed QCLNG LNG Facility, were considered.

Species vulnerability to cumulative effects from multiple LNG facilities on Curtis Island could include:

- Habitat loss leading to increased competition between fauna species.
- Increased abundance of pest and weed species, leading to competition with native species.
- Fragmentation of habitats.
- Ongoing light pollution leading to disrupted behaviour patterns in nocturnal species.
- Noise pollution leading to fauna stress or disorientation.
- Potential loss of species (e.g. Powerful Owl) through habitat loss (for foraging and nesting) and reduced abundance of prey species.

Cumulative impacts on terrestrial ecology as a result of the construction and operation of the QCLNG and GLNG LNG Facilities is discussed in more detail below.

7.7.1 Vegetation Clearing

The cumulative effects of vegetation clearing on Curtis Island from the two proposed LNG facilities (excluding pipeline rights of way or access roads) will result in removal of approximately:

- 72.5 ha of Endangered RE 12.3.3
- 21.1 ha of Of Concern RE 12.11.14
- 49.29 ha of Of Concern RE 12.11.6/12.11.14
- 132.8 ha of Not Of Concern RE 12.11.6.

These areas represent approximately 27, 71, 2.5 and 3 per cent respectively of these REs within a 10 km radius of the QCLNG site, on Curtis Island.

However, the State Government has designated the Curtis Island Industry Precinct for LNG developments. In so doing, it undertook an assessment of suitable locations, and took into consideration the environmental costs and benefits of the chosen area.

7.7.2 *Powerful Owl*

The development of the QCLNG and GLNG LNG Facilities will remove foraging habitat and several potential nest trees used by a pair of Powerful Owls in the south-western corner of Curtis Island. Although the majority of nest trees likely to be affected were classified as poor to moderate value, Powerful Owls are sensitive to the disturbance of nest sites. If suitable habitat occurs elsewhere on the island, such as in the adjacent Environmental Precinct, it is likely that this habitat is already occupied. The same applies to suitable habitat on the mainland. The territorial nature of owls makes it difficult for pairs (or individuals) to overcome habitat loss by foraging elsewhere. Mitigation measures (such as the establishment of nest boxes) can be implemented to try and increase the abundance of prey species in the available foraging area. However, based on the available information on Powerful Owls on the Island and considering the combined effects of loss of foraging area, loss of potential nest trees and potential disturbance of existing nest sites, it is likely that the cumulative impacts of the proposed LNG developments on Curtis Island would have a detrimental effect on one pair of Powerful Owls.

7.7.3 *Migratory Species*

The cumulative effect of the two LNG facilities would include increased disturbance and loss of low value shorebird foraging and roosting habitat on Curtis Island. The retention of a buffer between the LNG plants and intertidal habitat may reduce disturbance impacts on foraging shorebirds. However, several individuals that roost and forage in the claypan habitat at high tide will be displaced. The small number of birds displaced at high tide and low tide are likely to find alternative sites to roost and forage, such as at the more important South End shorebird site, or Laird Point. The cumulative impact of the LNG facilities on Curtis Island is therefore not considered to be significant.