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Appendix A1
Marine Turtle Management Plan



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MARINE TURTLE MANAGEMENT PLAN

1 INTRODUCTION

1.1 PURPOSE OF THIS PLAN

This Marine Turtle Management Plan (MTMP) focuses on managing potential impacts to marine turtles associated with the Port Hedland Outer Harbour Development. Specifically, this MTMP:

- focuses on management actions and strategies associated with construction and dredging activities; and
- outlines management strategies and monitoring programs that will be adopted to mitigate potential impacts associated with the construction phase.

For consistency, this MTMP follows the structure and, where appropriate, mitigation strategies proposed in the Outer Harbour Development Marine Mammal Management Plan (MMMP). Some management recommendations to mitigate impacts to marine turtles, such as the designated Marine Fauna Observers (MFO), will benefit marine mammals. Where appropriate, the same management approach presented here is proposed in the MMMP.

1.2 PROJECT OVERVIEW

BHP Billiton Iron Ore currently exports iron ore from port facilities in Port Hedland, Western Australia. The current port operations consist of processing, stockpiling and shiploading facilities at Nelson Point and Finucane Island (referred to as the Inner Harbour), located on opposite sides of the Port Hedland Harbour.

The Outer Harbour Development will be a new port facility near Port Hedland, linked to Finucane Island (**Figure 1.1**).

The entire facility is expected to be online by 2018. The total construction period will last approximately eight years.

Key marine structures and activities will include:

- a marine jetty extending from Finucane island to a wharf with eight berths;
- associated transfer stations, ore conveyors and ship loaders; and
- dredging for berth pockets, basins and departure channels.

1.3 PROJECT DESCRIPTION

The Outer Harbour Development will be established in four stages, with incremental expansions brought online over a five year period to reach the maximum capacity. The combined offshore and onshore construction period will last approximately eight years if each stage is built sequentially.

The marine infrastructure for the new offshore loading facility will be constructed on Finucane Island. The new jetty and wharf will extend nominally 4 km offshore in a northerly direction, adjacent to the existing inner harbour shipping channel (**Figure 1.1**). The new iron ore loading facility will be capable of berthing and loading vessels up to 320,000 deadweight tonnes (DWT) in size.

The key components of the offshore maritime infrastructure will comprise the following:

- access jetty structure, including abutment works;
- transfer station at the tail end of the wharf deck;
- wharf structure;
- berthing and mooring dolphins;

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- ship access gangways and conveyor cross-overs and cross-unders;
- aids to navigation;
- future provision of a ship arrestor barrier structure; and
- dredging works (24 hours per day, 7 days per week) for berth pockets and access and departure of the design vessels.

The marine components of the Outer Harbour Development will traverse both Western Australian State Waters and Commonwealth Waters (**Figure 1.1**)

Detailed bathymetry within a subtidal study boundary considered relevant to the Outer Harbour Development was obtained during airborne Light Detection and Ranging (LiDAR) surveys (SKM 2009a). The area covers in excess of 3,600 km², covering waters approximately 50 km to the east and west of Port Hedland, and extending 40 km seaward.

This MTMP:

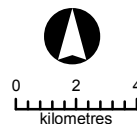
- provides an overview of marine turtle habitat usage within and adjacent to the proposed Outer Harbour Development;
- provides an overview of the potential impacts that may occur to marine turtles during construction and dredging activities;
- details the management measures that will be implemented to mitigate the potential impacts to marine turtles; and
- outlines the monitoring programmes that will be implemented during the construction activities.



This figure is an indicative representation of the current design of the Outer Harbour Development. Changes may be necessary as the engineering design progresses to ensure it is efficient, practical and within land disturbance requirements at the time of construction. Final design drawing files will be forwarded to the relevant Government authorities on finalisation and completion.

Legend

- Proposed Jetty
- Proposed Wharf
- Proposed Infrastructure Corridor
- Proposed Stockyards
- Proposed Goldsworthy Rail Loop
- Proposed Western Spur Railway
- Existing Railway
- Proposed Tug Access Channel
- Proposed Departure Channel
- Proposed Berth Pockets and Swing Basins
- Proposed Link Channel
- Proposed Crossover Channel
- Existing Shipping Channel



Scale = 1:250,000 at A4
Datum: GDA94
Map Grid: MGA94 Zone 50

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Source:
Australian Maritime Boundaries (AMB) and
Topography: GEODATA Topo 250K V3
© Commonwealth of Australia (GA), 2006
Channel: 112-SK-00500 (FAST JV 01/11/2008)
Channel: Navy Hydrographer, AUS00740
Imagery: Landsat Mosaic (2005)

Figure 2.1 Proposed Outer Harbour Development General Arrangement

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2 RELEVANT LEGISLATION

All marine turtles are protected under the *Wildlife Conservation Act 1950* (WA) and all six species are listed as Schedule 1 species. All species are listed migratory species under the Bonn Convention and are listed as either Endangered or Vulnerable under the Commonwealth *Environmental Protection and Biodiversity Conservation (EPBC) Act 1999* (**Table 2.1**).

Table 2.1 – The Conservation Status of Marine Turtle Species Occurring in Western Australian Waters

Species	Wildlife Conservation Act 1950	Environment Protection and Biodiversity Conservation (EPBC) Act 1999	Convention on Migratory Species (CMS) Appendix (as at October 2009)	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) Appendix (as at October 2009)	International Union for Conservation of Nature (IUCN) Status (as at October 2009)
Loggerhead Turtle <i>Caretta caretta</i>	Schedule 1*	Endangered	I & II	I	Endangered
Green Turtle <i>Chelonia mydas</i>	Schedule 1	Vulnerable	I & II	I	Endangered
Hawksbill Turtle <i>Eretmochelys imbricate</i>	Schedule 1	Vulnerable	I & II	I	Critically Endangered
Olive Ridley Turtle <i>Lepidochelys olivacea</i>	Schedule 1	Endangered	I & II	I	Vulnerable
Flatback Turtle <i>Natator depressus</i>	Schedule 1	Vulnerable	Not listed	I	Data Deficient
Leatherback Turtle <i>Dermochelys coriacea</i>	Schedule 1	Endangered	I & II	I	Critically Endangered

* Schedule 1. Fauna that is rare or likely to become extinct

3 EXISTING ENVIRONMENT

3.1 OVERVIEW

The following section summarises the information known on the marine turtle habitat usage within and adjacent to the project that has been determined from the literature and field studies conducted during 2008-2010 by Pendoley Environmental (**Table 3.1**). A detailed description of marine turtle usage within the Port Hedland region is provided in Pendoley Environmental (2009). The marine turtle life stages considered most likely to be present within the Outer Harbour Development area are:

- nesting and internesting female flatback turtles during the summer breeding season;
- juvenile and adult marine turtles of all species that breed, forage, rest or pass through the area; and
- post-hatchling flatbacks turtles that may utilise nursery habitat in the Port Hedland region.

3.2 TURTLE NESTING BEACHES

Turtle nesting within the Port Hedland region is dominated by flatback turtles, with very little green or hawksbill nesting recorded (Pendoley Environmental 2009). A regionally significant flatback rookery occurs at Mundabullangana (>1700 females per annum; Pendoley et al. in press) approximately 50 km west of the Outer Harbour Development. Moderate density flatback turtle nesting occurs at Cemetery Beach located approximately 6 km to the east of the Outer Harbour Development and low to moderate density flatback nesting at Paradise Beach approximately 15 km east of the Outer

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Harbour Development. Very low density flatback turtle nesting activity was present at Downes Island, which is located adjacent to the proposed development (**Figure 3.1**). None of these rookeries, however, are considered regionally significant when compared with rookery at Mundabullangana.

3.3 INTERESTING HABITAT

The principal interesting habitat utilised by flatback turtles nesting at Cemetery Beach was to the north and northeast of the nesting beach, away from the proposed development, with one turtle interesting to the west of Cemetery Beach, in the vicinity of the Outer Harbour Development. . From these data it appears that the most important interesting habitat for flatback turtles nesting at Cemetery Beach is the nearshore zone extending 50 km northeast along the coast, however, some interesting habitat is present within the Outer Harbour Development. Interesting females were also recorded within the existing shipping channel (Figure 3.2).

3.4 FORAGING HABITAT

Concentrations of resident foraging turtles were generally located around the offshore islands, including North and Little Turtle Islands, in creek mouths, over shallow intertidal platforms and out from the De Grey River mouth. The aggregations of turtles sighted during the aerial surveys were confirmed at North Turtle Island where juvenile green turtles were observed on the intertidal platform and this area is considered to be a significant foraging habitat for green turtles. Adult and juvenile green turtles are commonly observed within the Port Hedland Inner Harbour and here have been anecdotal reports of juvenile flatback turtles utilising the mangrove creeks of the Port Hedland Inner Harbour (C. Wilson, pers. comm. 2007; Biota 2004).

3.5 MIGRATORY PATHWAYS

The migratory corridors of different species of turtle (green, flatback and hawksbill) tracked from nesting beaches within the Pilbara region are located further offshore (usually in depths of 12–80 m) from the Outer Harbour Development (<http://www.seaturtle.org/tracking>). Nesting females from Cemetery Beach migrated to remote foraging grounds located away from the Outer Harbour Development (http://www.seaturtle.org/tracking/?project_id=574, and http://www.seaturtle.org/tracking/?project_id=357).

Table 3.1 – Summary of Known Marine Turtle Habitat Usage Within and Adjacent to the Port Hedland Outer Harbour Development

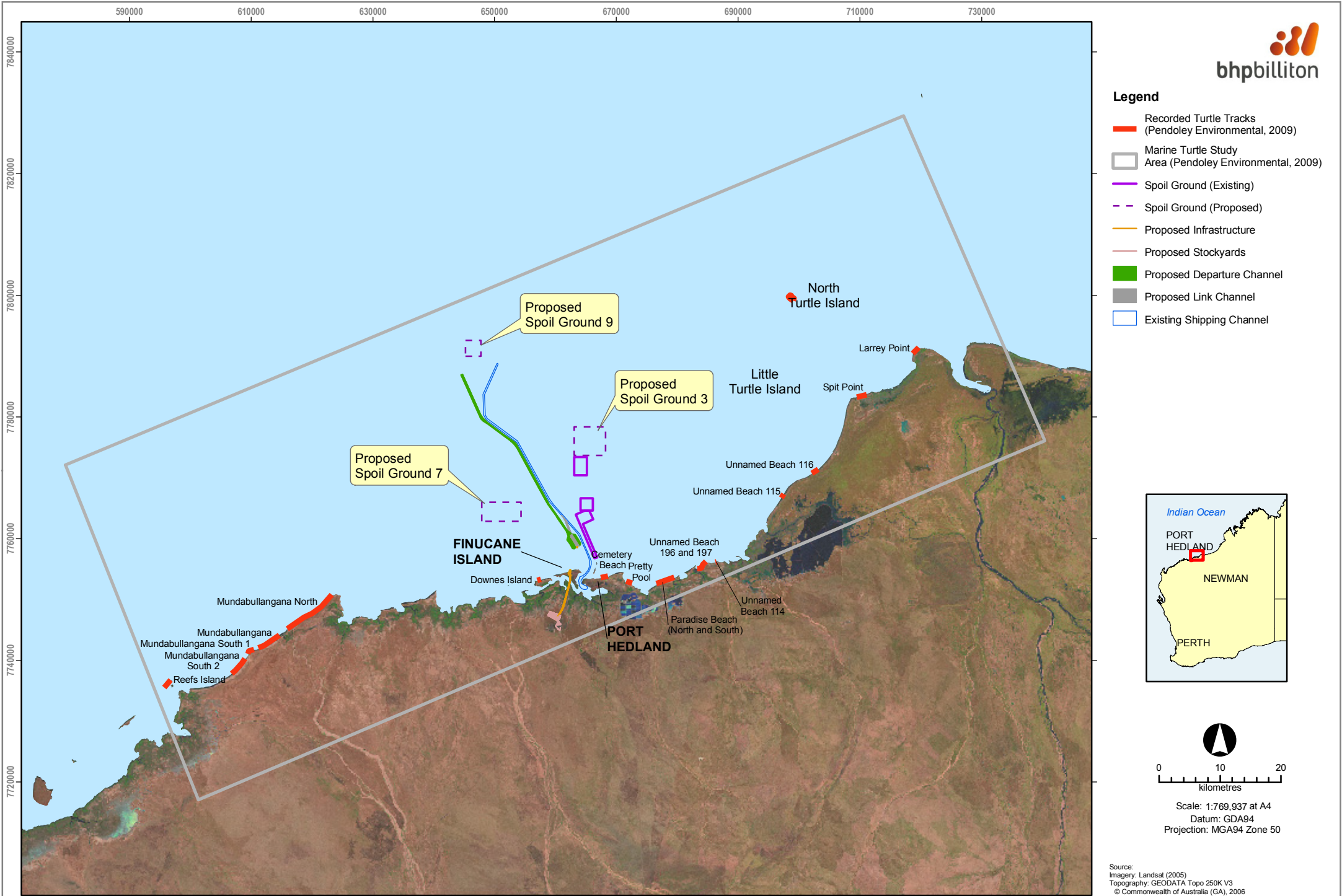
Site	Habitat type	Life stage	Species
Inner Harbour area	Foraging	Juvenile	Green Flatback
		Adult	Green
Outer Harbour area	Interesting	Adult	Flatback
	Foraging	Adult	Loggerhead
Mainland Coast	Foraging	Unknown	Green Flatback Hawksbill Loggerhead
Mundabullangana to De Grey River	Migratory pathway offshore	Adult	Green Flatback Hawksbill Loggerhead
Finucane Island	Unknown*	Unknown	Unknown
Downes Island	Nesting	Adult	Flatback
Weerde Island	Unknown*	Unknown	Unknown
Mundabullangana	Nesting	Adult	Flatback

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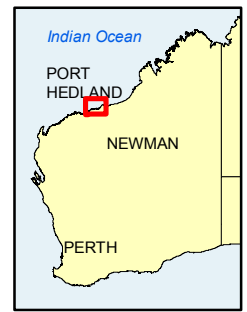
Site	Habitat type	Life stage	Species
De Grey River	Foraging	Adult	Green Flatback Hawksbill Loggerhead
Eighty Mile beach	Nesting	Adult	Flatback
North Turtle Island	Foraging	Adult	Green Flatback Hawksbill
	Foraging	Juvenile	Green
Little Turtle Island	Foraging	Adult	Green Hawksbill
		Juvenile	Green

*No evidence of nesting was found during 2008/09 surveys by Pendoley Environmental (2009)

Source: Public and unpublished Pendoley Environmental project reports



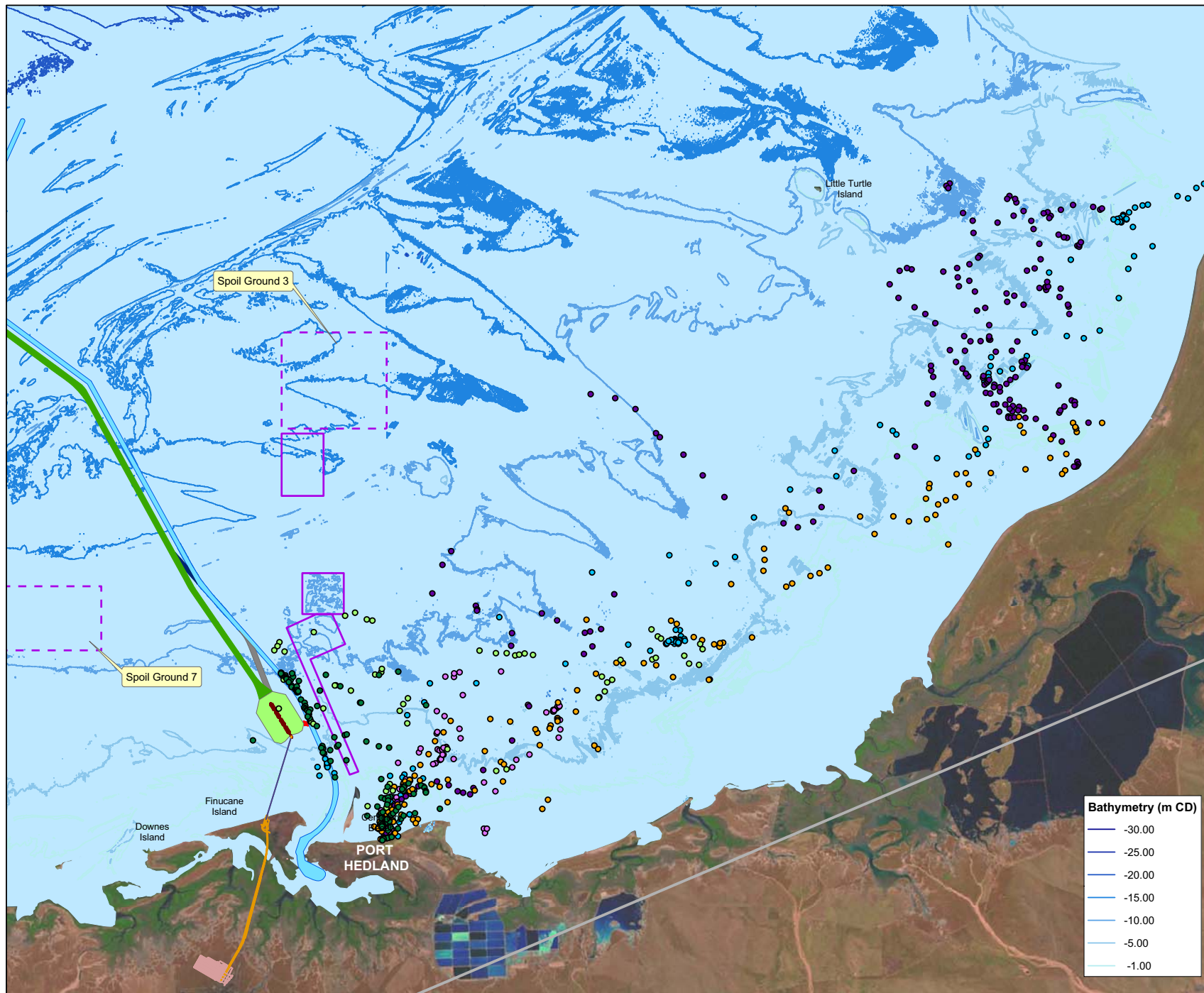
- Legend**
- Recorded Turtle Tracks (Pendoley Environmental, 2009)
 - Marine Turtle Study Area (Pendoley Environmental, 2009)
 - Spoil Ground (Existing)
 - Spoil Ground (Proposed)
 - Proposed Infrastructure
 - Proposed Stockyards
 - Proposed Departure Channel
 - Proposed Link Channel
 - Existing Shipping Channel



0 10 20
 kilometres
 Scale: 1:769,937 at A4
 Datum: GDA94
 Projection: MGA94 Zone 50

Source:
 Imagery: Landsat (2005)
 Topography: GEODATA Topo 250K V3
 © Commonwealth of Australia (GA), 2006

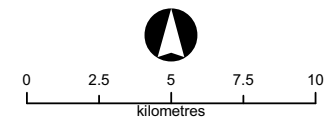
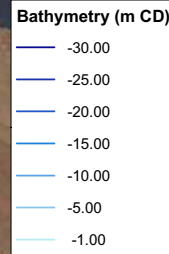
Figure 3.1 – Turtle Nesting Habitat Identified within the Port Hedland Region



Legend

- Tag 89762
- Tag 89761_2
- Tag 89761_1
- Tag 89760
- Tag 89759_2
- Tag 89759_1
- Proposed Departure Channel
- Proposed Berth Pockets and Swing Basins
- Proposed Link Channel
- Proposed Crossover Channel
- Existing Shipping Channel
- Proposed Tug Access Channel
- Spoil Ground (Existing)
- Spoil Ground (Proposed)
- Proposed Jetty
- Proposed Wharf
- Proposed Infrastructure Corridor
- Proposed Stockyards

Note: Data filtered to exclude speeds > 5 kts, topography > 1m, angles < 20 degrees. Includes LC 3, 2, 1, 0, A locations.



Scale = 1:185,000 at A3
Datum: GDA94
Projection: MGA94 Zone 50

Source:
Bathymetry: Tenix LiDAR (Nov 2007, April 2008)
Imagery: Landsat Mosaic (2005)
Topography: GEODATA Topo 250K V3
© Commonwealth of Australia (GA), 2006

Figure 3.2 – Preliminary Interesting Locations Identified for Four Flatback Turtles Tagged at Cemetery Beach

4 IMPACTS AND MANAGEMENT

4.1 OBJECTIVES AND KEY PERFORMANCE INDICATORS

The target environmental outcomes (key performance indicators) for this MTMP are:

State

- Although individual organisms may be impacted during the proposed Outer Harbour Development, impacts will not occur at the population or ecosystem levels.
- The EPA's objectives for the maintenance of abundance, diversity, geographic distribution and productivity of fauna at species and ecosystem levels, and improvement in knowledge, will be achieved.

Commonwealth

- No significant impact to any marine turtles listed as "Endangered" under the EPBC Act will occur
- No significant impact to any marine turtles listed as "Vulnerable" under the EPBC Act will occur

Note: With respect to the target environmental outcomes for listed marine fauna, 'significant impact' is defined as per the criteria provided within the EPBC act.

4.2 POTENTIAL IMPACTS

4.2.1 Dredging Entrainment and Disposal Burial

Dredging can affect marine turtles directly through injury or mortality through accidental intake and entrainment. Turtles are also at risk of being buried by the spoil disposal during dumping. The Outer Harbour Development proposes to undertake dredging using a combination of a Trailing Suction Hopper Dredge (TSHD) and a Cutter Suction Dredge (CSD). While CSDs do not move as quickly as TSHDs, suction forces at the rotating cutter head are similar. The dredging operations are proposed to occur over a 24 hour period using a TSHD and CSD vessel for an estimated duration of 4 years. Therefore, dredging may occur over at least four summer breeding seasons.

Internesting habitat for female flatback turtles nesting at Cemetery Beach is present within the proposed dredge and spoil disposal areas (Pendoley Environmental 2009). It was also found that the internesting flatback turtles were found to spend time within the existing shipping channel. However, the extent to which they utilise these areas and their behaviour during the internesting period are not fully understood. The remigration interval for flatback turtles is generally 1–3 years (Pendoley & Oates), indicating that the whole nesting population at Cemetery Beach may be exposed over the course of the dredging program.

Resident juvenile and adult turtles are also known to occur within the Outer Harbour Development. The field surveys confirmed that juvenile green turtles were common in creek mouths and over any shallow subtidal and intertidal habitat within the Port Hedland area. The most significant aggregations of resident foraging turtles are located further away from the Outer Harbour Development around the offshore islands and near the De Grey River.

Different dredge operation conditions pose differing levels of risk to internesting flatback turtles. The use of the CSD is considered a low risk, as no turtle mortalities have been reported with this dredge type (Dickerson et al. 2004). The use of the TSHD is considered a medium risk when being used in areas not favoured by marine turtles and/or outside the breeding season, and the use of the TSHD is considered a high risk in areas identified as habitat for marine turtles and/or during the breeding season.

4.2.2 Noise

Very little is known about the source levels and associated frequencies that cause physical injury or behavioural responses in marine turtles. Using the limited information available, it has been reported that physical injury and/or instantaneous permanent hearing damage to adult turtles is likely to occur at 240 dB re 1 μ Pa and behavioural and masking changes are likely to occur at levels above 120 dB re 1 μ Pa (SVT Engineering Consultants 2009). No supporting literature is available to determine levels of continuous noise that results in threshold hearing loss for marine turtles.

Underwater noise modelling and an assessment of potential impacts associated with construction activities on marine mammals have been undertaken for the Outer Harbour Development (Salgado Kent et al. 2009). The noise sources related to the Outer Harbour Development in order of predicted severity of underwater noise impacts are pile drivers, increased shipping and vessel traffic associated with harbour works and the dredges, typically the TSHDs (Salgado Kent et al. 2009). The equipment planned for use during construction has most of its energy below 1 KHz but the nature of the signals (impulsive vs. continuous) and the source levels are different. Noise levels recorded in a trial dredge program using a TSHD (McCauley 2006, Salgado Kent and McCauley 2006) indicated that broadband source levels could be as high as 180 dB re 1 μ Pa @ 1 m, with a drop off of signal strength to 140–147 dB re 1 μ Pa @ 1 m MSP at 200 m in an area with a steep sloping canyon dropping from ~20–100 m (Mustoe 2006). Source levels for pile driving are expected to range from a sound exposure level (SEL) of 207–209 dB re 1 μ Pa².s @ 1 m (Salgado Kent et al. 2009). Pile driving is proposed to occur over approximately 2 years.

Turtles are unlikely to experience injury or hearing loss from dredging noise. They are likely to show behavioural responses and avoid the area, however there is a possibility that they become habituated to the noise and remain within the vicinity for some period. Injury or threshold hearing loss in marine turtles may be caused by multiple pile driving pulses, particularly if animals are within metres of the source. The noise from pile driving during construction of the jetty is considered to pose a medium risk to marine turtles in the area, although it is considered that the regular pulses from piling activities may result in avoidance behaviour. It is acknowledged that little is known of the impact of noise on marine turtles.

4.2.3 Light Spill

Artificial lighting has the potential to reduce the reproductive success of marine turtles by deterring females from nesting beaches, and disorienting or misorienting hatchlings on the beach and at sea. Potential sources of light from the Outer Harbour Development include the permanent land-based facilities, permanent marine facilities as well as moored and operating dredging and export vessels (dredging is assumed to be 24 hour operations). A light assessment study has been undertaken for the Outer Harbour Development, including an assessment of the visibility of light from turtle beaches (Bassett 2009).

4.2.3.1 Nesting females

The closest nesting beach is Cemetery Beach (5 km to the east), which supports a moderate flatback rookery. The light assessment determined that Cemetery Beach will experience light from the proposed jetty, albeit less than moonlight.

During the construction period, lighting on ships and dredge vessels will also be visible from the beach. However, existing port development and cumulative modelling results shows that the order of magnitude in the illuminance value is the same; therefore it is unlikely that the Outer Harbour Development will provide any significant or detectable increase in effect on the nesting females. Experienced nesters are likely to continue to use the nesting beaches; it may be the first-time nesters (new recruits) that may be deterred from nesting.

4.2.3.2 Hatchlings on the beach

Upon emerging from the nest, turtle hatchlings crawl directly towards the sea. This sea-finding process is directed by several cues; light brightness, shape and form of the beach environment, and to a lesser extent beach slope (see Pendoley Environmental 2009 for review). Artificial lighting may adversely affect hatchling sea-finding behaviour in two ways; disorientation, where hatchlings crawl on

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circuitous paths; or misorientation, where they move landward, possibly attracted to artificial lights. The consequences of this disruption to sea finding are mortality resulting from increased exposure to predation, dehydration and exhaustion.

Anecdotal reports suggest that some flatback hatchlings on Cemetery Beach are currently being misoriented by light, however, the source of light is unknown and it is difficult to isolate the different light sources in the area. The light assessment determined that the western end of Cemetery Beach will experience light from the proposed jetty falling on the beach, albeit less than moonlight (Bassett 2009). During the construction period, lighting on ships and dredge vessels will be visible from the beach as a series of point sources. Given that hatchlings tend to ignore bright point sources of light, that Cemetery Beach is over 5 km away from the development and the level of existing lighting, the impact of light from the Outer Harbour Development is considered low to hatchlings on the beach.

4.2.3.3 Hatchlings in the ocean

Once into the water, hatchlings orientate by wave fronts and do not appear to rely on visual cues. Once flatback hatchlings enter the water it is assumed that they scatter in a fan-like pattern. It is considered possible that a small proportion of hatchlings may be exposed to the lights from the proposed wharf, jetty and vessels from the Outer Harbour Development as they swim offshore and become entrapped in the light spill, increasing predation risk and reducing hatchling survival rate.

Lighting from structures during construction and from vessels operating in the areas are considered low impacts to flatback turtle hatchlings due to the short-term nature of the impact and that vessels are a moving target and unlikely to entrap hatchlings which are typically carried away from their natal beaches by tides and currents.

4.2.3.4 Juveniles and adult resident turtles

The effect of artificial lighting of adult or juvenile turtles at seas is not known, although it is known that visual cues are used for navigation. Juvenile and adult turtles are known to occur within the Outer Harbour Development area as small aggregations of turtles have been observed off Downes and Finucane Island (Pendoley Environmental 2009). There is no information, published or otherwise, to suggest that light might have an impact on adults or juveniles.

4.2.4 Boat Strikes

Dredge vessels will be operating at approximately 2-4 knots during dredging and spoil disposal but will be travelling up to approximately 15 knots when sailing to the spoil disposal ground. All vessels must operate in accordance with PHPA requirements.

The risk to marine turtles from boat strikes increases with an increase in vessel speed, shallow water and reduced keel clearance. Boat strikes from construction and dredging vessels associated with the Outer Harbour Development is considered more likely to occur to marine turtles during construction due to higher vessel traffic (smaller vessels that can travel at higher speeds) and less likely during operations with larger vessels moving slowly.

4.2.5 Loss or Reduction in Habitat

The potential loss or reduction in quality of habitat may reduce available foraging and internesting habitats available for marine turtles. Existing seabed benthic communities at the wharf, berths, shipping channel and dredge spoil grounds will be lost directly through dredging or spoil disposal. Less than 10 % of the total dredge material will be original sea bed. Potential marine turtle habitat may also be lost indirectly through an increase in Total Suspended Sediments (TSS) in the water column.

It has been found that breeding female flatback turtles do utilise the proposed dredge and spoil disposal areas as internesting habitat, although it does appear to be limited (Pendoley Environmental 2009). However, it has also been shown that internesting flatback turtles from Cemetery Beach utilise the existing shipping channel as habitat, which suggests that additional internesting habitat may be created with the proposed shipping channel. There is likely to be some loss of internesting habitat, however, the potential impact to internesting females is considered low as other significant areas for internesting occur beyond the project area.

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The areas proposed for dredging and spoil disposal generally lacked any Benthic Primary Producers (BPPs; SKM 2009). The three preferred spoil ground locations have very little benthic cover; epifauna was observed at some locations and limited to small sponges and sea whips attached to rubble, feather stars clinging to sea whips and hydroids attached to small rocks (SKM 2009). These habitats are considered limited foraging habitat for turtles, although turtles were observed in these areas. These habitats are well represented elsewhere within the region, with important foraging grounds located around offshore islands (e.g. Little and North Turtle Islands) and the De Grey River mouth.

In addition, the Port Hedland area has naturally high levels of turbidity and periodic severe events associated with cyclones. Sediment fate modelling undertaken indicates that the potential zone of impact will be restricted to the areas immediately adjacent to the dredge and disposal areas as well as areas to the northeast and impacts to benthic marine habitat are likely to be minimal (APASA 2009). The potential impacts to foraging turtles are considered to be low, given the short to medium term effects of the increased turbidity levels. Turtles are likely to simply move to similar habitats that are well represented in the region.

4.2.6 Leaks and Spills

Leaks or spills of diesel, oil or chemicals into the intertidal or marine environment may prove toxic to marine turtles if ingested or in dermal contact. The external contact of marine turtles with leaked or spilt hydrocarbons may result in chronic or acute toxic action, in turn leading to impaired physiological function or death. Hatchling, post hatchling and juvenile flatback turtles are likely to be particularly vulnerable to oil spills given their usage of nearshore habitats and their large surface area to body mass ratio. Fouling of nesting beaches by hydrocarbons close to the Outer Harbour Development such as Cemetery Beach will affect eggs, hatchlings and females hauling ashore to nest if the leak/spill occurs during the nesting and hatching season. Resident juvenile and adult green turtles are also common in creek mouths and over any shallow subtidal and intertidal habitat within the Outer Harbour Development area.

A hydrocarbon spill is considered highly unlikely to occur given the strict industry standards and compliance. Given the standard management procedures and contingency plans that must be adhered to in order to comply with industry standards the potential impact is considered low to the local marine turtle population.

4.2.7 Liquid and Solid Waste Disposal

In the event that solid and liquid wastes are disposed of into the marine environment from marine vessels or infrastructure, marine turtles may be attracted to food scraps/sewage and may ingest solid wastes that are potentially harmful (e.g. polystyrene containers, plastic rubbish bags). Given the standard management procedures and contingency plans that must be adhered to in order to comply with industry standards the potential impact is considered insignificant to the local marine turtle population.

4.3 MANAGEMENT

4.3.1 Dredge Entrainment and Spoil Disposal Burial

4.3.1.1 Further Assessment of the Risk to Marine Turtles

Dredge entrainment and spoil disposal has been identified as a risk to internesting flatback turtles that may be present in the area. Obtaining a better understanding of turtle behaviour within the dredging and spoil disposal areas will aid in better defining and managing the risk to turtles.

Continuance of satellite tracking of nesting flatback turtles from Cemetery Beach will be conducted prior to construction activities to investigate their usage and behaviour within the dredging areas. In addition to the GPS satellites, temperature depth recorders (TDRs) will be attached to investigate the dive profiles and the amount of time spent on the bottom of the sea floor, as this is when they are most at risk of dredge entrainment.

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Systematic video transects, and concurrent boat-based observations were conducted during the 2009/2010 summer nesting season over the dredging and spoil disposal grounds to document the presence and abundance of turtles prior to the commencement of dredging. Detailed modelled benthic habitat mapping has been overlaid with data derived from satellite tracking to determine if females display any habitat preferences during internesting, which will also better define when dredging operations may be more or less of a risk.

4.3.1.2 Management Measures

The following management measures will be implemented to manage risk of impacts to marine turtles from the dredging operations:

General Management Measures

- Prior to commencement of construction, designated crew (one per vessel) will be trained as Marine Fauna Observers, and trained to observe for marine turtles and marine mammals, record sightings and the actions to be taken in event of sightings, injury or mortality.
- Site inductions for all vessel crew and awareness programmes covering procedures to be undertaken to minimise disturbance to marine fauna.
- If marine turtles are sighted in the area, relevant project vessels operating in the area will be notified.
- Operators of specified vessels will be required to maintain a watch for marine turtles and if they are spotted, vessels will avoid impacting the fauna (within safe operational constraints of the vessel).
- Any injuries or mortalities of marine turtles will be documented and reported to DEC/DSEWPaC.

CSD

- Within the operating constraints of the CSD, the dredge pumps will only be turned on when the cutter head is close to the sea bed.
- Within the operating constraints of the CSD, the dredge pumps will be turned off as soon as possible after the cutter head clears the sea bed (generally after the discharge pipe is clear).

TSHD Dredging Operations

- Upon arrival at the dredging location (each cycle) and prior to the commencement of dredging the area within 300m of the dredge (exclusion zone) will be visually inspected. If any marine turtles are sighted within the exclusion zone, dredging will not commence until the marine turtle has moved out of the exclusion zone or has not been sighted for 10 minute (note : the dredge may move location to ensure the turtle is out of the exclusion zone).
- The vessels MFO will maintain a watch for the marine turtles (during daylight hours) during the dredging operations. In the event that a marine turtle enters the exclusion zone during the dredging works, dredging operations will cease until the marine turtle is outside of the exclusion zone or has not been seen for 10 minutes.
- Within the operating constraints of the TSHD, dredge pumps will be turned on when the draghead is as close to the seabed as possible. On completion of dredging, the pumps will be turned off as soon as practicable possible (i.e. after the pipes are clear of dredged material).
- Subject to safe working practices, visual inspections of dredge hopper will be undertaken any observations of turtle remains will be reported.
- Turtle exclusion devices (tickler chains) will be used. The type of exclusion device utilised will be similar to that used on project throughout Western Australia.

TSHD Spoil Disposal Operations

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- Upon arrival at the spoil ground (each cycle) and prior to the commencement of disposal operations the area within 300m of the dredge (exclusion zone) will be visually inspected. If any marine turtles are sighted within the exclusion zone, disposal will not commence until the marine turtle has moved out of the exclusion zone or has not been sighted for 10 minutes (note : the dredge may move location to ensure the marine turtle is out of the exclusion zone).

4.3.2 Noise

Marine noise and vibrations during construction and operations will be managed by the following measures:

- All equipment and vessels should be operated and be maintained in accordance with appropriate industry and equipment standards including specifications for noise levels and manufacturer's specifications.
- Avoid, where possible, leaving engines and thrusters in standby or running mode unnecessarily.
- Regular monitoring will be conducted to assess compliance with noise and vibration levels.

The principal source of noise considered to pose the most risk to marine turtles is that produced during pile driving. Specific measures to manage noise during pile driving activities include:

- A trained MFO will be responsible for observing marine turtles during active piling at the piling site (e.g. on a jack up barge or adjacent support vessel).
- Vessel crew will undergo site inductions and clear briefings covering procedures to be undertaken to minimise disturbance to marine fauna provided by appropriately qualified personnel
- Existing acoustic controls on noise-generating equipment (including vessel engines, drill and piling equipment) will be implemented to reduce noise at source.
- Noise-generating equipment (including vessel engines, drill and piling equipment) will be routinely maintained and inspected to reduce unnecessary increases in noise levels from the equipment. All vessels shall operate in accordance with appropriate industry equipment noise standards.
- Where practical the practice of leaving engines, thrusters and auxiliary plant on standby or running mode will be avoided.
- If marine turtles are sighted in the monitoring area, project vessels operating in the area will be notified.
- Trained vessel crew will monitor and report observations of marine turtles within a designated monitoring zone (2500m radius of piling barge) around the pile driving operations. Observations are to be recorded on the Observation Record Form. In the event that a marine turtle is sighted within a designated exclusion zone (500m radius of the piling barge), piling activities will cease until the marine turtle moves outside of the exclusion zone or is not sighted for 20 minutes. Note: for reference, a 2000m exclusion zone applies for Marine Mammals (except dolphins).
- Carry out a "soft start" for pile driving by beginning a pile driving session with the lowest power possible and hammering at a low rate, then increasing hammer energy and rate to that desired. This should allow animals close to the source to move away and not be suddenly exposed to sound intensities sufficient to cause them serious injury.
- Any injuries or mortalities of marine turtles will be documented and reported to DEC/DSEWPaC.

4.3.3 Light Spill

Key management measures and guidelines specific to managing light spill and potential impacts to turtles that will be implemented where practicable include:

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- Minimise light intensity to as low as reasonably practicable in nearshore areas.
- Avoid use of white lights (e.g. mercury vapour, metal halide, halogen and fluorescent light) in proximity to turtle beaches. Use high pressure sodium lights where possible.
- Reduce lighting spill through shielding, directional alignment, window covering and other techniques.
- Reduce horizon glow through the use of downward facing luminaries, attention to reflecting surfaces and minimisation of external visibility of indoor lighting.
- Lighting on moored vessels at night will be kept to a minimum for safe operations.
- Periodic monitoring of the waters by trained vessel crew around dredge vessels during construction and around the jetty during operations for the presence of hatchlings.

4.3.4 Boat Strikes

Management measures for minimising the interaction of marine turtles with vessels during construction and operations include:

- Vessel crew will undertake site induction by appropriately trained project personnel.
- Vessel speeds will be under the control of the Vessel Master who will ensure that all vessels operate in a safe manner with due respect to ongoing operations, navigational constraints and environmental considerations.
- The Vessel Master will be advised of environmental matters from on-site environmental staff, including trained vessel crew, as applicable.
- Trained vessel crew will monitor and report turtle sightings from project vessels during daylight hours during the construction phase.
- Any incidents or injuries to turtles will be documented and reported to BHP Billiton Iron Ore who will report to DEC/ DSEWPaC as required.

4.3.5 Water Quality and Turbidity

A Dredging and Spoil Disposal Management Plan (DSDMP) will be prepared and implemented to minimise the potential effects of sediment plumes on marine habitats. Details of the proposed Water Quality Monitoring Program will be included in this management plan.

4.3.6 Hydrocarbon Leaks and Spills

Management, monitoring and reporting requirements for the use and storage of hydrocarbons during construction and operations will be in accordance with BHP Billiton Iron Ore's controls in place for Port activities. An oil spill on construction vessels associated with the Outer Harbour Development will be managed under the contractor's oil spill response Management Plan. An oil spill that enters the water will be managed by the Port Hedland Port Authority Oil Spill Contingency Plan.

4.3.7 Liquid and Solid Waste Disposal

Management, monitoring and reporting requirements for the disposal of wastes from construction and operations will be in accordance with BHP Billiton Iron Ore's controls and contingency procedures in place for Port activities.

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5 MONITORING AND INSPECTIONS

5.1 ECOLOGICAL MONITORING

5.1.1 Objectives

- Provide sufficient data to accurately determine the nesting population size of the Cemetery Beach flatback turtle rookery.
- Provide data from Cemetery Beach on individual reproductive behaviour, nesting population size, demographics, survivorship and recruitment.
- Provide better understanding of the use of the area proposed to be dredged by interesting turtles during the nesting season.

5.1.2 Methods

5.1.2.1 Flipper/PIT Tagging and Satellite Tracking at Cemetery Beach

Conduct flipper and Passive Integrated Transponder (PIT) tagging on nesting female flatback turtles at Cemetery Beach during the 2009/2010 flatback turtle nesting season (December/January) which will provide the basic biological data needed to determine the size of the nesting population and will provide solid evidence of any trends in turtle nesting over time and whether or not the turtle population is being impacted by project construction activities..

Further satellite tracking of nesting flatback turtles from Cemetery Beach will be conducted in the 2009/2010 flatback turtle nesting season to investigate their usage and behaviour within the dredging areas. In addition to the GPS tracking units, temperature depth recorders (TDRs) will be attached to investigate dive profiles and the amount of time spent on the bottom of the sea floor, as this is when they are most at risk of dredge entrainment. This information is critical to better managing the dredging program and reducing the potential impact to turtles.

5.1.2.2 Dredge Area Surveys

During the 2009/2010 flatback turtle nesting season conduct video transects of the sea-bed and surface surveys of the proposed project footprint and previously disturbed areas including the shipping channel and existing used spoil grounds to record turtle activity in these areas..

5.1.2.3 Aerial Survey

During the 2009/2010 flatback turtle nesting season undertake aerial survey of the coastline from De Grey river mouth to Mundabullangana Beach to map the turtle aggregations along the coast.

5.1.3 Reporting

Results and analysis of data collected during the 2009/2010 will inform this management plan, and be reported to support the Outer Harbour Development environmental impact assessment.

5.2 MONITORING OF TURTLE INJURIES AND MORTALITIES

5.2.1 Objectives

To monitor, record and report impacts of construction on marine turtle populations. This data will facilitate an annual review of construction impacts and impact controls.

5.2.2 Methods

The following monitoring and reporting methods will be undertaken:

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- Visual inspection of hopper loads for evidence of turtles and recording of observations to monitor for mortality of turtles. Certain operating conditions may preclude hopper inspections from being undertaken due to safety considerations.
- Any injured or dead turtles observed in-water during construction should be reported to BHP Billiton Iron Ore who will report to DEC/DSEWPaC as required.
- Sick or injured turtles may occur naturally within the area of proposed marine construction and/or dredging activities. Any sick or injured turtles observed by construction or dredging vessels will be recorded on the Marine Mammal and Turtle Observation Records form and reported to BHP Billiton Iron Ore who will report to DEC/ DSEWPaC as required.

5.2.3 Frequency

Monitoring of injuries or mortalities of marine turtles should occur prior to and during construction. Data collected prior to construction can be used as baseline data to determine if there is a change in frequency of reports during construction:

- Incidental data.
- Inspection of hopper loads during medium and high risk dredge operating conditions prior to emptying the dredge hopper at the spoil ground.

5.2.4 Reporting

Data collected of injuries and mortalities will be reported to BHP Billiton Iron Ore who will report to DEC/ DSEWPaC as required. Any incidents of injured or dead turtles that can be attributed to project-related activities will be investigated following BHP Billiton Iron Ore's Incident Investigation Procedure.

An annual review of observation data and incident reports will be undertaken by BHP Billiton Iron Ore, in consultation with a marine turtle specialist and dredge operators to enable consideration of the need for changes to turtle impact controls and management procedures.

6 REPORTING FRAMEWORK

6.1 ENVIRONMENTAL REPORTING

BHP Billiton Iron Ore will submit Annual Environmental Management Reports covering reporting requirements of this management plan.

6.2 ROUTINE INTERNAL REPORTING

A number of routine internal reporting formats will be used by BHP Billiton Iron Ore to effectively implement the requirements of this Plan. Routine reporting may include daily, weekly or monthly HES reports for specific scopes of work. These reports will include information such as details of environmental incidents (if any), environmental statistics and records, records of environmental audits and inspections, status of monitoring programs, tracking of environmental performance, etc.

6.3 INCIDENT REPORTING AND RESPONSE STRATEGY

6.3.1 Incident Reporting

BHP Billiton Iron Ore has an Incident Investigation Procedure, which it internally requires its employee and contractors to follow in the event of an environmental incident. This process will be applied to environmental incidents identified in this Plan where appropriate and reasonably practicable.

Any detected injury or mortality of any marine turtle listed as specially protected under the provisions of Section 14 (2) (ba) of the Western Australian *Wildlife Conservation Act 1950* shall be reported to the DEC and DSEWPaC within 48 hours of observation. The incident will be reported to the on-site

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BHP Billiton Iron Ore Environmental Supervisor who is then responsible for contacting DEC/DSEWPaC. Details of the incident including time and date of incident, cause of injury/ mortality and the species (if known) will be recorded and reported. Reports will be in electronic and hard copy format.

6.3.2 Incident Response Strategy

Adaptive management responses to marine turtle injury or mortality associated with proposal-related activities will follow BHP Billiton Iron Ore's Incident Investigation Procedure. This procedure will guide the management response, if required, in the event an injured or dead turtle is found. Following the implementation of any management actions associated with an incident, the effectiveness of the process and actions taken will be periodically reviewed. The results will guide adaptive management decisions and further actions if required.

In the event that two or more marine turtles suffer injury or mortality as a result of the dredging and spoil management activities:

- DSEWPaC and DEC will be notified within 48 hours as per existing reporting requirements;
- A review of current management measures shall be undertaken in consultation with a marine turtle expert to identify alternative or additional practical management measures that could be undertaken. While this review is undertaken, interim management measures to prevent possible source or sources of harm shall be implemented where practicable, to reduce the risks of further turtle injury or mortality. The measures that will be applied will be dependent on the circumstances surrounding the turtle injury/mortality.;
- Results of this review will be discussed with DSEWPaC and DEC within 14 days of the event.

6.4 REVIEW OF THIS PLAN

This MTMP will be reviewed on an annual basis and more often as required (for example, in response to new information) to ensure that the conditions and objectives outlined in this Management Plan are being met and fit for purpose. Reviews will address matters such as the overall design and effectiveness of the Plan, progress in environmental performance, changes in environmental risks, review of changes in environmental performance measures and actions, changes in business conditions, and any relevant emerging environmental issues.

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