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4 EXISTING ENVIRONMENT AND POTENTIAL IMPACTS

4.1 CLIMATE

The Blaydin Point Project site lies within the monsoonal (wet/dry) tropics of Northern Australia and experiences two distinct seasons: a hot, wet season from November to March and a warm, dry season from May to September. April and October are transitional months between the wet and dry seasons (BOM 2008). Maximum temperatures are defined as hot all year round, however November is the hottest month with a range of 25 °C to 34 °C, while June and July normally experience the lowest monthly minima with a range of 20 °C to 30 °C (BOM 2008).

Darwin has a mean annual rainfall of 1711 mm (on 111 rain days), most of which falls in the wet season (BOM 2008). Humidity over this period averages 70–80%. In the dry season, humidity is often below 35–55% and there is virtually no rainfall. Monthly mean evaporation ranges from 167 mm in February to 259 mm in October. The mean annual evaporation is 2630 mm (BOM 2008).

The monsoonal tropics also experience cyclone activity. The strongest winds and heaviest rainfall are associated with the passage of tropical cyclones, which can occur in the region at any time during the period November to April, and occur on average once every two years. Tropical cyclones cause most damage within a distance of 50 km from the coast. Aside from the impacts of strong winds, storm surge can be of concern to coastal developments and flood damage can also result from associated squally rains (URS 2004).

Project infrastructure will be designed to withstand extreme weather conditions, such as cyclones, including wind and flooding, along with sea level rises due to storm surge and climate change, as per accepted scientific modelling.

4.2 MARINE ENVIRONMENT


4.2.1 Oceanography and hydrology

Darwin Harbour is characterised by a macrotidal regime with a maximum range of 7.8 m. The mean neap tidal range is 1.9 m, while spring tides average 5.5 m. Tides are predominantly semidiurnal (two highs and two lows per day) (URS 2004).

Darwin Harbour is considered well protected, with wind-generated waves typically less than 0.5 m in height and with periods of two to five seconds. The majority of waves are generated within the harbour or in Beagle Gulf. Waves during cyclones would be predicted to be of the order of 3 to 3.5 m (GHD 1997).

Construction procedures for the Project will need to take account of large tidal ranges, particularly during the construction of the pipeline shore crossing and during land clearing and assembly of the jetty and MOF.

Dispersion and impacts of turbid plumes during dredging and pipelay are expected to be key issues for investigation during the environmental impact assessment (EIA)

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process. Investigation is likely to require oceanographic modelling to determine the predicted extent, persistence and intensity of plumes, prior to commencement of dredging.

Similarly, the potential impacts of liquid discharges and spills will be modelled during the EIA process to allow for appropriate planning. Trajectory modelling of spills, in the event that any should occur, will also be used in the development of oil spill contingency plans.

4.2.2 Darwin Harbour bathymetry

A channel >20 m deep (below Lowest Astronomical Tide (LAT)) extends down the centre of Darwin Harbour, from the Darwin Port limits to the confluence of Middle Arm and East Arm. The channel favours the eastern side of the harbour, with broader shallower areas occurring on the western side. The intertidal flats and shoals are generally more extensive on the western side of the harbour than on the eastern side (URS 2002).

The channel continues into East Arm, towards Blaydin Point, at water depths of >15 m LAT; the bathymetry in this area has been modified by previous dredging for the development of East Arm Port (URS 2002).

A slightly deeper channel extends into Middle Arm, up to the western side of Channel Island. A shallower channel (generally <10 m LAT depth) separates Wickham Point from Channel Island and terminates in Jones Creek (URS 2002).


As described in Section 3.5.1 *Offshore activities*, dredging will be required in the vicinity of Blaydin Point to allow for navigation channels and a ship turning basin. Disposal of dredging spoil may also affect the bathymetry of the harbour, although spoil disposal grounds have not yet been selected.

4.2.3 Marine water quality

Salinities in Darwin Harbour vary considerably during the year, with a strong freshwater influence during the wet season, when estuarine conditions prevail in all areas (URS 2002).

Dry-season salinity levels throughout the harbour are about 37 ppt (parts per thousand), with little stratification (URS 2004). At the height of monsoonal inflow during February and March, salinity in areas in the middle of the harbour can decrease to 27 ppt. Salinities in the arms, which are largely influenced by freshwater inflow, can reach as low as 17 ppt. The water column at this time is highly stratified (URS 2004).

With its tropical location, water temperatures in Darwin Harbour are relatively high, but some small seasonal variation does occur. Temperatures are typically 31–32 °C for most of the year, with little temperature stratification, but they decrease to about 29 °C during the height of the wet season (URS 2004).

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Light levels reaching the sea surface in Darwin Harbour are very high. However, because of the turbidity of the water the light is rapidly dissipated and the water becomes very dim at depths of only a few metres, particularly during the wet season when surface run-off causes elevated turbidity. Tidal cycles can also have an influence and turbidity is higher during spring tides than during neap tides due to the stronger tidal currents bringing fine seafloor sediments into suspension (URS 2004).

Water quality in Darwin Harbour is generally high, even though naturally turbid for most of the time. Anthropogenic influences within the harbour are confined to the port development at East Arm, Darwin waterfront (historical industrial activities), Sadgroves Creek and wastewater outfalls (URS 2004).

Studies of heavy metal concentrations in Darwin Harbour waters have previously been undertaken and all showed results below the ANZECC and ARMCANZ (2000) guidelines for maximum dissolved levels to protect aquatic ecosystems. In many cases, the readings were an order of magnitude, and sometimes two orders of magnitude, lower than the recommended upper limits (URS 2004).

For the onshore gas-processing facilities, a wastewater discharge outfall at an appropriate location may be required for nearshore disposal of treated wastewater which may contain trace levels of hydrocarbons and production chemicals. There may also be some smaller discharge requirements from temporary facilities such as sewage treatment. If such discharges occur, they would have the potential to impact on water quality. In order to inform the EIA process and for the management of liquid discharges, baseline studies of marine water quality and discharge modelling will be required. An appropriate location for the discharge outfalls and treatment standards will be selected in consultation with the Northern Territory Government regulators.


Stormwater run-off during construction and from sealed surfaces throughout the onshore gas-processing facility has the potential to impact on water quality; appropriate bunding, stormwater drains, settlement and treatment (if required) will be integrated into the engineering design of the facility to limit the potential for marine contamination.

4.2.4 Marine biota and habitats

The marine fauna of northern Australia is part of the vast Indo-West Pacific biogeographical province. The majority of species are widely distributed in this region, with the northern part of the Australian continent being simply a small part of the wider ranges of most species (URS 2004).

Offshore areas

The Ichthys Field lies 220 km from mainland Western Australia on the North West Shelf, in water depths of 230–280 m. The seabed in the vicinity of the well field is predominantly silty mud with heavy bioturbation (mixing of sediments by burrowing organisms).

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Soft substrates are typical of deep continental-shelf seabeds and this habitat type is very widely distributed in the deeper parts of the North West Shelf. INPEX has conducted ROV and grab sample investigations in the vicinity of the Ichthys Field in order to gain a better understanding of the seabed.

The soft sandy substrate of the Ichthys Field generally supports a diverse infaunal assemblage dominated by polychaetes and crustaceans that are widely distributed in the region. These bare substrates do not favour the development of diverse epibenthic communities.

Surveys conducted by INPEX identified a range of benthic communities, with composition influenced by substrate type, water depth and probably current regime. Deeper areas (150–250 m) generally supported very sparse benthic communities. Soft substrates supported few species of epibenthic organisms. Hard substrates were colonised by a more diverse assemblage, with species decreasing in density with increasing depth. The more common epibenthic organisms associated with areas of hard substrate included sponges, gorgonians, crinoids and black corals in low to medium densities. Species density also appeared to relate to sediment movement and seabed profile, with higher-profile features supporting significantly more abundant communities than the flatter pavements.


Pipeline routes

The pipeline routes from the Ichthys Field to the entrance to Darwin Harbour have not yet been surveyed. Information on the seabed characteristics along the pipeline routes is based on publicly available broad-scale mapping carried out and collated by various organisations such as Geoscience Australia.

Between the Ichthys Field and Darwin Harbour, both pipeline route options initially cross the Oceanic Shoals Bioregion designated by IMCRA (Interim Marine and Coastal Regionalisation of Australia) followed by a relatively short section of the Bonaparte Bioregion and finally the Anson–Beagle Bioregion. The seabed along the routes across the Oceanic Shoals and Bonaparte bioregions is predominantly composed of sands with areas of silty sands and muds generally associated with the lee areas of basins or palaeochannels. Nearer to shore the pipeline routes cross the northern part of the Anson–Beagle Bioregion which is characterised by gravelly sands, indicative of the significant input of sediments from terrigenous sources.

A portion of pipeline route parallels the existing Bayu-Undan – Darwin pipeline. The seabed habitats along the pipeline have been described by LeProvost Dames & Moore (LDM 1997) as predominantly silty sands with some ribbons of mobile, megarippled coarser sands. To the north of Charles Point, there are frequent sand waves (up to 3.5 m high). There are also isolated areas of calcarenite outcrops and scarps (LDM 1997), although the pipeline will be routed to avoid these where practicable.

The predominant components of the benthic fauna along the pipeline routes are expected to be polychaete worms and amphipods (small shrimp-like crustaceans) with lower abundances of solitary corals, gastropods and bivalve molluscs, brittlestars and a variety of other crustaceans.

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Any areas of subtidal hard substrate within the pipeline corridor are likely to be colonised by epibenthic biota similar to those occurring at Shepparton Shoal, described as comprising a low abundance (1–3 organisms per square metre) of small sponges and soft corals, with gorgonian sea fans and sea whips present in the shallower areas (of approximately 25 m water depth). No hard corals were identified, though visibility was very low and a high proportion of the organisms present were not identifiable from the video record (LDM 1997).

Darwin Harbour

Darwin Harbour has a complex assemblage of habitat types, with large differences in the extent of each. Many of the habitats are present as small units on a single shoreline, with complex habitats such as rocky shores, mangroves and mudflats all occurring within a small area (URS 2002). While the knowledge of the fish and invertebrate species living within the harbour is incomplete, the broad distribution of the majority of marine species suggests there will be few, if any, species restricted to the harbour itself (URS 2004).

Major biota communities within the Darwin Harbour include the following:

- rocky shore communities, particularly in the intertidal zone, which are dominated by gastropods, chitons, bivalves, barnacles and *Galeolaria* worms
- mangroves, with associated rich assemblages of invertebrate fauna
- benthic fauna, including amphipod crustaceans and polychaete worms, which provide a food source for fish and birds
- algal and sponge communities that have been found to be a food source for dugongs (Whiting 2001)
- coral communities, which are scattered as individual coral heads or colonies, not continuous reefs. Soft corals were found to be abundant on intertidal rock platforms at Wickham Point, along with sponges and mushroom-shaped ascidians (tunicates)
- seagrasses, in sparse beds, and with limited distribution
- subtidal pavement biota, such as sponges, soft corals and gorgonian whips, in locations where strong currents flow
- fish, of both resident benthic and transient pelagic species, in high abundance
- reptiles, including turtles and saltwater crocodiles
- mammals, including dugongs, Indo-Pacific humpback dolphins and Irrawaddy river dolphins (the Australian populations of which have recently been described as a new species *Orcaella heinsohni*, the Australian stumpfin dolphin) (URS 2002).

The corals found in Darwin Harbour are those which are tolerant of conditions which exclude the majority of coral species; these include variable salinity, high turbidity and sedimentation. It is likely that at least those individual animals living well within the harbour, such as the portion of the National Estate-registered coral area at Channel Island, are in suboptimal habitats and are naturally stressed (LDM 1997).

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Impacts to marine biota and habitats will primarily results from pipeline construction and dredging of the channel and turning basin creating localised habitat disturbance or removal in the vicinity of Blaydin Point. Installation of the offshore pipeline may result in loss of soft sediment habitat and potentially some hard habitats.

Rock armouring along the pipeline will replace a portion of soft-sediment habitat with a hard substrate that is likely to be colonised by filter-feeding benthic communities similar to those present on Shepparton Shoal and the subtidal rock habitats within Darwin Harbour. The increased three-dimensional habitat of the rock armour is likely to afford greater shelter for fish and may contribute to an increase in fish abundance along the pipeline corridor.

There may be also some indirect impacts from increased turbidity, sedimentation and re-suspension of contaminants from the sediments and noise and vibration from dredging activities. However, most of these should be temporary impacts during the construction phase, with few continuing into the operations phase.

Management actions and ongoing monitoring programs to assess the effectiveness of these actions will be developed in consultation with stakeholders during the EIA process.

4.2.5 Listed marine species in the Project area

There are a number of threatened marine species, listed under both the *Territory Parks and Wildlife Conservation Act 2001* (NT) (TPWC Act) and the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) (EPBC Act), which may be present in the Project area (Table 4-1).

Table 4-1: Listed marine species that may inhabit the offshore areas (Ichthys Field and pipeline routes) and Darwin Harbour

Species	Common name	Status under EPBC Act	Status under TPWC Act	Offshore areas	Darwin Harbour
MAMMALS					
<i>Balaenoptera musculus</i>	Blue whale	Endangered/ migratory	Not threatened	✓	
<i>Megaptera novaeangliae</i>	Humpback whale	Vulnerable/ migratory	Not threatened	✓	✓
TURTLES					
<i>Chelonia mydas</i>	Green turtle	Vulnerable/ migratory	Not threatened	✓	✓
<i>Dermochelys coriacea</i>	Leatherback turtle	Vulnerable/ migratory	Vulnerable	✓	✓
<i>Eretmochelys imbricata</i>	Hawksbill turtle	Vulnerable/ migratory	Not threatened	✓	✓
<i>Caretta caretta</i>	Loggerhead turtle	Endangered/ migratory	Endangered	✓	✓
<i>Lepidochelys olivacea</i>	Olive turtle	Ridley Endangered/ migratory	Not threatened	✓	✓

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Species	Common name	Status under EPBC Act	Status under TPWC Act	Offshore areas	Darwin Harbour
<i>Natator depressus</i>	Flatback turtle	Vulnerable/migratory	Not threatened	✓	✓
SHARKS					
<i>Rhincodon typus</i>	Whale shark	Vulnerable/migratory	Not threatened	✓	✓
<i>Pristis microdon</i>	Freshwater sawfish	Vulnerable	Vulnerable	✓	✓
<i>Pristis zijsron</i>	Green sawfish	Vulnerable	Vulnerable	✓	✓

Of the listed species, green turtles, hawksbill turtles and flatback turtles are known to use the Darwin Harbour regularly, while olive ridley turtles and loggerhead turtles are suspected to be infrequent users. Leatherback turtles are typically oceanic and unlikely to occur in the harbour (URS 2005).

The freshwater sawfish is usually found in fresh water and in the upper reaches of estuaries (NRETA 2008a), which may correspond with the Project area, particularly during the wet season. Similarly, the dwarf sawfish and the green sawfish inhabit coastal and estuarine waters and have been recorded in the Darwin Harbour region. Whale sharks and humpback whales are not known to visit Darwin Harbour (URS 2005).


The EPBC database search also identified five additional species of migratory marine birds and eight migratory marine mammal species (Bryde's whale, Antarctic minke whale, dugong, Australian snubfin dolphin, killer whale, Indo-Pacific humpback dolphin, spotted bottlenose dolphin and sperm whale) that may pass through the Project area. No critical habitats for threatened or migratory species were identified through the EPBC database search (DEWHA 2008).

Baseline surveys of the marine environment during the EIA process will further assist in identifying threatened species that may be impacted by the Project. Management plans will be implemented to mitigate impacts, where appropriate, in consultation with the Northern Territory EHA and the Commonwealth Department of the Environment, Water, Heritage and the Arts.

4.2.6 Marine pests

The Port of Darwin Harbour is considered free of introduced marine pest species, based on the outcome of a baseline study undertaken by the NT Government and CSIRO between 1998 and 2000. This is despite detection of an infestation of the black-striped mussel (*Mytilopsis sallei*) in harbour marinas in 1999, which was successfully eradicated (URS 2004).

The Project will involve additional shipping traffic into Darwin Harbour from overseas ports. Shipping volumes are likely to be highest during the construction phase, but will be regular and ongoing during the operations phase. This transport presents an increased risk of marine pest invasion into the area, which will require structured management and monitoring programs.

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Quarantine procedures will be developed for all forms of shipping traffic, dredging and pipelay vessels utilised in the Project, and will be finalised in consultation with the Darwin Port Authority and the Australian Quarantine and Inspection Service.

4.3 TERRESTRIAL ENVIRONMENT

4.3.1 Geology, soils and topography

Blaydin Point is on the central northern tip of the Middle Arm Peninsula, and consists of an “island” surrounded by intertidal flats, which are inundated at high tide.

While detailed surveys of the geology, soils and topography at Blaydin Point have not yet been carried out, the landscape is likely to be similar to that of Wickham Point, which was described in the: Public Environmental Report for the ConocoPhillips LNG plant (URS 2002).


Bedrock in the area consists of meta-sediments of the Early Proterozoic Finniss River Group, which have been metamorphosed to lower greenschist facies and have undergone one major deformation, which has produced steep dips and resulted in the pervasive north-north-east strike of the strata. The member of the Finniss River Group present is the Burrell Creek Formation, which consists of a sequence of phyllite, siltstone, shale, sandstone and conglomerate (URS 2002).

The overburden ranges in thickness from tens of centimetres up to 4 m and tends to increase towards the lower footslopes and valley floors. The overburden consists mostly of sands, silts and clays (URS 2002).

Tidal mudflats are composed of Quaternary marine alluvium of clay, silt and some fine sand (URS 2002).

The geology, topography and soils of the Project area will be thoroughly characterised as part of planning for the engineering design of the onshore facilities. It is noted that there is a potential for the presence of naturally occurring acid-sulfate soils in the intertidal areas. Project activities, such as pipelaying activities, could expose such soils. Therefore an acid-sulfate soils risk investigation will be conducted as part of the EIA.

Wherever possible, topsoil will be retained to assist in the rehabilitation of temporary areas at the site, particularly for the shore-crossing locations.

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4.3.2 Vegetation

Detailed vegetation studies of the Project area have commenced using aerial photograph interpretation, field surveys and desktop reviews of available data. A preliminary vegetation map generated from field surveys undertaken during the dry- season survey of Blaydin Point in 2007 is presented as Figure 4-1.

The terrestrial vegetation of Blaydin Point consists of eucalyptus woodland and dense monsoon vine forest. The woodland is dominated by *Eucalyptus tectifica* and *Corymbia polycarpa*, while the monsoon vine forest is composed predominantly of *Acacia auriculiformis* (GHD 2007).

These areas are surrounded by an area of mixed hinterland closed forest, which gives way to primarily *Ceriops* closed forest and tidal creek forest. The northern and eastern shoreline edges of Blaydin Point are lined by *Sonneratia* woodland.

Limited areas of salt flat and *Avicennia* open forest also occur on Blaydin Point.

The Project will require clearing of an area of approximately 300 ha (3 km²). This direct footprint includes areas of terrestrial vegetation noted above. Other minor indirect impacts may result from changes in ground- and surface water, dust deposition and the establishment of weeds.

Vegetation surveys are continuing and will provide a greater level of detail on the plant communities during both wet- and dry-season conditions to inform the EIA process.

Management measures and controls for avoiding and/or minimising impacts on vegetation will be incorporated in the environmental management program described in Section 7. Rehabilitation planning will be undertaken for temporary rehabilitation areas such as the pipeline shore-crossing area.



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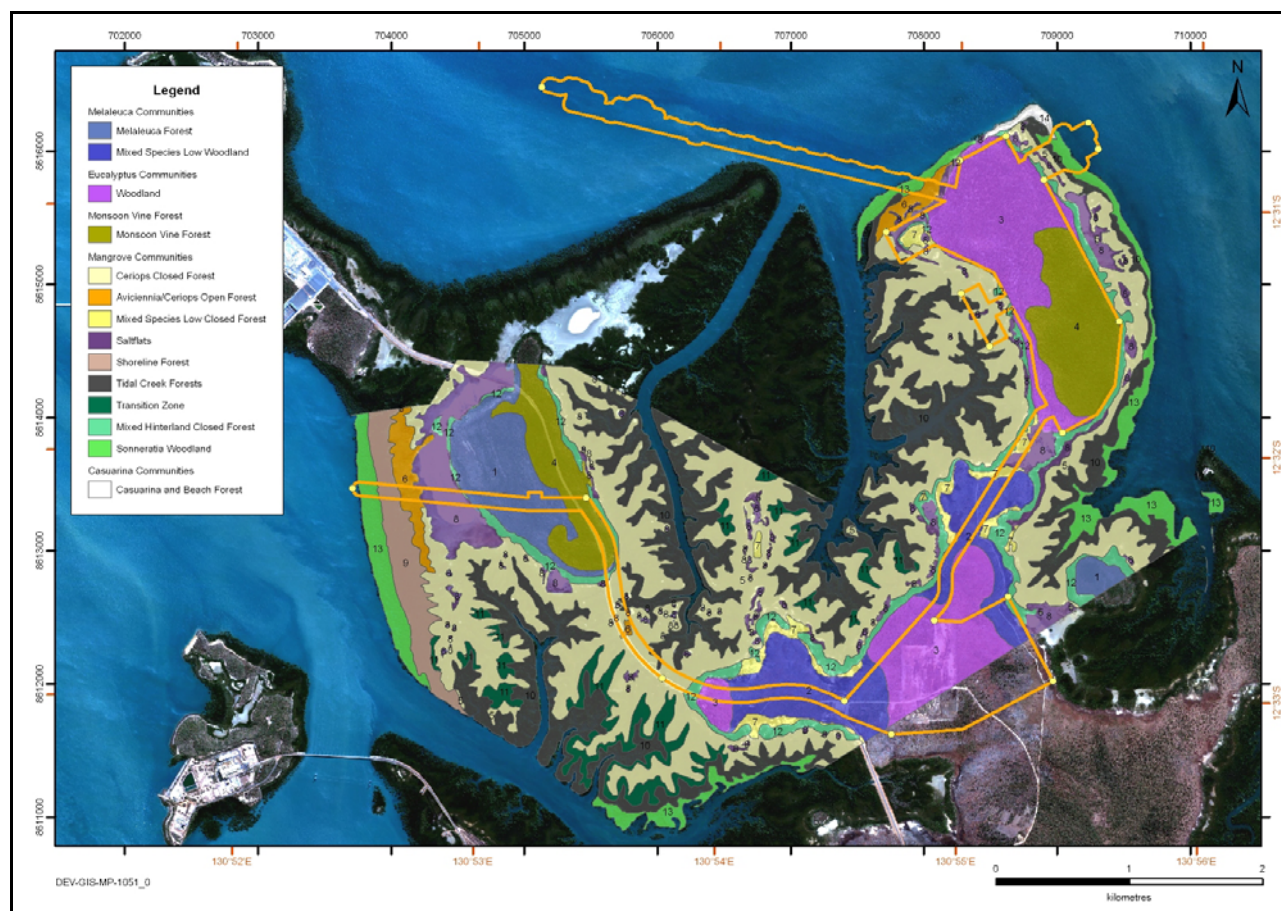


Figure 4-1: Vegetation distribution within the onshore Project area (GHD 2007): listed plant species and significant communities

4.3.3 Listed plant species and significant habitats

The intertidal zone extending from Blaydin Point is vegetated by mangroves which are included in a conservation zone. Of the 1595 ha of mangroves within Darwin Harbour, 95% are within this conservation zone and 1.5% have been cleared to date in total (Water Monitoring Branch 2005).

Monsoon vine forest communities are also present at Blaydin Point but are not currently zoned for conservation. This vegetation type is of regional conservation interest; it is represented in over 35 000 ha regionally, of which 50 ha is found on Blaydin Point.

The vegetation study conducted in the dry season (GHD 2007) found only one plant species listed as threatened under Northern Territory legislation (the TPWC Act). This is a cycad, *Cycas armstrongii*, which is endemic to the territory and classed as vulnerable. Although it is locally abundant across the western Top End region, the Cobourg Peninsula and the Tiwi Islands, it is listed as vulnerable because of its poor representation in conservation reserves (approximately 1%), and because its preferred habitat of deep loamy soils is favoured for agriculture, horticulture and forestry (NRETA (undated) in GHD 2007). Apart from land clearing, the most significant threat to the population of *C. armstrongii* is fire.

There are two threatened species of plants that may be present within the Project area as indicated by a search from the EPBC database on matters of national environmental significance. These are presented in Table 4-2 below.

Table 4-2: Listed plant species* on the EPBC database search within 20 km of Blaydin Point

Plants	Common name	Status under EPBC Act
<i>Ptychosperma bleeseri</i>	Darwin palm	Endangered
<i>Typhonium taylori</i>	A herb of the arum family	Endangered


* Note: these plant species have not been found within the onshore area in and around Blaydin Point (GHD 2007).

No additional threatened species and no threatened communities are recorded for the area on the EPBC database on matters of national environmental significance.

As noted above, direct and indirect impacts to vegetation in the Project area may occur and will be assessed through the EIA process.

4.3.4 Weeds

The declared weed *Lantana camara* was recorded in the monsoon vine forest at Wickham Point (URS 2002); at this stage its presence at Blaydin Point has not been confirmed. Lantana is a listed weed of national significance and is classified as a Schedule Class B/C weed ("growth and spread to be controlled") under the *Weeds Management Act 2001* (NT) (NRETA 2007).

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The Project will result in increased road construction and traffic into the Blaydin Point area, which has the potential to increase the risk of spreading weeds. Weed control programs will be implemented as required and will be incorporated into the environmental management program.

4.3.5 Terrestrial fauna

Detailed fauna studies of the Project area have commenced, including field surveys and desktop studies of available databases. These studies aim to characterise the habitats and species present within the Project area and provide an assessment of their local, regional and national significance.

Surveys conducted by INPEX in the dry season of 2007 (GHD 2007) recorded one bat species (*Mormopterus loriae ridei*) and little evidence of ground-dwelling mammals with only one mammal, the cosmopolitan pest species *Rattus rattus* (black rat) recorded during the trapping regime.

Of the 67 bird species observed, the most abundant and widespread was the white-throated honeyeater (*Melithreptus albogularis*) followed by the little friarbird (*Philemon citreogularis*). Honeyeaters (family Meliphagidae) were the most abundant and species-rich of groups followed by the fantails and flycatchers (family Dicuridae).

The bird communities within the study area can generally be classified into the following three categories, according to habitat preferences:


- generalist—these are species that occur in both of the major habitats present in the study area. Fourteen of the 67 species recorded (21%) are classified as generalist species
- mangroves and vine thickets—23 species (34%) were recorded solely from the mangroves and/or vine thickets
- savannah woodland—12 species (18%) were recorded solely from the savannah woodland.

A total of 14 species of reptile and five species of amphibians were recorded, including the introduced cane toad, *Bufo marinus*.

Potential impacts resulting from the Project may increase the level of disturbance to fauna from land clearing, noise and vibration, dust and increased risk of invasion by feral animals. The environmental management program will be designed to avoid or minimise these impacts.

4.3.6 Listed fauna species

No significant fauna species were recorded at Blaydin Point during the recent dry season survey of the Project area (GHD 2007). However, a number of threatened or migratory species could occur within the onshore Project area according to the Northern Territory Fauna Atlas and the NRETA fauna databases. Of those identified

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in these records, four are listed as threatened and known to occur in the Darwin area:

- *Chelonia mydas* (green turtle)—Vulnerable (EPBC Act)
- *Varanus mertensi* (Mertens's water monitor)—Vulnerable (TPWC Act)
- *Varanus panoptes* (floodplain monitor)—Vulnerable (TPWC Act)
- *Dasyurus hallucatus* (northern quoll)—Critically endangered / Endangered (EPBC/TPWC Acts).

The northern quoll (*Dasyurus hallucatus*) has previously been recorded on Middle Arm and may use the Blaydin Point area. However, this species is highly susceptible to cane toad poisoning and has declined or disappeared in areas of the Northern Territory where cane toads have recently invaded (NRETA 2008a).

The EPBC search engine lists additional threatened species as possibly occurring in the area (six species of reptile, four species of bird and three species of mammal). Of these additional species, the false water-rat (*Xeromys myoides*) has only been recorded sparsely in areas of the Northern Territory, but never in Darwin Harbour (NRETA 2008a). The other species are regarded as not likely to occur in the area. This is because the species have not been recorded within the onshore Project area, the appropriate habitat does not occur or because the birds present are well defined and threatened species would have been noted had they been present.

The EPBC search database results indicate that additional migratory species may occur in the project area (DEWHA 2008). This includes the estuarine crocodile (*Crocodylus porosus*), 6 species of terrestrial birds and 15 species of wetland birds.

As noted above, the Project may have direct and indirect impacts on local animal life. A continuation of the fauna studies above is planned to include wet-season data to inform the EIA process and to assist in developing the environmental management program.


4.3.7 Feral animals

Evidence of a number of feral animals was recorded in the dry-season surveys conducted by INPEX in 2007 (GHD 2007).

Cane toads are abundant in the Project area, with at least 20 individuals seen after dusk on tracks by observers travelling through the Project area. The introduced black rat (*Rattus rattus*) was also recorded by the trapping program.

Feral pigs (*Sus scrofa*) were not directly observed but were recorded from secondary evidence. Calls were heard from the mangroves, scats were collected from the tidal flats, and abundant diggings were noted.

Other feral animals may also exist in the area.

	<p style="text-align: center;">INPEX BROWSE, LTD.</p> <p style="text-align: center;">ICHTHYS GAS FIELD DEVELOPMENT</p> <p style="text-align: center;">NOTICE OF INTENT—BLAYDIN POINT, DARWIN</p>	<p>Doc No: DEV-EXT-RP-0050</p> <p>Revision: 2</p> <p>Date: 5 May 2008</p> <p>Page No: 35 of 52</p>
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The presence of feral animals will continue to be investigated during baseline fauna surveys of the Project area during the EIA process. Where possible, management measures to limit further spread of feral animals due to Project-related activities will be developed, in consultation with the Northern Territory's EHA.

4.3.8 Biting insects

Mosquitoes and midges are common on Middle Arm. The mosquito *Aedes vigilax* is considered to have the greatest potential as a pest and disease vector in the area. It and several other species are known to be vectors for Ross River virus, Barmah Forest virus and Murray Valley encephalitis. In addition, substantial numbers of biting midges breed in the Middle Arm area (URS 2002).

As required by the Northern Territory Government, baseline surveys of biting-insect populations at Blaydin Point will be undertaken during the EIA process. Onshore facilities will be designed in accordance with relevant Northern Territory Government guidelines, minimising exposed surface water wherever possible.

4.4 PHYSICAL ENVIRONMENT

4.4.1 Air quality


Within the Darwin airshed, bushfires are an major source of carbon monoxide, cadmium and its compounds, benzene and volatile organic compounds. The transport sector is a major source of nitrogen oxides, chromium compounds, sulfur dioxide, arsenic and its compounds and lead (DCC 2005).

Within large industry, mining is a significant source of arsenic, chromium compounds, lead compounds, nitrogen oxides, particulate matter with diameters of 10 µm or smaller (PM₁₀), sulfur dioxide, sulfuric acid and cadmium. The production of LNG within the Darwin airshed contributes further to VOC discharges (including benzene) and carbon monoxide (DCC 2005).

The Project will be located adjacent to an existing LNG plant at Wickham Point, and is expected to produce a similar composition of air emissions to that plant. The Project will therefore contribute to cumulative impacts on air quality, although, relative to other cities around Australia, the Darwin airshed is relatively clean and unpolluted.

Air-quality impacts will be a component of the EIA process, and will include modelling of the emissions likely to be produced by the INPEX facility as well as those produced by other emission sources in the area. A cumulative model will also be used which will include other facilities within the area such as the Wickham Point LNG plant and the Channel Island Power Station.

INPEX aims to minimise this burden to the airshed through appropriate design of the gas-processing facility.

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4.4.2 Noise and vibration

The expected noise and vibration impacts of the Project will be similar to those already produced by the Wickham Point LNG plant.

Other than the Wickham Point LNG Plant and associated access road, there are few sources of noise and vibrations in the Blaydin Point area. Residents in the vicinity of the Project area may experience intermittent disturbance from short term construction activities, particularly where increased heavy road traffic is involved.

Noise and vibration impacts to both humans and local fauna populations will be investigated during the EIA process, and will be minimised either through engineering design or procedural means, where possible.

4.4.3 Visual amenity

There is an expected change in the visual horizon from the change in land use at Blaydin Point from a partially disturbed site to an industrial area. The main plant area will consist of gas-processing trains that have vertical columns and storage tanks that would change the visual aspect. As noted previously, a similar facility already exists in close proximity to the Project area, and there are several other industrial sites positioned near the shores of Darwin Harbour. Middle Arm, including Blaydin Point, is also zoned for industrial development. Visual modification to the harbour will also result from increased shipping traffic and lighting.

A visual impact assessment, including computer-generated daytime and night-time vistas of the proposed onshore facility, will be a component of the EIA. Visual impacts will be the subject of stakeholder consultation.