MOTT MACDONALD

Agreement No. HMWSD 1/2019 (EP) Post-Construction Monitoring of Chinese White Dolphin (Line-transect Vessel Surveys) for the Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road at West Lantau Waters – Investigation

Monthly EM&A Report – January 2019

Highways Department

MOTT MACDONALD

Ramboll Hong Kong Limited
21st Floor, BEA Harbour View Centre
56 Gloucester Road
Wan Chai, Hong Kong

Attention: Mr. Manson Yeung – Independent Environmental Checker

Our Reference
GC/HY/jt/411565/L034

3/F International Trade Tower
348 Kwun Tong Road
Kowloon
Hong Kong

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Agreement No. HMWSD 1/2019 (EP)
Post-Construction Monitoring of Chinese White Dolphin (Line-transect Vessel Surveys) for the Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road at West Lantau Waters – Investigation

Monthly EM&A Report for January 2019

10 August 2020
By Email

Dear Sir,

In accordance with Condition 4.4 of the Environmental Permit (EP-352/2009/D) covering the captioned assignment, we are pleased to submit the certified Monthly EM&A Report for January 2019 for your verification.

Yours faithfully,
For Mott MacDonald Hong Kong Limited

Gary Chow
Environmental Team Leader

Encl.

cc.
Highways Department – Mr. Xavier Yam (By Email)

Ref.: HYDHZMBEEM00_0_8140L.20

10 August 2020

By Fax (3188 6614) and By Post

Highways Department
Major Works Project Management Office (Special Duties)
4th Floor, Ho Man Tin Government Offices
88 Chung Hau Street, Ho Man Tin, Kowloon

Attention: Mr David Chan

Dear Sirs,

Re: Agreement No. CE 48/2011 (EP)
Environmental Project Office for the
HZMB Hong Kong Link Road, HZMB Hong Kong Boundary Crossing Facilities, and Tuen Mun-Chek Lap Kok Link – Investigation

Agreement No. HMWSD 1/2019 (EP)
Post-Construction Monitoring of Chinese White Dolphin (Line-transect Vessel Surveys) for the Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road at West Lantau Waters - Investigation
Monthly EM&A Report for January 2019

Reference is made to the Environmental Team's submission of the Monthly EM&A Report for January 2019 certified by the ET Leader (ET's ref.: "GC/HY/jt/411565/L034" dated 10 August 2020) and provided to us via e-mail on 10 August 2020.

We are pleased to inform you that we have no adverse comments on the captioned submission. We write to verify the captioned submission in accordance with Condition 4.4 the Environmental Permit No. EP-352/2009/D.

Thank you very much for your attention and please feel free to contact the undersigned should you require further information.

Yours faithfully,
For and on behalf of
Ramboll Hong Kong Limited

Manson Yeung
Independent Environmental Checker
HZMB HKLR

c.c.	HyD	Attn.: Ms Karen Ho	(By Fax: 3188 6614)
	MMHK	Attn.: Mr Gary Chow	(By Fax: 2827 1823)

Internal: DY, YH, ENPO Site

Ramboll Hong Kong Limited 英環香港有限公司
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Executive Summary

This Monthly Environmental Monitoring and Audit (EM&A) Report is prepared for "Agreement No. HMWSD 1/2019 (EP) Post-Construction Monitoring of Chinese White Dolphin (Line-transect Vessel Surveys) for the Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road at West Lantau Waters – Investigation" (hereafter referred to as "the Assignment") for the Highways Department of Hong Kong Special Administrative Region (HKSAR).

This is the Monthly EM&A Report for the 3rd month of the post-construction phase of the Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road Project which summarises findings of the post-construction EM&A activities during the reporting period from 1 to 31 January 2019.

Environmental Monitoring and Audit Progress

A summary of the post-construction monitoring activities during the reporting period is listed as below:

- Chinese White Dolphin Monitoring (Line-transect Vessel Surveys): 4 and 8 January 2019

1 Introduction

1.1 Background of the Project

The Hong Kong-Zhuhai-Macao Bridge (HZMB) Hong Kong Link Road (HKLR) is a designated project under the Environmental Impact Assessment Ordinance (EIAO). The Environmental Impact Assessment (EIA) Report and Environmental Monitoring and Audit (EM&A) Manual (EIA Register No.: AEIAR-144/2009) for the project were approved by the Director of Environmental Protection in October 2009 and the Environmental Permit No. EP-352/2009 (EP) was issued in November 2009. The EP has been subject to several variations and the current one is EP No. EP-352/2009/D.

The HZMB HKLR was constructed under two works contracts namely Contract No. HY/2011/03 (HZMB HKLR – Section between Scenic Hill and Hong Kong Boundary Crossing Facilities (HKBCF)) and Contract No. HY/2011/09 (HZMB HKLR – Section between HKSAR Boundary and Scenic Hill). In accordance with the EP, the Contractors of Contract No. HY/2011/03 and Contract No. HY/2011/09 have separately employed their own Environmental Team (ET) and ET Leader to conduct construction phase monitoring of Chinese White Dolphin (CWD) in the North Lantau (NL) and West Lantau (WL) waters following the requirements specified in the EM&A Manual and the relevant contract specifications of the two contracts.

In accordance with Section 10.3 of the EM&A Manual, an ecological monitoring and audit programme is needed which will monitor potential impacts through construction and operation activities, and will verify the assessments which were made in the EIA report. In particular, the programme should include dolphin monitoring at NL and WL waters to be set up in order to verify the predictions of impacts and to ensure that there are no unforeseen impacts on the dolphin population during construction phase. Such dolphin monitoring should cover the pre-construction phase, the entire period of construction phase and after the completion of construction works (i.e. post-construction phase).

The main objective of the current Assignment commissioned by the Highways Department (HyD) is to conduct Post-Construction Monitoring of CWD in WL waters in compliance with the requirements stipulated in the EM&A Manual and the EP for the HZMB HKLR Project. The post-construction monitoring of CWD should be conducted for two years upon the completion of all marine-based construction activities.

The marine-based construction activities for the Contract No. HY/2011/09 was completed in October 2018. Subsequently, 10 months of post-construction dolphin monitoring (from November 2018 to August 2019) had been carried out by the Contract, while the remaining 14 months of post-construction dolphin monitoring (from September 2019 to October 2020) will be completed under this Assignment. In August 2019, Mott MacDonald Hong Kong Limited was appointed by the HyD to undertake the Environmental Team (ET) services for this Assignment for the post-construction monitoring of CWD in WL waters for the HZMB HKLR Project.

This is the Post-construction Phase Monthly EM&A Report for the 3rd month of the post-construction phase of the Project summarising the findings of the post-construction EM&A activities during the reporting period from 1 to 31 January 2019 and is submitted to fulfil Condition 4.4 of the EP.

1.2 Project Organisation

The project organisation and lines of communication with respect to the environmental management structure are shown in **Appendix A**. The key personnel contact names and numbers are summarised in **Table 1.1**.

Table 1.1: Contact Information of Key Personnel

Party	Position	Name	Telephone	Fax
Permit Holder (HyD)	Engineer	Ms. Karen Ho	2762 4979	3188 6614
Environmental Project Office / Independent Environmental Checker (Ramboll Hong Kong Limited)	Environmental Project Office Leader	Mr. Y H Hui	3465 2888	3465 2899
	Independent Environmental Checker	Mr. Ray Yan	3465 2836	3465 2899
Environmental Team (Mott MacDonald Hong Kong Limited)	Environmental Team Leader	Mr. Gary Chow	2828 5874	2827 1823

1.3 Environmental Status and Programme

As described in Section 1.1, the current Assignment is under the post-construction phase of the HZMB HKLR Project with all marine-based construction activities completed, thus there were no construction works involved.

The CWD monitoring programme covers all transect lines in WL survey area (refer to **Figure 1**) for twice per month throughout the entire post-construction monitoring period for two years. The current reporting period is the 3rd month of the post-construction CWD monitoring.

The CWD monitoring schedule during this reporting period and schedule of the planned CWD monitoring works in the next reporting period are provided in **Appendix C**.

2 Chinese White Dolphin Monitoring

2.1 Monitoring Requirements

According to the requirement stated in the EM&A Manual, a CWD monitoring programme was set up to conduct surveys for twice per month adopting the line-transect vessel survey method and covering the following transect lines in the West Lantau (WL) survey area as in the AFCD long-term marine mammal monitoring programme.

The CWD monitoring works were undertaken by a dedicated survey team comprising qualified dolphin specialist and experienced CWD surveyors. The qualified dolphin specialist was approved by the AFCD and EPD.

2.2 Monitoring Locations

The location of the WL survey area and all transect lines are depicted in **Figure 1**. The co-ordinates of all transect lines are shown in **Table 2.1**.

Table 2.1: Co-ordinates of Transect Lines in WL Survey Area

Line No.		Easting	Northing	Line No.		Easting	Northing
1	Start Point	803750	818500	7	Start Point	800200	810450
1	End Point	803750	815500	7	End Point	801400	810450
2	Start Point	803750	815500	8	Start Point	801300	809450
2	End Point	802940	815500	8	End Point	799750	809450
3	Start Point	802550	814500	9	Start Point	799400	808450
3	End Point	803700	814500	9	End Point	801430	808450
4	Start Point	803120	813600	10	Start Point	801500	807450
4	End Point	801640	813600	10	End Point	799600	807450
5	Start Point	801100	812450	11	Start Point	800300	806500
5	End Point	802900	812450	11	End Point	801750	806500
6	Start Point	802400	811500	12	Start Point	801760	805450
6	End Point	800660	811500	12	End Point	800700	805450

2.3 Monitoring Methodology

2.3.1 Line-transect Vessel Survey

The following monitoring protocol is consistent and compatible with the baseline and construction phase dolphin monitoring methodology, which was also designed and adopted by the Hong Kong Cetacean Research Project (HKCRP) team for the HZMB monitoring since 2011.

The survey team used standard line-transect methods (Buckland et al. 2001) to conduct the systematic vessel surveys, and followed the same technique of data collection that has been adopted over the past two decades of marine mammal monitoring surveys in Hong Kong developed by HKCRP (see Hung 2018, 2019). For each monitoring vessel survey, a 15-m inboard vessel with an open upper deck (about 4.5 m above water surface) was used to make observations from the flying bridge area.

Two experienced observers (a data recorder and a primary observer) made up the on-effort survey team, and the survey vessel transited through different transect lines at a constant speed of 13-15 km per hour. The data recorder searched with unaided eyes and filled out the datasheets, while the primary observer searched for CWD continuously through 7 x 50 *Fujinon* marine binoculars. Both observers searched the sea ahead of the vessel, between 270^{o} and 90^{o} (in relation to the bow, which is defined as 0^{o}). One to two additional experienced observers were available on the boat to work in shift (i.e. rotate every 30 minutes) in order to minimize fatigue of the survey team members. All observers are experienced in small cetacean survey techniques and identifying local cetacean species.

During on-effort survey periods, the survey team recorded effort data including time, position (latitude and longitude), weather conditions (Beaufort sea state and visibility), and distance travelled in each series (a continuous period of search effort) with the assistance of a handheld GPS (*Garmin eTrex*). Data including time, position and vessel speed were automatically and continuously logged by a handheld GPS throughout the entire survey for subsequent review.

When dolphins were sighted, the survey team would end the survey effort, and immediately record the initial sighting distance and angle of the dolphin group from the survey vessel, as well as the sighting time and position. Then, the research vessel would be diverted from its course to approach the animals for species identification, group size estimation, assessment of group composition, and behavioural observations. The perpendicular distance (PSD) of the dolphin group to the transect line would later be calculated from the initial sighting distance and angle.

Survey effort being conducted along the parallel transect lines that were perpendicular to the coastlines (as indicated in **Figure 1**) was labelled as “primary” survey effort, while the survey effort being conducted along the connecting lines between parallel lines was labelled as “secondary” survey effort. According to HKCRP long-term dolphin monitoring data, encounter rates of CWD deduced from effort and sighting data collected along primary and secondary lines have been similar in survey areas around Lantau Island. Therefore, both primary and secondary survey effort were presented as on-effort survey effort.

Encounter rates of CWD (number of on-effort sightings per 100 km of survey effort) were calculated in WL survey area in relation to the amount of survey effort conducted during each month of monitoring survey. Only data collected under Beaufort 3 or below condition would be used for encounter rate analysis. Dolphin encounter rates were calculated using primary survey effort alone, as well as the combined survey effort from both primary and secondary lines.

2.3.2 Photo-identification Work

When a group of CWD was sighted during the line-transect survey, the survey team would end effort and approach the group slowly from the side and behind to take photographs of them. Every attempt was made to photograph every dolphin in the group, and even photograph both sides of the dolphins whenever possible, since the colouration and markings on both sides may not be symmetrical.

At least one professional digital camera (Canon EOS 7D model) equipped with long telephoto lens (100-400 mm zoom) was available on board for researchers to take sharp, close-up photographs of dolphins as they surface. The images were shot at the highest available resolution and stored on Compact Flash memory cards for downloading onto a computer.

All digital images taken in the field were first examined, and those containing potentially identifiable individuals were sorted out. These photographs were then examined in greater detail, and were carefully compared to the existing CWD photo-identification catalogue maintained by HKCRP since 1995. CWDs can be identified by their natural markings, such as nicks, cuts, scars and deformities on their dorsal fin and body, and their unique spotting patterns can also be used as secondary identifying features (Jefferson 2000).

All photographs of each individual were then compiled and arranged in chronological order, with data including the date and location first identified (initial sighting), re-sightings, associated dolphins, distinctive features, and age classes entered into a computer database.

2.4 Monitoring Results

2.4.1 Line-transect Vessel Survey

Two sets of systematic line-transect vessel surveys were conducted on 4 and 8 January 2019, to cover all transect lines in WL survey area twice. The survey routes of each survey day are presented in Figures 2 to 3 of **Appendix B**.

A total of 67.36 km of survey effort was collected, with 100% of total survey effort being conducted under favourable weather conditions (i.e. Beaufort Sea State 3 or below with good visibility), as detailed in **Appendix B**. Out of the 67.36 km of survey effort, the total survey effort conducted on primary lines was 44.43 km, while the effort on secondary lines was 22.93 km.

During the monitoring surveys conducted in January 2019, five groups of 10 CWDs were sighted. All five dolphin groups were sighted during on-effort search, but only one of the sighting was made on the primary line (refer to sighting data presented in **Appendix B**). None of these dolphin groups was associated with operating fishing vessel.

Distribution of the dolphin sightings made in the reporting period is shown in Figure 4 of **Appendix B**. Four of the five dolphin groups were sighted in the middle portion of WL survey area (to the west of Kai Kung Shan), while one group was sighted a few kilometres to the northwest of Tai O Peninsula. Notably, none of the dolphin groups were sighted near the HKLR alignment.

Encounter rates of CWD deduced from the survey effort and on-effort sighting data made under favourable conditions (Beaufort 3 or below) are shown in **Table 2.2** and **Table 2.3**.

Table 2.2: Dolphin encounter rates per set in WL survey area during the reporting period

Survey Area	Survey Set	Encounter rate (STG) (no. of on-effort dolphin sightings per 100 km of survey effort)	Encounter rate (ANI) (no. of dolphins from all on-effort sightings per 100 km of survey effort)
		Primary Lines Only	Primary Lines Only
West Lantau (WL)	Set 1: January 4th, 2019	0.0	0.0
	Set 2: January 8th, 2019	4.5	4.5

Table 2.3: Overall dolphin encounter rates on primary lines only as well as both primary and secondary lines in WL survey area during the reporting period

Survey Area	Encounter rate (STG) (no. of on-effort dolphin sightings per 100 km of survey effort)		Encounter rate (ANI) (no. of dolphins from all on-effort sightings per 100 km of survey effort)	
	Primary Lines Only	Both Primary and Secondary Lines	Primary Lines Only	Both Primary and Secondary Lines
West Lantau (WL)	2.3	7.4	2.3	14.8

The average group size of the CWDs was only 2.0 dolphins per group, which was much lower than the averages in previous months of monitoring surveys. All four dolphin groups were small in size with just 1-4 animals per group.

2.4.2 Photo-identification Work

Six different individual CWDs were identified for six times during surveys in this reporting period, with details presented in **Appendix B**. All individuals were re-sighted only once during monitoring. Notably, none of these individuals was accompanied by any young calf during their re-sightings in this reporting period.

3 Conclusions

Post-construction phase EM&A work including the monitoring of CWD was conducted in accordance with the EM&A Manual during the reporting period.

In this month of post-construction monitoring of CWD in WL waters, vessel surveys were conducted on 4 and 8 January 2019 covering all transect lines in WL survey area twice. A total of 67.36 km of survey effort was collected, with five groups of 10 CWDs were sighted. All marine-based construction activities have been completed and as a result, no adverse impact on CWD was observed from the HZMB HKLR works.

Figures

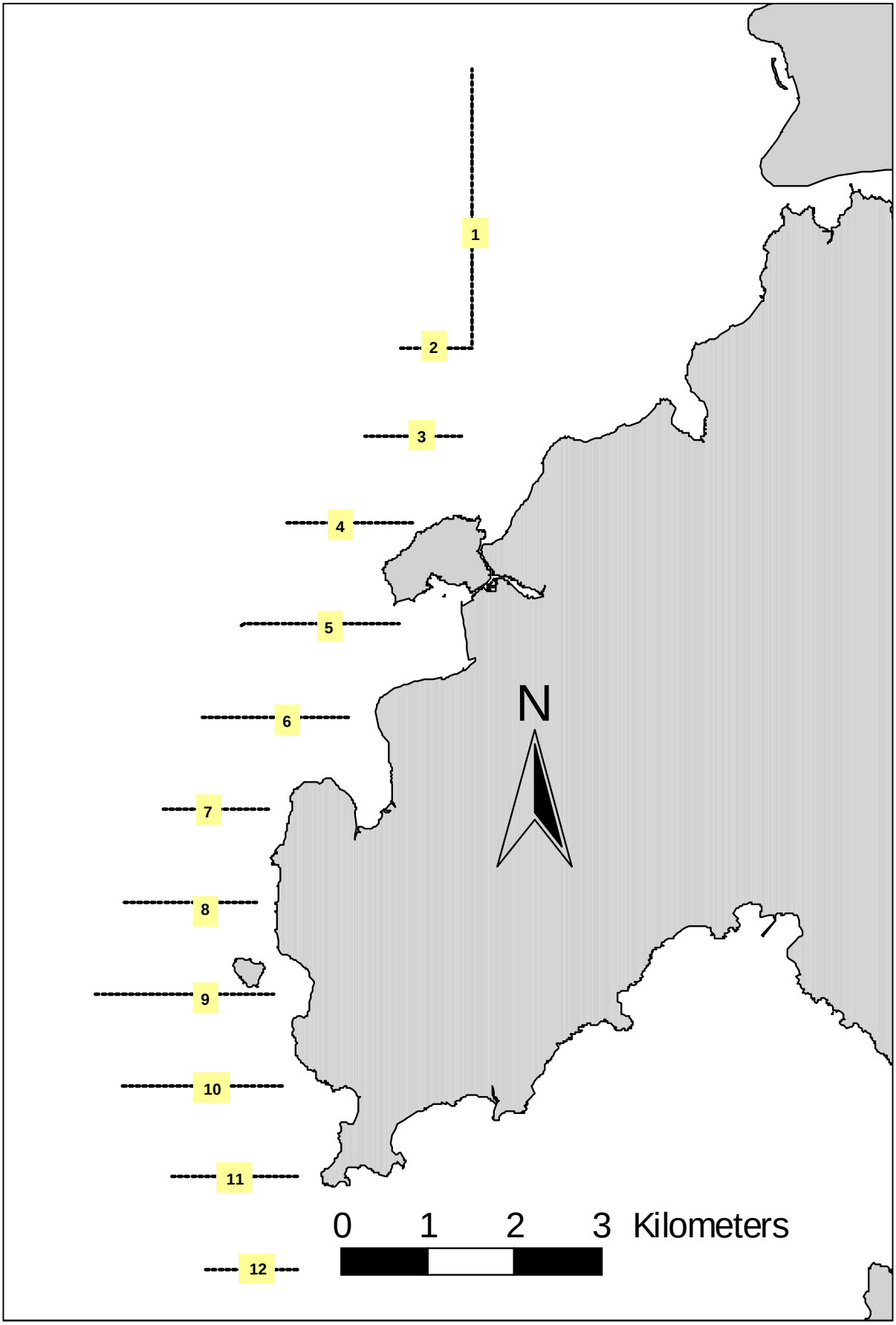
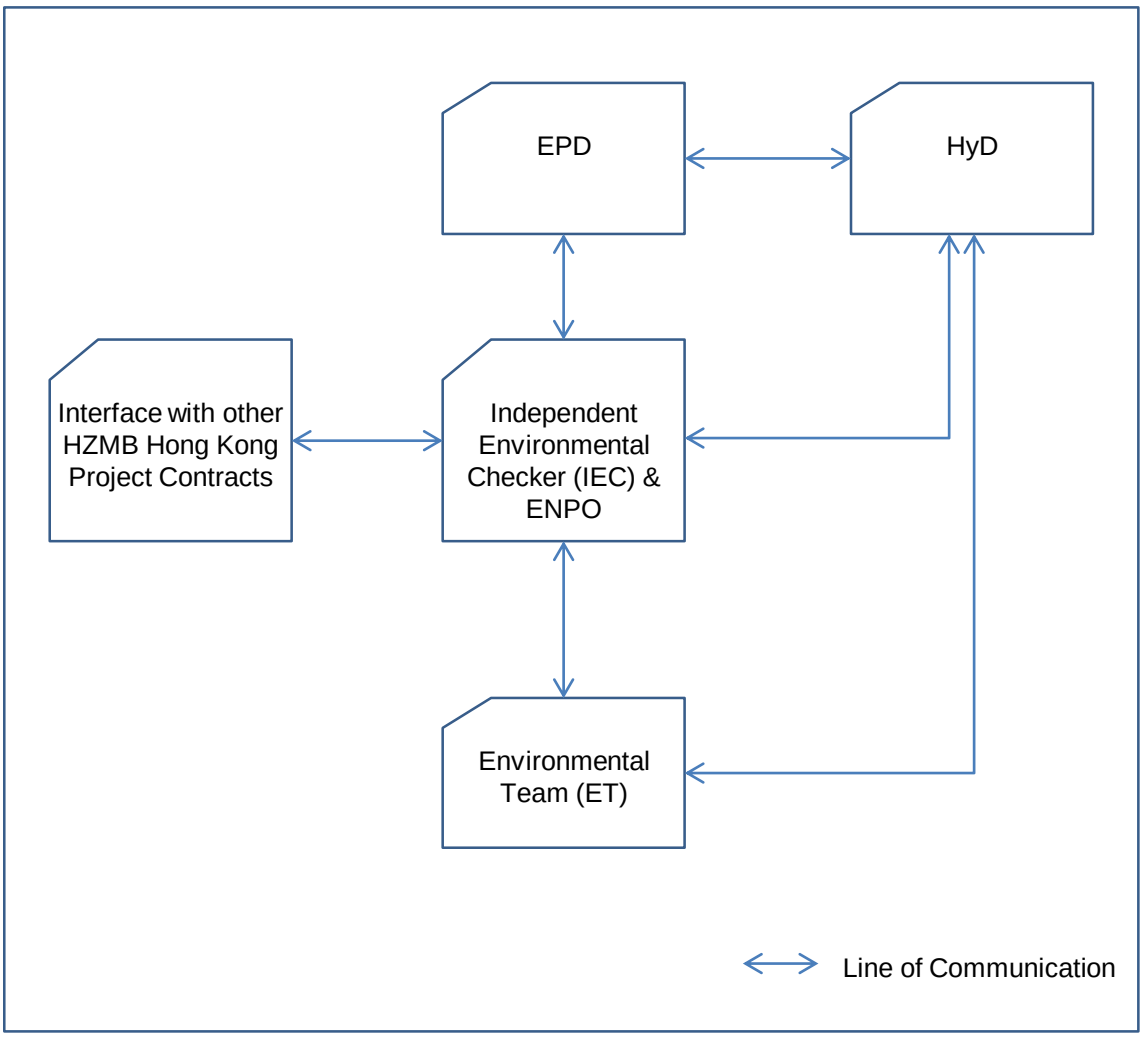


Figure 1. Transect Line Layout in West Lantau Survey Area

Appendix A Project Organisation for Environmental Works

Project Organisation for Environmental Works



Appendix B Chinese White Dolphin Monitoring Results

RAMBOLL

Ref.: HYDHZMBEEM00_0_7490L.19.doc

2 July 2019

By Fax (3767 5922) and By Post

ARUP
Level 5, Festival Walk
80 Tat Chee Avenue
Kowloon Tong, Kowloon

Attention: Mr. Michael Chan / Mr. Mark Ching

Dear Sirs,

Re: Agreement No. CE 48/2011 (EP)
Environmental Project Office for the
HZMB Hong Kong Link Road, HZMB Hong Kong Boundary Crossing Facilities, and Tuen Mun-Chek Lap Kok Link – Investigation

Contract No. HY/2011/09 HZMB Hong Kong Link Road - Section between HKSAR Boundary and Scenic Hill
Dolphin Monthly Monitoring – Monthly Progress Report (January 2019)

Reference is made to the submission of Dolphin Monthly Monitoring – Monthly Progress Report (January 2019) dated 21 January 2019 certified by the ET Leader (ET's ref.: MA12014/DCVJV/it190225_Jan19_2 dated 25 February 2019) and provided to us via e-mail on 26 June 2019.

We are pleased to inform you that we have no adverse comments on the captioned submission.

Thank you very much for your attention and please feel free to contact the undersigned should you require further information.

Yours sincerely,
For and on behalf of
Ramboll Hong Kong Limited

Ray Yan
Independent Environmental Checker
HZMB HKLR

c.c.

HyD	Mr. Cheng Pan	(By Fax: 3188 6614)
HyD	Mr. David Chan	(By Fax: 3188 6614)
ARUP	Mr. Eric Chan	(By Fax: 2268 3970)
Wellab	Dr. Priscilla Choy	(By Fax: 3107 1388)
DCVJV	Mr. C. S. Chu	(By Fax: 3121 6688)

Internal: DY, YH, DF, HW, ENPO Site

Ramboll Hong Kong Limited 英環香港有限公司
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consulting . testing . research

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Website:http://www.wellab.com.hk
E-mail:wellab@wellab.com.hk

Our Ref: MA12014/DCVJV/it190225_Jan19_2

Dragages-China Habour-VSL Joint Venture

Site Office: Tung Chung Waterfront Road,
adjacent to Tung Chung New Development Pier,
New Territories, Hong Kong

By Mail
25 February 2019

Attn.: Mr. W K Poon (Project Director)

Dear Sir,

Contract No. HY/2011/09
Hong Kong Link Road – Section between HKSAR Boundary and Scenic Hill
- Dolphin Monthly Monitoring - Monthly Progress Report (January 2019)

I refer to the Dolphin Monthly Monitoring - Monthly Progress Report (January 2019) dated 21 January 2019 for the captioned Contract prepared by Samuel Hung of Hong Kong Cetacean Research Project according to updated EM&A Manual, Section 10.7.1.

I hereby agree to certify the above document in accordance with the EP (No. EP-352/2009/D), Condition 1.9.

If you need any further information, please call me at 2151 2089 or 9161 7287.

Yours faithfully,
WELLAB Limited

Dr. Priscilla Choy
Environmental Team Leader

	CONTRACT NO. HY/2011/09 HONG KONG-ZHUHAI-MACAO BRIDGE HONG KONG LINK ROAD - SECTION BETWEEN HKSAR BOUNDARY AND SCENIC HILL	Contractor's Submission Form (CSF)

To: Mr. Michael CHAN (Supervising Officer's Representative)

Title of Submission:	Monthly Line-transect Survey Report (January 2019)
Submission Number:	HKLR9 / CS / DCV / ENV / 06597 / 1
Technical Document No.:	HKLR9 / DCV / ENV / 06597 / A
SOR Ref. No.	
SOR Document No.	
Specification Reference:	
Location of Works:	Whole project site

A41271

Description of Contents:

We are submitting the monthly line-transect vessel survey report for Chinese White Dolphin in January 2019.

ARUP SOR
RECEIVED
22 JAN 2019

Remarks: No. of copies : 1

Submission Date: 22 JAN 2019

Purpose of Submission : ☐ For Approval ☒ For Information ☐ For Record

Signature :				
Name :	CHU Chung Sing	C.S. MA		W K Poon
Position :	Environmental Officer	Safety Manager		Project Director
Date :	21.1.2019	21.1.2019		21.1.2019
	Originated by	**Reviewed by**	**Reviewed by**	**Approved by**

Distribution:

cc: Arup - Mr. Eric Chan (Supervising Officer)

Contract No. HY/2011/09
Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road – Section between HKSAR Boundary and Scenic Hill

Non - Technical Document

Document Ref. No.:

H	K	L	R	9	/	D	C	V	/	E	N	V	/	0	6	5	9	7	/	A
Project Code						Issuer Code				Doc. Code				Sequential Number						Rev.

Document Title:

Monthly Line-transect Survey Report (January 2019)

	PREPARED BY:	INTERNAL REVIEW:		INTERNAL APPROVAL
COMPANY	HK Cetacean Research Project	DCVJV	DCVJV	DCVJV
NAME	Samuel Hung	CHU Chung Sing	MA Chi Sing	WK POON
POSITION	Director	Environmental Officer	Safety Manager	Project Director
SIGNATURE				
DATE	January 2019	21.1.2019	21.1.2019	21.1.2019

Contract No. HY/2011/09
Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road – Section between HKSAR Boundary and Scenic Hill Dolphin Monthly Monitoring

Monthly Progress Report (January 2019)

Submitted by
Samuel K.Y. Hung, Ph.D., Hong Kong Cetacean Research Project

21 January 2019

1. Introduction

1.1. The Hong Kong Link Road (HKLR) serves to connect the Hong Kong-Zhuhai-Macao Bridge (HZMB) Main Bridge at the Hong Kong Special Administrative Region (HKSAR) Boundary and the HZMB Hong Kong Boundary Crossing Facilities (HKBCF) located at the northeastern waters of the Hong Kong International Airport.

1.2. According to the updated Environmental Monitoring and Audit (EM&A) Manual (for HKLR), monthly line-transect vessel surveys for Chinese White Dolphin should be conducted to cover the West Lantau survey area as in AFCD annual marine mammal monitoring programme.

1.3. Since November 2012, Hong Kong Cetacean Research Project (HKCRP) has been commissioned by Dragages – China Harbour – VSL JV to conduct this dolphin monitoring study in order to collect data on Chinese White Dolphins in West Lantau (WL) survey area, and to analyze the collected survey data to monitor distribution, encounter rate, abundance, activities and occurrence of dolphin calves. Photo-identification will also be collected from individual Chinese White Dolphins to examine their individual range patterns and core area use.

1.4. The present report summarizes the results of the survey findings during the monitoring month of January 2019.

2. Monitoring Methodology

2.1. Vessel-based Line-transect Survey

2.1.1. According to the requirement of the updated EM&A manual, dolphin monitoring programme should cover all transect lines in WL survey area (see Figure 1) twice per month. The co-ordinates of all transect lines are shown in Table 1.

Table 1. Co-ordinates of transect lines in WL survey area

Line No.		Easting	Northing		Line No.		Easting	Northing
1	Start Point	803750	818500		7	Start Point	800200	810450
1	End Point	803750	815500		7	End Point	801400	810450
2	Start Point	803750	815500		8	Start Point	801300	809450
2	End Point	802940	815500		8	End Point	799750	809450
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4	End Point	801640	813600		10	End Point	799600	807450
5	Start Point	801100	812450		11	Start Point	800300	806500
5	End Point	802900	812450		11	End Point	801750	806500
6	Start Point	802400	811500		12	Start Point	801760	805450
6	End Point	800660	811500		12	End Point	800700	805450

2.1.2. The survey team used standard line-transect methods (Buckland et al. 2001) to conduct the systematic vessel surveys, and followed the same technique of data collection that has been adopted over the last 20 years of marine mammal monitoring surveys in Hong Kong developed by HKCRP (see Hung 2017). For each monitoring vessel survey, a 15-m inboard vessel with an open upper deck (about 4.5 m above water surface) was used to make observations from the flying bridge area.

2.1.3. Two experienced observers (a data recorder and a primary observer) made up

the on-effort survey team, and the survey vessel transited different transect lines at a constant speed of 13-15 km per hour. The data recorder searched with unaided eyes and filled out the datasheets, while the primary observer searched for dolphins and porpoises continuously through 7 x 50 *Fujinon* marine binoculars. Both observers searched the sea ahead of the vessel, between 270° and 90° (in relation to the bow, which is defined as 0°). One to two additional experienced observers were available on the boat to work in shift (i.e. rotate every 30 minutes) in order to minimize fatigue of the survey team members. All observers were experienced in small cetacean survey techniques and identifying local cetacean species.

2.1.4. During on-effort survey periods, the survey team recorded effort data including time, position (latitude and longitude), weather conditions (Beaufort sea state and visibility), and distance traveled in each series (a continuous period of search effort) with the assistance of a handheld GPS.

2.1.5. Data including time, position and vessel speed were also automatically and continuously logged by handheld GPS throughout the entire survey for subsequent review.

2.1.6. When dolphins were sighted, the survey team would end the survey effort, and immediately record the initial sighting distance and angle of the dolphin group from the survey vessel, as well as the sighting time and position. Then the research vessel was diverted from its course to approach the animals for species identification, group size estimation, assessment of group composition, and behavioural observations. The perpendicular distance (PSD) of the dolphin group to the transect line was later calculated from the initial sighting distance and angle.

2.1.7. Survey effort being conducted along the parallel transect lines that were perpendicular to the coastlines (as indicated in Figure 1) was labeled as "primary" survey effort, while the survey effort being conducted along the connecting lines between parallel lines was labeled as "secondary" survey effort. According to HKCRP long-term dolphin monitoring data, encounter rates of Chinese white dolphins deduced from effort and sighting data collected along primary and secondary lines were similar in survey areas around Lantau Island. Therefore, primary and secondary survey effort were both presented as on-effort survey effort in this report.

2.1.8. Encounter rates of Chinese white dolphins (number of on-effort sightings per 100 km of survey effort) were calculated in WL survey area in relation to the amount of survey effort conducted during each month of monitoring survey. Only data collected under Beaufort 3 or below condition would be used for encounter rate analysis. Dolphin encounter rates were calculated using primary survey effort alone, as well as the combined survey effort from both primary and secondary lines.

2.2. Photo-identification Work

2.2.1. When a group of Chinese White Dolphins were sighted during the line-transect survey, the survey team would end effort and approach the group slowly from the side and behind to take photographs of them. Every attempt was made to photograph every dolphin in the group, and even photograph both sides of the dolphins, since the colouration and markings on both sides may not be symmetrical.

2.2.2. A professional digital camera (*Canon* EOS 7D Mark II model) equipped with long telephoto lenses (100-400 mm zoom) were available on board for researchers to take sharp, close-up photographs of dolphins as they surfaced. The images were shot at the highest available resolution and stored on Compact Flash memory cards for downloading onto a computer.

2.2.3. All digital images taken in the field were first examined, and those containing potentially identifiable individuals were sorted out. These photographs would then be examined in greater detail, and were carefully compared to the existing Chinese White Dolphin photo-identification catalogue maintained by HKCRP since 1995.

2.2.4. Chinese White Dolphins can be identified by their natural markings, such as nicks, cuts, scars and deformities on their dorsal fin and body, and their unique spotting patterns were also used as secondary identifying features (Jefferson 2000).

2.2.5. All photographs of each individual were then compiled and arranged in chronological order, with data including the date and location first identified (initial sighting), re-sightings, associated dolphins, distinctive features, and age classes entered into a computer database.

3. Monitoring Results

3.1. Vessel-based Line-transect Survey

3.1.1. During the monitoring month of January 2019, two complete sets of systematic line-transect vessel surveys were conducted on the 4th and 8th, to cover all transect lines in WL survey area twice. The survey routes of each survey day are presented in Figures 2-3.

3.1.2. From these surveys, a total of 67.36 km of survey effort was collected, with 100% of the total survey effort being conducted under favourable weather conditions (i.e. Beaufort Sea State 3 or below with good visibility) (Appendix I). The total survey effort conducted on primary lines (i.e. the horizontal lines perpendicular to the coastlines) was 44.43 km, while the effort on secondary lines (i.e. the lines connecting the primary lines) was 22.93 km.

3.1.3. During the monitoring surveys conducted in January 2019, five groups of ten Chinese White Dolphins were sighted. All five dolphin groups were sighted during on-effort search, but only one of them was made on primary line (Appendix II). None of these dolphin groups was associated with any operating fishing vessel during the monitoring month.

3.1.4. Distribution of the dolphin sightings made during January's surveys is shown in Figure 4. Four of the five dolphin groups were sighted in the middle portion of WL survey area (to the west of Kai Kung Shan), while one group was sighted a few kilometers to the northwest of Tai O Peninsula (Figure 4). Notably, none of them was sighted near the HKLR09 alignment.

3.1.5. During the January's surveys, encounter rates of Chinese White Dolphins deduced from the survey effort and on-effort sighting data made under favourable conditions (Beaufort 3 or below) are shown in Tables 2 & 3.

Table 2. Dolphin encounter rates (sightings per 100 km of survey effort) per set during January's surveys in West Lantau (WL)

		Encounter rate (STG) (no. of on-effort dolphin sightings per 100 km of survey effort)	**Encounter rate (ANI)** (no. of dolphins from all on-effort sightings per 100 km of survey effort)
		Primary Lines Only	**Primary Lines Only**
West Lantau	Set 1: January 4th	0.0	0.0
	Set 2: January 8th	4.5	4.5

Table 3. Overall dolphin encounter rates (sightings per 100 km of survey effort) in January's surveys on primary lines only as well as both primary lines and secondary lines in West Lantau (WL)

	Encounter rate (STG) (no. of on-effort dolphin sightings per 100 km of survey effort)		Encounter rate (ANI) (no. of dolphins from all on-effort sightings per 100 km of survey effort)	
	Primary Lines Only	**Both Primary and Secondary Lines**	**Primary Lines Only**	**Both Primary and Secondary Lines**
West Lantau	2.3	7.4	2.3	14.8

3.1.6. The average group size of Chinese White Dolphins sighted during January's surveys was only 2.0 individuals per group, which was much lower than the averages in previous months of HKLR09 monitoring surveys. All four dolphin groups were small in size with just 1-4 animals per group (Appendix II).

3.2. Photo-identification Work

3.2.1. Six different individual Chinese White Dolphins were identified six times during January's surveys (Appendices III and IV). All individuals were re-sighted only once during the monitoring month.

3.2.2. Notably, none of these individuals was accompanied by any young calf during their re-sightings in this month's monitoring surveys.

3.3. Conclusion

3.3.1. In this month of dolphin monitoring, marine construction activities have been completed under this contract, and as are result, no adverse impact on Chinese white dolphins was observed.

4. References

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- Jefferson, T. A. 2000. Population biology of the Indo-Pacific hump-backed dolphin in Hong Kong waters. Wildlife Monographs 144:1-65.

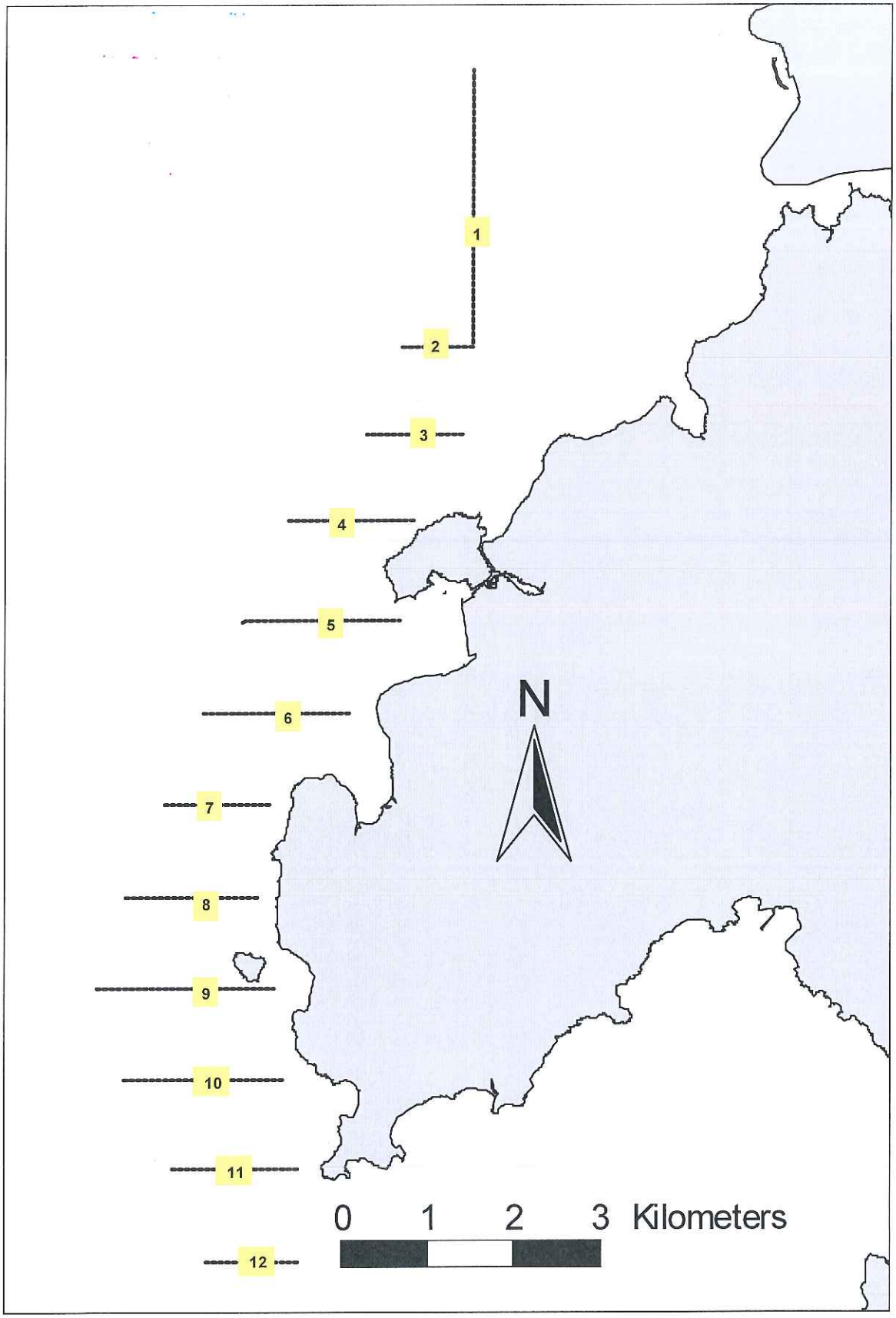

Figure 1. Transect Line Layout in West Lantau Survey Areas

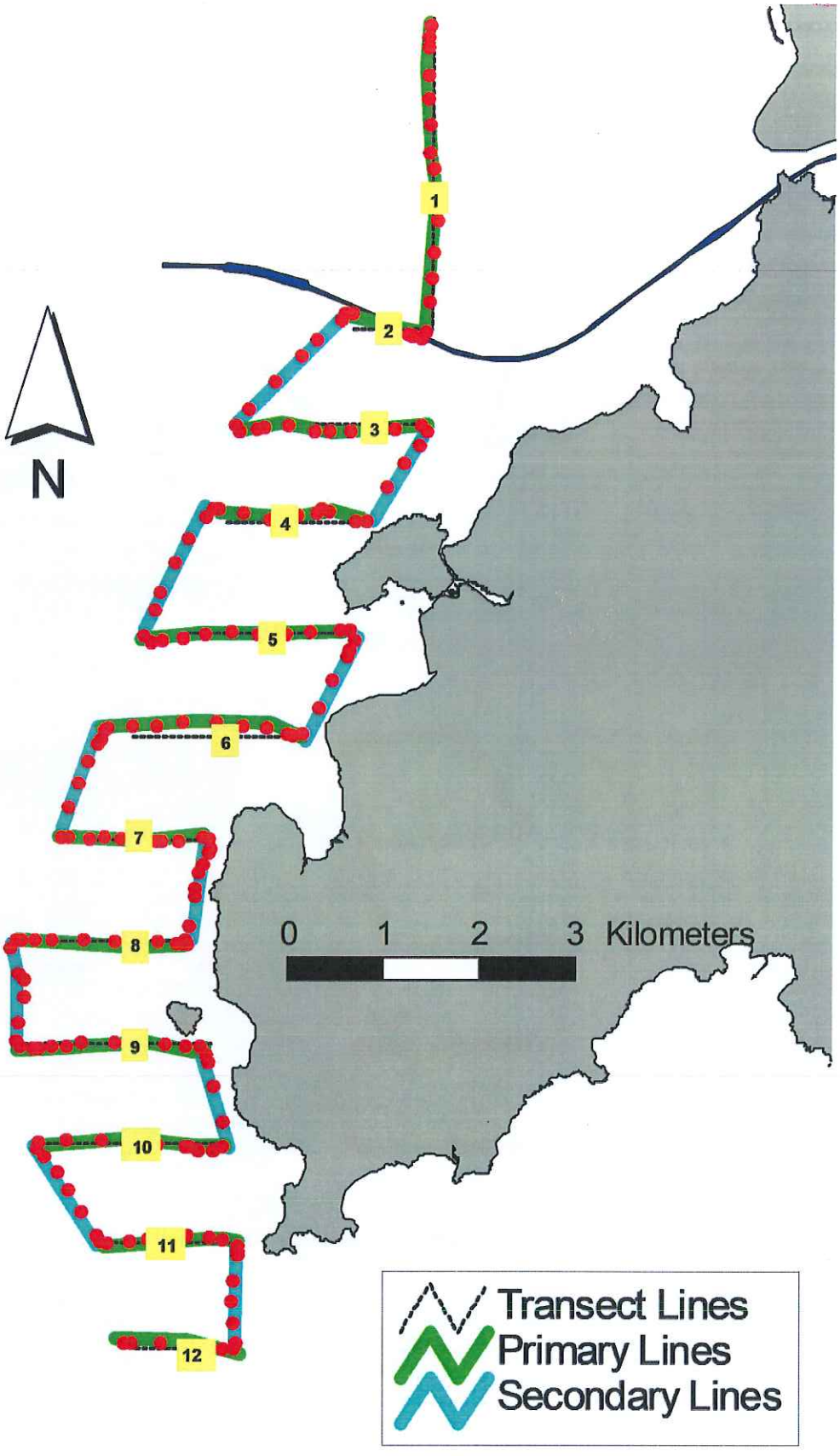

Figure 2. Survey Route on January 4th, 2019 (note: red dots represent the tracked positions of survey boat logged continuously by GPS throughout the course of the survey)

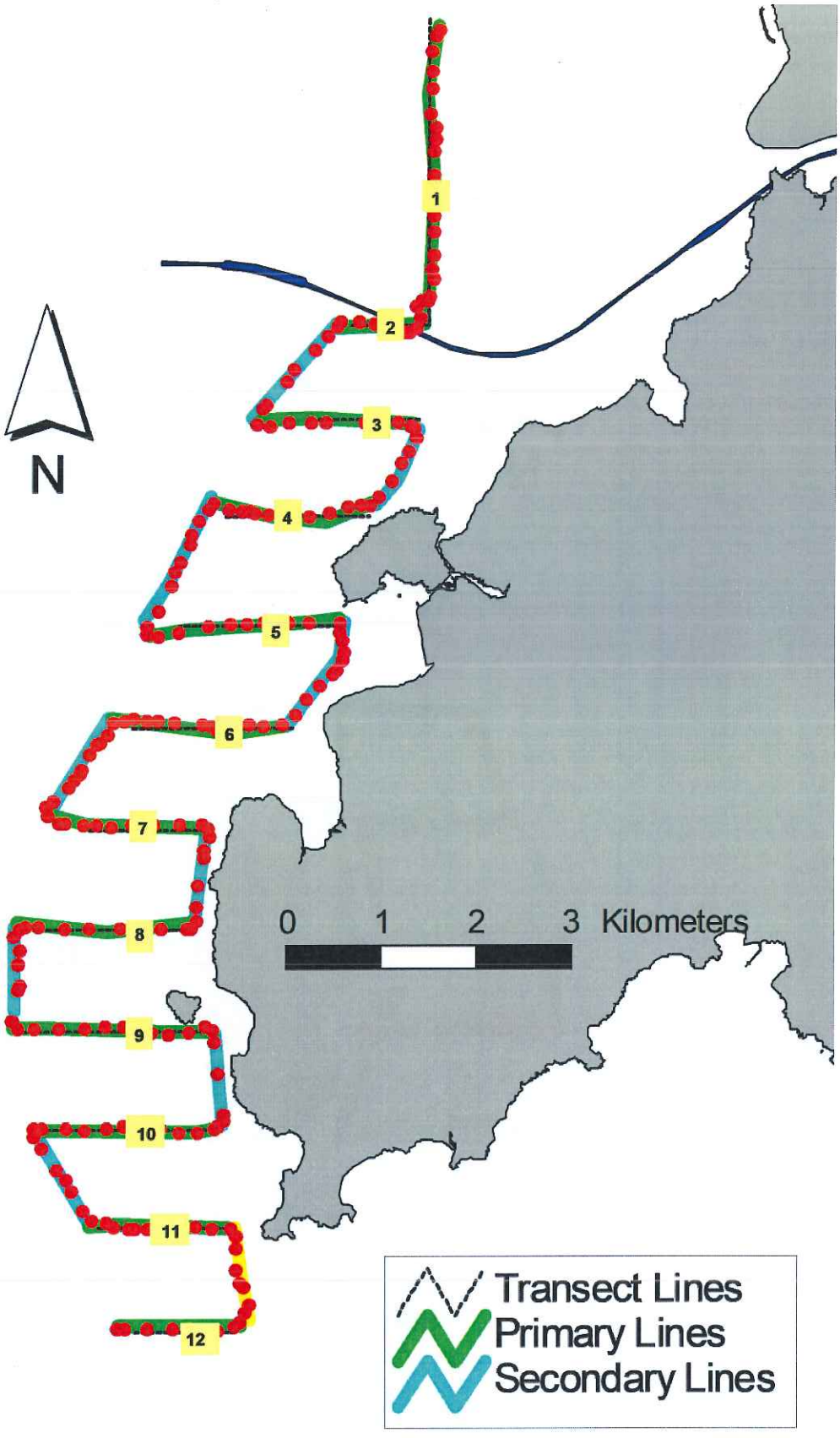

Figure 3. Survey Route on January 8th, 2019 (note: red dots represent the tracked positions of survey boat logged continuously by GPS throughout the course of the survey)

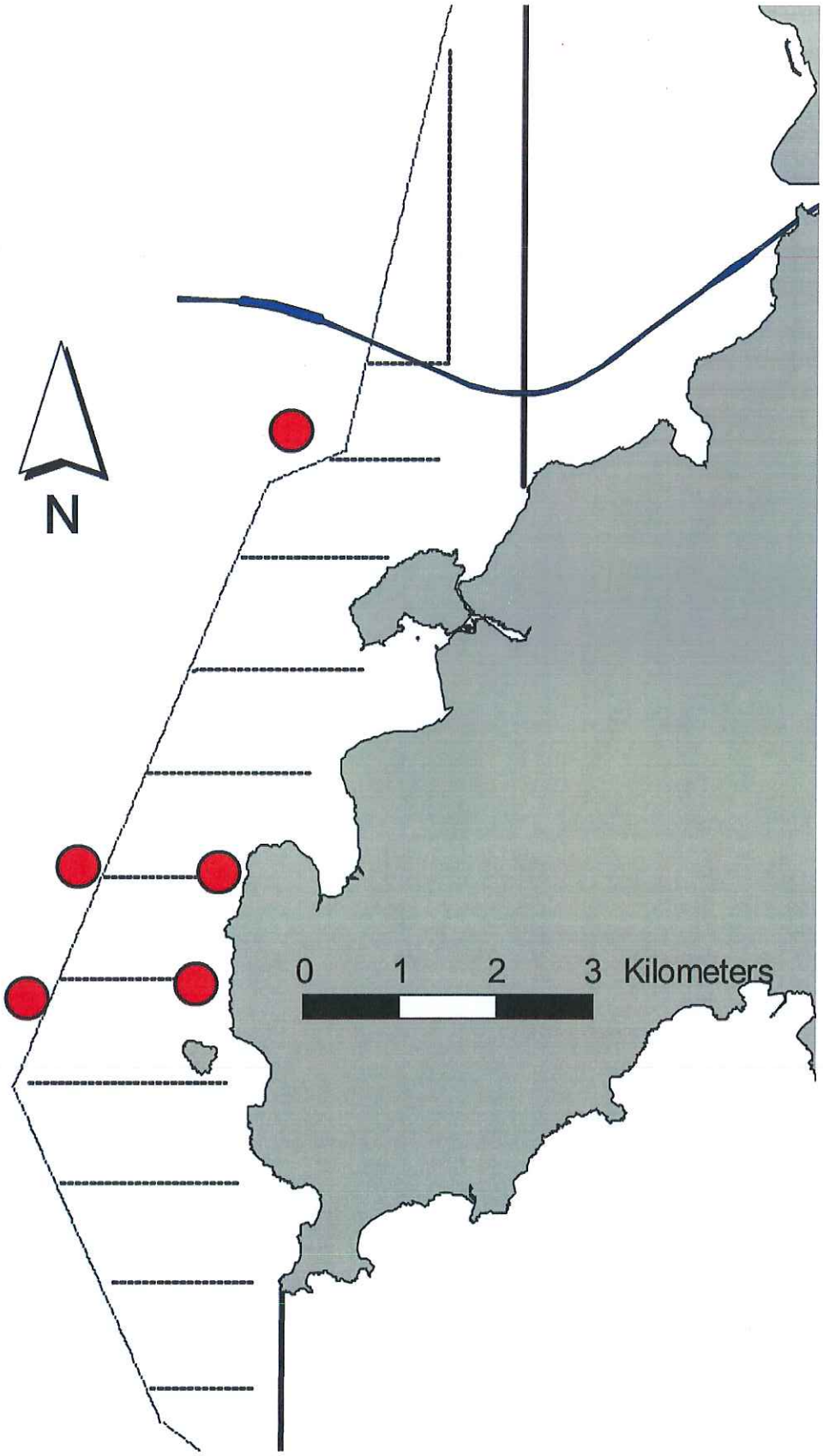

Figure 4. Distribution of Chinese White Dolphin Sightings during January 2019 HKLR09 Monitoring Surveys

Appendix I. HKLR09 Survey Effort Database (January 2019)

(Abbreviations: BEAU = Beaufort Sea State; P = Primary Line Effort; S = Secondary Line Effort)

DATE	AREA	BEAU	EFFORT	SEASON	VESSEL	TYPE	P/S
4-Jan-19	W LANTAU	2	12.53	WINTER	STANDARD36826	HKLR	P
4-Jan-19	W LANTAU	3	9.74	WINTER	STANDARD36826	HKLR	P
4-Jan-19	W LANTAU	2	6.82	WINTER	STANDARD36826	HKLR	S
4-Jan-19	W LANTAU	3	5.14	WINTER	STANDARD36826	HKLR	S
8-Jan-19	W LANTAU	2	10.69	WINTER	STANDARD36826	HKLR	P
8-Jan-19	W LANTAU	3	11.47	WINTER	STANDARD36826	HKLR	P
8-Jan-19	W LANTAU	2	6.26	WINTER	STANDARD36826	HKLR	S
8-Jan-19	W LANTAU	3	4.71	WINTER	STANDARD36826	HKLR	S

Appendix II. HKLR09 Chinese White Dolphin Sighting Database (January 2019)

(Abberviations: STG# = Sighting Number; HRD SZ = Dolphin Herd Size; BEAU = Beaufort Sea State; PSD = Perpendicular Distance; ND = Not Determined; BOAT ASSOC. = Fishing Boat Association; P/S: Sighting Made on Primary/Secondary Lines)

DATE	STG #	TIME	HRD SZ	AREA	BEAU	PSD	EFFORT	TYPE	NORTHING	EASTING	SEASON	BOAT ASSOC.	P/S
4-Jan-19	1	1137	1	W LANTAU	3	1	ON	HKLR	810530	799919	WINTER	NONE	S
4-Jan-19	2	1159	1	W LANTAU	2	157	ON	HKLR	809387	801143	WINTER	NONE	S
4-Jan-19	3	1219	3	W LANTAU	2	137	ON	HKLR	809236	799380	WINTER	NONE	S
8-Jan-19	1	1037	4	W LANTAU	2	7	ON	HKLR	814788	802125	WINTER	NONE	S
8-Jan-19	2	1151	1	W LANTAU	2	84	ON	HKLR	810471	801383	WINTER	NONE	P

Appendix III. Individual dolphins identified during HKLR09 monitoring surveys in January 2019

ID#	DATE	STG#	AREA
CH108	08/01/19	2	W LANTAU
NL259	04/01/19	1	W LANTAU
WL79	04/01/19	2	W LANTAU
WL210	04/01/19	3	W LANTAU
WL258	08/01/19	1	W LANTAU
WL283	08/01/19	1	W LANTAU

Appendix IV. Photographs of Identified Individual Dolphins in January 2019 (HKLR09)

Appendix C Monitoring Schedule

2019 JANUARY

Monitoring Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
30	31	01	02	03	04 Post-construction phase CWD monitoring (vessel survey)	05
06	07	08 Post-construction phase CWD monitoring (vessel survey)	09	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	01	02

Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road

2019 FEBRUARY

Monitoring Schedule

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
27	28	29	30	31	01	02
03	04	05	06	07	08	09
10	11	12 Post-construction phase CWD monitoring (vessel survey)	13	14	15 Post-construction phase CWD monitoring (vessel survey)	16
17	18	19	20	21	22	23
24	25	26	27	28	01	02