



# 10 Socio-economic impacts and management

## 10 SOCIO-ECONOMIC IMPACTS AND MANAGEMENT

### 10.1 Introduction

This chapter of the draft environmental impact statement (Draft EIS) describes the potential impacts of the Ichthys Gas Field Development Project (the Project) on the community in the vicinity of the development areas in and around Darwin Harbour, as well as on the wider regional economy.

The socio-economic impact assessment provided here includes discussion of the significance of potential impacts on a local and regional scale and presents management controls that would be implemented by INPEX to mitigate these impacts. While the assessment has focused mainly on social and community impacts in the Darwin region, consideration has also been given to the users of the offshore development area (such as commercial fishing operators) as well as to the broader Australian community, which will benefit from the economic flow-on effects generated by the Project.

A process of residual-risk assessment (explained in Chapter 6 *Risk assessment methodology*) has been applied to the social and economic impacts described in this chapter in a similar way to the methods applied to the physical and biological impacts discussed in Chapter 7 *Marine impacts and management* and Chapter 8 *Terrestrial impacts and management*. However, the socio-economic aspects of the Project's operating environment are complex, and are affected by a number of factors that are outside the direct influence of the Project. For example, the local labour market will vary according to national and international economic conditions, making the consequences of the Project (which would be a relatively large employer in the Darwin region) difficult to predict.

In addition, the consequences of certain socio-economic impacts are sometimes highly subjective and would be rated differently by different people. The consequences of reduced access to recreational fishing areas, for example, would be rated highly by those that participate in the activity and lower by those that do not. Similarly, the consequence of the Project employing large numbers of personnel in the Darwin region could be seen as a positive opportunity for employees, but a negative impact by other businesses seeking to attract or retain personnel.

For these reasons, "risk-ranking" has not been undertaken for some of the socio-economic aspects presented in this chapter. Potential impacts have been identified for all socio-economic aspects of the Project

that could affect the community, and management commitments have been developed to mitigate negative impacts and maximise benefits.

Management of some socio-economic aspects (e.g. traffic and heritage) will be implemented through the Project's Health, Safety and Environmental Management Process, which is consistent with the principles of the International Organization for Standardization's ISO 14000 environmental management series of standards. This comprehensive, auditable system will provide a structured approach to environmental management and is described in Chapter 11 *Environmental management program*.

### 10.2 Social impact assessment methods

In order to gauge community values and opinions on the potential impacts of the Project, a social impact assessment was carried out from June to September 2008. Interviews were conducted with a number of stakeholder groups, including government authorities, business and community groups (see Chapter 2 *Stakeholder consultation*). A representative sample of stakeholders was selected in an effort to canvass as broad a range of perspectives on the Project as possible.

These stakeholder interviews provided INPEX with a deeper understanding of the local issues, values and identified key community concerns associated with the development of the onshore processing plant. In addition to this, interviews assisted in gauging the acceptability of the potential management controls for socio-economic impacts in terms of the ability to reflect local values and priorities and satisfy the needs of the local community.

Ongoing community consultation, throughout the development of this Draft EIS, has further informed this social impact assessment. A full list of stakeholders consulted to date is provided in Chapter 2.

It should be noted that the environmental and social impacts associated with the development of the accommodation village are assessed under a separate approval process. To support this approval submission, consultation with the local community and other key stakeholders has been undertaken on the potential social impacts associated specifically with the location and function of the accommodation village and with the interactions of village residents with the community. Where relevant, feedback from the consultation process and identified management and mitigation outcomes have been included in this chapter.

### Summary of key issues identified during stakeholder consultation

Key socio-economic issues identified during the stakeholder consultation and which are addressed in this chapter include the following:

- concerns regarding the social integration of Project personnel with the community (Section 10.3.1)
- the potential impacts of an increase in population on the housing market, existing community services and social infrastructure, and the existing road system (sections 10.3.2, 10.3.3 and 10.3.4 respectively)
- the potential impacts on recreational activities, such as fishing and diving, in Darwin Harbour (Section 10.3.7)
- the potential impacts on Aboriginal and non-Aboriginal cultural and heritage values associated with the nearshore and onshore development areas (sections 10.3.8 and 10.3.9)
- the potential impact of the reduction in visual amenity associated with the development of the Project's onshore facilities (Section 10.3.11)
- concerns regarding public safety in Darwin Harbour and its surrounds (Section 10.3.14)
- the impacts of the Project's labour requirements on the local employment market (Section 10.4.3)
- the potential impacts on the commercial fishing and aquaculture industries in the nearshore and offshore development areas (Section 10.3.12).

In addition to the issues identified during the community consultation process, INPEX has noted additional areas of potential socio-economic impact. These have also been assessed in this chapter and include the following:

- potential impacts on non-Project-related maritime traffic generated during the construction and operations phases of the onshore facilities (Section 10.3.5)
- potential impacts on air traffic passing over the onshore development area during the operations phase (Section 10.3.6)
- potential impacts from noise generated at the onshore development area during the construction and operations phases (Section 10.3.10).

### 10.3 Social impacts and management

This section describes the range of potential positive and negative social impacts of the Project on the community in the Darwin region. It presents the management controls proposed to reduce or mitigate the negative impacts and to optimise the opportunities presented by the Project.

#### 10.3.1 Social integration

Darwin and Palmerston are considered socially well equipped to absorb an increase in people from other areas of Australia and from overseas. The region has experienced significant population movement over a long period and, as described in Chapter 3 *Existing natural, social and economic environment*, is relatively diverse and multicultural.

Consultation with stakeholders highlighted a number of concerns about potential social issues arising from the influx of the 2000–3000 predominantly male construction personnel required for the Project. This includes the potential for antisocial behaviour to impact on the quality of life enjoyed by the local community and visitors.

Project personnel who choose to reside in the wider community cannot as easily be held accountable for unacceptable social behaviour outside working hours as can those living in the more controlled environment of a company-owned accommodation village. While antisocial behaviour cannot be avoided at all times, the implementation of company strategies or policies designed to deal with socially unacceptable behaviour outside working hours can assist in minimising incidents.

As discussed in Chapter 4 *Project description*, it is proposed that an accommodation village be built to house the majority of construction personnel. The preferred site is at Howard Springs to the east of Palmerston. From the point of view of social integration, the proximity of this village to the local community and the inclusion of recreational facilities in its design have the potential to result in both positive and negative impacts.

Most of the businesses in this area have expressed the view that the proximity of the village would yield benefits directly from the flow-on effect of residents using their services or facilities (Hatch Infrastructure 2009). However the use of these services as a result of community integration may also result in pressure being placed on some business services or facilities, for example on local taverns, food outlets and sporting facilities. This in turn could affect service times or availability of services to local patrons or users.

## Management of social integration

The management controls to be implemented to assist in minimising the potential impacts associated with the integration of the workforce into the community include the following:

- INPEX personnel representing the Project will be expected to exhibit professional standards of behaviour as required by INPEX's Code of Conduct. Through the Project induction all personnel will be informed of the expectation that they will respect the community of the Darwin region at all times and behave accordingly.
- Project personnel will be subject to random drug and alcohol testing, which will assist in discouraging heavy drinking or other antisocial behaviour outside working hours.
- It is intended that the accommodation village will include a number of restaurants and licensed premises as well as a range of social and recreational facilities; these amenities will assist in reducing pressure on the existing facilities presently enjoyed by the local community.
- A code of conduct for the village residents will be developed and implemented.
- The preferred location for the accommodation village was selected in consultation with local government authorities and the Department of Planning and Infrastructure (DPI)<sup>1</sup>, and will be designed and operated with consideration for reducing potential social impacts on the local community.
- A Stakeholder Communication Plan (see Chapter 2) has been developed; this will create an avenue for the broader community to raise Project-related social issues and other matters and will be updated as required. Other avenues stakeholders can use to raise concerns about social issues and other impacts include the INPEX 1800 information line (1800 705 010) and the company's web site at <<http://www.inpex.com.au>>.

In addition, however, it is thought that the longer working hours required of Project workers will discourage workers from patronising hotels and bars after hours during their rostered periods of work at Blaydin Point. While it is anticipated that large numbers of local people will be employed during the construction phase, it is likely that the greater part of the construction workforce will be recruited on a fly-in, fly-out basis, and that most of these workers will return to their home states during their time off.

<sup>1</sup> The Northern Territory's Department of Planning and Infrastructure was restructured in December 2009 and its functions were transferred to two new departments, the Department of Lands and Planning (DLP) and the Department of Construction and Infrastructure.

## Residual risk

It was considered that the risk assessment process could not provide a realistic outcome for social integration, as both the likelihood and consequence of potential impacts on the community are very much dependent on individual actions and circumstances. It should be noted, too, that while integration of the workforce into the broader Darwin community may be seen as a good thing by some members of the community, it may be perceived less positively by others. INPEX will implement the management approaches described above and in Table 10-1 in order to manage the social effects of integration of its workforce and the community as effectively as possible.

### 10.3.2 Housing

Through the consultation process, stakeholders indicated their clear concern that the Project, particularly during the construction phase, would place significant pressure on Darwin's housing market. These concerns have their origin in the stakeholders' previous experience of major projects in the Darwin region that created periods of rapid population growth which had immediate impacts upon local housing affordability and availability. The concern is compounded by the fact that the local housing market is currently constrained.

Limited availability of property for purchase or rental, combined with strong growth in both wages and population figures, has resulted in substantial increases in sale prices and rentals over the past three years. In March 2009, Darwin's median house price was \$490 300 and the median unit price was \$362 085, representing increases of 6.23% and 18.77% respectively since March 2008. This continued growth contrasts significantly with performance in other Australian capital cities, which almost all saw decreases in median prices over the same period (Propell National Valuers 2009).

Darwin's rental market is also under pressure, with a vacancy rate of 2.1% in the first quarter of 2009. The average weekly rent for a two-bedroom unit in Darwin decreased at the beginning of 2009, but still increased by 14.28% during the year to March 2009 (Propell National Valuers 2009).

Housing affordability in Darwin will continue to be a key issue, as population growth is anticipated to outstrip the supply of new properties into the market. During the first quarter of 2009, for example, Darwin's population grew by 3319 or 2.83%, compared with a national increase of 1.71% (Propell National Valuers 2009). Furthermore, the population of the greater Darwin region (including Palmerston) is projected to increase between now and 2012 by 19 000 people to

**Table 10-1: Summary of impact assessment and residual risk for social integration**

Aspect	Activity	Potential impacts	Management controls and mitigating factors	Residual risk
Social integration	Recreational activities of construction workforce.	Increase in antisocial behaviour at local recreational venues such as hotels and bars.	<p>Personnel representing the Project will be expected to exhibit professional standards of behaviour as required by the INPEX Code of Conduct.</p> <p>Project personnel will be subject to random drug and alcohol testing.</p> <p>A code of conduct for the residents of the accommodation village will be developed and implemented.</p> <p>The longer workhours required from Project personnel may discourage workers from attending facilities such as hotels and bars outside the accommodation village after hours.</p> <p>The accommodation village will include facilities such as licensed restaurants and bars, which may reduce the use of existing local facilities by the construction workforce.</p> <p>A large proportion of construction workforce is likely to be recruited on a fly-in, fly-out basis, with the majority of personnel returning home during their time off.</p>	Not applicable
Social integration	Recreational activities of construction workforce.	Increase in pressure placed on social venues such as sporting facilities, food outlets, and taverns.	<p>The accommodation village will include a number of licensed restaurants and a range of social and recreational facilities will be established for the benefit of the residents. This will assist in limiting the pressure placed on existing facilities enjoyed by the local community.</p> <p>Ongoing consultation with the community will be undertaken to monitor the extent and impact of workforce integration.</p>	

an estimated total of 133 000, with a further projected increase of 63 000 people between now and 2030. The Northern Territory Government anticipates that it will need to provide approximately 1700 new dwellings per year (Henderson 2009).

**Management of housing**

In order to minimise the impact of the construction workforce (which may number between 2000 and 3000 people) on the local housing market, INPEX has made the decision to establish an accommodation village to house the majority of its workforce during the construction phase. It is intended that the village will be seen as a desirable place for workers to live and it will be designed to cater for a wide range of people, both singles and couples. It is likely that only a minority of Project employees will choose to live in the broader Darwin community.

Around 300 personnel will be required during the normal operations of the onshore processing plant at Blaydin Point, with a larger number of workers required for the necessary periodic maintenance campaigns. An accommodation strategy is being developed to identify and investigate accommodation requirements and options for the operations phase.

The accommodation strategy will also identify and investigate other Project accommodation requirements, including housing solutions for personnel who will visit the onshore Project area on a short-term basis during the construction phase.

Accommodation options will give consideration to avoiding the imposition of additional pressure on the local housing market, while maximising the opportunities to attract and retain suitable employees.

**Table 10-2: Summary of impact assessment and residual risk for housing**

Aspect	Activity	Potential impacts	Management controls and mitigating factors	Residual risk
Housing workforce	Accommodation requirements for the construction workforce in the Darwin area.	Increased pressure placed on an already difficult housing market.	An accommodation village will be constructed to house the greater part of the construction workforce. It is intended that this village will be seen as a desirable place to live and it will be designed to cater for a wide range of people, both singles and couples.  An accommodation strategy is being developed to address accommodation solutions for regular Project personnel as well as for short-term visitors during the operations phase (including teams brought in to carry out periodic maintenance operations).	Not applicable

**Residual risk**

It is not considered practical to apply risk assessment to the effects of the Ichthys Project on the Darwin housing market. The “consequence” of any potential impact would be considered differently by different community members—those who own property may perceive a rise in property values positively, while those wishing to buy property would view rising prices negatively. Further, wider economic conditions also affect property values and could change the “likelihood” of an impact on the local market attributable to the Project. INPEX will implement the management approaches described above and in Table 10-2 in order to manage the potential impacts of the Project on the housing market as effectively as possible.

**10.3.3 Key social infrastructure and services**

Social infrastructure and services that are of a communal, human or social nature will progressively be required as a community grows. The following sections discuss the potential impact on the “key” social infrastructure and services throughout the construction and operations phase of the Project. These include health services, emergency services and utilities infrastructure and services. Other potential impacts on social infrastructure and services such as the effects of the Project on housing, the effects of Project-related traffic on public roads, and the effects of Project navigation channels in Darwin Harbour, are discussed in sections 10.3.2, 10.3.4 and 10.3.5 respectively.

**Key social services**

*Health services*

Consultation with the Northern Territory’s Department of Health and Families (DHF) indicated that the Royal Darwin Hospital currently has adequate capacity to cope with a possible influx of Ichthys Project personnel for high-level emergency cases (i.e. those at imminent risk of death or at high risk). The DHF’s representatives, however, believed that triage services at present would be pushed to capacity with any large influx of Project personnel (Hatch Infrastructure 2009). The budget for 2009–2010 shows that funding (\$421 million) has been allocated to improving hospital services in the Northern Territory; this includes an allocation of \$5.08 million in Commonwealth funding which will be dedicated to reducing pressure on emergency departments. The Royal Darwin Hospital has been allocated \$245 million of this budget (Northern Territory Government 2009). The DHF representatives suggested that with the upgrade of services as a result of funding it was likely that triage services would be able to cope (Hatch Infrastructure 2009).

In addition, to assist in alleviating some of these pressures in the Palmerston area the development of a new “superclinic” has been announced by the Northern Territory Government; Stage 1 of the clinic began operations in December 2008 (Vatskalis, K. (Minister for Health) 2009). The 2009 budget allocated \$2 million towards the operation of this “hub” (Northern Territory Government 2009). The clinic will be a general-practice multi-service facility (i.e. with dental, general practitioner and other specialists), operating 24 hours a day and 365 days a year. The facility will not be an emergency service but will cater for urgent after-hours cases. Construction of the clinic was expected to be completed by mid-2010 (Hatch Infrastructure 2009).

As noted in Section 10.3.1, the greater part of the construction workforce is likely to be recruited under a fly-in, fly-out arrangement. Such personnel may prefer to use their own local (interstate) medical practitioners for general non-emergency medical matters, for example dentistry and health check-ups.

### *Emergency services*

There are currently four ambulances servicing the Darwin area, one of which is located in Palmerston. Discussion with DHF representatives indicated that this level of service is less than what is provided per head of population in other parts of Australia and that the service was currently operating at or beyond its capacity (Hatch Infrastructure 2009). The recent budget has allocated funding (\$960 000) to expand the ambulance service for Palmerston and surrounding areas (Northern Territory Government 2009). The DHF suggested that the Project should consider how it may assist in getting injured personnel to the Royal Darwin Hospital, given the substantial distances to be covered from both the onshore processing plant site and the preferred accommodation village location.

The Northern Territory Fire and Rescue Service (in conjunction with Bushfires NT) is the primary provider of fire and rescue services throughout the Darwin region. It is not anticipated that the Project, either during the construction phase or the operations phase, would place any pressure on either of these services during its normal operations. However in the event of a major emergency situation these services would have to be called upon.

In order to effectively plan for major emergency events such as cyclones and major accidents, INPEX will need to work with these existing emergency services to ensure that they have the capability and capacity to respond.

In addition to this, the onshore facility will need to be built to withstand the climatic conditions experienced in the Darwin region, for example, cyclones and storm surges. Fire-protection systems will need to be incorporated into the onshore processing plant design and the facility emergency response team will need to be able to act as the first responders in the event of a major emergency while waiting for outside assistance to arrive.

### *Utilities supply and infrastructure*

As noted in Section 10.3.1, the environmental and social impacts associated with the development of the accommodation village will be assessed under a separate approvals submission. This submission will address any potential impacts on utilities infrastructure and services as well as identifying management solutions. For this reason the primary focus of this section is on the utilities infrastructure and services that may be affected as a result of the construction and operations of the onshore processing plant.

### *Power supply and infrastructure*

Pressure on local power services and related infrastructure for the onshore Project is expected to be minimal during the construction phase and negligible during the operations phase.

The Northern Territory Government will be connecting construction headworks to the Blaydin Point site; this includes the supply of 22-kV-A overhead power to the Blaydin Point site from the Channel Island (or Weddell) power stations.

It is anticipated that diesel generators will be predominantly used to address power requirements for construction activities with some power from the Darwin grid required to support temporary construction buildings and lighting requirements.

Permanent power generation for the facility will be supplied by the main power generation turbines in the plant. Prior to these being installed and commissioned, power from diesel generators may be required, together with power from the Darwin grid. For this purpose, a transmission line may connect the facilities to the Northern Territory Government's power distribution system (operated by the Power and Water Corporation) at a point on Wickham Point Road. Distribution infrastructure, facilities and transformers may also be required. Once a permanent power supply has been established, some of the diesel generators will be available for standby service.

### *Water supply and infrastructure*

The water supply required for both the construction and operations phases is likely to come from the existing water main located in the road reserve of Wickham Point Road, which connects into the Darwin water supply scheme through the McMinns Water Treatment Storage Facility. Current advice from the Northern Territory's Power and Water Corporation (PWC) has indicated that there will be sufficient capacity to accommodate the water demands of the Project without adversely affecting regional supplies.

### Sewage infrastructure

Temporary ablution blocks will be put in place during the initial construction phase. As activities increase on site a temporary sewage treatment system will be installed. A permanent sewage treatment plant will be installed for the operations phase of the Project. Environmental impacts associated with wastewater discharge and sludge disposal from sewage treatment systems during the construction and operations phases are addressed in chapters 7 and 8. Pressure on the existing local mains sewerage infrastructure and services during both the construction and operations phases is considered to be negligible.

### Landfill capability and capacity

Local waste-disposal capabilities catering for wastes generated during the construction and operations phases will be addressed during the detailed design phase of the Project. This will be done in consultation with the relevant local-government authorities.

### Management of key social infrastructure and services

The following key management controls will be implemented to minimise the potential impacts on social infrastructure and services in the Darwin region.

### Social services

- A first-aid capability will be available at the onshore development area during both the construction and the operations phases. In addition, a similar first-aid capability will be available at the accommodation village during the construction phase.
- INPEX will work closely with the Northern Territory Police, Fire and Emergency Services in order to effectively plan for any major emergencies.
- A firefighting capability will be available, and strategically located firefighting stations will be established at the onshore processing plant.
- Fire-protection systems for the operations phase at the onshore Project site will be designed to enable INPEX personnel to handle fires capably until outside help arrives.
- Appropriate quantities of water will be stored and made available for firefighting purposes during both the construction and operations phases at the onshore processing plant.
- An emergency-response plan will be developed and emergency-response teams will be established at the onshore Project site for both the construction and operations phases of the Project. Emergency-response plans will address cyclone and major accident scenarios and will align with the Northern Territory Police, Fire and Emergency Services plans.

### Utilities infrastructure

- During construction of the onshore development area, power will predominantly be supplied using on-site diesel generators.
- The onshore processing plant will be self-sufficient in meeting its power generation requirements during operations. Backup systems will be in place to support the main power generation packages in the event of failure or emergency.
- Temporary ablution blocks and temporary sewage systems will be used during the construction phase.
- A permanent sewage treatment facility will be installed at the onshore Project site for the operations phase of the Project.
- Waste disposal facility capabilities for the construction and operations phases at the onshore development area will be addressed during the detailed design phase of the Project. This will be done in consultation with relevant local-government authorities.
- Ongoing consultation will be undertaken with local government, the Department of Lands and Planning (DLP) and the PWC in order to effectively plan for the provision of scheme water for Project requirements at the onshore processing plant.
- Development of the accommodation village will be undertaken in consultation with local government agencies, the DLP and the PWC in order to effectively plan the provision of the required power, water, sewerage infrastructure and waste disposal systems so as not to burden the existing supply systems and infrastructure.

### Residual risk

An assessment of the risk for social infrastructure and services is not considered realistic, as these are generally managed by government or third-party private businesses and are therefore outside INPEX's control. As with the issue of housing market impacts (Section 10.3.2), some community members may view added pressure on infrastructure as a positive opportunity for secondary business and growth, while others may consider this to be a negative impact of the Project. INPEX will implement the management approaches described above and in Table 10-3 in order to manage the potential impacts on social infrastructure and services as effectively as possible.



**Table 10-3: Summary of impact assessment and residual risk for social infrastructure and services**

Aspect	Activity	Potential impacts	Management controls and mitigating factors	Residual risk
Social services for the Project	Emergency health services for construction workforce.	Increased pressure placed on emergency health services, e.g. triage services.	First-aid clinics will be established at the onshore development area and at the accommodation village.  INPEX will work in conjunction with the Northern Territory Police, Fire and Emergency Services in order to effectively plan for any major emergencies.  An emergency response plan will be developed for both the construction and operations phase of the Project. Emergency response teams will be established.	Not applicable
	Emergency fire services for onshore development area.	Increased pressure on existing emergency fire services.	INPEX will work in conjunction with the Northern Territory Police, Fire and Emergency Services in order to effectively plan for any major emergencies.  A firefighting capability will be available, along with strategically located firefighting stations on the Project plant site.  Fire-protection systems for the operations phase will be designed to enable INPEX personnel to handle fires capably until external help arrives.	Not applicable
Utilities and infrastructure	Use of existing power, water and sewage infrastructure during construction, precommissioning and commissioning.	Increased pressure on utilities supply and infrastructure.	Diesel generators will predominantly be used to deal with power requirements for construction activities, with some mains power from the Darwin electricity grid. Temporary ablution blocks and sewage treatment systems will be in place to meet sewage management and treatment requirements during construction.  The PWC has advised that the water demands for the Project can be met using scheme water, without affecting regional supplies.  Ongoing consultation will be undertaken with local government, the DLP and the PWC in order to effectively plan for the provision of scheme water for Project requirements.	Not applicable
	Use of existing power, water and sewage infrastructure during operations	Increased pressure on utilities supply and infrastructure.	Permanent sewage-treatment facilities will be installed for the operations phase of the Project.  The onshore facilities will be self-sufficient in power generation capacity during the operations phase.  The PWC has advised that the water demands for the Project can be met using scheme water, without affecting regional supplies.  Ongoing consultation will be undertaken with local government, the DLP and the PWC in order to effectively plan for the provision of scheme water for Project requirements.	Not applicable

#### 10.3.4 Road traffic

Concerns about increased traffic congestion and road-safety risks were raised during stakeholder interviews, particularly by the Litchfield Council. The construction of the Darwin Liquefied Natural Gas plant (Darwin LNG plant) by ConocoPhillips between 2003 and 2006 resulted in traffic congestion that caused some community resentment.

The main impacts of the Project on local traffic will occur during the construction phase, when the transport of materials, equipment and commuting Project personnel to and from the onshore development area will increase vehicle movements on local roads in Darwin and Palmerston and on Middle Arm Peninsula. During the operations phase, traffic to the onshore processing plant will be limited to the smaller numbers of staff commuting to site and will be low in volume.

A traffic study was undertaken by URS Australia Pty Ltd (URS) to characterise the existing traffic conditions on relevant roads and to assess the potential impacts of traffic generated as a result of Project activities (URS 2009a, provided as Appendix 22 to this Draft EIS). The study focused mainly on road intersections as these have the greatest impact on the flow of traffic through an urban network; by studying the major intersections the general performance of the entire network can be understood.

Existing traffic conditions in Darwin, East Arm, Berrimah, Palmerston and Middle Arm were characterised using data collected from the DPI (now the DLP), as well as from manual traffic counts conducted at major intersections.

The Project's impact on existing traffic was assessed using the SIDRA INTERSECTION micro-analytical evaluation software package, which is used throughout the traffic engineering industry in Australia. Population growth predictions supplied by the Australian Bureau of Statistics were used as a guide to predict future volumes of traffic on local roads, outside those generated by the Project.

Transport of equipment and materials during the construction phase will mainly be undertaken by B-double trucks, consisting of a prime mover towing two semitrailers (with two articulation points). Buses will be used to transport the majority of workers from the accommodation village to the onshore development area. The module offloading facility at Blaydin Point will be used preferentially for transport of very large loads arriving by ship; however, on occasion some large loads may be required to be offloaded at East Arm Wharf and be transported to the onshore development area by over-dimension road vehicles.

A summary of the daily traffic likely to be generated during the peak of the construction phase is provided in Table 10-4. For this assessment all activities are assumed to occur concurrently and over the whole construction period.

The existing and future performance of the major intersections along the transport routes from Darwin, East Arm and Palmerston to the onshore development area were analysed using two main indicators:

- degree of saturation (DoS)—the ratio of actual traffic volume moving through an intersection compared with the capacity for which it was designed. Generally a DoS of 0.95 or below is considered acceptable in a congested urban road network, although often intersections will be shown to be operating at capacity in existing conditions. A DoS value of 1.0 indicates that the intersection is carrying traffic equal to its maximum design capacity.
- 95% queue length—the maximum queue length (in metres), which will not be exceeded 95% of the time. Queue lengths are used to determine lengths of dedicated turn lanes when preparing function designs. These measurements are also used as a secondary performance indicator in conjunction with DoS values, to understand if changes in traffic volumes produce unrealistic queue lengths.

It should be noted that the worst-case results for DoS and 95% queue length may come from different movements within an intersection in the same model. This is attributable to the interaction between traffic volumes, signal timing and the geometric layouts of each intersection. For example, a through movement in a single exclusive lane may exhibit a very long queue length but have a lower DoS as traffic can flow through the intersection unimpeded, whereas a shared through and right-lane turning lane may have a shorter queue length but a higher DoS as the right turns block through-traffic movement.

Major intersection performance was modelled for the assumed peak of the construction phase and the commencement of the operations phase respectively. In order to assess the worst-case scenarios, modelling focused on the morning and afternoon peak hours. Peak hours observed at each intersection varied somewhat between sites, but were generally between 7.15 and 8.15 a.m. and between 4.30 and 5.45 p.m.

For the purposes of the traffic study it has been assumed that all traffic generated by the Project will use the existing road network. Each origin–destination trip (see Table 10-4) was assigned a route and round trips were assumed to use the same route in reverse.

**Table 10-4: Average daily traffic generated at the peak of the construction period**

Assumed average peak daily road traffic generated by construction activities			
Origin	Destination	Approximate number of round trips per day	Cargo
Blaydin Point	Shoal Bay landfill	30	Construction waste, domestic waste and recyclables, green waste and hazardous materials
Blaydin Point	Shoal Bay landfill	80*	Acid sulfate soils for disposal
Darwin	Blaydin Point	170†	Raw materials, aggregate, sand, cement, asphalt, scaffolding, tools, equipment, personnel
East Arm Wharf	Blaydin Point	74	Fuel and cargo from maritime vessels
East Arm Wharf	Darwin	2	Cargo from maritime vessels
Mount Bundy quarry	Blaydin Point	60	Rock-armour and aggregate for site construction
Mount Bundy quarry	East Arm	102	Rock-armouring for pipeline stabilisation
Mount Bundy quarry	Shore-crossing location	3	Rock-armouring for stabilisation of the shore-crossing location
Accommodation village	Blaydin Point	100	Personnel from the accommodation village (bus movements)
Accommodation village	Blaydin Point	125	Personnel from the accommodation village (light-vehicle movements)
Accommodation village	Shoal Bay landfill	2	Waste and recyclables

\* Note that a number of methods for treatment and disposal of acid sulfate soils are being considered, including treatment in situ and disposal offshore. This number of vehicles would be required only if onshore landfill disposal were selected for the greater part of the material.

† This figure includes 100 cars transporting personnel.

Note: The figures presented in this table represent the base case for the traffic modelling study (see Appendix 22).

The routes used for non-personnel construction traffic (e.g. vehicles transporting construction materials) are shown in Figure 10-1, while the route used by personnel traffic from the accommodation village is shown in Figure 10-2.

In addition, at the time of modelling it was assumed that the peak of construction and the commencement of operations would be 2013 and 2015 respectively.

The analysis does not take into account the influence of the new Tiger Brennan Drive extension, which is anticipated to be complete in 2010. If this road is completed prior to the commencement of the construction phase, Project traffic will be able to utilise this more convenient route from Darwin to Palmerston. Overall the road network should operate more efficiently if this occurs.

#### Construction traffic (non-personnel)

Traffic modelling for the peak construction period (2013) indicates that non-personnel construction traffic will generate only very small incremental impacts at some parts of the road network, if any. A summary of DoS values and queue lengths for key intersections is provided in tables 10-5 and 10-6 respectively.

Note that not all entry points into an intersection have been shown in these tables—only the worst-affected from both a DoS value and queue-length perspective are presented. On occasion, there may be more than one entry point to consider.

Most intersections in the traffic network will be operating below the 0.95 DoS threshold even after construction traffic movements are added (Table 10-5). Exceptions are the Stuart Highway – Berrimah Road intersection in the afternoon peak hour, which is predicted to be operating at capacity (1.0 DoS) with or without Project construction traffic, and the Stuart Highway – Lambrick Avenue intersection, which is nearing its capacity (0.96 DoS). Population growth is likely to be the key influence bringing parts of the traffic network up to maximum capacity by 2013 (see Appendix 22).

Queue lengths are predicted to increase by relatively small amounts at many of the intersections as a result of non-personnel construction traffic. The largest change is a queue length increase of 54 m at the Berrimah Road – Wishart Road intersection during the afternoon peak period (Table 10-6).

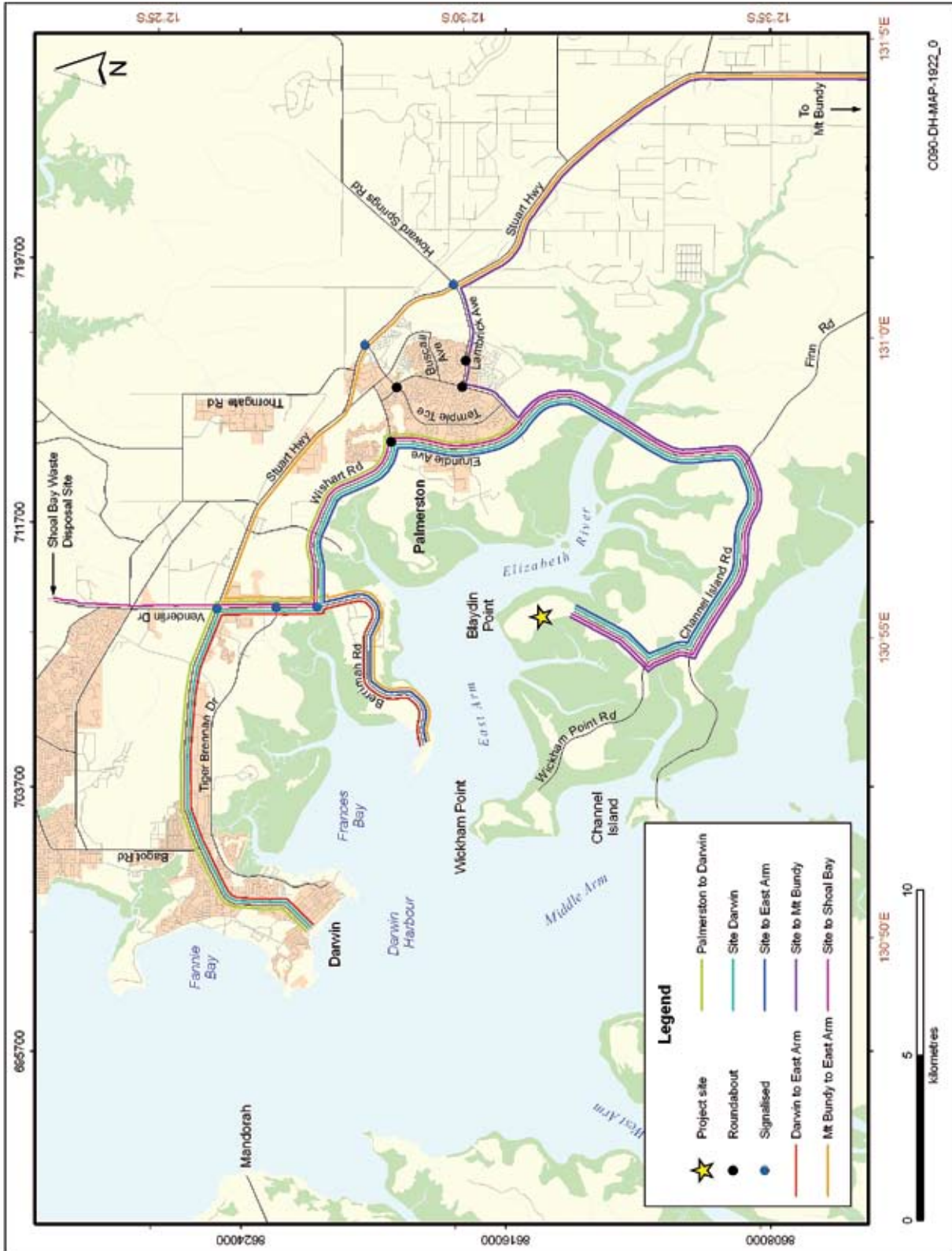


Figure 10-1: Assigned traffic routes for non-personnel construction traffic



C090-DH-MAP-1923\_0

Figure 10-2: Assigned traffic route for personnel construction traffic

**Table 10-5: Predicted DoS values at key intersections during the peak construction period (non-personnel construction vehicles only)**

Intersection	Peak (a.m./p.m.)	Background traffic	Background together with construction traffic	Affected intersection entry point(s)
Elrundie Avenue Wishart Road Hedley Place University Avenue	a.m.	0.77	0.82	Northbound Elrundie Avenue: left turn into Wishart Road (inbound).
	p.m.	0.79	0.81	Eastbound Wishart Road: right turn into Elrundie Avenue (outbound).
Berrimah Road Wishart Road	a.m.	0.73	0.76	Westbound Wishart Road: right turn into Berrimah Road (inbound)
	p.m.	0.90	0.91	Southbound Berrimah Road: left turn into Wishart Road (outbound).
Stuart Highway Berrimah Road Vanderlin Drive	a.m.	0.90	0.90	Southbound Vanderlin Drive: through movement into Berrimah Road.
	p.m.	1.00	1.00	Eastbound Stuart Highway: through movement (outbound).
Stuart Highway Lambrick Avenue Howard Springs Road	a.m.	0.96	0.96	South-west-bound Howard Springs Road: right turn into Stuart Highway and through movement into Lambrick Avenue.
	p.m.	0.84	0.85	South-east-bound Stuart Highway: through movement (outbound).
Elrundie Avenue Chung Wah Terrace Channel Island Road	a.m.	0.07	0.07	Northbound Elrundie Avenue: right turn into Chung Wah Terrace (inbound).
	p.m.	0.09	0.09	South-west-bound Chung Wah Terrace: left turn into Elrundie Avenue (outbound).
Channel Island Road Wickham Point Road	a.m.	0.10	0.10	North-west-bound Channel Island Road: right turn into Wickham Point Road (outbound).
	p.m.	0.11	0.11	South-east-bound Wickham Point Road: left turn into Channel Island Road (inbound).
Stuart Highway Temple Terrace	a.m.	0.86	0.87	North-west-bound Stuart Highway: through movement (inbound).
	p.m.	0.90	0.90	North-east-bound Temple Terrace: right turn into Stuart Highway (outbound).
Legend:		Degree of saturation <0.95: the intersection is operating below its maximum design capacity. Traffic levels would be considered acceptable.		
		Degree of saturation >0.95: the intersection is operating close to or above its maximum design capacity. Traffic levels would be considered too high.		

Source: URS 2009a.

### Construction personnel traffic

Movement of personnel from the accommodation village on Howard Springs Road to the onshore development area at Blaydin Point will utilise a similar route to some of the non-personnel construction traffic, such as the Stuart Highway – Lambrick Avenue intersection. The personnel traffic will also affect local roads near to the village, such as Whitewood Road and Howard Springs Road. It is estimated that 50 buses (driving two round trips per day) and 125 light vehicles (driving one round trip per day) would travel from the accommodation village to the onshore development area each day.

When incorporated into the traffic model, this additional personnel traffic increases the influence on

the Stuart Highway – Lambrick Avenue intersection, bringing it over maximum capacity (1.06 DoS) during the morning peak period (Table 10-7). During the afternoon peak period the intersection is predicted to operate below the 0.95 DoS threshold, although at 0.90 DoS it is nearing this upper level of traffic capacity. Relatively large increases in queue length are also predicted for this intersection, particularly in the morning (an increase of 235 m or the equivalent of 40 average-sized cars).

All the other intersections are predicted to operate well below the maximum design capacity during both morning and afternoon peaks, with minimal changes to queue lengths (see tables 10-7 and 10-8).

**Table 10-6: Predicted 95% queue lengths at key intersections during the peak construction period (non-personnel construction vehicles)**

Intersection	Peak (a.m./ p.m.)	Background traffic (m)	Background together with construction traffic (m)	Affected intersection entry point(s)
Elrundie Avenue Wishart Road Hedley Place University Avenue	a.m.	114	114	Northbound Elrundie Avenue: left turn into Wishart Road (inbound).
	p.m.	93	103	Westbound Wishart Road: through movement into University Avenue (outbound) and right turn into Elrundie Avenue (outbound).
Berrimah Road Wishart Road	a.m.	89	98	Westbound: Wishart Road: right turn into Berrimah Road (inbound).
	p.m.	324	378	Southbound: Berrimah Road: left turn into Wishart Road (outbound).
Stuart Highway Berrimah Road Vanderlin Drive	a.m.	341	356	Westbound Stuart Highway: through movement (inbound).
	p.m.	469	495	Eastbound Stuart Highway: through movement (outbound).
Stuart Highway Lambrick Avenue Howard Springs Road	a.m.	556	579	North-west-bound Stuart Highway: through movement (inbound).
	p.m.	224	230	South-east-bound Stuart Highway: through movement (outbound).
Stuart Highway Temple Terrace	a.m.	279	294	North-west-bound Stuart Highway: through movement (inbound).
	p.m.	214	219	South-east-bound Stuart Highway: through movement (outbound).

Source: URS 2009a.

**Table 10-7: Predicted DoS at key intersections during the estimated construction peak (construction and personnel vehicles)**

Intersection	Peak (a.m./ p.m.)	Background traffic	Background together with construction traffic (including personnel)	Affected intersection entry point(s)
Elrundie Avenue Chung Wah Terrace	a.m.	0.07	0.15	Westbound Chung Wah Terrace: turning left (outbound) into Elrundie Avenue.
	p.m.	0.09	0.17	Northbound Elrundie Avenue: turning right (outbound) into Chung Wah Terrace.
Stuart Highway Lambrick Avenue Howard Springs Road	a.m.	0.96	1.06	South-west-bound Howard Springs through movement (inbound) and right (inbound) turn into Stuart Highway.
	p.m.	0.84	0.90	South-east-bound Stuart Highway: through movement (outbound).
Channel Island Road Wickham Point Road	a.m.	0.10	0.19	North-west-bound Channel Island Road: Right turn into Wickham Point Road (outbound).
	p.m.	0.11	0.11	South-west-bound Wickham Point Road: left turn into Channel Island Road (inbound).
Whitewood Road Howard Springs Road	a.m.	0.55	0.79	Westbound Whitewood Road left (inbound) turn into Howard Springs Road.
	p.m.	0.70	0.83	North-east-bound Howard Springs Road right into Whitewood Road (outbound)
Legend:		Degree of saturation <0.95: the intersection is operating below its maximum design capacity. Traffic levels would be considered acceptable.		
		Degree of saturation >0.95: the intersection is operating close to or above its maximum design capacity. Traffic levels would be considered too high.		

Source: URS 2009a.

**Table 10-8: Predicted 95% queue lengths at key intersections during the estimated construction peak (construction and personnel vehicles)**

Intersection	Peak (a.m./p.m.)	Background traffic (m)	Background together with construction traffic (including personnel) (m)	Affected intersection entry point(s)
Elrundie Avenue Chung Wah Terrace	a.m.	No more than one car	No more than one car	Southbound Elrundie Avenue: through movement (outbound).
	p.m.	No more than one car	No more than one car	Northbound Elrundie Avenue: through movement (inbound).
Stuart Highway Lambrick Avenue Howard Springs Road	a.m.	556	791*	North-west-bound Stuart Highway: through movement (inbound).
	p.m.	224	308*	South-east-bound Stuart Highway: through movement (outbound).
Channel Island Road Wickham Point Road	a.m.	0	0	Not applicable.
	p.m.	0	0	Not applicable.
Whitewood Road Howard Springs Road	a.m.	45	84	Westbound Whitewood Road left (inbound) and right (outbound) turns into Howard Springs Road.
	p.m.	87	125	North-east-bound Howard Springs Road right (outbound) turn into Whitewood Road.

\* Large increases in queue length result from the addition of construction traffic, indicating that this intersection will be functioning poorly.  
Source: URS 2009a.

### Quarry traffic

Heavy-vehicle traffic will be required by the Project to transport material for rock-armouring from quarries outside Darwin to Blydin Point and East Arm Wharf. This is likely to involve around 105 round trips per day at the peak of construction, though this would depend on the schedule and stockpiling arrangements, which are yet to be finalised.

Heavy-vehicle movements from quarries in Katherine would use Stuart Highway, while traffic from quarries at Mount Bundy would use both Stuart Highway and Arnhem Highway. Stuart Highway is regularly used by high volumes of heavy-vehicle traffic (e.g. road trains), while the Arnhem Highway carries lower volumes of heavy – and light-vehicle traffic and is occasionally closed in the wet season as a result of flooding. Both routes pass through small towns, and in the outer metropolitan areas and through Palmerston the truck route will pass through commercial areas and potentially residential areas. The route to East Arm Wharf uses Berrimah Road where there is a school zone with a 40-km/h speed limit.

This type of road traffic could cause some localised traffic congestion and noise impacts to local communities as well as an increase in the risk of accidents between turning trucks and other traffic using the highways.

### Management of traffic and transport

Traffic modelling indicates that the Project is not likely to create a significant overall incremental impact on the operation of the road network when compared with background growth. However the study found that some of the key intersections would be operating at their capacity by 2013 as a result of general background growth in Darwin.

The potential impacts of Project road traffic on the surrounding community, including the vehicle movements required to access the rock quarry located at Mount Bundy and the limestone quarry at Katherine, will be managed through a traffic management plan developed in consultation with local-government authorities, schools and other local service providers. Traffic management objectives, targets, management controls and monitoring procedures have been incorporated into the Provisional Traffic Management Plan for the Project (see Chapter 11). This plan will guide the development of more detailed plans during the construction phase. The key management controls proposed are as follows:

- Bus transport from the accommodation village or designated pick-up areas will be provided for most of the construction workforce in order to minimise the number of vehicle movements.
- Designated routes for travel to and from quarries, the accommodation village, Darwin’s central business district (CBD), the airport and East Arm Wharf will be set for the Project. The selection



**Table 10-9: Summary of impact assessment and residual risk for traffic and transport**

Aspect	Activity	Potential impacts	Management controls and mitigating factors	Residual risk*		
				C†	L‡	RR§
Traffic and transport	Daily transport of construction personnel to site. Regular transport of materials and equipment from East Arm Wharf to site during construction. Transport of rock from the quarries to site.	Increased congestion on local roads. Increased risk of road accidents.	Provisional Traffic Management Plan. Buses provided to transport a majority of the Project personnel to and from work to reduce total traffic. Designated travel routes to and from quarries, accommodation facilities, the Darwin CBD and East Arm Wharf will be set for the Project. The Project will work in conjunction with the DLP to identify any proposed road projects that may need to be brought forward or upgrades that may need to be undertaken to assist in reducing potential pressure on existing road systems.	D (S2)	3	Medium

\* See Chapter 6 *Risk assessment methodology* for an explanation of the residual-risk categories, codes, etc.

† C = consequence.

‡ L = likelihood.

§ RR = risk rating.

process for the routes will give consideration to minimising disturbance to local traffic and will be communicated to all relevant personnel.

- INPEX will work together with the DLP to identify any proposed road projects that may need to be brought forward or upgrades that may need to be undertaken to assist in reducing potential pressure on existing road systems.

### Residual risk

A summary of the potential impacts, management controls, and residual risk for traffic is presented in Table 10-9. After implementation of these controls, impacts from traffic are considered to present a “medium” risk and it is likely that any effects on the community will be localised and reasonably short-term, extending only through the construction phase.

### 10.3.5 Maritime traffic and navigation

#### Vessel movements

Vessels servicing the Project will be operating in offshore and nearshore waters throughout the construction and operations phases, in areas that are used by other commercial and non-trading vessels. The Project’s offshore and nearshore infrastructure (both at the surface and submerged) will also present new obstacles that may affect navigation by other vessels.

There are no designated shipping lanes in the offshore development area. The location of the offshore facilities will be communicated to other ships through a “Notice to Mariners” from the Australian Hydrographic

Service. Mariners would need to plan their course around this area to avoid the Project facilities.

Given the vast area of open ocean around the Ichthys Field this impact to shipping activities is considered to be very minor.

The location of pipelay vessels will also be communicated by the publication of a “Notice to Mariners”. These vessels pose a very minimal risk of interruptions to shipping activities along the pipeline corridor because of the transient nature of the work during the construction period and the extensive areas of open ocean around the corridor.

As described in Chapter 3, a wide variety of trading and non-trading vessels use Darwin Harbour and total vessel numbers have been increasing in recent years. The Project vessels likely to be employed in the nearshore development area during construction and operations are described in Chapter 4. While these vessels will result in an increase in maritime traffic volumes in the Harbour, the nearshore development area is located within an existing operational port equipped with facilities to manage commercial vessels. Vessel movements and activities will be undertaken according to Darwin Port Corporation (DPC) regulations.

An estimated 5–10 shipments per month of modules, steelwork and equipment will arrive in Darwin Harbour for the Project over the construction phase. This would represent an increase of 1–2% in the total monthly vessel calls to Darwin Harbour, based on 2008–09 shipping levels (Darwin Port Corporation 2009), and should be well within the existing port’s capacity.

Also during the construction phase, a number of dredging vessels and support vessels will operate in the nearshore development area and will travel through the Harbour to the offshore spoil disposal ground (see Chapter 4). While the dredging program could extend for as long as four years, dredging activities will typically be centred on only one or two localised portions of the nearshore development area at any one time. At the peak of dredging, up to four separate operations could occur concurrently. It is not envisaged that dredging will interrupt normal shipping activities through the Port of Darwin, although exclusion zones will be implemented around dredging vessels for public and operational safety (as discussed further below). Maritime vessel operations will be coordinated in conjunction with the DPC at all times.

During the operations phase, up to four tanker vessels per week (approximately 16 per month) will visit Blaydin Point, which represents an increase in shipping in the Harbour of 3%, based on 2008–09 levels (Darwin Port Corporation 2009). Each tanker will be assisted through the Harbour by a fleet of four tugs and will be under the direction of a pilot from the DPC to ensure that navigation and berthing is carried out safely.

#### Effects on navigation and other maritime infrastructure

The offshore spoil disposal ground has been selected to avoid interference with shipping traffic travelling from the Howard Channel between the Vernon Islands and Darwin Harbour. Dredge spoil will be spread as evenly as possible in the disposal ground and will form clumps and piles over the seabed. Hydrodynamic modelling predicts that the fine and sandy components of this material will migrate with tidal currents to the north-east and south-west and that some could blend with the sand waves that currently exist near the entrance to Darwin Harbour (see Appendix 13). The effects of this transport of sediment on seabed depth are very small, in the order of a few centimetres, and are insignificant in terms of the maintenance of shipping channels out of Darwin Harbour.

Within Darwin Harbour, fine sediments released during dredging are predicted to migrate to shoreline areas. Build-up around existing maritime infrastructure, such as East Arm Wharf, the Hudson Creek export facility, the East Arm boat ramp and Stokes Hill Wharf, is predicted to reach depths of between 5 and 50 mm (see Appendix 13). These levels are very low and are not expected to affect shipping or recreational boating activities.

#### Management of maritime traffic and navigation

A safety exclusion zone with a radius of 500 m will be put in place around surface and subsurface equipment in the offshore development area. This safety zone will be gazetted under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cwlth) and will appear on Australian navigation charts. An additional “restricted navigation zone” 5 nautical miles wide will be implemented throughout the life of the Project. The gas export pipeline will also be gazetted on navigational charts after construction.

In Commonwealth waters there is the potential for a precautionary zone to be imposed around the gas export pipeline, but this will be the subject of further discussion with the relevant authorities. Should this zone around the pipeline be imposed, it would be gazetted under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and will also appear on Australian navigational charts.

To ensure that under-keel clearance is maintained for seagoing vessels in the offshore spoil disposal ground and that there are no disruptions to maritime traffic, INPEX will undertake periodic bathymetric surveys to confirm sediment deposition depth and patterns. The monitoring program will have the following components:

- A baseline survey of the whole spoil ground will be undertaken prior to the commencement of dredging.
- Interim surveys will be conducted over the dredge spoil ground areas to monitor the rate of build up and distribution of spoil on the seabed; this will be done every two to four weeks initially, then less frequently as the accumulation of the spoil in the spoil ground becomes better understood. Monitoring will be conducted so that the spoil does not create an area of shoal seabed less than a predefined depth as agreed with the DPC.
- A final survey of the spoil ground will be undertaken on completion of all dredging works to confirm sediment deposition depths and that there is sufficient under-keel clearance for maritime vessels.

In addition, INPEX will liaise with the DLP to prepare a “Notice to Mariners” advising them of changes in circumstances at or adjacent to the offshore spoil disposal ground.

A range of measures will be put in place to avoid navigational problems and potential vessel collisions in the offshore development area. These will include

lighting, communications, the deployment of anti-collision radar, and notification of the location of the offshore facilities and the gas export pipeline through a “Notice to Mariners”. Notices will be issued to ships and appropriate navigation lights and markers will be displayed. Standard maritime communications systems will be provided on all facilities.

Exclusion zones around dredge vessels, pipe-laying vessels and jack-up barges will be identified by the DPC through the Darwin Harbourmaster and notices. Enforcement of these exclusion zones will be in accordance with the Darwin Port by-laws. The restrictions will be dependent on the location and type of operation.

An application will be made to the relevant government and other regulatory agencies to implement a safety exclusion zone and restricted navigation zone around the nearshore infrastructure (the jetty and the module offloading facility) to maintain security and public safety. The safety exclusion zone will be determined through a series of safety assessments in consultation with the DPC and the Commonwealth’s Department of Infrastructure, Transport, Regional Development and Local Government (DITRD LG). The exclusion zone will be established to ensure that the safety of personnel and Harbour users is not compromised to below acceptable standards. These zones are not likely to affect navigation through the main body of the Harbour, but will preclude access by recreational boats to some areas near Blaydin Point.

Exclusion zones along the jetty trestles and the jetty heads (without a product tanker at berth) will be in the order of 500 m subject to the outcomes of the final quantitative risk assessment. These areas will be marked with buoys.

There will be an exclusion zone of 1000 m ahead and 500 m astern and on each side of the LNG carriers. This will be enforced by escort tugs. Exclusion zones around liquefied petroleum gas (LPG) and condensate vessels will be determined by the DPC.

Where the gas export pipeline lies within 3 nautical miles of the territorial sea, a precautionary zone of 200 m will be set. This zone will be gazetted and will appear on Australian navigational charts. Within this zone it is forbidden to drop or drag an anchor or perform an action that could damage the pipeline as prescribed by Section 66(5) *Threat to pipeline* of the *Energy Pipelines Act* (NT).

Vessel movements in the Harbour will be carried out according to the regulations of the DPC. In consultation with the DPC, navigation aids will be installed or relocated around the jetty and in the shipping channel to allow vessel movements by all Harbour users to continue safely and efficiently.

Maritime infrastructure zones in East Arm (e.g. the East Arm Wharf berths, the Hudson Creek export facilities and the East Arm boat ramp) will be checked periodically for sediment build-up caused by the nearshore dredging program. If sediment accumulation occurs to levels that could interrupt normal use of these facilities, cleaning or maintenance dredging will be carried out by INPEX.

### Residual risk

Potential impacts to maritime traffic and navigation are presented in Table 10-10 along with the proposed management strategies to minimise these impacts during the life of the Project. After implementation of these controls, impacts to maritime traffic and navigation are considered to present a “low” to “medium” risk as any effects will be localised and should be manageable through established regulatory systems.

### 10.3.6 Air traffic

INPEX has consulted with the Civil Aviation Safety Authority (CASA) and the Australian Defence Force regarding the potential impact of the onshore processing plant’s operations on aviation activities in the Darwin region. A specific study was undertaken by INPEX to assess the potential for the ground flare to impact on flight paths for Darwin Airport. The assessment involved the use of CSIRO and CASA software to model the exhausts, plumes and flare heights from the ground flare.

The assessment indicated that the vertical plume velocity during normal operations will not exceed the critical plume velocity of 4.3 m/s above heights of 443 m AGL (above ground level)<sup>2</sup>. The probability of an aircraft operating above an altitude of 451 m from the plume source that would be exposed to vertical gusts of greater than 4.3 m/s is acceptable in terms of CASA risk criteria. In addition, the Standard Terminal Arrival Routes contain a constraint of 1829 m, which will ensure that arriving aircraft remain vertically clear of the ground flare (Jones 2009).

The study also considered the risk of abnormal emergency operations at the plant site affecting flight paths. It was found that the probability of an

<sup>2</sup> A height “above ground level” is the height above the ground at any given location. It is not the same as the Australian Height Datum, which is the datum to which all vertical control for mapping in Australia is referred.

**Table 10-10: Summary of impact assessment and residual risk for maritime traffic and navigation**

Aspect	Activity	Potential impacts	Management controls and mitigating factors	Residual risk*		
				C†	L‡	RR§
Maritime traffic and navigation	Construction and operation of offshore infrastructure in open ocean.	Forced alteration of shipping route.	<p>Low level of shipping activity in the offshore development area.</p> <p>An application will be made to the relevant government regulatory agencies to implement a safety exclusion zone and restricted navigation zone. These zones will be gazetted on navigational charts.</p> <p>Standard maritime communications equipment, navigation lights and markers on all Project vessels.</p> <p>A “Notice to Mariners” on location of offshore infrastructure and pipeline will be issued.</p>	E (S2)	2	Low
Maritime traffic and navigation	Use of vessels for pipeline construction in offshore development area.	Forced alteration of shipping route.	<p>Standard maritime communications equipment installed on all vessels.</p> <p>Activities will be transient and short-term only.</p>	F (S2)	2	Low
Maritime traffic and navigation	Operation of nearshore construction vessels and dredge.	<p>Forced alteration of shipping route in the Harbour.</p> <p>Increase in competition for port resources with other users.</p> <p>Spoil disposal ground could cause hazards to shipping navigation in the area.</p>	<p>Cooperation with DPC to manage shipping traffic schedules and exclusion zones during construction.</p> <p>“Notice to Mariners” to be issued on nearshore construction activities, e.g. dredging and rock dumping.</p> <p>Construction-vessel traffic will be short-term in duration.</p> <p>Periodic bathymetric surveys to be undertaken to confirm sediment deposition depth and patterns.</p> <p>The spoil disposal ground is not located in a shipping route.</p> <p>Ensure that under-keel clearance at the spoil disposal ground is maintained for maritime vessels.</p>	E (S2)	6	Medium
Maritime traffic and navigation	Operation of tanker vessels in nearshore area.	<p>Forced alteration of shipping route in the Harbour.</p> <p>Increase in competition for port resources with other users.</p>	<p>Exclusion zones will be put in place around product tankers and will be enforced by tugs.</p> <p>Cooperation with DPC to manage shipping traffic schedules during operations.</p>	E (S2)	6	Medium

\* See Chapter 6 *Risk assessment methodology* for an explanation of the residual-risk categories, codes, etc.

† C = consequence.

‡ L = likelihood.

§ RR = risk rating.

aircraft being exposed to risk as a result of abnormal emergency operations was acceptable in terms of CASA risk criteria (Jones 2009).

The height of physical structures may also potentially impact on aviation activities in the Darwin region. Both the Airports (Protection of Airspace) Regulations 1996 (Cwlth) and Defence (Areas Control) Regulations 1989 (Cwlth) control the height of structures and the purpose for which they may be used within a 15-km radius of an aerodrome. The tallest physical structure proposed at the onshore site will be the turbine stacks with a projected height of 65 m. While it was found that the Blaydin Point site did fall within 15-km radius of Darwin International Airport, it was determined that the stacks would not penetrate the outer horizontal obstacle limitation surface for the airport (Jones 2009).

### 10.3.7 Recreation

There is little or no recreational activity (such as boating and fishing) in most of the offshore development area because of the distance from land and the very deep waters. However, there are some recreational fishing areas at the eastern end of the gas export pipeline route around the entrance to Darwin Harbour and near the offshore spoil disposal ground for dredged material.

The proposed offshore spoil disposal ground was selected in consultation with a number of stakeholders, including the Amateur Fishermen's Association of the Northern Territory (AFANT). This organisation identified a need to protect recreational fishing areas such as Charles Point Patches and the artificial reefs off Lee Point from sedimentation impacts caused by the spoil disposal activities. The spoil disposal ground location was selected to minimise impacts on these recreational fishing areas.

Darwin Harbour is used frequently for recreational fishing. Community consultation identified a specific concern among recreational fishermen that the development of the product loading jetty in the nearshore development area would exclude public access to Cossack Creek and Lightning Creek to the west of the Blaydin Point peninsula. While INPEX aims to minimise the impact of the facilities at Blaydin Point, including the loading jetty, on users of the Harbour, public health and safety are ultimately the paramount factors in respect of decisions on plant design and operating philosophy.

The results from the preliminary quantitative risk assessments (QRAs) conducted to date (and discussed more fully in Section 10.3.14 *Public safety*) indicate

that the onshore development area and pipeline do not pose unacceptable safety risks to Harbour users (GL 2009). Where risks posed to Harbour users in the vicinity of the jetty heads and trestle are higher than acceptable for active open spaces, nominal safety exclusion zones will be established. As the risk contours show that the acceptable risk contours border the main channel of Lightning Creek, risk values will need to be confirmed by a final QRA based on a complete plant design to determine whether access to these creeks can be maintained.

An assessment of the jetty design was undertaken by INPEX and the evaluation of jetty options is presented in Chapter 4. Prior to and during the assessment of the design, INPEX engaged extensively with stakeholders because of the potential for the jetty to impact on human use and the heritage values of the area.

As discussed in Chapter 3, Aboriginal people living in the Darwin area frequently fish and forage for food and other resources in intertidal areas at low tide, as well as in Darwin Harbour. Within the Harbour itself these activities are common around Nightcliff, Coconut Grove, Kulaluk, Sadgroves Creek, Lee Point and Blaydin Point. It is predicted that there will not be any direct Project impact on the Nightcliff, Coconut Grove, Kulaluk, Sadgroves Creek and Lee Point areas and therefore impacts on traditional fishing practices will be negligible for these areas. There will be an impact on traditional fishing practices undertaken on and around Blaydin Point during both the construction and operations phase. This is because public access to the onshore site will be restricted and marine exclusion zones will be put in place to ensure that public safety is not compromised. This impact is expected to be minimal given that the fishing areas affected represent a very small portion of the areas available in Darwin Harbour.

Also of concern to fishing values is the potential removal or disturbance of mangroves around Middle Arm Peninsula, although the area of mangroves to be disturbed by the Project represents only a small proportion of this habitat type within the Harbour overall as discussed in Chapter 8. The major dredging activities associated with the construction of the nearshore infrastructure are unlikely to have a significant impact on local marine ecology and fish populations as discussed in Chapter 7. Rock-armouring along the gas export pipeline through Darwin Harbour will provide new artificial habitat for benthic biota and fish that could improve recreational fishing opportunities, similar to the increased abundance of marine life present on the existing Bayu–Undan Gas Pipeline (see Chapter 3).

Recreational diving in the southern portion of Darwin Harbour could be impacted upon by the Project, particularly during the construction stage when dredging activities will cause increased turbidity and therefore reduced underwater visibility. In addition to this, recreational diving may be impacted upon during nearshore blasting activities when exclusion zones will be imposed for public safety reasons (see Section 10.3.14); however these are short-term activities and will only temporarily affect recreational diving.

Blaydin Point is occasionally used for fishing, camping and four-wheel-drive recreation. These activities will be banned from the onshore development area from the beginning of the construction phase because of the implementation of a safety exclusion zone that will be determined in consultation with the DPC and the DITRDLG. It is not considered that this will result in a significant impact as similar bushland areas exist in many locations around Darwin Harbour and the loss of access to Blaydin Point does not represent a major reduction in recreation sites.

#### Residual risk

A summary of the potential impacts, management controls, and residual risk for recreation is presented

in Table 10-11. After implementation of these controls, impacts to recreational values in Darwin Harbour are considered to present a “medium” risk. Three of these impacts are related to the design of nearshore infrastructure and will therefore exist for the life of the Project.

#### 10.3.8 Aboriginal cultural heritage

The Larrakia Development Corporation (LDC) and the Northern Land Council (NLC) expressed support for the Project’s potential to create business and employment opportunities for Aboriginal people. The LDC’s chair, as senior custodian, had provided advice to the Aboriginal Areas Protection Authority (AAPA) that no sacred sites would be impacted by the proposed Project design.

Aboriginal sacred sites located in Darwin Harbour are outside the nearshore development area. The AAPA issued a number of “authority certificates” through a process of pre-development assessment under the *Northern Territory Aboriginal Sacred Sites Act* (NT), confirming that the activities proposed for the Ichthys Project would avoid interference with sacred sites (Table 10-12).

**Table 10-11: Summary of impact assessment and residual risk for recreation**

Aspect	Activity	Potential impacts	Management controls and mitigating factors	Residual risk*		
				C <sup>†</sup>	L <sup>‡</sup>	RR <sup>§</sup>
Recreation	Operation of nearshore infrastructure (jetty) with exclusion zones for security and public safety.	Reduction in access to recreational fishing grounds.	Fishing areas to be affected represent a very small proportion of the areas available in Darwin Harbour.	E (S2)	6	Medium
Recreation	Dredging during construction of nearshore infrastructure.	Reduced access to recreational diving sites (e.g. wrecks) owing to reduced visibility in turbid waters.	Dredging is a construction-phase activity and will only temporarily reduce visibility	E (S2)	6	Medium
Recreation	Construction and operation of onshore infrastructure.	Loss of access to camping and four-wheel-drive areas and traditional hunting and gathering areas at Blaydin Point.	Many other similar areas are available around Darwin Harbour.	E (S2)	6	Medium
Recreation	Construction and operation of onshore infrastructure.	Loss of access to traditional fishing and foraging grounds on Blaydin Point.	Fishing and foraging areas to be affected represent a very small proportion of the areas available in Darwin Harbour.	E (S2)	6	Medium

\* See Chapter 6 *Risk assessment methodology* for an explanation of the residual-risk categories, codes, etc.

† C = consequence.

‡ L = likelihood.

§ RR = risk rating.

**Table 10-12: Authority certificates provided by the AAPA for the onshore and nearshore development areas**

Authority certificate	Subject area
C2008/041	Middle Arm Peninsula and nearshore waters
C2008/042	Middle Arm Peninsula and nearshore waters
C2008/191	Marine area between Cox Peninsula and Shoal Bay Peninsula, Darwin Harbour
C2009/011	Subsea pipeline corridor within Darwin Harbour in the Beagle Gulf

The buffer area designated for one site north of Mandorah is positioned adjacent to the proposed gas export pipeline corridor (see Chapter 3 for the location). Consultation with the AAPA and the Larrakia people was undertaken by INPEX in order to develop a management approach that protects this site. Vessel movements and anchoring for the Project will avoid impacts to sacred sites in accordance with the conditions laid down on the AAPA Authority Certificate.

Archaeological surveys of the onshore development area (presented in Chapter 3) indicate that nine sites (consisting mainly of shell and stone artefact scatters) and one isolated artefact are located close to, or within, the boundary of the onshore development area. All Aboriginal archaeological sites and objects are protected by the *Heritage Conservation Act* (NT) and ministerial permission is required to disturb them.

One archaeological site of high significance is located close to the proposed access road to Blaydin Point. Careful alignment of the road would allow preservation of this site, although extra signage or fencing may be warranted to protect it from damage by off-road vehicle or machinery movements. Management of this site is currently the subject of consultation with the Northern Territory's Department of Natural Resources, Environment, the Arts and Sport (NRETAS) and the Larrakia people.

Three sites will be required to be disturbed during construction: one isolated artefact located close to the pipeline corridor, a shell and stone artefact scatter and a subsurface midden/shell scatter located within the access road corridor. INPEX will request permission from the Heritage Branch of NRETAS to move or remove these sites. If permission is granted to move or remove these sites, advice will be sought from the traditional custodians on the correct procedures to be adopted for their removal.

#### Management of Aboriginal cultural heritage

A Provisional Heritage Management Plan has been compiled for the Project (see Annexe 9 to Chapter 11). This will guide the development of more detailed plans during the construction and operations phases. The provisional plan contains details of applicable management controls, procedures, monitoring and audit programs. Its key components are summarised as follows:

- A Larrakia Heritage Management Committee (LHMC) with a standing agenda will be established. It will be made up of representatives of the Larrakia people and INPEX.
- Prior to commencement of construction, Aboriginal sites within the onshore development area will be divided into two categories: those which will receive full protection from disturbance and those which may need to be removed.
- In the case of an Aboriginal heritage site which may have to be moved or removed, INPEX will request permission to do so from both the LHMC and the Heritage Branch of NRETAS. If permission is granted to remove the site, advice will be sought from the traditional custodians on the correct procedures to be adopted for its removal.
- Where the external boundary of an Aboriginal heritage site is 10 m or closer to any proposed construction activity, flagging, temporary fencing or similar will be erected 5 m from the site boundary and appropriate signage will be put in place. The boundary demarcation will be removed when the risk of disturbance no longer exists.
- Daily toolbox meetings, job hazard analyses, permit systems or similar will be implemented on site prior to the commencement of vegetation clearing or construction activities. These will be undertaken to ensure that work areas are clearly identified before operations commence to avoid accidental disturbance to heritage sites either inside or outside the heritage site boundaries.
- Anchor management plans will be developed to allow safe anchoring of vessels undertaking pipelay, dredging and piling activities in the vicinity of any nearshore heritage or sacred sites.
- Exclusion zones have been established around the marine sacred sites by the AAPA. No works are permitted within these exclusion zones.
- Monitoring will be undertaken for Aboriginal heritage sites. This will involve inspections by Larrakia representatives prior to and during the construction phase and during the commissioning and operations phases. Photographic records will be maintained for each of the sites.

The LDC has been engaged to develop a detailed Heritage Management Plan for the Project in consultation with the local traditional custodians. This plan will contain objectives and targets, management controls and monitoring for the ongoing protection of Aboriginal values in the vicinity of the onshore and nearshore development areas.

#### Residual risk

The risk assessment process for potential impacts to Aboriginal cultural heritage has been based on legal compliance with the *Heritage Conservation Act* (NT), under which these sites are protected (see Table 10-13). It is not considered appropriate to estimate the heritage value of these sites to the local community,

as traditional owners of the land would attribute different values to the sites than would newcomers to the Northern Territory. After implementation of the proposed management controls, the risk of impacts to Aboriginal heritage sites is considered to be “low”.

#### 10.3.9 Non-Aboriginal cultural heritage

##### Terrestrial heritage sites

Three World War II historical sites exist within the onshore development footprint. One of these sites contains the foundations of an anti-aircraft searchlight and other relics; it is located on the northern extremity of Blaydin Point. The other two sites (communications insulators) are located to the south of this main site (see Chapter 3).

**Table 10-13: Summary of impact assessment and residual risk for Aboriginal cultural heritage sites**

Aspect	Activity	Potential impacts	Management controls and mitigating factors	Residual risk*		
				C <sup>†</sup>	L <sup>‡</sup>	RR <sup>§</sup>
Aboriginal cultural heritage	Land clearing prior to construction in the onshore development area, and vehicle movement in the vicinity of heritage sites.	Disturbance or removal of Aboriginal archaeological sites within or near the onshore development footprint protected under the <i>Heritage Conservation Act</i> (NT).	Design of infrastructure to avoid onshore heritage sites where possible. Seek ministerial permission to disturb or remove a site. If permission is granted to remove or disturb a site, advice will be sought from the traditional owners on the correct procedures to be adopted for its removal.  Daily toolbox meetings, job hazard analyses, permit systems or similar will be implemented on site prior to the commencement of vegetation-clearing or construction activities.  Where the external boundary of an Aboriginal heritage site is 10 m or closer to any proposed construction activity, flagging, temporary fencing or similar will be erected 5 m from the site boundary and appropriate signage will be put in place.  Provisional Heritage Management Plan.	D (S3)	1	Low
Aboriginal cultural heritage	Construction vessel movements and anchoring in Darwin Harbour.	Disturbance to maritime sacred sites protected under the <i>Northern Territory Aboriginal Sacred Sites Act</i> (NT) and the <i>Heritage Conservation Act</i> (NT).	Exclusion zones have been established around the maritime sacred sites by the AAPA. No works will be permitted within these exclusion zones.  Anchor management plans will be developed to allow safe anchoring of vessels undertaking pipelay, dredging and piledriving activities in the vicinity of any nearshore heritage or sacred sites.  Provisional Heritage Management Plan.	D (S3)	1	Low

\* See Chapter 6 *Risk assessment methodology* for an explanation of the residual-risk categories, codes, etc.

† C = consequence.

‡ L = likelihood.

§ RR = risk rating.



It is likely that all of these sites will need to be removed or disturbed during construction activities. They are not listed on the Northern Territory Heritage Register nor are they the subject of interim conservation orders, so they do not require ministerial permission to disturb. However, INPEX will consult with the Heritage Branch of NRETAS before disturbing the sites and each will be surveyed and recorded prior to removal.

### Maritime wrecks

Awareness of the maritime heritage sites in the vicinity of the nearshore development area was moderately high during stakeholder consultation, in particular regarding the SS *Ellengowan* shipwreck and the six Catalina wrecks, these are discussed in Chapter 3. Maritime archaeologists indicated there was no way to remove the Catalina wrecks from the water without causing further damage and that they should remain in situ. Stakeholders generally did not identify any specific threats to the heritage values of these sites from the Project, other than the potential for direct physical disturbance during construction of nearshore infrastructure.

Three of the Catalinas are in close proximity to the dredging footprint for the shipping channel (see Figure 10-3). These particular wrecks were aircraft owned by the United States Navy and, as such, are specifically protected by the United States *Sunken Military Craft Act 2005* (SMCA) as well as by customary international law. In addition, in February 2009 the Northern Territory Heritage Advisory Council made recommendations to the Minister for Natural Resources, Environment and Heritage under Section 24 of the *Heritage Conservation Act* (NT) that all six Catalina wrecks be placed on the Northern Territory Heritage Register to afford them protection. These proposals have been subject to public consultation but have not yet been approved. At the same time as the recommendation was made, an interim conservation order was placed on the most recently discovered Catalina wreck (known as Catalina 6) by the Minister to provide legal protection to the site, additional to the provisions under US law, until a decision is made about whether to include the site on the Northern Territory Heritage Register. If the proposal to register the Catalina wrecks is approved, exclusion zones will possibly be required around each.

Sediment dispersion and accumulation modelling for the dredging program has been conducted by HR Wallingford (HRW) (the full report is presented in Appendix 13). The modelling indicated that small volumes of coarse material (sands) released by dredging could migrate into East Arm with tidal currents, moving to the north-east of the dredging

area. Total accretion outside the dredging footprint is predicted to be less than a few centimetres in depth. The Catalina 3 site, located north of the approach area and turning-basin dredging area, is predicted to receive this level of sedimentation. The wreck sites south of the dredging area, including Catalinas 4, 5 and 6 and the *Kelat*, are not predicted to be affected (see Appendix 13).

The potential effects on heritage values from sedimentation were reviewed by maritime archaeologists from URS Corporation in the United States. For some marine archaeological sites (e.g. Catalinas 4 and 5, which are relatively intact) it is considered that burial with sediments may serve, under the right circumstances, to enhance their protection and preservation. This could be made possible by reducing access to the wreck by looters and through stabilising parts of the wrecks that lack structural integrity (URS Corporation 2009).

Catalinas 4, 5 and 6 are United States Navy aircraft and, as noted above, are protected by the SMCA, which is intended to confer protection from inappropriate looting, salvaging, sport-diving activities, or disturbances resulting from otherwise permitted actions. During research for the heritage assessment, the Naval Historical Centre at the Washington Navy Yard, Washington, DC, indicated that preservation in situ through avoidance is the preferred conservation approach for maritime wrecks (URS Corporation 2009).

The United States does not currently have a bilateral agreement with Australia pertaining specifically to the SMCA, but the legislation has been applied to management of American shipwrecks in Australia in the past, in conjunction with Australian authorities. When it is proposed that the remains of sunken military craft should be removed from development sites, a permit needs to be obtained from the Naval Historical Centre. Removal may also need to be conducted by archaeologists that meet United States professional standards. As mentioned above, preservation in situ is generally preferred over a salvage operation (URS Corporation 2009).

Activities that could disturb the integrity of wrecks, such as diver inspections that entail the moving of sediment to expose the remains for documentation, also require permission from the United States Naval Historical Centre (URS Corporation 2009).

Other risks of disturbance by the Project to the Catalina wrecks, and other shipwrecks such as the *Kelat* and the SS *Ellengowan*, relate to the placement and movement of anchors and cables for construction vessels in the nearshore development area (e.g. from dredgers and pipelay barges). These may be mitigated

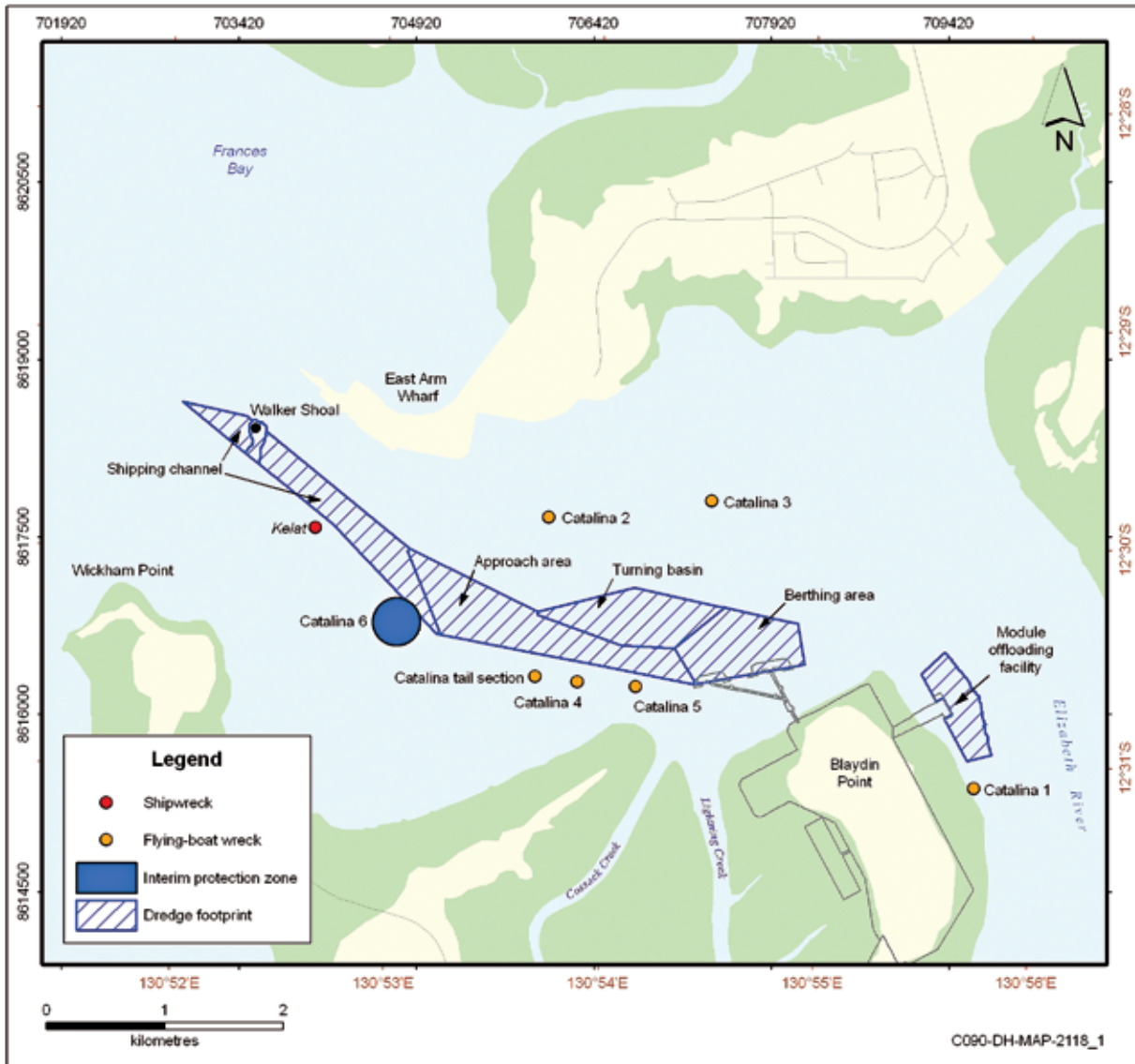


Figure 10-3: Location of Catalina wrecks in relation to the dredging footprint

through careful development of anchoring procedures and implementation of controlled zones.

It is not anticipated that any permits to disturb American wrecks under the SMCA will be required.

The potential impacts on maritime heritage sites during the operations phase will be limited to increases in sedimentation or sediment scouring on or around the Catalinas next to the navigational channel, turning basin and the berthing area arising from vessel operations and from periodic maintenance dredging.

The arrival and departure of tanker vessels at the product loading jetty will generate some resuspension of fine sediments from the seafloor because of propeller wash. While under some tidal conditions these fine sediments may be transported towards the US Navy Catalina wrecks, tidal currents would cause resuspension of this material and accumulation on the wrecks is not expected.

Preliminary studies indicate that maintenance dredging may be required approximately every 10 years. While this dredging would generate turbid plumes, seabed sedimentation effects in East Arm are expected to be similar to those generated during the construction phase, but on a smaller scale. Sediment accumulation on the wrecks is not expected as a result of maintenance dredging.

INPEX will periodically assess the sediment conditions of the Catalina wrecks adjacent to the shipping channel during the operations and in consultation with NRETAS determine whether any remedial action is required to address impacts should they arise.

#### Management of non-Aboriginal cultural heritage

A Provisional Heritage Management Plan has been compiled for the Project (attached as Annexe 9 to Chapter 11), which will guide the development

of more detailed plans during the construction phases. This plan contains details of applicable management controls, procedures, and monitoring and audit programs. Key components of this plan are summarised as follows:

- The World War II historical sites located on Blaydin Point are not listed and do not require approval to disturb; however, INPEX will consult with NRETAS's Heritage Branch before disturbing the sites and all sites will be surveyed and recorded.
- Anchor management plans will be developed in consultation with NRETAS's Heritage Branch, to allow safe anchoring of vessels undertaking pipelay, dredging and piledriving activities in the vicinity of any heritage sites.
- To minimise disturbance, a 100-m-radius controlled zone will be established around all known Catalina flying-boat wrecks. If it is deemed necessary to have anchors or anchor cable within this zone then the appropriate anchor management procedures identified in the anchor management plan will apply.
- To minimise disturbance, a 100-m-radius controlled zone (based on the intersection of latitude 12°32'16.3"S and longitude 130°52'06.3"E on the Port of Darwin 1:50 000 map sheet AUS 26) for the SS *Ellengowan* will apply. If it is necessary to have anchors or anchor cable within this zone then the appropriate anchor management procedures identified in the anchor management plan will apply.
- To minimise disturbance, a 100-m-radius controlled zone (based on the intersection of latitude 12°29'55.4"S and longitude 130°52'40.2"E on the Port of Darwin 1:50 000 map sheet AUS 26) for the *Kelat* will apply. If it is necessary to have anchors or anchor cable within this zone then the appropriate anchor management procedures identified in the anchor management plan will apply.
- Accurate differential GPS (dGPS) locations of all wrecks near the nearshore development area will be provided to construction contractors to enable accurate positioning.
- Before dredging commences, Catalina flying-boat wrecks will be inspected to determine the current levels of sedimentation and records of these inspections will be kept.
- During the construction and operations phases, INPEX will periodically assess sediment conditions of Catalina wrecks adjacent to the shipping channel and in consultation with NRETAS determine whether any remedial action is required to address impacts should they arise.

### Residual risk

The risk assessment process for potential impacts to non-Aboriginal cultural heritage has been based on legal compliance with the *Heritage Conservation Act* (NT), under which these sites are protected (see Table 10-14). It is not considered appropriate to estimate the heritage value of these sites to the local community, as different members of the community may assess the "consequence" of impacts to heritage values in different ways. For example, local historians or families of World War II veterans may consider the disturbances to wartime wrecks to be a negative impact of the Project, while newcomers to the Northern Territory may not place the same importance on these heritage features.

### 10.3.10 Airborne noise

The key sensitive receptors of the airborne noise generated by the onshore development area are residential suburbs and urban centres around Darwin Harbour. Darwin's CBD is located 10 km to the north-west of the onshore development area, across the Harbour waters, and the nearest residential area of Palmerston is located approximately 4 km to the east and north-east.

The main activities that could generate airborne noise in public areas around the onshore and nearshore development areas are normal plant operations and emergency flaring.

In order to assess the potential impacts of these noise sources on the community, noise propagation modelling was undertaken by SVT Engineering Consultants (SVT 2009). The modelling results were then compared against the ambient noise measurements conducted for residential areas in Bayview Haven and Palmerston (presented in Chapter 3) as a "baseline" for noise levels experienced prior to development of the Project.

An acoustic model was developed for the onshore processing plant using the SoundPLAN program, which produces noise contours over a defined area of interest. Noise reflection by the surfaces of waterbodies or by hard flat ground is integrated into the model, as is site-specific topography since noise can be absorbed by physical barriers like hills. Other physical barriers such as dense vegetation or large buildings can also absorb noise, but these are not accounted for by SoundPLAN. The model also accounts for meteorology, as climate factors such as wind direction can affect the intensity and the distance that sound travels from its source. "Worst-case" wind conditions (a soft steady wind travelling from the noise source towards sensitive receptors) are used in the model to provide a conservative estimate of noise

**Table 10-14: Summary of impact assessment and residual risk for non-Aboriginal cultural heritage sites**

Aspect	Activity	Potential impacts	Management controls and mitigating factors	Residual risk*		
				C†	L‡	RR§
Non-Aboriginal cultural heritage	Construction activities within the nearshore development area, including dredging and pipelay.	Accidental disturbance to maritime heritage sites listed under the <i>Heritage Conservation Act</i> (NT) or the <i>Historic Shipwrecks Act 1976</i> (Cwlth).	Design of infrastructure to avoid disturbance to sites. Anchor management plans will be developed in consultation with NRETAS's Heritage Branch to allow safe anchoring of vessels undertaking pipelay, dredging and piledriving activities in the vicinity of any heritage sites. Accurate dGPS locations of all wrecks near the nearshore development area will be provided to construction contractors to enable accurate positioning. Implementation of controlled zones around the SS <i>Ellengowan</i> , the <i>Kelat</i> , and Catalina flying-boat wrecks. Validation of dredging sedimentation modelling. Provisional Heritage Management Plan.	D (S3)	2	Medium
Non-Aboriginal cultural heritage	Vessel operations and periodic maintenance dredging activities within the nearshore development area during the operations phase.	Increases in sedimentation or sediment scouring on or around the Catalina flying-boat wrecks adjoining the shipping channel, the approach area, the turning basin and the berthing area.	INPEX will periodically assess sediment conditions in the vicinity of the Catalina wrecks adjacent to the shipping channel and, in consultation with NRETAS, will determine whether any remedial action is required to address impacts should they arise. Provisional Heritage Management Plan.	F (S2)	4	Low

\* See Chapter 6 *Risk assessment methodology* for an explanation of the residual-risk categories, codes, etc.

† C = consequence.

‡ L = likelihood.

§ RR = risk rating.

propagation. The results of this study are summarised below and the full technical report (SVT 2009) is provided in Appendix 20 to this Draft EIS.

The cumulative sound power level for all equipment at the onshore processing plant during normal operations is estimated to be approximately 127 dB(A), with an increase to 140 dB(A) during emergency flaring. These raw noise levels will be attenuated as the sound travels towards receptors in the wider area. Taking into account the local topography and land and water surfaces, the expected noise-emission contours for these noise sources are presented in figures 10-4 and 10-5.

Although no noise limits are currently prescribed by legislation in the Northern Territory, the following noise limits for receiving locations have been defined for the Project in consultation with NRETAS:

- residential, institutional and education areas: 55 dB(A) during the day and 45 dB(A) at night
- industrial areas: 70 dB(A) at all times.

As the onshore processing plant will operate 24 hours a day, the night-time noise limit of 45 dB(A) is particularly relevant for noise-sensitive receivers. Predicted noise levels at key receiving locations are presented in Table 10-15, with Table 10-16 providing examples of the noise levels from common sounds to allow for comparison; the noise-level readings are taken at a point adjacent to the source.

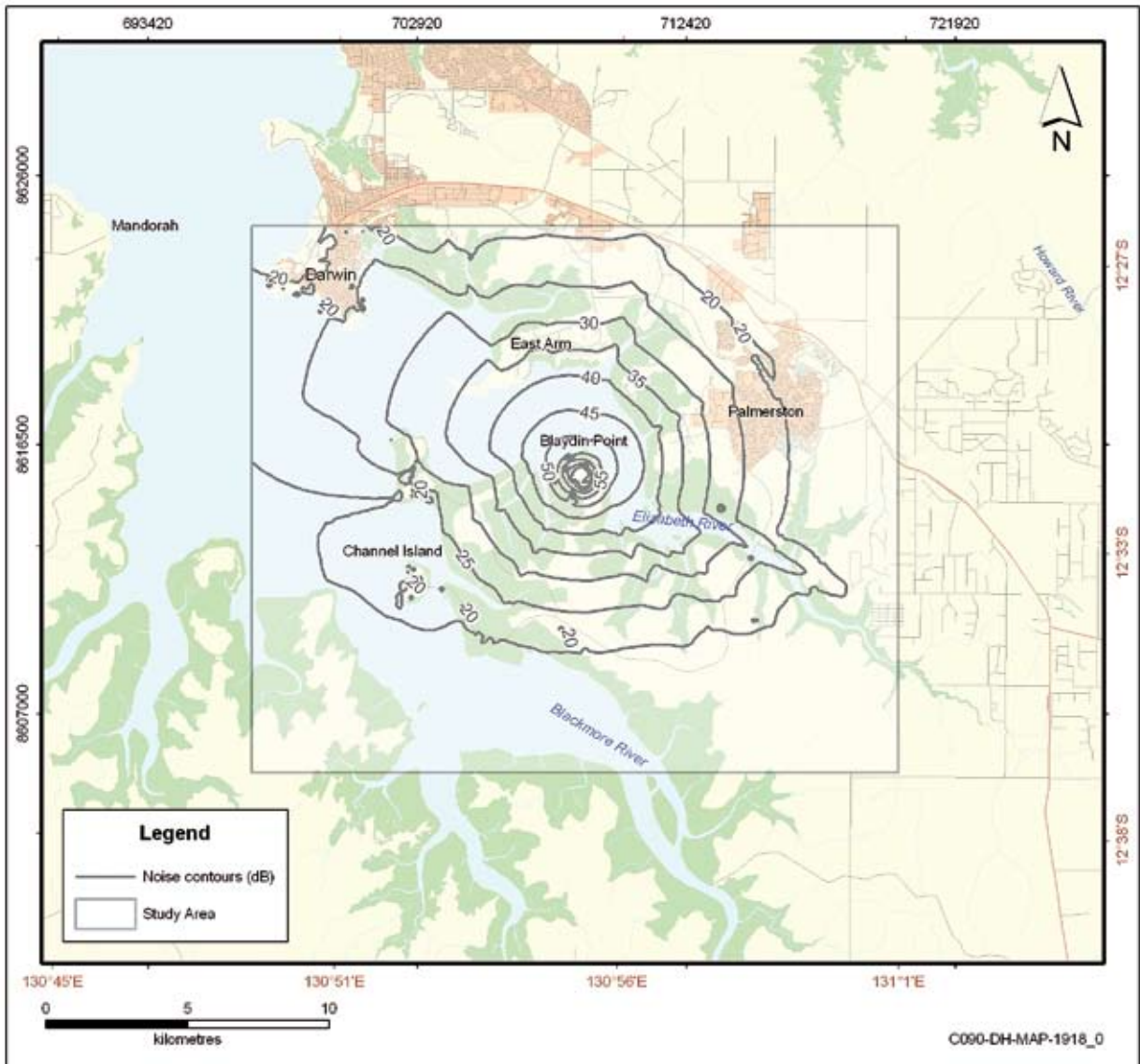


Figure 10-4: Noise contours for the onshore processing plant during normal operations

Table 10-15: Noise levels received at locations around Darwin Harbour

Location	Type of receiver	Predicted noise level received (dB(A))		Criteria limit for receiver (dB(A))
		Normal operations	Emergency flaring	
Western edge of Palmerston	Residential, institutional, education	33	40	55 (day) 45 (night)
Central Palmerston	Residential, institutional, education	25	32	55 (day) 45 (night)
East Arm Wharf	Industrial	37	45	70
Darwin LNG plant, Wickham Point	Industrial	30	40	70
Bayview Haven	Residential, institutional, education	20	35	55 (day) 45 (night)
Darwin CBD	Residential, institutional, education	24	34	55 (day) 45 (night)

Source: SVT 2009.

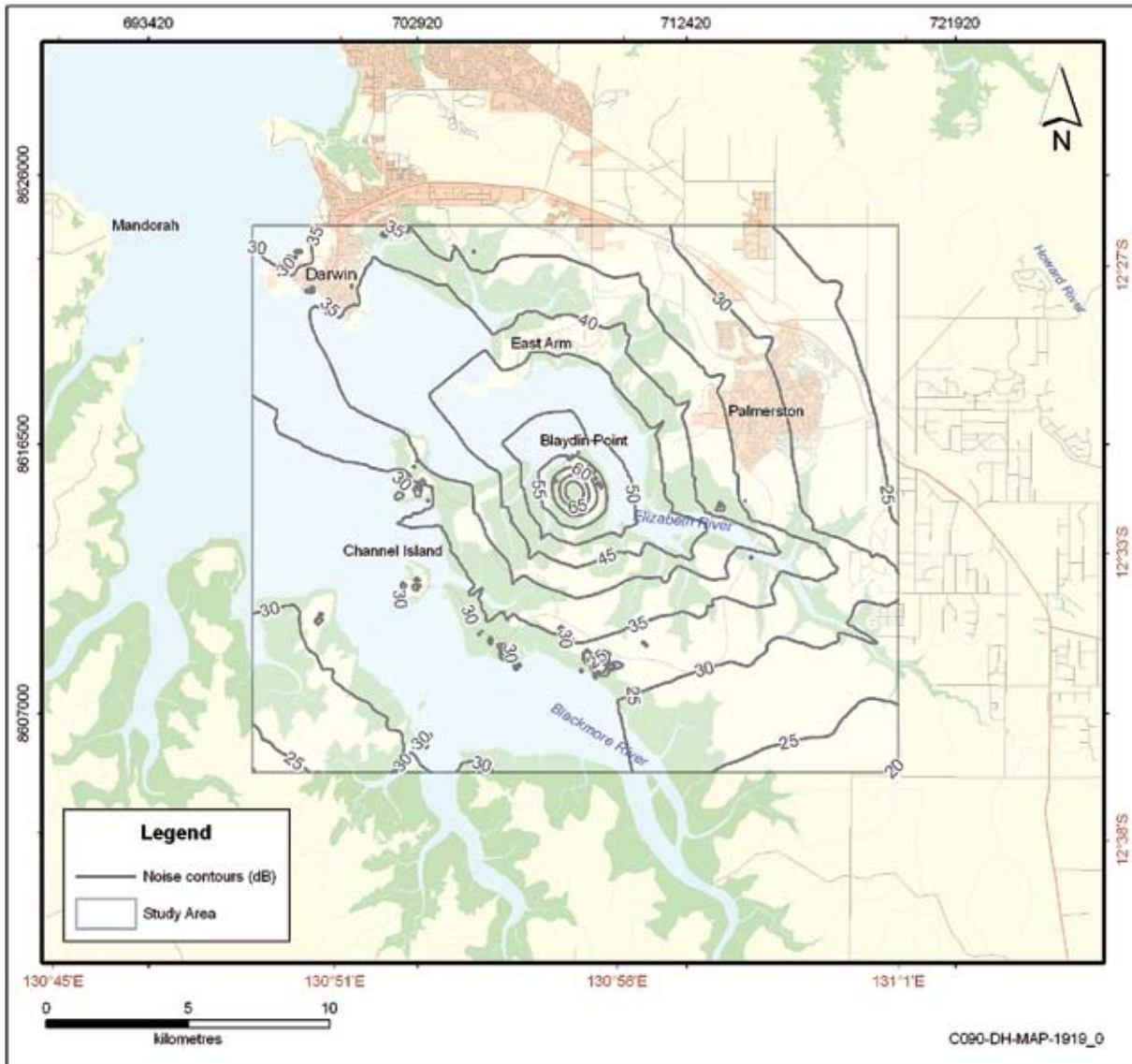


Figure 10-5: Noise contours for the onshore processing plant during emergency flaring

Table 10-16: Examples illustrating the decibel scale

Noise level in decibels (dB(A))	Noise source	Average subjective description
140	Jet engine	Intolerable
130	Rivet hammer	
120	Jet plane take-off	
110	Chainsaw	Very noisy
100	Sheet-metal workshop	
90	Lawnmower	
80	Heavy traffic	Noisy
70	Loud radio	
60	Normal conversation	
50	Low conversation	Quiet
40	Quiet radio music	
30	Whispering	
20	Quiet bedroom	Very quiet
10	Rustling leaves	
0	Threshold of hearing	

Received noise levels from normal operations and emergency flaring are well below the identified noise-limit criteria for residential and industrial receptors. The predicted noise emissions for normal operations are also below the actual ambient noise levels measured in Palmerston and Bayview Haven, as described in Chapter 3 (see Appendix 20).

#### Other construction noise

Piledriving for construction of the jetty will generate relatively high noise levels, which may be audible in the residential areas of western Palmerston, around 4 km away. Predictions of the propagation of piledriving noise can be difficult because there is a wide range in source levels associated with different types of equipment. Some preliminary modelling of piledriving noise is presented in Appendix 20.

Piledriving will be mainly undertaken during the day, but some night-time activities may occur if construction falls behind schedule. The significance of these received-noise levels is reduced somewhat by the nature of the activity—piledriving will be undertaken intermittently during the construction phase, with noise generated in a series of pulses interspersed with quieter periods when equipment is moved around or other construction activities are carried out. In addition, weather conditions would influence the propagation of noise: westerly winds, which are prevalent in the wet season, would carry the noise to Palmerston, while dry-season easterly and northerly winds would carry noise away from residential areas. Strong winds and rainstorms, however, would mask this noise.

Some piledriving may also be undertaken in the onshore development area. Noise source levels from this piledriving are likely to be lower, as small-diameter piles would be used. This piledriving would also be restricted to daytime hours, unless modelling indicates that noise propagation to community areas would be below permitted levels.

During the construction phase, dredging activities in the nearshore area will also generate sound-power emissions. However, these are expected to be lower than those generated by piledriving. For the Port of Melbourne channel deepening project, sound-power emissions generated by trailing suction hopper dredgers and backhoe dredgers were measured at around 110 dB(A) and 113 dB(A) respectively. Assuming no barriers or shielding, these noise emissions were expected to drop to 45 dB(A) or less within distances of around 500 m for the trailing suction hopper dredge and within 1000 m for the backhoe dredge (Jenkins & McKinnon 2006). In the context of the nearshore development area, sensitive

community receptors are located at much greater distances (e.g. Palmerston is 4 km away) and would not be disturbed by dredging noise.

Airborne noise generated by marine blasting is difficult to predict, as it is highly dependent on the size of the charge, the depth of water, the rock type and ambient environmental conditions. While blasting may be audible at some areas around the shoreline of Darwin Harbour, the blasts will be intermittent and short-term only, and will be accompanied by public notification as described below.

Noise from onshore construction activities is unlikely to exceed the noise levels associated with normal plant operations and is expected to be less than 40 dB(A) (SVT 2009).

There are no criteria currently prescribed by legislation in the Northern Territory for noise emissions from construction activities. The NRETAS guidelines for construction and demolition noise controls provide recommendations for reducing noise emissions during construction. These guidelines will be considered during the design, tender and construction stages of the Project.

#### Management of airborne noise

The main mitigating factors for airborne noise are the large distances between the Project site and the nearest noise-sensitive receptors. No adverse impacts are therefore anticipated (SVT 2009).

The design criteria for the ground flare will include noise mitigation measures to reduce the airborne noise emissions associated with flaring.

Piledriving and blasting management plans will be developed which will include management controls to minimise noise emissions to the community during the construction phase of the Project. These management controls will include the following:

- For onshore and marine blasting, smaller staggered blasts will be carried out to minimise ground vibration and noise levels.
- Blasting activities will only be undertaken in daylight hours.
- Adequate notice will be provided to communities which could be affected by the noise relating to blasting activities (e.g. Darwin Harbour users, Palmerston and the Darwin LNG plant at Wickham Point).
- It is intended that piledriving activities will be undertaken only during daylight hours. Night-time piledriving will only be necessary if Project construction activities fall significantly behind schedule.

A traffic management plan will be developed and will include controls for the management of the impacts of traffic noise on the community. For example, bus transport will be used for most of the workforce to reduce the number of vehicles driving from the accommodation village through residential areas to the onshore development area.

Airborne noise monitoring will be undertaken to confirm modelling predictions for the construction and operations phases of the Project.

### Residual risk

A summary of the potential impacts, management controls, and residual risk for airborne noise is presented in Table 10-17. The main mitigating factors for airborne noise are the large distances between the Project site and the nearest noise-sensitive receptors. The implementation of noise management controls will further reduce the risk of adverse impacts to the community. Most impacts from noise are considered to present a “medium” or “low” risk and it is likely that

**Table 10-17: Summary of impact assessment and residual risk for airborne noise**

Aspect	Activity	Potential impacts	Management controls and mitigating factors	Residual risk*		
				C†	L‡	RR§
Noise	Construction and commissioning activities such as piledriving, drilling and rock blasting; pneumatic testing of pipework; air blowing and flaring.	Noise and vibration causes disturbance or nuisance to the local community.	Onshore development area is located several kilometres from the nearest residential or urban area. Blasting activities will only be conducted during daylight hours. Piledriving activities are planned to be undertaken only during daylight hours; however night-time operations may be required if progress falls significantly behind schedule. Notification will be given to communities to give warning prior to blasting operations. Notification will be given to communities to give warning prior to night-time piledriving operations. Provisional Piledriving and Blasting Management Plan.	E (S2)	4	Medium
Noise	Road transport of workforce, vehicles, equipment, rock and materials during the construction phase.	Noise and vibration causes disturbance or nuisance to the local community.	Buses will be used for workforce transport to reduce the total number of vehicles on the roads. Designated traffic routes will be set for Project vehicles. Provisional Traffic Management Plan.	E (S2)	5	Medium
Noise	Generation of noise by normal operation of the onshore processing plant.	Noise and vibration causes disturbance or nuisance to the local community.	Onshore development area is located several kilometres from the nearest residential or urban area.	F (S2)	2	Low
Noise	Generation of noise by emergency flaring during operation of the onshore processing plant.	Noise and vibration causes disturbance or nuisance to the local community.	Onshore development area is located several kilometres from nearest residential or urban area. Noise mitigation measures will be incorporated into the design of the ground flare to reduce noise emissions.	E (S2)	4	Medium

\* See Chapter 6 *Risk assessment methodology* for an explanation of the residual-risk categories, codes, etc.

† C = consequence.

‡ L = likelihood.

§ RR = risk rating.



any effects on the community will be localised and small in scale. Noise generated during the construction phase of the Project will be short-term in duration.

### 10.3.11 Visual amenity

The potential for the Project to have negative impacts on visual amenity, including light pollution, was an issue that was raised during the stakeholder consultation process.

#### Visual impact assessment

The construction of industrial facilities in the undeveloped vegetated areas of the Darwin Harbour shoreline represents a distinct change in the visual character of the affected site and surrounds. In order to describe the likely effects of the Project on the visual amenity of Blaydin Point, a visual impact assessment process was undertaken (URS 2009b, provided as Appendix 23 to this Draft EIS). This assessment was based on the following components:

- the selection of key viewpoints of interest around Darwin Harbour in consultation with NRETAS
- a desktop assessment of the likely viewshed from these points using a digital elevation model
- site inspections to “ground-truth” these desktop assessments
- a rating of the visual impact experienced at each viewpoint
- the development of visual simulations of the Project on digital photographs from high – and medium-impact viewpoints.

These steps are described in more detail in the sections that follow.

#### Selection of key viewpoints

Fourteen areas of interest around Darwin Harbour were identified in consultation with NRETAS, with review from relevant government and non-government agencies including Tourism NT. These “viewpoints” were selected to account for a range of viewing angles, potential receptor types, and residential, cultural, heritage and tourism values. The locations of viewpoints of interest to this assessment and their primary values are listed in Table 10-18 and their locations around Darwin Harbour are presented in Figure 10-6.

#### Viewshed analysis

Viewshed analysis identifies areas that are visible from a given location. Viewsheds were created for all 14 viewpoints of interest around Darwin Harbour by computer modelling, using a digital elevation model of the Darwin Harbour region. This accounted for the heights of major items of infrastructure within the onshore development area (such as tanks and stacks) as well as the topography within the catchments of each viewpoint. Allowance was also made for average natural vegetation heights (on top of the topography of the ground surface) in areas of uncleared bushland—this allowance was not applied to urban areas, which were presumed to be cleared. The resulting viewsheds are presented in Appendix 23.

**Table 10-18: Viewpoints considered in the visual impact assessment, and their primary values**

Location	Main use of site
Mandorah Jetty	Tourism, low-density residential
Darwin CBD (view from high-rise building)	Tourism, high-density urban and residential
Survivors Lookout, Darwin Wharf precinct	Tourism, heritage
Stokes Hill Wharf, Darwin Wharf precinct	Tourism, heritage
Hilly residential area at Stuart Park	Medium-density residential
Harbour foreshore at Tipperary Waters	Medium-density residential
Harbour foreshore at Bayview Haven	Medium-density residential
Charles Darwin National Park lookout	Tourism, heritage
East Arm public boat ramp	Tourism, recreation
Planned residential subdivision in Berrimah (highest ground)	Planned medium-density residential
Palmerston suburban area (highest ground)	Medium-density residential
Planned residential subdivision in Palmerston (highest ground)	Planned medium-density residential
Elizabeth River Bridge	Transport route
Planned residential subdivision in Weddell (highest ground)	Planned medium-density residential

### Site inspections

Site inspections identified that some of the selected viewpoints were effectively screened from Blaydin Point by buildings, natural vegetation or topography. Photographs were taken at each viewpoint to record the existing view towards Blaydin Point; these are presented in Appendix 23.

### Rating of visual impact

Visual impact at the various viewpoints of interest to the study was ranked according to the following broad criteria:

- the distance from the onshore development area
- the proportion of the view taken up by the proposed onshore and nearshore facilities
- the number of potential viewers
- the values of the viewing area.

Viewpoints from which the onshore development area was visible were broadly considered to be “medium” to “high” impact sites. Viewpoints where the views to Blaydin Point were significantly obscured by vegetation, buildings or topography were considered “low” (or “no”) impact sites. These rankings are presented in Table 10-19.

The views from the East Arm public boat ramp were considered to receive a “high” impact from the Project, as this viewpoint is relatively close to Blaydin Point and is regularly used by recreational fishermen accessing the Harbour. The tanks and stacks of the onshore processing plant will be clearly visible from this site, along with the jetty and the tankers arriving or departing from the facility.

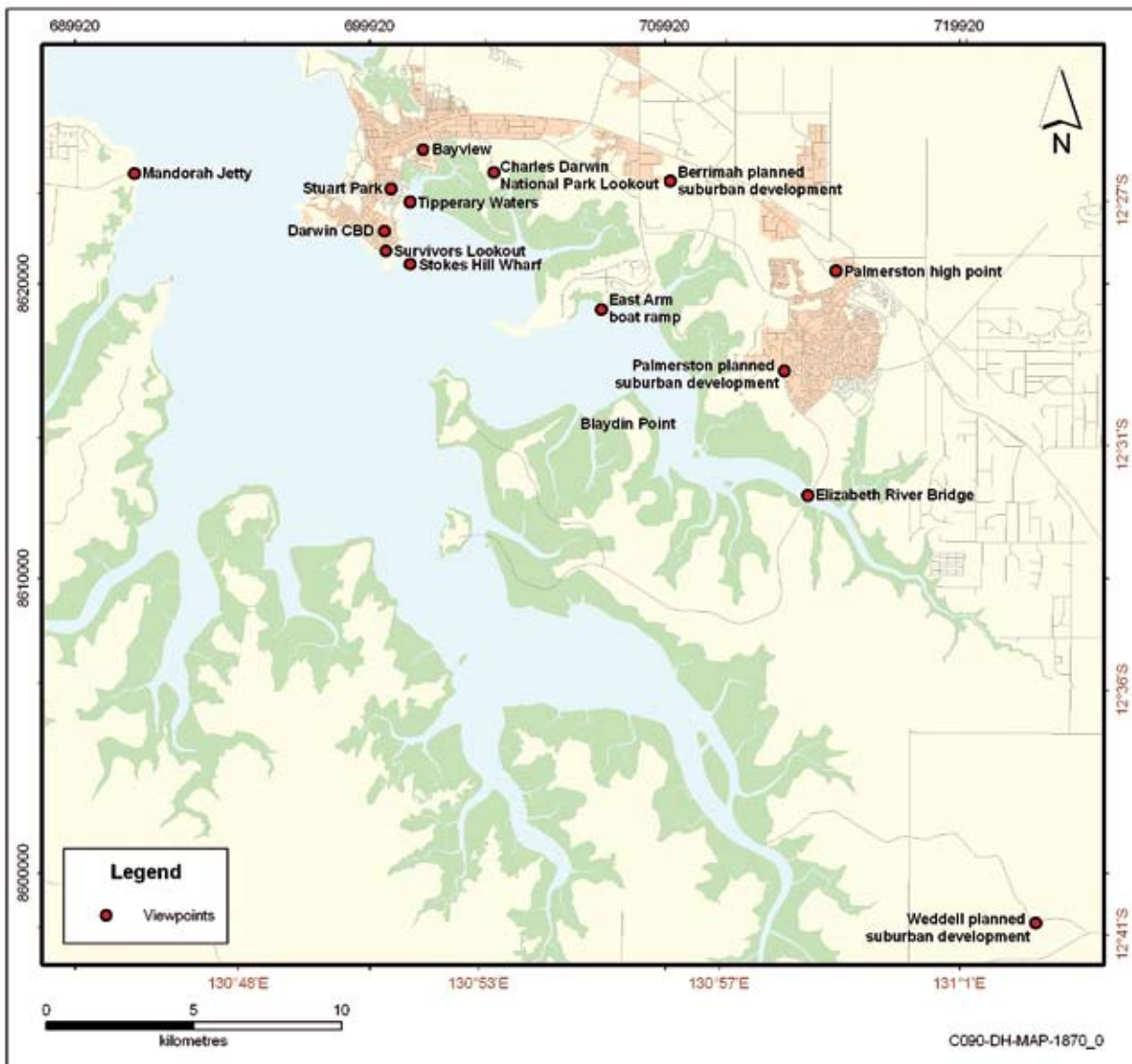


Figure 10-6: Viewpoint locations considered in the visual impact assessment

**Table 10-19: Rating of the Project’s potential visual impact from affected viewpoints**

Site	Values	Comments	Distance (km)	Visibility
Mandorah Jetty	Tourism Low-density residential	Blaydin Point is visible in the far distance from this location, with no obstructions. The proportion of the view taken up by the Project would be extremely low.	18	Low
Darwin CBD (view from high-rise building)	Tourism High-density urban and residential	The onshore development area is visible beyond East Arm Wharf. The long distance reduces the proportion of the view taken up by the Project. Viewers from this aspect may be long-term residents (e.g. of apartments or offices).	10	Medium
Survivors Lookout, Darwin Wharf precinct	Tourism Heritage	Most of Blaydin Point is visible; the view is similar in nature to that from Stokes Hill Wharf but with buildings and wharf in the foreground. The long distance decreases the proportion of view taken up by the Project.	9	Medium
Stokes Hill Wharf, Darwin Wharf precinct	Tourism Heritage	Blaydin Point is partially obscured by East Arm Wharf. The long distance reduces the proportion of the view that would be taken up by the Project. This site is considered an important tourism location in central Darwin.	8	Medium
Hilly residential area at Stuart Park	Medium-density residential	Blaydin Point is visible from this area, although distant and partly obscured by the infrastructure at East Arm Wharf as well as buildings or vegetation close to the viewpoint.	11	Medium
Harbour foreshore at Tipperary Waters	Medium-density residential	Blaydin Point is visible from this area, although distant and partly obscured by the infrastructure at East Arm Wharf.	10	Medium
Harbour foreshore at Bayview Haven	Medium-density residential	Blaydin Point is visible from this area, although distant and partly obscured by the infrastructure at East Arm Wharf.	10	Medium
Charles Darwin National Park lookout	Tourism Heritage	Blaydin Point is not visible from this vantage point because of tree cover close to the lookout, which completely obscures the view in that direction.	9	None
East Arm public boat ramp	Tourism Recreation	Blaydin Point is clearly visible, with no obstructions across the water. This is the closest viewpoint to the onshore development area. The tanks, product loading jetty and the presence of LNG tankers in the nearshore area are all easily discernible from this site.	3.5	High
Planned residential subdivision in Berrimah (highest ground)	Planned medium-density residential	Blaydin Point is obscured from this viewpoint by a small hill in the middle distance. Some of the Project infrastructure may be partly visible at the sides of this hill. The distance to Blaydin Point is around 10 km, which reduces the proportion of the view taken up by the Project.	8	Low
Palmerston suburban area (highest ground)	Medium-density residential	Blaydin Point is completely obscured from this viewpoint by vegetation in the middle distance.	8	None
Planned residential subdivision in Palmerston (highest ground)	Planned medium-density residential	As this area is vegetated with tall trees, the view to Blaydin Point is heavily obscured for a person standing at ground level.	4	Low

**Table 10-19: Rating of the Project’s potential visual impact from affected viewpoints (continued)**

Site	Values	Comments	Distance (km)	Visibility
Elizabeth River Bridge	Transport route	This viewpoint is relatively close to Blaydin Point but the view is partly obscured by a hill on Middle Arm. While there may be a large number of viewers from the bridge, most are likely to be in transit (i.e. in vehicles travelling across the bridge), thus reducing the viewing time.	5	Medium
Planned residential subdivision in Weddell (highest ground)	Planned medium-density residential	Blaydin Point is not visible from this vantage point because of the landform (hills) and vegetation between the two locations. The distance to Blaydin Point from this site is substantial at around 15 km.	20	None

*Visual simulations*

Computer-generated visual simulations were generated for onshore and nearshore development areas, for “high” and some “medium” impact viewpoints. Digital photographs were taken from the viewpoint locations, using a 50-mm camera lens. A panoramic image was developed by stitching four photographs together horizontally, presenting an image of approximately 60° width and 15° height. These dimensions were considered to represent the typical field of view of the human eye. In order to simulate the look of the Project infrastructure during the operations phase, visual simulations were developed using 3ds Max® software, which overlays a computer-simulated model of the buildings on to the base photographs from each viewpoint.

Examples of daytime and night-time views from the Darwin CBD (high-rise), Stokes Hill Wharf and the East Arm boat ramp are presented in figures 10-7, 10-8 and 10-9. A full set of simulations is provided in Appendix 23. It should be noted that night-time views have been provided for the Darwin CBD and Stokes Hill Wharf viewpoints, but not from the East Arm boat ramp which is closer to the development area. Lighting designs for the onshore processing plant and jetty are still in the preliminary stages of development and it is not possible to simulate light glows and reflections from close range with accuracy using computer imagery.

**Management of visual impact**

*Vegetated buffers*

Retaining a strip of natural mangrove vegetation around the onshore development area will provide a minor “buffer” for the visual impact of the site, although it is noted that most of the onshore infrastructure will project above the tree line. Mangrove vegetation will be maintained along the eastern and western sides of the onshore development area, which will shield the ground-based equipment at the onshore processing plant from boats in Darwin Harbour and from viewpoints such as the East Arm boat ramp and Elizabeth River Bridge. The construction of the product

loading jetty and the module offloading facility on the northern edge of Blaydin Point precludes the retention of shoreline vegetation in those areas.

*Lighting*

Subject to safe operability of the onshore facility, the lighting design implemented at the onshore and nearshore infrastructure will be selected with consideration of their visual impact on the community. In addition, a ground flare was chosen as part of the Project design to minimise light emissions and visual impacts on the community as a result of emergency flaring. The ground flare will be enclosed to further reduce light emissions.

*Air emissions*

It is noted that smoke from seasonal bushfires is a reasonably common feature of the skyline around Darwin Harbour during the dry season. Dark smoke, however, which could be produced during Project commissioning and periodically during operations by the ground flare, would likely be more intense and distinctive than seasonal bushfire smoke.

The ground and tankage flares will be designed to minimise generation of smoke through improvements in burning efficiencies and optimisation of the combustion process.

The negative impact of smoke and dust on the viewshed around Blaydin Point (and further off site) may be reduced through actions such as the following:

- Ground flares and tankage flares will be designed to minimise the generation of particulates (smoke).
- Dust-suppression techniques will be applied where necessary to protect worker health, vegetation health, and amenity.
- Multiple handling of material that has the potential to generate dust will be avoided where possible.
- Roads required for the operations phase will be sealed as soon as practicable after clearing in order to minimise dust emissions from vehicle movements.

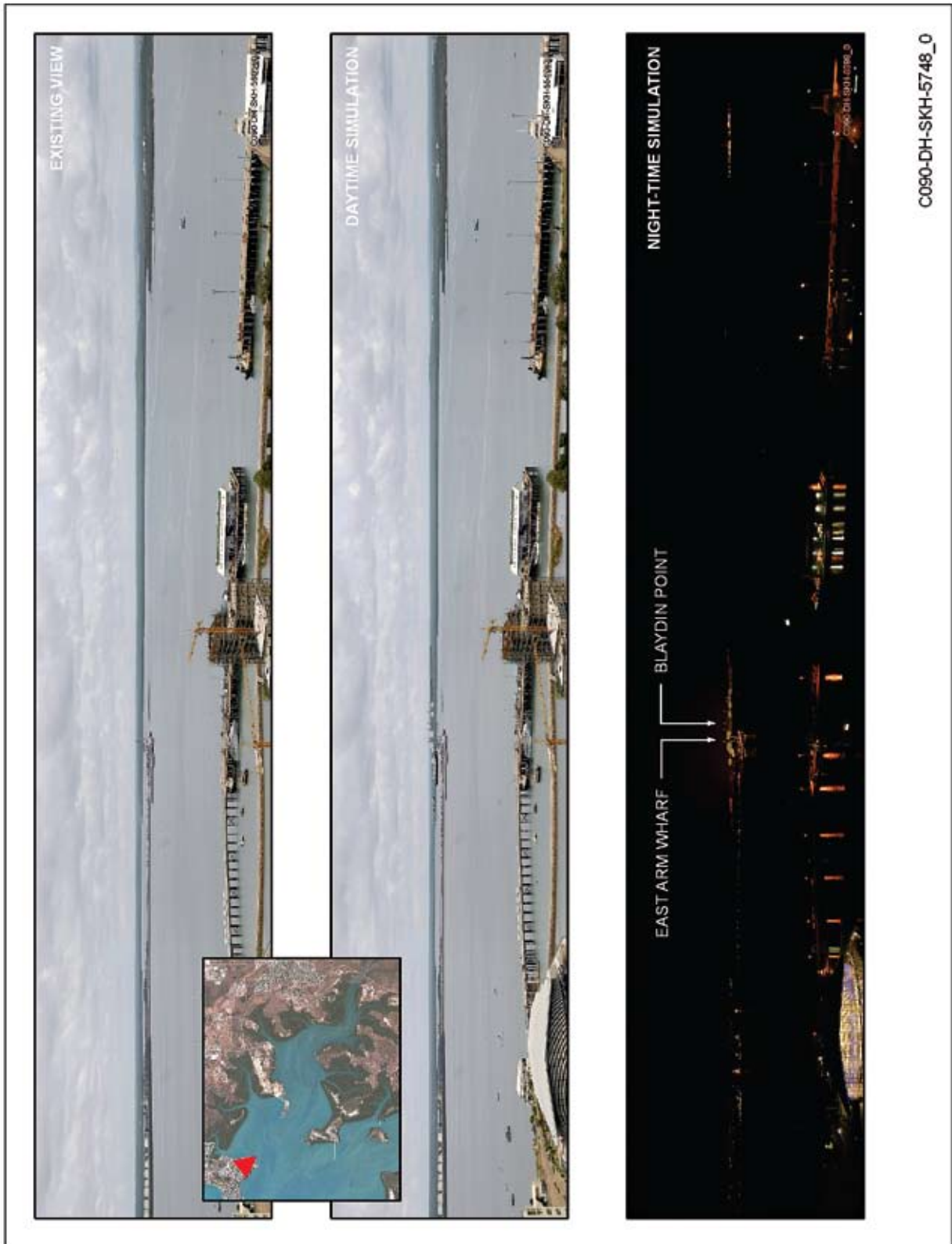


Figure 10-7: Existing and simulated views of the Project's Blaydin Point infrastructure from a high-rise building in Darwin's CBD



Figure 10-8: Existing and simulated views of the Project's Blaydin Point infrastructure from Stokes Hill Wharf



Figure 10-9: Existing and simulated views of the Project's Blaydin Point infrastructure from the East Arm boat ramp

These and other management controls have been included in the Provisional Air Emissions Management Plan and Provisional Dust Management Plan, attached to Chapter 11 as Annexe 2 and Annexe 7 respectively.

### Residual risk

Potential impacts to visual amenity are presented in Table 10-20, along with the proposed management strategies to minimise these impacts during the life of the Project. It is not considered appropriate to apply a residual-risk rating to visual amenity issues, as different members of the community may assess the “consequence” of these impacts in different ways. For example, some community members may prefer a natural landscape free from man-made infrastructure, while others may take an interest in the construction and operation of large industrial facilities, with the associated lighting and tanker vessel traffic.

### 10.3.12 Commercial fishing and aquaculture

#### Offshore

The offshore and nearshore development areas are located within the boundaries of a number of federal and state-managed commercial fisheries. Five commercial fisheries overlap the offshore development area at the Ichthys Field. As the pipeline extends east towards the Northern Territory, it crosses a further seven commercial fisheries. These commercial fisheries are described in detail in Chapter 3.

The surface facilities and support vessels in the offshore development area during all phases of the Project could represent obstacles for commercial fishing activities (e.g. longline fishing). Pelagic longline fishing occurs to a limited extent in the region, as part of the WA North Coast Shark Fishery – Joint

Authority Northern Shark Fishery, the Western Tuna and Billfish Fishery and the Southern Bluefin Tuna Fishery. A longline deployed upstream of the central processing facility (CPF) and the floating production, storage and offtake (FPSO) facility could snag surface and subsurface structures, and surface buoys on the longline could be run over by support vessels. Surface longlines are typically allowed to drift for 4–5 hours before a 10–12 hour retrieval period (Lopez et al. 1979; Sakagawa, Coan & Bartoo 1987). Assuming an average current speed of 0.25 m/s and a set time of 17 hours (5 hours drift and 12 hours recovery), longline fishers would need to avoid setting their lines within some 15 km upstream of the CPF in order to avoid snagging. In the context of the pelagic longline fishing area (which extends from the south-west coast of Western Australia northwards and eastwards to Cape York) this represents a very small area of exclusion.

Seabed infrastructure in the offshore development area, such as wellheads, flowlines, moorings and the gas export pipeline, could represent obstacles to trawling fisheries of which there are three in the vicinity of the offshore development area. The fishing efforts for two of these fisheries, the Commonwealth’s Northern Prawn Fishery and North West Slope Trawl Fishery, are presented in Figure 10-10, which also shows the area utilised by Western Australia’s Kimberley Prawn Managed Fishery. Note that fishing effort data can be subject to confidentiality; areas fished by five operators or fewer are not reported in publicly available databases and are not included in Figure 10-10. (The data used to create this figure were obtained from Western Australia’s Department of Fisheries and the Australian Fisheries Management Authority in February 2009.)

**Table 10-20: Summary of impact assessment and residual risk for visual amenity**

Aspect	Activity	Potential impacts	Management controls and mitigating factors	Residual risk
Visual amenity	Construction of onshore infrastructure.	Reduction in visual amenity resulting from visible dust.	Dust suppressants use on roads and stockpiles during dry conditions. Minimising ground disturbance and the multiple handling of soil or rock materials. Sealing the main access roads throughout the site and to the junction with Wickham Point Road. Provisional Dust Management Plan.	Not applicable
	Operation of onshore processing plant.	Reduction in visual amenity resulting from smoke and light emissions from flares.	Ground flare and tankage flare will be designed to minimise the generation of particulates (smoke). The ground flares will be shielded to reduce light emissions.	Not applicable



The greater part of the fishing effort associated with the North West Slope Trawl Fishery occurs to the west and north of the Ichthys Field. However, as fishing effort data do not account for five vessels or less, there is the potential that some fishing effort may occur within the offshore development area. A precautionary zone would be established around subsea equipment in the field in order to avoid damage to fishing and subsea equipment. The Kimberley Prawn Managed Fishery is located outside the offshore development area.

The gas export pipeline crosses an area utilised by the Northern Prawn Fishery. In order to avoid damage to fishing and the pipeline, a precautionary zone would be established around the pipeline in consultation with relevant regulatory authorities and fishery stakeholders. The protected area would be small in relation to the areas available to the fishery.

During construction of the gas export pipeline, a 500-m exclusion zone will be imposed around pipelay vessels. This will represent a very minor impediment to fishing activities owing to the transient nature of the movements of the vessels along the pipeline route and the vast areas of alternative fishing areas adjacent to the route.

The Northern Demersal Finfish Association raised some concerns about the risk of losing traps as a result of Project vessel movements in the offshore area throughout the life of the Project. Further liaison with this group will occur as the Project progresses.

### Darwin Harbour

There is little or no commercial fishing effort inside Darwin Harbour and therefore no threat of interference from the nearshore development area. Operators in

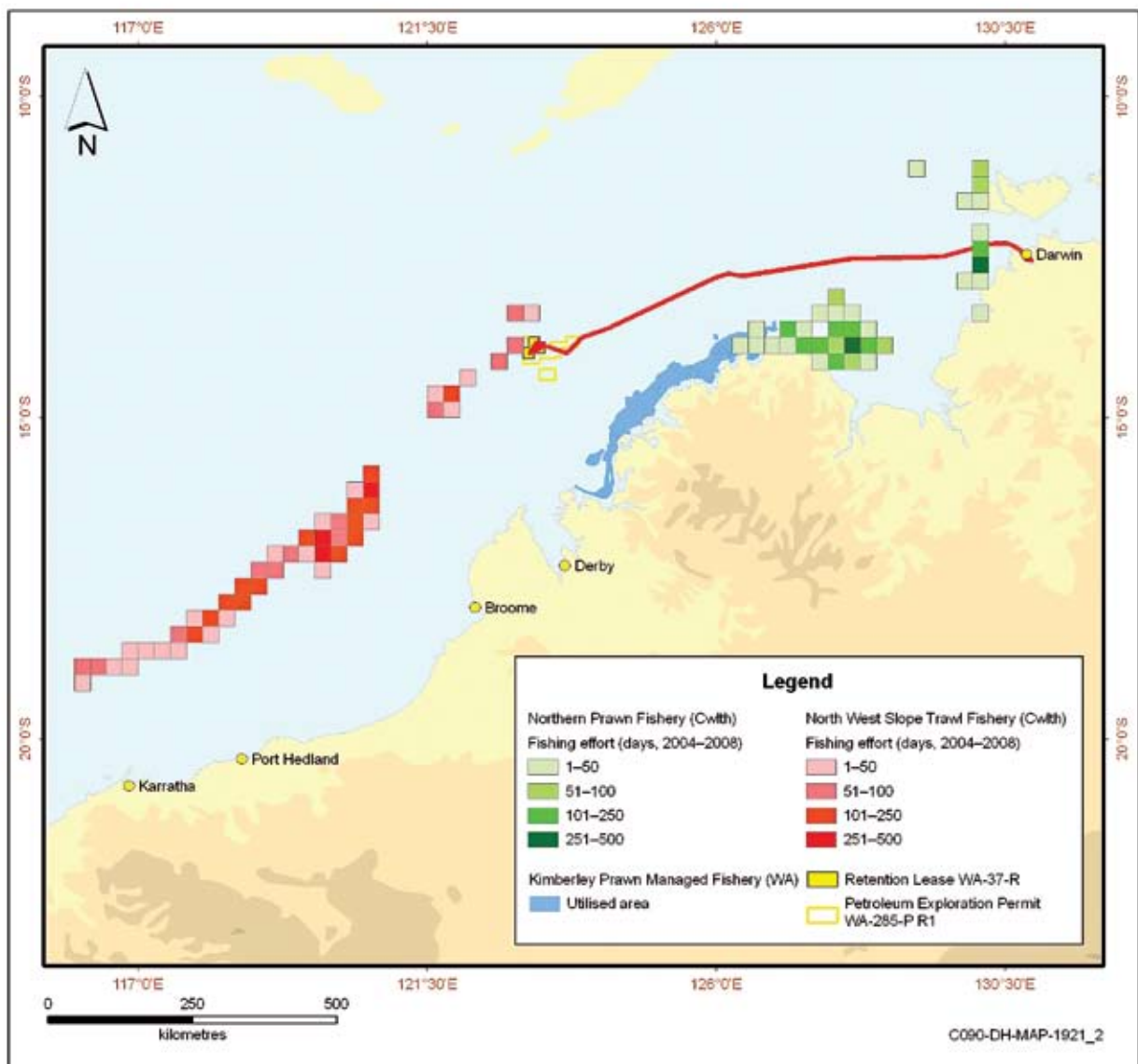


Figure 10-10: Commercial fishing effort in the vicinity of the Project

the Coastal Line Fishery managed by the Northern Territory are permitted to fish within Darwin Harbour, but rarely do so. Stakeholders from the Northern Territory seafood industry generally did not believe that the Project would impact on commercial fisheries.

The Aquarium Fishery managed by the Northern Territory includes Darwin Harbour, but as few as two operators actually fish in the area. Key marine habitat areas such as coral sites are to be protected from impacts from the Project through management controls, as described in Chapter 7, and negative effects to the aquarium fishery are not anticipated.

The Darwin Aquaculture Centre, based on Channel Island, receives water from an intake location at the south-west of the island. Modelling of turbid plumes from dredging for the nearshore development area indicated that this area could receive a small increase in suspended sediments during the 3-month period of dredging for the gas export pipeline shore crossing. As a result, filters for the seawater intake at the aquaculture centre may have to be changed more frequently during this period.

The risks of marine pest introductions associated with the Project are of concern to commercial fishing and aquaculture operators, as management controls such as limitations on border crossings and vessel movements could be implemented in the event of a pest outbreak. Marine pest risks and the measures that will be implemented to manage these risks are described in Chapter 7.

Commercial fishing operators also raised concerns about labour market impacts. During 2008, labour shortages had caused some fishing boats to operate only occasionally or on a rotational basis (with staff rotating between boats) and a number of boat owners were leaving the industry to work elsewhere. Management controls for labour issues are described in Section 10.4.3 *Employment and training*.

#### Management of commercial fishing and aquaculture impacts

An application will be made to the relevant government regulatory agencies to implement a safety exclusion zone with a radius of 500 m around surface and subsurface equipment in the offshore development area. This safety zone will be gazetted under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cwth) and will appear on Australian navigational charts. An additional “restricted navigation zone” 5 nautical miles wide will also be requested in this area. Notification of the location of the offshore facilities and gas export pipeline will be published through a “Notice to Mariners”.

In addition, an application will be made for permission to implement a precautionary zone around the offshore pipeline in consultation with the appropriate regulatory authorities.

A precautionary zone will be implemented within 200 m of the gas export pipeline in the nearshore development area, prohibiting dropping or dragging an anchor, or performing an action that could damage the pipeline (as prescribed by Section 66(5) of the *Energy Pipelines Act* (NT)).

#### Residual risk

Implementation of the above controls, impacts to commercial fishing and aquaculture are considered to present a “low” to “medium” risk and, as such, any effects will be localised and minor in scale (see Table 10-21).

#### 10.3.13 Defence

The eastern portion of the gas export pipeline route runs through the Northern Australia Exercise Area (NAXA), used by the Australian Defence Force for at-sea exercises and weapons firing training and shore-based weapons firing training. INPEX has obtained in-principle agreement from the Australian Defence Force to construct the gas export pipeline in this area. The concept will be formalised through the pipeline licensing process under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cwth) and the *Petroleum (Submerged Lands) Act* (NT).

It is proposed that a 1-km-wide exclusion zone will be implemented for live ammunition firing and grounding of submarines along the pipeline route within the NAXA. This will be incorporated into the Australian Defence Force’s safety template for the area. Prior to the commencement of construction, detailed surveys will be conducted to identify any unexploded ordnance within the proposed pipeline alignment. Further management controls to ensure the safety and operability of both the gas export pipeline and the NAXA will be developed through ongoing consultation with the Australian Defence Force.

The Bayu–Undan Gas Pipeline lies immediately to the north of the NAXA (which was reduced in extent to ensure that the pipeline was outside the area; consequently no operation exclusion zones were required. The Blacktip Gas Pipeline crosses the NAXA and an exclusion zone has been implemented to ensure that the pipeline is protected from military activities in the NAXA.

**Table 10-21: Summary of impact assessment and residual risk for commercial fishing**

Aspect	Activity	Potential impacts	Management controls and mitigating factors	Residual risk*		
				C†	L‡	RR§
Commercial fishing	Presence of offshore infrastructure in the open ocean.	Damage to fishing equipment or pipeline.	<p>An application will be made to the relevant government regulatory agencies to implement a safety exclusion zone around surface and subsurface equipment in the offshore development area. This will be gazetted and will appear on navigation charts.</p> <p>An application will be made to the relevant government regulatory agencies to implement a precautionary zone around the offshore pipeline in consultation with relevant regulatory authorities.</p> <p>A precautionary zone will be implemented within 200 m of the gas export pipeline in the nearshore development area.</p> <p>Notification of the location of the offshore facilities and gas export pipeline will be achieved through the publication of a “Notice to Mariners.”</p> <p>Navigation lights and markers on offshore infrastructure.</p> <p>Standard maritime communications equipment on all Project vessels.</p>	E (S2)	2	Low

\* See Chapter 6 *Risk assessment methodology* for an explanation of the residual-risk categories, codes, etc.

† C = consequence.

‡ L = likelihood.

§ RR = risk rating.

### 10.3.14 Public safety

The onshore development area is located several kilometres from the major population centres of Palmerston and Darwin. Members of the public may spend time closer to the site while boating in Darwin Harbour, fishing in the “Catalina creeks” (officially named Lightning Creek and Cossack Creek) near Blaydin Point, or visiting the southern part of Middle Arm Peninsula. Since the Project will be undertaking major construction activities, processing and storing large volumes of hazardous materials (in particular, LNG, LPG and condensate) and transporting high-pressure gas in a pipeline within Darwin Harbour, there are potential risks to which the public may be exposed.

#### Public safety during construction

Safety reviews for construction activities will be conducted during the detailed-design phase of the Project. Preliminary assessments have indicated that blasting in the onshore and marine environments could potentially pose a risk to public safety if not managed appropriately.

Marine blasting is likely to be undertaken during the construction phase of the Project as the hard substrate at Walker Shoal cannot be dredged. The risks to public safety associated with marine blasting result from shock waves in the water, which can cause injuries to any people in the water close to the blasting zone.

Onshore blasting may also be required during construction. In this case there is the potential for flyrock to pose a risk to public safety. It is predicted, however, that the potential for flyrock to be projected beyond the plant site boundaries will be minimal, as blasting operations will be designed to ensure that flyrock is contained within the site boundaries. INPEX plans to implement controls to make certain that such risk from flyrock is minimised.

Furthermore, the blasting program will be designed to ensure that onshore and marine blasting do not impact on the structural integrity of buildings, the Bayu–Undan Gas Pipeline, wharf structures and any underwater infrastructure.

### Management of public safety during the construction phase

A Provisional Piledriving and Blasting Management Plan has been compiled for the Project (attached as Annexe 12 to Chapter 11), which will guide the development of more detailed plans during the construction phase. This plan contains details of applicable management controls, procedures, and monitoring and audit programs. The key components of this plan applicable to public safety for nearshore and onshore blasting activities are summarised as follows:

- Notice will be given to the Northern Territory's DLP and the DPC advising vessel operators of any change to marine traffic conditions because of marine blasting activities.
- A safety exclusion zone for marine traffic and recreational water-users will be established around blasting areas. Public notices will be issued prior to blasting, to inform recreational water-users in any blasting area. INPEX will advise the community of the date, time and duration of the blasting activities and will provide details of the boundaries of the safety exclusion zone.
- Smaller staggered blasts will be used for onshore blasting operations, and correct "maximum instantaneous charge" and blast-hole sizes will be used to minimise flyrock generation.
- Blasting operations will only be undertaken during daylight hours and adequate notice will be provided to people who could be affected by the sound or activities (e.g. Darwin Harbour users, the citizens of Palmerston and the workforce at the Darwin LNG plant at Wickham Point).
- Public access to the onshore development area will be restricted throughout the construction period.

As noted above, the drill-and-blast program will be designed to ensure that no damage occurs to buildings, the Bayu–Undan Gas Pipeline, wharf structures or underwater infrastructure.

### Public safety during operations

In accordance with Australian and international practice, all Project infrastructure will be designed and operated consistent with the principle of managing risk to "as low as reasonably practicable" (ALARP) levels. This principle is supported by various legislative requirements that include licensing of the onshore processing plant site at Blaydin Point (including the product loading jetty) as a "major hazard facility" under the *Dangerous Goods Act* (NT) and the *Dangerous Goods Regulations* (NT). Public risk from major hazard facilities is managed in accordance with the National Standard for Control of Major Hazard Facilities and the Code of Practice (1996) issued by Safe Work Australia, formerly the Australian Safety and Compensation Council (NOHSC 2002).

Part of the process of acquiring a dangerous goods licence for a major hazard facility such as the onshore processing plant at Blaydin Point involves undertaking hazard identification and risk management processes in order to assess the safety risk to the public in the unlikely event of major incidents resulting from activities at the onshore plant.

Potential consequences from such incidents include:

- Fires: high-pressure gas or liquid releases may form jet fires, while low-pressure liquid releases or liquid drop-out from spray may form pool fires. Heat radiation generated as a result of these fires has the potential to lead to injuries or fatalities.
- Flash fires: an unignited gas cloud could form and migrate off site. On coming into contact with an ignition source, a flash fire could occur (i.e. an intense and short-duration fire). This event may burn back to the release location, eventually forming a jet fire or pool fire. There is a potential for fatalities to occur as a result of this type of event.
- Explosion: explosions can occur with some types of gas cloud or where a cloud forms in a confined or congested area. If ignition should occur under these circumstances, an overpressure may be generated. If such an overpressure is sufficiently large, injuries and fatalities may occur both outdoors and indoors, for example as a result of doors or windows being blown inwards.

These consequence scenarios form part of the inputs into the QRA described below.

In addition, incidents could arise from the onshore and inshore sections of the pipeline as a result of third-party interference, corrosion or catastrophic failure. These risks have also been assessed.

### Management of public safety during operations

In order to obtain the major hazard facility licence for the onshore plant from NT WorkSafe, a safety report needs to be produced that documents the risks identified and the controls that are being incorporated into the design of the onshore processing facilities. An approval will also be required from the Northern Territory's Department of Resources for the onshore and inshore sections of the gas export pipeline. The principal controls for the onshore and nearshore infrastructure design, construction and operations include the following:

- designing equipment and pipework to contain the range of pressures, temperatures and materials encountered in the process, in line with Australian and industry-wide standards and codes of practice

- laying sections of the nearshore gas export pipeline in Darwin Harbour in a trench and placing impact protection (dumped rock) over the trench to mitigate risks from anchor damage and ship grounding
- undertaking additional pipeline wall thickness and internal inspections of the gas export pipeline, using appropriate specialised instruments
- pressure-testing (hydrotesting) and installing leak-detection systems at the onshore gas-processing facilities and on the gas export pipeline
- positioning equipment in the facility to reduce off-site consequences by providing adequate separation distances
- providing an emergency shutdown and depressurisation system that will shut the plant down if a significant process upset should occur
- installing a fire-protection system designed to reduce the consequences of a potential accident and reduce the potential for escalation of a fire
- developing a safety-management system consistent with the requirements for a major hazard facility and pipeline. This would cover maintenance and inspection of hydrocarbon containment equipment; shipping operations; procedures and maintenance of lifting equipment; corrosion prevention systems and fire and explosion control systems
- implementing security plans, emergency plans and response procedures, prepared in consultation with the relevant emergency response authorities and others (e.g. the Darwin Port Corporation, the Northern Territory Police, the Fire and Emergency Services Authority, the Darwin LNG plant and NT WorkSafe) to mitigate consequences in the event of an incident
- restricting public access to the onshore processing plant throughout the operations phase.

### Residual risk

#### Quantitative risk assessment

Part of the risk management process involves undertaking a series of quantitative risk assessments (QRAs). A QRA is a process by which the level of risk to individuals and groups (both of the workforce and the public) is quantified using well-established methodologies and models. INPEX has been supported in this process by an experienced risk consultancy, Germanischer Lloyd Industrial Services UK Ltd. The consultancy's report (GL 2009) is provided as Appendix 24 to this Draft EIS and provides a technical summary of the preliminary QRA work undertaken to date; it describes risk associated with the current base-case design and incorporates the prevention and mitigation controls that are currently in place.

The preliminary QRA considered the safety risks from the following sources:

- the nearshore gas export pipeline in Darwin Harbour (approximately 27 km in length)
- the onshore gas export pipeline on Middle Arm Peninsula (approximately 6 km in length)
- the onshore processing plant, including the product loading jetty.

The risk evaluation process will continue through the design phase, as the design and operating philosophies are developed, to enable a final safety demonstration to be presented in the operations safety report and in submissions to the Department of Resources. Consultation with regulatory agencies on hazard identification and risk management will be ongoing.

#### Public risk criteria

When the onshore risk results were calculated, they were compared with safety risk criteria suggested by government to assess the suitability of the proposed location for a major hazard facility. The risk metrics used for this purpose are location-specific risk (LSR) contours which estimate risk levels at geographical locations around the plant for land-use planning purposes. It should be noted that the Blaydin Point site was offered to INPEX by the Northern Territory Government and that the site has been earmarked for future industrial development and is classified as such under the Northern Territory Planning Scheme (DPI 2008). INPEX was advised by NT WorkSafe that the "Victorian 'Interim' offsite individual risk criteria" should be used as a guideline to assess off-site risk levels around and from the onshore processing plant. These criteria state that the 10-per-million-per-year ( $1 \times 10^{-5}$ ) risk contour should not extend outside the plant site boundary.

It should also be emphasised that the risk contour approach estimates risk on a geographical basis. It assumes that a person is permanently and continuously present in one location, unprotected and unable to escape. In reality, individuals are in the vicinity of the plant's infrastructure only occasionally and are actually exposed to much lower risk.

#### Results from preliminary QRAs

Preliminary off-site risk contours for the onshore and nearshore development area are provided in Figure 10-11. Further details on risk contours are provided in Appendix 24.

Risk contours associated with the gas export pipeline for even the most conservative risk levels identified in the Victorian interim risk criteria do not extend over any residential areas or population centres. A risk level

of 10 per million per year ( $1 \times 10^{-5}$ ) is associated with the pipeline only in a short section close to the shore crossing, owing to a slightly higher chance of damage to the pipeline by external sources (e.g. potential future development) in this area (Appendix 24). The risk levels associated with the nearshore and onshore pipeline are considered tolerable, as risk-reduction measures are included in the preliminary design. These measures include active methods to protect against corrosion and erosion of the pipe wall, and protection from external impact by trenching and/or rock dumping in high-exposure areas.

Risk contours associated with the onshore processing plant for even the most conservative risk levels identified in the Victorian interim risk criteria do not extend over any residential areas or population centres. As shown in Figure 10-11, the risks posed to users of the Harbour in the vicinity of the jetty heads and trestle and some of the north-eastern inlets to Lightning

Creek may be higher than the acceptable risk levels of  $1 \times 10^{-5}$ . This means that nominal safety and security exclusion zones of approximately 500 m will need to be established around the jetty head and along the jetty trestle. As the  $1 \times 10^{-5}$  risk contour shows that the acceptable risk contour borders the main channel of Lightning Creek, risk values will need to be confirmed by a final QRA based on the completed final plant design to determine whether access to Lightning Creek can be maintained. Further permanent development (e.g. for industrial use) within the  $1 \times 10^{-5}$  risk contour is considered very unlikely and should be restricted for safety reasons. The risk levels associated with the onshore gas processing plant are also considered tolerable, as risk-reduction measures are included in the preliminary plant design (as described earlier in this section). Efforts to further reduce risks to public safety will continue throughout the design, construction and operations phases of the Project.

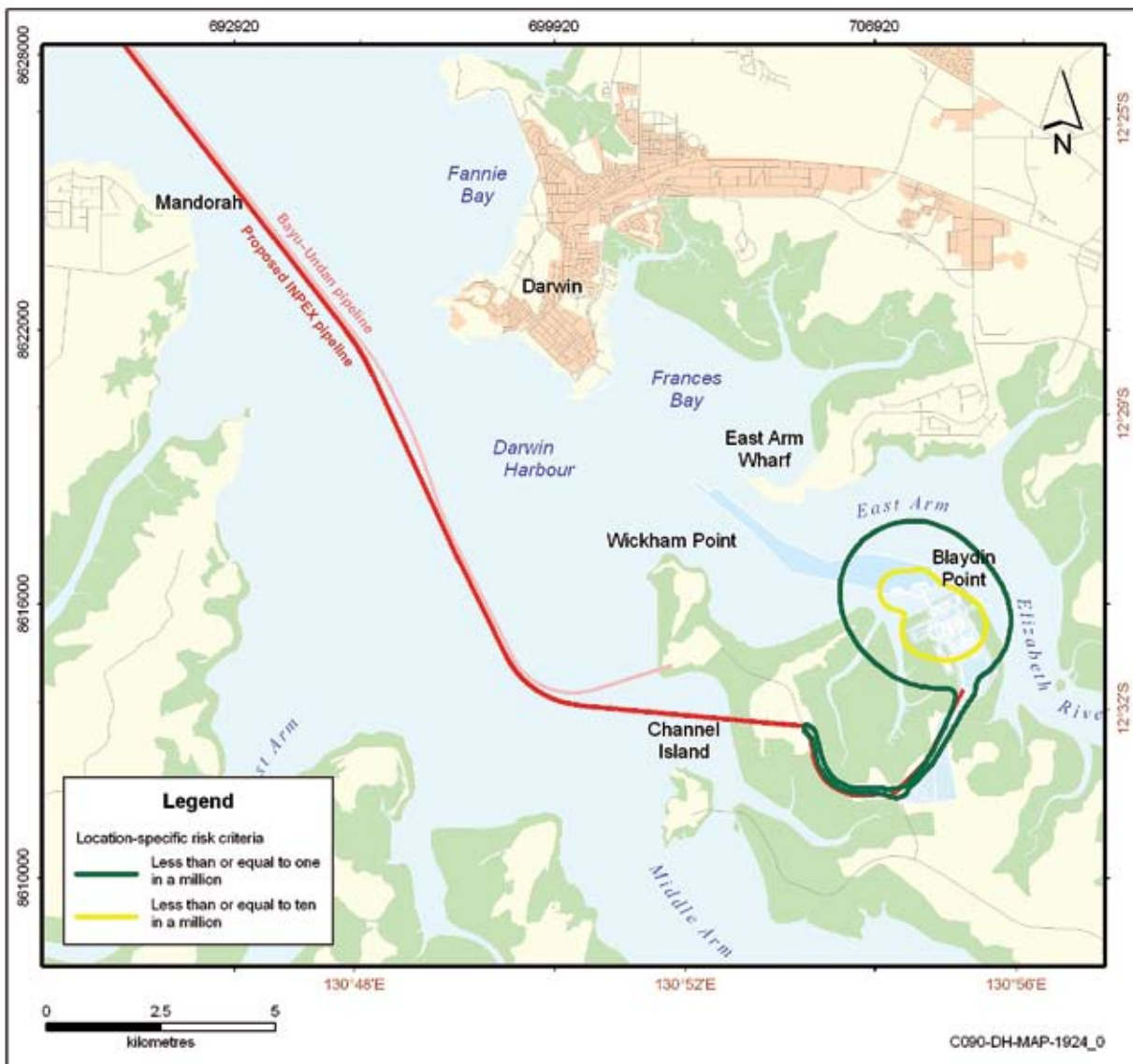


Figure 10-11: Location-specific risk contour map for the onshore development area and jetty

## 10.4 Economic effects and benefits

This section describes the range of potential positive and negative economic impacts of the Project on the community in the Darwin region, and presents the management controls proposed to reduce negative impacts and optimise the opportunities presented by the Project.

### 10.4.1 Economic impact modelling

In order to predict the economic impacts of the Project on the Northern Territory and Australian economies, URS developed an economic model in conjunction with Monash University's Centre of Policy Studies in 2008. The study employed the Monash Multi-Regional Forecasting (MMRF) model, which is used extensively by the private sector and governments in Australia to estimate the economic implications of large-scale development projects and government policy changes. (The MMRF, for example, is one of the models that the Commonwealth Treasury employed to investigate the implications of a carbon emissions trading scheme.)

The MMRF is a computable general equilibrium model and captures the indirect or "flow-on" economic impacts of a project on regional, state and national economies. The model takes into account supply constraints and the competition for available resources between the project of interest and other industries in the economy. In the MMRF model, the Australian economy is divided into any combination of eight economies representing the six states and two territories. Each region is modelled as an economy in its own right, with region-specific prices, consumers and industries.

The MMRF model shows the unfolding of the economic impacts of a project over a number of years. The analysis compares two time paths of economic development—one generated without the project (the "base case") and the other with the project. The deviations between these two time paths measure the impact of the project.

The assumptions used for the MMRF modelling for the Project are shown in Table 10-22.

INPEX plans to produce approximately 8.4 Mt of LNG and 1.6 Mt of LPG from the Blaydin Point facility each year. Approximately 85 000 barrels per day of condensate will be produced and exported from the offshore facilities, with approximately 15 000 barrels per day being produced and exported by sea from the onshore processing plant at Blaydin Point.

The construction period is approximately five years and the operating life of the Project is expected to be approximately 40 years. The Project will generate additional employment of over 2000 full-time personnel indirectly and directly. This increases the rate of employment by 3.4% over the base case.

The long-term oil (condensate) price is assumed to be US\$61, and the discount rate applied is 7%.

#### Impact on the Australian economy

The Project is predicted to contribute A\$3.5 billion (an additional 0.2%) to Australia's gross domestic product (GDP), as shown in Table 10-23.

The model predicts that the Project will contribute to an improvement in the Australian trade balance: average annual exports are A\$1.8 billion a year higher, while imports are only A\$438 million a year higher. The increase in the value of Australian exports is much less than the value of Project exports, because the Project's exports are predicted to cause an appreciation of the real exchange rate. This means that exports cause the Australian dollar to appreciate against other currencies, which, in turn, makes it more difficult to export. Hence the overall value of Australian exports increases by the net impact of the value of Project exports minus the decrease in exports caused by the Australian currency appreciation.

**Table 10-22: Baseline assumptions for economic modelling**

Factor	Baseline assumption
LNG production by the Project	8.4 Mt/a
LPG production by the Project	1.6 Mt/a
Condensate production by the Project	85 000 barrels per day (offshore facilities)
	15 000 barrels per day (onshore plant)
Construction period	5 years
Operations life	40 years
Additional employment over the base case	Over 2000 personnel
	3.4%
Long-term oil price (condensate)	US\$61
Discount rate	7%

The benefit to Australians from the Project is measured by the increase in real private (or household) consumption expenditure. It is predicted that real household consumption will be on average A\$1.8 billion (0.2%) higher each year as a result of the Project.

The increase in household consumption spending has a net present value (NPV) of about A\$24 billion (using a real discount rate of 7% over 50 years).

In total, the Project has a relatively modest impact on the Australian economy. Although it is a large development in terms of investment and value added, the Project has limited forward and backward economic linkages in the economy as a result of its low level of operating costs relative to revenues.

#### Impact on the Northern Territory economy

As expected, the Project has a much larger proportionate impact on the Northern Territory economy. The gross state product (GSP) of the Northern Territory is on average almost 18% higher each year as a result of the Project, as shown in Table 10-24.

The impact on the welfare of Northern Territory residents is measured by the change in private or household consumption expenditure. On average, household spending is expected to be A\$175 million a year (1.6%) higher as a result of the Project. This benefit has a net present value of around A\$2.4 billion.

To place this in perspective, Figure 10-12 shows the increase in per capita consumption spending over the life of the Project. The Project contributes to an increase in per capita consumption spending of an average of A\$1137 per annum in current dollar terms.

#### Employment—national and territory impacts

The modelling results suggest that the Project does not increase the level of employment in the Australian economy as a whole relative to the baseline scenario because a full employment assumption was made. The modelling does however produce a small increase in real wages.

While the direct impact of the Project on employment in the Northern Territory is minimal, the indirect impact is significant. The Project directly and indirectly generates additional employment equivalent to over 2000 full-time personnel. This is an increase of 3.4% compared with the baseline scenario. These jobs are derived from the increase in business activity directly related to the local spending of the Project and its employees and also because of the general increase in spending and economic activity as a result of higher household disposable income stemming from reductions in tax rates. Industries with potential for increases in employment as a result of the Project include civil engineering, maritime transport, hospitality and general supplies.

#### 10.4.2 Business opportunity

Local government and business groups expressed strong support for the Project, believing it would potentially increase employment, salaries, training and business development in Darwin, and that it would provide impetus to the further development of the Northern Territory's infrastructure and services.

Stakeholders suggested that flow-on benefits should be optimised through a local industry plan in cooperation with agencies such as the Northern Territory Industry Capability Network (NTICN).

**Table 10-23: Impact on the Australian economy over the life of the Project**

	Average annual change		NPV of impact
	A\$ million	% change	A\$ million
Real private consumption	1840	+0.2	24 306
Real investment	648	+0.2	–
Real exports	1782	+0.5	–
Real imports	434	+0.2	–
Real GDP	3500	+0.2	–
Real wage rate	–	+0.1	–

**Table 10-24: Impact on the Northern Territory economy over the life of the Project**

	Average annual change		NPV of impact
	A\$ million	% over base case	A\$ million
Real private consumption	175	1.6	2390
Real GSP	4094	17.6	–
Persons employed	2141	3.4	–



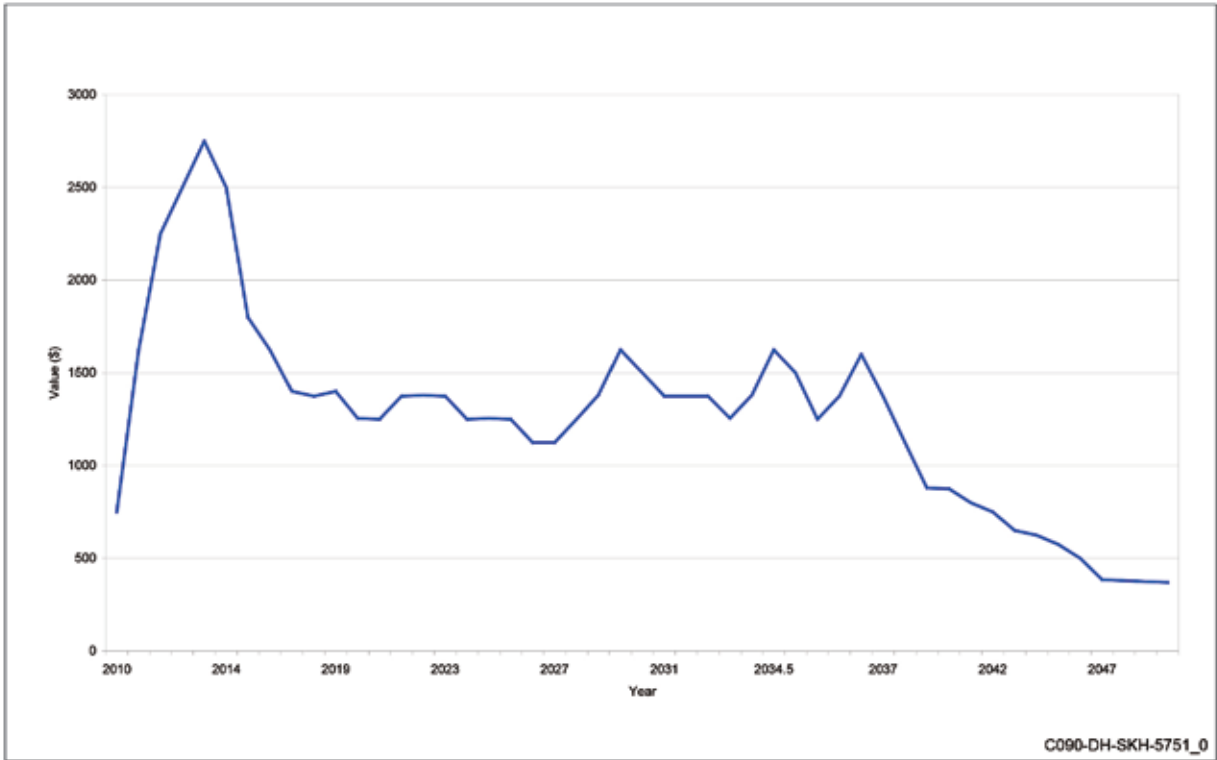


Figure 10-12: Impact of the Ichthys Project on per capita real consumption in the Northern Territory

Flow-on benefits could be expected in service industries such as the training, transport, tourism and hospitality sectors. The majority of stakeholders cautioned, however, that there were a number of existing constraints to the Northern Territory’s economic development, including the limited availability of housing, skills shortages and existing infrastructure operating at close to capacity.

The Project will develop a communication and engagement plan to support three key principles of the supplier relationship program and Industry Participation Plan objectives. These are as follows:

- communication—to facilitate early identification of opportunities for Australian industry participation through all tiers of supply
- inclusion—to support the integration of Australian industry through all tiers of supply
- education and feedback—to provide specific support and feedback for locally owned, small-to-medium enterprise and Aboriginal-owned business in Australia in order to encourage the adoption of international best practice supply standards.

The communication and engagement plan will include provision to:

- prepare industry briefings to communicate requirements and share information about the Project
- use Industry Capability Network (ICN) service offerings throughout the states and territories in Australia
- advise of upcoming tenders on Internet web sites from available industry service providers of vendor and Project information at <[www.projectgateway.com.au](http://www.projectgateway.com.au)>
- contribute input to relevant newsletters and publications
- produce internal communications and briefings to ensure that INPEX Project staff are informed and aware of the local Industry Participation Plan (IPP) requirements
- produce a “supplier diversity” brochure and manual for Project Gateway and the NTICN process
- prepare government briefings to discuss requirements and share information about the Project and Northern Territory industry capability.

### 10.4.3 Employment and training

The Project's demand for construction labour and skilled operations staff may contribute to reducing unemployment rates. There is the possibility that some local employers—for example in the building, fisheries and government sectors—may lose staff to the Project, particularly if there is salary competition. Therefore, while local business may see important commercial opportunities in the Project, they may also face increased competition for labour and higher labour costs. Overall, however, the Project's impacts on the local employment market are likely to be highly positive.

The Northern Territory labour market is limited in its ability to meet the skill and expertise requirements of the Ichthys Project or of the oil & gas industry in general. INPEX will support targeted training programs to further develop a local skilled construction labour force; this will include specific Aboriginal programs in the region.

Apprenticeships are currently at record levels (Northern Territory Government 2010), and the Project would have a positive effect in encouraging more people to take up skills training. People with higher-level skills who remained in the Northern Territory after the construction phase of the Project would further enhance the Territory's industrial base. During consultation, a number of stakeholders noted that ConocoPhillips had brought engineers in from interstate and that these had left Darwin at the end of the construction phase.

The Project represents an important opportunity for Aboriginal people in the Darwin region to increase their participation in the labour market and to acquire critical skills and technical qualifications. There is also an established framework to increase Aboriginal participation in training and apprenticeships in the Darwin region, which the Project could readily tap into.

INPEX recognises that employment opportunities will emerge through the construction phase of the Ichthys Project and with Ichthys LNG production for Aboriginal and non-Aboriginal locals. The company will explore and take advantage of successful training and development programs, infrastructure and initiatives to develop labour capability in LNG skills within the region.

INPEX is encouraging local people to apply for construction work associated with the Ichthys Project and will ensure that its systems and processes enable skilled individuals to access employment opportunities being offered by relevant contract employers at the time. When sourcing additional Project resources, contract employers will give preference to suitable local applicants with the relevant skills, qualifications and work history. In the operations phase, the Project will also be seeking suitably skilled and experienced personnel from the local labour market.

### 10.4.4 Local inflationary impacts

Stakeholders expressed concerns that the Project would contribute to local inflationary pressures. It was suggested that ConocoPhillips' Darwin LNG project had reversed the trend in the Northern Territory's inflation rates, which had previously been below the national average and is now above it. It was perceived that the Ichthys Project could exacerbate this trend through higher salaries, housing and rental costs.

The risk that the Project will result in significant increases in prices for goods and services is expected to be low. Any increase in prices is likely to be a short-term issue over the construction period. If housing and labour markets are managed according to the measures identified in sections 10.3.2 and 10.4.3, the total supply of housing and labour in the region will be sufficient to meet demand and the overall inflationary effect will be minimal.

### 10.4.5 Infrastructure constraints

It was noted that the use of the port facilities at Darwin are expanding rapidly. Some stakeholders expressed concern about the impact of the Project on capacity at the Port and the effect this might have on other industries, such as those exporting goods through the port, and the recreational and tourism sectors.

The Project will have its own separate jetty infrastructure during the operations phase, so will not affect the berthing facilities for other users of the Port of Darwin. However, tanker vessels arriving at Blaydin Point will require other port services such as pilotage, and there may be a physical constraint on the number of ships able to safely moor in the Harbour at any one time.

INPEX will collaborate with the DPC to coordinate port activities efficiently and safely throughout the construction and operations phases.

## 10.5 Conclusion

### 10.5.1 Outcome of risk assessment

The socio-economic aspects of the Project's operating environment are complex, and are influenced by many factors that are outside the influence of the Project. These include the fluctuations in national and global economies, and the resulting effects on labour markets.

The risk assessment process, taking into account management controls and mitigating factors, identifies 11 "medium" risk and 7 "low" risk potential socio-economic impacts associated with the Project. These risk ratings are considered acceptably low, mitigating risks to the livelihoods and lifestyles of the surrounding community.

Socio-economic impacts associated with the offshore development area are limited to interactions with commercial fishing and shipping activities. Any impacts to commercial fishing are likely to be minor. Data on fishing effort indicate that the offshore facilities will be located close to an area utilised by the North West Slope Trawl Fishery. However, it should be noted that fishing effort data do not record fishing areas fished by five operators or fewer and that it is possible therefore that some low-level fishing activities may occur in the vicinity of the offshore facilities. In addition, the gas export pipeline overlaps an area utilised by the Northern Prawn Fishery. In this case, however, the standard safety exclusion zone to be established will not significantly reduce the area available for fishing.

Potential impacts to shipping activities are also likely to be minor as there are no identified shipping channels in the vicinity of the offshore development area.

The Project's most intense socio-economic impacts are likely to be associated with the construction phase of the nearshore and onshore development areas. Road transport used for ferrying Project personnel and materials to the onshore development area will increase local traffic volumes, although modelling indicates that the incremental increase attributable to the Project is minor in comparison with the effects of expected population growth in the Darwin region.

Recreational fishing activities in East Arm and along the pipeline route will be temporarily disrupted in the immediate vicinity of Project vessels during the construction phase. Exclusion zones will be established around dredging, piledriving, pipelay and drill-and-blast vessels to manage public safety. These activities will be focused on localised areas in the nearshore development area and will not prohibit fishing and recreational boating nearby, provided that safe distances are maintained.

Aboriginal people living in the Darwin area frequently fish and forage for food and other resources in intertidal areas at low tide, as well as in Darwin Harbour. Within the Harbour itself these activities are common around Nightcliff, Coconut Grove, Kulaluk, Sadgroves Creek, Lee Point and Blaydin Point. It is predicted that there will not be any direct impact on Nightcliff, Coconut Grove, Kulaluk, Sadgroves Creek and Lee Point areas and therefore impacts on traditional fishing practice will be negligible for these areas. However, there will be an impact on traditional fishing practices undertaken on and around Blaydin Point during both the construction and the operations phases. This is because public access to the onshore site will be restricted and marine exclusion zones will be put in place for safety reasons. This impact is

expected to be minimal given that the fishing areas affected near Blaydin Point represent a very small proportion of the areas available in Darwin Harbour.

The Project will provide a high level of demand for personnel during its construction phase, which may be met locally in Darwin and Palmerston depending on the skill sets required, but is also likely to require fly-in, fly-out staff. An accommodation village will be developed in Howard Springs (east of Palmerston) to minimise the short-term impacts on the already constrained local housing market that might otherwise be caused by a large influx of Project personnel, many of whom will be single. The development of this facility is subject to its own approvals process.

Three Aboriginal archaeological sites will be disturbed during land-clearing for the onshore development area, subject to permission from NRETAS under the *Heritage Conservation Act* (NT). The onshore facilities have been designed around a number of other heritage sites that will remain undisturbed. Heritage sites in the vicinity of the nearshore development area will not be disturbed, as the maritime infrastructure has been designed specifically to avoid these sites. This includes a number of submerged Catalina flying-boat wrecks from World War II. Low levels of sand movement on to one of these wrecks (Catalina 3) may occur as a result of dredging activities, which represents a small increase in the natural movement of sand that already occurs throughout East Arm under ambient tidal currents. This is not expected to negatively affect the heritage values of the wreck site. The gas export pipeline has been aligned to avoid Aboriginal sacred sites in the nearshore development area.

Modelling of noise emissions from the onshore gas-processing plant indicates that received levels in the nearest residential areas (in Palmerston) will not exceed identified noise criteria and are unlikely to be audible above ambient noise in most conditions. Other impacts to the community that may be considered on a cumulative basis include light and visual amenity. In the local context, where several industrial facilities already operate on the shores of Darwin Harbour, the additional impacts imposed by the Ichthys Project are moderate. These impacts are mitigated by distance—the onshore development area is 4 km from Palmerston and 10 km from Darwin's CBD.

The Project facilities have been designed to minimise the risk to public safety associated with accidental events such as major hydrocarbon leaks or explosions. Controls to mitigate risks from major incidents include designing and constructing the facility in line with established industry standards and codes of practice, positioning equipment to reduce off-site consequences,

and developing and exercising emergency plans and response procedures in consultation with the relevant emergency-response authorities.

The results from the preliminary QRAs conducted to date indicate that the onshore development area and pipeline do not pose unacceptable safety risks to the public around Darwin and neighbouring residential areas such as Marlow Lagoon (which is adjacent to Palmerston). Where risks posed to users of the Harbour in the vicinity of the jetty heads and trestle are higher than acceptable for active open spaces, nominal safety exclusion zones will be established. As the acceptable risk contours border the main channel of Lightning Creek, risk values will need to be confirmed by a final QRA based on a complete plant design to determine whether access to this creek can be maintained.

Economic modelling indicates that the Project will benefit the Northern Territory economy, contributing an increase of almost 18% to the GSP during each year of operation and increasing household spending. The Project will also benefit the Australian economy with predicted average annual contributions of A\$3.5 billion (an additional 0.2%) to Australia's GDP. The Project offers opportunities for employment and training, with flow-on potential for business development and increased investment in infrastructure and services.

It is considered that the level of management and risk reduction presented in this chapter represents a proactive and conservative approach to maintaining socio-economic values, while allowing the Project to progress in a sustainable fashion. The management controls to be implemented will be further developed in consultation with stakeholders and will continue to be updated throughout the various stages of the Project. The community consultation initiated for this Draft EIS will be ongoing throughout the various stages of the Project, as described in Chapter 2.

### 10.5.2 Environmental management plans

As described throughout this chapter, a suite of management plans have been developed to direct the implementation of the management controls that reduce the potential for socio-economic impacts. These contain the objectives, targets, detailed actions and monitoring to be carried out to manage a variety of aspects, including the following:

- traffic
- heritage
- dredging and dredge spoil disposal
- piledriving and blasting
- air emissions
- dust.

INPEX's Health, Safety and Environmental Management Process is described in Chapter 11 and the provisional management plans that have been developed for the Project are attached as annexes to Chapter 11.

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