

Leighton Contractors  
(Asia) Limited

## Permanent Aviation Fuel Facility (EP-262/2007/B)

### Post-construction Marine Mammal Monitoring Report

7 April 2010

#### Environmental Resources Management

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## Permanent Aviation Fuel Facility for Hong Kong International Airport

### Environmental Certification Sheet EP-262/2007/B

#### Reference Document/Plan

Document/Plan to be Certified/ Verified:	Post-construction Marine Mammal Monitoring Report
Date of Report:	7 April 2010
Date prepared by ET:	7 April 2010
Date received by IEC:	7 April 2010

#### Reference EM&A Manual Requirement

EM&A Manual Requirement:	Section 8
Content:	<i>Dolphin Monitoring &amp; Mitigation Measures</i>
8.2.3	<p>A monitoring programme is required for during a period of 28 days prior to the operation of the PAFF. The period required for the post-construction monitoring is based on the monitoring conducted for the AFRF and is considered to be adequate to derive a reasonably large amount of data thereby allowing any significant trends in dolphin distribution to be detected (Jefferson pers. comm.). Six, one-day survey events will be undertaken within the 28 consecutive day period for the post-construction monitoring events.</p> <p>The monitoring should also be undertaken by a suitably qualified person (in biology) and should be independent of the construction contractor and should form part of the independent Environmental Team (ET). The IEC may audit the work of the ET if deemed necessary. Monitoring will be conducted following the methodology detailed below.</p>
8.2.4	<p>For the purpose of the EM&amp;A works, the "significance" level which will trigger the action plan shall be proposed by the ET as part of the post-construction monitoring programme design to be agreed with AFCD prior to the monitoring being undertaken.</p>
8.3	<p>Statistical procedures shall be used for data comparison. A range of applicable statistical procedures exist (e.g., t-test, ANOVA and ANCOVA, etc.) and the ET shall propose the procedure to be applied as part of the post-construction phase dolphin monitoring programme design to be agreed with AFCD prior to the monitoring being undertaken.</p>

#### ET Certification

I hereby certify that the above referenced document/~~plan~~ complies with the above referenced condition of EP-262/2007/B

Craig A Reid, Environmental  
Team Leader:



Date: 7 April 2010

### IEC Verification

I hereby verify that the above referenced document/~~plan~~ complies with the above referenced condition of EP-262/2007/B

Roger Leung, Independent  
Environmental Checker:



Date: 14 Apr 2010

Notes: EP-262/2007/B has replaced the former EP-262/2007/A, EP-262/2007 and EP-139-2002/A for the PAFF project after the resubmission of revised EM&A Manual and revised EIA Report respectively.

# Permanent Aviation Fuel Facility (EP-262/2007/B) Post-construction Marine Mammal Monitoring Report

7 April 2010


Prepared by: Francesca Zino/ Karen Lui/ Craig A Reid

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For and on behalf of  
Environmental Resources Management

Approved by: Craig A Reid

Signed:



Position: Environmental Team Leader

Date: 7 April 2010

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## EXECUTIVE SUMMARY

As part of the original Environmental Permit (EP-139/2002/A, Section 3.3) for the Permanent Aviation Fuel Facility (PAFF), both pre- and post- construction dolphin abundance monitoring are required for the project. Pre-construction dolphin monitoring (the baseline survey) was conducted over six days between 27 October and 1 November 2005, prior to commencement of construction activities in late November 2005. Construction of Phase 1a of PAFF completed on 20 March 2010. To comply with the EM&A requirement, post-construction monitoring of marine mammal abundance was undertaken between 22 March and 27 March 2010 prior to the operation of PAFF Phase 1a.

During post pre- and post- construction surveys, only one type of marine mammal, the Indo-Pacific Humpback dolphin (*Sousa chinensis*) or Chinese White Dolphin was observed. Humpback dolphin sightings were recorded on all survey days during both pre- and post-construction monitoring and throughout the entire Survey Area. Group sizes tended to be small throughout both pre- and post-construction monitoring and whilst all age classes of Humpback dolphins were recorded in the pre-construction marine mammal surveys, all except Unspotted Calves were recorded in the post-construction marine mammal surveys.

For both pre- and post- construction marine mammal monitoring, Humpback dolphins were recorded on all survey days and at different areas of the Survey Area. Results of the post-construction surveys show Humpback dolphin distribution to be predominantly concentrated north of Sha Chau Marine Park, with a smaller concentration to the west of Chep Lap Kok Airport. This differs to the pre-construction survey results which showed distribution concentrating off shore of Black Point, Sha Chau and Lung Kwu Chau Marine Park.

109 Humpback dolphin individuals were recorded from 38 on-effort sightings during pre-construction monitoring, whereas 44 individuals were recorded from 20 on-effort sightings during post-construction monitoring, with an additional sighting of seven individuals being recorded off-effort. While total number of on-effort sightings and individuals recorded were lower in post-construction monitoring than in pre-construction monitoring the variance of both sets of monitoring results is high and results of two-sample t-tests, using a 5% significance level, indicated that these variations between pre- and post-construction of PAFF were not significant.

Based on the results of the monitoring, it would appear that the construction of Phase 1a of PAFF does not appear to have had any adverse effects on the marine mammals in the vicinity. No further actions with regard to marine mammal monitoring are hence required, in accordance with the Action Plan in the *EM&A Manual*.

## CONTENTS

	<b>EXECUTIVE SUMMARY</b>	<b>I</b>
<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
<b>1.1</b>	<b>BACKGROUND TO THE STUDY</b>	<b>1</b>
<b>1.2</b>	<b>PURPOSE OF THIS REPORT</b>	<b>2</b>
<b>1.3</b>	<b>STRUCTURE OF THE DOCUMENT</b>	<b>2</b>
<b>2</b>	<b>POST-CONSTRUCTION SURVEY METHODOLOGY AND RESULTS</b>	<b>3</b>
<b>2.1</b>	<b>METHODOLOGY</b>	<b>3</b>
<b>2.2</b>	<b>RESULTS</b>	<b>7</b>
<b>3</b>	<b>SUMMARY &amp; CONCLUSION</b>	<b>15</b>

### LIST OF TABLES

Table 2.1	Summary of Equipment	6
Table 2.2	Results of on-effort Marine Mammal Surveys, Post-Construction between 22 March and 27 March 2010 (and Pre-Construction between 27 October and 1 November 2005)	8
Table 2.3	Age Class of Identified Humpback Dolphin <i>Sousa chinensis</i> Individuals. On-effort Data from Monitoring Post-Construction between 22 March and 27 March 2010 (and Pre-Construction between 27 October and 1 November 2005)	11
Table 2.4	A Summary and Description of Specific Types of Behaviour and Activities exhibited by Indo-Pacific Humpback Dolphin <i>Sousa chinensis</i>	12
Table 2.5	Statistical results of two-sample t-tests	14

### LIST OF FIGURES

Figure 2.1	Proposed and Actual Transect Lines for Post-Construction Marine Mammal Monitoring	4
Figure 2.2	Number of on-effort Sightings and Total Number of Individuals of Indo-Pacific Humpback Dolphin <i>Sousa chinensis</i> within the Survey Area (Data collected from 22 March to 27 March 2010)	8
Figure 2.3	Number of on-effort Sightings and Total Number of Individuals of Indo-Pacific Humpback Dolphin <i>Sousa chinensis</i> within the Survey Area (Data collected from 27 October and 1 November 2005)	9
Figure 2.4	Locations of Sightings of Indo-Pacific Humpback Dolphin <i>Sousa chinensis</i> within the Study Area (Data collected from 27 October to 1 November 2005 and 22 March to 27 March 2010)	10
Figure 2.5	Photographs of Humpback Dolphins <i>Sousa chinensis</i> captured during post-construction marine mammal monitoring between 22 March and 27 March 2010	13
Figure 2.6	Total number of sightings per day and total number of individuals recorded per day whilst on-effort (mean $\pm$ SD)	14

**LIST OF ANNEXES**

*Annex A Dolphin/Porpoise Sighting Sheet*

*Annex B Dolphin Sighting Data*

## 1.1 BACKGROUND TO THE STUDY

A Permanent Aviation Fuel Facility (PAFF) is required to ensure a secure means to supply aviation fuel during the operational lifetime of the Hong Kong International Airport (HKIA). The PAFF eliminates operations at the existing Aviation Fuel Receiving Facility (AFRF) adjacent to Sha Chau and supplies the HKIA. The PAFF has been designed to meet the capacity demand for the 2040 planning horizon of the HKIA and provide the required strategic storage and quality controls. The Airport Authority Hong Kong (AAHK) has been committed to expediting the PAFF, and after its completion the Sha Chau facility will be used for emergency backup purposes only.

The potential environmental impacts of the Project were studied in the Environmental Impact Assessment (EIA) Report "*Permanent Aviation Fuel Facility for Hong Kong International Airport*" (EIAO Register No: AEIAR-062-2002). The EIA was approved with conditions on 2 August 2002 under the *Environmental Impact Assessment Ordinance (EIAO)* and an Environmental Permit (EP-139/2002) associated with the construction works was granted on 28 August 2002. Due to minor changes to the detailed layout of the site and the site boundary, an application for a Variation to the Environmental Permit (VEP) (VEP-133/2004) was submitted to the Director of Environmental Protection (DEP) in January 2004 and the variation to the EP (EP-139/2002/A) was granted by the EPD in February 2004.

Pre-construction marine mammal monitoring took place between 27 October and 1 November 2005 and the construction works for PAFF, contracted to Leighton Contractors (Asia) Limited (LCAL), commenced in late November 2005. LCAL appointed ERM-Hong Kong, Limited (ERM) as the Environmental Team (ET) to implement the Environmental Monitoring and Audit (EM&A) programme for the Permanent Aviation Fuel Facility (the Project) during construction and operation works.

The decision by the EPD to grant the above Environmental Permit was, however, subject to a Judicial Review. The Judicial Review sided in the favour of the DEP, as did the subsequent Judgement from the Court of Appeal from the High Court for Judicial Review in March 2005. However, the DEP's decision to grant the EP was quashed by the Judgement of the Court of Final Appeal of July 2006 and construction works were stopped. By this time, all piling activities had been completed for the marine works.

In order to continue with the construction of the project, the project went through the statutory procedures under the EIAO again with a new design in order to obtain an environmental permit. The revised EIA was submitted in 2007 and the environmental permit (EP-262/2007) was granted in May 2007. The construction works and EM&A requirements were resumed on 9 July



2007 following the latest requirements of the *EP-262/2007/B* and the *EM&A Manual*.

Subsequently *EP-262/2007* was amended to *EP-262/2007/A*, issued by the EPD on 30 November 2007. A further Variation to the Environmental Permit was approved to allow dredging works to continue until March 2008 and as such, *EP-262/2007/A* was amended to *EP-262/2007/B*, issued by the EPD on 27 February 2008.

Construction of Phase 1a of PAFF completed on 20 March 2010 and to comply with the EM&A requirement, post-construction marine mammal monitoring was undertaken between 22 March and 27 March 2010 prior to the operation of PAFF Phase 1a.

## **1.2** *PURPOSE OF THIS REPORT*

As part of the EM&A programme, pre- and post-construction phase dolphin monitoring are required to evaluate whether there have been any effects on the animals as a result of the construction works.

This report presents the results of the post-construction phase dolphin monitoring and makes comparison with the pre-construction phase dolphin monitoring results.

## **1.3** *STRUCTURE OF THE DOCUMENT*

Following this introductory section, the remainder of the report is presented as follows:

- *Section 2* presents the methodology and results of the post-construction marine mammal surveys and makes comparison with results of the pre-construction marine mammal surveys, including the results of statistical data analysis;
- *Section 3* presents a brief summary of the report and the conclusion.

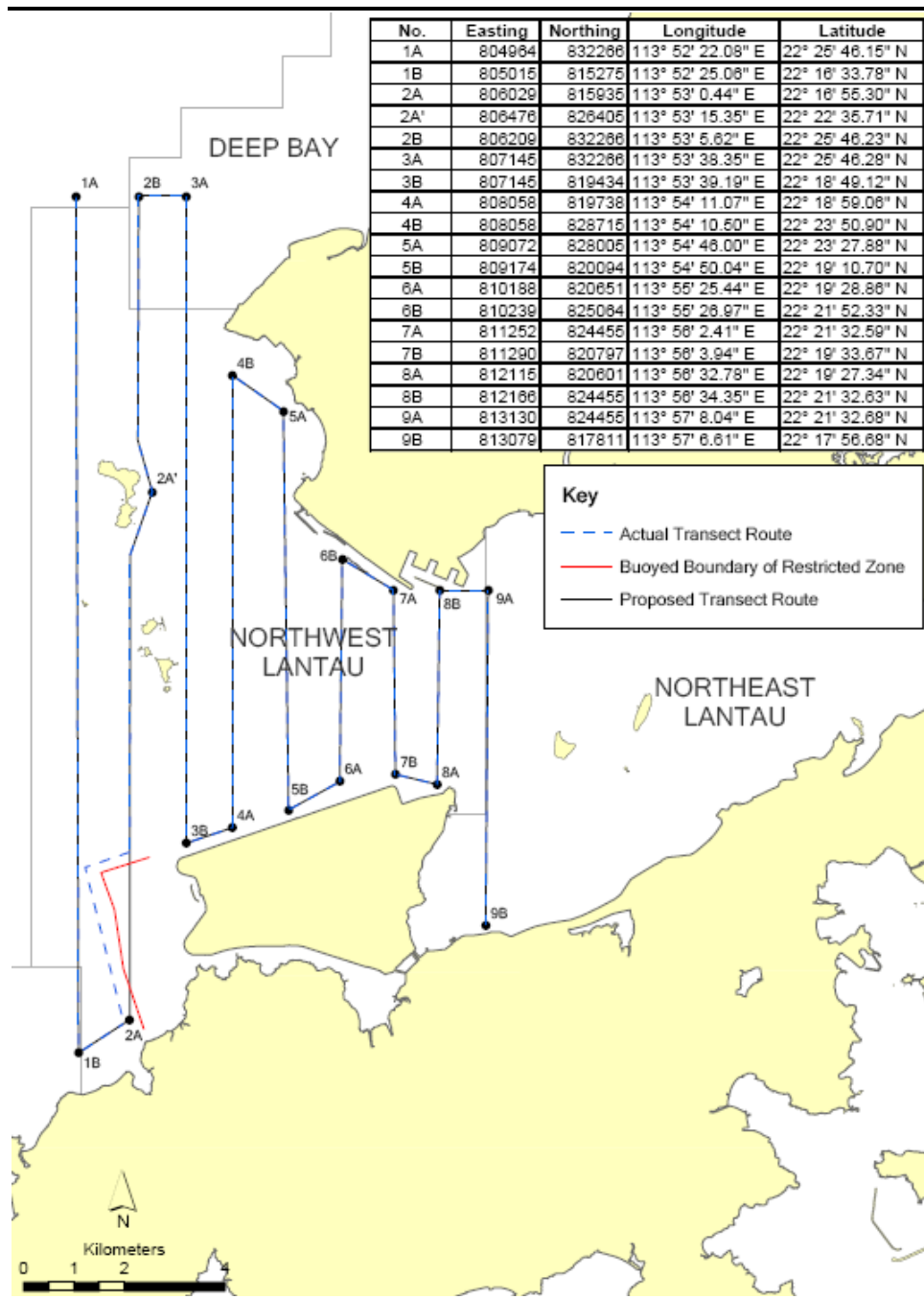
This *Section* presents the methodology and results of the post-construction marine mammal surveys. It makes comparisons between the pre- and post-construction monitoring results and presents statistical analysis of the two sets of data.

## 2.1 METHODOLOGY

### 2.1.1 Data collection

According to the *EM&A Manual* approved under the current EP (*EP-262/2007/B*), post-construction monitoring will consist of six, one-day survey events to be undertaken prior to the operation of the PAFF. In order to provide a suitable long-term dataset for comparison, post-construction monitoring employed the same methodology as far as possible, to that used in the pre-construction monitoring.

Line transect surveying techniques have now been standardised in Hong Kong Special Administrative Region Waters so that data from all surveys are directly comparable. Transect lines followed those reportedly used in the pre-construction dolphin monitoring as far as possible with some slight variation to the west of the airport around the buoyed restricted zone, as illustrated. The study area, with the proposed and actual transect lines, is presented in *Figure 2.1*.



**Figure 2.1** *Proposed and Actual Transect Lines for Post-Construction Marine Mammal Monitoring*

On each survey day, the survey vessel departed from Tuen Mun Marina Pier at 0830. Observation for incidental sighting began immediately upon departure from the assigned pier and continued until the vessel reached the survey area.

The survey vessel had an open upper deck, allowing for observer eye heights of approximately 4 m above water level and relatively unobstructed forward visibility between 270° and 90°. When on-effort, the vessel travelled along

the survey lines at a speed of approximately 7-8 knots (13 to 15 km/hr). The direction of the survey was alternated on different days to avoid possible biases related to the timing of the survey coverage.

Vessel-based transect observations by a three-person team were conducted by searching the 180° swath in front of the survey vessel (270° to 90°). The area behind the vessel was not searched, although dolphins observed there were recorded as off-effort sightings. A primary observer scanned the entire search path (270° to 90°) continuously with Brunton Marine 5002WMY (7x50) marine binoculars as the second member of the team, designated the data recorder, scanned the same area with the naked eye and occasional binocular check. The third observer on the boat rotated into the observation team after half an hour, thus relieving one of the initial team. Observers rotated every half an hour. While on-effort, observers were instructed to ignore potential sighting cues that could bias the sighting distance calibration (eg stern trawl fishing vessels).

As per the EM&A requirements, the monitoring was led by a suitably qualified person (degree in biology or marine sciences) who is independent of Leighton, and forms part of the independent Environmental Team (ET).

An important consideration in the survey was to ensure a strict timed quantification of 'sighting effort' in order to maximise the comparative value of the field survey results. The time and position for the start and end of a period of intensive, uninterrupted effort, and the sighting conditions such as visibility range and Beaufort scale associated with were all recorded. The collection of effort data allowed comparisons within a single study as well as between studies. Strict recording of time and speed travelling along the assigned transect (on-effort) was also recorded. Time spent during any deviation from the transect was recorded as 'off-effort'.

Provision was made for the survey to be postponed during periods of poor weather, when visibility was hindered (eg below 1km) or when Beaufort force was above 3 on average. Such conditions did not occur during the survey.

Sightings distant to 500m perpendicular distance and sightings of single dolphins that are hard to track were not pursued (with the possible exception of those distant to 500m ahead of the vessel). The initial sighting distance between the dolphin and the survey vessel and sighting angle were recorded in order to estimate the positions of the dolphins. These and other details of the sighting, including the exact location of the sighting and number of individuals were discussed on every occasion among the observation team and recorded immediately. Distances and angles were made as accurately as possible.

A global positioning system (GPS) was available on board and used during every field survey. A sighting record (*Annex A*) was filled out at the initial sighting with time, position, distance and angle data filled in immediately and verified between primary observer and recorder. All other information on

sea state, weather conditions (Beaufort Scale), as well as notes on the species, number, appearance and age classes (where possible) of the marine mammals, and any other information such as observed behaviours at the times of sightings and boat associations (if any), were completed at the end of the sighting.

A summary of equipment required for the post-construction dolphin monitoring is summarized in *Table 2.1*.

**Table 2.1** *Summary of Equipment*

Equipment	Type
Vessel for Monitoring	A monitoring boat with an upper deck with a relatively unobstructed forward visibility (270° – 90°) allowing for observer eye height of approximately 4m above water
Observation	Brunton Marine 5002WMY (7x50) marine binoculars with compass/reticule  Digital 35 mm SLR camera (Canon EOS 20D)  Telephotos lens (image stabilized) (Canon EF 300 mm f4 or 2.8 IS)  Compact flash memory cards
Calibration	Bushnell Yardage Pro Compact 800 laser range finder
Records	Clipboard
Navigation and Positioning	Hand held Global Positioning System Device (Garmin eTrex Legend®) (+ spare batteries)

### 2.1.2 *Statistical Analysis*

Two-sample t-tests were conducted to investigate if there was any significant variation in total number of dolphin sightings and total number of dolphin individuals recorded between pre-construction and post-construction periods. All data were collected in conditions of Beaufort force 3 or less and only records from on-effort observations were used for statistical analysis.

In accordance with the *Post-Construction Dolphin Monitoring Method Statement* agreed with EPD and AFCD, a 5% probability level was used as the criterion for rejection of the null hypothesis, ie the significance level <sup>(1)</sup>, and triggering of the Action Plan in the *EM&A Manual*.

Two-tailed hypotheses were tested to investigate whether there is any difference in the parameters between the pre- and post-construction monitoring periods. The two null and alternate hypotheses are presented below.

(1) Zar (1994) *Biostatistical Analysis* (4th Edition). Prentice-Hall, Inc. USA.

## Total number of dolphin sightings

$H_0$ : Total number of dolphin sightings <sub>pre-construction</sub> = Total number of dolphin sightings <sub>post-construction</sub>

$H_A$ : Total number of dolphin sightings <sub>pre-construction</sub>  $\neq$  Total number of dolphin sightings <sub>post-construction</sub>

## Total number of dolphin individuals

$H_0$ : Total number of dolphin individuals <sub>pre-construction</sub> = Total number of dolphin individuals <sub>post-construction</sub>

$H_A$ : Total number of dolphin individuals <sub>pre-construction</sub>  $\neq$  Total number of dolphin individuals <sub>post-construction</sub>

## 2.2 RESULTS

### 2.2.1 Survey Schedule and Transects

Post-construction phase dolphin monitoring was conducted during daylight hours for six days between 22 March 2010 and 27 March 2010. A small section of the proposed transect lines stated in the *Method Statement* overlapped with the buoyed area of the Airport Restricted Zone. The actual transect lines were therefore slightly modified as show in *Figure 2.1*. The pre-construction monitoring transects were also modified in this way, as stated in the results of the *Revised Baseline Review and Pre-Construction Phase Dolphin Monitoring Report*. Transect lines were followed as closely as possible, using onboard and handheld GPS systems for navigation, as well as visual markers.

### 2.2.2 Marine Mammal Abundance

The Indo-Pacific humpback Dolphin *Sousa chinensis* was the only marine mammal observed during the surveys. *Annex B* presents the detailed sighting data recorded during the surveys.

From on-effort recordings, there were 20 sightings of Humpback dolphins with a total of 44 individuals and there was one off-effort sighting where a group of seven individuals were observed. The number of on-effort sightings per survey day varied from a minimum of one to a maximum of six over the entire survey period and the number of individuals ranged from one individual to a group size of six individuals. While on-effort, the majority of Humpback dolphin groups observed (70.0%) were in group sizes of one to two individuals.

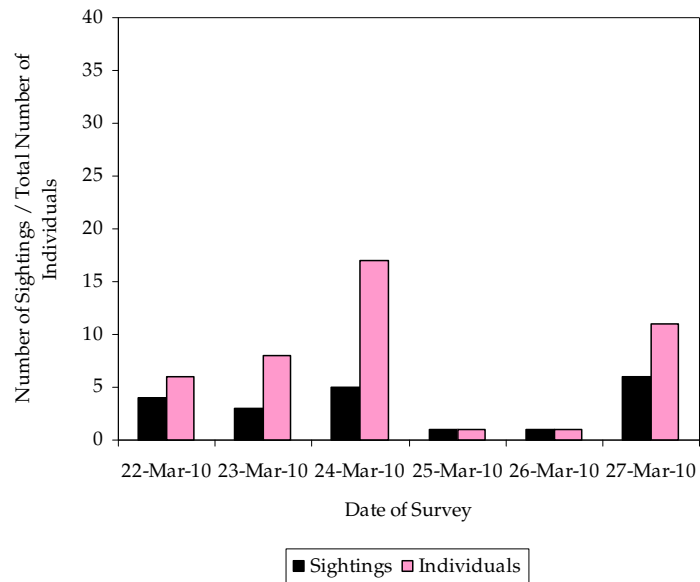
During the pre-construction marine mammal surveys, there was a greater abundance of Humpback dolphins, with a total of 109 individuals recorded from 38 sightings. For the number of individuals per sighting, similarly to the post-construction monitoring, the majority (over 55%) were in group sizes

of one to two individuals, and the range was from one individual to a group size of eight individuals.

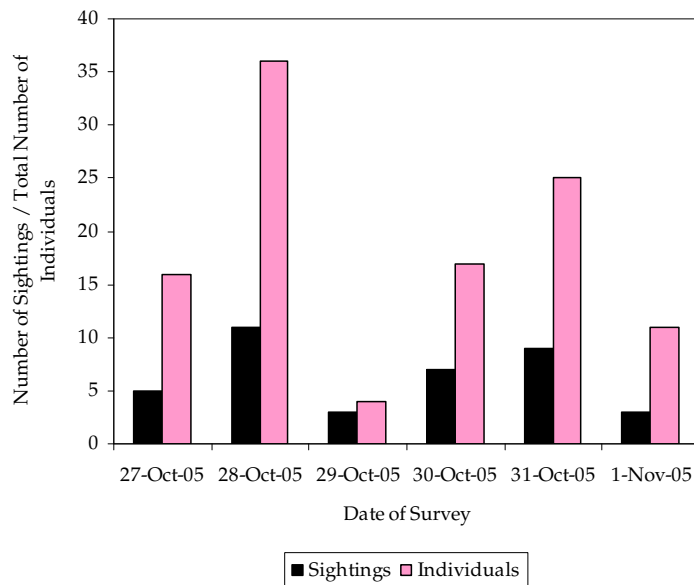
Daily records of marine mammal sightings for both the pre- and post-construction monitoring are summarised in *Table 2.2* and *Figures 2.2 and 2.3*.

**Table 2.2** *Results of on-effort Marine Mammal Surveys, Post-Construction between 22 March and 27 March 2010 (and Pre-Construction between 27 October and 1 November 2005)*

Date	Number of Sightings	Total Number of Individuals
Day 1 - 22 Mar 2010 (27 Oct 2005)	4 (5)	6 (16)
Day 2 - 23 Mar 2010 (28 Oct 2005)	3 (11)	8 (36)
Day 3 - 24 Mar 2010 (29 Oct 2005)	5 (3)	17 (4)
Day 4 - 25 Mar 2010 (30 Oct 2005)	1 (7)	1 (17)
Day 5 - 26 Mar 2010 (31 Oct 2005)	1 (9)	1 (25)
Day 6 - 27 Mar 2010 (1 Nov 2005)	6 (3)	11 (11)



**Figure 2.2** *Number of on-effort Sightings and Total Number of Individuals of Indo-Pacific Humpback Dolphin Sousa chinensis within the Survey Area (Data collected from 22 March to 27 March 2010)*

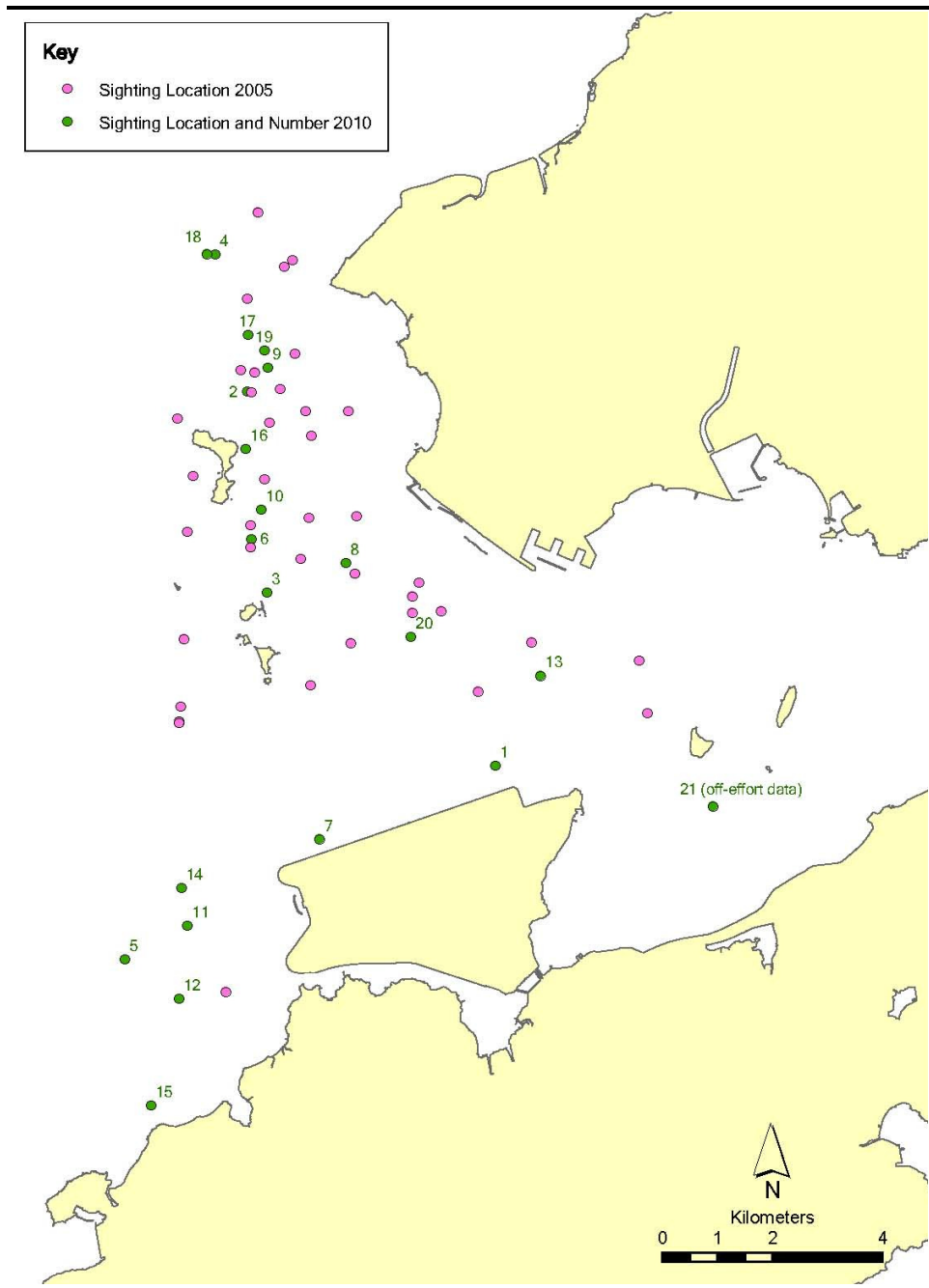


**Figure 2.3** *Number of on-effort Sightings and Total Number of Individuals of Indo-Pacific Humpback Dolphin *Sousa chinensis* within the Survey Area (Data collected from 27 October and 1 November 2005)*

### 2.2.3 *Marine Mammal Distribution*

For both pre- and post- construction marine mammal monitoring, Humpback dolphins were recorded on all survey days and at different areas of the Survey Area. *Figure 2.4* presents the dolphin distribution recorded during pre- and post-construction monitoring. Results of the post-construction surveys showed Humpback dolphin distribution to be predominantly concentrated north of Sha Chau Marine Park within the Study Area, with a smaller concentration to the west of Chep Lap Kok Airport. This differs to the pre-construction survey results which showed distribution concentrating only off shore of Black Point, Sha Chau and Lung Kwu Chau Marine Park.





**Figure 2.4** *Locations of Sightings of Indo-Pacific Humpback Dolphin *Sousa chinensis* within the Study Area (Data collected from 27 October to 1 November 2005 and 22 March to 27 March 2010)*

*Marine Mammal Age Class*

Humpback dolphins observed during the surveys were classified into age classes as accurately as possible, in accordance with the six classes identified by Jefferson (2000)<sup>(1)</sup> (Unspotted Adult, Spotted Adult, Spotted Subadult/Speckled, Spotted Juvenile/Mottled, Unspotted Juvenile and Unspotted Calf). The classification of age class is mainly based on their body size and length, skin colouring pattern, and density of spotting; their skin colour pattern changes dramatically throughout their lifespan, whitening as age increases and the spot patterns on juveniles and sub-adults disappear gradually as they get older.

Humpback dolphins of all age classes except Unspotted Calf were observed during the survey. The majority of dolphins observed while on-effort were recorded as Unspotted Adults (37 individuals, 84.1%). During pre-construction monitoring, all age classes were observed and largest age class (35% of identified individuals) were Spotted Adults. Age classes of identified individuals recorded during both pre- and post-construction monitoring are presented in *Table 2.3*.

**Table 2.3** *Age Class of Identified Humpback Dolphin Sousa chinensis Individuals. On-effort Data from Monitoring Post-Construction between 22 March and 27 March 2010 (and Pre-Construction between 27 October and 1 November 2005)*

Date	Unspotted Calf (UC)	Unspotted Juvenile (UJ)	Mottled (SJ)	Speckled (SS)	Spotted Adult (SA)	Unspotted Adult (UA)
Day 1 - 22 Mar 2010 (27 Oct 2005)		(1)	(3)	(1)	(4)	6 (1)
Day 2 - 23 Mar 2010 (28 Oct 2005)	(1)	1	1 (13)	(3)	1 (6)	5 (4)
Day 3 - 24 Mar 2010 (29 Oct 2005)				1 (1)	2 (1)	14
Day 4 - 25 Mar 2010 (30 Oct 2005)		(1)	(2)	(3)	(5)	1
Day 5 - 26 Mar 2010 (31 Oct 2005)	(4)	(1)	(3)	(3)	(6)	1
Day 6 - 27 Mar 2010 (1 Nov 2005)	(1)		2 (1)	(3)	1 (5)	10 (1)
<b>Total</b>	<b>0 (6)</b>	<b>1 (3)</b>	<b>3 (22)</b>	<b>1 (14)</b>	<b>4 (27)</b>	<b>37 (6)</b>

*Behaviour and Activities*

Marine mammals exhibit certain behaviours and for Humpback dolphins this has been previously characterised based on ongoing studies as presented in *Table 2.4*.







(1) Jefferson TA (2000) Population biology of the Indo-Pacific Humpback dolphin in Hong Kong waters. Wildlife Monographs 114:1-65

**Table 2.4** *A Summary and Description of Specific Types of Behaviour and Activities exhibited by Indo-Pacific Humpback Dolphin *Sousa chinensis**

Type of Social Behaviours and Activities	Descriptions
Travelling	Directional motion, swimming fast, taking regular breaths on water surface.
Feeding	Long jumping and high-speed chasing while hunting fish; On sea surface, swimming slowly rising intermittently before commencing the next dive. They may display certain behaviours such as feeding rushes, fish whacking, carousels, and fluking dives.
Milling/Resting	Remaining in one area without any sign of feeding or social interaction; move slowly with a drifting or gliding motion, rising slowly, or breathing while circling over the same area.
Socializing	Extensive bodily contact, inverted swimming, somersaulting, leaping and chasing with aerial activity; group activities centred on animate or inanimate objects; two to three individuals form a group.
Breaching	A behavioural pattern also known as body slamming or a 'log' jump. The animal rises out of the water at an angle between 90° to 45° to the sea surface. When exiting the water the dolphin's flippers, its abdomen or peduncle may clear the surface.
Spyhopping	Raising the head vertically out of the water, then sinking below the water without a splash. Used to check an area for hazards.
Porpoising	Fast, shallow, arching leaps with the dolphin coming either partially or entirely out of the water. It was only observed when the dolphins were boat chasing and allows the animals to combine shallow dives for fish with a fast rate of travel. The adults will show noticeable colour changes, turning from white to a deep pink. This is probably due to vascular dilation in the blubber layer and is, possibly, a flush response to prevent overheating.

Travelling, Feeding and Breaching activities were observed during on-effort post-construction monitoring and Socialising behaviour was observed in the one off-effort sighting. Five of the 20 on-effort sightings had association with fishing vessels, including P4, stern and shrimp trawlers. During the pre-construction monitoring, Breaching, Spy-hopping, Feeding, Porpoising and Socialising activities were observed and only two sightings had associations with fishing vessels, specifically shrimp trawlers.

Figure 2.5 shows a selection of photographs of Humpback dolphins recorded during the post-construction marine mammal surveys.

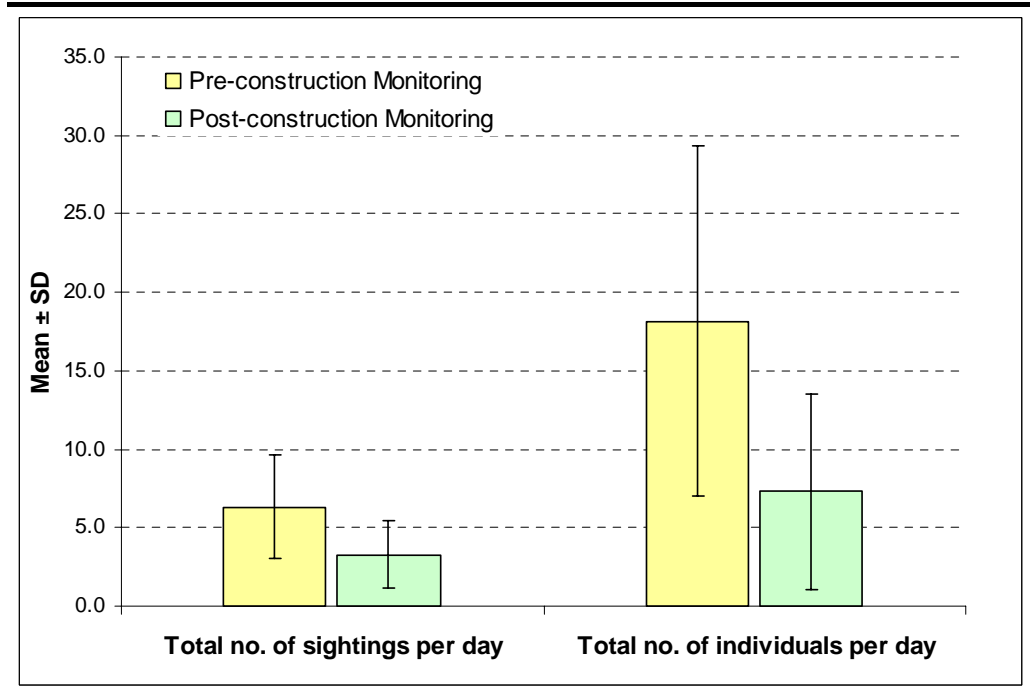
	
<p>Photo 1: Travelling Unspotted Adult and Spotted Juvenile/Mottled recorded on 23 March 2010 (Sighting 6).</p>	<p>Photo 2: Travelling Unspotted Adult recorded on 23 March 2010. (Sighting 6).</p>
	
<p>Photo 3: Travelling group recorded on 23 March 2010 (Sighting 7).</p>	<p>Photo 4: Travelling Spotted Adult and Unspotted Adult recorded on 23 March 2010 (Sighting 7).</p>
	
<p>Photo 5: Feeding and Travelling Unspotted Adult recorded on 27 March 2010 (Sighting 18).</p>	<p>Photo 6: Travelling Unspotted Adult with distinctive dorsal fin, recorded on 27 March 2010 (Sighting 19).</p>

**Figure 2.5** *Photographs of Humpback Dolphins Sousa chinensis captured during post-construction marine mammal monitoring between 22 March and 27 March 2010*

2.2.5

*Statistical analysis*

Figure 2.5 presents the mean total number of sightings and mean total number of individuals recorded during pre-construction and post-construction monitoring.



**Figure 2.6** *Total number of sightings per day and total number of individuals recorded per day whilst on-effort (mean ± SD)*

It appears that total number of sightings and total number of individuals recorded whilst on-effort, were both lower in post-construction monitoring than in pre-construction monitoring. Results of two-sample t-tests indicated that the variations were not significant in both parameters (Table 2.5).

**Table 2.5** *Statistical results of two-sample t-tests*

Parameters	df	t-Statistics two-tailed	p-value two-tailed
Total number of sightings	10	1.902	0.086
Total number of individuals	10	2.082	0.064

\*Data are homogenous as revealed by F-Tests ( $p > 0.05$ ).

Using a 5% probability level the null hypothesis is therefore accepted suggesting the PAFF construction works have had no adverse effects on the marine mammal abundance in the vicinity. No further action is required in accordance with the *EM&A Manual*.

Pre-construction monitoring was conducted from 27 October to 1 November 2005, during the autumn period (September to November), and construction of PAFF began in late November 2005. Marine piling activities were completed by July 2006 and further to this, dredging activities were carried out from December 2007 to March 2008, September 2008 to January 2009 and November 2009 to December 2009 with the construction of Phase 1a of PAFF, including the submarine pipeline, being completed in March 2010. During construction, mitigation measures to avoid disturbance to marine mammals were enforced. Post-construction monitoring was conducted from 22 March to 27 March 2010, during the spring period (March to May) prior to the operation of the Phase 1a.

109 Humpback dolphin individuals were recorded from 38 on-effort sightings during pre-construction monitoring, whereas 44 individuals were recorded from 20 on-effort sightings during post-construction monitoring, with an additional off-effort sighting of seven individuals. While total number of sightings and total number of individuals recorded were lower in post-construction monitoring than in pre-construction monitoring, the variance of both sets of monitoring results is high and results of two-sample t-tests, using a 5% significance level, indicated that the variation between pre- and post-construction of PAFF are not significant.

Based on the results of the monitoring, it would appear that the construction of Phase 1a of PAFF does not appear to have had any adverse effects on the marine mammals in the vicinity. No further actions with regard to marine mammal monitoring are hence required, in accordance with the Action Plan in the *EM&A Manual*.

Annex A

## Dolphin/Porpoise Sighting Sheet

# DOLPHIN / PORPOISE SIGHTING SHEET

## HIGH PRIORITY DATA (Record at Initial Sighting)

Date \_\_\_\_\_ Time \_\_\_\_\_ Sighting No. \_\_\_\_\_  
Sighting Distance (metres) \_\_\_\_\_ Sighting Angle (°) \_\_\_\_\_  
Sighting Angle - Dolphins \_\_\_\_\_ Sighting Angle - Bow of Boat \_\_\_\_\_  
Sighting Position (Initial) \_\_\_\_\_  
Sighting Position (dolphin) \_\_\_\_\_ (Trip: \_\_\_\_\_ km)

## LOW PRIORITY DATA (Record During or After Sighting)

**Species**  Humpback Dolphin **Effort**  On  
 Finless Porpoise  Off  
 Other

**Seen By** \_\_\_\_\_

**Group Size** Best \_\_\_\_\_ High \_\_\_\_\_ Low \_\_\_\_\_

**CWD\* Group Composition†** UC \_\_\_\_\_ UJ \_\_\_\_\_ SJ \_\_\_\_\_  
SS \_\_\_\_\_ SA \_\_\_\_\_ UA \_\_\_\_\_

**FP‡ Group Composition** Claves \_\_\_\_\_ Adults \_\_\_\_\_

**Beaufort**  0  1  2  3  4  5  6  7+

**Boat Assoc.**  None  Pair  Shrimp  Hang  
 Other \_\_\_\_\_

**Photos**  Yes  No

**Survey Area** \_\_\_\_\_

**Survey Type** \_\_\_\_\_

## BEHAVIOUR / COMMENTS

Feeding  Socializing  Travelling  Milling/Resulting  
 Breaching  Spy-hopping  Porpoising

**Other Behaviour** \_\_\_\_\_

**Identified Individual(s)** \_\_\_\_\_

**Other Comments** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

\* CWD = Chinese White Dolphin

† UC = Unspotted Calf, UJ = Unspotted Juvenile, SJ = Spotted Juvenile, SS = Spotted Sub-Adult, SA = Spotted Adult, UA = Unspotted Adult

‡ Finless Porpoise



Annex B

## Dolphin Sighting Data

Permanent Aviation Fuel Facility (PAFF) - Post-Construction Marine Mammal Monitoring from 22 March to 27 March 2010

Dolphin Sighting Records

Sighting No.	Date	Time	Survey Vessel Coordinates (N-Lat)	Survey Vessel Coordinates (E-Long)	Sighting Distance (m)	#Sighting Angle from Vessel (°)	Group size	Group Composition*	Beaufort	Boat Association	Behaviour	Other comments
1	22-Mar-10	10:04	22° 20.001'	113° 56.489'	1300	240	1	1UA	1	None	Breaching	Transect 8B to 8A
2	22-Mar-10	12:58	22° 23.220'	113° 53.194'	150	9	2	2UA	1	None	Travelling	Dolphins heading south. Just to the north of Lung Kwu Chau in the marine park. Transect 3B to 3A
3	22-Mar-10	13:57	22° 21.491'	113° 53.177'	500	125	1	1UA	2	Stern Trawler	Feeding	Following fishing vessel. Transect 2A' to 2A
4	22-Mar-10	16:08	22° 24.571'	113° 52.430'	750	80	2	2UA	2	None	Travelling	Transect 1B to 1A
5	23-Mar-10	10:50	22° 17.854'	113° 52.177'	480	245	1	1UA	1	Hang Trawler	Feeding	Following fishing vessel. Transect 1A to 1B
6	23-Mar-10	11:54	22° 21.819'	113° 53.178'	150	60	4	2UA, 1SJ, 1UJ	1	Stern Trawler	Travelling	Travelling in vicinity of fishing vessel. Transect 2A to 2A'
7	23-Mar-10	13:33	22° 18.911'	113° 54.061'	150	280	3	2UA, 1SA	1	None	Travelling	Travelling North to South. Swam past starboard side of survey vessel. At turning point of 4A, on transect 4A to 4B
8	24-Mar-10	11:33	22° 21.244'	113° 54.663'	1000	315	4	3UA, 1SS	2	None	Travelling	One dolphin smaller than the other, but hard to distinguish details. Transect 5B to 5A
9	24-Mar-10	11:57	22° 23.685'	113° 53.860'	800	250	2	2UA	2	None	Travelling	At turning point of 4B, on transect 4B to 4A
10	24-Mar-10	14:21	22° 22.280'	113° 53.237'	320	140	2	2UA	2	None	Travelling	Around 2A' on transect 2B to 2A
11	24-Mar-10	15:00	22° 18.200'	113° 52.643'	250	205	6	4UA, 2SA	3	None	Travelling	Possibly feeding. Transect 2A' to 2A, after rounding the end of the runway restricted zone, near 2A
12	24-Mar-10	15:31	22° 17.313'	113° 52.209'	500	80	3	3UA	2	None	Travelling	Dolphins heading south. Transect 1B to 1A
13	25-Mar-10	15:39	22° 20.175'	113° 56.531'	750	330	1	1UA	3	None	Travelling	Transect 8A to 8B
14	26-Mar-10	13:51	22° 18.541'	113° 52.576'	200	210	1	1UA	2	None	Travelling	Transect 2B to 2A
15	27-Mar-10	10:38	22° 16.364'	113° 52.131'	150	125	1	1UA	2	Shrimp Trawler	Feeding	Transect 1A to 1B
16	27-Mar-10	11:38	22° 22.730'	113° 53.335'	250	275	1	1UA	2	P4	Travelling	Very close behind P4 vessel. Near Lung Kwu Chau marine park. Transect 2A' to 2B
17	27-Mar-10	11:50	22° 23.931'	113° 52.995'	400	110	1	1UA	2	None	Breaching	Breached twice. Transect 2A' to 2B, near 2B
18	27-Mar-10	11:57	22° 24.615'	113° 52.958'	320	280	2	2UA	2	Stern Trawler	Feeding, Travelling	Following the fishing vessel. Transect 2A' to 2B, near 2B
19	27-Mar-10	12:22	22° 23.866'	113° 53.385'	300	180	4	3UA, 1SA	2	None	Travelling	Over 1km away from Lung Kwu Chau marine park. Transect 3A to 3B
20	27-Mar-10	14:35	22° 20.529'	113° 55.277'	900	320	2	2UA	2	None	Travelling	Travelling in a southerly direction. Transect 6A to 6B
21	27-Mar-10	15:56	22° 19.293'	113° 58.060'	150	120	7	5UA, 2SJ	2	None	Socializing, Travelling	<b>OFF EFFORT.</b> Travelling back from 9B to Central, near north eastern shore of Lantau
*Key:			# Compass bearing is used (North = 0 degree )									
UC = Unspotted Calf												
UJ = Unspotted Juvenile												
SJ = Spotted Juvenile												
SS = Spotted Sub-adult												
SA = Spotted Adult												
UA = Unspotted Adult												

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