

**CITIC PACIFIC MINING MANAGEMENT SINO IRON PROJECT**

**CAPE PRESTON MARINE TURTLE SURVEYS**

**JANUARY AND MARCH 2009**



**REPORT BY**

**PENDOLEY ENVIRONMENTAL PTY LTD**



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<b>Project manager:</b>	Dr Kellie Pendoley
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# 1 INTRODUCTION

## 1.1 Project Background

CITIC Pacific Mining Management Pty Ltd (CPMM) is operating the Sino Iron project, a large-scale magnetite iron ore project 85 km south west of Karratha, in Western Australia's coastal Pilbara region. The project has over 6 billion tonnes of identified and prospective magnetite resources with a potential 70 Mtpa production of high grade iron ore concentrate and pellets for 25 years and beyond. The project includes open cut mining and large scale downstream processing, and involves construction of significant infrastructure including a magnetite concentrator, pellet plant, port facilities at Cape Preston, power station, desalination plant, accommodation village and airport.

The Sino Iron Project was approved by the Minister for Environment in 2003 under Ministerial Statement No. 635. Condition 6 of the statement was the preparation and implementation of a Fauna Management Plan for the Sino Iron Project, in which there is a requirement to conduct turtle monitoring. Pendoley Environmental was commissioned by CPMM to conduct a baseline survey of marine turtles at Cape Preston, prior to developing the turtle monitoring programme. The results of the survey will be incorporated and utilised in the Fauna Management Plan.

## 1.2 Scope of Works and Objectives

Pendoley Environmental was commissioned by CPMM to undertake the following scope of works:

- Conduct a baseline survey of marine turtle species at Cape Preston (**Figure 1**) in accordance with methods described in the Fauna Management Plan (Strategen, 2008):
  - Identify significance of nesting beaches;
  - Water activity census in significant feeding areas;
  - Establish levels of predation on nests;
  - Determine abundance of nests on specific sections of beach over specified time intervals.
- Provide recommendations for future monitoring of marine turtles at Cape Preston; and
- Provide advice on selection of monitoring targets and trigger levels for the turtle monitoring programme.

The baseline survey targeted the four species of marine turtle that occur or potentially occur in the project area and included the green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), loggerhead turtle (*Caretta caretta*) and flatback turtle (*Natator depressus*).





Figure 1: Location of Project

## 1.3 Background Information

### 1.3.1 WA Species of Significance

Six species of marine turtles from two families (*Cheloniidae*, *Dermochelyidae*) inhabit West Australian waters. All six species are considered endangered or vulnerable and are protected by state and federal legislation and international organisations (**Table 1**).

Knowledge of loggerhead turtle populations within the study region is sparse. No large olive ridley turtle rookeries have been recorded in Australia, although low density nesting occurs in northern Australia.



Leatherback turtles are occasional visitors to Western Australian waters and have not been documented nesting.

Four marine turtle species, the green, flatback, hawksbill and loggerhead turtle, may potentially occur within the project area.

**Table 1: The conservation status of marine turtle species occurring in Western Australian waters**

Species	Wildlife Conservation Act 1950	EPBC Act 1999	CMS Appendix (as at June 2008)	CITES Appendix (as at 12 Feb 2008)	IUCN Status (as at July 2008)
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 imbricata</i>	Schedule 1	Vulnerable	I & II	I	Critically Endangered
Olive Ridley Turtle <i>Lepidochelys olivacea</i>	Schedule 1	Endangered	I & II	I	Endangered
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

\* Convention on Migratory Species (CMS) – protection by nations that are parties to conventions

\* Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) – controls international trade in listed species

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

### 1.3.2 Significant Habitats

#### Foraging Habitat

Foraging habitat varies among species and life stage. Post-hatchling green and hawksbill turtles use an oceanic nursery habitat and typically feed on small animal life associated with marine debris at convergence zones in the open ocean (Bjorndal, 1996, Witherington, 2002). The location and diet of flatback turtles during this life stage is not known, though it is thought to be confined to continental shelf waters (Walker and Parmenter, 1990).

Adult green turtles are predominately herbivorous, feeding on seagrass and algae, and are therefore most often found feeding on seagrass beds or, more frequently in the Pilbara waters, on reefs with abundant algal communities. Adult and juvenile flatback turtles feed predominantly on bottom-dwelling organisms (invertebrates) such as holothurians, sea pens and soft corals as well as jelly fish. Post



hatchling flatback turtles feed on macrozooplankton (Limpus, 2007). Loggerhead turtles typically feed on free living and sessile invertebrates such as crustaceans and molluscs, while juvenile and adult hawksbill turtles generally feed on sponges and other reef dwelling invertebrates (Bjorndal, 1996).

Algae dominated foraging habitat for green turtles occurs throughout the Pilbara coastal waters and is most evident on shallow rocky platforms surrounding islands and the mainland coast. Hawksbill foraging has been confirmed for the reef systems in the Mary Anne group and is expected to occur on all reef habitats in the Pilbara waters. Flatback foraging habitat has not been identified in Western Australia, however, preliminary satellite tracking programs suggest flatback turtles are foraging on yet to be identified food sources in waters 30 – 50m deep. Similarly, foraging habitat for post-hatchling flatback turtles has not been identified but is expected to occur across the continental shelf waters of the North West Shelf.

### **Mating Habitat**

Mating occurs within the marine environment either en route, or adjacent to, nesting beaches (Pendoley, 2005).

- Green turtles: Mating aggregations of green turtles are known to occur off Barrow, Thevenard, Serrurier and Montebello Island beaches during early summer (Pendoley, 2005; K. Pendoley, pers. obs.). No further mating habitat has been identified elsewhere in the Pilbara at this time. However, mating is expected to occur close to green turtle nesting sites in the nearshore mainland and coastal island waters.
- Hawksbill turtles: Mating of hawksbill turtles has been observed in shallow water off the nesting beaches at Rosemary and Delambre Islands (A. Vitenbergs, pers obs.) and off Varanus Island (K. Pendoley, pers obs).
- Flatback turtles: The location of mating grounds for flatback turtles in the Pilbara is unknown.
- Loggerhead turtles: The location of mating grounds for loggerhead turtles in WA is unknown.

### **Nesting Habitat and Reproductive Periods**

The following regionally significant nesting sites for the four species of marine turtles have been identified (Prince, 1994a; 1994b; Pendoley, 2005):

- Green turtle rookeries at Barrow Island, Serrurier Island, within the Montebello Island complex and at the Lacepede Islands;
- Hawksbill turtle rookeries at Rosemary Island in Dampier Archipelago, Beacon, Bridled and Varanus Islands in the Lowendal group, and Ah Chong Island and SE Island in the Montebello group;



- Flatback turtle rookeries at Barrow Island, within the Montebello Island complex, on Bridled and Varanus Island within the Lowendal Island complex, on Cowrie Beach on Mundabullangana Station, and at Eighty Mile Beach in the southern Kimberley region; and
- Loggerhead turtle rookery at the Muiron Islands. The Muiron Islands appear to be the northern limit of nesting for this species.

Nesting beach habitats most commonly associated with the three turtle species typically found in the Pilbara region has been described by Pendoley (2005) as follows:

- Hawksbill turtles are found associated with beaches located close to nearshore coral reefs and the beach sediment typically comprises a shallow bed of coarse sand and coral rubble (e.g. Beacon Island and Rosemary Island).
- Green turtles nest on high energy, steeply sloped beaches comprising deep well sorted medium grain sized sand, with a deep water approach to the beach independent of tide state (i.e. the intertidal zone is narrow or absent, e.g. west coast of Barrow Island and exposed beaches of North West and Trimouille Islands in the Montebello group).
- Flatback turtles favour low energy beaches that are typically narrow with moderate grain size and a low to moderate beach slope. The beach bed is often shallow (underlain by rock platform or clay) and the beach approach obstructed by broad intertidal mud or limestone intertidal platforms (e.g. east coast of Barrow Island, south coast of Thevenard Island and Mundabullangana).
- Loggerhead turtles favour sandy, wide, open beaches backed by low dunes and fronted by a flat sandy approach from the ocean.

It is worth noting that this description represents currently known preferred habitat only and is not exclusive of others types of unknown, less preferable or potentially less suitable habitat types.

Breeding seasons (encompassing mating, nesting and hatchling emergence periods) are different for individual species. Typical breeding seasons for the four marine turtle species are:

- Green turtles: November to April with peak nesting in December to January;
- Flatback turtles: November to March with peak nesting in December to January;
- Loggerhead turtles: October to March with peak nesting in late December; and
- Hawksbill turtles: August to April with peak nesting in October to November.

Low level year round nesting may also occur in hawksbill and green populations, though this varies from year-to-year.



### Interesting Habitat

The interesting habitat is the area that a breeding female turtle occupies between nesting events within a nesting season. During this time, while eggs for the next clutch are developing within the female she will not feed. For green and hawksbill turtles this habitat is typically located in shallow water within several kilometres of the nesting beach (Pendoley, 2005). Satellite tracking data show that flatback turtles use interesting grounds within 5 to 10km of their mainland nesting beaches (K. Pendoley, pers. comm.; <http://www.seaturtle.org/tracking>).

**Table 2: Summary of currently known habitat types for various life stages of marine turtle species identified within the Pilbara region**

Life Stage		Green turtle	Flatback turtle	Hawksbill turtle	Loggerhead turtle
Post-hatchling		Oceanic nursery/pelagic	Coastal waters	Oceanic nursery/pelagic	Oceanic nursery/pelagic
Adult	Mating	Offshore from nesting habitat.	Currently unknown in WA.	Offshore from nesting habitat.	Currently unknown in WA.
	Foraging	Neritic habitats associated with seagrass/algal beds and mangrove habitat.	Currently unknown in the Pilbara.	Shallow reef, patch reef habitat.	Subtidal and intertidal coral and rocky reefs, seagrass meadows and deeper, soft-bottomed habitats of the continental shelf.
	Nesting	High energy, steeply sloped beaches. Deep well sorted medium grain size. Deep water approach.	Low energy, narrow beaches. Moderate grain size. Low to moderate beach slope.	Shallow coarse sand and coral rubble associated with nearshore coral reefs.	Sandy, wide, open beaches backed by low dunes and fronted by a flat sandy approach from the sea.
	Interesting	Shallow coastal waters within several kms of the nesting beach.	Shallow nearshore coastal waters within 5-10km of nesting beach.	Shallow coastal waters within several kms of the nesting beach.	Shallow coastal waters within several kms of the nesting beach.

### 1.3.3 Previous Studies

The Austeel Biological Survey (Phase 1; HGM, 2000) documented signs of turtle nesting (body holes) on the northern end of the eastern side of Cape Preston, however, no identification was established. Adult/sub-adult turtles were also documented at “no-name” creek, the tidal creek south of Cape Preston.

Surveys conducted by the former Department of Conservation and Land Management (CALM; now Department of Environment and Conservation) in 2000, 2004 and 2006 found that the beaches did not appear to be significant turtle rookeries on a regional or national scale, although DEC stated that the beaches “may represent a significant marine turtle nesting resource”.



A survey of the Cape undertaken in October/November 2002 found no evidence of turtle nesting on either coast at this time (Pendoley *et al.*, 2003). A baseline survey conducted for Mineralogy during December 2002 and January 2003 identified extremely low density of turtle nesting on Cape Preston (Maunsell, 2004). The results are summarised in **Table 3**.

**Table 3: Summary of results from 2002/2003 baseline survey (Maunsell, 2004)**

	Green/Flatback tracks	Hawksbill/Loggerhead tracks	Old tracks/Uncertain ID	Old nests/body holes
<b>Eastern Beach</b>				
South	2	0	0	16
Central	1	0	0	4
North	0	0	0	0
<b>Western Beach</b>				
North	2	4	2	5
Central	1	0	0	1
South	1	0	0	0
Mangrove Beach	1	0	0	0
<b>TOTAL</b>	<b>8</b>	<b>4</b>	<b>2</b>	<b>26</b>

Results indicated that green turtles may favour the south-eastern beaches, while flatback turtles may favour the south-western beaches. The nearshore algal-rock benthic community was utilised as feeding habitat by large juvenile and sub-adult green turtles. Additionally, observations indicated that the nearby mangal and creek habitat was important for juvenile turtles.



## 2 METHODOLOGY

### 2.1 Field Surveys

The survey was undertaken between 2 and 7 January 2009 to coincide with the peak of the Pilbara green and flatback turtle nesting season (Pendoley, 2005). The survey was undertaken by Dr Jessica Oates, Ms Naysa Balcazar and Ms Verity Steptoe. A further survey was undertaken by Dr Jessica Oates on 26 March 2009 of the south-eastern beach. The western and eastern beaches of Cape Preston were divided into sections of beach based on previous surveys. The western side of the Cape was divided into Mangrove Beach, North, Central and South and the eastern side of the Cape was divided into North, Central and South (**Figure 2**).

A snapshot survey of the western coast (including Mangrove Beach) was conducted on 3<sup>rd</sup> January 2009 and part of the eastern coast of Cape Preston on 6<sup>th</sup> January 2009. The remaining section of beach along the eastern coast was surveyed on 26 March 2009. Track census surveys were conducted over a 1km transect on the western side that covered part of the north and central section between 3 and 6<sup>th</sup> January 2009 (**Figure 2**). These sections of beach were based primarily on accessibility and the level of nesting activity found during the snapshot survey.

The 'snapshot' survey of the beaches involved recording all nesting activity on the beach as well as the physical characteristics of the beach. This includes:

- Turtle tracks below high tide mark (BHT). These tracks indicate the number of animals attempting to nest since the overnight high tide. This is therefore an underestimation of the number of turtles traversing the beach overnight as it does not account for animals crawling up and down the beach before the high tide had come and gone and thereby sweeping the beach clean of all tracks.
- Turtle tracks above last high spring tide level (ALHST). This information provides an indication of the sea turtle activity on the beach in the recent past. This could be days to months depending on the metocean conditions (e.g. cyclones, storms and tidal surge will wipe the beach clean), along with the size, orientation and sediment characteristics of the beach. Secondary visual cues are also used to determine past nesting attempts, such as crab burrow holes through less-recent tracks, overlay of hermit crab, Perentie or bird tracks and erosion level of crawls.
- Observations of any turtles on the beach and in the water. The behaviour of the animals in the water provides an indication of habitat usage and might include mating aggregations, developmental habitat or foraging ground.
- Number of nests. It is not possible to be completely accurate about this figure since the only way to get an accurate figure is to dig up each nest and confirm the presence of eggs, and because on dense-usage beaches one body pit often overlays that of another turtle. Indicators



used to assess whether eggs have been laid include the size, shape and compaction of sand at the potential nest site, and track characteristics (where observable).

- Hatchling emergence. Nests emerging within the recent past, as seen by expanding 'fans' of hatchling tracks from a distinct source point. As stated for track counts this count is dependent on, and much more susceptible to the metocean conditions of the previous days and months.
- Nest predation. Nest predation is recorded for nests that clearly show evidence of animal foot prints and digging to egg/hatchling depth. Eggs, egg shell or hatchling remains may be visible. Occurrences of animals patrolling over a nest and stopping to scratch the surface are recorded as a 'sniff', typically this is by varanid lizards though bandicoot, bettong and fox may behave in a similar manner on beaches supporting these species.

The track census surveys of the sections of the North and Central western beaches involved drawing a line in the sand above the high tide mark the day prior to starting the track counts. Overnight track census counts were then conducted on the next three consecutive mornings (3-6 January 2009), recording all turtle tracks that crossed the line. Due to weather and access issues, the first morning of track counts (3 January 2009) could not be conducted. The line was redrawn daily and new counts made. Any new tracks were walked to determine whether the turtle laid a nest. Information including species of turtle, signs of predation, wind, weather and tide conditions was also recorded each day. The track census survey methodology used for this program is based on techniques developed for beach surveys within the Barrow/Montebello/Lowendal Island complex (Pendoley 2005) and consistent with IUCN SSC Marine Turtle Specialist Group methodology (Schroeder and Murphy, 1999).





**Figure 2: Cape Preston Beaches.**

Red lines indicate the division between the different beach sections. The yellow line indicates the location of the track census transect.



## 2.2 Limitations of the Surveys

The limitations associated with the marine turtle surveys of Cape Preston were:

- Sea turtle nesting is cyclic and consequently short-term studies such as this only provide information pertaining to that particular day and cannot be extrapolated out to represent what happens on a yearly basis.
- The timing of the survey was based on the peak nesting period for green and flatback turtles, therefore, any hawksbill nesting would not be recorded as peak nesting is earlier in the year during October.
- The length and location of the track census transect were limited by accessibility along the western side of Cape Preston and the extreme temperatures (up to 47°C) experienced during the survey.
- Track census surveys were not conducted on the eastern side and snapshot surveys of only the north and central sections were conducted in January 2009 as it was unable to be accessed by boat and vehicle access was also limited.
- A snapshot survey of the south-eastern beach was conducted in March 2009. This timing is outside the peak nesting season for turtles, however, it is towards the end of the peak hatching season and any emerged nests would be observed.
- The first morning of track counts was not conducted due to the field staff falling ill on the 3<sup>rd</sup> January and the extreme high temperatures predicted for that day.



### 3 RESULTS

Marine turtle nesting activity on Cape Preston was extremely low across all the beaches surveyed. Survey results are presented in **Table 4** and **Figure 3**.

**Table 4: Summary of January and March 2009 baseline marine turtle surveys**

	Flatback tracks	Green tracks	Old tracks	Old nests/ body holes	Predated nests	Hatchling tracks
<b>Eastern Beaches</b>						
North	0	0	0	0	0	0
Central	0	0	0	1	1	0
South	0*	0*	0*	3*	1*	1 (flatback)*
<b>Western Beaches</b>						
North	0	0	0	5	1	0
Central	0	0	0	8	1	0
South	2	1	2 (flatback)	7	1	0
Mangrove	0	0	0	0	0	0
<b>TOTAL</b>	<b>2</b>	<b>1</b>	<b>2</b>	<b>21</b>	<b>4</b>	<b>1</b>

\* – surveyed in March 2009

#### 3.1 Western Beaches

##### 3.1.1 Mangrove Beach

The snapshot survey of Mangrove Beach revealed no turtle nesting activity on the beach. This beach was not surveyed as part of the track census due to the absence of any observed activity.



### 3.1.2 North-western Section

During the snapshot survey of this section of beach, no tracks were observed, however there were five old craters. In addition one predated nest was observed, likely to have been due to a varanid lizard based on the tracks in and around the nest. Part of this beach section (the southern 300 m) was surveyed over the following three days as part of the track census, however, no further turtle activity was recorded. This beach is shown in **Plate 1** below.



**Plate 1: North-western beach section**



### 3.1.3 Central-western Section

During the snapshot survey of this section of beach, no tracks were observed, however there were eight old craters. In addition one predated nest was observed, due to a varanid lizard based on the tracks in and around the nest. Part of this beach section (the northern 800 m) was surveyed over the following three days as part of the track census, however, no further turtle activity was recorded. This beach is shown in **Plate 2** below.



**Plate 2: Central-western beach section**



### 3.1.4 South-western Section

During the snapshot survey of this section of beach, one overnight green track, two overnight and two old flatback tracks were observed. Seven old craters and one predated nest were also observed. A varanid lizard appeared to have predated the nest based on the tracks in and around the nest. This section of beach was not surveyed as part of the track census due to access limitations. This beach is shown in **Plate 3** below.



**Plate 3 : South-western beach section**



## 3.2 Eastern Beaches

### 3.2.1 North-eastern Section

The snapshot survey of this section of beach revealed no evidence of turtle nesting activity on the beach. This section of beach was not surveyed as part of the track census due to access limitations. This beach is shown in **Plate 4** below.



**Plate 4:** North-eastern beach section



### 3.2.2 Central-eastern Section

During the snapshot survey of this section of beach, one old crater and one predated nest (varanid lizard) were observed (**Plate 5**). No tracks were observed during the survey. This section of beach was not surveyed as part of the track census due to access limitations. This beach is shown in **Plate 6** below.



**Plate 5: Predated nest**



**Plate 6: Central-eastern beach section**

### 3.2.3 South-eastern Section



This section of beach was surveyed later than the other beaches (March 2009) due to access issues. During the snapshot survey of this section of beach, three old craters were observed. No adult turtle tracks and one flatback hatchling track were observed during the survey. This beach had a high density of fox tracks and one predated nest was observed. Seven adult and 15 juvenile green turtles were observed in the shallow water from the beach. This beach is shown in **Plate 7** below.



**Plate 7: South-eastern beach section**





**Figure 3: Results of snapshot surveys along western and eastern sides of Cape Preston.**

Note that the south section on the eastern side of the Cape was not surveyed. Red lines indicate the division between the different beach sections. The yellow line indicates the location of the track census transect.

Legend

- Light blue circles = old craters (numbers in brackets represent number of craters if more than one was found)
- Purple circles = predated nests
- Dark blue squares = old flatback tracks
- Red squares = overnight flatback tracks
- Green squares = overnight green tracks
- Orange diamonds = hatchling tracks



### 3.3 Predation

Lizard tracks (suspected *Varanus* lizard) were observed on all beaches surveyed. Fox tracks were observed on the northern sections of both the eastern and western beaches of the Cape. A total of four predated nests were observed, and all appeared to be predated by a varanid lizard based on tracks in and around the nests.

### 3.4 Opportunistic Observations

Non-systematic boat surveys frequently recorded juvenile green turtles were frequently observed often in the creeks to the south and to the south east of Cape Preston (Pendoley *et al.*, 2003). During the 2009 surveys boat surveys near the beaches were unable to be conducted due to restricted boat access. No turtles were observed in the waters off the western beaches during the January 2009 survey, however, the surveys were generally conducted at low tide and therefore there was little water available. A number of adult and juvenile green turtles were observed on the south-eastern beaches during the March 2009 survey. Dead juvenile green turtles were found washed up on Mangrove Beach and the northern section of the western beaches. The cause of these deaths is unknown.



## 4 CONCLUSIONS AND RECOMMENDATIONS

### 4.1 Conclusions

The recent survey confirmed that Cape Preston appears to support very low density nesting of flatback and green turtles based on turtle tracks. Previous surveys of the Cape have also concluded low levels of nesting activity by marine turtles. Nesting activity appeared to be concentrated in the central and upper southern sections of the western beaches. Previous surveys suggested that hawksbill turtles favoured the north-western beaches, green turtles favoured the south-eastern beaches and flatback turtles favoured the south-western beaches (Maunsell, 2004). The current survey did not reveal any strong patterns in species distributions along the beaches.

The beaches surveyed do not appear to be highly significant for nesting marine turtles. Numbers of turtles nesting were not in regionally or nationally significant numbers compared with other flatback turtle rookeries in the Pilbara region, for example, over 1700 flatback turtles nest annually at Mundabullangana, north-east of Cape Preston (Pendoley *et al.*, in press). This conclusion is supported by previous survey results, which report a similarly low incidence of nesting activity. The overall incidence of nesting activity (tracks and body holes) for all species was 34 occurrences in 2000 (CALM, 2000), 40 occurrences in 2002/2003 (Maunsell, 2004), zero occurrences in 2004 (CALM, 2005), 31 occurrences in 2006 (DEC, 2006) and 45 occurrences in 2009 (this report).

The timing of the survey prevents any conclusions regarding nesting activity of hawksbill turtles to be made. Hawksbill turtles have a peak nesting period earlier in the year (October) and it is possible that they may nest on Cape Preston but little evidence remained due to the nature of the sand they favour, erosion and other weathering processes. Evidence of hawksbill nesting, particularly at the northern end of the western beaches, has been recorded in previous surveys (Maunsell, 2004).

Although the area may have limited use for nesting, the area may be an important foraging ground. This is suggested by the observations of juvenile and sub-adult predominantly green turtles offshore of survey beaches in previous surveys and in the mangrove creek systems to the south and south-east of Cape Preston during this survey. Intertidal creek systems appear to be important habitat for juvenile green turtles in some environments. Moderate to high densities of juvenile green turtles have been recorded in the vicinity of Cape Preston and surrounding islands (Pendoley *et al.*, 2003). It is also possible that the nearshore intertidal area surrounding Cape Preston supports sub-juvenile flatback turtles who favour turbid, nearshore waters (Pendoley pers. comm., 2004).



## 4.2 Turtle Monitoring Program

It is recommended that a conservative approach to turtle management is adopted for the Cape Preston area given:

- Confirmed very low levels of nesting activity for green and flatback turtles; and
- The significance of benthic habitats to green turtles (juvenile and adult) for foraging and possibly sub-juvenile flatback turtles.

As such, as a minimum the following factors should be considered in relation to turtle management:

- Minimise disturbance to nesting beaches;
- Minimise disturbance to all mangrove communities in the area;
- Minimise and control recreational and industry use of boats within the creeks and nearshore waters;
- Prevent vehicular access to beaches;
- Minimise port and beach lighting as much as possible given OH &S considerations and use best available technology to manage lighting the area to prevent misorientation and disorientation of marine turtle hatchlings;
- Ensure that construction and operation of facilities is not conducted at peak nesting and hatchling emergence periods;
- Implement fox-baiting programs to aid in prevention of predation of hatchlings; and
- Develop and implement a sea turtle monitoring program.

The turtle monitoring program recommended is summarised in **Table 5** and discussed in detail below. The proposed schedule for the monitoring program is shown in **Table 6**.



Table 5: Turtle monitoring program and corrective actions

Item #	Activity	Frequency	Target	Corrective Action
1	Monitor and document light spill on beaches	Physical monitoring: Light audit at beginning of nesting season prior to and during construction, and post-commissioning.  Biological monitoring: Hatchling fan monitoring for two weeks at peak of hatching season in: <ul style="list-style-type: none"> <li>December/January for hawksbill hatchlings</li> <li>February/March for flatback/green hatchlings</li> </ul>	Nesting turtles and turtle hatchlings are not disturbed or misoriented by Project activities.	Identify cause of disturbance – light audit surveys.  Manage the light source.  If needed, develop further contingency plans, e.g. manual intervention.
2	Monitor for evidence of predation on nesting beaches	Weekly during turtle nesting and hatching seasons.	No more than 10% predation of nests by non-native predators i.e. foxes.	Increase feral animal control program.  Protect nests using grids, etc.
3	Monitor for evidence of unauthorised access to nesting beaches	Weekly during turtle nesting and hatching seasons.	No unauthorised access.	Incident report.  If needed, develop further contingency plans, e.g. increase education and awareness.
4	Conduct Turtle Biological Monitoring Program: <ul style="list-style-type: none"> <li>Adult nesting activity</li> <li>Hatchling fan monitoring</li> <li>Nest success</li> </ul>	Two weeks during: <ul style="list-style-type: none"> <li>October (hawksbill nesting)</li> <li>December/January (flatback/green adult nesting and hawksbill hatchling fan monitoring)</li> <li>February/March (flatback/green hatchling fan monitoring)</li> </ul>	Turtle Monitoring Program completed on annual basis.	Review monitoring program annually based on results.  If hatchling fan monitoring shows hatchling misorientation, manage light source.



#### 4.2.1 Item 1 – Monitor and document light spill on beaches

The light spill on nesting beaches and the potential impacts to adult and hatchling turtles should be monitored using two methods:

- Physical - A light audit survey should be conducted annually at the beginning of the nesting season (i.e. October) prior to construction, during construction and post-commissioning to determine if light spill may impact on nesting turtles; and
- Biological - Hatchling fan monitoring program as part of the Turtle Biological Monitoring Program should be conducted for two weeks during December/January (hawksbill hatchlings) and March (flatback/green hatchlings) each year to determine whether hatchlings are being disoriented by light spill from the Project (see Section 4.2.4 for more detail).

A physical light audit should be carried out prior to construction to document the baseline light field using photographic and instrumental equipment. Light will be quantified for long term comparative monitoring using a spectroradiometer and sky quality meter. Light audits should be carried out annually before the nesting season during construction and at least three years post-commissioning.

The hatchling fan monitoring can be conducted by trained on-site environmental staff daily for a two week period during the peak of the hawksbill hatchling (December) and flatback/green hatchling (February/March) emergence period. All nesting beaches on the Cape should be monitored and can be accessed using ATVs. Successful nests are recorded when five or more tracks are sighted. Fan spread and fan offset angles are measured to determine the extent to which hatchlings are being disoriented.

If hatchlings are found to be disoriented by light spill from the Project then contingency actions should be implemented to mitigate the determined impacts. These may include:

- Additional light audit surveys to determine the light source responsible;
- Manage the light source including can the light source be:
  - removed;
  - lowered;
  - shielded;
  - filtered;
  - changed for a longer wavelength;
  - wattage reduced;
  - redirected;
  - repositioned;
  - put on a motion sensor/timer.

If these measures are not effective then manual intervention may need to be considered, i.e. collecting the hatchlings and transferring them to a dark beach for release.



#### 4.2.2 Item 2 – Monitor for evidence of predation on nesting beaches

Evidence of predation on nesting beaches should be conducted weekly during the nesting and hatching periods (i.e. October to April). This can be done by on-site environmental staff patrolling the eastern and southern beaches on ATVs (or similar). Any evidence of predation would be recorded, including the species, number of nests, etc. If more than 10% of nests are found to be predated by non-native predators (i.e. foxes), then corrective actions should be implemented. Corrective actions may include increasing the feral animal control program and placing grids over nests to protect the eggs and hatchlings.

#### 4.2.3 Item 3 – Monitor for evidence of unauthorised access to nesting beaches

Evidence of any unauthorized access to nesting beaches should be monitored weekly by environmental staff during the nesting and hatching periods (i.e. October to April). Any unauthorised access of the eastern and southern beaches should be reported using an Incident Report and appropriate contingency actions should be developed and implemented. These actions may include barricades to prevent access, improve signage, review and improve educational activities, training and inductions.

#### 4.2.4 Item 4 – Turtle Biological Monitoring Program

The methodology and scope of the annual Turtle Monitoring Program should be finalised in consultation with the DEC. The aim of the Program is to determine the usage by turtle populations of the Cape Preston beaches and the impact on usage resulting from the Project. The surveys should be conducted to cover the peak nesting periods for the four most common species; the green, flatback, hawksbill and loggerhead turtles. The monitoring program should consist of:

- Track census survey of all nesting beaches on the southern and eastern sides for a two-week period in October and December/January to identify the relative significance of nesting beaches for each species, monitor populations and assess trends at key nesting beaches and to measure effectiveness of sea turtle management;
- In-water census in areas considered to be of significance to feeding turtles; and
- Hatchling fan monitoring and nest success survey for two weeks during the peak of hawksbill and flatback/green turtle hatching season (see Section 4.2.1 above).

The track census survey should be conducted across all nesting beaches on the southern and eastern side of the Cape for a two-week period in October to capture the peak nesting of hawksbill turtles and December/January to capture the peak nesting of green, flatback and loggerhead turtles. Given the low density of nesting recorded on the Cape, all beaches should be monitored to provide a more accurate picture of turtle usage on the Cape. The track census survey can be conducted daily by trained on-site environmental staff using ATVs to access the beaches. ATVs are commonly used in other programs for monitoring turtle nesting beaches and are essential for the safety of personnel working in the extreme heat of the Cape. The number of overnight tracks should be recorded as well as the species if known (or



a photo will be taken for later identification). Any new nests associated with tracks should also be recorded to determine the abundance of nests on sections of nesting beaches. Opportunistic observations such as any predated nests, emerged nests, etc should be recorded.

The in-water census survey should be conducted within the tidal creeks to the south and south-east of the Cape and offshore of the beaches for a week every year in the winter months. The survey would involve conducting fixed transects from a boat and recording the number, species and size of any turtles observed.

Training will be essential for the on-site environmental staff conducting the monitoring program and will be provided in the field by qualified biologists. Qualified marine turtle biologists will provide scientific advice and support to the field staff and oversee the management of the Turtle Monitoring Program.

The Turtle Monitoring Program should be implemented prior to construction and maintained for the duration of construction and two years post-construction depending on the results collected and review of the Turtle Monitoring Program. The Turtle Monitoring Program should be reviewed annually.

**Table 6: Proposed schedule for turtle monitoring program**

Activity	Oct	Nov	Dec	Jan	Feb	Mar	Apr-Aug
Light audit							
Adult hawksbill turtle track census							
Adult flatback/green turtle track census							
Hawksbill fan monitoring and nest success							
Flatback/green fan monitoring and nest success							
Predation and unauthorised access monitoring							
In-water surveys							



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