



Browse LNG Precinct



Browse Liquefied Natural Gas Precinct

Strategic Assessment Report

(draft for public comment)

December 2010

PART 1

Executive Summary

How to Make a Submission

The Western Australian Environmental Protection Authority (EPA) invites people to make a submission on this proposal. The environmental impact assessment process is designed to be transparent and accountable, and includes specific points for public involvement, including opportunities for public review of the Strategic Assessment documents. In releasing this document for public comment, the EPA advises that no decisions have been made to allow this proposal to be implemented.

The State of Western Australia, through the Minister for State Development (the Proponent), proposes to develop an onshore, common-user Liquefied Natural Gas (LNG) Precinct to process natural gas from Browse Basin gas fields off the west Kimberley coast. The Department of State Development (DSD) has been charged with advancing this proposal under the direction of the Proponent.

In accordance with the *Environmental Protection Act 1986* and the *Environment Protection and Biodiversity Conservation Act 1999*, a **Strategic Assessment Report (SAR)** has been prepared which describes this proposal and its likely effects on the environment. The **SAR** is available for a public review period of **12 weeks from 13 December 2010**, closing on **8 March 2011**.

Comments from government agencies and from the public will assist the EPA to prepare an assessment report in which it will make recommendations to government.

Where to get copies of this document

The document/s may be accessed through the consultation portal at <http://public-consult.epa.wa.gov.au/portal> or the proponent's website at <http://www.dsd.wa.gov.au/>. This online public consultation portal will provide a user friendly platform to review the documentation and submit comments directly to the EPA.

Printed copies of the Executive Summary with a CD of the full document and Appendices may also be obtained from Sarah Woods, Department of State Development, Level 6, 1 Adelaide Terrace, East Perth, Western Australia 6004 (telephone: 9222 3191) free of charge. A limited number of the full set of documents have also been printed for distribution to key agencies, stakeholder groups and for placement in libraries.

Why write a submission?

A submission is a way to provide information, express your opinion and put forward your suggested course of action - including any alternative approach. It is useful if you indicate any suggestions you have to improve the proposal.

All submissions received by the EPA will be acknowledged. Electronic submissions will be acknowledged electronically. The proponent will be required to provide adequate responses to points raised in submissions. In preparing its assessment report for the Minister for the Environment, the EPA will consider the information in submissions, the proponent's responses and other relevant information. Submissions will be treated as public documents unless provided and received in confidence, subject to the requirements of the *Freedom of Information Act 1992*, and may be quoted in full or in part in each report.

Why not join a group?

If you prefer not to write your own comments, it may be worthwhile joining with a group or other groups interested in making a submission on similar issues. Joint submissions may help to reduce the workload for an individual or group, as well as increase the pool of ideas and information. If you form a small group (up to 10 people) please indicate all the names of the participants. If your group is larger, please indicate how many people your submission represents.

Developing a submission

You may agree or disagree with, or comment on, the general issues discussed in the **SAR** or the specific proposals. It helps if you give reasons for your conclusions, supported by relevant data. You may make an important contribution by suggesting ways to make the proposal environmentally more acceptable.

When making comments on specific proposals in the **SAR**:

- clearly state your point of view;
- indicate the source of your information or argument if this is applicable; and
- suggest recommendations, safeguards or alternatives.

How to Make a Submission (continued)

Points to keep in mind.

By keeping the following points in mind, you will make it easier for your submission to be analysed:

- attempt to list points so that issues raised are clear. A summary of your submission is helpful;
- refer each point to the appropriate section, chapter or recommendation in the **SAR**;
- if you discuss different sections of the **SAR**, keep them distinct and separate, so there is no confusion as to which section you are considering; and
- attach any factual information you may wish to provide and give details of the source. Make sure your information is accurate.

Remember to include:

- your name,
- address,
- date; and
- whether you want your submission to be confidential.

The closing date for submissions is: **8 March 2011**

The EPA prefers submissions to be made via the consultation portal at:

<http://public-consult.epa.wa.gov.au/portal>

Alternatively, submissions can be

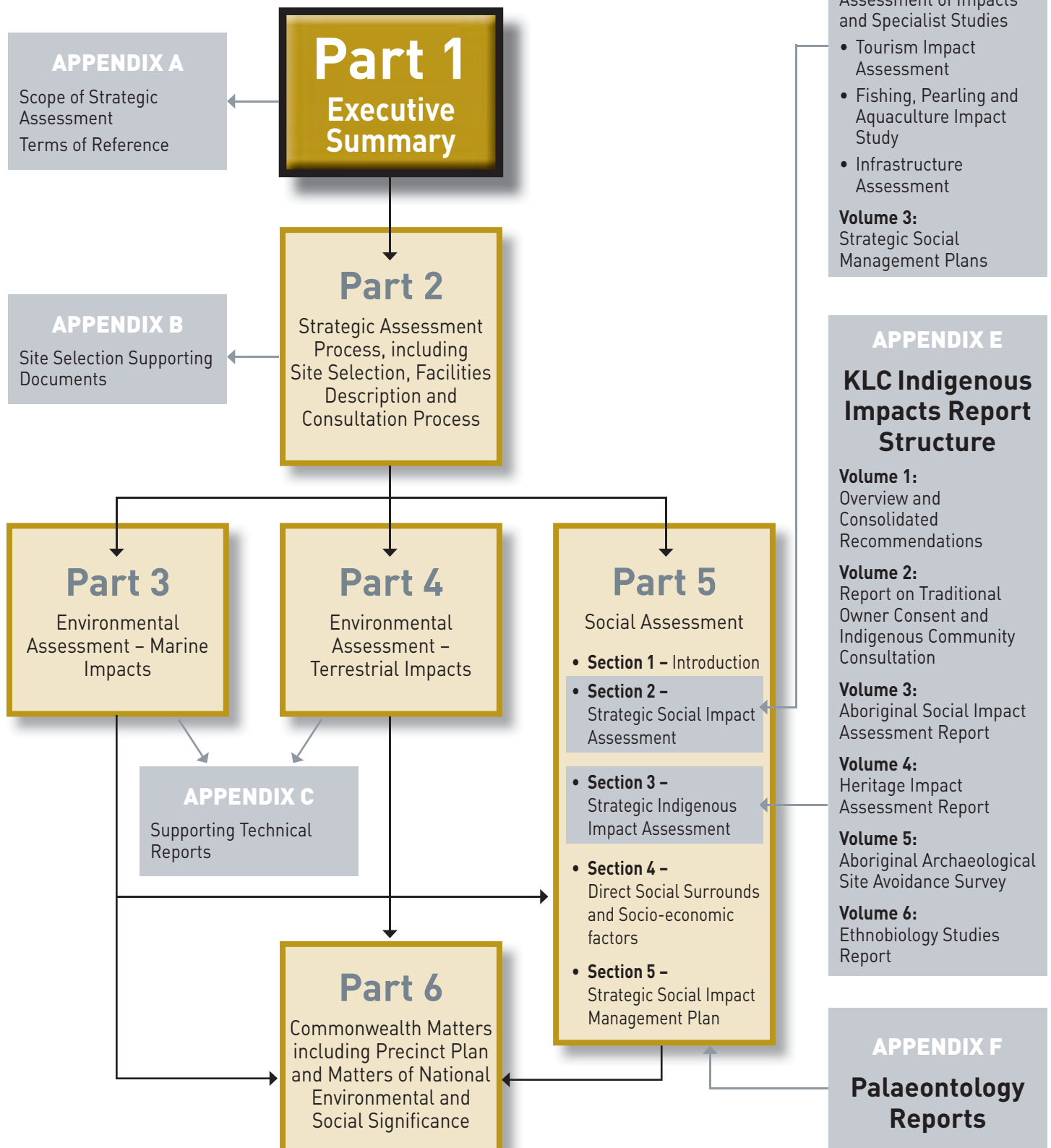
- made by email to submissions@epa.wa.gov.au.
- posted to: Chairman, Environmental Protection Authority, Locked Bag 33, CLOISTERS SQUARE WA 6850, Attention: Warren Tacey; or
- delivered to the Environmental Protection Authority, Level 4, The Atrium, 168 St Georges Terrace, Perth, Attention: Warren Tacey.

If you have any questions on how to make a submission, please ring the EPA assessment officer, Warren Tacey on 6467 5710 or Kathryn Schell on 6467 5426.

Browse LNG Precinct

Strategic Assessment Report – Structure Display

The State of Western Australia, through the Minister for State Development, has developed the Browse LNG Precinct Strategic Assessment Report (SAR) to enable consideration of a proposed common user liquefied natural gas (LNG) Precinct to process natural gas from the Browse Basin gas fields, at a location near James Price Point, approximately 60 kilometres north of Broome. This SAR is presented in six parts as shown in the following diagram. You are invited to make a submission by visiting the Environmental Protection Authority website at <http://public-consult.epa.wa.gov.au/portal>. Appendices are also available at <http://www.dsd.wa.gov.au/browseLNG>.



PREFACE

Browse LNG Precinct – Strategic Assessment Report

I am pleased to present for public examination and comment the Strategic Assessment Report for the proposed Browse Liquefied Natural Gas (LNG) Precinct.

This report is designed to meet the assessment requirements of both the Western Australian and Commonwealth environmental agencies.

It examines potential environmental, heritage and social impacts of constructing and operating LNG processing and export facilities, at a location near James Price Point, approximately 60 kilometres north of Broome, and outlines strategies for the management of those impacts.

Government agencies led by the Department of State Development, Woodside as a potential foundation precinct user, and external consultants have conducted extensive research and consultation and the report is informed by the results of more than 70 studies and numerous consultation activities.

The Western Australian Government's proposal is to establish a single, commercially viable gas processing site at a suitable location to attract and facilitate at least two projects processing the gas resources of the offshore Browse Basin.

The precinct will minimise environmental impacts, both through its design and rigorous ongoing management, and by avoiding ad hoc development along the Kimberley coast.

If the proposal is acceptable, this \$30 billion project will enable Western Australia and the Kimberley Region to gain maximum benefits in terms of investment, business and employment, from development of the massive Browse Basin.

For the Kimberley economy, construction of LNG processing facilities will create many new local employment and business opportunities, while their ongoing operations will provide additional resilience to the regional economy.

Development of the precinct will be accompanied by wider investment in public facilities and services, and workforce development to ensure these benefits are realised.

For Aboriginal people, through recognition of the interests of traditional owners of the precinct site, the development will bring major new funding for their communities, and for employment, training and business development.

I encourage you to read this report and invite you to make your contribution to decision-making about this proposal.



Colin Barnett MLA
PREMIER; MINISTER FOR STATE DEVELOPMENT

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Nomenclature, Acronyms, Measurements and Units List

Acronym	Definition
ABS	Australian Bureau of Statistics
AH Act	<i>Aboriginal Heritage Act 1972 (WA)</i>
AHC	Australian Heritage Council
AHD	Australian Height Datum
ANZECC	Australian and New Zealand Environment Conservation Council
ARMCANZ	Agriculture and Resource Management Council of Australia and New Zealand
ASIA	Aboriginal Social Impact Assessment
Best Practice	The application of the best available mitigation measures that are practicable in the particular circumstances of a proposal to avoid or minimise environmental impact.
BLNG Precinct	Browse Liquefied Natural Gas Precinct
BPA	Broome Port Authority
BPP	Benthic Primary Producer
BPPH	Benthic Primary Producer Habitat
°C	degrees celsius, degrees centigrade
Category A	These are the core elements of the BLNG Precinct, including associated infrastructure, necessary to process and export hydrocarbons.
Category B	These are indirect activities and actions as a result of the BLNG Precinct that are considered in the impact assessment but do not form part of the approvals process.
Category C	Related projects that are outside the scope of the Strategic Assessment but form part of the cumulative impact assessment.
CHMP	Cultural Heritage Management Plan
CO ₂	Carbon Dioxide
CO ₂ -e	Carbon Dioxide Equivalents
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DSDMP	Dredging and Dredge Spoil Disposal Management Plan
DEC	Department of Environment and Conservation
DEWHA	Commonwealth Department for the Environment, Water, Heritage and the Arts, now SEWPAC
DIA	Department of Indigenous Affairs
DMAG	Dredging Management Advisory Group
DoW	Department of Water
DSD	Department of State Development
EP Act	<i>Environmental Protection Act 1986</i>
EPA	Environmental Protection Authority
EPBC Act	<i>Environment Protection and Biodiversity Conservation Act 1999</i>
FEED	Front End Engineering Design
FESA	Fire and Emergency Services Authority of Western Australia
FID	Final Investment Decision
FLNG	Floating LNG
GGAP	Greenhouse Gas Abatement Plan

Acronym	Definition
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GL	gigalitre
GST	Goods and Services Tax
ha	hectare
HIA	Heritage Impact Assessment
HoA	Heads of Agreement
hr	hour
IFPIC	Indigenous Free Prior Informed Consent
ILUA	Indigenous Land Use Agreement
IMCRA	Interim Marine and Coastal Regionalisation for Australia
IMS	Introduced Marine Species
KLC	Kimberley Land Council
km	kilometre
KPP	Kadar Pearson and Partners
LGA	Local Government Area
LIA	Light Industrial Area
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
µm	micrometre
m	metre
mg L ⁻¹ , mg/L	milligram per litre
ms ⁻¹ , m/s	metre per second
Mt	megatonne (million tonne)
Mtpa	million tonnes per annum
MWh	megawatt hour
NAGD	National Assessment Guidelines for Dredging
NDT	Northern Development Taskforce
NEPM	National Environment Protection Measure
NES	National Environmental Significance (i.e. matters of NES)
Nm	nautical mile
NNTT	National Native Title Tribunal
NO ₂	nitrogen dioxide
NT	Northern Territory
NTA	<i>Native Title Act 1993</i>
NWQMS	National Water Quality Management Strategy
PASS	Potential Acid Sulphate Soils
PCG	Precinct Control Group
PFCEMP	Port Facilities Construction Environmental Management Plan
Precinct Plan	The formal Plan for the BLNG Precinct under Commonwealth legislation (see also Plan)

Acronym	Definition
proponent	Commercial proponents will undertake projects within the Precinct.
Proponent	The Proponent for the Precinct is the Minister for State Development
PSD	Particle size distribution
RIWI Act	<i>Rights in Water and Irrigation Act 1914</i>
SAR	Strategic Assessment Report
SEWPAC	Commonwealth Department of Sustainability, Environment, Water, Population and Community
SIA	Social Impact Assessment
SoSA	Scope of the Strategic Assessment
SRE	Short Range Endemic
SRG	Stakeholder Reference Group
tcf	trillion cubic feet
TDS	Total Dissolved Solids
TEC	Threatened Ecological Community
TONC	Traditional Owner Negotiating Committee
TSS	Total Suspended Solids
UNDRIP	United Nations Declaration of Rights of Indigenous People
WA	Western Australian
Woodside	Woodside Energy Limited

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1. Introduction

The State of Western Australia (**WA**), through the Minister for State Development (the **Proponent**), proposes to develop an onshore, common-user Liquefied Natural Gas (**LNG**) precinct to process natural gas from Browse Basin gas fields off the west Kimberley coast. The Department of State Development (**DSD**) has been charged with advancing this proposal under direction of the Proponent.

The Browse Liquefied Natural Gas Precinct (**BLNG Precinct** or **Precinct**) would consist of LNG processing facilities and associated infrastructure, and would be located in the vicinity of James Price Point, approximately 60 kilometres (**km**) north of Broome, on the west Kimberley coast of Western Australia. The BLNG Precinct would provide a location for processing gas and associated products from the Browse Basin with an LNG production capacity of up to 50 million tonnes per annum (**Mtpa**). If it were to occur, full development of the Precinct would most likely be phased in as demand for additional processing capacity arises. The Precinct would accommodate a minimum of two **proponents** at one location and enable sharing of common-user facilities such as the port, roads, infrastructure corridors and workers' accommodation. A **Precinct Plan** has been developed to meet the requirements of the State and Commonwealth Governments.

Woodside Energy Limited (**Woodside**), on behalf of the Browse LNG Development Joint Venture participants, was appointed as a potential Foundation Proponent for the Precinct under the Preliminary Development Agreement signed in October 2009. This Agreement established Woodside as a partner with the State Government in bringing the project to completion.

A detailed and comprehensive assessment has considered the environmental, social, economic, heritage and strategic implications of the Precinct should it reach its full capacity. The assessment process has involved desktop studies, field surveys, modelling, data analysis, impact assessment and stakeholder consultation, the results of which are documented in the BLNG Precinct Strategic Assessment Report (**SAR**).

The purpose of this Strategic Assessment Report is to meet the requirements of the State and Commonwealth governments in accordance with the Terms of Reference. The Strategic Assessment includes a high level impact assessment (including social factors), a description of the strategic proposal, identifying 'future proposals' (to be approved under the *Environmental Protection Act 1986* (the **EP Act**)) and the Precinct Plan (to be endorsed under the *Environment Protection and Biodiversity Conservation Act 1999* (the **EPBC Act**)), and includes the Proponent's proposed draft conditions that may be applied to future proposals. The document includes a summary of existing information, identifying main impact areas and sets out the proposed management arrangements, mitigation and safeguards to ensure impacts are managed.

The Strategic Assessment Report is presented in six parts:

Part 1: Executive Summary

Part 2: Strategic Assessment Process including Site Selection, Facilities Description and Consultation Process

Part 3: Environmental Assessment – Marine Impacts

Part 4: Environmental Assessment – Terrestrial Impacts

Part 5: Social Assessment

Part 6: Commonwealth Matters including Precinct Plan, Management Arrangements and Matters of National Environmental and Social Significance

This Executive Summary provides an overview of the Strategic Assessment Report and includes an outline of the proposed BLNG Precinct, a summary of the Strategic Assessment process including site options considered, and a synopsis of the potential impacts to environmental, social and Indigenous values and proposed mitigation measures, along with the management framework within which appropriate outcomes would be delivered.

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2. Objectives and Benefits

The BLNG Precinct proposal aims to establish a single, commercially viable gas processing location on the west Kimberley coast, with suitable land tenure, governance principles, and strategic approvals in place, to attract and facilitate a minimum of two LNG projects and to commercialise gas from the Browse Basin.

The location of the proposed BLNG Precinct in the vicinity of James Price Point was chosen via an extensive site selection process involving consultation with a broad spectrum of stakeholders and a collaborative review of a comprehensive set of technical, environmental, heritage, economic and social criteria.

Benefits to the nation, the state and the region arising from LNG development include:

- benefits to Traditional Owners acknowledged to be the custodians of the land;
- provision of services to design, build and maintain projects within the Precinct;
- provision of support services including (but not limited to) catering, cleaning, port services, security, environmental management, machining and tooling, office support and transportation;
- provision of jobs through the employment of construction and operational workforces;
- jobs and contracts arising from the design, management and construction of related infrastructure such as roads and houses;
- expenditure arising from the jobs and contracts created leading to many indirect benefits;
- state taxes and duties applying to Precinct projects and other service companies (for example state payroll tax is estimated to be \$45 million during construction);
- various service fees to Government trading enterprises charged with managing the Precinct;
- local council rates and charges applying to those projects and companies;
- a share of royalties from those developed gas resources which fall into State waters; and
- a share of Goods and Services Tax (**GST**) revenues and other Commonwealth increases in revenue that would arise from this project - these are likely to be significant as the estimated positive impact on Australia's gross domestic product (**GDP**) from a similar 15Mtpa development by Chevron was \$64 billion (Chevron, 2010a).

The development of the BLNG Precinct is expected to result in billions of dollars of capital investment, create thousands of jobs and provide opportunities for specialist service providers. It would encourage the establishment of industry-focused training, education and research institutes, and specialist risk management and emergency response resources in the region. The proposal would also provide significant economic and other social benefits to Traditional Owners and west Kimberley Indigenous communities.

The establishment of the BLNG Precinct would reduce the duplication of infrastructure such as ports, accommodation and roads, which would be required should individual companies build 'stand alone' facilities. A single, common-user LNG precinct would offer economic efficiencies to proponents, while reducing the development footprint compared to multiple, stand-alone LNG processing facilities – thus limiting the potential disturbance to environmental, cultural and heritage values.

A common-user precinct would also enable a coordinated and consistent approach to: management of potential environmental, heritage and social impacts; monitoring of cumulative effects; and auditing and control mechanisms.

In addition to local, regional and national benefits, the establishment of an economically viable gas processing precinct that facilitates the delivery of gas from the Browse Basin to international markets would deliver global benefits in helping to reduce greenhouse emissions through displacement of more carbon-intensive fuels.

The extensive studies and assessments undertaken demonstrate that these significant benefits can be delivered while protecting the important environmental, heritage and social values of the region.

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3. Strategic Assessment and Management Framework

In recognition of the environmental and heritage values of the west Kimberley region, as well as the significant economic potential of the Browse Basin gas reserves, a Strategic Assessment Agreement was entered into in 2008 by the State and Commonwealth Ministers for the Environment. This agreement provides for the assessment of impacts of proposed actions through a concurrent and collaborative process. The Terms of Reference for the assessment were publicly reviewed and agreed in 2008, and are provided in (DSD, 2010c) **Appendix A-3**. A tabulation of where each of the Terms of Reference has been addressed in the Strategic Assessment Report is provided in **Annexure A** (at the back of this document).

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* and the Western Australian *Environmental Protection Act 1986* have differing information requirements and follow different approval processes, as summarised in the following sections and illustrated in **Figure 3-1**.

3.1. EPBC Act Approvals Process

The BLNG Precinct proposal is to be assessed as a “Precinct Plan” pursuant to Section 146(l) of the EPBC Act, the key steps of which are:

- 1) Strategic Assessment Agreement is entered into (completed February 2008).
- 2) Terms of Reference for the Strategic Assessment are developed, publicly reviewed and endorsed (completed July 2008).
- 3) Preparation of a Strategic Assessment Report outlining the impacts of implementing actions and the accompanying Precinct Plan for consideration by the Commonwealth Minister (this report).
- 4) Ministerial recommendations made.
- 5) Endorsement of the Precinct Plan by the Commonwealth Minister.
- 6) Consideration for approval of actions under the Precinct Plan.

3.2. EP Act Approvals Process

The BLNG Precinct proposal is to be assessed as a “strategic proposal” pursuant to Section 38 of the EP Act. The process is being undertaken in accordance with the following three stages:

- 1) **Stage 1:** Early strategic advice provided by the Environmental Protection Authority (EPA) under section 16(e) of the EP Act regarding environmental sensitivities associated with short-listing of sites for the BLNG Precinct. This stage has been completed with EPA advising in December 2008 that impacts at the site are likely to be manageable.
- 2) **Stage 2:** Assessment of a strategic proposal as described in this document under Section 38 of the EP Act and the setting of implementation conditions that will apply to “derived proposals¹”.
- 3) **Stage 3:** Consideration for declaration of derived proposals and the application of relevant conditions.

Once approved by the EPA and the Department of Sustainability, Environment, Water, Population and Community (SEWPAC) for public release, this Strategic Assessment Report is subject to a public review period as determined by the EPA. The Proponent then responds to public comments and modifies the Strategic Assessment Report as necessary. The EPA will then prepare a report outlining its assessment and any recommended conditions.

A person who disagrees with the content and/or recommendations in the EPA assessment report may lodge an appeal with the WA Minister for the Environment within 14 days of the release of the EPA report. The Minister will evaluate the

¹ Derived proposals are future project-specific proposals referred to the EPA and deemed to fit within the scope of the approval for the Strategic Proposal under s39B of the EP Act.

merit of the appeals and consult with decision-making authorities on whether the proposal may be implemented and, if so, what conditions should be applied. If there is agreement that the proposal can be implemented, the Minister will issue a statement that the strategic proposal may be implemented and prescribe the implementation conditions to be applied. At this point in the process, there is no approval to implement any specific future proposals identified in the strategic proposal under the EP Act. Commercial proponents wishing to construct an LNG plant in the Precinct would need to refer a specific proposal to the EPA. Commercial proponents may request the EPA to declare the referred proposal to be a Derived Proposal. The EPA may declare that the referred proposal is a Derived Proposal if it was identified in the strategic proposal and it was decided that it could be implemented. The Authority may declare a proposal to be “derived” provided that:

- environmental issues were adequately assessed in the Strategic Assessment;
- there is no significant new or additional information justifying reassessment; and
- there has been no significant change in relevant environmental factors since the strategic proposal was assessed.

The Proponent has also proposed in this Strategic Assessment that management plans be provided to the EPA during this phase. These management plans and other required information will be provided for evaluation in order for the EPA to determine as to whether the referred proposal could be a derived proposal under Section 39B. The EPA may, after receiving the management plans and other information, request further information until it is in a position to decide whether or not the proponent of the derived proposal has demonstrated that the proposal can achieve the environmental outcomes that have been determined as a result of this Strategic Assessment.

3.3. Approach to Impact Assessment

The environmental and social impact assessment of the strategic proposal involved the development of a nominal project description, the completion of baseline studies, assessments of potential impacts and the development of management measures, as outlined below.

3.3.1. Nominal Project Description

It is proposed that the BLNG Precinct would accommodate a minimum of two projects at one location. Full development of the Precinct may well occur over an extended period in response to global demands for LNG. As such, the BLNG Precinct is a strategic proposal, rather than a specific project. The uncertainty regarding the design, operation, scale and timing of future developments presents various challenges for the Proponent in conducting this assessment, as well as for the regulatory agencies, stakeholders and the general public in considering the acceptability of the proposal. In response, the Proponent has strived to present the most realistic expectations regarding the characteristics of the development concept. Wherever possible, the concept has been considered at its full production capacity of 50Mtpa of LNG.

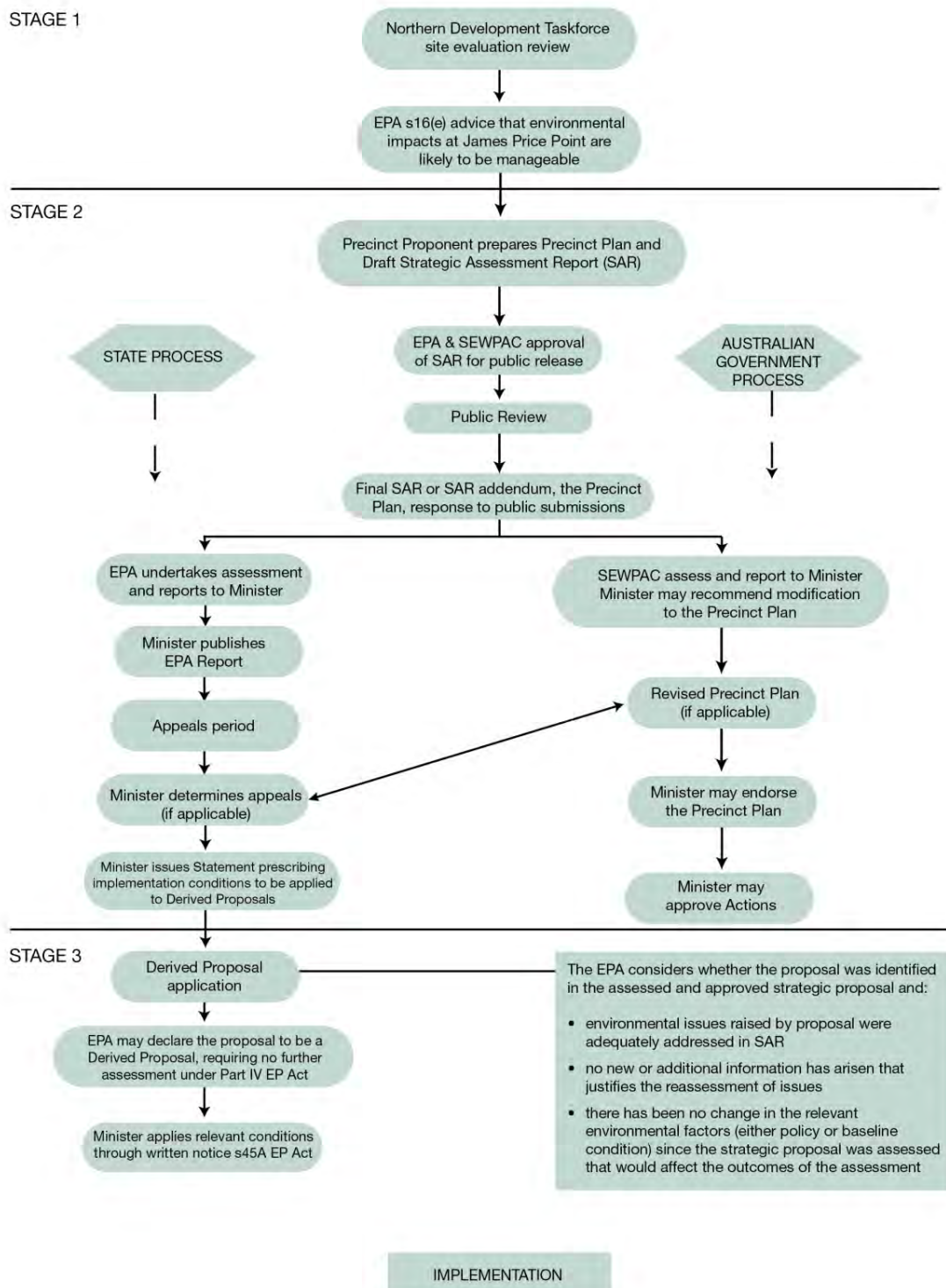
The BLNG Precinct Strategic Assessment Report does not include consideration of other forms of processing industry than those associated with LNG. Processing activities included within the description include: LNG; LPG; condensate; and support activities associated with the above. Throughout this document, the terms “gas processing”, “hydrocarbon processing” and “LNG processing” are used interchangeably to define these processing activities.

Activities not included in the Strategic Assessment Report include:

- gas processing into products (e.g. methanol, ammonia, oil refining or synthetic diesel);
- petrochemicals production (e.g. ethylene, propylene, plastics manufacture etc); and
- the processing of minerals (e.g. hot briquetted iron production, aluminium or steel refineries etc).

3.3.2. Baseline Studies

Comprehensive baseline environmental and social information was obtained to support the impact assessment of the proposal. Some information used was collected during the site selection process and this was supplemented by extensive site-specific field studies to enable the existing environmental, social and heritage values of the selected proposal area to be appropriately understood. All studies were conducted in accordance with the Scope of the Strategic Assessment (DSD, 2010b; **Appendix A-2**) as endorsed by the EPA and the then Commonwealth Department for the Environment, Water, Heritage and the Arts (**DEWHA**), now SEWPAC.

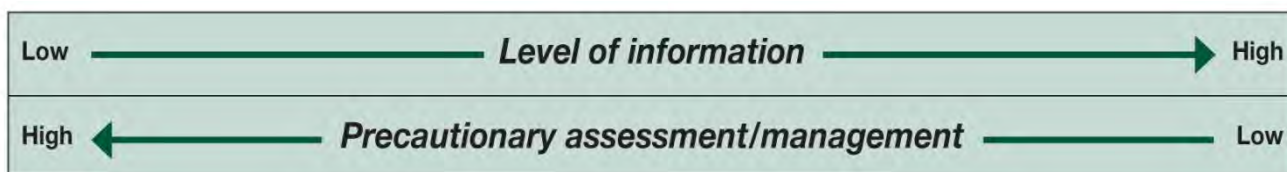


■ **Figure 3-1 Outline of the Strategic Assessment Process.**

3.3.3. Impact Assessment

The nominal project description was analysed in relation to the identified environmental, social and heritage values to identify potential impacts during construction, operation and decommissioning of the BLNG Precinct. These impacts were assessed in accordance with the Scope of the Strategic Assessment and relevant government guidelines and international standards. Matters of National Environmental Significance (NES) pursuant to the EPBC Act have been assessed using the same methodology.

Furthermore, in an effort to overcome difficulties associated with the uncertain nature of derived proposals, consistent definitions regarding the significance of potential impacts were adopted, and a greater level of precautionary assessment or management was applied (refer to **Figure 3-2**).



■ **Figure 3-2 Sliding Scale for Environmental Management Approach.**

3.3.4. Cumulative Impact Assessment

A range of infrastructure and activities would be directly required as part of the BLNG Precinct. In addition, there are numerous indirect activities and related projects that may to some extent be associated with the establishment of the Precinct. Indirect activities and actions as a result of the BLNG Precinct proposal such as possible changes to the Broome Airport, Broome Port, or regional roads do not form part of the approvals process for the Precinct. Similarly, related projects such as petroleum exploration activities, Browse Basin field development, or feed-gas pipelines in Commonwealth waters are outside the scope of the proposal. However, both these categories have been considered as part of the cumulative impact assessment. In this regard, an assessment was made of whether the impacts arising from core elements of the BLNG Precinct would be altered by indirect activities or related projects both locally and regionally and over short and longer timeframes.

3.3.5. Consultation

Extensive stakeholder consultation with advisory agencies, members of the public, Indigenous groups and other stakeholders is an integral part of the Strategic Assessment process. The consultation process aims to ensure clear, transparent communications between the DSD, and future commercial proponents and interested and affected stakeholders through listening, recording and responding to issues relating to the proposal as they arise. The process provides an opportunity for DSD and future commercial proponents to share information with stakeholders regarding the project.

A Stakeholder Reference Group (SRG) has been established to obtain the perspectives of key non-government stakeholders in relation to the impact assessment and proposed management plans for the proposed BLNG Precinct. The Reference Group seeks to engage individuals who can provide a broad perspective in their area of interest or expertise.

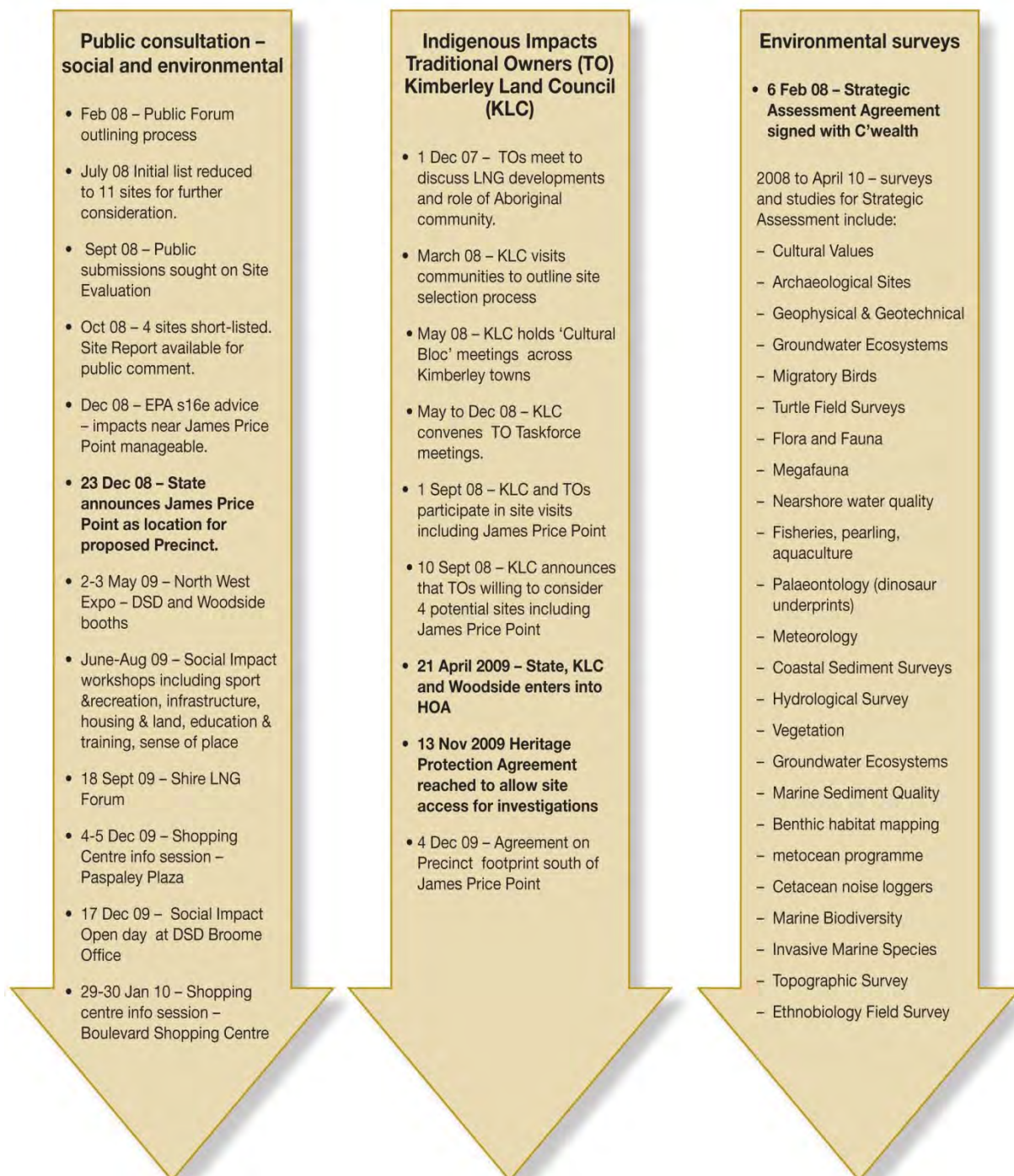
State and Commonwealth Departments, Ministers, other Government agencies and local government have been consulted directly via a separate process, principally comprising high level briefings.

Stakeholders directly affected by the proposed BLNG Precinct, such as Traditional Owners and pearl leaseholders, continue to be consulted directly.

Although there is no legislative requirement for consultative processes subsequent to a Strategic Approval, the Proponent will encourage ongoing consultation by commercial proponents through the derived proposal phase.

A summary of the consultation process is presented schematically in **Figure 3-3**.

**June 2007 – State endorsed strategy to develop Browse gas;
43 sites evaluated against environmental, social, technical & economic criteria;**



**Over the past 12 months, consultation has continued in parallel with:
Environmental and heritage surveys;
Native Title Negotiations; and
Preparation of the Strategic Assessment Report**

■ **Figure 3-3 Summary of the Consultation Process.**

3.4. Management Framework

A key outcome of the Strategic Assessment process will be to establish the State Management Framework that will apply to future proponents within the BLNG Precinct. In this regard, a number of controls exist, or will be in place, to ensure appropriate environmental outcomes are achieved. Key arrangements will include:

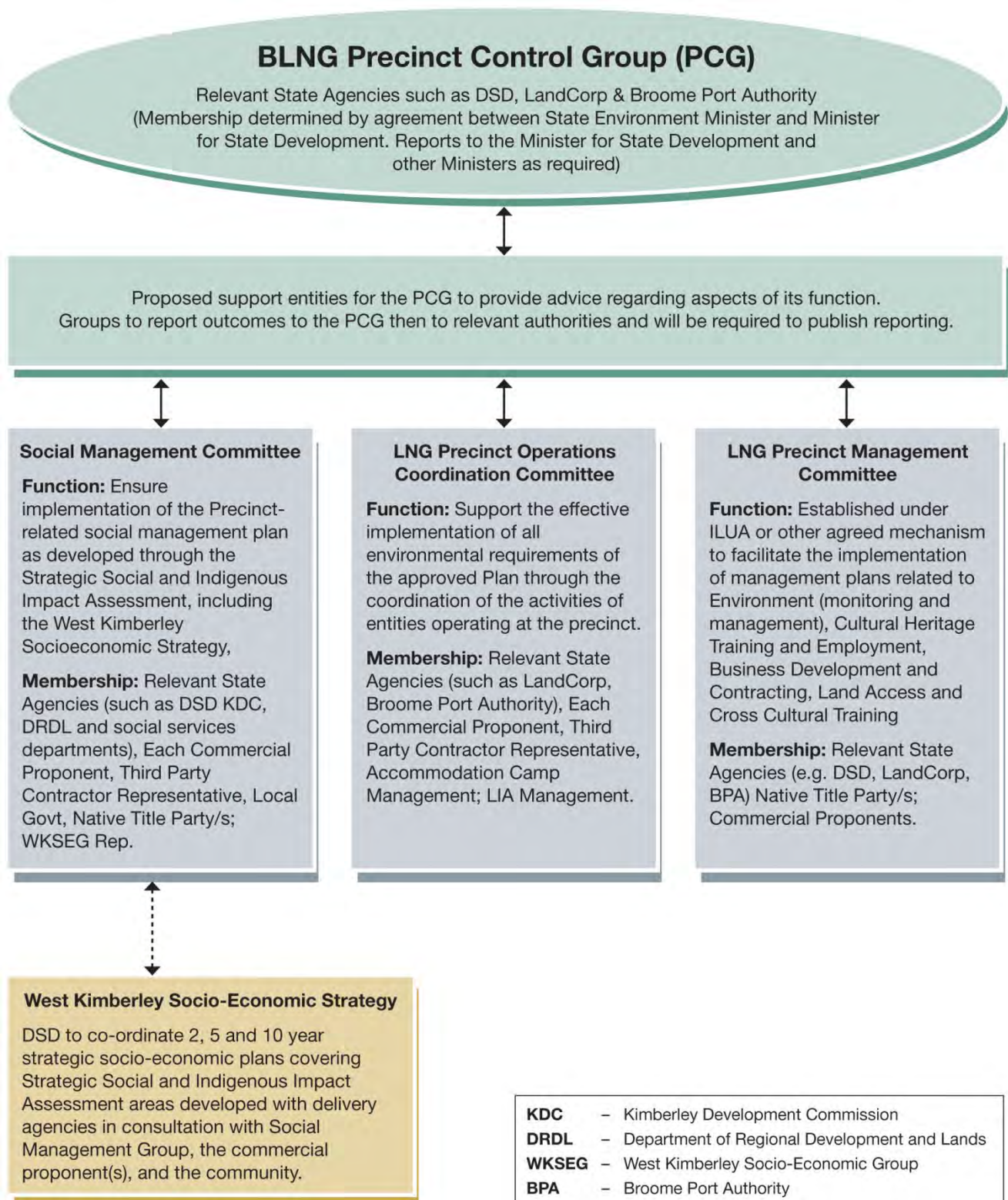
- Environmental conditions imposed by the State Minister for Environment to derived proposals;
- Conditions imposed by the Commonwealth Minister for Sustainability, Environment, Water, Population and Community to approved actions or classes of actions;
- Conditions of works approvals and environmental licences under Part V of the EP Act;
- Requirements under Part V of the EP Act related to general environmental harm and pollution;
- Future planning controls under Regional or Town Planning Schemes;
- Conditions to be applied to leases in the BLNG Precinct; and
- Other State and Commonwealth statutes.

The implementation of derived proposals under the Precinct Plan will require coordinated interaction between government authorities and commercial proponents. To ensure delivery of the necessary environmental and social management measures, a BLNG Precinct Management Structure is to be established. This is to be coordinated via the proposed BLNG Precinct Control Group, assisted by designated support groups, committees, and strategies (see **Figure 3-4**). The BLNG Precinct Control Group will report to the Minister for State Development and other Ministers as required, and will be comprised of the relevant State agencies (such as DSD, Western Australian Land Authority (**LandCorp**) and the Broome Port Authority). Committees will be formed from State Government Agencies, local government, Traditional Owners and industry representatives.

The DSD will be responsible for overseeing and coordinating the management arrangements and safeguards described in this Strategic Assessment Report. Key roles have been identified for the marine and terrestrial land management agencies (currently the Broome Port Authority and LandCorp) for ensuring compliance by future proponents within the BLNG Precinct through contractual arrangements such as lease and licence requirements.

Commercial proponents of derived proposals under this Precinct Plan will need to comply with conditions determined during this Strategic Assessment process. Such commercial proponents may include Government agencies, LNG companies, the Port Authority and private developers, depending on the nature of the action or proposal. The derived proposals will need to include details of responsibilities for the implementation of environmental management requirements to the satisfaction of DSD, the EPA or the Minister for Environment, as appropriate.

While there are numerous mechanisms to ensure that environmental and heritage requirements are complied with, and the regulators of these requirements are clearly identified, the same does not apply to broader social impacts and commitments that are identified in this Strategic Assessment Report. In the absence of formal social impact compliance mechanisms, DSD will have a significant role in liaising with other relevant government agencies to ensure that commitments, monitoring and reporting on social impacts and management is undertaken.



■ **Figure 3-4 BLNG Precinct Management Structure.**

3.4.1. Mitigation Measures

Based on the conclusions of the impact assessment, appropriate environmental management and impact mitigation measures have been developed to ensure that the identified environmental, social and heritage objectives can be achieved. In response to the strategic nature of the assessment, where detailed baseline and project scope may not be available, a range of mechanisms have been proposed to provide certainty that the identified environmental, heritage and social objectives could be achieved. These include:

- controls by other regulatory processes;
- application of outcome-based conditions;
- conduct of sensitivity analyses;
- assessment of reasonable worst case scenarios;
- conduct of impact assessments;
- application of 'best practice' management measures; and
- preparation of management plans for derived proposals.

For some factors, a range of approaches have been proposed to achieve the required level of certainty. For example, a range of air emissions scenarios have been assessed to determine whether a sensitive receptor would be unacceptably affected and an outcome-based condition has also been proposed that sets air quality limits at the boundaries of the BLNG Precinct.

Certain management measures presented in Parts 3, 4, 5 and 6 of the Strategic Assessment Report make reference to the demonstration of the application of 'best practice'. For the purposes of the Strategic Assessment Report, the term 'best practice' is defined as the following:

'the application of the best available mitigation measures that are practicable in the particular circumstances of a proposal to avoid or minimise environmental impact'. The process of achieving best practice would include developing design and management measures against international benchmarks whilst having regard to local conditions and circumstances (including costs) and to the current state of technical knowledge'.

The philosophy of application of best practice, as outlined above, is the underlying approach for developing environmental management plans and design of proposals consistent with the management framework identified in the Strategic Assessment.

3.4.2. Review

A regular review of the implementation of the mitigation measures and safeguards will be conducted every five years by DSD, in consultation with OEPA and SEWPAC. The purpose of the review will be to ensure continuous improvement with management strategies and safeguards amended to adopt best practice measures.

3.4.3. State Government Monitoring and Reporting

The State Government will monitor the development of the BLNG Precinct by commercial proponents, progress on the implementation of State measures, and cumulative impacts of activities based on monitoring programs of individual commercial proponents. This information will be collated in an Annual BLNG Precinct Environmental Report prepared by the State Government, submitted to SEWPAC and made publicly available.

3.4.4. Proponent Monitoring and Adaptive Management

Commercial proponents will be required to incorporate monitoring and adaptive management into their operations. Monitoring programs will be outlined in Management Plans developed by commercial proponents and provided to the relevant agencies for their consideration during the derived proposal and/or Action application processes. All such Management Plans will include contingency measures and remedial actions to be triggered should monitoring indicate that performance measures or targets have not been achieved or are not likely to be achieved.

3.4.5. Compliance, Reporting and Enforcement

Auditing will be undertaken by DSD and commercial proponents in accordance with conditions of approval. Compliance and performance reporting conditions are expected to be imposed by the Minister for Environment via Statements outlining conditions for derived proposals. Compliance reporting will be required annually, whilst performance reporting is required five-yearly. Regulators will assess and review audits to check for compliance against conditions.

Non-compliance with conditions of an Implementation Statement issued under the EP Act is an offence. Section 48 of the EP Act details the powers that the Western Australian Minister for the Environment has in relation to non-compliance.

3.5. Land and Asset Tenure Basis

The land required for the BLNG Precinct is comprised entirely of unallocated Crown land, which includes the seabed out to the three nautical mile (Nm) State territorial limit. It is located on part of the land and adjacent waters subject to a registered claim under the Commonwealth *Native Title Act 1993* (NTA) by the Goolarabooloo Jabirr Jabirr native title claimant group. Development of the BLNG Precinct cannot proceed in the absence of the appropriate land tenure being granted under the *Land Administration Act 1997* (WA), with the granting of such tenure being subject to acquiring the native title rights and interests over the area of land required.

The State Government has been negotiating with the Kimberley Land Council (KLC), which represents the registered native title claimant group, since January 2008 to secure the areas required for the BLNG Precinct. It is the State Government's preference to secure the land required via an Indigenous Land Use Agreement (ILUA) under the NTA, which would ultimately register the consent of the claimant to the establishment and operation of the BLNG Precinct. However, given continued questions about the authority of parties to negotiate such an Agreement and the timing issues that this presents, in September 2010, the State announced that it would commence a formal land acquisition process under the *Native Title Act 1993*. This process involves negotiating in good faith with registered native title claimants for a six-month period. If agreement cannot be reached, the State will refer the matter to the National Native Title Tribunal (NNTT) for arbitration for up to a further six months, after which the Tribunal determines if the development may be done, and if so, under what conditions.

Land tenure within the BLNG Precinct would ultimately be granted by the State of Western Australia to individual commercial proponents in the form of leases, easements or licences, granted through the State land management body LandCorp under the WA *Land Authority Act 1992* and the Broome Port Authority (BPA) which would be responsible for management of the Port under the *Port Authority Act 1999*. Freehold land would not be granted to individual commercial proponents.

The State Government and Woodside (as a potential foundation commercial proponent) have together committed to delivering about \$1.5 billion of social and economic benefits to local Aboriginal communities, under a Heads of Agreement (HoA) signed by the KLC on behalf of the Goolarabooloo Jabirr Jabirr claimants in April 2009. The Heads of Agreement includes:

- recognising the claimants as Traditional Owners of the affected land;
- providing an area of land, equivalent to that required for the precinct, to the Traditional Owners under freehold title;
- creating new economic opportunities, including in business development and trade training;
- strengthening environmental and heritage protection on the Dampier Peninsula, including creating new conservation reserves;
- reforming of Indigenous land tenure to help establish appropriate titles for home ownership and economic development in Dampier Peninsula communities;
- creating Traditional Owner controlled funds for economic development, housing, education and cultural preservation;
- increasing funding to improve Government facilities and services for the wider community;
- when the land is no longer needed, returning it fully remediated to the Traditional Owners; and
- requiring an equivalent level of commitments to that provided by the potential Foundation Proponent from future commercial proponents as and when they undertake projects at the Precinct.

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4. Site Selection and Development Options

The Browse Basin has gas reserves of some 34.6 trillion cubic feet (**tcf**) of gas and some 600 million barrels of condensate. The Browse Basin gas reserves are already being developed and the key question for the State of Western Australia is how best to develop these gas resources to maximise long term social and economic benefit for Western Australia and the local region while protecting the environmental, cultural and heritage values.

While the Western Australian Government recognises this opportunity to create a significant economic opportunity for the State, it is also conscious of the very high environmental and Indigenous values of the iconic Kimberley wilderness.

The State, in mid 2007, was concerned by the pattern being followed by industry in identifying and pursuing locations for gas processing along the west Kimberley coastline. The State's concern arose not just from an environmental and heritage perspective but also from the amount of suitable land area available at these specific locations. Each location previously considered had only been capable of supporting one major developer. This would have potentially created a situation of having multiple locations interspersed along the Kimberley coastline.

Under Western Australian law, future gas developers are legally afforded the right to apply to the State for land tenure and to seek subsequent environmental and heritage approvals for a gas processing facility. Thus, it is inevitable that unless one west Kimberley onshore location of suitable area to accommodate multiple developers is identified, ad hoc proposals for development sites will continue to be made well into the future.

In response, the Western Australian Government proposed to establish a single, commercially viable gas processing site at a suitable location to attract and facilitate at least two projects processing the gas resources of the offshore Browse Basin that would provide Western Australia and the Kimberley region the best opportunity to benefit in terms of investment, business and employment. Most particularly for Aboriginal people, the development would bring major new funding for their communities, and employment, training and business development opportunities.

A site selection process was designed which analysed a range of considerations including technical, economic, marine and terrestrial environment, natural and Indigenous heritage, and other Indigenous and socio-economic constraints. A range of development options were considered to determine the suitability of the State's proposal as well as to define the preferred location for the State's proposed development. Development options considered included:

- Floating LNG (**FLNG**) processing facilities;
- sites in the Pilbara region to the south of the Kimberley (Onslow, Burrup Peninsula, Cape Lambert or Port Hedland);
- locations to the north east of the Kimberley in the Northern Territory (**NT**) (Middle Arm, Glyde Point or Bynoe Harbour); and
- development at one of 43 locations in the Kimberley region (including offshore at Scott Reef, the Maret Islands or at Wilson Point in the Camden Sound).

The site selection process used analyses and input by the Western Australian Government, the Commonwealth Government, Traditional Owners, and industry (primarily Woodside and INPEX Browse Pty Ltd) to identify the most suitable location for the BLNG Precinct. The process and rationale for the ultimate choice of a site in the vicinity of James Price Point as the location of the BLNG Precinct is described in the sections below.

Several companies have over time considered and are continuing to consider various options for processing the Browse Basin gas reserves. Options have included: floating LNG platforms; offshore processing at Scott Reef; and onshore processing at Dampier, Darwin or at various locations along the west Kimberley coastline (including Wilson Point in the Camden Sound and the Maret Islands).

From an economic and technical perspective, the most feasible options were found to be offshore processing at Scott Reef and onshore processing at Wilson Point and Maret Islands, albeit that environmental and heritage constraints for these locations were identified as extremely significant. Some of the key economic and technical factors in respect to the onshore locations are the proximity to the gas reserves to the coast, the natural port features and the land elevation.

Floating LNG facilities in this region would also be restricted, through climatic conditions and safety requirements. Industry generally considers floating facilities as more suitable for small, stranded or remote reserves. This is therefore not a suitable option for most gas developers as this would severely restrict the number of tonnes per annum that can be produced as compared to the size of the gas reserves available. For example, this option was selected by Shell for the development of its Prelude field with estimated gas reserves of 2.5 – 3.0tcf, noting that the proposal by Woodside as a potential Foundation Proponent is based on estimated reserves of around 15tcf. It could also lead to the ‘cherry picking’ of easier gas reserves, leaving otherwise economic resources in the ground and rendering them commercially unviable in their depleted state.

4.1. Location Options not on the Kimberley Coast

The site selection process considered location options for the BLNG Precinct outside of the Kimberley region. As part of this process, the then DEWHA, commissioned a specialist independent study to undertake a comparative analysis of location options including 50 possible locations in the Pilbara, the Northern Territory and offshore as well as the Kimberley (GHD, 2009a; **Appendix B-7**). The GHD report noted that economic constraints for the development would require the site to be within 500km of the gas resource, unless significant industrial infrastructure (such as a port, shipping channel etc) were present with spare capacity. This constraint discounted many Pilbara coastal sites. The study also noted that the presence of industry on the Pilbara coast did not necessarily represent lower environmental values than the Kimberley.

In addition to the above study, the Northern Development Taskforce (**NDT**) engaged WorleyParsons Services Ltd to further evaluate onshore LNG development concepts outside of the Kimberley Region (WorleyParsons, 2008; **Appendix B-5**). This study included broad consultation with industry representatives to consider their views on the viability of various options.

Overall, assessments of numerous location options, including the analyses by both GHD and WorleyParsons, concluded that, while a Kimberley site may cause marginally higher net environmental and heritage impacts than site options outside the region, it was most attractive based on technical and economic considerations.

4.2. Location Options within the Kimberley Region

A site in the vicinity of James Price Point was selected as the proposed location for the BLNG Precinct following an extensive and systematic site selection process. Key criteria applied to the process were:

- the suitability of locations in terms of technical, environmental and Indigenous heritage constraints;
- proximity to the gas fields and existing infrastructure;
- potential impacts on existing communities and current land uses;
- views of the Indigenous people of the Kimberley as represented by the Traditional Owner Taskforce; and
- advice of the Western Australian EPA provided to the Minister for Environment under Section 16(e) of the EP Act.

More than 40 potential sites were initially identified by the State for consideration (refer to **Figure 4-1**). These sites were located onshore in the Kimberley. Of these, 11 sites were identified for more detailed examination.

The 11 sites were subject to extensive technical, environmental, heritage and social studies. The investigations included comprehensive stakeholder consultation involving over 100 people with professional expertise in areas such as oil and gas, the environment, heritage, fishing, pearling, planning, tourism and Aboriginal culture.

The two-part Site Evaluation Report (NDT, 2008b; **Appendix B-3** and NDT, 2008c; **Appendix B-4**) was released for public comment in 2008 and was supported by over 1,500 pages of appendices consisting of environmental reports, data, maps and NDT working documents. The NDT responded to the 243 written and 46 verbal submissions received and provided all documentation to the EPA for advice.

This process identified a short-list of three sites:

- North Head;
- James Price Point; and
- Gourdon Bay.

A fourth site, Anjo Peninsula, was later added at the request of Traditional Owners.

The NDT engaged WorleyParsons to undertake geotechnical assessments of the sites, complete a number of environmental studies and further consult with industry, the KLC, Aboriginal communities and local government (WorleyParsons, 2008; **Appendix B-5**).

In December 2008, the EPA concluded that, based on the information available, a site in the vicinity of James Price Point was the least constrained of the Dampier Peninsula sites evaluated and that environmental risks and impacts were likely to be manageable (EPA, 2008).

As a result, a site in the vicinity of James Price Point was selected by the State Government as the location for the BLNG Precinct.

4.3. Precinct Layout Options

Detailed assessment of the site in the vicinity of James Price Point continued in consultation with Traditional Owners and regulatory agencies to determine its exact location and layout; taking into account engineering design criteria, as well as heritage and environmental values.

As a result of these assessments, it was decided to locate the Precinct immediately to the south of James Price Point (refer **Figure 4-2**) as this location offers:

- a shorter distance to deep water, providing both cost and environmental benefits;
- nearshore habitat that is of a lower environmental sensitivity than areas to the north;
- land of a lower elevation, providing greater opportunity to reduce impacts on visual amenity; and
- the opportunity to set the plant, storage and other facilities back from coast, reducing impacts on significant vegetation and fauna habitat.

The process of ongoing consultation with Traditional Owners will continue through the development of a Cultural Heritage Management Plan (**CHMP**) being negotiated between the State, the foundation commercial proponent and the KLC.

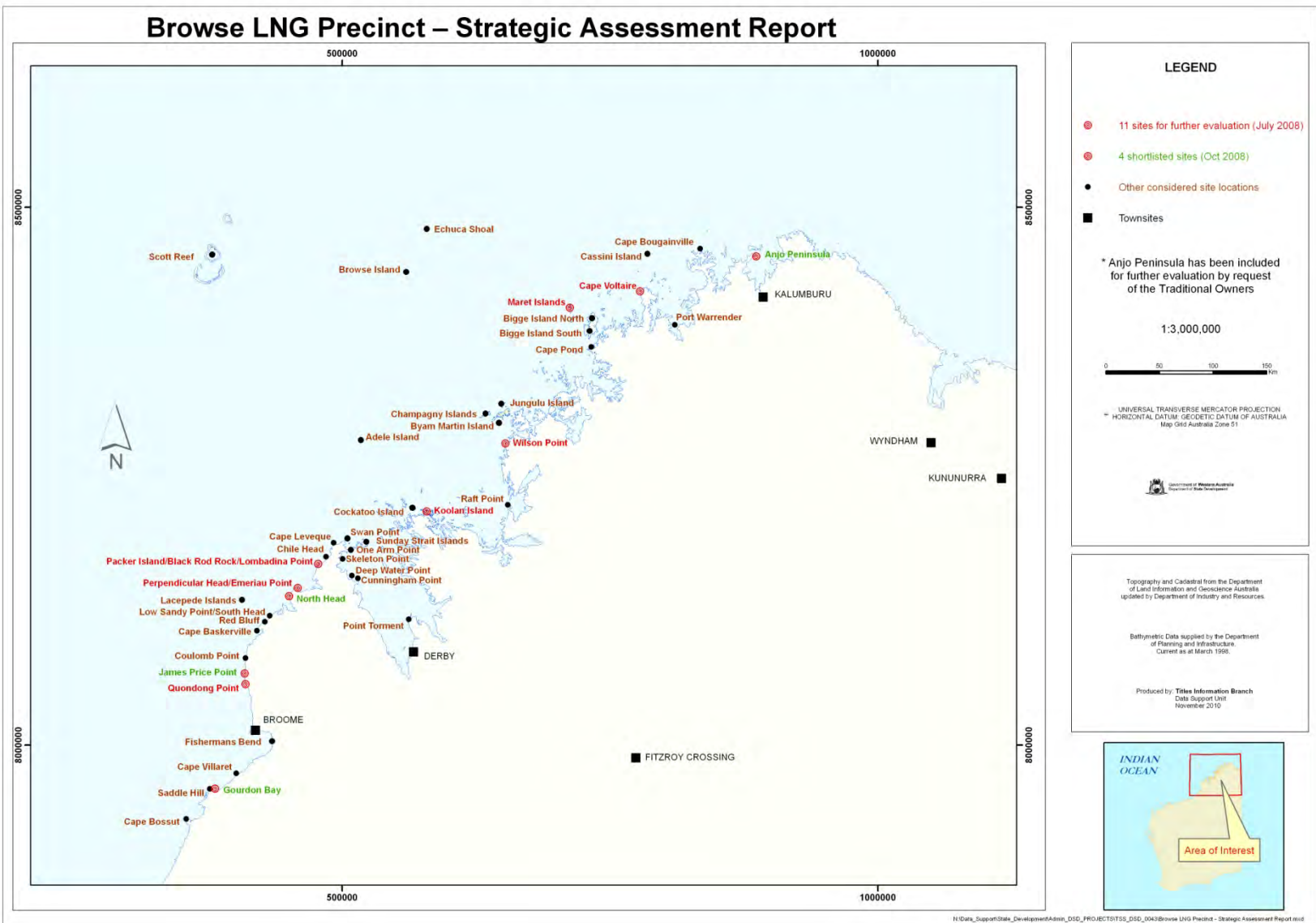
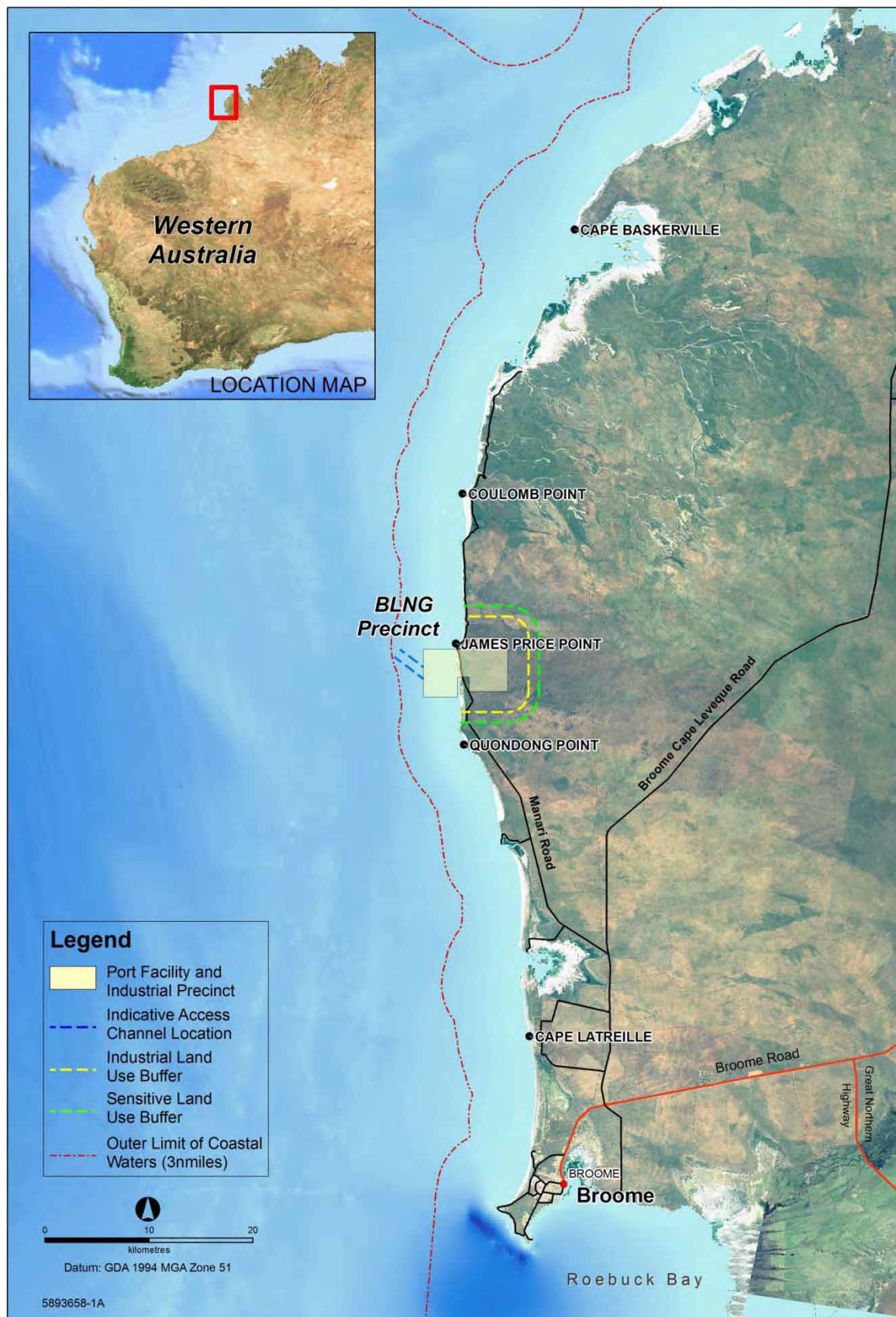


Figure 4-1 Sites Considered as Part of the Site Selection Process.



■ Figure 4-2 The Location of the BLNG Precinct South of James Price Point.

4.4. The “No Development” Option

As outlined in **Section 2**, the establishment of the BLNG Precinct and the development of a number of gas processing facilities at a single location offers significant economic, social and environmental benefits. In this regard, if the Precinct were not to be developed, the following may eventuate:

- The gas reserves of the Browse Basin may be developed via the establishment of multiple gas processing facilities along the Kimberley coast, which would increase the overall environmental and social footprint, reduce operational efficiencies, drive up development costs through the need to duplicate infrastructure, and reduce the opportunity to deliver more coordinated, consistent and higher standard of environmental performance.
- The gas reserves may be developed at distance from the Kimberley, driving up costs, increasing technical risk and decreasing the commercial competitiveness of such projects in the international market.
- Some of the gas reserves could be developed outside of Western Australia (in the Northern Territory or in Commonwealth waters), thus denying the Kimberley region the significant regional economic and community benefits that would otherwise flow from this large, long-term development.
- The gas reserves may not be developed at all, thus removing the ability to deliver greenhouse benefits that would be realised by Browse Basin LNG displacing coal in power generation in international markets.

In addition to these more strategic benefits, there are specific legal and commercial imperatives for the Browse LNG Development Joint Venture Participants (Woodside, Chevron, Shell, BP and BHP Billiton Petroleum) in agreeing to develop a foundation project in the vicinity of James Price Point. These arise from the retention lease renewals approved in December 2009 which included conditions to drive the earliest commercialisation of resources. Specifically, a 120-day period was set for the Joint Venture Partners to agree to the BLNG Precinct as the development concept. The Joint Venture partners agreed to the concept in the timeframe set and are now working toward the establishment of the foundation LNG development, should the BLNG Precinct proposal be approved. Other Retention Lease conditions require the Joint Venture Partners to commence Front End Engineering Design (**FEED**) in 2011 in order to reach a Final Investment Decision (**FID**) by June 2012 with respect to the LNG development.

5. The BLNG Precinct Proposal

5.1. The Proponent

The Proponent for the BLNG Precinct proposal is the Minister for State Development, presently the Hon. Colin Barnett MLA, as representative of the State of Western Australia.

Woodside, on behalf of the Browse LNG Development Joint Venture participants, was appointed as the potential Foundation Proponent for the BLNG Precinct under the Preliminary Development Agreement signed in October 2009. This Agreement established Woodside as a partner with the State Government in bringing the project to completion.

5.2. Overview

The BLNG Precinct concept is centred on the production of LNG for international markets. To enable this, raw hydrocarbons from the gas fields of the Browse Basin would be transported to the Precinct via subsea pipelines. Onshore within the Precinct, the gas would be processed, liquefied and stored, prior to being loaded onto purpose-built ships for transport to market. Condensate (a light crude oil) would be separated from the incoming gas stream, treated, stored and loaded into tankers for transport to Australian or international markets. Liquefied Petroleum Gas (**LPG**), comprised largely of propane and butane, may also be produced within the gas processing facilities located within the Precinct. A general overview of the LNG production process is provided in **Figure 5-1**, and an indicative layout is shown on **Figure 5-2**.

A range of facilities, infrastructure and operational activities would be required to enable and support the processing, production, storage and transport of these hydrocarbon products. In addition, there are a variety of indirect activities and related projects that may to some extent be associated with the establishment of the Precinct. These are dealt with in this assessment in the manner outlined in **Table 5-1**.

The assessment process reported in the Strategic Assessment Report has been focussed on **Category A** related activities, however, commentary is provided on **Category B** and **Category C** activities.

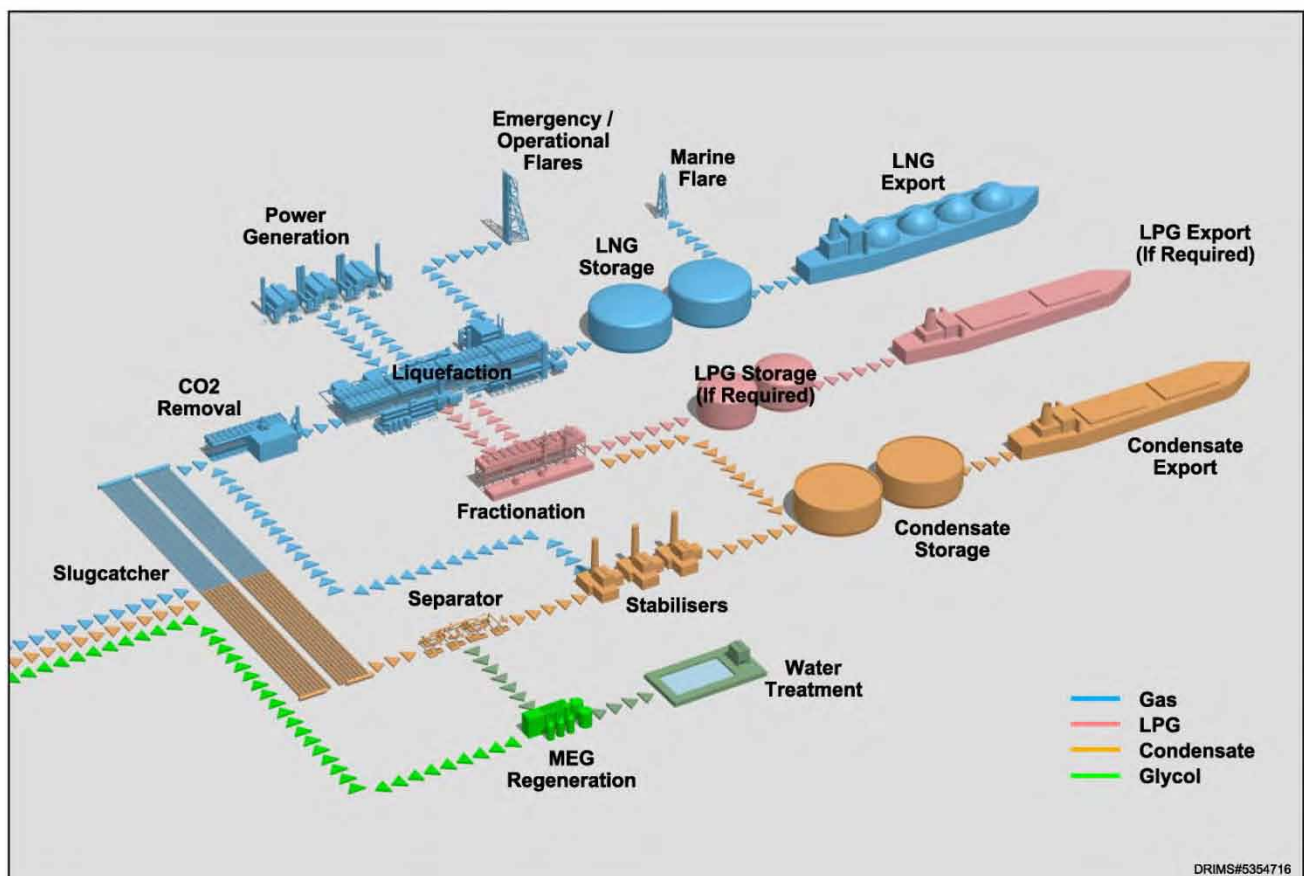
■ **Table 5-1 Categories of Facilities and Activities.**

Category	Description	Detail	Examples
A	BLNG Precinct	These are the core elements of the BLNG Precinct, including associated infrastructure, necessary to process and export hydrocarbons.	<ul style="list-style-type: none">• LNG, condensate and other hydrocarbon processing facilities;• Port Facilities;• Light Industrial Area;• Workers Accommodation; and• Infrastructure within and immediately adjacent to the Precinct.
B	Indirect Activities	These are indirect activities and actions as a result of the BLNG Precinct that are considered in the impact assessment but do not form part of the approvals process.	<ul style="list-style-type: none">• Broome Airport;• Broome Port;• Regional roads;• Housing;• Waste Management; and• Material Sourcing.
C	Related Projects	Related projects that are outside the scope of the Strategic Assessment but form part of the cumulative impact assessment.	<ul style="list-style-type: none">• Petroleum exploration activities;• Browse field development;• Pipelines and infrastructure in Commonwealth waters;• Road to the Precinct; and• Pioneer Camp.

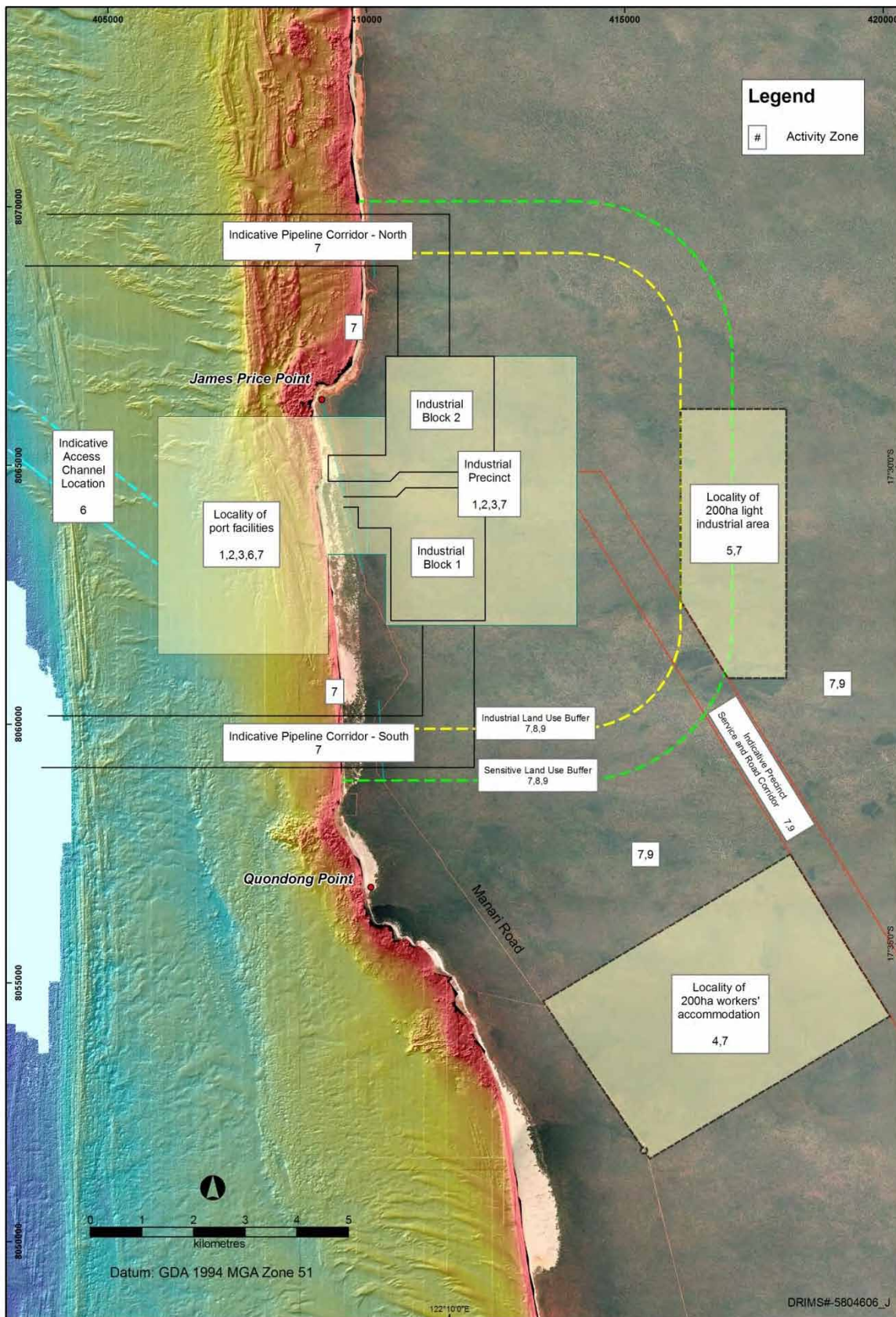
5.3. Major Components

The onshore processing facilities, supporting utilities and directly associated infrastructure within the Precinct (Category A) would likely comprise:

- gas pre-treatment, conditioning, compression and liquefaction processing trains;
- hydrocarbon storage (LNG, LPG and condensate);
- port facilities;
- power generation and other utilities;
- flare and fuel system facilities;
- carbon dioxide (CO₂) removal and potential CO₂ compression facilities;
- administration facilities and other plant buildings (including central control room);
- workers' accommodation;
- light industrial area;
- effluent treatment facilities;
- access roads and haul roads within the BLNG Precinct; and
- feed- and utility-pipeline corridors from the 3Nm limit to the LNG facilities.



■ Figure 5-1 Schematic Diagram of Typical LNG Production Process.



■ **Figure 5-2 Indicative BLNG Precinct Layout.**

Note: Numbers denote 'activity zones' as described in **Table 5-2**.

For planning and assessment purposes, the BLNG Precinct has been considered as a number of key activity zones, as shown in **Figure 5-2**. These zones would include the entire land and marine footprints, which involve up to 2,490 hectares (**ha**) of land for the Browse LNG Precinct area. Ancillary infrastructure including minor access roads, service corridors, pipeline corridors and other infrastructure make up to a further 547ha, representing a total land area of 3,037ha. Layout of the Precinct and its major components would be subject to land use buffer zoning in accordance with State Planning Policy and relevant EPA guidelines. As such, two buffer zones totalling approximately 3,000ha are proposed:

- Industrial Land Use Buffer Zone (2,000 metres (**m**)), which would exclude all uses not directly associated with hydrocarbon processing; and
- Sensitive Land Use Buffer Zone (3,000m) which would exclude all sensitive land uses such as residential developments, caravan parks, tourist accommodation, general commercial use or land uses related to public presence greater than 24 hours (**hrs**).

The BLNG Precinct proposal includes the construction, operation, maintenance and decommissioning of these facilities. The key facilities under the Precinct Plan are shown in **Table 5-2**.

■ **Table 5-2 Key Characteristics Table of Facilities under the Precinct Plan (Category A).**

Activity Zone (see Figure 5-2)	Activity	Description of Activity
1	LNG-related hydrocarbon processing	<p>Production facilities, including:</p> <ul style="list-style-type: none"> • Facilities for the receipt, transportation, and processing of hydrocarbons, including pre-treatment, conditioning, compressing and liquefaction of gas to produce Liquefied Natural Gas (LNG) and other hydrocarbon products such as condensate and potentially LPG; • Power generation; • Carbon dioxide (CO₂) removal and potentially CO₂ compression facilities (for potential sequestration); • Storage facilities for hydrocarbons including LNG, condensate and other hydrocarbon products; • Flaring and fuel systems; • Feed and utility pipelines from the approximately 3 nautical miles (Nm) State Waters limit to and within the Precinct; • Wastewater treatment facilities; • Utilities (e.g. nitrogen supply, diesel supply and fire water, etc); and • Any other activities necessary or ancillary to such Activities to a plant capacity limit equivalent to 50 million tonnes of LNG per annum. <p>These would give rise to air, greenhouse gas (GHG), and effluent emissions.</p>
2	Product Storage	Storage, handling and delivery of products derived from the processing of hydrocarbons including liquefaction of gas into LNG and other hydrocarbon products and any other requirements necessary or ancillary to such Activities.
3	Product Export	Port facilities through which the loading of LNG and other hydrocarbon products into tankers for product export would occur.
4	Workers' Accommodation	Accommodating workers associated with the Activities described in this table (excluding Broome Pioneer Camp).
5	Light Industrial Area	Light Industrial Area (LIA) facilities for third party contractors ancillary to the Activities described in this table.
6	Port Facilities	<p>Port Facility through which the loading of LNG and other hydrocarbon products into tankers, delivery of raw materials, construction materials and plant components from marine vessels would occur, including:</p> <ul style="list-style-type: none"> • Shipping channel, turning basin, navigation aids and offshore anchorage area; • Export jetty facilities with loading berths; • Breakwaters;

Activity Zone (see Figure 5-2)	Activity	Description of Activity
		<ul style="list-style-type: none"> Seawalls (small scale breakwater); Marine Facility; Small vessel all weather harbouring facilities; Access (causeway); and Rock load out wharf.
7	Supporting Infrastructure	<p>Supporting infrastructure associated with the Activities described in this table including:</p> <ul style="list-style-type: none"> Water supplies for Precinct activities (including groundwater bores); Borefields; Access and haul roads within the Precinct (excluding main Precinct Access Road); Fire management; Administration and other plant buildings (including central control rooms, and telecommunications); and Concrete batching plants and rock screening and crushing facilities. <p>Also includes service corridors and connecting infrastructure between the Precinct, LIA and workers accommodation, including:</p> <ul style="list-style-type: none"> power lines; water transmission; effluent pipelines; and telecommunications.
8	Buffer Zones	Industrial and sensitive land use buffers and Manari Road diversion.
9	Fire Management	Management of fire within buffer zones and the wider Dampier Peninsula.

5.4. Construction

Typical construction activities associated with establishment of an LNG facility would commence with construction of roads, development of the pioneering camp, site clearing and earthworks, followed by establishment of construction camp. This would then be followed by construction of LNG processing trains and plant utilities, storage and distribution systems, port facility, administration and plant buildings, and permanent accommodation for the operational workforce.

Construction of the foundation development is likely to occur over four to five years, with each expansion of the LNG facilities involving a nominal construction period of three to five years. The size of the workforce would be dependent on the construction profile; however, for planning purposes, an allowance has been made for 2,500 to 6,000 direct and indirect personnel, taking into account workforce for a potential Foundation Proponent development, future expansion and construction undertaken in parallel by more than one commercial proponent of the Precinct.

Key construction activities are summarised in **Table 5-3**.

■ **Table 5-3 Summary of Construction Activities.**

Key Activity	Construction Component
Site preparation	Roads, site clearing, earthworks and levelling, stormwater management, sourcing of fill (aggregate, road base etc).
Onshore construction	Transport of materials (onshore and marine, including modules), foundations, tanks, plant (LNG and other).
Nearshore construction	Dredging, export jetty, breakwaters, Port Facility.
Pipelines (product, glycol, CO ₂ etc.)	Pipelines in state waters (3Nm), shore crossings, onshore pipelines.
Supporting infrastructure	Construction camp, Light Industrial Area, lay down areas, crushing and screening, concrete batch plant, fuel and chemical storage, waste management, water supply, power supply, wastewater treatment, stormwater management, services corridors.

5.5. Operations

Once operational, the LNG processing facilities would operate continuously over 24 hours with the exception of planned shutdown for maintenance or emergency events. Key operational activities anticipated for the LNG facilities at the Precinct are summarised in **Table 5-4**.

■ **Table 5-4 Key Operational Activities for the LNG Facilities.**

Key Activity	Operational Component
Processing	Gas processing, product storage and offloading.
Vessel operations	Shipping vessels, support vessels.
Dredging	Maintenance dredging.
Maintenance and site management	Maintenance of facilities, fire management, stormwater management.
Supporting infrastructure	Permanent accommodation (village), power supply, water supply, fuel and chemical storage, wastewater treatment, waste management.

For planning purposes, it has been assumed that an operational workforce of between 650 and 1,000 personnel will be required for 50Mtpa of LNG production. It has been assumed that some personnel would work on a fly-in-fly-out basis, while others would reside in the Broome area.

An additional workforce of 900 – 1,000 personnel would be required during major shutdowns for maintenance (approximately every eight years) dependent on the size of the facilities and the planning schedule for shutdown.

5.6. Decommissioning

Decommissioning of the BLNG Precinct would occur in accordance with regulatory requirements and industry practice at the time. Facilities to be decommissioned would include the gas processing facilities, plant utilities, Port Facilities and supporting infrastructure, export pipelines, onshore pipelines and other pipe work.

Prior to removal of equipment, facilities would be depressurised, purged and flushed of any hydrocarbons to reduce potential environmental impacts during removal of equipment. Once equipment is removed from site, rehabilitation would commence to ensure that the condition of the site reflects the existing surrounding environment. This would involve contouring the surrounding landscape and revegetation of native flora species. Recovery of equipment would take into account opportunities for re-use or recycling, wherever feasible.

6. Identification of Key and Relevant Factors

The Scoping Phase of the assessment focussed on the application of a systematic approach to identify potential impacts and determine their environmental significance. Risk assessment was used to identify the range of potential impacts based on potential interactions between the receiving environment (“environmental factors”, including social factors), and environmental stressors (“environmental aspects”). These factors were presented to the EPA for its consideration in the Browse LNG Precinct Scope of the Strategic Assessment (DSD, 2010b; **Appendix A-2**). The Proponent’s scoping assessment took into consideration the standard controls that would be in place to prevent an aspect from occurring, as well as the nature of the materials or substances that contribute to the aspect.

Those factors that required in-depth investigation during the impact assessment phase were identified in accordance with the following qualitative definitions:

Key Factors:

- Potential impacts may raise significant concern from stakeholders; and/or
- Require high/moderate level of mitigation and/or management for potential impact to comply with guidelines and standards; and/or
- Direct/permanent loss of environmental attributes or conservation significance and/or social attributes of significance; and/or
- Represent a severe or high rating from the screening assessment.

Other Relevant factors:

- Potential impacts are unlikely to be of significant concern from stakeholders; and/or
- Potential impacts will be minor requiring minimal management measures to comply with guidelines and standards; and/or
- Potential impacts will be localised and short-term, with minimal loss to environmental attributes of conservation significance and/or social attributes of significance; and/or
- Represent a medium, low or less than low rating from the screening assessment.

The environmental factors and resultant significance rating identified through the impact assessment phase are presented in **Table 6-1**. These factors were further evaluated through existing information, findings of investigation studies, consultation with relevant stakeholders and experience gained from similar projects undertaken developing North West Shelf gas fields.

■ **Table 6-1 Environmental Factors and Significance Rating.**

Key Factors	Other Relevant Factors
Marine Environment (reported in Part 3 of the Strategic Assessment Report)	
<ul style="list-style-type: none"> • Marine water quality; • Benthos including benthic primary producers; • Marine mammals; and • Marine reptiles. 	<ul style="list-style-type: none"> • Tidal regimes, currents and hydrodynamics; • Marine sediment quality; • Fish; and • Marine ecosystem integrity.
Terrestrial Environment (reported in Part 4 of the Strategic Assessment Report)	
<ul style="list-style-type: none"> • Terrestrial flora and vegetation; • Greenhouse gas emissions; and • Terrestrial fauna. 	<ul style="list-style-type: none"> • Soils and geomorphology; • Surface water; • Groundwater; • Terrestrial ecosystem integrity; • Air quality; and • Species of ethno-biological significance.
Community and Social Surrounds (reported in Part 5, Section 4 of the Strategic Assessment Report unless otherwise specified)	
<ul style="list-style-type: none"> • Palaeontology; • Aboriginal heritage; • Visual amenity; • Light and landscape character; • Commercial fishing; • Aquaculture and pearling; • Tourism; • Sports, recreation and land use (including recreational fishing); and • Community services (reported in Part 5, Section 2). 	<ul style="list-style-type: none"> • Environmental heritage and conservation areas; • Colonial heritage; • Mining (reported in Part 5, Section 2); • Agriculture (reported in Part 5, Section 2); and • Human health.

7. Environmental Assessment – Marine

The proposed BLNG Precinct is situated within the Kimberley region, however from a marine bioregional perspective, it is more accurately defined as being in the Canning Marine Bioregion (DEWHA, 2004). The area is associated with a diverse range of fauna and flora including migrating birds, turtles, dugongs, whales and dolphins. The Canning Marine Bioregion supports feeding, breeding, and resting habitat for many plants and animals which contribute to the biodiversity of the bioregion. The Kimberley region also supports an active population of people with a diversity of backgrounds, experiences, and interests with many utilising the marine resources of the bioregion. These are discussed further in **Part 5 (Social Impact Assessment (SIA))**.

The following tables summarise the existing physical and ecological marine environment of the Canning Marine Bioregion and more localised James Price Point coastal area and outline the impacts and mitigation measures for the key marine environmental values.

In most instances, the significance of residual impact following the implementation of mitigation measures was assessed to be low or very low. One exception to this was related to impacts on Marine Water Quality, where the site disturbance and excavation for the port development is unable to be avoided and the impact was assessed as high. To the extent possible, this impact has been reduced by the selection of the location to the south of James Price Point which reduced dredge volumes and avoided areas supporting significant areas of benthic primary producer habitat (**BPPH**). Further detailed work is required through the development of a Dredging and Dredge Spoil Disposal Management Plan (**DSDMP**), to demonstrate best practice management techniques and technologies which would be applied to minimise potential dredging impacts.

One other instance where residual impacts were not assessed as low or very low, related to the impacts which site disturbance and excavation activities would have on benthos (including BPPH) and in particular on seagrass, algae and filter feeders. This was assessed as medium significance. Although this unavoidable impact was considered to be very localised and would not impact on significant areas of high value benthos due to avoidance of such areas during site selection, it was assessed as being of medium significance because the impact would be long term. To manage this impact, the DSDMP noted above would also need to demonstrate that impacts to benthos will be minimised.

The only other instance where residual impacts were not assessed as low or very low was the potential impact of marine discharges on Marine Ecosystem Integrity, which was assessed as medium. It was considered that while routine discharges were unlikely to have a significant impact following mitigation measures, there was the potential for significant impacts in the unlikely event of a major hydrocarbon spill. It is proposed that such impacts would be reduced through the implementation of an Emergency Response Plan including spill contingency procedures and coordination of proponents in the event of emergency response procedures. Commercial proponents will also be required to produce a Hydrocarbon and Chemical Spill Response Contingency Plan.

In order to provide stakeholders with additional information regarding the extent of some potential marine environmental impacts associated with the proposed BLNG Precinct, DSD has commissioned a series of comprehensive modelling programs and reports, which will be made available for public review during the Strategic Assessment Report public consultation period. The aim of this supplementary information is to complement the environmental impact assessment and demonstrate that the environmental outcomes described throughout the Strategic Assessment Report would be achieved.

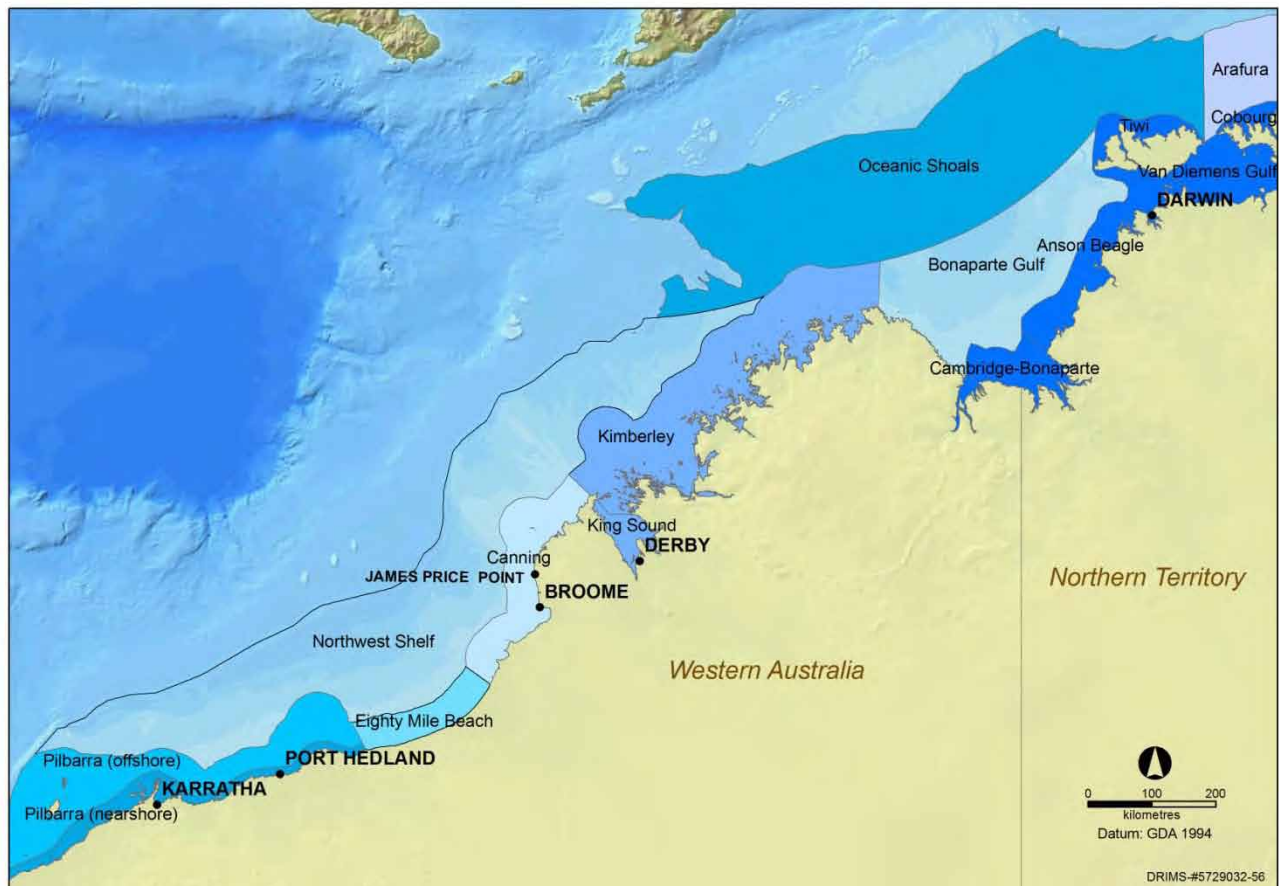
Specifically, this supplementary information will provide details from the following studies:

- Hydrocarbon spill modelling;
- Effects of proposed infrastructure on coastal processes;
- Wastewater discharge modelling; and
- Benthic habitat loss calculations (in accordance with EPA Environmental Assessment Guideline 3).

The accuracy of the additional modelling work is to some extent dependent on the maturity of engineering design which has now progressed to a stage that warrants the modelling being undertaken. At the time of printing, the additional modelling studies were underway and it is proposed that these four studies be released during the public comment period and be available for six weeks public review.

7.1. Existing Marine Environment

The Canning Marine Bioregion is a sub-region of the North West Marine Region (IMCRA, 2006). The Canning Marine Bioregion extends from the southern boundary at Cape Missiessy to the western edge of Cape Leveque (**Figure 7-1**). This region includes a vast abyssal seafloor and a broad continental shelf with atolls and islands. James Price Point is located on the coast and represents a low energy environment, receiving occasional storm surges from cyclonic weather events. The Bioregion includes rocky shores, fringing coral reefs, sandy beaches, sand flats, seagrass, mangroves and mud flats.



Source: DEWHA, 2009a.

■ Figure 7-1 Marine Subregions of the North West Marine Region.

7.1.1. Physical Characteristics

A summary of the key physical characteristics of the marine environment of the James Price Point coastal area is presented in **Table 7-1**.

■ **Table 7-1 Marine Physical Characteristics.**

	Description
Coastal Geomorphology	<ul style="list-style-type: none"> The Kimberley region has two distinct types of coastal geomorphology: flat-bedded Speewah and the Kimberley Group sandstones and siltstones. The coastal sediments of the Dampier Peninsula include quartz beach sands, shell ridges, mudflats, limestone platforms and sand dunes. James Price Point coastal area is composed of red pindan soil and characterised by narrow beaches, with an intermittent rocky shoreline and platforms of lithified coastal sediments, which adjoin stretches of low lying cliffs and sand dunes to the landward side.
Subtidal Geomorphology and Bathymetry	<ul style="list-style-type: none"> The coastal regions of the Canning Basin are bounded by the geological features of the Pilbara Block to the south and the Kimberley Block to the north. The coastline in the James Price Point coastal area runs north to south, with the nearshore seabed contours running parallel to the shoreline.
Sediment Quality	<ul style="list-style-type: none"> The particle size distributions (PSD) of marine sediments in the Kimberley region vary from clay and silt to coarse sand and gravel. Sediments of the James Price Point coastal area are predominantly sand. Sediments of the James Price Point coastal area are of high quality with no contamination detected during surveys.
Oceanography and Coastal Processes	<ul style="list-style-type: none"> The oceanography of the Kimberley region is strongly influenced by the Indonesian Throughflow current. Tides near the James Price Point coastal area are semi-diurnal (two highs and two lows each day). The tidal range at James Price Point is approximately 7.8m, tidal forcing is likely to dominate the current regime for the James Price Point coastal area. The combination of strong tide, undulating topography and year-round strong solar heating generates a water column that is vertically well mixed with strong topographical forcing.
Water Quality	<ul style="list-style-type: none"> Water quality is high with no traces of contamination or anthropogenic inputs. Variable levels of turbidity occur, often associated with the macro-tidal regime and meteorological perturbations. Surveys showed benthic light availability (i.e. photosynthetically active radiation) reduced by as much as 200-fold during peak turbidity conditions. Periods of elevated turbidity are largely restricted to the bottom layer of the water column from presumed natural re-suspension of sediments. Surveys showed the median total suspended solids (TSS) value was 2.8 milligrams per Litre (mg/L) across the James Price Point coastal area, with a summer median of 7.5mg/L and a winter median of 2.3mg/L. The 95th percentile TSS level (November 2009 – September 2010 data, average of all water quality monitoring sites) was 28.6mg/L, with a summer and winter 95th percentile level of 34.3mg/L and 9.8mg/L respectively.

7.1.2. Marine Ecological Characteristics

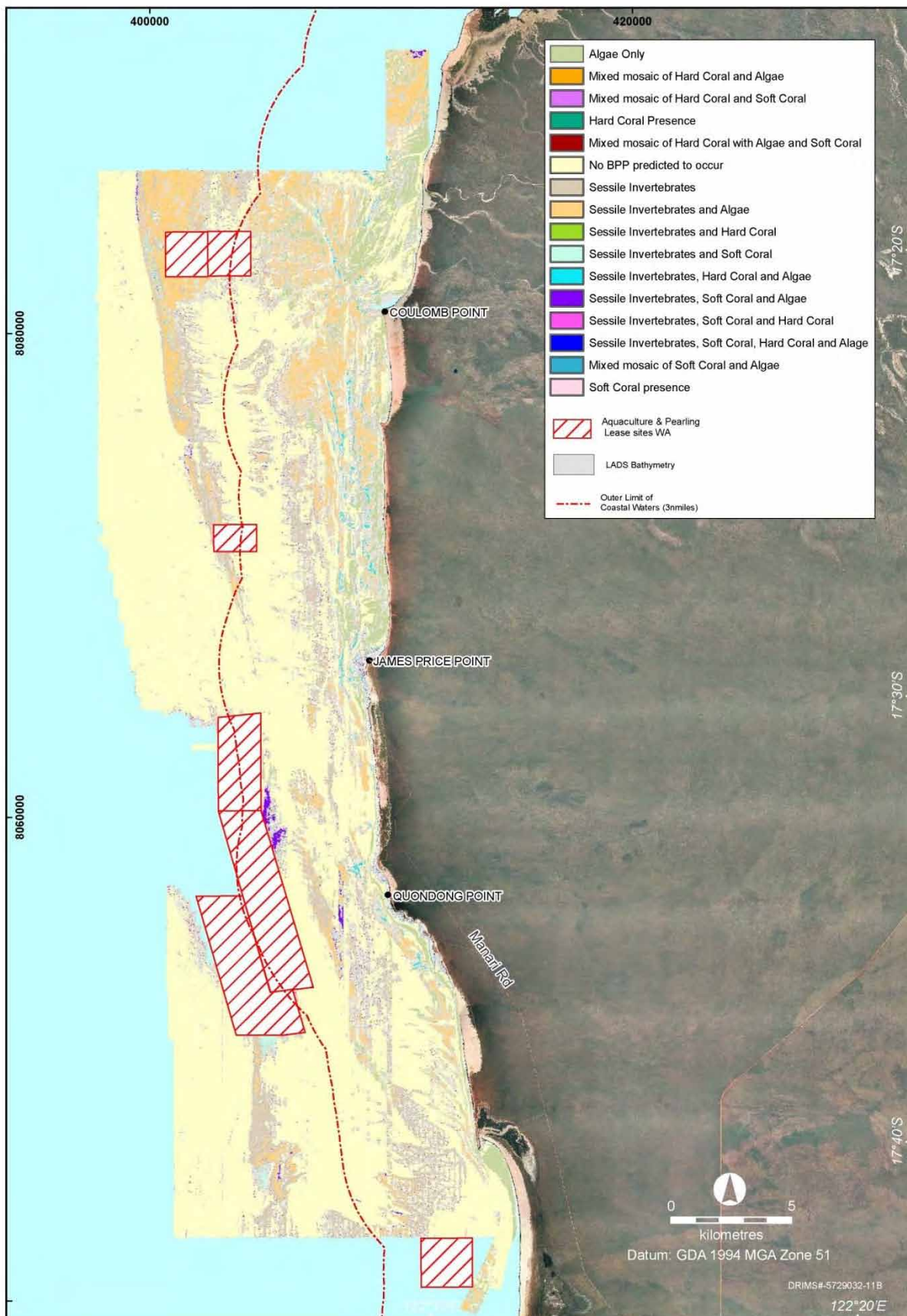
The coastal areas of the Dampier Peninsula provide habitat for a range of marine flora and fauna species including benthic primary producers (**BPP**) (e.g. seagrass and coral), fish, reptiles and marine mammal species. Studies conducted as part of this assessment confirmed that the Bioregion contains unique and complex habitats supporting a high level of biological diversity. However, habitats within the James Price Point coastal area were shown to be well represented throughout the wider Canning and Kimberley Bioregions. Humpback whales are known to utilise the inshore waters surrounding the Dampier Peninsula, moving between feeding grounds in the Antarctic to breeding grounds in the Kimberley region. Regionally significant marine turtle nesting beaches are also known to occur at the Lacepede Islands (located approximately 65km north of James Price Point). Similarly, dugongs are known to occur throughout the coastal regions of the Dampier Peninsula including the James Price Point coastal area.

A summary of the key ecological characteristics of the marine environment in the James Price Point coastal area is presented in **Table 7-2** and BPPH is shown on **Figure 7-2**.

■ **Table 7-2 Marine Ecological Characteristics.**

	Description
Intertidal and Subtidal Substratum	<ul style="list-style-type: none"> The intertidal zone of the James Price Point coastal area is typical of the broader Dampier Peninsula and is dominated by flat, sandy areas with relatively sparse, intermittent habitat of rocky substratum and reef platforms. A combination of hard and soft substrate was identified in inshore areas near James Price Point, whereas, mostly softer sandy substrate was observed in the offshore areas.
Phytoplankton	<ul style="list-style-type: none"> Nutrients and planktonic organisms are transported to and from the North West Marine Region by the southerly movement of the Indonesian Throughflow current and the south-east and north-west monsoonal wind-driven currents. Diatoms are the most commonly occurring phytoplankton within the North West Marine Region. Planktonic communities found in the James Price Point coastal area are typical of the Region.
Benthic Primary Producers (BPPs)	<ul style="list-style-type: none"> The dominant subtidal habitat type is bare substrate, consisting mostly of sand which occasionally supports seagrass communities. Macroalgae is the dominant benthic primary producer habitat in the James Price Point coastal area. Subtidal seagrass communities are patchily distributed and their abundance dramatically changes seasonally. Hard corals (predominately single colonies) are scattered throughout the James Price Point coastal area in generally low densities. In the lower littoral reefs, benthic communities are comprised of hard and soft coral, macroalgae and filter feeding invertebrates. Filter feeding communities are a prominent component of the benthic environment within the James Price Point coastal area.
Marine Invertebrates	<ul style="list-style-type: none"> Intertidal surveys recorded a relatively low abundance and diversity of species along James Price Point coastal area. Sparse to medium densities of marine invertebrates have been identified along patches of low relief reef along the James Price Point coastal area. The most abundant benthic invertebrates found along the Dampier Peninsula between Quondong Point and Coulomb Point were echinoids, crinoids, ascidians and dense patches of sea pens. Dredge epi-benthic sled samples identified the greatest crustacean diversity at the Quondong to Coulomb Point (49 species), followed by Gourdon Bay (39 species), Packer Island (21 species) and Perpendicular Head (16 species). Most of the crustacean specimens collected belong to the order Decapoda, which contains the most familiar groups of crustaceans – the crabs, lobsters, prawns and shrimps. Low numbers of molluscs were recorded along the James Price Point coastal area.

	Description
Marine Reptiles	<ul style="list-style-type: none"> • Six species of marine turtle may utilise the marine habitat offshore from the Dampier Peninsula (including the James Price Point coastal area) during movements and migrations and possibly as foraging habitat. • Flatback and green turtles were the most commonly occurring species along the James Price Point coastal area; however, this area does not support consistently high densities of turtles (RPS, 2010b; Appendix C-2). • The beaches within the James Price Point coastal area are considered unsuitable for nesting, due to periods of inundation during spring high tides, incline of the beach, rocky substrate around the coastal zone and limited space for nesting between the aeolian sands and the intertidal platform. • Sea snakes were found to be widely distributed and abundant along the Dampier Peninsula coastline. • The James Price Point coastal area is not considered a significant freshwater or estuarine crocodile habitat as it does not support estuarine or mangrove environments.
Marine Mammals	<ul style="list-style-type: none"> • A number of marine mammal species (including whales, dolphins, orcas and dugongs) were recorded in the vicinity of James Price Point coastal area. • Some species have a regular and predictable seasonal presence, while others have less well known migratory patterns or are transient at all times of the year. • The bottlenose (<i>Tursiops spp.</i>) and spinner dolphin (<i>Stenella longirostris</i>) were the most commonly recorded species during both vessel and aerial surveys. • The humpback whale is of particular significance as the Dampier Peninsula (including the James Price Point coastal area) forms a component of the Group IV humpback whale migration route from early June to November. However, the James Price Point coastal area is not considered to be significant for feeding, calving or socialising of humpback whales. • Since the cessation of whaling, the group IV population has increased by approximately 10% per annum. • The Dampier Peninsula coastline provides dugong habitat. Habitat features of greatest importance are seagrass beds, which are important foraging areas. • Surveys indicated that Roebuck Bay supports the most stable and highest population of dugong adults and calves, while the James Price Point coastal area supports a transient population.
Fish	<ul style="list-style-type: none"> • Surveys identified that fish communities were both diverse and abundant, despite the relatively shallow water depth, and lack of seabed features and sub-tidal coral reefs. • No species identified were endemic to the James Price Point coastal area, with species observed broadly representative of the wider Canning Marine Bioregion. • The Dampier Peninsula coast is a broad transitory area for sawfish species moving between riverine systems including the near shore marine environment adjacent to James Price Point.



■ **Figure 7-2 Benthic Primary Producer Habitat in the Vicinity of James Price Point.**

7.2. Marine Environment - Impacts and Mitigation Measures

7.2.1. Tidal Regimes, Wave Climate, Currents and Hydrodynamics

The development of the coastal and marine components of the BLNG Precinct, including alterations to the seabed profile and the physical presence of nearshore Port Facilities, has the potential to affect coastal processes within the James Price Point coastal area. Studies of these processes, including a Coastal Processes Sediment Transport Study and Hydrodynamic Modelling, have established that the development may alter the incident waves propagating toward the local shoreline and could result in the build up of sediment against shore-crossing structures and/or the modification of inshore tidal currents and sediment transport pathways. However, through the avoidance (via prior site selection) of coastal types particularly sensitive to changes in coastal processes (such as mangroves), the studies indicate that the development is likely to result in only minor and local disturbance to a regionally well represented landform. Therefore, the significance of potential impacts to coastal processes was considered to be low and able to be managed under specifically prepared Environmental Management Plans and other approvals.

A range of management measures would be applied to mitigate potential impacts on coastal processes. Depending on the nature of the derived proposal, such mitigation measures may include:

- Establishment of the Broome Port Authority as the statutory Port Authority for the BLNG Precinct and with regulatory functions for the associated port area.
- A requirement for proponents of derived proposals to prepare and implement a Port Facilities Construction Environmental Management Plan (PFCEMP), to the satisfaction of the Western Australian Minister for Environment.
- Conditions on derived proposals requiring that commercial proponents:
 - demonstrate application of best practice measures to be implemented to minimise impacts on coastal processes from onshore and nearshore marine infrastructure, with design measures supported by detailed hydrodynamic modelling; and
 - develop and implement a Final Closure Plan, in consultation with key stakeholders, to be submitted to the Chief Executive Officer of Department of Environment and Conservation (**DEC**) at least five years prior to the planned date of closure.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals shall prepare and implement a PFCEMP, which addresses the following:

- schedule of construction activities;
- details of the construction methods to be used;
- environmental training and inductions;
- environmental monitoring, management, contingencies and reporting;
- stakeholder consultation; and
- consistency with requirements of Broome Port Authority and BLNG Precinct Environmental Management Framework.

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 7-3**.

■ **Table 7-3 Significance of Potential Impacts to Tidal Regimes, Wave Climate, Currents and Hydrodynamics.**

Aspect	Example Mitigation Measures ¹	Significance of Residual Impact	Basis of Conclusion
Marine Site Disturbance and Excavation	<ul style="list-style-type: none"> Derived proponents to demonstrate design measures to minimise impacts supported by hydrodynamic modelling and closure planning. 	Very Low	<ul style="list-style-type: none"> Residual impacts relate to minor disturbances to well represented landforms and/or habitats. Localised coastal re-adjustment expected. Any changes will be localised and minor relative to the semi-diurnal tidal inundations and oscillations naturally experienced in the James Price Point coastal area. For more details refer to Part 3, Section 2.1.3.1.
Physical Presence	<ul style="list-style-type: none"> Derived proponents to demonstrate application of best practice management and mitigation measures to minimise impacts on coastal processes from onshore and nearshore marine infrastructure. 	Low	<ul style="list-style-type: none"> Given the dynamic nature of the local marine environment, including the regular occurrence of tropical cyclones, potential impacts likely to be highly localised. For more details refer to Part 3, Section 2.1.3.2.
¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in Part 3, Section 2.1.			

7.2.2. Marine Sediment Quality

Aspects associated with the development and operations of the BLNG Precinct, including site disturbance and marine discharges, have the potential to impact on marine sediment quality through physical changes to the sediment structure, mobilisation of any contaminants associated with maintenance dredging and potential accumulation of organic materials, heavy metals and hydrocarbons from routine wastewater discharges.

A range of management measures would be applied to mitigate potential impacts on marine sediment quality. Depending on the nature of the derived proposal, such mitigation measures may include:

- Establishment of the Broome Port Authority as the statutory Port Authority for the BLNG Precinct and with regulatory functions for the associated port area.
- Preparation by the Broome Port Authority of a BLNG Precinct Port Environmental Management Plan for the port area, in consultation with DEC.
- Preparation and implementation of a range of Plans by proponents of derived proposals to the satisfaction of the Minister for Environment, including:
 - Port Facilities Construction Environmental Management Plan;
 - Dredging and Dredge Spoil Disposal Management Plan;
 - Hydrocarbon and Chemical Spill Contingency Plan; and
 - Marine Wastewater Discharge Management Plan.
- Conditions on derived proposals requiring that commercial proponents:
 - ensure that bioaccumulation toxicant concentrations in discharges meet relevant Australian and New Zealand Environment Conservation Council/Agriculture and Resource Management Council of Australia and New Zealand (**ANZECC/ARMCANZ**) (2000) National Water Quality Management Strategy (**NWQMS**) species protection guideline levels within and at the boundary of the mixing zone;
 - verify the performance of outfalls in terms of achieving the required dilutions, under a range of flow rates, meteorological and sea state, immediately following commissioning of wastewater plants; and
 - ensure that an assessment of sediment quality meets the National Assessment Guidelines for Dredging (**NAGD**) (2009).

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals shall prepare and implement a Marine Wastewater Discharge Management Plan, to ensure that disposal of treated wastewater from operation of the BLNG Precinct facilities is undertaken and managed in a way that minimises the environmental impacts and is consistent with the local water quality environmental values. The plan shall include:

- details of the discharge including outfall location, outlet design and discharge volumes, rates and quality;
- construction method and management;
- identification of conditions used in hydrodynamic modelling which shall include any approved changes to water quality as a result of other outfall proposals; and
- results of hydrodynamic modelling of wastewater outfall in order to demonstrate compliance with the approval conditions, and environmental monitoring, contingencies and reporting.

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 7-4**.

■ **Table 7-4 Significance of Potential Impacts to Marine Sediment Quality.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Marine Site Disturbance and Excavation	<ul style="list-style-type: none"> Implementation of a Dredging and Dredge Spoil Disposal Management Plan. Implementation of a Port Facilities Construction EMP. Ecological and water quality monitoring. 	Low	<ul style="list-style-type: none"> High sediment quality currently within the BLNG Precinct area. Remote chance for mobilisation of contaminants during maintenance dredging where there has been an accumulation of material during the life of the BLNG Precinct. Accumulation of contaminants has not been observed within the existing port at Dampier. Short-term, small reduction in sediment quality. No exceedance of applicable ANZECC and NAGD Sediment Quality Guidelines expected. For more details refer to Part 3, Section 2.2.3.1.
Sediment Deposition and Turbidity	<ul style="list-style-type: none"> As above. 	Low	<ul style="list-style-type: none"> Impacts localised and short term given the natural coastal processes For more details refer to Part 3, Section 2.1.3.2.
Marine Discharges	<ul style="list-style-type: none"> Water quality treatment to achieve relevant criteria. Routine monitoring of water column. 	Low	<ul style="list-style-type: none"> Impacts localised. High-dispersive capability of the receiving environment. For more details refer to Part 3, Section 2.1.3.3.
¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in Part 3, Section 2.2 .			

7.2.3. Marine Water Quality

An ongoing water quality monitoring program, coupled with the use of historical satellite imagery analysis was used to characterise the existing marine water quality of the James Price Point coastal area. These studies established that the area contains highly variable levels of turbidity, largely associated with the macro-tidal regime and meteorological conditions. During times of naturally occurring high turbidity, such as during cyclones, light availability for benthic organisms (such as seagrass and macroalgae) is significantly reduced for relatively prolonged periods.

The most notable activity causing temporary change to water quality will be the large capital dredging program required to establish the shipping channel and port facilities. Dredging and disposal of dredge spoil is likely to result in an increase in sedimentation and turbidity around the marine construction activities and marine facilities. The associated impacts have been predicted through sediment dispersion/water quality modelling. Due to the nature of a Strategic Assessment and the need to provide flexibility for future proponents, it was important to develop a suitable 'base case' scenario that could be modelled to provide a conservative indication of potential environmental impacts. A sensitivity analysis was carried out to test the effect of altering the base case variables associated with the introduction of a large volume of fines into the James Price Point nearshore environment.

The model was used in the first instance, to approximate the dispersion of sediments from a nominal source location off James Price Point (nominated to represent the turning basin, where most dredging would be required). This model described the spreading, sedimentation and re-suspension of dredged sediments under the influence of seasonal water circulation patterns and the associated dispersion processes. This model focused on the dispersion of fine sediments (<63 micrometres (μm)) as the primary influence on water quality. Dredged spoil material will likely be disposed of at an offshore spoil ground and therefore, the sediment dispersion modelling and assessment has also taken this activity into account.

Modelling the base case scenario over a year of continuous fines discharge, determined the extent of sediment movement and subsequent impacts to water quality. Although there are observed seasonal variations, the modelling showed the potential extent of the plume is likely to extend roughly equally north and south of dredging activities (except during summer/neap conditions where the pressure field often extends further northward than southward). These results support the view that elliptical tidal circulation patterns in the James Price Point coastal area play a dominant role in water movement and sediment dispersion patterns.

The modelling and sensitivity analysis concluded that the impacts are typically temporary and that changes to water quality are not likely to extend to sensitive environments including the northern extent of Dampier Peninsula, the popular tourist beaches around Broome, the Lacepede Islands or Roebuck Bay.

The potential impact to water quality was an important consideration in the site selection process which led to the selection of James Prince Point as the preferred location for the Precinct. Modelling the base case has provided certainty that the siting was optimal to protect sensitive environments from the changes to water quality that would result from dredging activities.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals shall prepare and implement a Dredging and Dredge Spoil Disposal Management Plan, to the satisfaction of the Western Australian Minister for Environment, demonstrating the application of best practice management techniques and technologies to minimise potential dredging impacts. The Plan shall include:

- consideration of the re-use of suitable dredge material for MOF construction, where practicable;
- design of the MOF including construction of bunds to isolate fill material from wind and wave action;
- consideration of applicability of management techniques and technology in meeting location specific WQ environmental values and environmental quality objectives;
- consideration of re-use of reclaimed material to minimise ocean disposal;
- measures to minimise dredging impacts during sensitive ecological windows;
- a monitoring strategy for ecological receptors and health during marine construction (including baseline surveys);
- the development of trigger levels for benthic communities and water quality that define additional management responses;
- mechanisms to audit and assess environmental performance of proponents during construction; and

- a communications strategy to inform other local marine users of times of peak construction activity that may influence non-construction related activities within the area.

The DSDMP will be subject to assessment under the Commonwealth *Environment Protection (Sea Dumping) Act* 1981, including appropriate stakeholder consultation.

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 7-5**.

■ **Table 7-5 Significance of Potential Impacts to Marine Water Quality.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Marine Site Disturbance and Excavation	<ul style="list-style-type: none"> Implementation of a Dredging and Dredge Spoil Disposal Management Plan. Implementation of a Port Facilities Construction EMP. Ecological and water quality monitoring. 	High	<ul style="list-style-type: none"> Recent dredging programs on the North West Shelf have demonstrated that, given appropriate management and contingency procedures, prolonged dredging campaigns do not result in significant impacts to local environmental values. Based on industry experience, it is considered by the proponent that design and active management and monitoring measures can successfully mitigate impacts and achieve acceptable outcomes. For more details refer to Part 3, Section 2.3.4.1.
Marine Discharges (routine)	<ul style="list-style-type: none"> Implementation of a Wastewater Discharge Management Plan, which will include: <ul style="list-style-type: none"> hydrodynamic modelling; environmental monitoring; and water quality treatment. 	Low	<ul style="list-style-type: none"> Highly unlikely that contaminants will be detectable above background levels beyond the immediate mixing zone due to dynamic nature of receiving environment. Derived proponents will need to: <ul style="list-style-type: none"> achieve the relevant ANZECC / ARMCANZ water quality guidelines within an agreed mixing zone; and undertake regular ecotoxicity testing to target 99% species level of protection beyond the BLNG Port Area. For more details refer to Part 3, Section 2.3.4.2.
Marine Discharges (non-routine)	<ul style="list-style-type: none"> Implementation of spill prevention and rapid response measures. Hydrocarbon and Chemical Spill Contingency Plan. Future BLNG Precinct proponents to undertake oil spill modelling. 	Low	<ul style="list-style-type: none"> Likelihood of significant environmental impacts associated with spills reduced through site selection. James Price Point coastal area was selected as the site with least environmental constraints and environmental risks were likely to be manageable. For more details refer to Part 3, Section 2.3.4.2.
¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in Part 3, Section 2.3.			

7.2.4. Benthos including Benthic Primary Producers

Aspects associated with the construction and operation of the BLNG Precinct that could have an impact on benthos, including BPPs include site disturbance and excavation, sedimentation and turbidity, light emissions, marine discharges and the risk of invasive marine species (**IMS**). Potential impacts on marine habitats and benthos have been greatly reduced by locating the BLNG Precinct away from regionally significant coral reefs, seagrass and filter feeding communities.

The direct excavation and disturbance of substrate, predominantly during dredging activities, is largely confined to the footprint of marine infrastructure and the immediate surrounding area (largely limited to the Port Facility). The loss of benthic habitat resulting from impacts on water quality and light availability for photosynthesising BPPs, as a result of sediment deposition and turbidity associated with dredging and spoil disposal, extends over a greater area, however, this loss is considered temporary and recovery likely after dredging activities have ceased.

A range of management measures would be applied to mitigate key potential impacts on benthos. Depending on the nature of the derived proposal, such mitigation measures may include:

- Establishment of a Dredging Management Advisory Group (**DMAG**) to provide advice to the Proponent, EPA and/or the Minister for Environment as appropriate.
- Establishment of the Broome Port Authority as the statutory Port Authority for the BLNG Precinct and with regulatory functions for the associated port area.
- Preparation by the Broome Port Authority of a BLNG Precinct Port Environmental Management Plan for the port area, in consultation with DEC.
- Preparation and implementation of a range of Plans by proponents of derived proposals to the satisfaction of the Minister for Environment, including:
 - Invasive Marine Species Management Plan;
 - Port Facilities Construction Environmental Management Plan;
 - Dredging and Dredge Spoil Disposal Management Plan;
 - Hydrocarbon and Chemical Spill Contingency Plan; and
 - Marine Wastewater Discharge Management Plan.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals shall prepare and implement a Hydrocarbon and Chemical Spill Contingency Plan, to the satisfaction of the Western Australian Minister for Environment, for each activity, which addresses the following:

- effective and timely management of spills;
- roles and responsibilities of response personnel;
- procedures for incident response;
- objectives, targets and associated monitoring; and
- alignment and compliance with the State Government Precinct Emergency Response Plan.

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 7-6**.

■ **Table 7-6 Significance of Potential Impacts to Benthos including Benthic Primary Producers.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Marine Site Disturbance and Excavation	<ul style="list-style-type: none"> Identification of key environmental values. Development of water quality objectives and criteria within the Port through a BLNG Precinct Environmental Management Plan. 	Medium	<ul style="list-style-type: none"> While impacts are certain, they are anticipated to be confined in the vicinity of the BLNG Precinct. For more details refer to Part 3, Section 2.4.3.1.
Sediment Deposition and Turbidity	<ul style="list-style-type: none"> Derived proponents will be required to prepare and implement a Dredging and Dredge Spoil Disposal Management Plan. 	<p>Medium (Seagrass, algal and filter-feeders)</p> <p>Low (Corals)</p>	<ul style="list-style-type: none"> Seagrass, algal and filter-feeding communities are relatively abundant in area. Temporary loss, as the underlying conditions for re-colonisation would be present after the activity has been completed. Low coral abundance in the area. For more details refer to Part 3, Section 2.4.3.2.
Marine Discharges (routine)	<ul style="list-style-type: none"> Outfall designed to promote sufficient initial mixing to minimise the areal extent of the mixing zone within the Port area. Discharge location will be selected to minimise potential impacts to significant benthos. Proponents will be required to achieve the appropriate water quality guidelines, as demonstrated by modelling and monitoring. 	Low	<ul style="list-style-type: none"> Routine discharges would be confined to the BLNG Precinct.
(non routine)	<ul style="list-style-type: none"> Measures to prevent loss of containment. Rapid response procedures. 	Very Low	<ul style="list-style-type: none"> Non-routine release events are restricted to surface waters, and benthic organisms are unlikely to be exposed to discharges at the site of a spill. Non-routine release events are unlikely. For more details refer to Part 3, Section 2.4.3.3.
Invasive Marine Species	<ul style="list-style-type: none"> Enforcement of IMS inspection requirements. Port Authority EMP to include preparation and enforcement of vessel operating requirements including IMS management. 	Low	<ul style="list-style-type: none"> Introduction and establishment of IMS, as a result of BLNG Precinct activities, unlikely, due to the low endemism, high biodiversity and competitive exclusion exhibited by existing biota. Industry experience indicates that design and management measures can be expected to be successful to mitigate against this potential impact. For more details refer to Part 3, Section 2.4.3.4.
¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in Part 3, Section 2.4 .			

7.2.5. Fish

The construction and operation of the BLNG Precinct has the potential to impact on fish communities in the immediate vicinity through loss of supporting habitat, changes in habitat quality, physical presence of infrastructure, potential introduction of invasive marine species and increased noise levels and vibration. These potential impacts are predominantly associated with the construction phase (in particular the site disturbance, excavation, sediment deposition and turbidity associated with dredge activities), but ongoing effects may also result from marine discharges, light emissions and the physical presence of the Port Facilities. Fish likely to occur at James Price Point are representative of the wider Canning Marine Bioregion, these effects are unlikely to be significant at a regional or species level.

A range of management measures would be applied to mitigate potential impacts on fish. Depending on the nature of the derived proposal, such mitigation measures may include:

- Development of local water quality environmental values and objectives, incorporating the marine waters off James Price Point, which are consistent with the WA State Water Quality Management Strategy.
- Establishment of the Broome Port Authority as the statutory Port Authority for the BLNG Precinct and with regulatory functions for the associated port area.
- Preparation by the Broome Port Authority of a BLNG Precinct Marine Environmental Management Plan for the port area, in consultation with DEC.
- Preparation and implementation of a range of Plans by proponents of derived proposals to the satisfaction of the Minister for Environment, including:
 - Invasive Marine Species Management Plan;
 - Port Facilities Construction Environmental Management Plan;
 - Dredging and Dredge Spoil Disposal Management Plan;
 - Hydrocarbon and Chemical Spill Contingency Plan; and
 - Marine Wastewater Discharge Management Plan.
- Conditions on derived proposals requiring that commercial proponents:
 - ensure that bioaccumulation toxicant concentrations in discharges meet relevant ANZECC/ARMCANZ (2000) NWQMS species protection guideline levels within and at the boundary of the mixing zone; and
 - verify the performance of outfalls in terms of achieving the required dilutions, under a range of flow rates, meteorological and sea state, immediately following commissioning of wastewater plants.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals shall prepare and implement a Port Facilities Construction EMP, which may include the following environmental management measures:

- scheduling blasting for daylight hours only, avoiding dawn and dusk, to allow for effective visual monitoring and minimising health and safety concerns;
- smaller, more frequent blasts planned using sequential explosive charges to minimise cumulative impacts of the explosions, as opposed to less frequent, larger blasts;
- warning charges used to encourage animals to move away from the construction area prior to a blast detonation;
- shaped charges used to focus blast energy along fracture lines; and
- reference to Listing Advice and approved Conservation Advice for *Pristis* spp.

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 7-7**.

■ **Table 7-7 Significance of Potential Impacts to Fish.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Physical Presence	<ul style="list-style-type: none"> Implementation of a Port Facilities Construction Environmental Management Plan. 	Very Low	<ul style="list-style-type: none"> Localised nature of the marine infrastructure associated with the BLNG Precinct. For several species of fish and invertebrates with pelagic larvae, mean larval dispersal distances are in the order of 25–150km. Impacts associated with shading are likely to be minimal and localised to individuals that utilise the habitat within the footprint. The provision of additional hard substrate and additional structural complexity will encourage the settlement of a variety of marine invertebrates creating potentially new habitat for fish. For more details refer to Part 3, Section 2.5.4.1.
Marine Site Disturbance and Excavation	<ul style="list-style-type: none"> Implementation of a Port Facilities Construction Environmental Management Plan. 	Low	<ul style="list-style-type: none"> It is predicted that fish will avoid the area during construction. Impacts will be temporary and localised and not threaten community viability. Permanent loss of habitat will be small. Outside of the direct disturbance, re-colonisation of benthos and recovery in population numbers will occur over time. For more details refer to Part 3, Section 2.5.4.2.
Sediment Deposition and Turbidity	<ul style="list-style-type: none"> Implementation of a Dredging and Dredge Spoil Disposal Management Plan. 	Low	<ul style="list-style-type: none"> No unique or structurally complex habitats containing a high diversity or abundance of BPPs and filter feeders were observed within the area directly offshore from James Price Point. Impacts from the sediment plume to areas of more complex habitats (e.g. Coulomb Point and Quondong Point), would be temporary with recovery of benthos and primary producers anticipated within five years from the cessation of dredging. Fish are predicted to return to certain areas of impact once suitable habitat has recovered. For more details refer to Part 3, Section 2.5.4.3.
Marine Noise and Vibration	<ul style="list-style-type: none"> Implementation of a Port Facilities Construction Environmental Management Plan. Adoption of measures such as soft-start piling, where practicable. 	Low	<ul style="list-style-type: none"> Behavioural changes that may result would not lead to mortality of individuals. Noise and vibration arising from ships, boats, dredgers, aircraft and pipe-laying activities during the construction and operations phase appear unlikely to result in acute effects. For more details refer to Part 3, Section 2.5.4.4.

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Marine Discharges (routine)	<ul style="list-style-type: none"> Outfall to be designed such that there will sufficient initial mixing to minimise the areal extent of the mixing zone within the Port area. Proponents will be required to achieve appropriate water quality guidelines, as demonstrated by modelling and monitoring. 	Low	<ul style="list-style-type: none"> Dynamic nature of the marine environment, resulting in diurnal flushing of nearshore waters by the strong tidal movement. Mobile species can move away from the affected area and are likely to avoid any deleterious effects. Routine discharges would be confined to the BLNG Precinct.
(Non-routine)	<ul style="list-style-type: none"> Hazardous liquids stored and handled in accordance with industry standards. Implementation of an Emergency Response Plan and Hydrocarbon and Chemical Spill Contingency Plan in the unlikely event that a major spill does occur. 	Low	<ul style="list-style-type: none"> Any impacts are unlikely to result in population level effects. For more details refer to Part 3, Section 2.5.4.5.
Invasive Marine Species	<ul style="list-style-type: none"> Enforcement of IMS inspection requirements. Port Authority EMP to include preparation and enforcement of vessel operating requirements including IMS management. 	Very Low	<ul style="list-style-type: none"> It is generally considered unlikely that an IMS would successfully establish and have an impact on fish given the resilience of the fauna within the Precinct area (Hutchings <i>et al.</i>, 2002). For more details refer to Part 3, Section 2.5.4.6.
¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in Part 3, Section 2.5.			

7.2.6. Marine Mammals

Development of the BLNG Precinct has the potential to affect marine mammals via marine noise, vessel movements, infrastructure presence and loss and/or changes to habitat. The selection of a location in the vicinity of James Price Point for the Precinct has significantly reduced potential impacts on marine mammals. Benthic habitat studies and extensive marine mammal surveys have confirmed that James Price Point does not represent regionally significant foraging habitat and its location avoids potential impacts on recognised humpback whale calving and resting areas. Residual effects are expected to be largely temporary and localised, involving a small proportion of the regional population for any species and unlikely to be significant at species level.

Marine noise and vibration is considered a key aspect with the potential to impact on marine mammals, particularly during the construction phase. High intensity impulsive noises associated with marine construction activities, such as blasting and piling, will be managed to ensure the potential for physiological effects is minimised but may result in a localised behavioural response to individuals occurring in the immediate port area and result in avoidance of the port construction areas. No detectable decreases in abundance or lasting effects on population are likely to occur.

The risk to marine mammals from vessel movements during construction and operational activities will proportionally increase from the current level of risk in the region due to existing vessel traffic. Restrictions will be placed on vessel speeds and routes to minimise potential effects.

A range of management measures would be applied to mitigate key potential impacts on marine mammals. Depending on the nature of the derived proposal, such mitigation measures may include:

- Establishment of the Broome Port Authority as the statutory Port Authority for the BLNG Precinct, with regulatory functions for navigation and construction in the port area.
- Preparation by the Broome Port Authority of a BLNG Precinct Port Environmental Management Plan for the port area, in consultation with DEC.
- Preparation and implementation of a range of Plans by proponents of derived proposals to the satisfaction of the Minister for Environment, including:
 - A Marine Fauna and Vessel Interaction Management and Monitoring Strategy;
 - Dredging and Dredge Spoil Disposal Management Plan;
 - Vessel Management Plan; and
 - Port Facilities Construction Environmental Management Plan.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals shall prepare and implement a Vessel Management Plan (VMP), which may include the following measures:

- vessel speed restrictions within the Marine Precinct Port area;
- training for selected vessel crew to sight and manage interactions with marine mammals; and
- vessel contractor(s) to be provided with a map showing sensitive environmental features, including humpback whale aggregation areas and foraging areas for dugongs. These areas will be avoided as far as practicable.

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 7-8**.

■ **Table 7-8 Significance of Potential Impacts to Marine Mammals.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Marine Noise and Vibration	<ul style="list-style-type: none"> Use of warning charges and soft-start procedures to encourage animals to move away from the construction area. Port Facilities Construction Environmental Management Plan which would include a range of measures to manage marine mammal interactions. 	Low	<ul style="list-style-type: none"> No detectable decreases in abundance or lasting effects on population are likely to occur. Industry experience indicates that proposed management measures can be expected to be successful. For more details refer to Part 3, Section 2.6.3.1.
Sediment Deposition, Turbidity, Marine Site Disturbance and Excavation	<ul style="list-style-type: none"> Implementation of a Dredging and Dredge Spoil Disposal Management Plan. 	Low	<ul style="list-style-type: none"> Limited seagrass (dugong habitat) present. Localised impacts. No detectable impacts to communities or populations expected. For more details refer to Part 3, Section 2.6.3.2.
Marine Discharges (routine)	<ul style="list-style-type: none"> Outfall to be designed such that there will be sufficient initial mixing to minimise the areal extent of the mixing zone within the Port area Proponents will be required to achieve appropriate water quality guidelines. 	Very Low	<ul style="list-style-type: none"> Low concentrations of contaminants expected in the BLNG Precinct treated wastewater. High rates of dilution at the points of discharge and the reduced extent of the mixing zone will result in intermittent exposure of marine mammals.
(Non-routine)	<ul style="list-style-type: none"> Hazardous liquids stored and handled in accordance with industry standards. Implementation of an Emergency Response Plan and Hydrocarbon and Chemical Spill Contingency Plan in the unlikely event that a major spill does occur. 	Very Low	<ul style="list-style-type: none"> Relatively small inventory of hydrocarbons present during construction. Mammals are expected to only have minimal exposure prior to moving away from the area. For more details refer to Part 3, Section 2.6.3.3.
Vessel Movement	<ul style="list-style-type: none"> Implementation of a marine fauna and vessel interaction management and monitoring strategy. Vessel speed restrictions within the Marine Precinct Port area. 	Low	<ul style="list-style-type: none"> Experience at other ports along the north-west WA coast indicates that cetaceans successfully cross major shipping corridors (i.e. Port Hedland and Dampier Ports) and continue their migration, with little evidence of vessel strike incidents. No significant impact to population viability is anticipated. For more details refer to Part 3, Section 2.6.3.4.

¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in **Part 3, Section 2.6.**

7.2.7. Marine Reptiles

The aspects of the BLNG development with the greatest potential to affect marine reptiles are marine noise and vibration, sedimentation, site disturbance and excavation activities. High intensity noises emitted during marine construction activities, such as piling, are likely to disturb individual marine reptiles within the immediate area and result in temporary avoidance of the areas affected by construction. Site disturbance and excavation activity will cause an indirect impact on reptiles associated with the loss of benthos, resulting in a reduction in foraging habitat. The majority of habitat loss has been assessed as temporary, and will not significantly impact food resource availability for marine reptiles, given the other extensive foraging areas throughout the adjacent Dampier Peninsula coastal region. Effects on the nearest regionally significant turtle nesting beaches, such as the Lacepede Islands approximately 65km north of the James Price Point coastal area, are not expected because the localised nature of impacts will not extend that distance.

A range of management measures would be applied to mitigate potential impacts on marine reptiles. Depending on the nature of the derived proposal, such mitigation measures may include:

- Establishment of the Broome Port Authority as the statutory Port Authority for the BLNG Precinct, with regulatory functions for navigation and construction in the port area.
- Preparation by the Broome Port Authority of a BLNG Precinct Port Environmental Management Plan for the port area, in consultation with DEC.
- The preparation and implementation of a range of Plans by proponents of derived proposals to the satisfaction of the Minister for Environment, including:
 - Dredging and Dredge Spoil Disposal Management Plan;
 - Vessel Management Plan; and
 - Port Facilities Construction Environmental Management Plan.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals shall prepare and implement a Vessel Management Plan (VMP), which may include the following measures:

- vessel speed restrictions within the Marine Precinct Port area;
- training for selected vessel crew to sight and manage interactions with marine fauna; and
- vessel contractor(s) to be provided with a map showing sensitive environmental features, including key turtle nesting areas. These areas will be avoided as far as practicable.

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 7-9**.

■ **Table 7-9 Significance of Potential Impacts to Marine Reptiles.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Marine Noise and Vibration	<ul style="list-style-type: none"> Adopting soft-start piling, where practicable to trigger avoidance before impacts occur. 	Very Low	<ul style="list-style-type: none"> The James Price Point coastal area does not support consistently high densities of turtles. Noise associated with vessel activity is unlikely to result in turtle population level effects. Any behavioural changes that may result would not lead to mortality of individuals. For more details refer to Part 3, Section 2.7.3.1.
Sediment Deposition, Turbidity, Marine Site Disturbance and Excavation	<ul style="list-style-type: none"> Implementing a Port Facilities Construction Environmental Management Plan (PFCEMP). 	Low	<ul style="list-style-type: none"> The James Price Point coastal area does not support consistently high densities of turtles. Direct and indirect impacts are unlikely to result in turtle population level effects. For more details refer to Part 3, Section 2.7.3.2.
Marine Discharges (routine)	<ul style="list-style-type: none"> Outfall to be designed such that there will sufficient initial mixing to minimise the areal extent of the mixing zone within the Port area Proponents will be required to achieve appropriate water quality guidelines. 	Very Low	<ul style="list-style-type: none"> The James Price Point coastal area does not support consistently high densities of turtles. Low concentrations of contaminants expected in the BLNG Precinct treated wastewater. High rates of dilution at the points of discharge and the reduced extent of the mixing zone will result in low and intermittent exposure.
(Non-routine)	<ul style="list-style-type: none"> Hazardous liquids stored and handled in accordance with industry standards. Implementation of an Emergency Response Plan and Hydrocarbon and Chemical Spill Contingency Plan in the unlikely event that a major spill does occur. 		<ul style="list-style-type: none"> Relatively small inventory of hydrocarbons present during construction, controls to be in place throughout all operations. For more details refer to Part 3, Section 2.7.3.3.
Light Emissions	<ul style="list-style-type: none"> No specific measures proposed for managing light emissions on marine turtles given the lack of significance of the James Price Point coastal area for these species. Management measures to reduce light impacts on social receptors will also synergistically reduce light emissions for marine and terrestrial species. 	Very Low	<ul style="list-style-type: none"> Significant turtle nesting habitat is located at distance (over 60km) from Precinct. There are no significant turtle nesting beaches in the immediate James Price Point coastal area. Impacts will be highly localised, minimal and not at the population level. For more details refer to Part 3, Section 2.7.3.4.
Vessel Movements	<ul style="list-style-type: none"> Implementation of a marine fauna and vessel interaction management and monitoring strategy. Briefing vessel contractors of sensitive environmental features. Restricting vessel speeds. 	Very Low	<ul style="list-style-type: none"> No detectable impact to communities and populations would occur. Impacts will be highly localised, minimal and not at the population level. For more details refer to Part 3, Section 2.7.3.5.

¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in **Part 3, Section 2.7.**

7.2.8. Marine Ecosystem Integrity

The construction and operation of the BLNG Precinct, in particular the dredging and nearshore marine construction, has the potential to impact marine ecosystem integrity, primarily through the increased risk of invasive marine species becoming established. The location of the BLNG Precinct away from regionally significant marine ecosystems was a key management strategy to enable potential impacts to ecosystems to be adequately managed.

A range of management measures would be applied to mitigate potential impacts on marine system integrity. Depending on the nature of the derived proposal, such mitigation measures may include:

- Establishment of a Dredging Management Advisory Group to provide advice to the proponent, EPA and/or the Minister for Environment as appropriate.
- Establishment of the Broome Port Authority as the statutory Port Authority for the BLNG Precinct and with regulatory functions for the associated port area.
- Preparation by the Broome Port Authority of a BLNG Precinct Port Environmental Management Plan for the port area, in consultation with DEC.
- Preparation and implementation of a range of Plans by proponents of derived proposals to the satisfaction of the Minister for Environment, including:
 - Invasive Marine Species Management Plan;
 - Port Facilities Construction Environmental Management Plan;
 - Dredging and Dredge Spoil Disposal Management Plan;
 - Hydrocarbon and Chemical Spill Contingency Plan; and
 - Marine Wastewater Discharge Management Plan.

The establishment of invasive marine species as a result of the BLNG Precinct could lead to an irreversible loss of BPPH; however, the likelihood of this occurring with appropriate management measures in place is remote, due to the low endemism, high biodiversity and competitive exclusion exhibited by existing biota.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals shall prepare and implement an Invasive Marine Species Management Plan (IMSMP), to the satisfaction of the Western Australian Minister for Environment on advice from and in consultation with the Department of Fisheries, to minimise the risk of introducing IMS into Australian waters during the life of the activity. The plan shall be developed in consultation with the AQIS and will be applied to vessels, barges and immersible equipment that plan to enter and operate within the Precinct. The IMSMP will be consistent with the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry, and will adhere to the AQIS Australian Ballast Water Management Requirements under the Quarantine Act (1908).

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 7-10**.

■ **Table 7-10 Significance of Potential Impacts to Marine Ecosystem Integrity.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Physical Presence	<ul style="list-style-type: none"> Commercial proponents to demonstrate application of best practice management and mitigation measures to minimise impacts on coastal processes from onshore and nearshore marine infrastructure. 	Low	<ul style="list-style-type: none"> Impacts associated with the physical presence of the marine infrastructure will be localised to the BLNG Precinct project area, and are not expected to affect ecosystem integrity at a bioregional scale. For more details refer to Part 3, Section 2.8.3.1.
Marine Site Disturbance and Excavation	<ul style="list-style-type: none"> Identification of key environmental values and development of water quality objectives and criteria within the Port through a BLNG Precinct Environmental Management Plan (BPEMP). 	Low	<ul style="list-style-type: none"> The recovery of local ecosystem stability and productivity is predicted to occur within the short-term. A potential release of sediment contaminants would be very localised to within the direct vicinity of the activities and would not impact on surrounding waters due to rapid dilution. For more details refer to Part 3, Section 2.8.3.2.
Sediment Deposition and Turbidity	<ul style="list-style-type: none"> Demonstration of best practice management techniques and technologies which would be applied to minimise potential dredging impacts. Ecological and water quality monitoring. 	Low	<ul style="list-style-type: none"> The recovery of local ecosystem stability and productivity is predicted to occur within the short-term. Impacts localised and short term given the natural coastal processes. For more details refer to Part 3, Section 2.8.3.3.
Marine Noise and Vibration	<ul style="list-style-type: none"> Port Facilities Construction Environmental Management Plan which would include a range of measures to manage marine fauna interactions such as soft-start piling, where practicable. 	Low	<ul style="list-style-type: none"> Given the localised and intermittent nature of primary noise-generating activities, therefore not predicted to result in ecosystem level effects. For more details refer to Part 3, Section 2.8.3.4.
Marine Discharges	<ul style="list-style-type: none"> Outfall designed to promote sufficient initial mixing to minimise the areal extent of the mixing zone within the Port area. Discharge location will be selected to minimise potential impacts to significant benthos. Proponents will be required to achieve appropriate water quality guidelines, as demonstrated by modelling and monitoring. Measures to prevent loss of containment. Rapid response procedures. 	Medium	<ul style="list-style-type: none"> Impacts from routine marine discharges would be localised (i.e. within the mixing zone) and are unlikely to have effects on the broader marine ecosystem. With the application of proposed preventative and mitigation measures, impacts can be managed to achieve acceptable outcomes. For more details refer to Part 3, Section 2.8.3.5.
Invasive Marine Species	<ul style="list-style-type: none"> Enforcement of IMS inspection requirements. Port Authority EMP to include preparation and enforcement of vessel operating requirements including IMS management. IMSMP to be developed in consultation with the Australian Quarantine Inspection Service (AQIS) and will be applied to vessels, barges and immersible equipment that plan to enter and operate within the Precinct. 	Low	<ul style="list-style-type: none"> Introduction and establishment of IMS, as a result of BLNG Precinct activities, unlikely, due to the low endemism, high biodiversity and competitive exclusion exhibited by existing biota. Industry experience indicates that design and management measures can be expected to be successful to mitigate against this potential impact. For more details refer to Part 3, Section 2.8.3.6.

¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in **Part 3, Section 2.8.**

8. Environmental Assessment – Terrestrial

The proposed BLNG Precinct is situated within the Kimberley region, however, from a terrestrial bioregional perspective it is more accurately defined as being in the Dampierland Bioregion and the Pindanland subregion of this Bioregion which includes the Dampier Peninsula (DEC, 2009a and DEWHA, 2004). The area is associated with a number of important features including monsoon vine thickets, vast grassland of the Roebuck Plains, coastal swamps adjacent to Eighty Mile Beach and a number of rare plants. The Kimberley region also supports an active population of people with a diversity of backgrounds, experiences, and interests with many utilising the terrestrial resources of the Bioregion. These are discussed further in **Part 5** (Social Impact Assessment).

The following tables summarise the existing physical and ecological terrestrial environment of the Dampierland Bioregion and in particular, the more localised James Price Point coastal area and outline the impacts and mitigation measures for the key terrestrial environmental values.

In most instances, the significance of residual impact, following the implementation of mitigation measures, was assessed to be low or very low. One exception to this was related to impacts on Terrestrial Flora and Vegetation where the clearing for the development is unable to be avoided and the impact was assessed as high, in particular because of the necessity to clear a small area of monsoon vine thicket on the coastal fringe. To the extent possible, this impact was minimised through the refined site selection process by setting the Precinct back from the coast. However, it could not be totally avoided without the likelihood of significantly increasing marine impacts and risks to Indigenous heritage. To address this residual impact, increased protection and improved management of the vegetation on the Dampier Peninsula, in particular monsoon vine thicket, is proposed.

The only other instance where residual impacts were not assessed as low or very low related to the impact which the physical presence of the BLNG Precinct would have on groundwater recharge which was assessed as medium significance. Although this potential impact was considered to be very localised, it would be long term. Monitoring of the impacts of this would be undertaken and responses developed as necessary. The management framework presented in the Strategic Assessment Report is focused on the mitigation of potential downstream ecological impacts relevant to this assessment.

Overall, the assessment of the impacts on the terrestrial environment demonstrates that the site selection process undertaken by the Northern Development Taskforce succeeded in ensuring that most areas of environmental significance or sensitivity were avoided. It also supports the S16(e) advice of the Environmental Protection Authority that environmental risks and impacts were likely to be manageable (EPA, 2008). For example, the site selection resulted in most impacts being on Pindan vegetation which is very common on the Dampier Peninsula (representing approximately 90% of known extent of all vegetation communities) and which, through improved management measures, can have its environmental condition enhanced to maintain or improve overall environmental outcomes on the Peninsula.

8.1. Existing Terrestrial Environment

8.1.1. Physical Characteristics

While some preliminary on-site geotechnical investigations have been completed to date, much of the physical terrestrial information for the BLNG Precinct has been inferred based on what is currently known of the broader Dampier Peninsula and James Price Point coastal area. Future geotechnical studies and hydrogeological investigations are proposed and will provide further information specific to the James Price Point coastal area for use in engineering design by future proponents within the Precinct.

Occurring on the western edge of the Dampier Peninsula, many of the physical terrestrial features of the James Price Point coastal area are typical of the broader Dampier Peninsula. Key features include vast undulating Pindan sand plains, which are known for their poor surface drainage and subsequent sheet erosion, as well as an absence of the extensive river systems typical of the northern Kimberley region.

The key physical characteristics of the terrestrial environment of the James Price Point coastal area are summarised in **Table 8-1**.

■ **Table 8-1 Terrestrial Physical Characteristics.**

	Description
Geology	<ul style="list-style-type: none"> Quaternary age sand plains and beach dune complexes to a depth of approximately 30m occur across much of the James Price Point area. Broome Sandstone is a key geological feature which occurs to depths of approximately 300m across much of the Dampier Peninsula, including in the James Price Point area. Remaining geological features of the Dampier Peninsula and James Price Point area include the Jarlemai Siltstone, Alexander Formation and Wallal Sandstone.
Soils and landforms	<ul style="list-style-type: none"> The topography of the James Price Point coastal area is relatively flat with elevation rising gradually towards the east. Pindan sand plains dominate the James Price Point coastal area and Dampier Peninsula occurring to a depth of 5 – 20m. An elevated coastal dune system, approximately 20m in height, occurs between James Price Point and Quondong Point. North of James Price Point itself 6m high soft Pindan Cliffs form the boundary of the shoreline along parts of the coastline. Potential acid sulphate soils may be associated with the shallow sedimentary basins that form at the intersection of the coastal dune sands.
Surface water	<ul style="list-style-type: none"> No permanent freshwater systems occur within the James Price Point coastal area. Several ephemeral drainage lines occur and are expected to flow following high intensity rainfall events. Drainage lines predominately run east-west and discharge to the ocean north of James Price Point or flow to natural drainage basins occurring at the landward side of the dune system between James Price Point and Quondong Point. Overland sheet flow is a common feature of Pindan sand plains of the Dampier Peninsula and is expected to occur within the James Price Point coastal area.
Groundwater	<ul style="list-style-type: none"> Major aquifer systems are represented by the Broome Sandstone Aquifer, Wallal Aquifer and deeper Permian age rocks of the Poole Sandstone and Grant Group Aquifers. Groundwater levels in the Broome Sandstone are about 2m Australian Height Datum (AHD) near the coast, reflecting an unconfined aquifer with groundwater flow to the sea. This aquifer occurs to a depth of approximately 60m. Broome Sandstone Aquifer is fresh with salinities in the range of 250 – 500mg/L total dissolved solids (TDS) inland from the coast. Recharge to the Broome Sandstone Aquifer is likely to be via outcrop areas or direct infiltration from Pindan sands. Superficial aquifers are likely to occur immediately above the Broome Sandstone. Superficial aquifers and/or the Broome Sandstone Aquifer may help to support coastal vegetation such as monsoon vine thicket and drainage basin communities.
Groundwater Use	<ul style="list-style-type: none"> The Dampier Peninsula is located within the Canning-Kimberley Groundwater Area. Groundwater abstraction is subject to licensing under the <i>Rights in Water and Irrigation Act 1914 (RIWI Act)</i>. There are 10 groundwater licences on the Dampier Peninsula, outside the Broome Groundwater Area, totalling around 0.35 gegalitres (GL) per year. The groundwater is used for a variety of purposes including agro-forestry, community water supply, petroleum exploration and road infrastructure maintenance. The Broome town water supply is sourced from a borefield located within the Broome Water Reserve to the northeast of the town. Water is extracted from the Broome Sandstone Aquifer.

8.1.2. Ecological Characteristics

The Dampier Peninsula is located within the Pindanland subregion of the Dampierland Bioregion (DEWHA, 2004). The Pindanland subregion is characterised by the vast sand plains supporting pindan vegetation which cover much of the Dampier Peninsula.

Vegetation and habitats of the James Price Point coastal area are dominated by Pindan shrubland and woodland vegetation. Importantly monsoon vine thicket, a State-listed Threatened Ecological Community (**TEC**), occurs in association with the coastal dunes between Quondong Point and James Price Point, and elsewhere in the Dampier Peninsula in small scattered pockets. The flora and fauna species and habitat assemblages occurring within the James Price Point coastal area are typical of much of the surrounding Dampier Peninsula and support habitats for priority flora and fauna species of conservation significance. While there has been little past disturbance as a result of clearing activities, the James Price Point coastal area is currently subject to ongoing pressures associated with weed invasion, introduced terrestrial pests and altered fire regimes. As part of the former Waterbank Station, the James Price Point coastal area was historically subjected to heavy grazing pressure, however current impacts from grazing are considered to be low.

The key ecological characteristics of the terrestrial environment of the James Price Point coastal area are summarised in **Table 8-2**.

■ **Table 8-2 Terrestrial Ecological Characteristics.**

	Description
Flora and Vegetation	<ul style="list-style-type: none"> Vegetation of the Dampier Peninsula includes coastal dune and beach communities, sand plain communities, and monsoon vine thickets. The James Price Point coastal area has moderate to high local species richness. Pindan shrubland and woodland communities are the dominant vegetations type occupying the landward areas of the James Price coastal Point area. Flora and vegetation communities of conservation significance in the vicinity of James Price Point include priority flora species, monsoon vine thicket vegetation, drainage basin vegetation, and coastal heath vegetation. The flora and vegetation communities of conservation significance recorded within the James Price Point coastal area are known to occur elsewhere on the Dampier Peninsula where suitable habitat occurs. Vegetation in the vicinity of James Price Point is considered to be in good to very good condition; however, specific areas are subject to disturbance from weed invasion and altered fire regimes.
Introduced flora	<ul style="list-style-type: none"> Weeds are considered a major threat to the conservation of biodiversity assets on the Dampier Peninsula. A total of 22 weed species are known to occur in the James Price Point coastal area. The most widespread serious weeds within the James Price Point coastal area are Buffel grass (<i>Cenchrus ciliaris</i>) and Kapok bush (<i>Aerva javanica</i>). Weeds primarily occur in association with previously disturbed areas, such as along Manari Road and around informal camping areas.
Fauna habitats	<ul style="list-style-type: none"> Seven main habitat units were identified within the James Price Point coastal area, based on differences in substrate, vegetation and landform. None of the identified habitats are restricted to the James Price Point coastal area. Monsoon vine thickets at James Price Point have been identified as an important habitat assemblage. All vegetation communities provide some habitat potential for State and Commonwealth listed fauna species.
Terrestrial fauna	<ul style="list-style-type: none"> Wet and dry season surveys found direct or indirect evidence of 194 vertebrate species at James Price Point, comprising 21 mammals, 51 reptiles, four amphibians and 118 bird species. Eight fauna species of conservation significance were recorded and a further eleven species determined to possibly occur within the area based on the presence of suitable habitat. Fauna habitats are generally widespread and there are no habitats critical to the survival of conservation significant species identified within the James Price Point coastal area. In comparison with other sites on or near the Dampier Peninsula, the coastline between Coulomb Point and Quondong Beach supports relatively low numbers of migratory shorebirds. Based on underlying geology, it is unlikely that any regionally significant habitat for subterranean fauna occurs within the James Price Point coastal area. The potential presence of short range endemic (SRE) invertebrates is currently uncertain and will be subject to further studies.
Introduced fauna	<ul style="list-style-type: none"> Four species of introduced fauna are known to occur in the James Price Point coastal area: the feral cat; domestic house mouse; black rat; and domestic cattle. Introduced fauna species are known to be having a negative impact on fauna populations within the Kimberley region.
Fire regimes	<ul style="list-style-type: none"> Fire is recognised as an important process for maintaining vegetation structure, as it aids regeneration of some species, however, changed fire regimes have detrimentally impacted on biodiversity throughout the Dampier Peninsula. The majority of the James Price Point coastal area has been burnt three to four times within the 12-year period between 1997 and 2009, which is more frequent than is optimum for the majority of vegetation types in this area.

8.1.3. Atmospheric Characteristics

There are no major man-made atmospheric emission sources in the vicinity of James Price Point. A combination of bushfires, dust storms and remote industrial activities are currently the major causes of reduced air quality in the Kimberley. While not in close proximity to James Price Point, key pollution generating industries within the Kimberley include electricity generation, iron ore mining, quarrying, and other non-metalliferous mining activities.

Background noise levels within the James Price Point area are generally attributed to non-anthropogenic sources, such as wave action on the beach or faunal calls. Some minor contribution comes from passing and visiting tourists and recreational users along the coastal area; however, these noise levels are generally transient and will not be consistent in level. There are no permanent populations within the James Price Point area; the nearest permanent residential receptor is at Willie Creek some 30km south of James Price Point. However, there are temporary or transient residents that use the area for recreational four-wheel driving, camping, fishing and other outdoor pursuits.

The key atmospheric characteristics of the James Price Point coastal area are summarised in **Table 8-3**.

■ **Table 8-3 Key Atmospheric Characteristics.**

	Description
Meteorology	<ul style="list-style-type: none"> The Kimberley region has a tropical monsoonal climate that is characterised by a hot and humid 'wet' season from November to March (summer) and a 'dry' season (winter) from April to October. The mean maximum monthly temperature fluctuates between 29 degrees Centigrade (°C) in July and 40°C in November. The mean minimum monthly temperature ranges between 14°C in July and 26°C in December. Ninety percent of the Kimberley's rainfall occurs during the wet season, resulting in large volumes of water being discharged into the ocean from the region's main rivers. Annual wind patterns are dominated by westerly winds (blowing approximately 19% of the year at speeds typically between 3.5 and 8.8m per second (m/s)). On average, Broome is affected by cyclone-induced gale-force winds approximately once every four years.
Air quality	<ul style="list-style-type: none"> Fires are the dominant source of pollutants in the region. High levels of pollutants result from the very large area of land burned, and the accumulation of pollutants as the fires burn for several days. There are no major anthropogenic emission sources in the James Price Point coastal area or generally within the Dampier Peninsula with the exception of prescribed burning. Current information indicates that for the pollutants of most concern at a regional level (particulates, ozone and Nitrogen Dioxide (NO₂), concentrations may occasionally approach or exceed National Environment Protection Measure (NEPM) ambient air standards from existing contributing sources.
Greenhouse gases	<ul style="list-style-type: none"> There are no major anthropogenic greenhouse gas emission sources in the James Price Point coastal area, with the exception associated with prescribed burning of vegetation.
Ambient light	<ul style="list-style-type: none"> No permanent artificial light sources exist at the James Price Point coastal area as the site is located on a relatively undeveloped stretch of coastline. Night time light would be expected from non-anthropogenic sources such as the moon. Occasional and low level light emissions could occur from short-term fishing, vessel mooring, aquaculture activities or recreational camping in the area.

8.2. Terrestrial Environment – Impacts and Mitigation Measures

8.2.1. Soils and Geomorphology

Local soils and geomorphology may be affected as a result of site excavation activities during construction, the ongoing physical presence of onshore processing facilities and service corridors, terrestrial wastes and discharges, and as a result of an altered fire regime.

Impacts related to these aspects are expected to be localised, and in most cases, restricted to the direct clearing and construction footprints of the BLNG Precinct facilities and service corridors.

A range of management measures would be applied to mitigate potential impacts on soils and geomorphology. Depending on the nature of the derived proposal, such mitigation measures may include:

- Preparation and implementation of a Closure and Decommissioning Strategy by the State Government.
- Preparation of a Final Closure Plan by proponents of derived proposals as a condition of approval.
- Preparation and implementation of a range of Plans by proponents of derived proposals to the satisfaction of the Minister for Environment, including:
 - Construction Environmental Management Plans;
 - Rehabilitation Plans;
 - Hydrocarbon and Chemical Spill Contingency Plans; and
 - Waste Management Plans.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents will be required to prepare a CEMP, which may include environmental management measures such as:

- site levelling and preparation activities staged to avoid exposing large areas of soil to wind and water erosion;
- cut and fill excavation shaped to maintain slope stability;
- temporary erosion control berms, drains and sediment barriers installed as necessary and maintained until final construction clean-up is completed;
- ground stabilisation techniques established in more vulnerable cleared areas such as unstable sections of dunes and areas of excessive sheet flow;
- runoff control measures adopted around potential onshore dredge spoil storage areas;
- presence or absence of acid sulphate soils to be determined and managed accordingly; and
- dust suppression techniques adopted during construction such as water or surface stabilisation.

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 8-4**.

■ **Table 8-4 Significance of Potential Impacts to Soils and Geomorphology.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Site Disturbance and Excavation	<ul style="list-style-type: none"> Standard management measures such as slope stabilisation and erosion control. 	Low	<ul style="list-style-type: none"> Impacts will be localised. Considered by the proponent, based on industry experience, that design, management and rehabilitation measures can reasonably be expected to be successful. For more details refer to Part 4, Section 2.1.3.1.
Terrestrial Wastes and Discharges	<ul style="list-style-type: none"> Impermeable bunding Capture of emergency discharge. 	Low	<ul style="list-style-type: none"> Any soil contamination would be confined to the immediate vicinity of the BLNG Precinct. For more details refer to Part 4, Section 2.1.3.2.
Altered Fire Regimes	<ul style="list-style-type: none"> Implementation of a managed fire regime. 	Very low	<ul style="list-style-type: none"> Reduction in fire intensity likely, resulting in less soil being exposed. For more details refer to Part 4, Section 2.1.3.3.
Physical Presence of Infrastructure	<ul style="list-style-type: none"> Barriers. Hard surfacing. 	Very low	<ul style="list-style-type: none"> Impacts will be very localised and minor. For more details refer to Part 4, Section 2.1.3.4.
¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in Part 4 Section 2.1.			

8.2.2. Surface Water

The construction and operation of the BLNG Precinct may impact on surface waters by contamination of surface water runoff associated with routine (controlled) wastes and discharges and non-routine (unplanned events) discharges. Other impacts may include increased sediment load in surface runoff during construction activities and alteration of surface hydrology flow patterns by the creation of permanent hardstand areas, including roads, and drainage to manage runoff and stormwater flows. Potential impacts relevant to surface water / groundwater interactions are addressed in **Section 8.2.3.**

A range of management measures would be applied to mitigate potential impacts on surface water. Depending on the nature of the derived proposal, such mitigation measures may include:

- Preparation and implementation of a overarching Emergency Response Plan by the State Government with advice from Fire and Emergency Services Authority of Western Australia (**FESA**)
- Preparation and implementation of a range of plans by proponents of derived proposals to the satisfaction of the Minister for Environment, including:
 - Ecological Surface Water Requirements Management Plan prior to the commencement of construction;
 - Final Closure Plan;
 - Construction Environmental Management Plan; and
 - Hydrocarbon and Chemical Spill Contingency Plan.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents will be required to prepare a CEMP, which may include environmental management measures such as the following:

- water quality control for management of potential water quality impacts resulting from construction or operational activities;
- bunding or other means of containment (such as impervious berms) of hydrocarbon and chemical storages and areas likely to present a contamination hazard;
- techniques to be used for management of sediment loads and erosion such as revegetation, sediment basins, erosion berms and maintenance programs;
- collection and treatment of first flush water from paved process areas;
- discharge of surface water collected from potential contamination areas to minimise surface water quality impacts; and
- minimise the amount of constructed impervious areas as far as practicable (with reference to DoW Stormwater Manual 2004).

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 8-5.**

■ **Table 8-5 Significance of Potential Impacts to Surface Water.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Terrestrial Wastes and Discharges	<ul style="list-style-type: none"> Storage of chemicals and hydrocarbons in bunded areas. Contaminated surface water run-off capture and treatment prior to discharge. Implementation of an Emergency Response Plan. 	Low	<ul style="list-style-type: none"> Impacts will be minimised or avoided through the management measures proposed. Only minor changes to local water resources are likely to occur, resulting in local, short term and small reduction in water quality. No exceedance of applicable ANZECC water quality guidelines expected. For more details refer to Part 4, Section 2.2.3.1.
Site Disturbance and Excavation	<ul style="list-style-type: none"> Construction of stormwater control and management structures to capture runoff and sediment (e.g. rock armouring, use of settlement ponds). Maintaining natural surface water flows where practicable. 	Low	<ul style="list-style-type: none"> Impacts will be minimised or avoided through the management measures proposed. Infrastructure will be designed to manage surface water flows. Any impacts will be localised and only a minor change in sub-catchment surface water hydrology and flow regimes within the BLNG Precinct is expected. For more details refer to Part 4, Section 2.2.3.2.
Physical Presence of Facilities and Infrastructure	<ul style="list-style-type: none"> Implementation of appropriate stormwater controls, such as the construction of structures specifically designed to maintain natural surface water flows and volumes where practicable. 	Low	<ul style="list-style-type: none"> As above. For more details refer to Part 4, Section 2.2.3.3.

¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in **Part 4 Section 2.2.**

8.2.3. Groundwater

Aspects of the BLNG Precinct including terrestrial wastes and discharges, physical presence of infrastructure, site disturbance and excavation, and groundwater abstraction have the potential to impact on groundwater resources. Some of these impacts may include: contamination of aquifers; groundwater drawdown; and subsequent impacts on habitats. There is the potential that the physical presence of facilities and infrastructure may result in changes in water infiltration and re-charge rates, considering the connectivity of the surface water / groundwater interface.

A range of management measures would be applied to mitigate potential impacts on groundwater. Depending on the nature of the derived proposal, such mitigation measures may include:

- Preparation and implementation of a overarching Emergency Response Plan by the State Government with advice from Fire and Emergency Services Authority of Western Australia.
- Development and implementation by the State Government of a Management and Monitoring Strategy for Vegetation of Medium to High Conservation Significance, with particular reference to remnant monsoon vine thicket and drainage basin vegetation.
- Preparation and implementation of a range of plans and additional actions by proponents of derived proposals to the satisfaction of the Minister for Environment, including:
 - Limiting loss of significant vegetation communities to prescribed cumulative loss thresholds;
 - Final Closure Plan;
 - Groundwater Abstraction Management Plan;
 - Hydrocarbon and Chemical Spill Contingency Plan; and
 - Construction Environmental Management Plan.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals will be required to prepare and implement a Groundwater Abstraction Management Plan to address the following:

- the scope and studies to be completed as part of the hydrogeological assessment for future licensing under the *Rights in Water and Irrigation Act 1914*;
- groundwater sources to be utilised and proposed volumes to be abstracted;
- design and location of borefield and abstraction regimes to minimise groundwater drawdown and saltwater intrusion, and potential impacts on stygofauna, groundwater dependent ecosystems and other users;
- a groundwater monitoring program designed to monitor for potential impacts on the resource (e.g. water quality and drawdown), saltwater interfaces, groundwater dependent ecosystems (if applicable) and other users (if applicable);
- reporting requirements; and
- water efficiency methods employed.

The above measures will be considered and addressed in consultation with the Department of Water.

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 8-6**.

■ **Table 8-6 Significance of Potential Impacts to Groundwater.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Site Disturbance and Excavation	<ul style="list-style-type: none"> Technical practices to neutralise any acid generating potential. 	Very low	<ul style="list-style-type: none"> Low likelihood of Potential Acid Sulphate Soils (PASS) being present. Any changes in groundwater recharge patterns likely to be localised and minor. For more details refer to Part 4, Section 2.3.3.1.
Physical Presence of Infrastructure	<ul style="list-style-type: none"> Design and location of borefield. Implementation of abstraction regimes to minimise groundwater drawdown and saltwater intrusion, and potential impacts on stygofauna, groundwater dependent ecosystems and other users. Groundwater monitoring program. 	Medium	<ul style="list-style-type: none"> Any changes in groundwater recharge patterns would be local (confined to the BLNG Precinct), although long term in nature. For more details refer to Part 4, Section 2.3.3.2.
Terrestrial Wastes and Discharges	<ul style="list-style-type: none"> Storage of chemicals and hydrocarbons in bunded areas. Contaminated surface water run-off capture and treatment prior to discharge to the environment. Implementation of an Emergency Response Plan. 	Very low	<ul style="list-style-type: none"> Low likelihood of uncontained spills. Comprehensive emergency response measures will be in place to minimise impacts. For more details refer to Part 4, Section 2.3.3.3.
Groundwater Abstraction	<ul style="list-style-type: none"> The hydrogeological assessment for future licensing under the <i>Rights in Water and Irrigation Act 1914</i>. Implementation of a groundwater monitoring program designed to monitor for potential impacts on the resource (e.g. water quality and drawdown), saltwater interfaces, any groundwater dependent ecosystems and any other users. 	Low	<ul style="list-style-type: none"> Appropriate controls provided by licence requirements. Monitored by the Department of Water (DoW). For more details refer to Part 4, Section 2.3.3.4.
¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in Part 4, Section 2.3 .			

Management of the Precinct by the BLNG Precinct Control Group (**PCG**) (see **Section 3.4** of this document) will ensure that the relevant environmental policies, regulations and guidelines are adhered to, and control measures implemented as proposed. On this basis, the environmental outcome for groundwater from activities directly associated with the BLNG Precinct would be expected to be acceptable.

8.2.4. Terrestrial Flora and Vegetation

Aspects of the BLNG Precinct development including groundwater abstraction, altered surface water flows, altered fire regimes, potential introduced pests, site disturbance and excavation and terrestrial discharges and spills have the potential to impact on terrestrial flora and vegetation in the vicinity of James Price Point. Impacts to these aspects are expected to be localised within the Precinct footprint area, service corridors and immediate surrounds, but long-term because of the lifespan of the project. The vegetation communities and flora species present in the vicinity of James Price Point are widespread on the Dampier Peninsula. However, vegetation clearing is considered a high risk to conservation significant communities, due to the removal of up to 9% of monsoon vine thicket in excellent condition within the Dampier Peninsula (using results of Commonwealth Scientific and Industrial Research Organisation (**CSIRO**) spatial analysis of regional extent) and limited loss of coastal heath, and coastal communities. However, recent DEC mapping has indicated that nearly twice as much of monsoon vine thicket Threatened Ecological Community may occur on the Dampier Peninsula as previously mapped. Using this data, the removal of the monsoon vine thicket associated with the proposal will be up to 4.9%. This is not anticipated to represent a significant impact or detrimentally affect the viability and representation of this community on the Dampier Peninsula as more than 90% of the known extent of monsoon vine thickets will remain.

The value of vegetation and flora, and the potential for impacts on the significant communities was considered in the comparison of the net impacts/benefits in the site selection process which led to a location in the vicinity of James Price Point being selected the preferred location for the Precinct. The conservation significance of the vine thicket is recognised and was considered in the layout and design of the Precinct. The most significant measure to reduce impacts involves the proposed set-back of the majority of Precinct facilities behind the sensitive coastal fringe, and limiting clearing to critical shore crossing infrastructure. These measures would significantly reduce the loss of monsoon vine thicket.

A range of management measures would be applied to mitigate potential impacts on terrestrial flora and vegetation. Depending on the nature of the derived proposal, such mitigation measures may include:

- Implementation of the Dampier Peninsula Land Use and Infrastructure Plan by the State Government.
- Establishment of additional nature reserves and/or National Parks, by the State Government, within the Dampier Peninsula to secure representative vegetation of the Peninsula in reserves.
- Preparation of a variety of management plans and strategies by the State Government such as:
 - Fire Management Strategy for the Dampier Peninsula;
 - Overarching Emergency Response Plan;
 - Closure and Decommissioning Strategy for the BLNG Precinct;
 - Community Engagement Plan; and
 - Management and Monitoring Strategy for Vegetation of Medium to High Conservation Status
- Preparation and implementation of a range of plans by proponents of derived proposals to the satisfaction of the Minister for Environment, including:
 - Rehabilitation Plan;
 - Hydrocarbon and Chemical Spill Contingency Plan;
 - Quarantine Management Plan;
 - Terrestrial Weed Management Plan; and
 - Construction Environmental Management Plan.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, DSD through its involvement in the BLNG Precinct Control Group, will develop and implement a Management and Monitoring Strategy for Vegetation of Medium to High Conservation Significance, with particular reference to remnant monsoon vine thicket and drainage basin vegetation. The Strategy will inform all proponents of derived proposals of requirements for detailed management plans specific to individual activities and will include a framework in which the following Plans will be implemented:

- Fire Management Plan;
- Terrestrial Fauna Management Plan;
- Terrestrial Weed Management Plan; and
- appropriate management of hydrology (both surface water and groundwater).

The effectiveness of the Strategy is to be measured via condition and health monitoring for a defined area within and surrounding the BLNG Precinct area and associated buffer zones. Annual reporting on success of the program is to be made publicly available.

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 8-7**.

■ **Table 8-7 Significance of Potential Impacts to Terrestrial Flora and Vegetation.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Vegetation and Habitat Clearing	<ul style="list-style-type: none"> Implementation of a management and monitoring strategy for vegetation of medium to high conservation significance. Limiting the extent of areas to be cleared. 	High	<ul style="list-style-type: none"> Local site clearing cannot be further avoided. For more details refer to Part 4, Section 2.4.3.1.
Groundwater Abstraction	<ul style="list-style-type: none"> Design and location of borefield. Implementation of abstraction regimes to minimise groundwater drawdown. Groundwater monitoring program. The hydrogeological assessment for future licensing under the <i>Rights in Water and Irrigation Act 1914</i>. 	Very low	<ul style="list-style-type: none"> Controlled under licence requirements Monitored by the DoW. For more details refer to Part 4, Section 2.4.3.2.
Introduced Flora Pests	<ul style="list-style-type: none"> Implementation of ongoing weed control, quarantine procedures and a management. Implementation of a monitoring strategy for vegetation of medium to high conservation significance. 	Low	<ul style="list-style-type: none"> Mitigation measures likely to reduce the incidence of weed species and improve the quality of vegetation communities. For more details refer to Part 4, Section 2.4.3.3.
Altered Fire Regime	<ul style="list-style-type: none"> Implementation of a managed fire regime in areas around the Precinct including the application of low intensity prescribed burning. 	Low	<ul style="list-style-type: none"> It is likely that the implementation of a managed fire regime will result in reduced fire intensity and improvements to vegetation condition. For more details refer to Part 4, Section 2.4.3.4.
Physical Presence of Infrastructure	<ul style="list-style-type: none"> Engineering to maintain surface flows to areas where flows are obstructed. Implementation of an Ecological Surface Water Requirements Management Plan. 	Low	<ul style="list-style-type: none"> Any impacts will be localised and small scale. Management and mitigation measures expected to present a high likelihood of success. For more details refer to Part 4, Section 2.4.3.5.
Site Disturbance and Excavation	<ul style="list-style-type: none"> Groundwater licensing. Industry practice dust control. 	Medium	<ul style="list-style-type: none"> Any impacts will be localised and small scale. Management and mitigation measures expected to present a high likelihood of success. For more details refer to Part 4, Section 2.4.3.6.
Terrestrial Wastes and Discharges	<ul style="list-style-type: none"> Storage of chemicals and hydrocarbons in bunded areas. Contaminated surface water run-off capture and treatment prior to discharge. Implementation of an Emergency Response Plan. 	Very low	<ul style="list-style-type: none"> Low likelihood of uncontained spills. Comprehensive emergency response measures will be in place. For more details refer to Part 4, Section 2.4.3.7.

¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in **Part 4, Section 2.4.**

8.2.5. Species of Ethno-biological Significance

BLNG Precinct construction activities that could impact on species of ethno-biological significance include vegetation and habitat clearing, altered fire regimes and altered surface water regimes. Local representation of some species of ethno-biological significance such as the gubinge or bush plum (*Terminalia ferdinandiana*) found in coastal communities, pindan shrubland and in the monsoon vine thickets may be impacted. The monsoon vine thicket has also been identified as being of particular significance as a location providing water and shelter from harsh weather as well as being rich in ethno-biological values. Fauna of known ethno-biological significance including lizards, snakes, wallabies and birds may also be impacted by construction and operations activities on a local scale but no significant effect will occur at the broader regional level.

All of the vegetation communities and flora species found within the Precinct footprint and are also found more broadly across the Dampier Peninsula. However, the gubinge is commercially harvested by Traditional Owners and removal of this species from the Precinct footprint may place greater pressure on this species across the Peninsula. Altered surface water or groundwater flows and altered fire regimes from new ignition sources as a result of the BLNG Precinct also have the potential to affect species of ethno-biological significance on a broader scale if not managed properly.

A range of management measures would be applied to mitigate potential impacts on species of ethno-biological significance. Depending on the nature of the derived proposal, such mitigation measures may include:

- Identification of important ethno-biological species (including gubinge) harvest areas within the BLNG Precinct by the State Government in cooperation with Traditional Owners and subsequent Traditional Owner involvement in all aspects of management of areas containing ethno-biologically significant species.
- Development and implementation of a range of management plans by the State Government in cooperation with Traditional Owners such as:
 - A plan to maintain ethno-biologically significant harvest areas outside of the BLNG Precinct;
 - A Fire Management Strategy for the Dampier Peninsula; and
 - An overarching Emergency Response Plan.

Additional measures to be taken and management plans to be written by commercial proponents include:

- Ensuring no loss of vegetation, including monsoon vine thickets, outside of prescribed cumulative loss limits.
- Preparation of an Ecological Surface Water Requirements Management Plan in consultation with DEC and DoW.
- Preparation and implementation of the following management plans to cover construction and operations activities:
 - BLNG Precinct Fire Management Plan;
 - Hydrocarbon and Chemical Spill Contingency Plan for construction and operation;
 - Quarantine Management Plan; and
 - Construction Environmental Management Plan.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals will be required to contain loss of vegetation including monsoon vine thicket in excess of the limits of cumulative loss prescribed for the BLNG Precinct, and the State will consult with Traditional Owners with regard to management of areas containing ethno-biologically significant species.

Conclusions regarding the significance of residual impacts are summarised in **Table 8-8**.

■ **Table 8-8 Significance of Potential Impacts to Species of Ethno-biological Significance.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Vegetation and Habitat Clearing	<ul style="list-style-type: none"> If ethno-biologically important harvest areas are identified, a management plan will be prepared to develop measures to maintain these resources in the surrounding areas and provide for access for Traditional Owners. Limiting the extent of areas to be cleared. 	Low	<ul style="list-style-type: none"> Impacts will be localised in respect of clearing. Traditional Owners will be consulted to determine the significance of the areas to be cleared and to support the development of appropriate responses. For more details refer to Part 4, Section 2.5.3.
Altered Fire Regime	<ul style="list-style-type: none"> Implementation of a managed fire regime in areas around the Precinct including the application of low intensity prescribed burning. BLNG Precinct Fire Management Plan. 	Low	<ul style="list-style-type: none"> It is likely that the implementation of a managed fire regime will result in reduced fire intensity and improvements to vegetation condition. For more details refer to Part 4, Section 2.5.3.
Physical Presence of Infrastructure	<ul style="list-style-type: none"> Engineering to maintain surface flows to areas where flows are obstructed. Implementation of an Ecological Surface Water Requirements Management Plan. 	Low	<ul style="list-style-type: none"> Any impacts will be localised and small scale. Management and mitigation measures expected to present a high likelihood of success. For more details refer to Part 4, Section 2.5.3.
¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in Part 4, Section 2.5 .			

8.2.6. Terrestrial Fauna

Development of the BLNG Precinct has the potential to impact on terrestrial fauna through vegetation clearing, physical presence, vehicle movements, altered fire regimes, terrestrial discharges, disturbance from light and noise and the potential for altered hydrological and hydrogeological regimes. The impacts of vegetation clearing during construction may result in loss of fauna habitat, injury or death of declared rare or protected terrestrial fauna and habitat fragmentation and edge effects. Introduced weeds and fauna pests have the potential to result in additional competition to native flora and fauna species and may impact terrestrial fauna habitats present in the area. Potential impacts from introduced feral pests are further considered in **Section 8.2.7**.

The impacts on populations of species of conservation significance, which may include habitat loss or fragmentation leading to displacement of fauna species, as well as injury or mortality through excavations and vehicle movements, have been minimised through the siting of the Precinct. James Price Point contains habitats that are well represented elsewhere on the Dampier Peninsula and this was a key consideration in the site selection process. It is considered that due to this, it is highly unlikely that the conservation status of any fauna species will be affected.

A range of management measures would be applied to mitigate potential impacts on terrestrial fauna. Depending on the nature of the derived proposal, such mitigation measures may include:

- Establishment of conservation reserves on the Dampier Peninsula by the DEC in locations to maximise protection of habitat of conservation significant species.
- Preparation and implementation of a Fire Management Strategy for the Dampier Peninsula by the State Government with advice from the DEC and Indigenous Ranger groups.
- Preparation and implementation of an overarching Emergency Response Plan by the State Government with advice from FESA.
- Development and implementation of a Management and Monitoring Strategy for Vegetation of Medium to High Conservation Significance with particular reference to monsoon vine thicket and drainage basin vegetation by the State Government with advice from the DEC.
- Preparation and implementation of a Closure and Decommissioning Strategy for the Browse LNG Precinct by the State Government.

Additional actions and the preparation and implementation of a range of plans by proponents of derived proposals to the satisfaction of the Minister for Environment may include:

- Further geotechnical and hydrogeological investigations to determine the presence/absence of subterranean fauna in accordance with EPA Guidance Statement No. 54 and 54a.
- Preparation and implementation of a range of plans for construction and operation by the commercial proponents in consultation with the DEC including:
 - Fauna Management Plan, including management of feral pest species;
 - Fire Management Plan;
 - Rehabilitation Plan;
 - Hydrocarbon and Chemical Spill Contingency Plan;
 - Quarantine Management Plan;
 - Terrestrial Weed Management Plan; and
 - Construction Environmental Management Plan.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals will prepare and implement a Fauna Management Plan, in consultation with the Department of Environment and Conservation, that addresses:

- objectives, targets and associated monitoring;
- pre-clearing searches for conservation significant species;
- fauna handling procedures;
- speed limits;
- waste management measures;
- procedures to deal with trapped fauna and trap mortality;
- noise management associated with terrestrial blasting and piling;
- monitoring of pest species numbers, with particular reference to feral cats and the European Red Fox;
- potential trapping and baiting control programs; and
- potential exclusion measures such as fencing.

A more detailed description of proposed mitigation measures, including those listed below for specific aspects is presented in **Part 4, Section 2**.

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 8-9**.

■ **Table 8-9 Significance of Potential Impacts to Terrestrial Fauna.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Vegetation and Habitat Clearing	<ul style="list-style-type: none"> • Establishment of conservation reserves on the Dampier Peninsula by the DEC in locations to maximise protection of habitat of conservation significant species. • Implementation of a management and monitoring strategy for vegetation of medium to high conservation significance. • Limiting the extent of areas to be cleared. • Fauna Management Plan. 	Low	<ul style="list-style-type: none"> • Clearing to be limited to defined areas. • Suitable habitat will continue to persist for these species both in the vicinity of James Price Point coastal area and elsewhere on the Dampier Peninsula. • For more details refer to Part 4, Section 2.6.3.1.
Vehicle Movements	<ul style="list-style-type: none"> • Construction Environmental Management Plan. • Fauna Management Plan to define speed limits. 	Very low	<ul style="list-style-type: none"> • Any impacts will be localised and small scale. • Management and mitigation measures expected to present a high likelihood of success. • For more details refer to Part 4, Section 2.6.3.2.
Site Disturbance and Excavation	<ul style="list-style-type: none"> • Procedures to avoid trapping fauna in excavations. • Industry practice dust control. 	Very low	<ul style="list-style-type: none"> • Any impacts will be localised and small scale, and unlikely to significantly affect local fauna populations. • Management and mitigation measures expected to present a high likelihood of success. • For more details refer to Part 4, Section 2.6.3.3.

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Light Emissions	<ul style="list-style-type: none"> Industry practice lighting control. 	Very low	<ul style="list-style-type: none"> Any impacts will be localised and small scale. Light emissions are not expected to affect nearest significant areas for migratory birds, e.g. Roebuck Bay. Management and mitigation measures expected to present a high likelihood of success. For more details refer to Part 4, Section 2.6.3.4.
Noise and Vibration	<ul style="list-style-type: none"> Noise management controls, to be defined in Construction EMP and Fauna Management Plan. 	Low	<ul style="list-style-type: none"> Any impacts will be localised and small scale. Management and mitigation measures expected to present a high likelihood of success. For more details refer to Part 4, Section 2.6.3.5.
Dust Emissions	<ul style="list-style-type: none"> Industry practice dust control, including dust suppression techniques during construction. 	Very low	<ul style="list-style-type: none"> Any impacts will be localised and small scale. Management and mitigation measures expected to present a high likelihood of success. For more details refer to Part 4, Section 2.6.3.6.
Groundwater Abstraction	<ul style="list-style-type: none"> Design and location of borefield. Implementation of abstraction regimes to minimise groundwater drawdown. Groundwater monitoring program. The hydrogeological assessment for future licensing under the <i>Rights in Water and Irrigation Act 1914</i>. 	Very low	<ul style="list-style-type: none"> Controlled under licence requirements. Monitored by the Department of Water. For more details refer to Part 4, Section 2.6.3.7.
Physical Presence of Infrastructure	<ul style="list-style-type: none"> Engineering to maintain surface flows to areas where flows are obstructed where practicable. Implementation of an Ecological Surface Water Requirements Management Plan. 	Low	<ul style="list-style-type: none"> Any impacts will be localised and small scale. Management and mitigation measures expected to present a high likelihood of success. For more details refer to Part 4, Section 2.6.3.8.
Altered Fire Regime	<ul style="list-style-type: none"> Implementation of a managed fire regime in areas around the Precinct including the application of low intensity prescribed burning. 	Low	<ul style="list-style-type: none"> It is likely that the implementation of a managed fire regime will result in reduced fire intensity and improvements to vegetation condition. For more details refer to Part 4, Section 2.6.3.9.
Terrestrial Wastes and Discharges	<ul style="list-style-type: none"> Storage of chemicals and hydrocarbons in bunded areas. Contaminated surface water run-off capture and treatment prior to discharge. Implementation of an Emergency Response Plan. Hydrocarbon and Chemical Spill Contingency Plan. 	Very low	<ul style="list-style-type: none"> Low likelihood of uncontained spills. Comprehensive emergency response measures will be in place. For more details refer to Part 4, Section 2.6.3.10.
¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in Part 4, Section 2.6 .			

8.2.7. Terrestrial Ecosystem Integrity

The ecological integrity of an area can be affected by disturbance to, or losses of, areas of significant biological diversity. Aspects of the BLNG Precinct with the potential to impact on terrestrial ecosystem integrity include vegetation clearing, physical presence, altered fire regime and introduced pests.

Fragmentation and edge effects have the potential to occur as a result of vegetation clearing for the construction of the BLNG Precinct and the shore crossing and southern pipeline corridor. It is of particular concern for vegetation communities that are linear in structure. In the vicinity of James Price Point, the monsoon vine thicket and other linear coastal communities will be most susceptible to these processes. While fragmentation and edge effects may occur as a result of the BLNG Precinct, impacts to vegetation communities will be highly localised although long-term and impacts to fauna will be localised and short-term.

It is expected that locally occurring bird and mammal species would be capable of continuing to access other habitat areas within the James Price Point coastal area. While there is the potential for the fragmentation of coastal habitats, it is considered unlikely that this would significantly impact local fauna populations as those identified in surveys are generally mobile and do not have restricted habitat requirements. Through the adoption of appropriate flora and vegetation management strategies and a fauna management plan, impacts on flora, vegetation and fauna communities as a result of fragmentation are likely to be avoided, as overall vegetation and fauna habitat condition can be improved.

Altered fire regimes have the potential to result in disturbance of fauna habitat, conservation significant vegetation communities and conservation significant flora.

Introduced pests have the potential to impact terrestrial ecosystem integrity by causing disturbance to conservation significant vegetation communities and fauna populations. Introduced weeds and fauna species already occur in the vicinity of James Price Point. Increased access to the area is unlikely to result in any new introduced weed species, as on-site management measures such as vehicle washdowns can be expected to be successful. However, the existing weeds may impact on conservation significant vegetation communities due to an increase in their abundance. The introduction of new pest species is considered unlikely, however, if new introductions occurred they would have the potential to threaten the abundance of a Commonwealth or Western Australia Listed Fauna species.

The physical presence of the BLNG Precinct has the potential to impact terrestrial ecosystem integrity by causing declines in vegetation health due to reduction of surface water flows and declines in health of groundwater dependent vegetation (where groundwater drawdown occurs). The vegetation communities most likely to be affected by the physical presence are the monsoon vine thickets and drainage basin communities. Declines in vegetation health due to reductions in surface water flows, are unlikely to occur, but would have the potential to have a long-term impact on vegetation communities outside the project footprint. Declines in the health of groundwater dependent vegetation such as the monsoon vine thickets are unlikely to occur as potential impacts to groundwater will be managed (as outlined in **Section 0**) and as a result, would cause localised impacts only.

Such aspects are considered to present a very low to low level of significance on terrestrial ecosystem integrity and were reduced during the site selection process, which considered known terrestrial ecological sensitivities as one of a number of criteria leading to the preferred siting of the BLNG Precinct at James Price Point. It is recognised that impacts such as habitat clearing, fragmentation and disturbance as a result of the Precinct Development, along with the current threatening processes evident on the Dampier Peninsula (including introduced pests, altered fire regime and grazing) should be considered in the management measures and safeguards proposed for the Precinct to maintain terrestrial ecosystem integrity values in the James Price Point coastal area.

A range of management measures would be applied by the State Government to mitigate potential impacts on terrestrial ecosystem integrity. Depending on the nature of the derived proposal, such mitigation measures may include:

- preparation and implementation of a Fire Management Strategy for the Dampier Peninsula;
- preparation of an overarching Emergency Response Plan;
- development and implementation of an Engagement Plan to manage all interactions with public users of the marine and terrestrial environment in and around James Price Point, including recreational users and tourism operators;
- development and implementation of a Management and Monitoring Strategy for Vegetation of Medium to High Conservation Significance; and
- preparation and implementation of a Closure and Decommissioning Strategy for the BLNG Precinct.

Additional actions and the preparation and implementation of a range of plans by proponents of derived proposals to the satisfaction of the Minister for Environment may include:

- Restrictions on the loss of vegetation including monsoon vine thicket in excess of the prescribed limits of cumulative loss.
- Preparation and implementation of a range of management plans by the commercial proponents such as:
 - Final Closure Plan;
 - Ecological Surface Water Requirements Management Plan;
 - Fire Management Plan for construction and operation activities;
 - Quarantine Management Plan;
 - Terrestrial Weed Management Plan;
 - Rehabilitation Plan;
 - Fauna Management Plan, including management of feral pest species;
 - Hydrocarbon and Chemical Spill Contingency Plan for construction and operation activities; and
 - Construction Environmental Management Plan.

Following the application of appropriate management and mitigation measures, it is expected that the BLNG Precinct would result in the removal of up to 3,037ha of vegetation during construction of the BLNG Precinct and supporting infrastructure. Other aspects such as altered fire regimes, introduced pests and the physical presence of infrastructure potentially impacting on surface and groundwater can all be managed with appropriate management plans and mitigation measures in place to reduce these impacts. As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals will prepare and implement a Quarantine Management Plan, to the satisfaction of the Western Australian Minister for Environment, for construction and operation activities, which addresses the following:

- baseline information regarding non-indigenous species;
- objectives, targets and associated monitoring;
- profile of potential quarantine risks based on where the equipment is sourced (locally, interstate, overseas);
- species-specific or generic response plans to minimise and manage any incursions or spread;
- on-site management measures (including investigation of the requirements for establishing an on-site fumigation facility, wash-down facility and Quarantine Approved Premise);
- process for earth moving machinery, vehicles, plant and equipment to be free of soil and vegetation prior to entering and exiting the BLNG Precinct;
- management and control of Declared Plants (as defined by the *Agriculture and Related Resources Protection Act 1976*);
- monitoring program during and after the activity has been completed;
- reporting on inspections and monitoring;
- consultation with AQIS, DAFWA and DEC;
- and integration with the State Government Emergency Response Plan.

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 8-10**.

■ **Table 8-10 Significance of Potential Impacts to Terrestrial Ecosystem Integrity.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Vegetation and Habitat Clearing	<ul style="list-style-type: none"> Establishment of conservation reserves on the Dampier Peninsula by the DEC in locations to maximise protection of habitat of conservation significant species. Implementation of a Management and Monitoring Strategy for Vegetation of Medium to High Conservation Significance. Limiting the extent of areas to be cleared. Fauna Management Plan. Closure planning. 	Low	<ul style="list-style-type: none"> Clearing to be limited to defined areas. Suitable habitat will continue to persist for these species both in the vicinity of James Price Point coastal area and elsewhere on the Dampier Peninsula. For more details refer to Part 4, Section 2.7.4.1.
Introduced Flora Pests	<ul style="list-style-type: none"> Implementation of ongoing weed control, quarantine procedures and a management. Implementation of a monitoring strategy for vegetation of medium to high conservation significance. 	Low	<ul style="list-style-type: none"> Mitigation measures likely to reduce the incidence of weed species and improve the quality of vegetation communities. For more details refer to Part 4, Section 2.7.4.2.
Introduced Fauna Pests	<ul style="list-style-type: none"> Implementation of quarantine procedures and a management, in Quarantine Management Plan. 	Low	<ul style="list-style-type: none"> Management and mitigation measures expected to present a high likelihood of success. For more details refer to Part 4, Section 2.7.4.3.
Physical Presence of Infrastructure	<ul style="list-style-type: none"> Engineering to maintain surface flows to areas where flows are obstructed where practicable. Implementation of an Ecological Surface Water Requirements Management Plan. 	Very low	<ul style="list-style-type: none"> Any impacts will be localised and small scale. Management and mitigation measures expected to present a high likelihood of success. For more details refer to Part 4, Section 2.7.4.4.
Altered Fire Regime	<ul style="list-style-type: none"> Implementation of a managed fire regime in areas around the Precinct including the application of low intensity prescribed burning. 	Low	<ul style="list-style-type: none"> It is likely that the implementation of a managed fire regime will result in reduced fire intensity and improvements to vegetation condition. For more details refer to Part 4, Section 2.7.4.5.

¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in **Part 4, Section 2.7.**

8.2.8. Air Quality

Atmospheric emissions from the construction and operation of the BLNG Precinct have the potential to reduce ambient air quality adjacent to the industrial precinct which could affect human health, amenity or environmental values. Dust emissions are likely to be the dominant concern during the construction phase of facilities within the BLNG Precinct and will be controlled through the application of standard measures such as water trucks, covering stockpiles and site rehabilitation. During operation, air emissions from the proposed BLNG Precinct are expected to be mostly generated by the combustion of natural gas in the gas turbines and from flaring associated with the gas processing plants.

A range of management measures would be applied by the State Government to mitigate potential impacts on air quality. Depending on the nature of the derived proposal, such mitigation measures may include:

- Ensuring planning and layout of the BLNG Precinct is subject to appropriate strategic land use buffer zoning in alignment with State Planning Policy (Industrial Buffer Policy) and EPA guidelines (Guidance Statement No. 3), to ensure appropriate separation distances between industrial and other land uses.
- Implementation of buffer zones for the BLNG Precinct to meet the national environment protection goals of approved National Environment Protection Measures and other established environmental quality criteria.
- Air emission limits that will be prescribed in an Air Quality Management Plan and licence conditions.

In addition, a number of actions would be required of proponents of derived proposals. Depending on the nature of the proposal, these may include submission of:

- an “Air Monitoring Results and Emission Control Performance Report” annually for their LNG facility. Such reports would be submitted to the EPA and made publicly available;
- an Air Quality Management Plan, and/or; and
- a Construction Environmental Management Plan.

The Air Quality Assessment demonstrates that the construction and operational atmospheric emissions from the BLNG Precinct will be largely contained within the area in close proximity to the BLNG Precinct, encapsulated by the buffer zones surrounding the facilities. Ground-level pollution concentrations from the BLNG Precinct are anticipated to be low for most of the year and unlikely to give rise to adverse air quality or amenity issues beyond the boundary. Emissions will be managed, monitored and responded to through the Air Quality Management Plan, to ensure that best available practicable and efficient technologies are used to minimise and monitor air emissions from the LNG facilities during operations. Dust emissions from construction activities will be managed through the Construction Environmental Management Plan.

On a regional scale, the contribution from the BLNG Precinct to the predicted concentrations of most pollutants will be low. The predicted existing concentration levels of ozone are typically in the range of 60% to 85% of the NEPM standard. The predicted particulate levels exceed the NEPM PM₁₀ standard with more than five exceedances of the NEPM for much of the Dampier Peninsula, due to the overwhelming contribution from natural fires. The BLNG Precinct is predicted to make a relatively small contribution to cumulative regional air quality.

Any decrease in air quality from dust emissions resulting in public health or amenity impacts would be localised and of a short-term nature. Any increase in dust deposition impacts on vegetation and ephemeral drainage lines from atmospheric emissions during construction would have negligible consequence as it is a readily controllable and both a localised and temporary impact. Although unlikely, decreases in air quality and deposition impacts from gaseous emissions during operations resulting in health impacts would be localised, short-term and only representing a small increase over baseline levels. Similarly, any impacts to local amenity from atmospheric emissions during operations would only be slightly above baseline levels. Further refinement of the conservative assessment of local emissions will be undertaken as engineering details for individual facilities are matured, to ensure emissions are actively managed and reduced to achieve best practice measures. The impacts from dust and gaseous emissions on public health and amenity were a key consideration in the siting of the BLNG Precinct away from any sensitive receptors.

The level of significance of impacts to air quality from construction phase emissions are considered very low given the establishment of buffer zones around the BLNG Precinct to maintain appropriate separation distances, and impacts from dust can be managed through implementation of appropriate dust controls in accordance with standard industry practice.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals will prepare an Air Quality Management Plan that addresses the following:

- compliance within the buffer zones determined by the State Government;
- results of cumulative air quality modelling;
- compliance with ambient NEPM standards;
- meteorological monitoring results;
- an emissions monitoring program, which will likely include nitrogen compounds, BTEX, and hydrogen sulphide emissions from the LNG plant;
- participation in an ambient air monitoring program with other proponents of derived proposals; and
- annual reporting obligations.

Conclusions regarding the significance of residual impacts associated with relevant aspects are summarised in **Table 8-11**.

■ **Table 8-11 Significance of Potential Impacts to Air Quality.**

Aspect	Example Mitigation Measures ¹	Significance of Impact	Basis of Conclusion
Dust Emissions	<ul style="list-style-type: none"> • Industry practice dust control, including dust suppression techniques and speed controls during construction. • Strategic land use buffer zoning to ensure appropriate separation distances between industrial and other land uses. • Construction Environmental Management Plan. 	Very low	<ul style="list-style-type: none"> • Any impacts will be localised and small scale. • Management and mitigation measures expected to present a high likelihood of success. • For more details refer to Part 4, Section 2.8.3.1.
Gaseous Emissions	<ul style="list-style-type: none"> • Strategic land use buffer zoning to ensure appropriate separation distances between industrial and other land uses. • Air Quality Management Plan to ensure that best available practicable and efficient technologies are used to minimise and monitor air emissions from the LNG facilities during operations. • Air emission limits that will be prescribed in an Air Quality Management Plan and licence conditions. 	Very low	<ul style="list-style-type: none"> • Remote location away from residential receptors, as supported by site selection process. • Modelling demonstrates small incremental contributions of most pollutants from the BLNG Precinct to regional air quality, taking into account existing contributing sources (including bushfires). Further refinement of the conservative assessment of local emissions will be undertaken as engineering details for individual facilities are matured, to ensure emissions are actively managed and reduced to achieve best practice measures. • Proponents to be expected to manage and monitor emissions to minimise off-site emissions. • For more details refer to Part 4, Section 2.8.3.2.

¹ A more detailed description of proposed mitigation measures, including those listed above for specific aspects is presented in **Part 4, Section 2.8**.

8.2.9. Greenhouse Gas Emissions

Australian LNG can play a significant role reducing global greenhouse emissions through displacement of higher emitting fuels such as coal. For every tonne of CO₂ emitted in LNG production within Australia, at least four tonnes can be reduced globally by displacing coal-fired power generation. This lower carbon emission rate makes natural gas a comparatively clean energy source, relative to other hydrocarbon fuels and can form part of the global solution to climate change.

Proposals such as the BLNG Precinct can play an important part in a low carbon future. This is because technologies for power generation using natural gas, including LNG production and transportation, are proven and Australia, which has 1.4% of known natural gas reserves worldwide (BP, 2010), has been a reliable supplier of LNG to international customers for more than 20 years.

Where used as a transitional fuel, LNG power generation systems produce 1.7 times more power for the same carbon emissions as coal-fired generation (Hondo, 2005). This means that a peak export rate of 50Mtpa of LNG could generate 750,000,000 megawatt hours (**MWh**) of electricity; resulting in emission reductions of 312 million tonnes (**Mt**) CO₂ equivalents (**CO₂e**) per year where LNG displaces coal-fired power generation. This saving is equivalent to 1.26% of global emissions referenced against a year 2000 baseline (Boden *et al.*, 2009).

The primary sources of atmospheric emissions from facilities within the BLNG Precinct are reservoir emissions and combustion emissions. Reservoir emissions are largely dependent on the concentrations of CO₂ naturally occurring in the subsurface reservoir. Emissions resulting from the combustion of natural gas to produce energy to operate the plant vary according to plant design and operating procedures, and can be influenced by environmental conditions (such as air temperature), which impacts on plant efficiency.

Greenhouse gas emissions from the BLNG Precinct may range from 12Mt CO₂e to 39Mt CO₂e per year depending on the plant capacity, not taking into account potential abatement. The legislative requirements and policy context at State and Commonwealth levels are evolving. In line with EPA objectives, commercial proponents seeking to locate in the BLNG Precinct will be required to submit a Greenhouse Gas (**GHG**) Abatement Plan, in consultation with the relevant regulatory agencies. Under such plans, commercial proponents would need to demonstrate that facilities have been designed and operated to reduce greenhouse gas emissions through application of best practice measures. As part of this process, operators will be required to benchmark the greenhouse gas efficiency of their operations.

A range of options to further reduce greenhouse gas emissions are available, and will be the subject of further investigation to evaluate their feasibility as part of Greenhouse Gas Abatement Plans.

As an example of proposed management measures presented in the Strategic Assessment Report relevant to this factor, proponents of derived proposals prepare a Greenhouse Gas Abatement Plan (**GGAP**), to the satisfaction of the Minister for Environment, that addresses the following:

- targets for greenhouse gas emissions;
- inventory of greenhouse gas emissions;
- best practice measures to reduce greenhouse gas emissions including controls to maintain plant reliability and reduce venting and flaring;
- strategies to incorporate greenhouse considerations in plant design, technology selection and operation, including defined targets and timeframes for achievement of no regrets measures such as energy efficiency programs;
- evaluation of the feasibility of greenhouse gas emissions reduction opportunities;
- compliance with any national scheme for reduction of CO₂e emissions. The GGAP will be reviewed should future national or state schemes be enacted to appropriately respond to future requirements;
- independent verification of emissions in line with national schemes for managing and reporting greenhouse gas emissions;
- regular monitoring and external reporting, auditing of greenhouse gas emissions and performance; and
- periodically review the effectiveness of improvement measures through the regular monitoring of greenhouse gas emissions and adaptive management of emissions, aimed at reducing the greenhouse gas emissions per tonne of LNG produced where practicable.

The GGAP for individual LNG facilities would be expected to include specific abatement targets and timeframes for achievement, including ‘no regrets’ measures such as energy efficiency programs. The GGAP will be subject to a period of public review prior to finalisation.

Emissions of greenhouse gas, unlike other common air emissions, affect the earth’s weather system globally. Taking into account a range of potential outcomes and also recognising that global warming and associated climate change are the cumulative results of many such sources across the globe, its contribution to climate change is currently unknown. For this reason, the assessment does not draw conclusions on residual impacts for this factor.

9. Matters of National Environmental Significance

The matters of National Environmental Significance (NES) potentially affected by activities directly or indirectly associated with the development of the BLNG Precinct are:

- wetlands of international importance;
- listed threatened species;
- listed migratory species; and
- Commonwealth marine area.

The key aspects of the BLNG Precinct that may affect matters of NES (and matters that have a high likelihood of being eligible for listing as matters of NES) have been determined based on the assessments for marine and terrestrial factors. Key aspects associated with the development of the BLNG Precinct include vegetation and habitat clearing, noise and vibration, light emissions, site disturbance and excavation, physical presence, sediment deposition and turbidity, vessel movements, and marine discharge and spills.

In addition to direct activities, some indirect and related projects have the potential to affect matters of NES.

Overall the assessment of the impacts on matters of NES demonstrates that the site selection process undertaken by the Northern Development Taskforce succeeded in ensuring that most areas of environmental significance or sensitivity were avoided. It also supports the S16(e) advice of the Environmental Protection Authority that environmental risks and impacts were likely to be manageable (EPA, 2008) and that the site selection had avoided the whale aggregation and calving areas towards the northern end of the Dampier Peninsula, as well as turtle nesting areas on the Lacepede Islands. Impacts on significant seagrass areas in Roebuck Bay and Beagle Bay used by dugongs had also been avoided. Similarly, for terrestrial impacts, the site selection resulted in most of these being on Pindan vegetation which is very common on the Dampier Peninsula and which, through improved management measures, can have its environmental condition enhanced to maintain or improve overall environmental outcomes on the Peninsula.

9.1. Wetlands of International Importance

While neither Roebuck Bay nor Eighty Mile Beach, which are important shorebird sites, are expected to be impacted directly by the BLNG Precinct activities, there are potential indirect impacts through increased visitation. The State will support appropriate management of impacts through existing mechanisms and processes.

Previously identified threats to Eighty Mile Beach and Roebuck Bay include pest animal species, weed species outcompeting native species and changing the habitat of the wetland and public access (Australian Government, 2010). Potential impacts from indirect activities as a result of the BLNG Precinct are primarily associated with pressures from a population increase in Broome and associated development arising from increased workforce and service industries. Numerous site management measures are already in place including a program to minimise disturbance to northern shores, a port emergency response plan, and a fishing sustainability assessment.

Quantification of the extent of potential impacts on these wetlands is difficult to assess; however, management will involve an across-state agency approach to protect the values of Roebuck Bay and Eighty Mile Beach. The prediction of impact from the development of the BLNG Precinct is also difficult to isolate from impacts arising from existing environmental issues and threatening processes.

Any impacts arising from indirect activities and related projects will be offset by supporting the development of Roebuck Bay Management Plan and DEC's management of Eighty Mile Beach. The WA State Government has recently announced the creation of marine parks to protect these areas.

9.2. Listed Threatened Species

Listed threatened species that are most likely to be impacted by the BLNG Precinct include the humpback whale, a number of species of marine turtles and the Greater Bilby. The site selection process has reduced the likelihood of potential impacts on these species by avoiding critical habitats and a number of other management measures are identified which further reduce the likelihood of impacts. These include further surveys, the development of management plans and the establishment of terrestrial and marine conservation reserves targeted to protect key habitat.

There are up to five threatened terrestrial species that could potentially be affected by the Precinct Plan, specifically associated with the key aspects of vegetation and habitat clearing, noise and vibration and light emissions. These species include:

- Greater Bilby (*Macrotis lagotis*) – Vulnerable (EPBC Act);
- Golden-backed Tree-rat (*Mesembriomys macrurus*) – Vulnerable (EPBC Act);
- Golden Bandicoot (*Isoodon auratus*) - Vulnerable (EPBC Act), Schedule 1 *Wildlife Conservation Act 1950 (WC Act)*;
- Australian Painted Snipe (*Rostratula australis*) – Vulnerable (EPBC Act), Migratory (EPBC Act); and
- Masked Owl (northern) (*Tyto novaehollandiae kimberli*) – Vulnerable (EPBC Act).

Habitat for these species includes monsoon vine thicket, pindan woodland, shrublands, and drainage basins all of which are found widely outside of the James Price Point coastal area. Of the species listed above, only the Australian painted snipe and the masked owl have recently been recorded near James Price Point. All of these species have the potential to occur on site but if they do are likely to be in very low numbers.

The key focus for management of all of the terrestrial listed threatened species will be to confirm the species presence in the area and, if present, to: minimise impacts to potential habitats; develop a regional strategy to protect the species; prioritise vine thickets outside the Precinct for conservation; implement a regional fire management strategy; and undertake feral animal control in conservation reserves.

Monsoon vine thickets are not addressed in this Strategic Assessment as a matter of NES; however, they are addressed separately in **Part 4**, as they are a listed State threatened ecological community. Management arrangements are also provided to protect the monsoon vine thickets as they provide potential habitat for threatened species under the EPBC Act.

The cumulative impact assessment considered habitat clearing associated with other known projects in the region, such as the Broome North Housing Development. Fauna studies conducted as part of the planning for the latter development did not identify any fauna species of conservation significance, and as such, this development is not expected to contribute cumulative impacts to the proposed BLNG Precinct.

Potential impacts and mitigation measures related to marine turtles are summarised in **Part 3, Section 2.7**, while those associated with humpback whales are covered in **Part 3, Section 2.6**.

While there was no evidence of sawfish species (*Pristis microdon*, *P. zijsron* and *P. clavata*) in the James Price Point coastal area (Cappo *et al.*, 2010b; **Appendix C-6**) they may still occur as all species are known to utilise inshore coastal waters. Occurrences of these species in the area are most likely to be transient, as they migrate through the area to more suitable habitats such as estuaries.

Marine site disturbance and excavation is likely to result in an increase in turbidity and loss of benthic habitat potentially used by sawfish. Such impacts are not likely to be significant, given that habitats within the James Price Point coastal area are unlikely to represent unique or critical sawfish habitat and these species inhabit naturally turbid waters.

Water quality is likely to be altered because of discharges beyond background conditions within a small defined mixing zone (e.g. 50m) surrounding marine outfalls. The potential for significant water quality decline is low given the dynamic nature of the marine environment, resulting in diurnal flushing of nearshore waters by the strong tidal movement. Mobile species, including sawfish, can move away from the affected area and are likely to avoid any deleterious effects.

The introduction and establishment of invasive marine species could have an adverse impact on sawfish species through competition for food and habitat, alteration of habitat and introduction of parasites and diseases. It is generally considered unlikely that an IMS would successfully establish and have an impact on sawfish given the resilience of the fauna within the study area (Hutchings *et al.*, 2002). The lack of invasive marine species across northern Australia suggests that the marine ecosystem is relatively resistant to establishment of such species.

The key focus for mitigation of potential impacts to sawfish species will be on minimising the time over which dredging will occur and managing marine discharges.

The freshwater sawfish has been recorded at Eighty Mile Beach and Roebuck Bay, with potential impacts from indirect activities at these areas associated with changes in the surface water regime potentially affecting mangrove communities surrounding Roebuck Bay and increased public access and recreation affecting habitat value. Fishing, particularly net fishing, is a major threat to these species; therefore, increases in recreation as a result of population increase in the area may affect the populations of sawfish in more critical habitats.

9.3. Listed Migratory Species

Many of listed migratory species are also listed as threatened and so are considered above. The site selection process has reduced the likelihood of potential impacts on these species and a number of other management measures are identified which further reduce the likelihood of impacts.

Approximately 1km of shoreline of the James Price Point coastal area will be permanently modified for the shore crossing, with temporary disturbance of an additional 1km for pipeline corridors. This removal of nearshore and coastal habitat is unlikely to have a significant impact on migratory shorebird species because this area only represents a small proportion of the total available habitat for shorebirds in the area and there are far more important feeding and roosting areas for shorebirds elsewhere on the Dampier Peninsula.

The key focus for management of migratory birds will be on minimising impacts on coastal habitats and prioritising areas of high value to migratory birds on the Dampier Peninsula for conservation.

The main potential for cumulative impacts from indirect activities and related projects arises from increased public access and recreation that may affect habitat value through destruction of habitat and spread of weeds, including that located at Roebuck Bay and Eighty Mile Beach. The State, as part of its state-wide conservation reserve management approach, will progressively prepare management strategies or plans to protect the values of these areas where required.

Potential impacts and mitigation measures related to marine mammals are summarised in **Part 3, Section 2.6**.

The habitat in the James Price Point coastal area is not considered suitable for crocodiles (estuarine or freshwater). However, individuals may pass through the area as they access suitable mangrove habitat further south. Those individuals that do pass through the area may be subject to noise and vibration emissions primarily during construction or be struck by moving vessels. These impacts are not expected to significantly affect the population of this species.

9.4. Commonwealth Marine Area

A number of listed marine species are also listed as threatened and so are considered above. The site selection process has reduced the likelihood of potential impacts on these species and a number of other management measures are identified which further reduce the likelihood on impacts. Separate approvals will also be required for many of the activities likely to impact on these animals (e.g. offshore developments).

Listed marine bird species are unlikely to be susceptible to impacts from the proposed marine activities in the Commonwealth Marine Area. The key aspects associated with development of the BLNG Precinct that could affect listed pipefish and seahorses, sea snakes and cetaceans, in the Commonwealth Marine Area, specifically include vessel movements and marine discharges, introduction of invasive marine species, turbidity and sediment deposition as a result of site disturbance and excavation, and noise and vibration emissions from drilling and blasting activities. In addition, related upstream project will necessitate vessel movements and pipeline construction which may affect the Commonwealth Marine Area.

Pipefishes are most likely to occur in seagrass meadows with seahorses most likely to occur in macroalgal habitats. However, given the limited nature of these seagrass habitats, pipefish generally are not expected to be abundant or diverse. Macroalgae habitat is predicted to have a widespread distribution and to be broadly represented throughout the region.

Pipefish and seahorses may be affected by changes to water quality, noise and vibration and introduced marine species. Given that the areas potentially affected are not likely to provide significant habitat for pipefish or seahorses, relatively low numbers in the James Price Point coastal area would be at risk of impact.

Impacts on sea snakes in the Commonwealth Marine Area are most likely to be associated with changes in water quality, specifically turbidity resulting from site disturbance and excavation and spoil disposal. These aspects are considered unlikely to cause significant impacts on sea snakes as they are highly mobile species and will avoid the area until the disturbance ceases (with these disturbances expected to be short-term and temporary).

The number and type of vessels operating within the Commonwealth Marine Area will increase as a result of the construction and operation of the BLNG Precinct. However, vessel movements are unlikely to directly affect sea snakes due to their fast movement and good auditory perception for avoidance. Noise and vibration, associated with blasting and piling closer to the coast, is unlikely to affect sea snake species given the distance these emissions would be required to travel. Avoidance of the area, if any, may be the only behavioural characteristic exhibited.

10. Social Assessment

The WA Government recognised that the establishment of the BLNG Precinct would likely bring both positive and negative social impacts for the people of the Shire of Broome, including Broome itself and the communities in neighbouring Shires in the area of impact from Derby to Bidyadanga. In recognition of this, the WA Government and the Commonwealth agreed that a strategic Social Impact Assessment, including an Aboriginal Social Impact Assessment (**ASIA**) was required as part of the Strategic Assessment for the establishment of the BLNG Precinct. The SIA included looking at past, current and likely future trends in Broome's population and the potential additional impact that the construction and operation of the BLNG Precinct, would have on services, housing, businesses and employment.

The Strategic Assessment Report presents the findings of these impact assessments in three main sections:

- **Strategic SIA** (see **Section 10.1**) - This section provides a summary of the strategic SIA undertaken by the State. For the purposes of reporting, the summary in the Strategic Assessment Report focuses on the indirect social impacts of the BLNG Precinct on Broome and the surrounding region (termed Category B impacts in the Scope of Strategic Assessment).
- **Strategic Indigenous Impact Assessment** (see **Section 10.2**) – This impact assessment provides a summary of the various Indigenous Impact Reports prepared by the Kimberley Land Council; addressing both the direct and indirect impacts of the BLNG Precinct (termed Category A and B activities).
- **Direct Social Surrounds and Social-Economic Factors** (see **Section 10.3**) – This section provides an overview of the direct impacts resulting from activities associated specifically with the BLNG Precinct, focused largely on the James Price Point coastal area (termed Category A activities).

10.1. Strategic Social Impact Assessment

The Department of State Development led an integrated strategic-level SIA process which was summarised in **Part 5, Section 2** of the Strategic Assessment Report). This process was reported on in three volumes:

- Volume 1: Scope and Profile (DSD, 2009a; **Appendix D-1**);
- Volume 2: Assessment of Impacts and Specialist Studies (DSD, 2009b; **Appendix D-2**); and
- Volume 3: Strategic Social Impact Management Plan (DSD, 2009c; **Appendix D-3**).

These three volumes can also be found on the DSD website at <http://www.dsd.wa.gov.au>.

The SIA process included four separate specialist studies:

- Tourism Impact Assessment undertaken by Broome-based Kadar Pearson and Partners (**KPP**) and commissioned by Tourism WA at <http://www.dsd.wa.gov.au> (KPP Business Development, **Appendix D-5**);
- Fishing Industry Impact Assessment undertaken by Big Island Research Pty Ltd and commissioned by Department of Fisheries at <http://www.fish.wa.gov.au/docs/op/index.php?0706> (Big Island Research, 2009);
- Infrastructure Assessment undertaken by AECOM and commissioned by the Department of Planning at <http://www.dsd.wa.gov.au> (AECOM, 2010d; **Appendix D-6**); and
- Aboriginal Social Impact Assessment (prepared by the Kimberley Land Council (**KLC**)) (see **Section 10.2**).

10.1.1. Existing Socio-economic Environment

10.1.1.1. Social Characteristics of the Kimberley

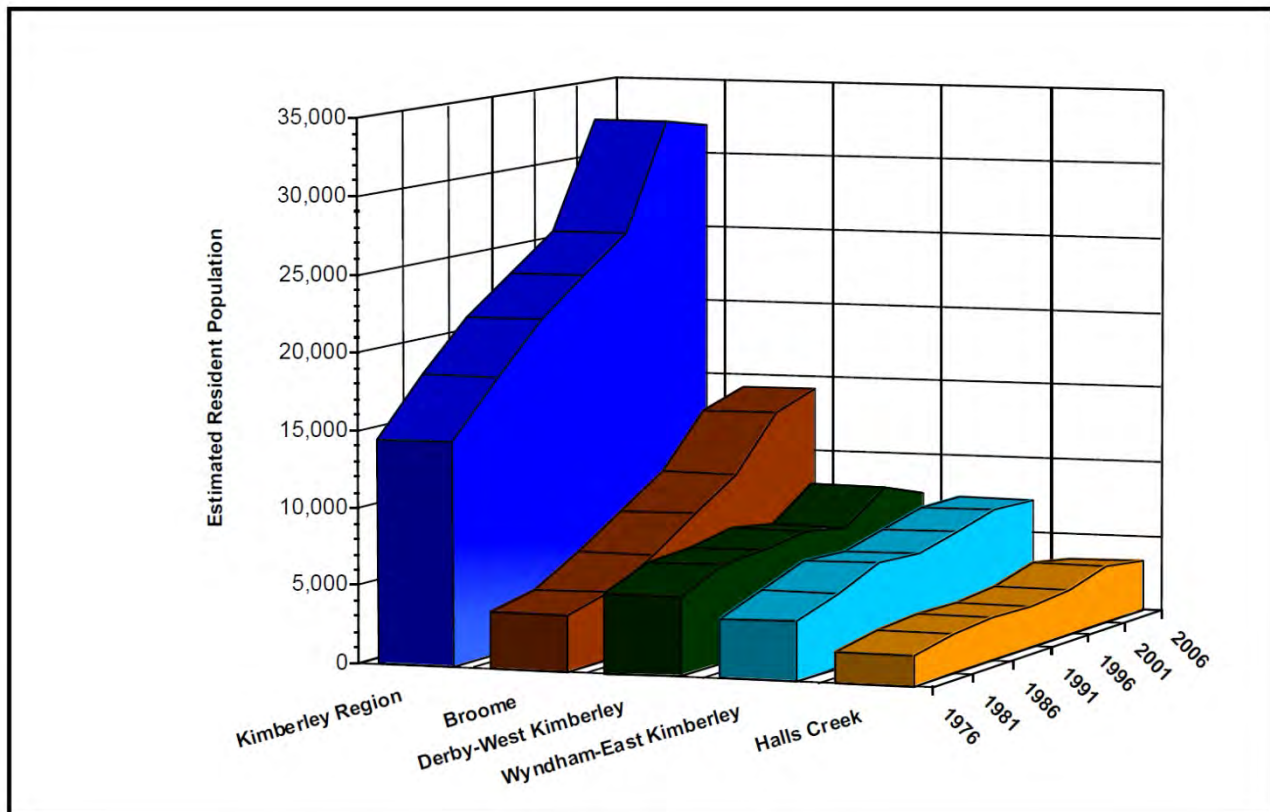
The Estimated Resident Population of the Kimberley region in 2008 was 34,185 (Australian Bureau of Statistics, (**ABS**) 2009)². This figure equates to 1.6% of the State's population and 6% of the population in regional Western Australia³. An important feature of the Kimberley region population is the large proportion of Indigenous people with 42.1% compared to 3% for Western Australia as a whole. The Indigenous population is comparatively young in age (median age of 22) compared to the older non-Indigenous median age for the region of 35.

Of the Kimberley's local government authorities, the Shire of Broome (15,386 persons) has the largest proportion with 45% of the region's population in 2008, followed by the Shire of Derby-West Kimberley (7,799 or 23%) and the Shire of Wyndham-East Kimberley (7,662 or 22%) while the Shire of Halls Creek (3,338 or 10%) is significantly less populated (**Appendix D**). The Shire of Broome also has the largest number of jobs in the region and in 2006, 42% (5,563) of the Kimberley region's jobs were in the Shire of Broome. These jobs were mainly in the services sector (public administration and safety, education and training and health care and social assistance).

Population growth is a key feature of the Kimberley and population growth in the region accounted for 7.6% of growth in regional WA in the ten years between 1998 and 2008 (**Appendix D**). It is notable that past population increases in the Kimberley region have not been experienced uniformly across the region. In the ten year period from 1998 to 2008, the Shire of Broome accommodated 73% of the region's population growth. Derby-West Kimberley and Wyndham-East Kimberley accommodated 10% and 17% respectively, while Halls Creek had a minor decline (**Appendix D**).

² Post census estimate. Estimates for 2008 are based on revised final estimated residential population for 2006 released on 23 April 2009 (ABS 2009). The previous ABS final estimated residential population (the 19 August 2008 release) has been questioned by State demographers Australia-wide, including the Western Australian State demographer and the update does not change the Kimberley Region. The official 2008 estimate may be conservative.

³ Western Australia excluding the Perth Metropolitan Region (Perth Statistical Division).



■ **Figure 10-1 Estimated Residential Population of Local Government Areas (LGA) of the Kimberley Region, 1976-2006.**

Figure 10-1 and Table 10-1 illustrate the changes in the population of the Kimberley region over the 30 year period between 1976 and 2006. During this period, the Kimberley region's population more than doubled from 14,430 in 1976 to 31,928 in 2006 and its share of the State's non-metropolitan population increased from 4.2% to 5.9%. Importantly, this period captured the decline in population of Derby-West Kimberley and the significant increase in population in the Shire of Broome. In 1976, Derby was the regional service centre whereas many of these services are now provided in Broome.

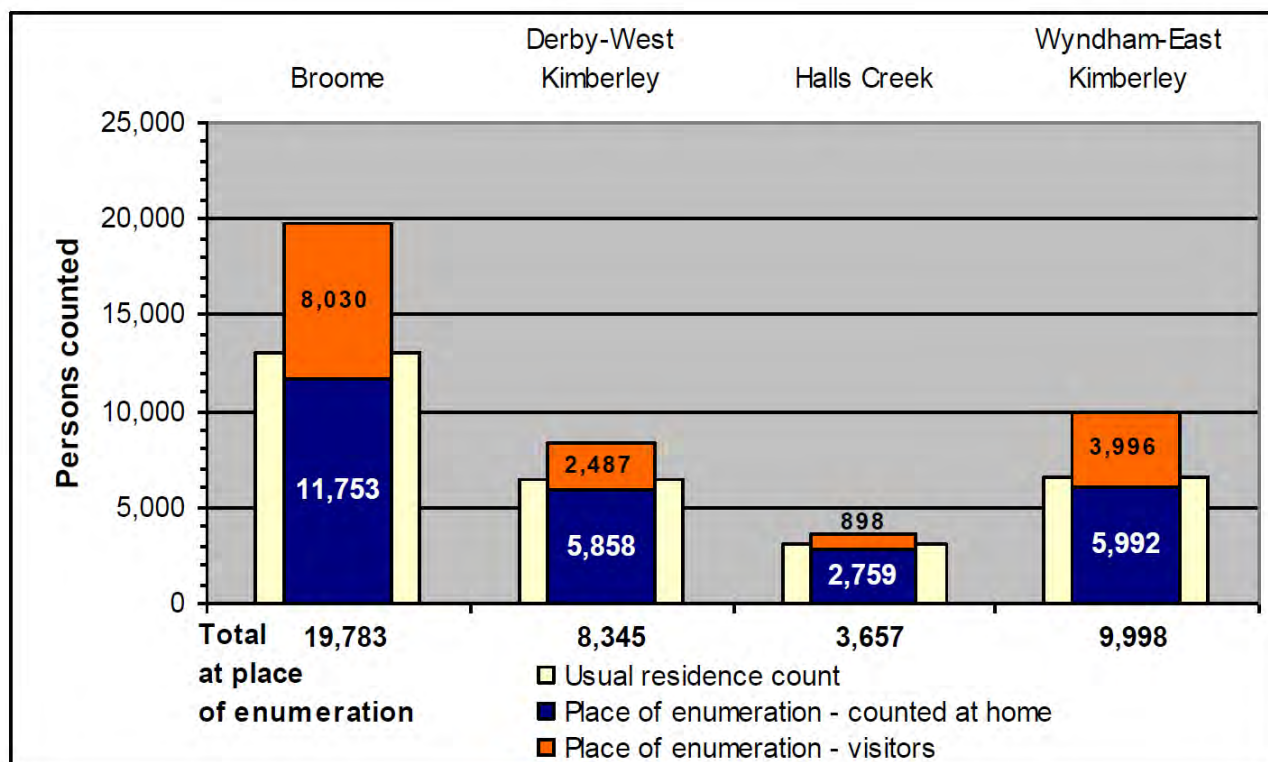
■ **Table 10-1 Estimated Resident Population of LGA of the Kimberley Region, 1976 – 2006.**

Local Government Area	Estimated Resident Population at 30 June						
	1976	1981	1986	1991	1996	2001	2006
Broome	3,590	4,280	5,923	7,887	9,766	13,196	14,175
Derby-West Kimberley	5,090	6,330	6,501	7,019	6,512	8,467	7,355
Halls Creek	1,940	2,540	2,748	2,679	2,910	3,751	3,239
Wyndham-East Kimberley	3,810	4,790	5,952	5,790	6,484	7,211	7,159
Kimberley Region	14,430	17,940	21,124	23,375	25,672	32,625	31,928
Regional WA	345,580	378,020	408,899	447,305	470,164	508,157	540,633
WA	1,178,340	1,300,060	1,459,019	1,636,067	1,765,256	1,901,159	2,059,381

Sources:

1976	Estimated Resident Population in Local Government Areas, WA - 1976, 1981 and 1982. Australian Bureau of Statistics WA Office. Cat No. 3203.5. 7 September 1983.
1981	Estimated Resident Population in Local Government Areas, WA 30 June 1981 to 1985. Australian Bureau of Statistics Perth. Cat No. 3203.5. 12 November 1986.
1986	Estimated Resident Population by Age and Sex in Statistical Local Areas 30 June 1992. Australian Bureau of Statistics Canberra. Cat No. 3203.5. 26 September 1994.
1991	Regional Population Growth, Australia. Australian Bureau of Statistics Canberra. Cat No. 3218.0. 25 July 2002.
1996 – 2000	Regional Population Growth, Australia. Australian Bureau of Statistics Canberra. Cat No. 3218.0. 19 August 2008.
2001 – 2008	Regional Population Growth, Australia. Australian Bureau of Statistics Canberra. Cat No. 3218.0. 23 April 2009.

The Kimberley is a popular tourist destination and a snapshot of the extent of tourism was provided by the August 2006 census that was undertaken near the peak of the Kimberley tourist season. **Figure 10-2** shows the number of visitors (orange) to the Kimberley local government areas as opposed to the people counted at home (blue) and the people who claimed that the relevant area was their usual place of residence (cream). The impact of tourists is particularly marked in the Shire of Broome and causes a burden for relevant human services such as health. On census night, 37% of people counted were visitors to the region (WA average 7%); and, in the Shire of Broome, of 19,783 people counted, 8,030 (40.6%) were considered visitors.

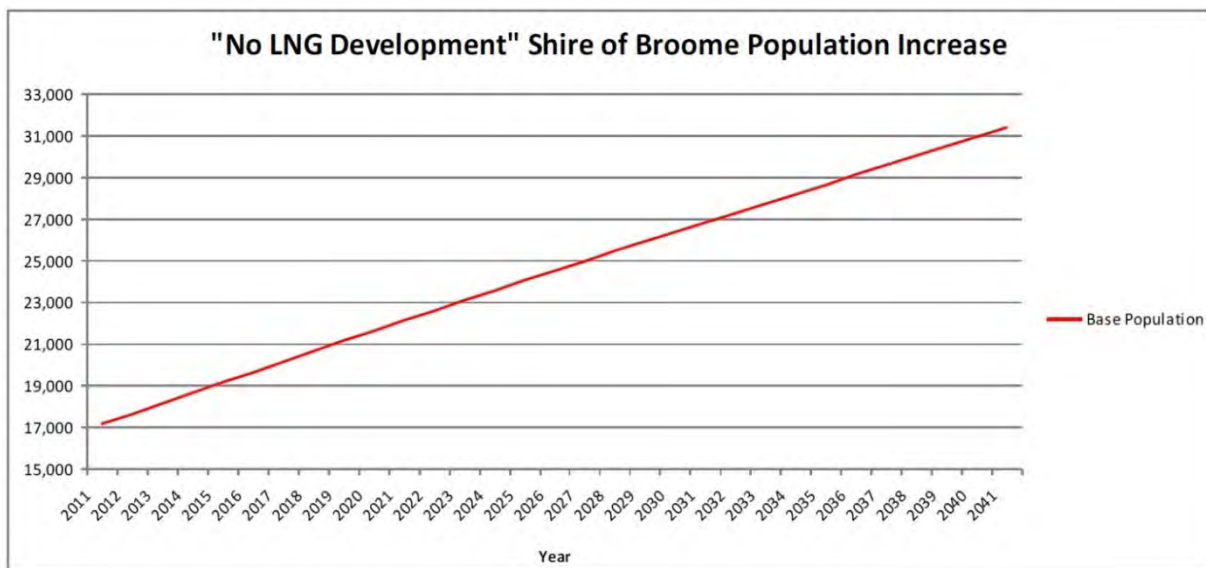


■ **Figure 10-2 Visitors and Residents in LGA of the Kimberley Region, 2006.**

10.1.1.2. Social Characteristics of the Shire of Broome

Even without the proposed establishment of the BLNG Precinct, the Shire of Broome demonstrates exceptionally high growth with a 4.7% per annum population increase from 1976 to 2006. Broome is currently experiencing the effects of this significant population growth with the demand for many services outstripping supply.

As illustrated in **Figure 10-3**, this growth is projected to continue. The population projections for the Shire of Broome, undertaken by the Western Australian State demographer as part of this Strategic Assessment, show a mid-range projection from 17,100 people in 2011 to 31,400 people in 2041.

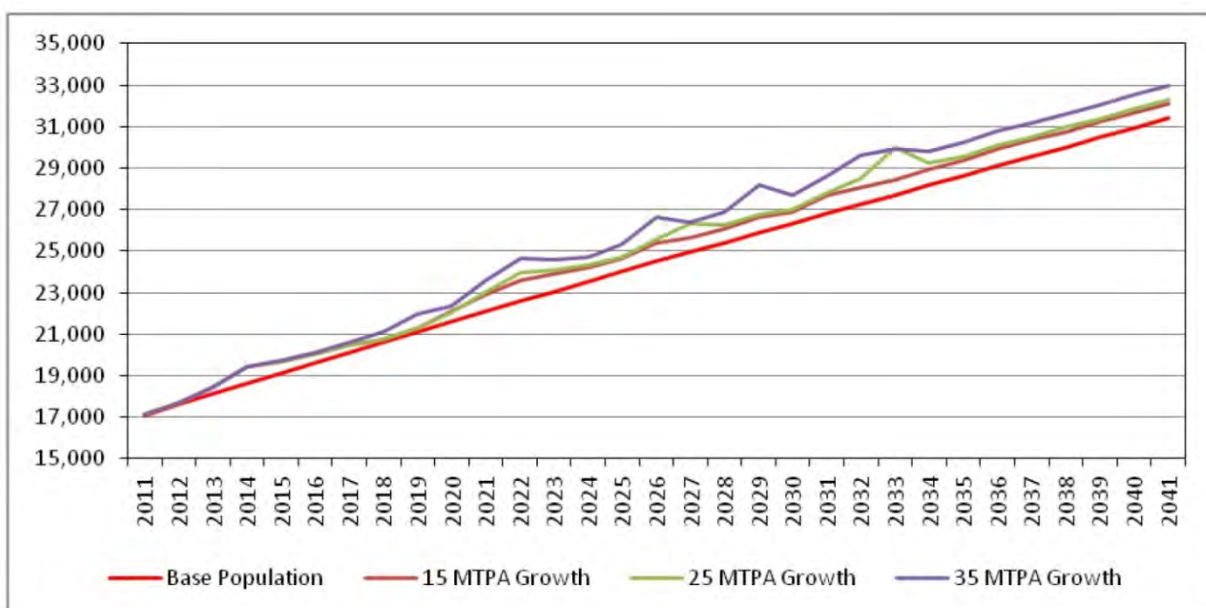


Source: (Produced by EBC (2009); and reported in **Appendix D**)

■ **Figure 10-3 Projected Mid-range Population of the Shire of Broome (No LNG Development).**

10.1.2. Impact Assessment - Social

The DSD Strategic Social Impact Assessment (DSD, 2009a; **Appendix D-1**, DSD, 2009b; **Appendix D-2** and DSD, 2009c; **Appendix D-3**) assessed the social impacts resulting from the development of the Precinct on the primary impact area (Precinct site and the town of Broome) and the secondary impact areas (the Dampier Peninsula, Derby and Bidjardanga). This assessment included detailed population modelling based on low, medium and high workforce assumptions. **Figure 10-4** shows the projected base population growth against population growth under LNG production scenarios of 15Mtpa, 25Mtpa and 35Mtpa, respectively over 30 years. The modelling demonstrates that the projected baseline population growth in the Shire of Broome is the primary factor influencing the demand for additional human services and facilities and not the potential development of the Precinct at James Price Point. Population increases attributable to the Precinct development are an additive component which further contributes to the existing impacts from natural population growth.



Source: (Produced by EBC (2010); and reported in **Appendix D**)

■ **Figure 10-4 Shire of Broome Population Increase with 15, 25, and 35Mtpa Scenarios.**

The impacts and opportunities identified in the strategic SIA were reported in **Part 5, Section 2** of the Strategic Assessment Report as:

- economic factors;
- demand for land and housing;
- social infrastructure, public utilities and transport;
- health services and facilities;
- education, training and employment;
- sport and recreation;
- tourism;
- police, justice, social needs and services;
- community identity and sense of place; and
- social mix and values.

The Assessment identified that the social impacts to which the region is most vulnerable to change associated with the BLNG Precinct (in magnitude and likelihood) relate to:

- housing availability, affordability and homelessness;
- community identity and sense of place;
- development of the regional economy, specifically with respect to workforce competition and small businesses that undergo rapid growth during construction phases;
- cost of living; and
- community wellbeing and social and health service delivery.

Social mitigation and management strategies for development of the BLNG Precinct were developed within the context of the issues outlined above and with regard to three key themes:

- Broome's unusually high projected natural⁴ population growth over the 30 year time span of the assessment;
- the lack of current services capacity in Broome to manage additional population; and
- social and land management issues of importance to the Traditional Owners.

As a result of these issues, the primary social mitigation measure to be employed is to separate the BLNG construction workforce from Broome as much as possible in the short term and until otherwise agreed by the principal parties. Over time and through the implementation of effective adjustment strategies, greater and more sustainable integration of the Broome and workforce populations could occur, particularly with the operational workforce.

Potential impacts from both the temporary and permanent workforce are of significant concern for most stakeholders. These include Broome residents, Traditional Owners, the tourism industry, the fishing industry and Broome and Dampier Peninsula community members. Accommodating the large scale construction workforce away from Broome and managing its social and environmental impacts on the Dampier Peninsula will be a key focus for management. Such management strategies will however, be developed in recognition that such an approach may lessen the direct BLNG Precinct-related economic opportunities for Broome and the local area. This will be balanced against the substantial economic opportunities that will likely derive from the significant projected population increase itself.

The long lifespan of the BLNG Precinct is such that flexibility in the mitigation and management measures will be essential. In this regard, an adaptive management approach is proposed, in which social management measures are captured in agreements or conditions associated with proponent access and operation within the BLNG Precinct in a manner that keeps pace with changes in the region.

⁴ Includes births, deaths and migration.

The SIA mitigation and management measures are aimed at addressing the impacts and enhancing opportunities of the BLNG Precinct, mainly within the primary impact area. These mitigation and management measures are discussed in more detail in **Part 5, Section 5**.

The key social mitigation and management strategies are central to the assumptions made in the strategic SIA and mitigate flow on impacts. The strategies will take the form of Precinct conditions or other similar mechanisms for proponents. The arrangements will have a mechanism to change the conditions, subject to agreement from relevant commercial parties. These Precinct conditions will be audited on a regular basis. Suggested management strategies that should be included in the Precinct conditions include those related to:

- a Managed Access Construction Camp;
- access to Broome and Dampier Peninsula;
- management of Worker behaviour;
- local living incentives;
- cross-cultural training;
- education, training and employment;
- Indigenous workforce development;
- transient/opportunistic workforce management;
- strategies to retain local benefits;
- Precinct emergency services and policing; and
- transport management.

In addition to the Precinct condition strategies, the following strategies will be developed:

- Marine Resource Impacts Management Strategy;
- Tourism Impacts Management Strategy;
- Recreational Impacts Management Strategy;
- Broome Character and Sense of Place Management Strategy;
- Housing Strategy;
- West Kimberley Socio-economic Strategy; and
- Governance and Monitoring Strategy.

10.2. Strategic Indigenous Impact Assessment

As part of the assessment and consultation processes being undertaken, DSD commissioned the KLC, as the representative of the Goolarabooloo /Jabirr Jabirr native title claimants and as representative body for the purposes of the Commonwealth *Native Title Act 1993*, to undertake an Indigenous Impact Assessment comprising the following:

- Indigenous Impacts Report Volume 1: Overview and Consolidated Recommendations (KLC, 2010a; **Appendix E-1**).
- Indigenous Impacts Report Volume 2: Traditional Owner Consent and Community Consultation, a report on the consultation and agreement processes (O'Faircheallaigh et al., 2010; **Appendix E-2**).
- Indigenous Impacts Report Volume 3: Aboriginal Social Impact Assessment; a report on the social and economic impacts (Kahn, 2010; **Appendix E-3**).
- Indigenous Impacts Report Volume 4: Heritage Impact Assessment (**HIA**), a report on Aboriginal cultural heritage values and impacts (KLC, 2010b; **Appendix E-4**).
- Indigenous Impacts Report Volume 5: Aboriginal Archaeological Site Avoidance Survey (Eureka, 2010; **Appendix E-5**).
- Indigenous Impacts Report Volume 6: Ethnobiology Report, James Price Point (Margetts and Grabasch, 2010a and 2010b; **Appendix E-6** and **Appendix E-7**).

The Indigenous Impact Reports form part of **Appendix E** Supporting Documents of this Strategic Assessment Report and are available on the Department of State Development's website at: <http://www.dsd.wa.gov.au/7901.aspx> with the findings summarised in **Section 10.2.1** to **Section 10.2.5** on the following factors:

- potential socio-economic impacts on Indigenous People;
- Indigenous cultural heritage values;
- potential impacts on Aboriginal Heritage Sites and archaeology;
- potential impacts on Indigenous environmental values; and
- customary fishing.

The State's objectives to achieve informed consent and to confer benefits to the Region's Indigenous people are discussed in **Section 10.2.6**.

10.2.1. Potential Socio-economic Impacts on Indigenous People

The KLC was funded to undertake an Aboriginal Social Impact Assessment to assess the socio-economic impacts on Indigenous people arising from the development of the Precinct as part of the Strategic Assessment of the BLNG Precinct proposal (**Appendix E**). Most of the issues and concerns raised by participants of the ASIA fall under the following impact categories:

- impacts on land and sea country;
- social impacts of increased population in Broome, both in the town itself and in the Dampier Peninsula;
- housing and the cost of living;
- economic, employment and enterprise development;
- education and training;
- health and well-being;
- youth;
- service delivery and infrastructure;
- distributive impacts and the equitable distribution of benefits to Indigenous people;
- land tenure issues; and
- culture and heritage.

The key concern and risk identified by the ASIA was that Indigenous people will be disproportionately exposed to some of the negative risks associated with the development of the Precinct (such as cost of living) and less set up to take advantage of the opportunities the Precinct offers (due, for example, to poorer education and health outcomes than those of the general community). In other words, there is likely to be inequity in the distribution of impacts within the general population with the majority of Indigenous people more likely to experience negative impacts and less likely to experience the positive benefits associated with development of the BLNG Precinct.

A broad range of agreements with Indigenous people will be implemented and mitigation measures adopted to protect cultural values, improve underlying social issues and provide for socio-economic benefits, including opportunities to participate in the development of land management planning for the Dampier Peninsula and to undertake ranger training.

The assessment concludes that the development of the Precinct is likely to have a major impact on Aboriginal people. The underlying relative deficiencies in housing, education, employment, training and other factors will limit the extent to which the Precinct-related opportunities can be taken up by Aboriginal people. The report found that the extent to which these underlying issues are addressed will help shape the nature of the impacts and opportunities. This theme is consistent with the broader DSD Social Impact Assessment conducted as part of the Strategic Assessment. The central finding of the DSD Social Impact Assessment is that social impacts from the Precinct are manageable; however their effect is likely to be substantially amplified given the already stressed social services and socio-economic environment of the west Kimberley, particularly Broome. This notwithstanding, the Precinct offers the region a unique opportunity to substantially alleviate its existing social pressures through government and commercial proponent activity that not only mitigates impact, but provides benefits that may also relieve the region's presently fragile social state. This represents an advantage that may not have existed without the prospect of the Precinct.

10.2.2. Indigenous Cultural Heritage Values

Several studies have been completed to support the assessment of potential effects on Indigenous cultural heritage values. These include the following:

- a desktop study and review of the existing Aboriginal registered site information available at the WA Department of Indigenous Affairs (DIA);
- a Traditional Owner Cultural Values Survey undertaken as part of the site selection process around James Price Point;
- Indigenous Impacts Report Volume 4: Heritage Impact Assessment, a report on Aboriginal cultural heritage values and impacts;
- Indigenous Impacts Report Volume 5: Aboriginal Archaeological Site Avoidance Survey; and
- Indigenous Impacts Report Volume 6: Ethnobiology Report, James Price Point.

These studies found that the following Aboriginal heritage impacts may result:

- impacts on the cultural heritage values in the surrounding Kimberley region; and
- disturbance of Aboriginal sites within the BLNG Precinct.

In its assessment of potentially affected cultural heritage values, the HIA covers James Price Point and Broome as Primary Impact Areas and the area surrounding as the Secondary Impact Area (including communities on the Dampier Peninsula and the communities of Derby and Bidjardanga). The report identifies the existence of dreaming trails and important sites across the region. The report identifies that the Lurujarri Heritage Trail (which extends from Minarriny/Coulomb Point to Yinara South of Broome) may be directly affected by the Precinct Plan as it crosses the area designated for the BLNG Precinct. There are archaeological heritage sites that have been identified with the James Price Point area that are potentially impacted by the Precinct Plan. It is also possible that these sites have ethnographic significance. Further survey work will be done before the Precinct Plan is implemented to ensure that any impacts are appropriately managed and mitigated to the extent possible. This will enable more detailed assessment of the sites that are identified before the Precinct Plan is implemented.

The HIA concludes that the Traditional Owners of the James Price Point area and the wider Dampier Peninsula are part of an interconnected system of country, culture, people and places across the Dampier Peninsula and the wider HIA area. As such the development of the Precinct Plan has the potential to affect these interconnected values. The HIA identifies the importance of Indigenous cultural values associated with the James Price Point area that are potentially directly affected by the Precinct Plan. Even if the localised impact of the Precinct Plan means that the impact on the values is limited and manageable, the values are also potentially indirectly affected by the development by virtue of their interconnected nature. The report concludes that in this regard impacts are more difficult to predict and quantify. For example, Jabirr Jabirr people and other groups on the Dampier Peninsula believe that ancestral beings travelled the country and during their travels imbued the physical landscape with spiritual meaning. Specific places where the ancestral beings are known to have travelled and interacted with the landscape are places of particular importance for the Jabirr Jabirr people.

The HIA concludes that language groups of the Dampier Peninsula area share a distinct culture-scape, or alternatively, their culture-scapes are especially interconnected. Their languages are related, and they share other cultural features, including beliefs about the pre-existing souls of people called rai or raya. They share ancestral creator beings who are said to have created their countries, and provided them with their Law, and they share Peninsula Law which embraces all of the local and regional Dreaming beings, Dreaming events and locations, and associated ethics and rituals. The HIA concludes that as a consequence, the impact of the BLNG Precinct may be experienced not only by the Traditional Owners for the James Price Point area but by other groups to the north, south and east that share Law and ritual practice, and who have responsibilities to 'look after' the Law and places associated with it.

Resources obtained from the land and the sea as well as other benefits derived from country (such as those from resource development benefit agreements), are also important for Kimberley Aboriginal people as components in the regional exchange system known as wurnan. Wurnan is a fundamental component of Kimberley traditional culture and a significant part of the 'connectedness' between the language groups and countries of the region.

The heritage values of the region were also assessed against the criteria for National Heritage listing. The HIA sets out the possible values. As part of the assessment of the Kimberley region for possible inclusion on the National Heritage List, the James Price Point locality was assessed by the Aboriginal Heritage Commission (AHC) for possible national heritage values. Following its preliminary assessment, the AHC found that, while James Price Point had heritage values, there was insufficient evidence to demonstrate that they reach the very high threshold required for National Heritage listing. The AHC subsequently released a map of the area it considered might have national heritage values, which did not include James Price Point.

The HIA analysis of potential impacts was conducted on the assumption that the interconnectedness of culture, land, people and country means that impacts of the Precinct Plan in the James Price Point area can have indirect impacts on cultural values across the wider HIA area. The HIA also qualifies that at the time the HIA was prepared the Precinct Plan the subject of the strategic assessment was subject to further development, so it was therefore not possible to identify all potential impacts on cultural values / Aboriginal heritage from the Precinct Plan and significant uncertainty exists in relation to the scale, duration, and permanence of those impacts.

10.2.3. Potential impacts on Cultural Heritage Values and Related Management Strategies

Several studies have been completed to assist in the assessment of the impacts on Aboriginal heritage. These comprise: a desktop study; a Traditional Owner Cultural Values Survey undertaken as part of the site selection process around James Price Point; and a subsequent Archaeological Survey undertaken to inform the Strategic Assessment of the BLNG Precinct.

Additional to the potential risks identified in the Scoping Document (DSD, 2010b; **Appendix A-2**), many of which related to potential physical disturbance of heritage sites, the HIA identified the following potential sources of indirect impacts:

- increased visitor numbers to traditional country;
- damage to rock art sites, rock engraving sites and other sites of cultural significance caused by emissions from the activities or classes of activities under the Precinct Plan; and
- sourcing of construction materials (quarrying, etc).

The HIA raises that a potential indirect impact is increased visitor numbers to traditional countries on and surrounding the Dampier Peninsula as a result of increased population in the region. This relates to a broad geographical area that includes the entirety of the HIA area, as well as areas beyond it within the Kimberley region because it is argued in the HIA that there will be impacts not only on specific sites of cultural and heritage significance to Kimberley Aboriginal people, but also on the cultural land- and seascapes of which such sites are integral components.

The HIA also raises potential impacts on rock art/engraving sites from LNG associated activities and identifies potential sources as dust and other emissions (increased vehicular traffic, mining and quarrying) during construction, and operational emissions such as mercury, hydrogen sulphate and carbon dioxide from the liquefaction process, emissions from power generation and desalination activities, and anthropogenic acidification of rain resulting from industrial activities. The HIA provides an overview of available information on rock art sites and identifies three registered rock art/engraving sites on the Dampier Peninsula close to a 150km radius from James Price Point; the concentration of registered sites within this radius is significantly less than that in the rest of the area (see Figure 32 in HIA for regional map).

The KLC commissioned an archaeological survey of the proposed BLNG Precinct in December 2009. The survey focused on the onshore component of the proposed development, while noting that additional archaeological work to investigate the potential for Aboriginal and other heritage values in the intertidal zone of the LNG Precinct area will be required. The Aboriginal archaeological Site Avoidance survey found no archaeological sites other than those already documented on the DIA registers. While much of the inland area of the Precinct has not been subject to survey, the Traditional Owners have expressed the view that in general, travel up and down the Peninsula has been restricted to the coastal areas. Only four registered sites were identified within the Project Area. The survey confirmed that the eastern boundary of Walmadany (DIA Site ID 13076) extends into the Project Area but has not yet been determined. Based on the archaeological report it does not appear that any of these sites are of a nature that disturbance could not be managed. Further archaeological survey work will be conducted as required to ensure that any works that are commenced are conducted in accordance with the requirements of the applicable heritage legislation.

The mitigation and management strategies developed for the Precinct Plan will address the heritage values and sites potentially affected by the Precinct Plan. They will also take into account the regional aspects of the heritage values associated with the HIA area. These are set out in the Strategic Assessment Report and include the following key initiatives:

- Commitments under the Heads of Agreement, for the State and Woodside to “work with the Native Title Party and the KLC to design, construct, operate, decommission and rehabilitate the LNG Precinct in a manner that where possible avoids impacts on Aboriginal sites, including (without limitation) song lines, or minimises any impact on Aboriginal sites in accordance with the Studies Agreement (dated 7 May 2008), the proposed Heritage Protection Agreement and any future cultural heritage management plans”.
- Procedures set out in the Heritage Protection Agreement regarding Traditional Owners’ rights, how the parties to the agreement will manage heritage studies, what will be done in the event of the discovery of a site, how applications to the Aboriginal Cultural Material Committee established under the Western Australian *Aboriginal Heritage Act 1972 (AH Act)* will be managed and how other activities will be conducted.
- The development of a Cultural Heritage Management Plan that will document how any vulnerable sites will be monitored, managed and protected during the construction and operational phases of the Precinct. Each proponent seeking to establish a project within the precinct will be required to develop a CHMP.
- The BLNG Precinct Management Structure, as delineated in **Part 6, Section 3**, will provide another important mechanism to monitor, manage and report on any potential cultural heritage impacts, specifically through the Precinct Management Committee.
- Social impact management strategies including a Managed Access Construction Camp access camp, organised recreational activities and cultural awareness training.
- Existing plans by the DIA and the Department of Environment and Conservation to develop a Dampier Peninsula Land Use and Infrastructure Plan and associated conservation reserve in collaboration with the KLC and Traditional Owners to help address existing and ongoing impacts of various land uses on the Dampier Peninsula.
- The development of a BLNG Precinct ILUA or similar land agreement.

The Commonwealth *Aboriginal and Torres Strait Islander Heritage Protection Act 1984* applies in conjunction with the AH Act of WA and was introduced to enable the Commonwealth to protect significant Aboriginal areas and sites when State or Territory law does not provide effective protection. The Minister can only take action when he or she receives an application by or on behalf of Aboriginals or Torres Strait Islander people to protect a specified area from injury or desecration.

These management strategies are designed to provide multiple triggers for Traditional Owners to be involved in the management of potential impacts on cultural heritage. Detailed archaeology and anthropology surveys, including further engagement with the Traditional Owners, are proposed for the Precinct to ensure that there is a comprehensive approach to understanding the tangible, intangible and cultural heritage of the area. These will be conducted in accordance with the Heritage Protection Agreement between the State, the KLC on behalf of the Traditional Owners and Woodside. The parties have agreed to work together to minimise impacts on Aboriginal heritage sites where possible, including working with the Traditional Owners on the layout of the Precinct. Sites of significant importance will be protected not only by the provisions of the AH Act but through the development of a Cultural Heritage Management Plan being negotiated between the State, the Foundation Proponent and the KLC.

10.2.4. Indigenous Environmental Values

Potential impacts on species and environmental values are very relevant to Indigenous people because of the economic, social and cultural significance of particular species and activities (such as fishing) and their unique relationship with the landscape. Many species of plants and animals found in Indigenous country are of economic and religious importance to their Traditional Owners. This is the case for the Dampier Peninsula people, as well as for Aboriginal People in other parts of the Kimberley.

Plants and animals are part of the cultural land and seascapes of these areas and, as such, they are significant components of the Aboriginal heritage of the Precinct area. Certain areas are both recognised and named as especially rich sources for such resources. For example, Packer Island (north of Pender Bay) and the immediate hinterland to the east continue to be a focus for Aboriginal people to source bush foods, as it was in the past. Turtle and dugong continue to be highly prized resources. Many varieties of reef, near-shore and offshore fish species are caught by line, spear

and/or trapped in man-made or natural fish traps. Mangrove areas and associated mudflats are sourced for various shellfish species and mud crabs at low tide. Birds and reptiles have also been harvested for food in the region. Gums from trees have been used and honey extracted from tree hollows. These activities also reinforce and support people's social relationships and connections to country.

Potential impacts on species of Ethno-biological significance and associated management strategies have been outlined above in **Section 8.2.5**.

10.2.5. Customary Fishing

A customary fishing study was commissioned by the State to investigate the fishing practices of Indigenous people likely to be affected by the Precinct Plan (Big Island Research, 2010). The study identifies that Aboriginal people in northern Australia fish much more regularly than people in the general population. This is likely to be due to a range of factors including: relative poverty (the need to provide food); lack of alternative recreational opportunities (especially in the small communities where the Commonwealth focused much of its research); and a desire to be “on country” to focus on Aboriginal identity.

Research has included estimates of the types of fishing in which Aboriginal people in general are known to engage. Very few Aboriginal people own boats for fishing, although the numbers who do are probably growing. Most customary fishing is from shore; line fishing is easy and accessible to all who can get to the coast with a simple hand line. However, nets are also used both to procure bait and for catching fish such as mullet, which are a highly valued fish but which are difficult to catch with hook and line (see **Figure 10-5**).

From this study it is predicted that the Precinct Plan is likely to affect customary fishing in the immediate vicinity of the Precinct just south of James Price Point because the facilities will restrict access and much of the fishing done is land based or close to shore. However, access to James Price Point itself will be maintained from Broome via the Precinct access road and an unsealed track around the Precinct itself and will be managed through the Recreation Management Strategy, Dampier Peninsula Land Use and Infrastructure Plan; and management plans developed in consultation with the Traditional Owners for the proposed conservation reserve that is to surround the Precinct.

Customary fishing in the immediate vicinity of the Precinct has declined in recent years and fishing appears to be conducted regularly and by a large proportion of the Indigenous population at a variety of coastal locations in the impact area. While cultural values associated with customary fishing will be affected if fishing at James Price Point declines as a result of the development, it appears likely that customary fishing would not stop as a result of the development but would continue elsewhere as discussed above. On this basis, it can be concluded that the cultural values associated with fishing activities can be maintained notwithstanding the implementation of the Precinct Plan.



■ **Figure 10-5 Casting for Bait near Manari.**

10.2.6. State's Objective to Achieve Informed Consent and to Confer Benefits to the Region's Indigenous People

Under the Terms of Reference for the Strategic Assessment, the question of “whether the Traditional Owners have given informed consent, in a culturally appropriate manner to the implementation of the Plan” needs to be addressed. The Strategic Assessment Report must also include any details of consultation, in addition to the statutory consultation, about the Plan. The State's process to achieve informed consent and details of its consultation are described in **Part 5, Section 3.9** of this report.

On 15 June 2007 the Cabinet of the Western Australian Government established the Northern Development Taskforce “to identify one or more suitable strategic industrial sites to minimize the environmental and heritage footprints of, and be practicable for, proposed Browse Basin gas-based projects”. At that time a key objective of government was to establish the basis for the meaningful participation of Kimberley Aboriginal communities in a site selection process to underpin “informed consent” for the development of the Browse Basin gas at a site on the Kimberley coast and ultimately for the BLNG Precinct Plan under the Strategic Assessment.

Between December 2007 and September 2008, comprehensive engagement was undertaken with the West Kimberley Traditional Owners by the KLC, funded by the NDT. The process was to underpin the ultimate “informed consent” decision in anticipation of finding a suitable site that was technically viable, environmentally sustainable and acceptable to Aboriginal people, taking into account Aboriginal heritage, cultural significance and any related impacts on the Aboriginal community. That consultation informed the decision to reduce the number of suitable sites from the 43 assessed to four. The KLC have noted the site selection process conducted between December 2007 and September 2008 embodied the principle of Indigenous Free Prior Informed Consent (**IFPIC**) to a substantial degree. This is consistent with its view that the IFPIC *reflects the fundamental cultural values and political principles held by Kimberley Traditional Owners*, and is the appropriate standard for its report.

The Strategic Assessment Report's Terms of Reference negotiated between the State and the Commonwealth, which were made available for Public Comment in July 2008, did not imply that the IFPIC would apply. At the time, the Australian Government did not support the United Nations Declaration of Rights of Indigenous People (**UNDRIP**) and declined to become a signatory.

The State's objective has and continues to be, to achieve the highest possible level of Traditional Owner informed consent and to confer substantial benefits arising from the development of the Precinct to the region's indigenous people. Since early 2009, the development timelines have been subject to the retention lease conditions required by Woodside and its JV Partners to make a final investment decision by mid-2012. The KLC and the Traditional Owners consider the commercial timeframes did not afford them enough time nor provide enough detailed information to meet IFPIC principles. Notwithstanding, the State, the KLC representing the Traditional Owners Negotiating Committee (**TONC**), and Woodside have continued to negotiate. A range of significant milestones have been achieved, including development of a comprehensive Traditional Owners Information Booklet, a Studies Agreement, a Heads of Agreement, a Heritage Protection Agreement and ongoing Funding Agreements. Negotiations in good faith are continuing within the land acquisition process provided for under the future act provisions of the Native Title Act.

10.3. Direct Social Surrounds and Socio-economic Factors

Part 5, Section 4 of the Strategic Assessment Report assesses factors that were identified through the *Browse LNG Precinct Scope of the Strategic Assessment* (DSD, 2010b; **Appendix A-2**) report but were either not assessed within the original scope of the overall SIA and ASIA, or required further detailed assessment in the context of the BLNG Precinct and direct Category A related impacts. These factors provide further context to the social surrounds and economic context for the BLNG Precinct, addressing current knowledge of those surrounds, their key characteristics, and the potential impacts on them related to the proposed development, and the mitigation and management measures designed to address the impacts. The section addresses the following factors:

- Environmental Heritage and Conservation Areas;
- Palaeontology;
- Colonial Heritage;
- Visual Amenity, Light and Landscape Character;
- Commercial Fishing;
- Aquaculture and Pearling;
- Tourism;
- Sports, Recreation and Land Use (including Recreational Fishing); and
- Human Health.

10.3.1. Environmental Heritage and Conservation Areas

The EPA objective for heritage does not specifically relate to environmental heritage, but to historical and cultural associations and related legislation. However, it is considered by the Proponent that by meeting the EPA's objectives for biophysical factors, the BLNG Precinct proposal could be deemed acceptable with respect to environmental heritage.

The Commonwealth's objective is to avoid significant impacts on matters of NES, the environment on Commonwealth land or the environment generally where it involves actions by Commonwealth agencies. There are no listed places protected pursuant to the EPBC Act that occur within or near the site. Additionally, in its preliminary assessment of National Heritage values of the west Kimberley, the Australian Heritage Council found that there was insufficient evidence to demonstrate that heritage values in the vicinity of James Price Point reached the very high threshold required for National Heritage listing. In making a decision on whether to include a place in the National Heritage List, The Minister for Sustainability, Environment, Water, Population and Communities must have regard to the Australian Heritage Council's final assessment on whether a place meets any of the National Heritage criteria, all comments received and "may seek, and have regard to information or advice from any source [s.324JJ(5)(b) of the EPBC Act]". While the Australian Heritage Council's final assessment will become publically available following a decision of the Minister for Environment on National Heritage listing, current knowledge indicates that there are unlikely to be any significant impacts on National Heritage matters. The Minister's final decision is expected by 30 June 2011.

The nearest conservation area is the Coulomb Point Nature Reserve, located some 15km from the BLNG precinct, and therefore no direct impacts are anticipated. Indirect impacts may result from increased visitors to the reserve following the restriction of public access at James Price Point for fishing, camping and other recreational activities, as well as improved road access to the areas and the presence of BLNG Precinct staff.

A range of management measures would be applied to mitigate potential impacts on terrestrial conservation areas. Depending on the nature of the derived proposal, such mitigation measures may include:

- Fire and weed management in and around Coulomb Point Nature Reserve and any other nature reserves established in the vicinity of the Precinct Plan area in collaboration with the DEC;
- Measures to improve the value of vegetation of medium to high conservation significance and to manage terrestrial construction related impacts;
- Education and awareness campaigns for BLNG Precinct staff and contractors regarding low-impact behaviour within nature reserves;
- DEC to monitor visitor numbers to Coulomb Point Reserve camping area;
- DEC to develop a management plan for the Coulomb Point Reserve; and
- Access controls to be considered in consultation with the local council, Traditional Owners and DEC.

Furthermore, the State Government intends, through the implementation of the Dampier Peninsula Land Use and Infrastructure Plan, to facilitate the establishment of additional nature reserves and/or national parks within the Dampier Peninsula.

After management and mitigation measures have been applied, it is not expected that the establishment of the BLNG Precinct will result in significant impact on the nearby Coulomb Point Nature Reserve

10.3.2. Palaeontology

Site surveys undertaken by a palaeontologist from the WA Museum on the exposed intertidal platform of Broome sandstone within the likely direct impact areas from construction identified a section where possible dinosaur (likely sauropod) underprints occurred. These possible footprints were assessed to be of a much lower quality compared to other palaeontological sites on the Dampier Peninsula, which occur in Broome sandstone in localities from Broome along much of the coastline. It is possible however that museum grade dinosaur track ways would become exposed during construction.

The construction of the Port facilities will remove or disturb Broome sandstone that could contain other paleontological resources. Sediments from excavation activities could be shifted and deposited elsewhere in the marine environment resulting in burial of previously unrecorded paleontological resources.

The potential mitigation proposed for this impact is that any actions that may disturb offshore or intertidal Broome sandstone at the BLNG Precinct would be required, as a condition of approval, undertaking of the following:

- Identify the potential for fossil materials or footprints to occur;
- Conduct additional focused surveys at the most appropriate time of the year (lowest tide) of any areas not already surveyed potentially containing dinosaur footprints prior to disturbance of the Sandstone; and
- If footprints, or other fossils, are discovered or known to be in the planned disturbance area, the evidence will be scientifically documented and an appropriate response determined in consultation with the Western Australian Museum and the Traditional Owners.

Several management plans associated with the marine and terrestrial environment such as the Dredging and Dredge Spoil Disposal Management Plan will also assist in managing paleontological resources.

As the underprints within the James Price Point coastal area identified to date are considered to be of lower quality than other resources along the coast, the relatively small amount of shoreline (up to 2km) to be disturbed is considered of local rather than regional significance (see **Figure 10-6**)



■ **Figure 10-6 Sauropod Underprints, South of James Price Point.**

Note: Left photo - Relatively large (~70cm in diameter) sauropod underprint with positive relief.
Right photo - Two degraded sauropod underprints.

10.3.3. Colonial Heritage

No significant colonial heritage values are likely to be impacted, with the closest likely sites being shipwrecks found near Barred Creek, 20km to the south of James Price Point. Regardless, a precautionary approach is proposed and the following measures will be implemented to avoid significant impacts on colonial heritage values:

- Fire management plans will be developed to reduce the likelihood of impact on colonial heritage from fire.
- Establishment of construction related management plans which include measures to limit impacts on marine colonial heritage.
- The physical presence of Port facilities may lead to impacts on colonial heritage associated with coastal erosion. Such impacts will be mitigated by the application of appropriate design measures.
- Colonial heritage management strategies will be included in Management Plans governing:
 - Excavation both on land and offshore; and
 - Workforce accommodation, access and recreation.

Implementation of these heritage management measures will avoid significant impacts on colonial heritage values and support compliance with relevant heritage legislation during the development of the BLNG Precinct.

10.3.4. Visual Amenity, Light and Landscape Character

The establishment of facilities at James Price Point is highly likely to impact the visual amenity, light and landscape character of the area given its largely undeveloped nature and the scale of development. While there are no permanent settlements in the James Price Point coastal area, several informal campgrounds and an access track are present.

The recreational and tourist visitors who utilise the coastal strip and nearshore waters are the key visual and light sensitive receptors. The landscape character units of note are areas associated with the marine waters and coastal fringe in the vicinity of James Price Point, as shown in **Figure 10-7**.

Potential impacts on landscape character and visual amenity have been mitigated primarily through the site selection process and the choice of James Price Point as the preferred location for the BLNG Precinct, which presents a relatively low level of visual impact. Impacts on these factors will be further reduced by:

- application of appropriate buffer zones;
- implementation of a Visual Amenity Management Plan;
- implementation of an appropriate Decommissioning and Closure Strategy; and
- implementation of a Rehabilitation Management Plan.

The BLNG Precinct proposal presents a range of potential impacts on the landscape character and visual amenity. The significance of impacts to visual amenity due to spills is very low (i.e. not requiring specific management) as they result in a very temporary reduction in public amenity. At the other extreme, the impacts to landscape character associated with clearing of vegetation would result a temporary but significant reduction in public amenity (i.e. requiring State Government measures to be applied or specific conditions set for derived proposals including the preparation of Management Plans to the satisfaction of the EPA and SEWPAC).



■ Figure 10-7 Location of Existing Landscape Character Units and Extent of Viewshed.

10.3.5. Commercial Fishing

Construction and operation of the BLNG Precinct may result in a range of impacts on commercial fishing activities associated with the introduction of invasive marine species, light emissions, the use of infrastructure and services, creation of restricted areas, increased demand for labour, noise and vibration, discharges and spills, sediment deposition and turbidity, site disturbance and excavation, and vessel movements. These aspects would be addressed through a range of environmental and social factors and mitigation measures as outlined in previous sections, which would also serve to reduce impacts on commercial fishing. Further consultation with affected licence-holders and other stakeholders would be required to determine the extent of impact and appropriate management.

Measures will be implemented to reduce and contain impacts in the marine environment (thereby minimising impacts on commercial fishing). These include the establishment of the Broome Port Authority and several management plans targeted on reducing impacts associated with site disturbance and excavation and sediment deposition and turbidity.

Potential involvement of commercial fishers may include:

- creation of a commercial fishing industry liaison role within the implementation of the Precinct Plan;
- input to final design options to consider passage points through infrastructure (if practical); and
- ongoing monitoring of catch rates of commercial fishers pre- and post-BLNG Precinct development.

Due to the uncertainty regarding permanent change to fish availability, it will be important to monitor catch rates as a key indicator of potential impacts on commercial fishing. However, based on available information, it is considered unlikely that the activities of commercial fishers will be compromised over the long term.

10.3.6. Aquaculture and Pearling

Pearling and aquaculture leases are widely distributed throughout the North West Bioregion, however only pearling operations (predominately the species *Pinctada maxima*) are located in proximity to James Price Point. The closest pearl farm to the BLNG Precinct is approximately 4km west of James Price Point and extends 15.7km to the south. Two pearling leases are located approximately 18km north-west and 30km north of James Price Point, respectively.

The construction and operation of the BLNG Precinct, in particular the dredging and marine construction activities, have the potential to impact on pearling operations in the vicinity through changes in water quality, introduction of invasive marine species and physical disturbance.

A number of aspects were assessed as posing a very low level of significance to pearling and aquaculture (i.e. able to be managed through Management Plans), these included impacts associated with marine noise and vibration, vessel movements, and site disturbance and excavation, the latter of which was considered to be an unlikely occurrence (i.e. unusual or unexpected) that may result in commercial loss due to temporary loss of access. The physical presence of the BLNG Precinct was the only aspect requiring State Government measures to be applied or conditions set on derived proposals), as the export pipeline would likely intersect a portion of the pearl lease adjacent from the BLNG Precinct and may modify existing habitat. This impact will be managed through an engagement process with potentially affected aquaculture and pearling operators and permit holders as a basis for determining measures to avoid, reduce or mitigate impacts on existing operations, coupled with various management plans and State Government measures to control operations within the Port Area.

10.3.7. Tourism

It is anticipated that construction and operation of the BLNG Precinct will result in some disturbance of marine and land based tourism activities in the vicinity of James Price Point, primarily associated with changes to access.

Consultation conducted during the Strategic Assessment determined that 51% of Broome residents believe that the BLNG Precinct could co-exist with tourism with 45% disagreeing that this was possible. Furthermore, while half of the industry stakeholders, visitors and resident groups surveyed considered that the proposed development would have a negative impact on the Kimberley's reputation and image, half of those surveyed felt that the LNG development would increase the economic base and economic diversity of the region.

Mitigation measures proposed to address potential impacts on the marine environment, recreation fishing and terrestrial conservation areas, would also apply to reducing impacts on tourism related to access. These measures, in conjunction with ongoing consultation with the tourism sector and the Traditional Owners, are expected to appropriately mitigate impacts on tourism and visitor activities.

10.3.8. Sports, Recreation and Land Use (including Recreational Fishing)

The recreation and landscape values most likely to be affected by the development of the BLNG Precinct include current access to the coast in the James Price Point area for active or passive recreation purposes such as camping, fishing, boating, picnics and various water activities for both local residents and tourists. While some access will be maintained, it will be restricted compared to current arrangements. Mitigation measures proposed to address potential impacts on recreation fishing, terrestrial conservation areas and tourism (discussed above), would also apply to reducing impacts on recreation.

While a significant increase in demand on existing sport and recreational infrastructure attractions is not expected as a consequence of the BLNG Precinct workforce, pressures as a result of non-precinct related population increases are anticipated, even should the Precinct not proceed.

A Fishing Industry Impact Study was conducted by the Department of Fisheries. The study was based largely on the perceptions of recreational and commercial fishers (including pearling and aquaculture) about the potential impacts caused by the establishment of the LNG Precinct. The report raised a number of concerns including the need for small scale boating facilities in Broome.

Impacts on recreational fishing may result from jetty installation, dredging activities, spoil disposal, vessel movements, anchoring and mooring, pipeline installation and wastewater disposal. As a result, the development of the BLNG Precinct may reduce catch biomass, fishing efficiencies and access to fishing areas (particularly in response to restrictions due to an invasive marine species in the unlikely event of one occurring) to a very limited extent, however, it is unlikely that impacts on recreational fishing will be significant.

A range of management measures would be applied to mitigate potential impacts on recreational fishing. Depending on the nature of the derived proposal, such mitigation measures may include:

- implementation by commercial proponents of various management plans including a Port Facilities Construction Emergency Management Plan and a Vessel Management Plan;
- maintenance of vehicle access around the Precinct site and/or establishment of alternative coastal routes
- establishment of alternative recreational boating facilities;
- establishment of medium-scale boating facilities in Broome capable of catering for recreational and charter vessels, commercial fishers, and pearling vessels – (announcement in the 2010/2011 State Budget of the staged funding of a major boat launching ramp, sheltering breakwater, dredged basin and floating jetty for Broome); and
- preparation of a coastal access and recreation plan (Broome to Coulomb Point) to rationalise recreational camping and access, make provision for sustainable use of the area and determine associated management requirements.

With the exception of ‘the Peanut’ and ‘the Puddle’ offshore fishing areas which were identified as important for sailfish fishing, the mitigation measures described above in conjunction with planned infrastructure upgrades and expansion activities at the Port of Broome, are expected to prevent significant detrimental effect on recreational fishing activities in the region associated with the development of the BLNG Precinct.

10.3.9. Human Health

The Strategic Assessment considered health impacts on individuals and communities as a result of the development of the BLNG Precinct as well as flow-on impacts for local communities. Direct health impacts relate to human exposure to emissions, workforce practices and workforce health. They are difficult to quantify for the construction phase of the BLNG as they are driven largely by the associated temporary population increases, which vary under the possible development scenarios.

Due to the relatively small population impacts associated with the BLNG Precinct, escalated demand for health services is anticipated to be minimal. However, it is noted that small impacts can have major ramifications for a service system that is already operating beyond its capacity, and that is set to undergo greater stress with the expected natural population increases in the Broome region, even if the Precinct were not to proceed.

Measure aimed at establishing buffer zones around the BLNG Precinct and management of discharges and emissions will limit the risk of impacts on human health. The establishment of health care facilities at the Precinct will reduce pressures on services in Broome.

11. Conclusion

The State of Western Australia, through the Minister for State Development, is seeking to develop the BLNG Precinct to:

- provide long term economic prosperity for the Kimberley Region and Western Australia;
- minimise the environmental footprint associated with processing gas from the Browse Basin; and
- work with industry to ensure that the potential socio-economic benefits of such a major development are realised while the potential negative impacts, especially at the local and regional scale, are minimised.

The Browse Basin gas reserves are already being developed and the key question for the State of Western Australia is how best to develop the Browse Basin resource to maximise long term social and economic benefit, while protecting the environmental, cultural and heritage values. There are considerable benefits that would be obtained from development of the BLNG Precinct if it is to go ahead. These include:

- A range of economic growth opportunities arising from a foundation \$30 billion project including regional, State, and national jobs, contracts for both construction and operation of the precinct, and indirect economic stimulus for the local economy which would follow.
- New opportunities for Traditional Owners in terms of education, jobs, business development, and financial incentives as well as Indigenous empowerment through an active role in the management of the Precinct.
- Additional growth opportunities commensurate with future expansions and future users of the Precinct.
- Additional protection and management of the local and regional environment, ensuring that its values are maintained.
- The protection of the vast and iconic wilderness environment of the Kimberley by avoiding further development in the most sensitive and significant areas (in addition to the recent announcement of the Kimberley Conservation Parks providing conservation and protection to an area of land and sea half the size of Tasmania).
- A broadening of the local economic base to provide more people staying in hotel accommodation during the tourist off seasons, and more flights helping to lower the cost of tourists visiting the area.
- Significant benefits in terms of royalty and tax revenue to State and Federal Governments.

The fundamental driver for onshore LNG processing in the west Kimberley is that this coastline is adjacent to the Browse Basin gas resource that requires processing. Other gas processing options in the Pilbara and the Northern Territory would require the unprocessed gas to be transported through at least an additional 500km of pipeline. Development in the vicinity of James Price Point means that the distance the unprocessed gas needs to travel is minimised which in turn minimises the environmental and economic resources required to transport the gas. Although all sites have potential environmental and heritage constraints, the site selection process was designed to find the least constrained site where environmental issues could be managed and where the Traditional Owners were confident that heritage values could also be managed.

An important goal is to minimise the environmental footprint of LNG gas processing by ensuring that the BLNG Precinct will have the capacity for a minimum of two proponents to process gas in the one location. The major environmental and economic benefit of the proposal is a single shipping channel and port that will service proponents without needing to be significantly larger than that required for a single proponent. Other common user infrastructure will include roads, buffers, accommodation areas and a Light Industrial Area to service the BLNG Precinct. Having all these facilities in one location reduces fragmentation of habitats in the area and the risk of edge effects associated with clearing and development. By developing the Precinct, a range of potential impacts will also be avoided through the application of the Precinct Plan and good management measures. These include:

- potential negative impacts to the 'sense of place' of Broome, and to its all important tourism industry;
- ad hoc development along the Kimberley coastline; and
- potential impacts upon important features of the Kimberley such as the marine wildlife or dinosaur footprints.

The consolidation of gas processing also limits potential adverse impacts on amenity and access to a single site. This is especially important to minimise the impacts on tourism, recreation and the region's "sense of place". The Precinct will

inevitably affect the amenity of the James Price Point area for camping and fishing and for safety reasons there will be access restrictions within the Precinct area and the port.

A “project ready” BLNG Precinct will provide commercial proponents with an attractive option to develop gas processing facilities in Western Australia. The Browse Basin gas reserves are expected to provide gas for many generations and so this investment incentive is intended to provide long term economic prosperity at the regional, state and national level.

The population modelling undertaken indicates that, assuming that the mitigation and management measures are implemented, the level of population increase will be limited. For example, a 35Mtpa development may only add a further 5% to the population of the Shire of Broome. There are existing social infrastructure deficits and areas of social issues in Broome that are well documented. Given the significant projected increase in population attributed to the region’s natural growth these will need to be addressed and managed into the future regardless of the establishment of the Precinct. The economic input provided by the implementation of the Precinct Plan offers an opportunity to provide additional resources to address existing issues and support future growth.

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Annexure A Outline of where each of the Terms of Reference have been Addressed within the Strategic Assessment Report

Item	Term of Reference	Section where Terms of Reference are addressed in the SAR
1	Project Purpose The Report must include a general description of the purpose that a Common-user LNG Hub (the Precinct) will serve, including the resources the Precinct will need to function, the actions or classes of actions likely to be undertaken, the scope of related activities, the estimated life of the Precinct, and the regional context in which the Precinct will operate.	<ul style="list-style-type: none"> A description of the purpose, objectives and benefits are described in the Introduction (Part 2, Section 1). The rationale for the Precinct Plan is described in Part 2, Section 3. The classes of action are described in Part 6, Section 3.
2	Description of the Precinct Plan The Report must include a detailed description of the Precinct Plan to which the Agreement relates, including (but not limited to): <ol style="list-style-type: none"> How the Precinct Plan has been developed and its legal standing; Identifying the person(s) or authority responsible for its adoption or implementation, and their jurisdiction; The legal structure under which owners, managers and users of the Precinct will participate in the Precinct; The basis of land/asset tenure; A description of the management arrangements required to ensure the Precinct Plan is implemented successfully; and Identifying the actions or classes of actions that are a subject of the Precinct Plan, including the short, medium and long term aspects of the actions or classes of actions at or associated with the Precinct. These could include relevant construction, operational and decommissioning aspects as well as a comprehensive description of each type of development or facility comprising the Precinct and its associated infrastructure. 	<ul style="list-style-type: none"> The Precinct Plan and management arrangements are provided in Part 6, Section 3. The description of activities and facilities comprising the Precinct and its associated infrastructure is provided in Part 2, Section 5. Land and asset tenure is described in Part 2, Section 7.
3	Project Focus The Report must provide the rationale for the need to develop the Precinct. The Report must include an analysis of the impacts as they relate to the bio-physical, social and economic aspects of the development proposal associated with the development of the Precinct.	<ul style="list-style-type: none"> The rationale for the Precinct Plan is provided in Part 2, Section 3. The analysis of impacts is provided in Part 3 (Marine), Part 4 (Terrestrial) and Part 5 (Social and Economic).
4	Short-listing Process The Report must include a copy of the finalised Site Selection Criteria, and a comprehensive description of how the proposed site(s) for the Precinct were identified including (but not limited to) consideration of: <ol style="list-style-type: none"> EPBC Act matters of National Environmental Significance (NES) (both current and identified as prospective, including likely National Heritage values); Land tenure; Stakeholder and public consultation; How the Site Selection Criteria were used in the shortlisting; The independent verification of feasibility and technical or engineering constraints as identified by the oil and gas industry; Regional environmental and social context and other relevant socio-economic matters inclusive of site security issues; 	<ul style="list-style-type: none"> Site Selection Criteria are included in (NDT, 2008a) Appendix B-2. Short-listing Process is described in Part 2, Section 4. Matters of NES are discussed in Part 6, Section 2. Land tenure is discussed in Part 2, Section 7. Stakeholder and Public Consultation is summarised in Part 2, Section 9. Description of how criteria were used in short-listing is provided in Part 2, Section 4. Independent verification is discussed in Part 2, Section 4.

Item	Term of Reference	Section where Terms of Reference are addressed in the SAR
	<p>g) An analysis of technically and economically viable gas processing options outside the Kimberley, focusing on locations that already have substantial industrial infrastructure, inclusive of floating LNG; and</p> <p>h) Cultural heritage and Indigenous knowledge, and Indigenous aspirations.</p>	<ul style="list-style-type: none"> Regional, environmental and social context is provided for Marine (Part 3, Section 1), Terrestrial (Part 4, Section 1) and Social (Part 5, Section 2 and Section 3). Viable gas processing options evaluation is discussed in Part 2, Section 4. Cultural heritage and Indigenous knowledge (Part 5, Section 3).
5	<p>The Environment Likely to be Affected</p> <p>The Report must provide a detailed description of the environment likely to be affected by the Precinct Plan, the actions or classes of actions taken under the Precinct Plan including any associated infrastructure and construction and operational activities. This description must identify the environmental assets and characteristics, including biophysical processes associated with the site(s) selected in the Precinct Plan and the terrestrial and marine environments likely to be directly or indirectly impacted, for example:</p> <p>a) Components of biodiversity including maintenance of important ecological processes recognising the potential importance of large intact areas in protecting and maintaining ecological processes;</p> <p>b) Listed threatened species, other protected and significant taxa (EPBC Act or WA listed), and new, unnamed species or taxa;</p> <p>c) A description of ecological communities, with reference to Threatened Ecological Communities (EPBC Act or WA listed) or other significant ecological communities;</p> <p>d) A description given about how uncertainties will be treated in relation to the environment that will be affected;</p> <p>e) Potential National Heritage values;</p> <p>f) Any physical environmental drivers influencing the environmental characteristics of the site or surrounds, or influencing the potential impacts on the site or surrounds, including tidal regime, cyclonic and other severe weather conditions and coastal processes;</p> <p>g) Any other environmental factors required to be described in the environmental impact assessment scoping document developed for the assessment under the EP Act; and</p> <p>h) Indigenous environmental values and Indigenous cultural heritage (environmental) values, including all values held by Traditional Owners in the area likely to be affected and including broader biological communities, habitats and environments in which species with Indigenous environmental/conservation values might live.</p>	<ul style="list-style-type: none"> The description of the environment potentially affected is provided in each of the impact assessment documents: Part 3 (Marine); Part 4 (Terrestrial); and Part 5 (Social and Indigenous).

Item	Term of Reference	Section where Terms of Reference are addressed in the SAR
6	<p>Environmental Impacts</p> <p>The Report must include an assessment of the potential impacts of the Precinct Plan, the actions or classes of actions taken under the Precinct Plan including any associated infrastructure, construction and operational activities on the environment including matters of NES and effects of the environment on the Precinct Plan. In particular, the assessment must include:</p> <ol style="list-style-type: none"> A description of the potential impacts of the Precinct Plan on the environment (including to the extent possible, information on the degree of confidence with which impacts can be predicted and quantified and any indirect impacts as defined by Section 527E of the EPBC Act); An assessment of the nature and extent of the likely impacts on the environment, including whether the impacts will be short or long term, at the local and/or regional scale and cumulative impacts; An assessment of the extent to which impacts on the environment are likely to be unknown, unpredictable or irreversible; An analysis of the significance of potential impacts on known (or prospective) matters of NES – with reference to the EPBC Act Policy Statement 1.1 Significant Impact Guidelines and other relevant guidelines or policy advice; and Reference to the technical data (including traditional/Indigenous knowledge) and other information relied upon in assessing the environmental impacts of the Precinct Plan, including information collected and compiled to be consistent with the expectations of the Western Australian Environmental Protection Authority, including, but not limited to, that outlined in relevant position and guidance statements. 	<ul style="list-style-type: none"> The assessment of impacts is provided in Part 3 (Marine), Part 4 (Terrestrial) and Part 5 (Social and Indigenous). The matters of NES are analysed in Part 6, Section 2.
7	<p>Indigenous Impacts</p> <p>The Report must include a comprehensive analysis of the potential impacts of the Precinct Plan on Indigenous people and culture (including matters of NES and those prescribed under the <i>Aboriginal Heritage Act 1972 (WA)</i> (AH Act) and the WA EP Act) that are likely to be directly or indirectly affected by the Precinct Plan, in particular, the analysis must include:</p> <ol style="list-style-type: none"> A description of the potential impacts, including socio-economic impacts, of the Precinct Plan on Indigenous people (including to the extent possible, information on the degree of confidence with which impacts and indirect impacts can be predicted and quantified)⁵; An assessment of whether any impacts on Indigenous people (including Indigenous heritage) are likely to be unknown, unpredictable or irreversible; An analysis of the significance of potential impacts on known listed and unlisted Aboriginal heritage sites, objects or landscapes and values of cultural significance with reference to the <i>Aboriginal Heritage Act 1972</i>-section 5,6 and Indigenous Heritage values under the EPBC Act. Reference to the technical data and other information relied upon in assessing the Indigenous heritage impacts of the Precinct Plan; and 	<ul style="list-style-type: none"> Indigenous impact assessment summary is presented in Part 5, Section 3 and included in full in Appendix E. Informed Consent is discussed in Part 5, Section 3.9.

⁵ Certain Indigenous information and knowledge provided as part of the assessment and consideration of approval for a Common-User LNG Precinct is confidential and will not necessarily be made available to the public.

Item	Term of Reference	Section where Terms of Reference are addressed in the SAR
	e) Whether the Traditional Owners have given informed consent, in a culturally appropriate manner to the implementation of the Precinct Plan.	
8	<p>Proposed Management Arrangements for the LNG Precinct and Associated activities</p> <p>The Report must include a description of legislation, policies, performance and mitigation measures that are relevant to the implementation of the Precinct Plan, the actions and classes of actions undertaken under the Precinct Plan, to avoid, minimise, manage and mitigate the associated environmental and Indigenous impacts.</p> <p>The Report must include information on any other requirements for approval that apply, or are likely to apply, in relation to the Precinct Plan including details of any Local or State Government planning scheme, or plan or policy under any Local or State Government planning system, or State or Commonwealth legislation, such as:</p> <ol style="list-style-type: none"> What environmental assessment of the proposed project has been, or is being, carried out under the scheme, plan or policy; How the scheme, plan or policy provides for the prevention, minimisation and management of any relevant impacts; Explicit clarification as to who is responsible for the proposed management arrangements; How the scheme will ensure that obligations contained in the <i>Aboriginal Heritage Act 1972 (WA)</i> are met; and How to provide effective protection for places that can be considered under the <i>Aboriginal and Torres Strait Islander Heritage Protection Act 1984</i>. <p>The Report must set out specific management arrangements, including the possible role of Traditional Owners in those arrangements. It must describe arrangements that will be in place under or associated with the Precinct Plan that are intended to ensure that development and operation of the Precinct and associated actions and classes of actions are undertaken in a manner designed to avoid impacts on significant environments, minimise environmental impacts generally and enable areas beyond the hub and port precinct to be maintained in an environmentally and an ecologically sustainable manner.</p> <p>The report must also provide a description of the likely effectiveness of these management arrangements and to what extent they will meet endorsement criteria at Attachment C (see Appendix A-3).</p>	<ul style="list-style-type: none"> Management arrangements are included in Part 6, Section 3.8. The effectiveness of management arrangements is provided through the setting of performance targets in Part 6, Section 3.8, and through the provision of adaptive management mechanisms in Part 6, Section 3.9.

Item	Term of Reference	Section where Terms of Reference are addressed in the SAR
9	<p>Proposed Safeguards and Mitigation Measures</p> <p>The Report must identify and describe the specific measures intended to prevent, minimise and compensate for the potential environmental impacts of the Precinct Plan, and any measures to rehabilitate or offset damage to the environment. The Report must recognise and detail the role that Traditional Owners will play in these matters.</p> <p>The Report should include an analysis of the expected or predicted effectiveness of these measures. The assessment should identify the basis (e.g. statutory or policy) for implementation of each measure and the agency or authority responsible for ensuring implementation. The assessment must also identify how the relevant agency or authority will ensure compliance with these measures, and what steps will be taken in the event that environmental performance is other than anticipated.</p> <p>The Report must identify and describe the specific measures intended to avoid, minimise and mitigate for the potential environmental and Indigenous impacts of the Precinct Plan, and any measures to rehabilitate damage to the environment or impacts on Indigenous peoples live, values, or culture.</p> <p>The Report must also identify any program that is proposed to be put in place under the Precinct Plan to monitor and report on the proposed safeguards, mitigation and offset measures in the short and long term.</p>	<ul style="list-style-type: none"> Mitigation Measures and Safeguards are described in Part 6, Section 3 and after each impact assessment included in Part 3, Part 4 and Part 5. This includes an assessment of the residual significance of impact as an indication of effectiveness. Implementation basis and process are described in Part 6, Section 3.8.
10	<p>Sources of Information</p> <p>For information used in the assessment, the Report must state:</p> <ol style="list-style-type: none"> The source of the information used in the assessment; How recent the information is; How the reliability of the information was tested; and What uncertainties (if any) are in the information. 	<ul style="list-style-type: none"> Throughout the document. The key source documents for the description of the existing environment and the impact assessment are included in technical appendices (Appendix B, Appendix C, Appendix D, Appendix E and Appendix F).
11	<p>Consultation</p> <p>The Report must include any details of consultation, in addition to the statutory consultation, about the Precinct Plan, including:</p> <ol style="list-style-type: none"> Details of the consultation process for site selection including the public process and directed engagement with stakeholders, and the outcome of these consultations; Any consultation that has already taken place, including with Indigenous communities; Proposed consultation about relevant impacts of the action, including with Indigenous communities; and If there has been consultation about the proposed development, and if so, whether there is any documented response resulting from the consultation (including how the assessment and Report have addressed issues raised by the consultation). 	<ul style="list-style-type: none"> Consultation undertaken is described in Part 2, Section 9. Further detail on consultation activities with Indigenous communities is provided in Part 5, Section 3. Further detail on consultation activities as part of the social impact assessment is provided in Part 5, Section 2.

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Annexure B Summary Table of Contents for SAR (all six parts)

Part 1: Executive Summary

1. Introduction
2. Objectives and Benefits
3. Strategic Assessment and Approvals Process
4. Options
5. The BLNG Precinct Proposal
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7. Environmental Assessment – Marine
8. Environmental Assessment – Terrestrial
9. Matters of National Environmental Significance
10. Social Assessment
11. Conclusion
12. References

Annexure A: Outline of where each of the Terms of Reference have been Addressed within the Strategic Assessment Report

Annexure B: Summary Table of Contents for SAR (all six parts)

Part 2: Strategic Assessment Process including Site Selection, Facilities Description and Consultation Process

1. Introduction
2. Strategic Assessment and Approvals Process
3. Rationale for the Precinct Plan
4. Site Selection Process and Development Options
5. Description of Activities and Facilities under the Precinct Plan (Category A)
6. Indirect Activities and Related Projects
7. Land and Asset Tenure
8. Impact Assessment Methodology
9. Consultation Undertaken
10. References

Annexure A: Complete Table of Contents including Figures, Tables and Appendices for SAR (all six parts)

Annexure B: Complete Nomenclature, Acronyms, Measurements and Units List

Annexure C: Complete References and Bibliography for SAR (all six parts)

Part 3: Environmental Assessment – Marine Impacts

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 - 1.2. Studies and Surveys
 - 1.3. Physical Marine Environment
 - 1.4. Ecological Marine Environment
 - 1.5. Marine Management Framework
2. Marine Factors
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 - 2.2. Relevant Factor: Marine Sediments
 - 2.3. Key Factor: Marine Water Quality
 - 2.4. Key Factor: Benthos Including Benthic Primary Producers
 - 2.5. Relevant Factor: Fish
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 - 2.7. Key Factor: Marine Reptiles
 - 2.8. Relevant Factor: Marine Ecosystem Integrity
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Part 4: Environmental Assessment – Terrestrial Impacts

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 - 1.1 Existing Terrestrial Environment
 - 1.2 Studies and Surveys
 - 1.3 Physical Terrestrial Environment
 - 1.4 Ecological Terrestrial Environment
 - 1.5 Atmospheric Environment
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 - 2.4 Key Factor: Terrestrial Flora and Vegetation
 - 2.5 Relevant Factor: Species of Ethno-biological Significance
 - 2.6 Key Factor: Terrestrial Fauna
 - 2.7 Relevant Factor: Terrestrial ecosystem integrity
 - 2.8 Relevant Factor: Air Quality
 - 2.9 Key Factor: Greenhouse Gas Emissions
3. References

Part 5: Social Assessment

1. Introduction
2. Strategic Social Impact Assessment
3. Strategic Indigenous Impacts Assessment
4. Direct Social Surrounds and Social-Economic Factors
5. Strategic Social Impact Management Plan (SSIMP)
6. References

Annexure A: Predicted Housing Demand

Annexure B: Key Dates and Events, Site Selection Process and Traditional Owner Task Force Processes

Annexure C: ASIA Recommendations

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Part 6: Commonwealth Matters including Precinct Plan and Matters of National Environmental and Social Significance

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List of Appendices

- Appendix A: Scope of the Strategic Assessment including Terms of Reference
- Appendix B: Various Technical Reports, Supporting the Site Selection Process
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