MOTT MACDONALD

Expansion of Hong Kong International Airport into a Three-Runway System

Construction Phase Annual EM&A Report No.1

May 2017

Airport Authority Hong Kong

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This Construction Phase Annual EM&A Report No. 1 has been reviewed and certified by

the Environmental Team Leader (ETL) in accordance with

Section 15.5 of the Updated EM&A Manual

Certified by: 

Terence Kong
Environmental Team Leader (ETL)
Mott MacDonald Hong Kong Limited

Date: 9 May 2017

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By Email

Airport Authority Hong Kong
HKIA Tower, 1 Sky Plaza Road
Hong Kong International Airport
Lantau, Hong Kong

Attn: Mr. Lawrence Tsui, Principal Manager

9 May 2017

Dear Sir,

Contract No. 3102
3RS Independent Environmental Checker Consultancy Services

Submission of Revised Construction Phase Annual EM&A Report No.1

Reference is made to the Environmental Team's submission of the Revised Construction Phase Annual EM&A Report No.1 under Condition 15.5 of the Updated EM&A Manual certified by the ET Leader on 9 May 2017.

We would like to inform you that we have no adverse comment on the captioned submission. Therefore we write to verify the captioned submission in accordance with the requirement stipulated in Condition 2.3 of EP-489/2014.

Should you have any query, please feel free to contact our Roy Man at 3922 9365 or the undersigned at 3922 9376.

Yours faithfully,
AECOM Asia Co. Ltd.

Jackel Law
Independent Environmental Checker

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Executive Summary

The "Expansion of Hong Kong International Airport into a Three-Runway System" (the Project) serves to meet the future air traffic demands at Hong Kong International Airport (HKIA). On 7 November 2014, the Environmental Impact Assessment (EIA) Report (Register No.: AEIAR-185/2014) for the Project was approved and an Environmental Permit (EP) (Permit No.: EP-489/2014) was issued for the construction and operation of the Project.

Airport Authority Hong Kong (AAHK) commissioned Mott MacDonald Hong Kong Limited (MMHK) to undertake the role of Environmental Team (ET) for carrying out the Environmental Monitoring & Audit (EM&A) works during the construction phase of the Project in accordance with the Updated EM&A Manual (the Manual).

This is the 1st Construction Phase Annual EM&A Report for the Project which summarizes the monitoring results and audit findings of the EM&A programme during the reporting period from 28 December 2015 to 31 December 2016, while the Section on Chinese White Dolphin Monitoring summarizes the results between 18 December 2015 to 31 December 2016.

Key Activities in the Reporting Period

Key activities of the Project carried out in the reporting period were related to the following contracts:

Advanced Works:

Contract P560 (R) Aviation Fuel Pipeline Diversion Works

- Site preparation and establishment works;
- Construction of temporary concrete footing;
- Setup of site office;
- Antenna farm structural protection works;
- Stockpiling of excavated materials from Horizontal Directional Drilling (HDD) operation at stockpiling area;
- Construction of containment pit at Sheung Sha Chau Island;
- HDD work at launching site and Sheung Sha Chau Island; and

Deep Cement Mixing (DCM) Works:

Contracts 3201 to 3205 DCM Works

- Mobilization and off-site plant fabrication;
- Laying of geotextile and sand blanket; and
- DCM trial works.

Other Works:

Contract 3213 CLP Cable Diversion Enabling Works

- Installation of silt curtain;
- Excavation works and removal of armour rock at the western part of the airport;
- Construction of drawpit; and

- Installation of cable trough, backfilling, and reinstatement of armour rock.

EM&A Activities Conducted in the Reporting Period

The EM&A programme was undertaken in accordance with the Manual of the Project. A summary of the monitoring and audit activities during this reporting period is presented as follows:

Monitoring/ Audit Activities	Number of Sessions
1-hour Total Suspended Particulates (TSP) Air Quality Monitoring	411
Noise Monitoring	265
Water Monitoring	64
Ecological Monitoring	6
Vessel line-transect surveys for Chinese White Dolphin (CWD) monitoring	10
Land-based theodolite tracking survey effort for CWD monitoring	25

Six month CWD baseline monitoring was conducted between 18 December 2015 and 17 June 2016 and continued in July 2016 prior to the commencement of construction for marine works. Impact monitoring was commenced on 1 August 2016, although there were no marine construction activities in August and September 2016. A total of 5,619.7 km survey effort was conducted for the vessel line transect survey during the 12-month monitoring period. A total of 208 groups of 785 CWD individuals were sighted, with 46 groups of 181 CWDs recorded in northwest Lantau, 4 groups of 16 CWDs in airport west, 96 groups of 347 CWDs in western Lantau and 62 groups of 241 CWDs in southwest Lantau. No CWDs were sighted in northeast Lantau during the 12-month reporting period. The combined encounter rate by number of dolphin sightings and by number of dolphins were 3.44 and 13.44 respectively. No exceedance of the encounter rates for Action and Limit Levels were recorded during the construction phase. Average annual abundance of CWD in Hong Kong western waters was estimated at 60 individuals in 2016 from line-transect analysis. CWD relative occurrence from land-based surveys around Lung Kwu Chau peaked in spring, concurrent with the start of the wet season. Waters around Lung Kwu Chau remain an important year-round habitat for CWD, especially for foraging. Passive acoustic monitoring showed dolphins used the area around south of Sha Chau throughout the year, but with increased activity during winter and spring months. The acoustic data also showed consistently higher levels of dolphin clicking activity at night, which may indicate increased using of echolocation by dolphins during hours of darkness.

Ferry movements between Hong Kong International Airport (HKIA) SkyPier and Zhuhai / Macau were audited in the reporting period in accordance with the Marine Travel Routes and Management Plan for High Speed Ferries of SkyPier (SkyPier Plan). In total, 10,043 ferry movements between HKIA SkyPier and Zhuhai / Macau were audited in the reporting period. The daily movements of all SkyPier High Speed Ferries (HSFs) in the reporting period ranged between 1 and 97, which falls within the maximum daily cap number of 125. There are fewer ferry movements on 1st, 2nd August and 21st October 2016 due to typhoon. The annual daily average of all the SkyPier HSFs in 2016 was 91 movements, within the annual daily average cap of 99 SkyPier HSF movements. Most of the diverted HSFs had travelled through the Speed Control Zone (SCZ) with average speeds within 15 knots, which complied with the SkyPier Plan. Three cases of average speed deviation were due to public safety. All ferry movements that did not strictly follow the diverted route were investigated. Most of the deviation cases were related to strong tidal wave and current, or giving way to other vessels due to safety and emergency situations.

The audit of construction and associated vessels has started in August 2016 in accordance with the Marine Travel Routes and Management Plan for Construction and Associated Vessels (MTRMP-CAV). ET has conducted weekly audit to ensure that the contractors were fully complied with the requirements of the MTRMP-CAV. A total of 24 skipper training workshops were conducted by the ET from August to December 2016 with captains of construction vessels associated with 3RS contracts. Another 18 skipper training workshops were held by contractors' Environmental Officers (EO) and competency tests had been conducted subsequently with the trained captains by ET.

On the implementation of the Marine Mammal Watching Plan, silt curtains were deployed by the contractors for sand blanket laying works with dolphin observers used in accordance with the Plan. On the implementation of the Dolphin Exclusion Zone (DEZ) Plan, dolphin observers were deployed by the contractors for continuous monitoring of DEZs for DCM trial works in accordance with the DEZ Plan. Trainings for the dolphin observers on the implementation of MMWP and DEZ monitoring were provided by the ET prior to the aforementioned works. Testing of night vision devices used for DEZ monitoring was also conducted before the DCM trials. From contractors' MMWP observation records and DEZ monitoring records, no marine mammals were observed within or around the DEZ and silt curtains during the reporting period. Audits of acoustic decoupling for construction vessels were also carried out by the ET.

Ecological monitoring was undertaken monthly at the HDD daylighting location on Sheung Sha Chau Island in accordance with the Updated EM&A Manual. During the reporting period, no encroachment into the egretry area at Sheung Sha Chau by the HDD daylighting location or mooring of flat top barge was recorded.

Review of Environmental Quality Performance Limits (Action and Limit levels)

During the reporting period, five exceedance cases involving Action Level of 1-hour total suspended particulates (TSP) monitoring were recorded during the reporting period. Investigations were carried out immediately for each of the exceedance cases. The investigation results indicated that the exceedances were not related to the Project. There were, however, no exceedance cases involving Limit Level of 1-hour TSP monitoring throughout the reporting period.

For water quality, the monitoring results for dissolved oxygen (DO), total alkalinity, and chromium obtained during the reporting period were in compliance with their corresponding Action and/or Limit Levels stipulated in the EM&A programme for triggering the relevant investigation and follow-up procedures under the programme if being exceeded. For turbidity, suspended solids (SS) and nickel, some of the testing results had exceeded the relevant Action or Limit Levels, and the corresponding investigations were conducted accordingly. The investigation findings concluded that all the exceedances were not due to the Project.

No breach of the Action or Limit Levels in relation to noise, waste and CWD monitoring were recorded during the reporting period.

Implementation Status and Review of Environmental Mitigation Measures

Weekly site audits were carried out during the reporting period to confirm the implementation measures undertaken by the contractors. Environmental issues related to the construction activities, including air quality, noise, waste, CWD and ecology were monitored and/or reviewed.

The recommended environmental mitigation measures, as included in the EM&A programme, were implemented properly in the reporting period. The EM&A programme effectively monitored the construction activities and ensure the proper implementation of mitigation measures.

Summary Findings of the EM&A Programme

The following table summarizes the key findings of the EM&A programme during the reporting period:

	Yes	No	Details	Analysis / Recommendation / Remedial Actions
Breaches of Limit Level^		✓	No exceedance of project-related limit level was recorded.	Nil
Breaches of Action Level^		✓	No exceedance of project-related action level was recorded.	Nil
Complaints Received	✓		A complaint on night time work at Sheung Sha Chau was received on 29 Dec 2016.	The complaint investigation was carried out in accordance with the Complaint Management Plan. The investigation detail is presented in S3.2.1.
Notification of any summons and status of prosecutions		✓	No notifications of summons or prosecution were received.	Nil
Changes that affect the EM&A	✓		The Baseline Water Quality Monitoring Report was updated on 12 December 2016.	Nil

Remarks: ^ only exceedance of Action/ Limit Level related to Project works will be highlighted.

1 Introduction

1.1 Background

On 7 November 2014, the Environmental Impact Assessment (EIA) Report (Register No.: AEIAR-185/2014) for the "Expansion of Hong Kong International Airport into a Three-Runway System" (the Project) was approved and an Environmental Permit (EP) (Permit No.: EP-489/2014) was issued for the construction and operation of the Project.

Airport Authority Hong Kong (AAHK) commissioned Mott MacDonald Hong Kong Limited (MMHK) to undertake the role of Environmental Team (ET) for carrying out the Environmental Monitoring & Audit (EM&A) works during the construction phase of the Project in accordance with the Manual submitted under EP Condition 3.1. The Manual is available on the Project's dedicated website (accessible at: http://env.threerunwaysystem.com/en/index.html). AECOM Asia Company Limited (AECOM) was employed by AAHK as the Independent Environmental Checker (IEC) for the Project.

The Project covers the expansion of the existing airport into a three-runway system (3RS) with key project components comprising land formation of about 650 hectares and all associated facilities and infrastructure including taxiways, aprons, aircraft stands, a passenger concourse, an expanded Terminal 2, all related airside and landside works and associated ancillary and supporting facilities. The existing submarine aviation fuel pipelines and submarine power cables also require diversion as part of the works.

Construction of the Project is to proceed in the general order of diversion of the submarine aviation fuel pipelines, diversion of the submarine power cables, land formation, and construction of infrastructure, followed by construction of superstructures.

The updated overall phasing programme of all construction works and contract description is presented in **Appendix A**.

1.2 Scope of this Report

This is the 1st Construction Phase Annual EM&A Report for the Project which summarizes the key findings of the EM&A programme during the reporting period from 28 December 2015 to 31 December 2016.

1.3 Project Organisation

The Project's organisation structure and the contact details of the key personnel are provided in **Appendix B** and **Table 1.1** respectively.

Table 1.1: Contact Information of Key Personnel

Party	Position	Name	Telephone
Project Manager's Representative (Airport Authority Hong Kong)	Principal Manager, Environment	Lawrence Tsui	2183 2734
Environmental Team (ET) (Mott MacDonald Hong Kong Limited)	Environmental Team Leader	Terence Kong	2828 5919
	Deputy Environmental Team Leader	Heidi Yu	2828 5704
	Deputy Environmental Team Leader	Keith Chau	2972 1721
Independent Environmental Checker (IEC) (AECOM Asia Company Limited)	Independent Environmental Checker	Jackel Law	3922 9376
	Deputy Independent Environmental Checker	Joanne Tsoi	3922 9423
Advanced Works:			
Contract P560(R) Aviation Fuel Pipeline Diversion Works (Langfang Huayuan Mechanical and Electrical Engineering Co., Ltd.)	Project Manager	Wei Shih	2117 0566
	Environmental Officer	Lyn Lau	5172 6543
DCM Works:			
Contract 3201 DCM (Package 1) (Penta-Ocean-China State-Dong-Ah Joint Venture)	Project Director	Tsugunari Suzuki	9178 9689
	Environmental Officer	Kanny Cho	9019 1962
Contract 3202 DCM (Package 2) (Samsung-BuildKing Joint Venture)	Project Manager	Ilkwon Nam	9643 3117
	Environmental Officer	Dickson Mak	9525 8408
Contract 3203 DCM (Package 3) (Sambo E&C Co., Ltd.)	Project Manager	Seong Jae Park	9683 8693
	Environmental Officer	Calvin Leung	9203 5820
Contract 3204 DCM (Package 4) (CRBC-SAMBO Joint Venture)	Project Manager	Kyung-Sik Yoo	9683 8697
	Environmental Officer	David Man	6421 3238

Party	Position	Name	Telephone
Contract 3205 DCM (Package 5) (Bachy Soletanche - Sambo Joint Venture)	Deputy Project Director	Min Park	9683 0765
	Environmental Officer	Margaret Chung	9130 3696
Reclamation Works:			
Contract 3206 (ZHEC-CCCC-CDC Joint Venture)	Project Manager	Kim Chuan Lim	3693 2288
	Environmental Officer	Kwai Fung Wong	3693 2252
Other Works:			
Contract 3213 CLP Cable Diversion Enabling Works (Wing Hing Construction Company)	Project Manager	Michael Kan	9206 0550
	Environmental Officer	Ivy Tam	2151 2090

1.4 Contact information for the Project

The contact information for the Project is provided in **Table 1.2**. The public can contact us through the following channels if they have any queries and comments on the environmental monitoring data and project related information.

Table 1.2: Contact Information of the Project

Channels	Contact Information
Hotline	3908 0354
Email	env@3rsproject.com
Fax	3747 6050
Postal Address	Airport Authority Hong Kong HKIA Tower 1 Sky Plaza Road Hong Kong International Airport Lantau Hong Kong Attn: Environmental Team Leader Mr Terence Kong c/o Mr Lawrence Tsui (TRD)

1.5 Summary of Construction Works

The key activities of the Project carried out in the reporting period included five DCM contracts, an advanced works contract, and a CLP cable diversion enabling work contract. The DCM contracts involved DCM trials, laying of geotextile and sand blanket; the advanced works contract involved the HDD works and construction of containment pit; and the CLP cable diversion enabling work contract involved construction of concrete cable trough below the surface of the existing seawall.

The locations of the works areas are presented in **Figure 1.1** to **Figure 1.2.** Some site investigation works were carried out during the reporting period.

1.6 Summary of EM&A Programme Requirements

The status for all environmental aspects is presented in **Table 1.3**.

Table 1.3: Summary of status for all environmental aspects under the Manual

Parameters		Status
Air Quality		
Baseline Monitoring	At least 14 consecutive days before commencement of construction work	The baseline air quality monitoring result has been reported in Baseline Monitoring Report and submitted to EPD under EP Condition 3.4.
Impact Monitoring	At least 3 times every 6 days	On-going since its commencement in December 2015.
Noise		
Baseline Monitoring	Daily for a period of at least two weeks prior to the commencement of construction works	The baseline noise monitoring result has been reported in Baseline Monitoring Report and submitted to EPD under EP Condition 3.4.
Impact Monitoring	Weekly	On-going since its commencement in December 2015.
Water Quality		
General Baseline Water Quality Monitoring for reclamation, water jetting and field joint works	Three days per week, at mid-flood and mid-ebb tides, for at least four weeks prior to the commencement of marine works.	The baseline water quality monitoring result has been reported in Baseline Water Quality Monitoring Report and submitted to EPD under EP Condition 3.4.
General Impact Water Quality Monitoring for reclamation, water jetting and field joint works	Three days per week, at mid-flood and mid-ebb tides.	On-going since its commencement in August 2016.
Initial Intensive Deep Cement Mixing (DCM) Water Quality Monitoring	At least four weeks	To be commenced according to the Detailed Plan on Deep Cement Mixing.
Early/ Regular DCM Water Quality Monitoring	Three times per week until completion of DCM works.	On-going since its commencement in August 2016.
Waste Management		
Waste Monitoring	At least weekly	On-going since its commencement in December 2015.
Land Contamination		
Supplementary Contamination Assessment Plan (CAP)	At least 3 months before commencement of any soil remediation works.	To be submitted with the relevant construction works.
Contamination Assessment Report (CAR) for Golf Course	CAR to be submitted for golf course first; programme for submission of supplementary CAR at the other areas to be agreed.	The CAR for Golf Course was submitted to EPD.
Terrestrial Ecology		
Egretry Survey Plan	Once per month in the breeding season between April and July, prior to the commencement of HDD drilling works.	The revised Egretry Survey Plan was submitted and approved by EPD under EP Condition 2.14.
Ecological Monitoring	Monthly monitoring during the HDD construction works period from August to March.	On-going since its commencement in March 2016.
Marine Ecology		

Parameters		Status
Pre-Construction Phase Coral Dive Survey	Prior to marine construction works	The Coral Translocation Plan was submitted and approved by EPD under EP Condition 2.12.
Coral Translocation	-	Carried out in accordance with the Coral Translocation Plan.
Chinese White Dolphins (CWD)		
Baseline Monitoring	6 months of baseline surveys before the commencement of land formation related construction works. Vessel surveys: Two full surveys per month; Land-based theodolite tracking: Two days per month at the Sha Chau station and two days per month at the Lung Kwu Chau Station; and Passive Acoustic Monitoring (PAM): For the whole duration of baseline period.	Baseline CWD results were reported in the CWD Baseline Monitoring Report and submitted to EPD in accordance with EP Condition 3.4.
Impact Monitoring	Vessel surveys: Two full surveys per month; Land-based theodolite tracking: One day per month at the Sha Chau station and one day per month at the Lung Kwu Chau Station; and PAM: For the whole duration for land formation related construction works.	On-going since its commencement in August 2016. Land-based theodolite tracking: In addition to the frequency as stipulated in the Manual, supplemental theodolite tracking is ongoing during the initial implementation period for the SkyPier Plan, i.e. in total twice per month at the Sha Chau station and three times per month at the Lung Kwu Chau station
Landscape and Visual		
Baseline Monitoring	One-off survey within the Project site boundary prior to commencement of any construction works	The baseline landscape & visual monitoring result has been reported in Baseline Monitoring Report and submitted to EPD under EP Condition 3.4.
Impact Monitoring	Weekly	On-going since its commencement in December 2015.
Environmental Auditing		
Regular site inspection	Weekly	On-going since its commencement in December 2015.
Marine Mammal Watching Plan (MMWP) implementation measures	Monitor and check	On-going since its commencement in November 2016.
Dolphin Exclusion Zone Plan (DEZP) implementation measures	Monitor and check	On-going since its commencement in December 2016.
SkyPier High Speed Ferries (HSF) implementation measures	Monitor and check	On-going since its commencement in December 2015.
Construction and Associated Vessels Implementation measures	Monitor and check	On-going since its commencement in August 2016.
Complaint Hotline and Email channel	Construction phase	On-going since its commencement in December 2015.
Environmental Log Book	Construction phase	On-going since its commencement in December 2015.

Taking into account the construction works in the reporting period, impact monitoring of air quality, noise, water quality, waste management, ecology and CWD were carried out in the reporting period.

The EM&A programme also involved weekly site inspections and related auditing conducted by the ET for checking the implementation of the required environmental mitigation measures as recommended in the approved EIA Report. In order to enhance environmental awareness and closely monitor the environmental performance of the contractors, environmental briefings and regular environmental management meetings were conducted.

The EM&A programme has been undertaken in accordance with the recommendations presented in the approved EIA Report and the Manual. A summary of implementation status of the environmental mitigation measures for the construction phase of the Project during the reporting period is provided in **Appendix C**.

2 Environmental Monitoring and Auditing

2.1 Air Quality Monitoring

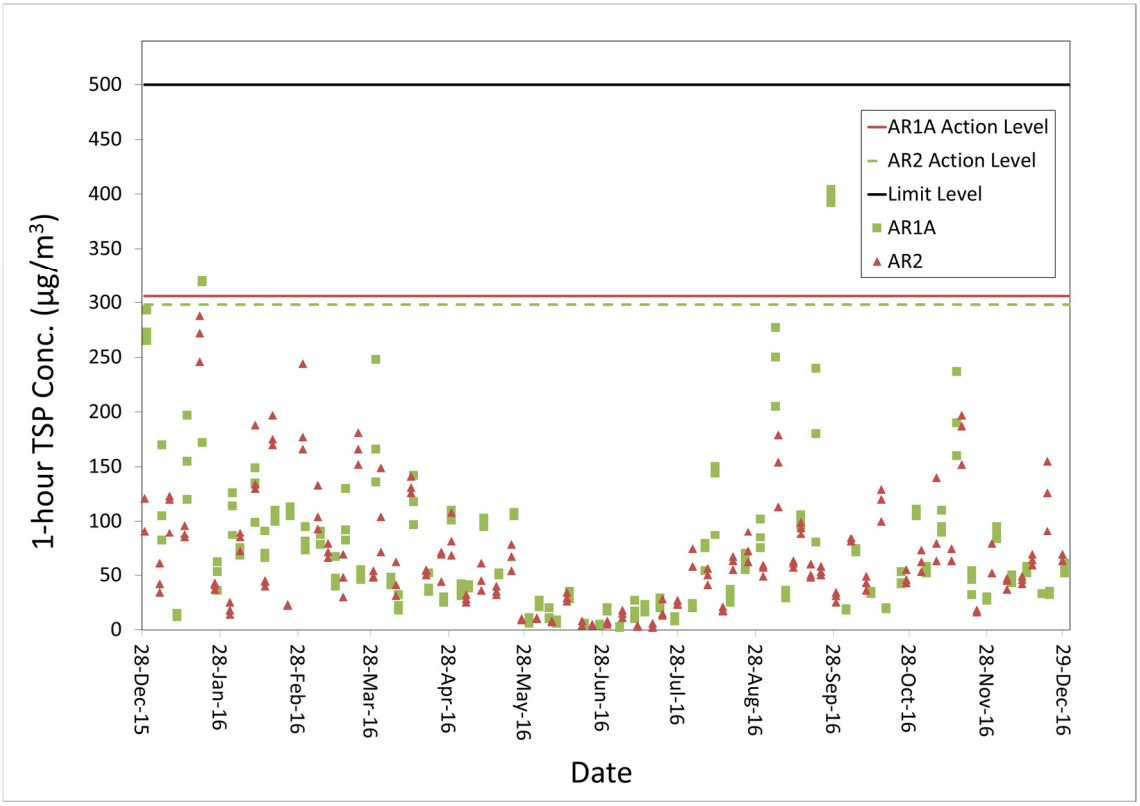
Impact 1-hour Total Suspended Particulates (TSP) monitoring was conducted three times every 6 days at two representative monitoring stations during the reporting period. The locations of monitoring stations are described in **Table 2.1** and presented in **Figure 2.1**. The Action and Limit Levels of the air quality monitoring stipulated in the EM&A programme for triggering the relevant investigation and follow-up procedures under the programme are provided in **Table 2.1**.

Table 2.1: Impact Air Quality Monitoring Stations

Monitoring Station	Location	Action Level (µg/m^3)	Limit Level (µg/m^3)
AR1A	Man Tung Road Park	306	500
AR2	Village House at Tin Sum	298	

The graphical plots of impact air quality monitoring results during the reporting period are presented in **Graph 1**.

Graph 1: Graphical Plot of 1-hour TSP concentration at AR1A and AR2 during the Reporting Period



Two Action Level exceedances of 1-hour TSP monitoring started at 10:00 and 11:00 were recorded at AR1A on 21 January 2016. Actions were taken accordingly based on the established Event and Action Plan as presented in the Manual. IEC and AAHK were informed of the exceedances. It was confirmed that no major dusty construction activities were conducted by contract P560(R), the major land works, when the exceedances were measured. It is thus considered that the exceedances were not related to the Project.

Another three Action Level exceedances of 1-hour TSP monitoring started at 08:52, 09:52 and 10:52 were recorded at AR1A on 27 September 2016. Actions were taken accordingly based on the established Event and Action Plan as presented in the Manual. IEC and AAHK were informed of the exceedances. According to on-site observation by monitoring team, hazy weather was observed during monitoring. It was confirmed that no major dusty construction activities were conducted by P560(R) contractor when the exceedances were measured. The exceedances of 1-hr TSP might possibly be due to the changes in the background air quality level and not project-related.

No exceedance of the Action and Limit Level was recorded at AR2 in the reporting period.

The weather varied from fine to rainy in the reporting period. Wind direction was mainly northeast or northwest in the reporting period.

The key activities of the Project carried out in the reporting period can be referred to Section 1.5 of this report. Those works were not likely to cause adverse dust pollution.

The active construction site is around 3 kilometres away from the nearest air sensitive receiver in Tung Chung. The major dust sources during the reporting period were observed to be local air pollution and nearby traffic emissions. It is considered that the monitoring work in the reporting period was effective and there was no adverse impact attributable to the works of the Project.

2.2 Noise Monitoring

Impact noise monitoring was conducted at five representative monitoring stations once per week during 0700 and 1900 during the reporting period. The locations of monitoring stations are described in **Table 2.2** and presented in **Figure 2.1**. The Action and Limit levels of the noise monitoring stipulated in the EM&A programme for triggering the relevant investigation and follow-up procedures under the programme are provided in **Table 2.2**.

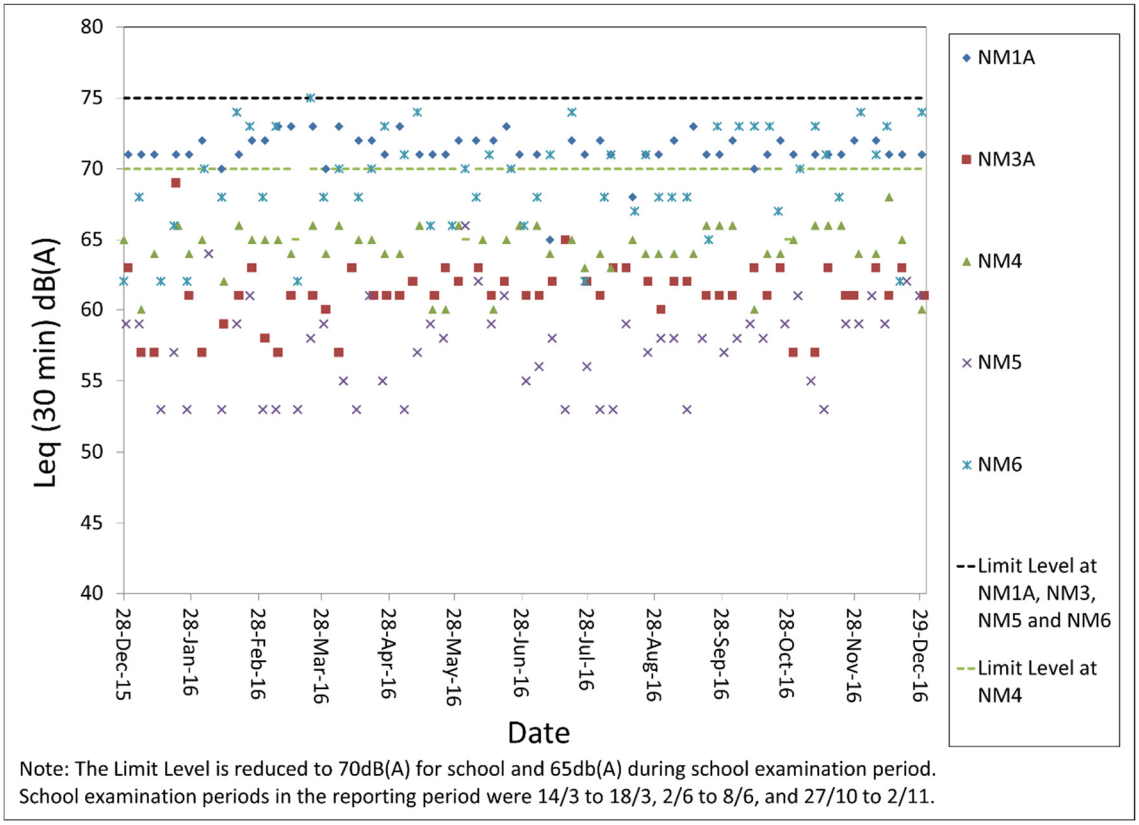
The graphical plot of impact noise quality monitoring results during the reporting period are presented in **Graph 2**.

Table 2.2: Impact Noise Quality Monitoring Stations

Monitoring Station	Location	Action Level	Limit Level
NM1A	Man Tung Road Park	When one documented complaint is received from any one of the sensitive receivers	75 dB(A)
NM3A	Site Office		75 dB(A)
NM4[(i)]	Ching Chung Hau Po Woon Primary School		65dB(A) / 70 dB(A)
NM5	Village House in Tin Sum		75 dB(A)
NM6	House No. 1, Sha Lo Wan		75 dB(A)

Note: [(i)] reduce to 70dB(A) for school and 65dB(A) during school examination periods.

Graph 2: Graphical Plot of L_{eq} (30 min) at NM1A, NM3A, NM4, NM5, and NM6 during the Reporting Period



Note: The Limit Level is reduced to 70dB(A) for school and 65db(A) during school examination period. School examination periods in the reporting period were 14/3 to 18/3, 2/6 to 8/6, and 27/10 to 2/11.

No exceedance of the Action and Limit Level was recorded at all monitoring stations in the reporting period.

The key activities undertaken in the reporting period were not likely to cause adverse noise impact. The active construction work is around 900 metres away from the nearest noise sensitive receivers in the villages in North Lantau. The major noise sources during the reporting period were observed to be aircraft noise at NM3A and NM5, aircraft noise and helicopter noise at NM6, road traffic noise at NM1A, and school activities at NM4 in the background. It is considered that the monitoring work in the reporting period was effective and there was no adverse impact attributable to the works of the Project.

2.3 Water Quality Monitoring

Water quality monitoring commenced in August 2016, although there were no marine construction works in August and September 2016. Water quality monitoring was conducted at a total of 22 water quality monitoring stations, comprising 12 impact stations, seven sensitive receiver stations, and three control stations in the vicinity of the water quality sensitive receivers around the airport island in accordance with the Manual. **Table 2.3** describes the details of the monitoring stations. **Figure 2.2** shows the locations of the monitoring stations.

Table 2.3: Monitoring Locations and Parameters for Impact Water Quality Monitoring

Monitoring Stations	Description	Coordinates		Parameters
		Easting	Northing	
C1	Control	804247	815620	DO, pH, Temperature, Salinity, Turbidity, SS, Total Alkalinity, Heavy Metals[2]
C2	Control	806945	825682	
C3[3]	Control	817803	822109	
IM1	Impact	806458	818351	
IM2	Impact	806193	818852	
IM3	Impact	806019	819411	
IM4	Impact	805039	819570	
IM5	Impact	804924	820564	
IM6	Impact	805828	821060	
IM7	Impact	806835	821349	
IM8	Impact	807838	821695	
IM9	Impact	808811	822094	
IM10	Impact	809838	822240	
IM11	Impact	810545	821501	
IM12	Impact	811519	821162	
SR1[1]	Future Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities (HKBCF) Seawater Intake for cooling	812586	820069	DO, pH, Temperature, Salinity, Turbidity, SS
SR2[3]	Planned marine park / hard corals at The Brothers / Tai Mo To	814166	821463	
SR3	Sha Chau and Lung Kwu Chau Marine Park / fishing and spawning grounds in North Lantau	807571	822147	
SR4A	Sha Lo Wan	807810	817189	
SR5A	San Tau Beach SSSI	810696	816593	
SR6	Tai Ho Bay, Near Tai Ho Stream SSSI	814663	817899	
SR7	Ma Wan Fish Culture Zone (FCZ)	823742	823636	
SR8	Seawater Intake for cooling at Hong Kong International Airport (East)	811593	820417	

Notes:
[1] The seawater intakes of SR1 for the future HKBCF are not yet in operation, the future permanent location for SR1 during impact monitoring is subject to finalisation after the HKBCF seawater is commissioned.

[2] Details of selection criteria for the two heavy metals for early regular DCM monitoring refer to the Detailed Plan on Deep Cement Mixing available on the dedicated 3RS website http://env.threerunwaysystem.com/en/ep-submissions.html). DCM specific water quality monitoring parameters (total alkalinity and heavy metals) were only conducted at C1 to C3, SR2, and IM1 to IM12

[3] According to the baseline water quality monitoring report, C3 station is not adequately representative as a control station of impact/ SR stations during the flood tide. The control reference has been changed from C3 to SR2 from 1 September 2016 onwards.

2.3.1 Action and Limit Levels for Water Quality Monitoring

The Action and Limit Levels for general water quality monitoring and regular DCM monitoring stipulated in the EM&A programme for triggering the relevant investigation and follow-up procedures under the programme are presented in **Table 2.4**. The control and impact stations during flood tide and ebb tide for general water quality monitoring and regular DCM monitoring are presented in **Table 2.5**.

Table 2.4: Action and Limit Levels for General Water Quality Monitoring and Regular DCM Monitoring

Parameters	Action Level (AL)		Limit Level (LL)	
Action and Limit Levels for general water quality monitoring and regular DCM monitoring (excluding SR1& SR8)				
DO in mg/L (Surface, Middle & Bottom)	Surface and Middle 4.5 mg/L		Surface and Middle 4.1 mg/L 5 mg/L for Fish Culture Zone (SR7) only	
	Bottom 3.4 mg/L		Bottom 2.7 mg/L	
Suspended Solids (SS) in mg/L	23	or 120% of upstream control station at the same tide of the same day, whichever is higher	37	or 130% of upstream control station at the same tide of the same day, whichever is higher
Turbidity in NTU	22.6		36.1	
Total Alkalinity in ppm	95		99	
Representative Heavy Metals for early regular DCM monitoring (Chromium)	0.2		0.2	
Representative Heavy Metals for early regular DCM monitoring (Nickel)	3.2		3.6	
Action and Limit Levels SR1				
SS (mg/l)	To be determined prior to its commissioning		To be determined prior to its commissioning	
Action and Limit Levels SR8				
SS (mg/l)	52		60	

Note:

1. For DO measurement, non-compliance occurs when monitoring result is lower than the Action or Limit Levels.
2. For parameters other than DO, non-compliance of water quality results when monitoring results is higher than the Action or Limit Levels.
3. Depth-averaged results are used unless specified otherwise.
4. Details of selection criteria for the two heavy metals for early regular DCM monitoring refer to the Detailed Plan on Deep Cement Mixing available on the dedicated 3RS website http://env.threerunwaysystem.com/en/ep-submissions.html)
5. The action and limit levels for the two representative heavy metals chosen will be the same as that for the intensive DCM monitoring.

Table 2.5: The Control and Impact Stations during Flood Tide and Ebb Tide for General Water Quality Monitoring and Regular DCM Monitoring

Control Station	Impact Stations
Flood Tide	
C1	IM1, IM2, IM3, IM4, IM5, IM6, IM7, IM8, SR3
SR2^1	IM7, IM8, IM9, IM10, IM11, IM12, SR1A, SR3, SR4A, SR5A, SR6, SR8
Ebb Tide	
C1	SR4A, SR5A, SR6
C2	IM1, IM2, IM3, IM4, IM5, IM6, IM7, IM8, IM9, IM10, IM11, IM12, SR1A, SR2, SR3, SR7, SR8

^1 As per findings of Baseline Water Quality Report, the control reference has been changed from C3 to SR2 from 1 Sep 2016 onwards.

2.3.1 Analysis and Interpretation of Monitoring Results

Summary of Monitoring Results

Water quality monitoring was conducted at 12 impact stations (IM), seven sensitive receiver (SR) stations and three control stations in the vicinity of water quality sensitive receivers around the airport island in accordance with the Manual. The purpose of water quality monitoring at the IM stations is to promptly capture any potential water quality impacts from the Project before the impacts could become apparent at sensitive receivers (represented by the SR stations).

Water quality monitoring commenced in August 2016. No marine construction works were conducted in August and September 2016, and hence no adverse water quality impact associated with the project was observed in August and September 2016.

During the monitoring period between October and December 2016, the monitoring results for DO, total alkalinity, and chromium obtained were in compliance with their corresponding Action and Limit Levels. For turbidity, SS and nickel, some of the testing results had exceeded the relevant Action Levels or Limit Levels during the reporting period. Investigations were carried out immediately for each of the exceedance cases, and the investigation findings concluded that all the exceedances were not due to the Project. Summaries of turbidity, SS, and nickel compliance status are presented in **Table 2.6 to 2.10**.

Findings for Turbidity Exceedance

Table 2.6 and **Table 2.7** presents a summary of the turbidity compliance status at IM and SR stations during mid-ebb and mid-flood tide for the reporting period.

Table 2.6: Summary of Turbidity Compliance Status at IM and SR Stations (Mid-Ebb Tide)

Date	IM1	IM2	IM3	IM4	IM5	IM6	IM7	IM8	IM9	IM10	IM11	IM12	SR2	SR3	SR4A	SR5A	SR6	SR7	SR8
19/11/2016																			
No. of Turbidity Exceedances	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2.7: Summary of Turbidity Compliance Status at IM and SR Stations (Mid-Flood Tide)

Date	IM1	IM2	IM3	IM4	IM5	IM6	IM7	IM8	IM9	IM10	IM11	IM12	SR2	SR3	SR4A	SR5A	SR6	SR7	SR8
01/10/2016																			
01/11/2016																			
17/11/2016																			
No. of Turbidity Exceedances	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0

Note: The monitoring dates that are not presented in the above tables were in full compliance with their corresponding Action and Limit Levels. Detailed results are presented in **Appendix D**.

Legend:

No exceedance of Action Level and Limit Level

Exceedance of Action Level recorded at monitoring station located downstream of the 3RS Project based on dominant tidal flow

Exceedance of Action Level recorded at monitoring station located upstream of the 3RS Project based on dominant tidal flow

Upstream station with respect to 3RS Project during the respective tide based on dominant tidal flow

Investigations were conducted for each of the exceedance cases and details of the investigation findings are presented in the Construction Phase Monthly EM&A Report no. 10 and 11. All exceedances were found not due to the Project.

IM Stations

Overall, the turbidity exceedances that occurred during this reporting period appeared to be very sporadic and isolated cases with neither temporal nor spatial trend to indicate that the turbidity exceedances were linked to Project activities. Such isolated cases appear to be more characteristic of natural fluctuation, and this is supported by the baseline monitoring which also showed occasionally elevated turbidity levels that are of a magnitude similar to or greater than the turbidity exceedances that occurred during this reporting period.

SR Stations

There were no turbidity exceedances at any SR stations.

Findings for SS Exceedances

Table 2.8 and **Table 2.9** presents a summary of the SS compliance status at IM and SR stations during mid-ebb and mid-flood tide for the reporting period.

Table 2.8: Summary of SS Compliance Status at IM and SR Stations (Mid-Ebb Tide)

Date	IM1	IM2	IM3	IM4	IM5	IM6	IM7	IM8	IM9	IM10	IM11	IM12	SR2	SR3	SR4A	SR5A	SR6	SR7	SR8
04/10/2016																			
15/10/2016																			
20/10/2016																			
25/10/2016																			
12/11/2016																			
15/11/2016																			
19/11/2016																			
26/11/2016																			
29/11/2016																			
01/12/2016																			
03/12/2016																			
No. of SS Exceedances	2	3	2	3	2	5	2	0	1	1	0	0	0	3	5	0	0	0	0

Table 2.9: Summary of SS Compliance Status at IM and SR Stations (Mid-Flood Tide)

Date	IM1	IM2	IM3	IM4	IM5	IM6	IM7	IM8	IM9	IM10	IM11	IM12	SR2	SR3	SR4A	SR5A	SR6	SR7	SR8
04/10/2016																			
15/10/2016																			
20/10/2016																			
22/10/2016																			
25/10/2016																			
01/11/2016																			
03/11/2016																			
05/11/2016																			
08/11/2016																			

Date	IM1	IM2	IM3	IM4	IM5	IM6	IM7	IM8	IM9	IM10	IM11	IM12	SR2	SR3	SR4A	SR5A	SR6	SR7	SR8
12/11/2016																			
15/11/2016																			
17/11/2016																			
19/11/2016																			
24/11/2016																			
29/11/2016																			
17/12/2016																			
20/12/2016																			
27/12/2016																			
No. of SS Exceedances	2	3	3	1	0	1	1	0	0	1	2	3	0	0	6	1	9	0	0

Note: The monitoring dates that are not presented in the above tables were in full compliance with their corresponding Action and Limit Levels. Detailed results are presented in **Appendix D**.

Legend:

- No exceedance of Action Level and Limit Level
- Exceedance of Action Level recorded at monitoring station located downstream of the 3RS Project based on dominant tidal flow
- Exceedance of Action Level recorded at monitoring station located upstream of the 3RS Project based on dominant tidal flow
- Exceedance of Limit Level recorded at monitoring station located downstream of the 3RS Project based on dominant tidal flow
- Exceedance of Limit Level recorded at monitoring station located upstream of the 3RS Project based on dominant tidal flow
- Upstream station with respect to 3RS Project during the respective tide based on dominant tidal flow

Investigations were conducted for each of the exceedance case and details of the investigation findings are presented in the Construction Phase Monthly EM&A Report no. 10, 11 and 12. All exceedances were found not due to the Project.

IM Stations

Overall, it was observed that the SS exceedances during this reporting period occurred frequently at those IM stations which are located upstream of the 3RS Project, particularly during mid-flood tide. Such exceedances at upstream stations would unlikely be affected by the Project.

Separately, during mid-ebb tide, it is observed that exceedances at IM stations occur at both upstream and downstream stations on the same monitoring day. Such concurrent (upstream and downstream) exceedances observed at these IM stations on the same monitoring day suggest that there might be other sources of SS that were not related to the Project.

SR Stations

At SR stations, except for SR4A during mid-ebb tide, exceedances occurred when the respective SR stations are located upstream of the Project during mid-ebb and mid-flood tide, hence exceedances at these upstream SR stations are unlikely to be due to the Project. In addition, it is noted that similarly high SS levels were observed at these SR stations during baseline monitoring, which suggested that such SS elevations are not uncommon under ambient conditions due to natural fluctuation.

Separately, a number of consecutive exceedances were observed affecting SR4A during mid-ebb tide. While this SR station is located downstream of the Project during mid-ebb tide, similar exceedances at the IM stations located between the Project and the SR station were not

observed on most of the monitoring days, while the baseline monitoring results at SR4A showed similar high SS levels during baseline monitoring. It is thus considered that such SS elevations are not uncommon under ambient conditions due to natural fluctuation.

Findings for Nickel Exceedances

Table 2.10 presents a summary of the nickel compliance status at IM and SR stations for the reporting period. There were no nickel exceedances during mid-ebb tide for the reporting period.

Table 2.10: Summary of Nickel Compliance Status at IM Stations (Mid-Flood Tide)

Date	IM1	IM2	IM3	IM4	IM5	IM6	IM7	IM8	IM9	IM10	IM11	IM12	SR2	SR3	SR4A	SR5A	SR6	SR7	SR8
22/11/2016																			
No. of nickel Exceedances	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0

Note: The monitoring dates that are not presented in the above table were in full compliance with their corresponding Action and Limit Levels. Detailed results are presented in **Appendix D**.

Legend:

- No exceedance of Action Level and Limit Level
- Exceedance of Action Level recorded at monitoring station located downstream of the 3RS Project based on dominant tidal flow
- Exceedance of Action Level recorded at monitoring station located upstream of the 3RS Project based on dominant tidal flow
- Exceedance of Limit Level recorded at monitoring station located downstream of the 3RS Project based on dominant tidal flow
- Exceedance of Limit Level recorded at monitoring station located upstream of the 3RS Project based on dominant tidal flow
- Upstream station with respect to 3RS Project during the respective tide based on dominant tidal flow

Investigations were conducted for each of the exceedance cases and details of the investigation findings are presented in the Construction Phase Monthly EM&A Report no. 11. All exceedances were found not due to the Project.

IM Stations

Nickel is a representative heavy metal for DCM monitoring. It is worth noting that no DCM activities were conducted during the monitoring period. Hence it is considered that occasional elevations in nickel levels may arise due to other sources not associated with the Project.

SR Stations

There were no nickel exceedances at any SR stations.

Conclusions

Based on the findings of the exceedance investigations presented in Construction Phase Monthly EM&A Report no. 10, 11 and 12, it was concluded that the exceedances during this reporting period were not due to the Project. Hence no SR stations were adversely affected by the Project. All required actions under the Event and Action Plan had been followed. Exceedances appeared to be due to natural fluctuation (such as naturally higher baseline SS levels at individual SR stations) or other sources not related to the Project.

Nevertheless, recognising that the IM stations represent a 'first line of defense', the non-project related exceedances identified at IM stations have been attended to as triggers of precautionary measures. As part of the EM&A programme, the construction methods and mitigation measures for water quality will continue to be monitored and opportunities for further enhancement will

continue to be explored and implemented where possible, to strive for better protection of water quality and the marine environment.

In the meantime, the contractors were reminded to implement and maintain all mitigation measures during weekly site inspection. These include maintaining the silt curtain for sand blanket laying properly and maintaining the levels of materials on barges to avoid overflow as recommended in the Manual.

2.4 Waste Monitoring

In accordance with the Manual, the waste generated from construction activities was audited once per week to determine if wastes were being managed in accordance with the Waste Management Plan (WMP) prepared for the Project, contract-specific WMP, and any statutory and contractual requirements. All aspects of waste management including waste generation, storage, transportation and disposal were assessed during the audits. The Action and Limit Levels of the construction waste are provided in **Table 2.11**.

Table 2.11: Action and Limit Levels for Construction Waste

Monitoring Stations	Action Level	Limit Level
Construction Area	When one valid documented complaint is received	Non-compliance of the WMP, contract-specific WMPs, any statutory and contractual requirements

Weekly waste monitoring of the Project construction works to check and monitor the implementation of proper waste management practices were conducted during the reporting period.

Recommendations were provided during monitoring including setup and implementation of the waste recording system, storage of stockpiled materials, spill control and management, provision and proper maintenance of drip trays for chemical containers, removal of oil stain on ground as chemical waste on sites, proper disposal of sewage effluent from construction workforce as well as proper collection, sorting and disposal of Construction and Demolition (C&D) materials and general refuse. In addition, relevant contractors were reminded to provide spill kit, personal protective equipment in the spill kits and chemical storage area, and to handle the chemical waste properly. The contractors had taken actions to implement the recommended measures.

Under the P560(R) Contract, about 1,850 cubic metres of excavated materials were produced from the HDD launching site and Sheung Sha Chau during the reporting period. Such materials are temporarily stored at the stockpiling area and for reuse in the Project.

In addition, metals and paper were recycled. During the reporting period, around 46 tonnes of general refuse and 0.5 tonnes of chemical waste were disposed of to the West New Territories (WENT) Landfill and Tsing Yi Chemical Waste Treatment Centre respectively. No C&D material was disposed off-site during the reporting period.

No exceedance of the Action or Limit Levels was recorded in the reporting period.

2.5 CWD Monitoring

This section summarises the results of the CWD monitoring effort over a 12-month period between 18 December 2015 and 31 December 2016 (covering 6-month baseline monitoring of the pre-construction period and 6-month construction phase monitoring commencing on 1 August 2016), to gather information on the spatial and temporal distribution patterns,

abundance, and density of the CWD in the western Hong Kong waters. Supplementary information collected focuses on northwestern Lantau waters including the habitat use and behaviours of CWD before and during the construction phase of the 3RS project has also been reviewed. Seasonal variation has been considered using a whole year of data collected to facilitate the review of the CWD encounter rate and Event and Action Plan.

2.5.1 Summary of Monitoring Requirements

CWD monitoring was conducted by undertaking vessel line-transect surveys at a frequency of two full surveys per month, supplemented by land-based theodolite tracking and Passive Acoustic Monitoring (PAM). The frequency of the theodolite tracking was two days per month at both the Sha Chau (SC) station and Lung Kwu Chau (LKC) station during the 6-month baseline monitoring. The monitoring frequency during the construction phase for marine works was one day per month at both stations as stipulated in the Manual requirement. Additional theodolite tracking at SC station and LKC station (in total 2 tracking days and 3 tracking days per month at respective stations in both baseline and 6-month construction phase for marine works) were also conducted on a voluntary basis to collect supplementary information for the project. PAM was also deployed from January to December 2016 with a duty cycle of 20% for the baseline and construction phases with data supplementing the results of both vessel and land-based surveys. For detail on CWD monitoring and data analysis methodologies refer to Section 10.2.4 of the Manual. The locations of the CWD vessel survey transects are shown in **Figure 2.3**, whilst the land-based survey stations are described in **Table 2.12** and depicted in **Figure 2.4**. The location of the Passive Acoustic Monitoring devices are shown in **Figure 2.5**.

Table 2.12: Land-based Survey Station Details

Stations	Location	Geographical Coordinates	Station Height (m)	Approximate Tracking Distance (km)
D	Sha Chau (SC)	22° 20' 43.5" N 113° 53' 24.66" E	45.66	2
E	Lung Kwu Chau (LKC)	22° 22' 44.83" N 113° 53' 0.2" E	70.40	3

Construction phase monitoring of CWDs commenced in August 2016, although there were no marine construction works in August and September 2016. The Action Level (AL) and Limit Level (LL) for CWD monitoring were formulated by an action response approach using the running quarterly dolphin encounter rates (Encounter Rate by Number of Dolphin Sightings 'STG' and Encounter Rate by Number of Dolphins 'ANI') derived from baseline monitoring data, as presented in the CWD Baseline Monitoring Report. The derived values of AL and LL for CWD monitoring are shown in **Table 2.13**.

Table 2.13: Derived Values of Action Level (AL) and Limit Level (LL) for Chinese White Dolphin Monitoring

	NEL, NWL, AW, WL and SWL as a Whole
Action Level	Running quarterly STG < 1.86 & ANI < 9.35
Limit Level	Two consecutive running quarterly (3-month) STG < 1.86 & ANI < 9.35

2.5.2 Summary of Vessel Line-transect Survey Monitoring Results

Survey Effort

During the reporting period from mid-December 2015 to December 2016, survey effort was completed in NEL, NWL, AW, WL and SWL survey areas. Although the frequencies of visiting each survey area per survey month were identical, the survey efforts of different survey areas varied and were generally in proportion to the size of each survey area (i.e. larger survey area having longer transect distance travelled). A total of 5,619.7 km of survey effort was conducted in this reporting period (NEL: 1,139.0 km, NWL: 1,955.2 km, AW: 114.9 km, WL: 783.8 km, and SWL: 1,626.8 km). The percentages of the total survey effort conducted in NEL, NWL, AW, WL and SWL were around 20.3%, 34.8%, 2.0%, 13.9% and 28.9% respectively.

Around 89.6% (i.e. 5,035.9 km) of the survey effort was conducted under favorable weather condition (i.e. Beaufort 0-3 and visibility of approximately 1,200 m or beyond), that can be utilized for the analyses of encounter rates, density and abundance of CWDs in western Hong Kong waters. The survey effort data are provided in Appendix A of CWD Baseline Monitoring Report, Appendix E of Quarterly EM&A Report No 3 and No.4.

Sighting Distribution

During mid-December 2015 to December 2016, 208 groups consisting of 785 CWD individuals were sighted. Amongst these 208 groups of CWDs, 173 groups with 677 individuals were sighted during on-effort surveys under favourable weather condition (i.e. Beaufort 0-3 and visibility of approximately 1,200 metres or beyond).

The number of sightings by survey area recorded that NWL comprised 46 groups of 181 CWDs, AW comprised 4 groups of 16 CWDs, WL comprised 96 groups of 347 CWDs, while there were 62 groups of 241 CWDs in SWL. No CWDs were sighted in NEL during the entire reporting period.

In NWL, most CWDs were sighted within or in close vicinity of the Sha Chau and Lung Kwu Chau Marine Park (SCLKCMP), particularly north off Lung Kwu Chau, with a few sightings (including AW sightings) recorded at the southwestern part of the survey area. No dolphins were sighted in the eastern part of the survey area or within the 3RS land-formation footprint.

In WL, CWDs were quite evenly sighted along the coast and off-shore waters from Sham Wat to Fan Lau, with relatively more sightings near Fan Lau.

In SWL, CWDs frequented along the coastal waters from Fan Lau to Shui Hau with more sightings recorded in the western part of the survey area, especially near Fan Lau. CWDs were also scattered around the western side of the Soko Islands.

The sighting locations of CWDs during this reporting period are depicted in Figure 1 of **Appendix E**.

Encounter Rate

Two types of dolphin encounter rates were calculated based on the data collected from mid-December 2015 to December 2016. They included the number of dolphin sightings per 100 kilometres survey effort (STG) and total number of dolphins per 100 kilometres survey effort (ANI). The dolphin encounter rates were calculated by using survey data collected under favorable weather condition only (i.e. Beaufort Sea State 3 or below with favorable visibility).

From mid-December 2015 to December 2016, the combined STG and ANI of CWDs (from NEL, NWL, AW, WL and SWL) were 3.44 and 13.44 respectively. Compared by area, WL had the highest STG and ANI amongst the survey areas, followed by SWL, AW and NWL. The

encounter rate of NEL was zero as no dolphins were sighted in the reporting period. By season, summer had the highest STG and ANI while the lowest encounter rates occurred in winter. The highest STG and ANI both occurred in July 2016 while the lowest STG and the lowest ANI appeared in January and March respectively. Dolphin encounter rates by survey area and a summary of monthly encounter rates are presented in Table 1 and Table 2 of **Appendix E** while the trends of both monthly STG and ANI are presented in Figure 2 and Figure 3 of **Appendix E**.

For comparison with the Action/Limit levels for CWD monitoring, running quarterly STGs and ANIs were calculated from the commencement of construction phase monitoring in August 2016. No Action Level was triggered in this reporting period. The running quarterly STGs and ANIs from August to December 2016 are summarized in Table 2 of **Appendix E** while the trends of both quarterly STG and ANI were presented in Figure 2 and Figure 3 of **Appendix E**.

The CWD Baseline Monitoring Report recommended a review of the encounter rate levels adopted as Action and Limit Levels for construction phase monitoring, as well as a review of CWD encounter rates across different seasons after collection of 12 months CWD monitoring data. The trends for the running quarterly STG and ANI from March to December 2016 (shown in Figure 2 and Figure 3, **Appendix E**) have been further reviewed, by comparing the seasonal variations of CWD quarterly encounter rates with the Agriculture, Fisheries and Conservation Department (AFCD) long term marine mammals monitoring results over the past six years (2010 to early 2016) covering the NEL, NWL, WL and SWL waters (Figure 4, **Appendix E**). The findings show that for both the 3RS monitoring results and AFCD long term records, the first quarter (i.e. January to March) of the year is still the low season for CWD encounters, with the values of STG and ANI consistently being the lowest during Q1. Seasonal variation can be reflected in the AFCD long term records that the CWD running encounter rates generally increase in Q2 and show a crest in Q3 (with some exceptions in the timing of crest – peaks in April and November 2011, a crest in Q4 2013 and a 'late' crest between September and November in 2015). Compared to the seasonal variations reflected in the AFCD long term records, the running quarterly encounter rates of the 3RS monitoring results (March to December 2016) were generally lower and with a narrower range (STG: 1.86 – 4.93; ANI: 8.99 – 21.75) throughout the year. The 2016 3RS monitoring data did not show a significant high quarterly encounter rates for STG and ANI (peak at 4.9 and 21.8 respectively), while the lowest peak for AFCD from 2010 to 2015 was at around 8 and 30 for STG and ANI respectively (AFCD 2016 peak season data is yet to be available for comparison of the 2016 trend.) As the peak quarterly encounter rates for STG and ANI values for 3RS baseline were still low, the setting of another set of AL/LL with a narrow range of different values may not represent the status of the peak season, therefore it is proposed to maintain the existing AL/LL derived from the CWD Baseline Monitoring Report and to further review when more data are available. Therefore, the encounter rates previously established during the baseline monitoring period will continue to be used and thus the Event and Action Plan remains unchanged.

Density and Abundance Estimation

Line transect analyses to estimate the density and abundance of CWDs in Hong Kong waters during the time period of this report were conducted (Table 3, **Appendix E**). Overall, estimates of density and abundance were similar to those conducted by AFCD long-term dataset. As in past analyses, the area with the highest abundance and highest density was West Lantau (this has been consistent over the 21-year AFCD monitoring period). Northeast Lantau still registered zero sightings and an abundance estimate of zero, although recently some sightings of dolphins have been made in NEL by the Hong Kong-Zhuhai-Macao Bridge (HZMB) monitoring efforts (L. J. Porter, pers. comm. to T. A. Jefferson, Jan. 2017).

In addition to estimating year-round abundance for each of the survey areas, a seasonal analysis was also conducted (the pooled dataset from all survey areas have been used, as stratifying by both survey area and season would reduce the sample sizes, and result in estimates with unacceptably-low levels of precision). The seasonal estimates (refer to Table 3 of **Appendix E**) were reasonably similar and generally in line with what was expected from past research, with the exception that the spring estimate was quite high, and this is higher than expected from past work, where spring estimates were generally the low season for dolphin numbers in Hong Kong.

Habitat Use

Habitat use of CWD amongst the survey areas was examined by using quantitative grid analysis, both SPSE and DPSE values were calculated in all grids amongst all survey areas for the time period from mid-December 2015 to December 2016, for the first time for 3RS CWD monitoring.

In this reporting period, the important habitat of CWDs in NWL waters with high dolphin densities was north of Lung Kwu Chau. In WL and SWL waters, the important habitats of CWDs were near Tai O, Yi O, Peaked Hill and Fan Lau. The number of on-effort dolphin sightings per 100 units of survey effort (SPSE) and number of dolphins per 100 units of survey effort (DPSE) were calculated for the period from mid-December 2015 to December 2016 and depicted in Figure 5 of **Appendix E**.

Group Size

During the period from mid-December 2015 to December 2016, group size of CWDs ranged from one to 24 individuals, with an overall average of 3.77 ± 3.09. The average group sizes of NWL, AW, WL and SWL were 3.93, 4.0, 3.61 and 3.89 respectively. By four solar seasons, the average group size of CWDs was the highest in winter (4.21) but the lowest in autumn (2.91). The summaries of the average group size of CWDs by survey areas and by seasons were presented in Table 4 and Table 5 of **Appendix E**.

Small and medium sized CWD groups accounted for most of the sightings during mid-December 2015 to December 2016 (48.1% and 47.1% respectively). Only 10 sightings, that accounted 4.8% of the sightings, contained 10 or more animals per group.

Both small and medium sized CWD groups were sighted throughout the distribution range of dolphins in North, West and Southwest Lantau waters. Medium sized CWD groups were sighted more than small sized groups in the confluence of NWL, AW and WL survey areas where the HZMB Hong Kong Link Road aligned. There were relatively more large sized CWD groups sighted in WL and SWL than in NWL. In NWL, two large CWD groups were sighted in the area close to Deep Bay. In WL, the large CWD groups were sighted in waters between Yi O and Fan Lau. While in SWL, two large CWD groups were sighted in off-shore areas to the west of the survey area, with another large group sighted near Fan Lau and another was recorded in waters around Shek Pik. The sighting distribution of CWDs with different group sizes is illustrated in Figure 6 of **Appendix E**.

Activities and Association with Fishing Boats

Although vessel surveys do not provide the most unbiased information on the behaviour and activities of dolphins (due to the potentially disturbing presence of the vessel itself, and also the low vantage point of small vessels), nonetheless behaviour and activity data were collected from the vessel surveys.

During the reporting period from mid-December 2015 to December 2016, a total of 84 and 16 groups of CWDs were observed engaging in feeding and socializing activities, comprising of 40.4% and 7.7% of all CWD sightings respectively. Moreover, 34 and 17 groups of CWDs were sighted engaging in travelling and resting/milling activities respectively. The sighting locations of CWD groups engaged in different types of activities are depicted in Figure 7 of **Appendix E**.

Feeding activities mainly occurred north of Lung Kwu Chau in NWL and along the coast of WL and SWL, from Sham Wat to Shui Hau. Occasional feeding activities were also observed in southwestern corner of SCLKCMP and AW in NWL, and the central and western parts of Soko Islands. Considering the sample size of sighting data of different survey areas, AW has the highest percentage of feeding (although it should be kept in mind that the sample size in AW was very small), followed by SWL (Table 6, **Appendix E**).

A total number of 15 sightings of CWDs were observed associating with operating fishing boats, including gill netters (three groups), purse seiners (10 groups), single trawlers (one group) and pair trawlers (one group), accounted for 7.2% of all sightings. Although a trawling ban has been implemented in December 2012, illegal trawling activities were still often observed near the western and south-western borders of Hong Kong. Two groups of CWDs, one in NWL and another in SWL were observed feeding in association with trawling activities. Purse seiners were the most often observed fishing boat type that CWDs associated with. The operation of purse seiners with aggregated fisheries resources that the CWDs might have found beneficial to associate with. Operations of purse seiners were often observed in northern waters off Lung Kwu Chau and along the coastal waters of WL and SWL where CWDs also frequented. The sighting locations of CWD groups associated with operating fishing boats were depicted in Figure 8 of **Appendix E**.

Socializing activities were mainly sighted around Lung Kwu Chau and Fan Lau. Traveling activities in NWL were mainly sighted in areas close to Deep Bay. While in WL, traveling activities frequently occurred relatively off-shore from Yi O to Fan Lau. There were also several sightings with traveling activities scattered in SWL. In addition, resting/milling activities mainly occurred in WL and SWL. Three sightings of resting/milling activities were sighted in waters around the HZMB Hong Kong Link Road. The percentages of different activities for each of the survey areas were shown in Table 6 of **Appendix E**.

Mother-calf Pairs

During the reporting period from mid-December 2015 to December 2016, 15 out of all sightings were observed having mother-and-unspotted calf, or mother-and-unspotted juvenile pairs. The percentages of sightings with mother-calf pairs in NWL, WL and SWL were 8.7%, 6.3% and 8.0% respectively. These percentages were calculated by dividing the no. of sightings with mother-calf pairs of a survey area by the total no. of sightings of that survey area. The sighting distribution of mother-calf pairs are depicted in Figure 9 of **Appendix E**.

Photo Identification – Summary

From mid-December 2015 to December 2016, a total number of 165 CWD individuals were identified altogether 365 times from all sightings. These 165 identified CWD individuals were divided into three photo catalogues namely NL, WL and SWL accordingly to their first sighting locations. NL, WL and SWL catalogues contain 49, 63 and 53 individuals respectively. Amongst these 165 identified individuals, 82 (49.7%) were sighted more than once.

The number of re-sightings of an identified animal range from two to 10 times. The re-sighting rates (i.e. number of identified individuals that were re-sighted more than once divided by the total number of the identified individuals in the catalogue) of NL, WL and SWL catalogues were

38.8%, 52.4% and 56.6% respectively. Twelve out of these 82 re-sighted individuals were sighted 5 times or more. The most frequently re-sighted animals were NLMM006, NLMM013 and SLMM010, all were re-sighted 10 times from mid-December 2015 to December 2016. Summary of the photo-identification of CWDs is presented in Table 7 of **Appendix E**.

Photo Identification – Range Use of Identified CWD individuals

Re-sighting locations of identified CWD provide a basic idea of the range use of the individual dolphin.

Amongst these 82 re-sighted individuals, 43 individuals showed cross-area movement between different survey areas. This accounted for about 26.1% of all 165 identified animals. Fourteen (32.6%) out of these 43 animals were re-sighted in both NWL (including AW) and WL, while 32 (74.4%) animals were recorded in both WL and SWL. Five (11.6%) out of these 43 animals were re-sighted in three main survey areas (i.e. WL, SWL and NWL including AW). These five animals were NLMM019, NLMM021, SLMM011, WLMM027 and WLMM054.

Despite the fact that a number of identified CWD individuals were re-sighted in different survey areas, a significant proportion of animals were observed not crossing between different survey areas and were sighted in only one survey area repeatedly. For instance, 10 individuals occurred repeatedly in NWL only, 16 animals were re-sighted within WL only, while 12 animals occurred repeatedly in SWL only. The re-sighting locations of those re-sighted individuals that involved in NWL were depicted in the location maps in Figure 10 of **Appendix E** to provide indicative locations of their range used.

2.5.3 Summary of Land-based Theodolite Tracking Monitoring Results

Survey Effort

During mid-December 2015 to December 2016, a total of 59 days (including 60 survey sessions) and 361:49 (hh:mm) of land-based theodolite survey effort have been accomplished (Table 8 of **Appendix E** for summary, raw data refer to Appendix E of CWD Baseline Monitoring Report, Quarterly EM&A Report No. 3 and No.4). A total of 128 CWD groups were tracked from land, with 126 from the LKC station, and two from the SC station (Table 9 and Figure 11 of **Appendix E**). After the raw data were filtered, 51 CWD group focal follows from LKC and one from SC fit criteria for analyses. From these focal follow tracks, 78 and three 10-minute segments from LKC and SC respectively, were extracted for analyses. CWD group sighting per survey effort was 0.58 from LKC and 0.01 from SC.

Time of Day

The diurnal pattern of CWDs was calculated by dividing the total tracking time of CWD groups (prior to filtering data) by the total effort per hour block. Off LKC, the highest percentages of CWD groups (per hour of effort) were during the 1000 hour block (18.91%) and 1400 hour block (19.64%) (Figure 12 of **Appendix E**). The two groups recorded off SC were tracked during the 1000 and 1100 hour blocks only.

Time of Year

The highest percentage of CWD groups observed from LKC was during the 5th study period, between 18 April and 17 May 2016 (18.25%), as the wet season began, and the lowest percentage observed was during the 4th study period, between 18 March and 17 April 2016 (1.59%). CWDs were only observed from SC during the 6th and 8th survey months between 18 May and 17 June, and August 2016. For details, refer to Figure 13).

Group Size

The mean group size of CWD filtered tracks off LKC was 3.08±1.81, ranging from singletons to a maximum group size of 9. The sighting distribution of CWDs relative to group sizes is represented in Figure 14 of **Appendix E**. Singletons were most often observed near shore and group sizes of CWDs were largest around the SCLKCMP boundary where ferry traffic is routed around the perimeter of the marine park. The mean group size of CWDs was 2.59±1.64 (n=37) within the park, 3.19±1.44 (n=25) outside of the park, and 3.85±2.39 (n=16) crossing the marine park boundary. A basic one-way ANOVA and sequential Bonferonni post hoc test showed a significantly larger mean group size, at alpha level 0.05, of CWDs around the marine park boundary than those within the marine park (p=0.016). As will be mentioned in discussion, this trend may reflect sighting bias wherein single individuals may be more difficult to locate farther from the survey platform and easier to find and track larger group sizes at greater distances. However, CWD group sizes were not significantly larger beyond the park boundary relative to those around the boundary perimeter.

Group size of CWDs within 500 m of diverted SkyPier HSFs (<15 knots) was 3.50±2.07 (n=8), and for non-SkyPier HSFs (≥15 knots) was 4.29±2.69 (n=7). Group size with no vessels within 500 m was 2.91±1.64 (n=58). A basic one-way ANOVA showed no significant differences in group size based on vessel type present (p=0.122). While not significantly different, possibly due to small sample sizes in the presence of ferries, the possibility exists that dolphins more often aggregate together in the presence of vessels, especially those moving at high speed.

Only two groups, both with 4 individuals, were observed off SC (shown in Figure 15 of **Appendix E**). Detailed information on group size is shown in Table 10 of **Appendix E**.

Behavioural State

Excluding the unknown behavioural category from the filtered segments, foraging and travelling were observed most frequently (40.91% and 28.57%, respectively), and milling, resting, and socialising were observed least frequently (2.60%, 3.68%, and 5.84%, respectively) off LKC (Figure 16 of **Appendix E**). Travelling was the only behaviour recorded off SC.

Vessel Activity

Off LKC, vessels were recorded within 500 meters of focal CWD groups on 20 occasions (based on filtered 10-min segments), including diverted SkyPier HSFs under speed restriction on 8 occasions, non-SkyPier HSFs on 7 occasions, and other vessels (e.g., fishing and government vessels) on 5 occasions. A basic one-way ANOVA showed a significant difference at the 0.05 alpha level in CWD speed relative to vessel type present (p=0.015), and no significant differences in CWD reorientation rate (p=0.518) or linearity (p=0.128) relative to vessel type present. A sequential Bonferonni post hoc test showed a significant difference in CWD speed at alpha level 0.05 when diverted SkyPier HSFs under speed restriction were present (p=0.003) compared to no vessels present. There was also a significant difference in CWD speed at alpha level 0.1 when non-SkyPier HSFs were present (p=0.066) compared to no vessels present. There was no difference in CWD speed when other vessels were present (p=0.516).

There was no significant difference in CWD swimming speed, reorientation rate, or linearity based on high speed ferry presence when compared to slower speed ferry presence. However, sample sizes for the vessel categories are very small (e.g., all <15 samples), and therefore not robust, and should be interpreted with caution. The small sample sizes may reflect CWD potential avoidance of vessels off LKC.

CWD fine-scale movement patterns off LKC varied based on natural and artificial factors. CWDs swam slower and changed bearing more often when foraging than when travelling, as expected. CWDs generally swam in a less linear fashion when in larger social groupings. CWDs also swam significantly faster when moving across and outside of the marine park boundary. Although the SCLKCMP is an artificial construct lacking physical barriers, there are tangible differences based on vessel restrictions and operating routes within and beyond the designated area. Movement patterns did not change significantly relative to vessel presence, including high speed ferries and high speed ferries under speed restrictions. However, sample size in this category was low. CWDs may actively avoid vessels; for example, swimming quickly away from vessels when approaching the marine park boundary, making detection of groups within 500 m of a vessel less likely. The high-speed ferry speed restrictions in the area may allow dolphins to change course and swim away from oncoming vessels moving at slower speeds.

2.5.4 Summary of Passive Acoustic Monitoring Results

Dolphin Detection Rates Per Day

During the period of 8 Jan to 28 Dec 2016 (Deployments 1 through 7), dolphins were detected at site A5 (location refers to **Figure 2.5**) in a total of 210 of 74,234 files (0.28% of files) (Table 11 of **Appendix E**). Dolphins were detected on 104 of 261 (40%) days with recording effort (Table 11 and Figure 17 of **Appendix E**). On days with dolphins detected, the mean percentage of files with detections per day was 0.7%, and the maximum percentage of files with dolphin detections was 4.17%, on 7 Feb 2016 (Figure 17 of **Appendix E**). Clicks (including burst pulses) were the predominant type of dolphin signal detected (n = 209 detections). Of these, 18 were noted to be burst pulses and they were detected in the months of October through December 2016. Only one whistle was detected in data from this monitoring period, recorded on 27 November 2016.

Dolphin detection rates were greatest during winter and spring months (January through May) and lowest in summer, and showed a slight increase again in autumn (Figure 17 of **Appendix E**). During Deployments 1, 2, 3 and 6 (8 Jan – 13 May and 6 Oct – 7 Nov 2016), dolphins were detected on 40% - 65% of recording days, and in 0.2% - 0.6% of files on average. Detection rates were lower during Deployments 4, 5 and 7 (20 May – 12 Sep and 17 Nov – 28 Dec 2016), in which dolphins were detected on 29%, 18% and 24% of recording days respectively, and in 0.1% of files (Figure 17 of **Appendix E**).

These values represent reductions in the same metrics compared to previous monitoring at site A5 in 2013. During the comparable time period of 8 Jan to 7 Dec 2013 (the last day of recording effort for the previous EIA study), dolphins were present on 206 of 284 recording days (73%) (Figure 18 of **Appendix E**). In 2013, dolphins were detected in 763 of approximately 81,790 files (0.93% of files), and on days with dolphins the mean percentage of files with detections was 1.3%, nearly double the mean percentage of files on days with dolphins in 2016 (0.7%). The percentage of files per day with dolphin detections exceeded 4% on 11 days during the 2013 time period, whereas in 2016 the percentage of files with dolphin detections exceeded 4% on only one day.

Dolphin Diel Pattern

Dolphin detection rates at A5 from 8 Jan to 28 Dec 2016 were greater at night than during daytime and exhibited a clear diel pattern, with peak detection hours between 2100-2200 and 0200-0300 (Figure 19 of **Appendix E**). This pattern of detection was similar compared to the 2013 monitoring period, with higher numbers of detections during night-time and fewest detections at midday (as seen throughout Hong Kong waters, in general). No seasonal

differences in the diel pattern were evident, although the overall numbers of detections in summer and autumn were lower than in winter and spring (Figure 20 of **Appendix E**).

Sound Pressure Levels Per Day

Ambient received noise levels (referred to as sound pressure levels or SPL) at the EAR were calculated for each recording within the full effective frequency bandwidth (~0 to 32 kHz) as well as octave bands of 0-2 kHz, 2-4 kHz, 4-8 kHz, 8-16 kHz, and 16-32 kHz. Mean sound pressure levels over the full bandwidth ranged from approximately 104 to 117 dB rms re 1 µPa over the recording period (Figure 21 of **Appendix E**). Mean sound pressure levels were approximately 5 dB lower in winter through early spring (Jan-Mar) compared to late spring and summer (Apr-early Sep) in all frequency bands. During the period of 5-10 Feb 2016, sound pressure levels in the 0-2 kHz band declined sharply by approximately 7 dB (affecting the full band level as well), this was likely due to less marine traffic during the period of Lunar Chinese New Year contributing to this "dip", and "normal" levels resumed after the public holiday.

Sound pressure levels in the 16-32 kHz band, in which energy from CWD clicks occurs, ranged from approximately 95 to 103 dB, and were 3-5 dB lower in winter and spring compared to summer and autumn (Figure 21 of **Appendix E**). Indo-Pacific humpback dolphin click and whistle frequencies are above 16 kHz and below 10 kHz, respectively (Sims et al. 2011); however, these sounds were very rare in the data compared to other sound sources and would not be distinguishable in ambient noise plots.

Influence of Ambient Sound Level on Dolphin Detections

The extent to which ambient received sound levels influenced detectability of dolphin signals is not quantified for this data set. However, the daily mean SPL for A5 in 2016 (Figure 21 of **Appendix E**) was similar to values reported for the same site over the same period in corresponding octave bands in 2013, to within approximately ± 2 dB (Figure 22 of **Appendix E**). Therefore, the potential masking effect of background noise on dolphin signals in 2016 was comparable to any masking effect in 2013. This suggests that the lower dolphin detection rate in 2016 compared to 2013 reflects a true reduction in dolphin signals, rather than an increase in background noise resulting in increased masking of signals.

Diel Sound Pressure Level

Mean sound pressure levels plotted by hour revealed a daily peak during the hours of 1700-1900, which was most pronounced in the 0-2 kHz frequency band (Figure 23 and Figure 24 of **Appendix E**). This daily peak was most pronounced in spring and summer months (March-August), subsided in autumn, and was not distinctive in winter. This seasonally shifting peak is similar to the diel pattern of sound pressure levels reported during previous Hong Kong PAM efforts (Munger et al. 2016), and is hypothesized to be related to a local fish chorus, probably dominated by croakers (family Sciaenidae). Sound pressure levels in the 16-32 kHz band remained relatively flat and constant (within 2 dB) throughout all hours of the day (Figure 23 and Figure 24 of **Appendix E**).

The contribution of daily vessel traffic and anthropogenic noise can best be seen in the winter plot, where the fish chorus peak is weak or absent. Full-bandwidth sound pressure levels begin to increase at 0700 throughout the day and reach a maximum of >110 dB in the afternoon; SPL then decreases after 1900 throughout the night to minimum values of ~107 dB between 0300 and 0500 (Figure 23 of **Appendix E**).

2.5.5 Discussions on CWD Monitoring Results

This report summarises the findings of the 12-month CWD monitoring results from mid-December 2015 to December 2016 for the 3RS Project. Overall, while the general patterns emerging from the vessel-based survey work are along the lines of what would be expected from our previous experience, they have also provided important information on the shifting patterns of dolphin use of the area of western Hong Kong, as both environmental and anthropogenic changes affect the habitat of the animals in complex and sometimes-unpredictable ways. However, for the most part, our observations fit into the expected behavior of dolphins shifting away from the parts of their habitat that are most affected by potentially-disturbing marine construction activities (such as some aspects of land reclamation) and high-speed vessel traffic. Both previous observations of CWDs in Hong Kong and information from the literature on responses of closely-related species of marine mammals predict such behavior, and this is indeed what is being observed (note the much-decreased use of NEL and NWL, and increased use of SWL in the recent decade or so). Our previous experience would also lead us to believe that dolphins will indeed shift back into at least some of those habitat areas once the disturbing factors are lessened (3RS approved EIA (Mott MacDonald, 2014) and Hoyt 2011), and assuming that the overall population is still reasonably robust and the habitat receives effective protection from the main threats. The monitoring work that we will conduct over the next several years will be focused on determining whether in fact this has been the case with CWDs in Hong Kong. Certainly, the protection of important habitat areas where the dolphins have historically done much of their feeding and calf-rearing activities will help to ensure that this will be the case.

Vessel survey data from this monitoring period found no CWDs in the NEL area. There is initial indication that SWL and WL areas are being more heavily used by CWDs, and this may have resulted from CWDs shifting their activities to parts of their home range in SWL and WL waters to avoid the NEL area. Similar findings on shifting of habitat use of some dolphins from northern Lantau to west and southwest Lantau waters were recorded in 2015 by the AFCD study (Hung, 2016). However, despite these changes, some regions within North Lantau waters are still being used as important dolphin habitat (especially the area around Lung Kwu Chau and the Urmston Road area near Castle Peak).

Based on theodolite data, the waters off Lung Kwu Chau remain an important foraging area for CWDs throughout the year. Relative occurrence peaked in April 2016, concurrent with the beginning of the wet season. No clear pattern of occurrence emerged off LKC relative to 3RS construction activities. Group sizes of CWDs were generally smaller closer to shore, with the largest groups occurring in closer proximity to the SCLKCMP boundary, at times beyond the marine park. It is possible that this perception of group size difference close to shore vs. further from shore is an artefact due to the fact that dolphins are more easily seen and tracked from shore when at greater distance when they are in larger group sizes. Further work will hopefully clarify this present uncertainty.

There were very few CWDs observed off Sha Chau, only 2 groups observed throughout the entire year. The only behaviour observed from this location was travelling, suggesting that CWDs are simply moving through this area to more suitable habitat. This is a sharply-reduced use of the area north of the airport and south of the Sha Chau/Lung Kwu Chau Marine Park from earlier studies, as expected relative to increasing marine works in this area. However, night-time recordings of CWDs indicated that use is not as low as detected by vessel and shore-based work alone.

The passive acoustic monitoring (PAM) data continue to provide useful information, especially on patterns of dolphin vocalization at night, which has previously been unavailable to us. The

diurnal detection of clicks showed a consistent pattern of higher levels at night compared with the day, which may be indicative of increased use of echolocation by dolphins during hours of darkness.

The PAM data provide evidence that dolphins are using the area around A5 throughout the year. Dolphins were present on more than half the recording days (59-65%) in winter and early spring (Jan-Mar), and on 18-42% of days in the late spring through autumn. The per-file detection rates were also highest in winter and spring; taken together, these metrics suggest that dolphins use the A5 area more frequently and intensively in winter and spring than in the summer. Dolphins were detected more frequently during nighttime hours than during the day, and this may be related to increased nocturnal foraging behaviour and/or avoidance of the A5 area during the day when anthropogenic activity is greater.

Dolphin detection rates were considerably lower in 2016 than in 2013 at the same monitoring site. This probably represents a true decrease in dolphin detections rather than increased masking of signals, as the ambient noise levels were comparable between years.

2.5.6 Conclusions of CWD Monitoring Results

Although the analyses presented in this report will be updated with larger datasets in the future, as the construction phase for the 3RS continues, it is a good beginning on the process of building up data to examine the potential effects of the 3RS construction, and also to evaluate effectiveness of mitigation measures. Several findings can be made at this point, although some of these should be considered preliminary.

Key Findings:

1. In general, findings from this study are consistent with findings from the long-term monitoring commissioned by AFCD,
2. Dolphins have remained extremely uncommon around the Brothers Islands of NE Lantau,
3. Both SW Lantau and W Lantau were being used more heavily in 2016 than in the past, likely due to dolphins moving away from the more disturbed habitats in NW and NE Lantau (e.g. potential disturbance from HZMB projects including the HKBCF, the Hong Kong Link Road and other associated projects),
4. There have been no exceedances of the encounter rate Action and Limit Levels derived from the CWD Baseline Monitoring Report during the first six month of impact monitoring,
5. Waters around Lung Kwu Chau remain an important year-round habitat, especially for foraging,
6. Average annual abundance in Hong Kong's western waters covering NWL, AW, NEL, SWL and WL was estimated at 60 individuals in 2016 from line-transect analysis,
7. Relative occurrence from land-based surveys around LKC peaked in spring, concurrent with the start of the wet season,
8. Group sizes of CWDs were generally smaller closer to shore, with larger groups in closer proximity to the Sha Chau and Lung Kwu Chau Marine Park boundary,
9. CWDs had slower swimming speeds and changed direction more frequently when foraging than when traveling,
10. Shore-based work found very few dolphin groups off Sha Chau (much reduced from past levels),
11. Acoustic monitoring showed consistently higher levels of clicking activity at night, which may indicate increased using of echolocation by dolphins during hours of darkness,

12. Dolphins used the area around PAM A5 throughout the year, but with increased activity during winter and spring months, and
13. Dolphin acoustic detection rates were lower in 2016 than in 2013 at the same site, which is consistent with the decreased use of the NW Lantau area, as seen from the visual survey work.

Each main survey type (i.e. vessel-based line transect and photo-identification surveys, land-based surveys with theodolite-tracking, and passive acoustic monitoring) provides important data that are complementary, and when analysed together, they provide a robust dataset to examine the kinds of issues that need to be considered for proper management and conservation of the dolphins.

2.5.7 Site Audit for CWD-related Mitigation Measures

During the reporting period, silt curtains were in place by the contractors for sand blanket laying works and at least two dolphin observers were deployed by each contractor in accordance with the Marine Mammal Watching Plan. Teams of at least two dolphin observers were deployed by contractors for continuous monitoring of the Dolphin Exclusion Zone (DEZ) for DCM trial works in accordance with the DEZ Plan. Trainings for the dolphin observers on the implementation of MMWP and DEZ monitoring were provided by the ET prior to the aforementioned works, with the training records kept by the ET. Testing on night vision devices for Dolphin Exclusion Zone monitoring was also conducted before the DCM trials. From the contractors' MMWP observation records and DEZ monitoring records, no dolphins or other marine mammals were observed within or around the DEZ and silt curtains during the reporting period. These contractors' records were also audited by the ET during site inspection.

Audits of acoustic decoupling for construction vessels were carried out during weekly site inspection and summarised in Section 2.6. Summary of audits of SkyPier High Speed Ferries route diversion and speed control and construction vessel management are presented in Section 2.8 and Section 2.9 respectively.

2.6 Weekly Environmental Site Inspection

Site inspections of the construction works were carried out on a weekly basis to monitor the implementation of proper environmental pollution control and mitigation measures for the Project. Bi-weekly site inspections were also conducted by the IEC. Observations have been recorded in the site inspection checklist and passed to the contractor together with the appropriate recommended mitigation measures where necessary.

The key observations from site inspection and associated recommendations were related to:

- display of Non-road mobile machinery (NRMM) labels for generators;
- improvement of dust control and spill prevention measures;
- provision of wheel washing facilities for vehicles before leaving the construction site;
- display of noise emission labels for air compressors;
- improvement of efficiency and capacity of wastewater treatment facilities;
- provision of sandbags around the gully to prevent surface runoff;
- better maintenance of drainage channel;
- sewage effluent from construction workforce;
- provision and proper maintenance of drip trays for chemical containers;
- removal of oil stains on ground as chemical waste;

- review of the capacity of chemical waste storage area;
- proper collection, sorting and disposal of inert and non-inert C&D materials;
- display of Environmental Permit at site entrance; and
- erection of site hoarding.

In addition, recommendations were provided during site inspection on construction vessels, which include:

- provision of spill kit and chemical waste storage area for the chemical waste;
- display of Environmental Permit;
- provision of spare silt curtain on required construction vessels; and
- provision of acoustic decoupling for noisy equipment.

In addition, CNP compliance check of the use of powered mechanical equipment for Contract P560(R) during restricted hour at the launching site was carried out by the ET on 11 July 2016. The use of powered mechanical equipment was complied with the requirements of CNP.

The daily visual inspection checklists for silt curtains and bi-weekly diver inspection records which were implemented by the contractors in accordance with the Silt Curtain Deployment Plan had been checked during site inspection, summarizing that the silt curtains were maintained in the correct positions and intact without obvious defects or damage.

A summary of implementation status of the environmental mitigation measures for the construction phase of the Project during the reporting period is provided in **Appendix C**.

2.7 Ecological Monitoring

In accordance with the Updated EM&A Manual, ecological monitoring shall be undertaken monthly at the HDD daylighting location on Sheung Sha Chau Island to identify and evaluate any impacts with appropriate actions taken as required to address and minimise any adverse impact found.

Monthly ecological monitoring was carried out in March, August, September, October, November and December 2016 on Sheung Sha Chau Island. No encroachment into the egretry area at Sheung Sha Chau by the HDD daylighting location or mooring of flat top barge was recorded during ecological monitoring.

2.8 Audit of the SkyPier Plan

During the initial implementation period, the SkyPier HSFs encountered occasional difficulties as reported by Ferry Operator (FO) in strictly observing the 15-knot speed limit throughout the SCZ. Further training workshops for the SkyPier operators who operate the diverted route to Zhuhai and Macau were held in January 2016 and March 2016 to ensure their full understanding of and adherence to the routing and speed control requirements. The situation has considerably improved in February and March 2016 by undertaking training workshops, and ferry movement monitoring and audit. The IEC has also performed audit on the compliance of the requirements as part of the EM&A programme. The latest summary of compliance of SkyPier Plan between 1 April 2016 and 31 December 2016 is presented in **Table 2.14**.

Four skipper workshops were held from May to December 2016 with ferry operators and relevant ferry captains to refresh their understanding about the requirements of the SkyPier Plan such as the routing and speed control requirements with discussion on the deviation cases, experience sharing and recommendations to strengthen the implementation of SkyPier Plan.

In total, 10,043 ferry movements between HKIA SkyPier and Zhuhai / Macau were audited in the reporting period. The daily movements of all SkyPier HSFs in the reporting period ranged between 1 and 97, which falls within the maximum daily cap number of 125. There were fewer ferry movements on 1st, 2nd August and 21st October due to typhoon. The annual daily average of all SkyPier HSF movements in 2016 was 91, which falls within the annual daily average cap of 99 SkyPier HSF movements.

Most of the HSFs travelled through the SCZ with average speeds below 15 knots, which complied with the SkyPier Plan. Three cases of average speed deviation were due to public safety. All ferry movements that were not strictly following the diverted route have been investigated. Insufficient Automatic Identification System (AIS) data were received from some HSFs due to interference effect of AIS signal as reported by the FO after checking the condition of the AIS transponders. In such cases, vessel captains were requested to provide the radar track photos which indicated that the vessel entered the SCZ though the gate access point and no speeding in the SCZ.

Table 2.14 Summary of Key Audit Findings against the SkyPier Plan

Requirements in the SkyPier Plan	Apr-16	May-16	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16
Total number of ferry movements recorded and audited	805	837	816	836	809	814	839	837	867
Use diverted route and enter / leave SCZ through Gate Access Points	800	836	811	829	802	813	835	832	866
No. of SkyPier HSFs in compliance with Average Speed within 15 knots in SCZ	805	837	815	836	809	814	839	836	867
Daily Cap (including all SkyPier HSFs)	86-95	88-95	88-96	88-94	10-94	87-95	1-96	88-93	87-93

Source: excerpt from Monthly and Quarterly EM&A Reports

Note: There were fewer ferry movements on 1st and 2nd August 2016 (52 and 10 movements respectively) due to typhoon.

There was only one HSF movement on 21st October 2016 due to typhoon Signal No. 8 on that day.

2.9 Audit of Construction and Associated Vessels

The audit of construction and associated vessels in accordance with the MTRMP-CAV has started since August 2016. ET has conducted weekly audit of relevant information including AIS data, vessel tracks and other relevant records provided to MTCC by the contractors to ensure that the contractors were fully complied with the requirements of the MTRMP-CAV. The 3-month rolling programme for construction vessel activities were also checked every month to ensure the logistic of construction vessels were well planned to achieve a practicable minimum. The IEC has also performed audit on the compliance of the requirements as part of the EM&A programme.

Deviations including speeding in the works area, entry from non-designated gates, not following the designated route and entering no-entry zones were identified. All the concerned contractors were reminded to comply with the requirements of the MTRMP-CAV during the weekly MTCC audit and such deviations were also reviewed and highlighted during the monthly Environmental Management Meeting.

A total of 24 skipper training workshops have been held by ET between August and December 2016 with 299 concerned captains of construction vessels associated with the 3RS contracts to familiarise them with the predefined routes, general education on local cetaceans, guidelines for avoiding adverse water quality impact, the required environmental practices / measures while operating construction and associated vessels under the Project, and guidelines for operating vessels safely in the presence of CWDs. Another 18 skipper training workshops have been held with 83 captains by contractor's Environmental Officers (EO) and competency tests had been conducted subsequently with the trained captains by ET. In addition, ET had participated Marine Management Liaison Group meetings to assist and resolve any marine issues which might be encountered under 3RS Project.

2.10 Review of the Key Assumptions Adopted in the EIA Report

With reference to Appendix E of the Manual, it is noted that the key assumptions adopted in approved EIA report for the construction phase are still valid and no major changes are involved. The environmental mitigation measures recommended in the approved EIA Report remain applicable and shall be implemented in undertaking construction works for the Project.

3 Report on Non-compliance, Complaints, Notifications of Summons and Prosecutions

3.1 Compliance with Other Statutory Environmental Requirements

During the reporting period, environmental related licenses and permits required for the construction activities were checked. No non-compliance with environmental statutory requirements was recorded.

3.2 Analysis and Interpretation of Complaints, Notification of Summons and Status of Prosecutions

3.2.1 Complaints

An environmental complaint was received on 29 December 2016 regarding night time work at Sheung Sha Chau. Investigation was conducted by the ET in accordance with the Manual and the Complaint Management Plan (CMP) of the Project. The contractor of Contract P560(R) Aviation Fuel Pipeline Diversion Works reported that emergency rescue works had to be carried out in view of the unexpected ground condition at Sheung Sha Chau. Such emergency rescue works were considered as crucial and vital in order to avoid building up of excessive drilling fluid pressure, which might lead to an uncontrollable spillage outside the contaminant pit, causing significant environmental impact at Sheung Sha Chau. Subsequent to the emergency rescues, the contractor has already taken immediate actions to improve the drilling fluid system as well as strengthen the control and communication measures with all relevant parties. ET will continue to closely monitor the implementation and effectiveness of the remedial measures in preventing re-occurrence of similar events.

3.2.2 Notifications of Summons or Status of Prosecution

During the reporting period, no notifications of summons or prosecution were received.

3.3 Cumulative Statistics

Cumulative statistics on exceedance, non-compliance, complaints, notifications of summons and status of prosecutions are summarized in **Table 3.1** and **Table 3.2**.

Table 3.1: Statistics for Valid Exceedances for the Environmental Monitoring

		Total no. recorded in the reporting month	Total no. recorded since the project commenced
1-hr TSP	Action	0	0
	Limit	0	0
Noise	Action	0	0
	Limit	0	0
Waste	Action	0	0
	Limit	0	0

		Total no. recorded in the reporting month	Total no. recorded since the project commenced
Water	Action	0	0
	Limit	0	0
CWD	Action	0	0
	Limit	0	0

Remark: Exceedances, which are not project related, are not shown in this table.

Table 3.2: Statistics for Non-compliance, Complaints, Notifications of Summons and Prosecution

Reporting Period	Cumulative Statistics			
	Non-compliance	Complaints	Notifications of Summons	Prosecutions
This reporting period	0	1	0	0
From 28 December 2015 to end of the reporting period	0	1	0	0

4 Conclusion and Recommendation

In the reporting period from 28 December 2015 to 31 December 2016, the EM&A programme has been implemented in accordance with the Manual of the Project. The EM&A works carried out during the reporting period include construction dust and noise measurements, water quality monitoring, ecological monitoring on Sheung Sha Chau Island, vessel line-transect surveys, land-based theodolite tracking surveys supplemented with passive acoustic monitoring for CWD monitoring as well as environmental site inspections and waste monitoring for the Project's construction works.

During the reporting period, five exceedance cases involving Action Level of 1-hour TSP monitoring were recorded during the reporting period. Investigations were carried out immediately for each of the exceedance cases. The investigation results indicated that the exceedances were not related to the Project. There were, however, no exceedance cases involving Limit Level of 1-hour TSP monitoring throughout the reporting period.

For water quality, the monitoring results for DO, total alkalinity, and chromium obtained during the reporting period were in compliance with their corresponding Action and Limit Levels. For turbidity, SS and nickel, some of the testing results exceeded the relevant Action or Limit Levels during the reporting period. Investigations were carried out immediately for each of the exceedance cases, and the investigation findings concluded that all the exceedances were not due to the Project.

No breach of the Action or Limit Levels in relation to the construction noise, waste and CWD monitoring were recorded during the reporting period.

All site observations made by the ET were recorded in the site inspection checklists and passed to the contractor together with the recommended follow-up actions. No encroachment or disturbance to the egretry area on Sheung Sha Chau was recorded during monthly ecological monitoring.

A total of 5,619.7 km survey effort was conducted for the vessel line transect monitoring for CWD during the 12-month monitoring period. A total of 208 groups of 785 CWD individuals were sighted, with 46 groups of 181 CWDs recorded in NWL, 4 groups of 16 CWDs in AW, 96 groups of 347 CWDs in WL and 62 groups of 241 CWDs in SWL. No CWDs were sighted in NEL during the 12-month reporting period. The combined encounter rate by number of dolphin sightings and by number of dolphins were 3.44 and 13.44 respectively. No exceedance of the encounter rates for action and limit levels were recorded during the construction phase. Average annual abundance of CWD in Hong Kong western waters was estimated at 60 individuals in 2016 from line-transect analysis. CWD relative occurrence from land-based surveys around Lung Kwu Chau peaked in spring, concurrent with the start of the wet season. Waters around Lung Kwu Chau remain an important year-round habitat for CWDs, especially for foraging. Passive acoustic monitoring showed dolphins used the area around south of Sha Chau throughout the year, but with increased activity during winter and spring months. The acoustic data also showed consistently higher levels of dolphin clicking activity at night, which may indicate increased using of echolocation by dolphins during hours of darkness.

Ferry movements between HKIA SkyPier and Zhuhai / Macau were audited in the reporting period. In total, 10,043 ferry movements between HKIA SkyPier and Zhuhai / Macau were audited in the reporting period. The daily movements of all SkyPier HSFs in the reporting period ranged between 1 and 97, which falls within the maximum daily cap number of 125. There are fewer ferry movements on 1st, 2nd August and 21st October due to typhoon. The annual daily average of all SkyPier HSFs in 2016 was 90.86 movements, which falls within the annual daily average cap of 99 SkyPier HSF movements. Most of the HSFs had travelled through the SCZ with average speeds below 15 knots, which complied with the SkyPier Plan. A few cases of average speed deviation were due to public safety. All ferry movements that did not strictly follow the diverted route have been investigated.

The audit of construction and associate vessels has started since August 2016. ET has conducted weekly audit to ensure the contractors have provided sufficient information to the MTCC and the contractors fully complied with the requirements of the MTRMP-CAV. A total of 24 skipper training workshops were conducted by the ET from August to December 2016 with concerned captains of construction vessels associated with 3RS contracts. Another 18 skipper training workshops were conducted by contractors' EO and competency tests had been conducted subsequently with the trained captains by ET.

On the implementation of Marine Mammal Watching Plan, silt curtains were in place by the contractors for sand blanket laying works and dolphin observers were deployed in accordance with the Plan. On the implementation of Dolphin Exclusion Zone Plan, dolphin observers were deployed by the contractors for continuous monitoring of the DEZ for DCM trial works in accordance with the DEZ Plan. Trainings for the dolphin observers on the implementation of MMWP and DEZ monitoring have been provided by the ET prior to the aforementioned works. Testing on night vision devices for Dolphin Exclusion Zone monitoring was also conducted before the DCM trials. From the contractors' MMWP observation records and DEZ monitoring records, no dolphin or other marine mammals were observed within or around the DEZ and silt curtains during the reporting period. Audits of acoustic decoupling for construction vessels were also carried out by the ET.

Overall, the recommended environmental mitigation measures, as included in the EM&A programme, have been effectively implemented during the reporting period. Also, the EM&A programme implemented by the ET has effectively monitored the construction activities and ensure the proper implementation of mitigation measures.

Figures

824000 N
822000 N
820000 N
818000 N
804000 E
806000 E
808000 E
810000 E
812000 E
814000 E

Contract P560 (R)-
Target Daylightling
Location

LEGEND:
- LAND FORMATION
- TEMPORARY WORKS AREA BOUNDARY
- BOUNDARY OF KEY CONSTRUCTION ACTIVITIES

RECLAMATION WORKS AREA
(please refer to Figure 1.2)

Contract P560 (R)-
Launching Site

Contract 3213 Site

Contract P560 (R)-
Site Office

Contract P560 (R)-
Stockpiling Area

Contract 3213 Site Office

0 250 500 750 1000 m
1 : 30 000 SCALE BAR

Rev.	Date	Description	Checked
A	31AUG15	FIRST ISSUE	DC

香港國際機場 HONG KONG INTERNATIONAL AIRPORT
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Mott MacDonald

Title

LOCATIONS OF KEY CONSTRUCTION ACTIVITIES IN THIS REPORTING PERIOD

Consultant's Signatures for Approval		Date
Design	DC	31AUG15
Checkers	DC	31AUG15
Design Supervisor	EC	31AUG15
Authorised Representative	JFP	31AUG15

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No.
FIGURE 1.1

Scale at A3
1 : 30000

Rev.
A

Filename: J:\355482\REPORT\ENV\CWSLP\FIG 1.dgn

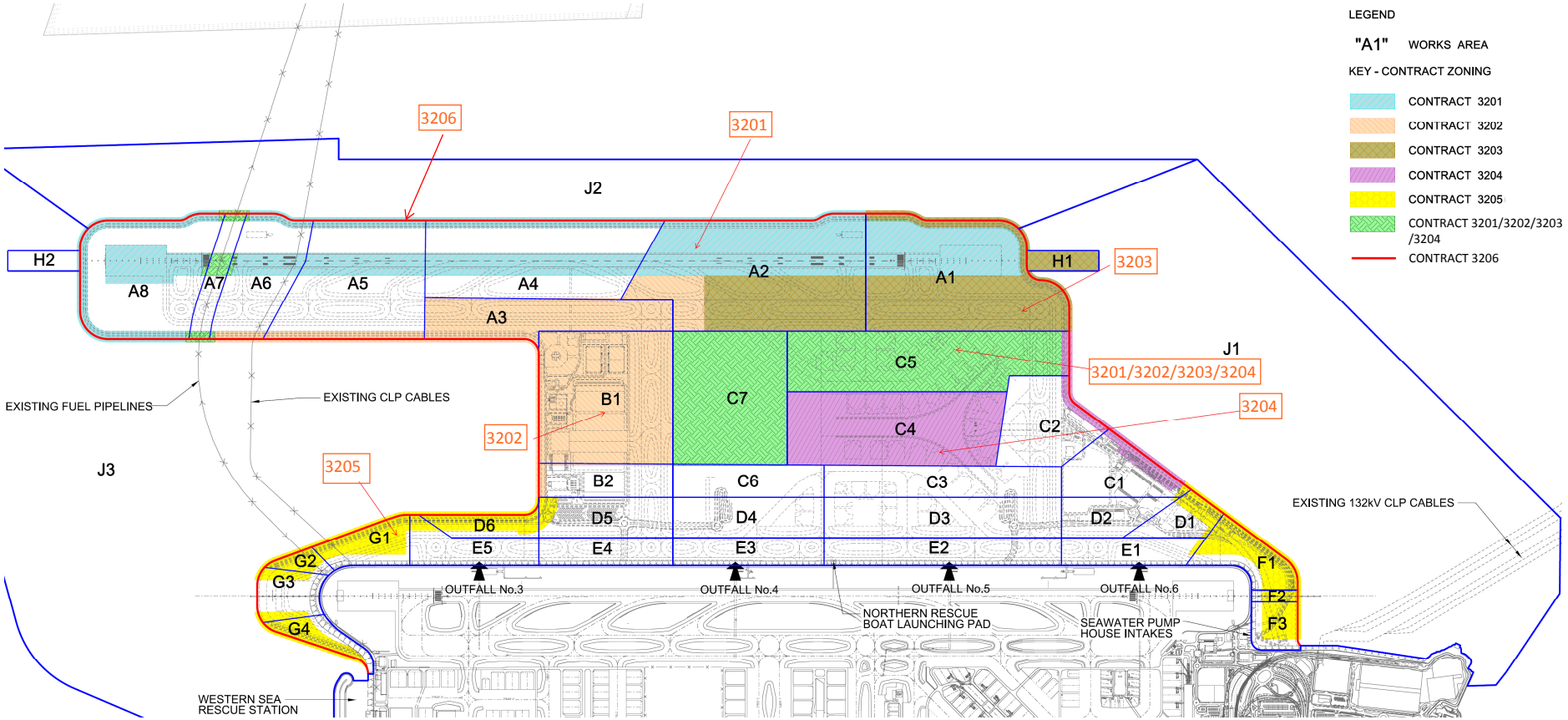

FIGURE 1.2- LOCATIONS OF RECLAMATION WORKS AREA

LEGEND:

- RECLAMATION AREA
- NOISE MONITORING STATION (UPDATED EM&A MANUAL)
- AIR QUALITY MONITORING STATION (UPDATED EM&A MANUAL)
- CHEK LAP KOK WIND STATION

806000 E
808000 E
810000 E
812000 E
814000 E
820000 N
818000 N

NM1A AR1A
NM2
NM3A
NM4
NM5 AR2
NM6

0 200 400 600 800 1000 m
1 : 22 500 SCALE BAR

Rev.	Date	Description	Checked
A	06JAN16	FIRST ISSUE	RO
B	29JAN16	GENERAL REVISION	RO
C	11FEB16	GENERAL REVISION	RO

香港國際機場 HONG KONG INTERNATIONAL AIRPORT
Airport Authority HKIA Tower, 1 Sky Plaza Road, Hong Kong International Airport, Lantau, Hong Kong
Tel : (852) 2181 7111 Fax : (852) 2824 0717

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Title

LOCATIONS OF AIR AND NOISE MONITORING STATIONS AND CHEK LAP KOK WIND STATION

Consultant's Signatures for Approval		Date
Design	AM	11FEB16
Checkers	AM / TK	11FEB16
Approver	EC	11FEB16

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No.

FIGURE 2.1

Scale at A3 1 : 22500

Rev. C

Filename: J:\355482\REPORT\ENV\EMA\160211\FIG 2.1.dgn

805000 E
810000 E
815000 E
820000 E
825000 N
820000 N
815000 N
HKSAR BOUNDARY
C1
C2
C3
IM1
IM2
IM3
IM4
IM5
IM6
IM7
IM8
IM9
IM10
IM11
IM12
SR2
SR3
SR4A
SR5A
SR6
SR7
SR8
LEGEND:
LAND FORMATION FOOTPRINT
500m ENVELOPE
IMPACT STATION
SENSITIVE RECEIVER
CONTROL STATION
0 500 1000 1500 2000 m
1 : 60 000 SCALE BAR

Rev.	Date	Description	Checked
A	02DEC15	FIRST ISSUE	DC
B	04MAY16	GENERAL REVISION	RO
C	06JUN16	GENERAL REVISION	LC

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Title

LOCATIONS OF WATER QUALITY MONITORING STATIONS

Consultant's Signatures for Approval		Date
Design	DC	06JUN16
Checkers	DC / TK	06JUN16
Approver	EC	06JUN16

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No.

FIGURE 2.2

Scale at A3 1 : 60000

Rev. C

Filename: J:\355482\REPORT\ENV\EMA\160606\MCL-P132-EMA-5-002.dgn

800000 E
805000 E
810000 E
815000 E
820000 E
825000 E
830000 E
835000 E
840000 E
845000 E
830000 N
825000 N
820000 N
815000 N
810000 N
805000 N

NORTHWEST LANTAU

NORTHEAST LANTAU

SOUTHWEST LANTAU

WEST LANTAU

LEGEND:
- HKSAR BOUNDARY
- LAND FORMATION FOOTPRINT
- DOLPHIN VESSEL SURVEY TRANSECT ROUTE
- DOLPHIN VESSEL SURVEY TRANSECT ROUTE

0 1 2 3 4 km
1 : 125 000 SCALE BAR

Rev.	Date	Description	Checked
A	02DEC15	FIRST ISSUE	JC

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Mott MacDonald

Title

VESSEL BASED DOLPHIN MONITORING TRANSECTS IN BASELINE MONITORING

Consultant's Signatures for Approval		Date
Design	JC	02DEC15
Checkers	JC / TK	02DEC15
Approver	EC	02DEC15

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No.

FIGURE 2.3

Scale at A3 1 : 125000

Rev. A

Filename: J:\355482\REPORT\ENV\EMA\151202\MCL-P132-EMA-10-002.dgn

804000 E
806000 E
808000 E
810000 E
812000 E
814000 E
816000 E
818000 E
820000 N
822000 N
824000 N
826000 N

E
D

沙洲及龍鼓洲海岸公園
SHA CHAU AND LUNG KWU CHAU MARINE PARK

HKSAR BOUNDARY

LEGEND:
- LAND FORMATION FOOTPRINT
- HONG KONG INTERNATIONAL AIRPORT
- LAND BASED SURVEY LOCATION

0 500 1000 1500 2000 m
1 : 45,000 SCALE BAR

Rev.	Date	Description	Checked
A	02DEC15	FIRST ISSUE	JC

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Title

LAND BASED DOLPHIN MONITORING IN BASELINE AND CONSTRUCTION PHASES

Consultant's Signatures for Approval		Date
Design	JC	02DEC15
Checkers	JC / TK	02DEC15
Approver	EC	02DEC15

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No.

FIGURE 2.4

Scale at A3 1 : 45000

Rev. A

Filename: J:\355482\REPORT\ENV\EMA\151202\MCL-P132-EMA-10-004.dgn

804000 E
806000 E
808000 E
810000 E
812000 E
814000 E
816000 E
818000 E
820000 E

828000 N
826000 N
824000 N
822000 N
820000 N
818000 N

龍鼓洲
LUNG KWU CHAU

沙洲及龍鼓洲海岸公園
SHA CHAU AND LUNG KWU CHAU MARINE PARK

沙洲
SHA CHAU

A5

HKSAR BOUNDARY

LEGEND:

LAND FORMATION FOOTPRINT

HONG KONG INTERNATIONAL AIRPORT

AUTONOMOUS PASSIVE ACOUSTIC MONITORING LOCATION

0 500 1000 1500 2000 m
1 : 45 000 SCALE BAR

Rev.	Date	Description	Checked
A	02DEC15	FIRST ISSUE	JC

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Airport Authority HKIA Tower, 1 Sky Plaza Road, Hong Kong International Airport, Lantau, Hong Kong
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Mott MacDonald

Title

LOCATIONS FOR AUTONOMOUS PASSIVE ACOUSTIC MONITORING IN BASELINE AND CONSTRUCTION PHASES

Consultant's Signatures for Approval		Date
Design	JC	02DEC15
Checkers	JC / TK	02DEC15
Approver	EC	02DEC15

EXPANSION OF HONG KONG INTERNATIONAL AIRPORT INTO A THREE-RUNWAY SYSTEM

Drawing No.

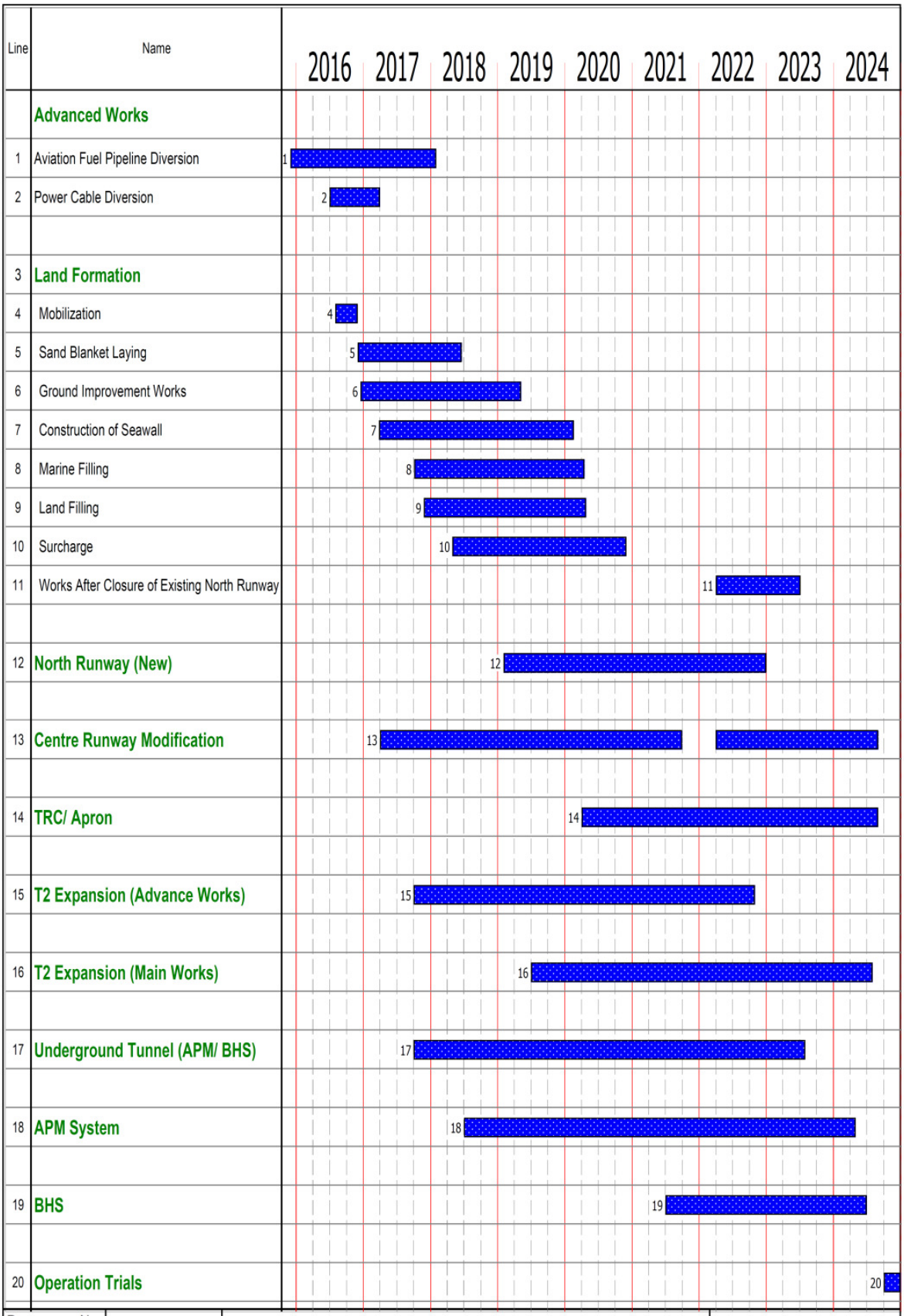
FIGURE 2.5

Scale at A3
1 : 45000

Rev. A

Filename: J:\355482\REPORT\ENV\EMA\151202\MCL-P132-EMA-10-005.dgn

Appendix A. Construction Programme and Contract Description



Programme No.	3-AAP-EPP-0-A0
Revision/Date	'A'/(12-Jul-16)
Prepared	VT
Checked	PY

3RS Phasing Programme

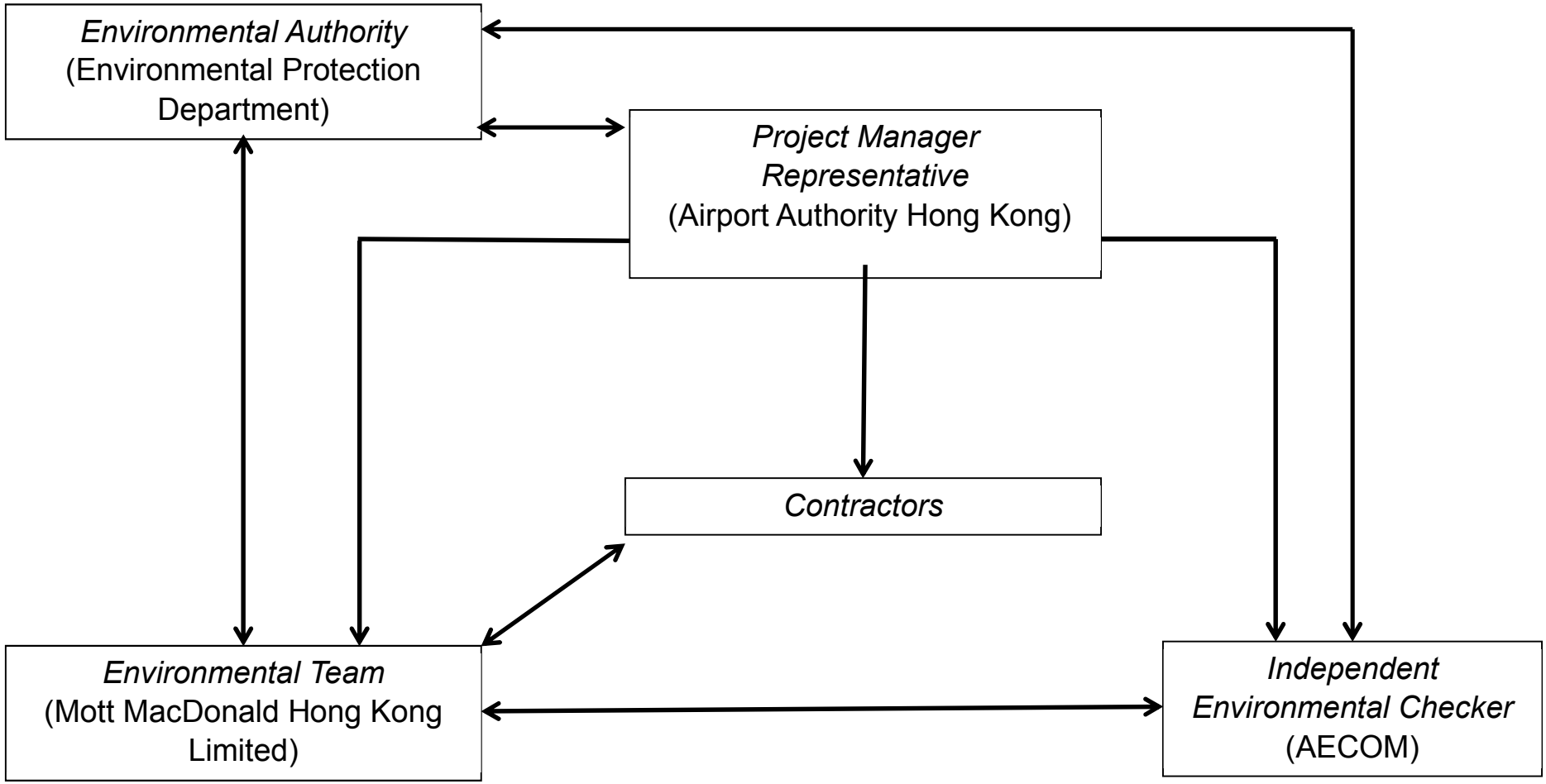
香港國際機場 HONG KONG INTERNATIONAL AIRPORT

Contract Description

Contract No.	Contract Title	Contractor	Key Construction Activities
P560 (R)	Aviation Fuel Pipeline Diversion Works	Langfang Huayuan Mechanical and Electrical Engineering Co., Ltd.	Diversion of the existing submarine aviation fuel pipelines will use a horizontal directional drilling (HDD) method forming two rock drill holes by drilling through bedrock from a launching site located at the west of the airport island to a daylighting point adjacent to the offshore receiving platform at Sha Chau. Two new pipelines will be installed through the drilled tunnels. The total length is approximately 5 km. Drilling works will proceed from the HDD launching site at the airport island.
3201	Deep Cement Mixing (Package 1)	Penta-Ocean-China State-Dong-Ah Joint Venture	The works covered by the Contract 3201, 3202, 3203 and 3204 comprise ground improvement of seabed using Deep Cement Mixing (DCM) method, the major construction activities including without limitation the following • Geophysical surveys; • Supply and placing of geotextile and sand blanket under seawalls; • Supply, maintenance, installation and removal of silt curtain systems; • Preliminary construction trails; • Supply and installation of DCM clusters within the works areas; and • Coring, sampling and testing of DCM treated soils and reporting works.
3202	Deep Cement Mixing (Package 2)	Samsung-BuildKing Joint Venture	
3203	Deep Cement Mixing (Package 3)	Sambo E&C Co.,Ltd	
3204	Deep Cement Mixing (Package 4)	CRBC-SAMBO Joint Venture	
3205	Deep Cement Mixing (Package 5)	Bachy Soletanche- Sambo Joint Venture	
3206	Reclamation Contract	ZHEC-CCCC-CDC Joint Venture	The works covered by the Contract 3206 comprise the formation of approximately 650 hectares of land north of the existing airport island for the project, the major construction activities including without limitation the following • Site clearance and demolition; • Geotechnical and ground improvement works; • Seawall construction; • Marine and land filling works; and • Civil works.

3213	CLP Cable Diversion Enabling Works	Wing Hing Construction Company	CLP cable diversion enabling works of Sha Chau South, Sheung Sha Chau and Lung Kwu Chau at Hong Kong International Airport Landside. The major construction activities including without limitation the following: • Geotechnical instrumentation and monitoring of the Works; • Temporary removal of armour rock and underlayers of existing seawall and subsequent reinstatement to its original condition; • Construction of the concrete cable trough embedded at about 3m below the surface of the existing seawall; and • Supply, installation, maintenance, and subsequent removal of temporary generator sets for temporary power supply with associated fuel supply and pump system located at Sheung Sha Chau, Sha Chau South and Lung Kwu Chau Islands.

Appendix B. Project Organization Chart


Environmental Authority
(Environmental Protection Department)
Project Manager Representative
(Airport Authority Hong Kong)
Contractors
Environmental Team
(Mott MacDonald Hong Kong Limited)
Independent Environmental Checker
(AECOM)

Appendix C. Environmental Mitigation Implementation Schedule (EMIS) for Construction Phase

Appendix C Environmental Mitigation Implementation Schedule (EMIS) for Construction Phase

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			Air Quality Impact – Construction Phase		
5.2.6.2	2.1	-	**Dust Control Measures** ▪ Water spraying for 12 times a day or once every two hours for 24-hour working at all active works area.	Within construction site / Duration of the construction phase	I
5.2.6.3	2.1	-	▪ Covering of at least 80% of the stockpiling area by impervious sheets. Water spraying of all dusty materials immediately prior to any loading transfer operation so as to keep the dusty material wet during material handling.	Within construction site / Duration of the construction phase	I
5.2.6.4	2.1	-	Dust control practices as stipulated in the Air Pollution Control (Construction Dust) Regulation should be adopted. These practices include: Good Site Management ▪ Good site management is important to help reducing potential air quality impact down to an acceptable level. As a general guide, the Contractor should maintain high standard of housekeeping to prevent emission of fugitive dust. Loading, unloading, handling and storage of raw materials, wastes or by-products should be carried out in a manner so as to minimise the release of visible dust emission. Any piles of materials accumulated on or around the work areas should be cleaned up regularly. Cleaning, repair and maintenance of all plant facilities within the work areas should be carried out in a manner minimising generation of fugitive dust emissions. The material should be handled properly to prevent fugitive dust emission before cleaning.	Within construction site / Duration of the construction phase	I
			Disturbed Parts of the Roads ▪ Each and every main temporary access should be paved with concrete, bituminous hardcore materials or metal plates and kept clear of dusty materials; or ▪ Unpaved parts of the road should be sprayed with water or a dust suppression chemical so as to keep the entire road surface wet.	Within construction site / Duration of the construction phase	I
			Exposed Earth ▪ Exposed earth should be properly treated by compaction, hydroseeding, vegetation planting or seating with latex, vinyl, bitumen within six months after the last construction activity on the site or part of the site where the exposed earth lies.	Within construction site / Duration of the construction phase	N/A

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			Loading, Unloading or Transfer of Dusty Materials ▪ All dusty materials should be sprayed with water immediately prior to any loading or transfer operation so as to keep the dusty material wet.	Within construction site / Duration of the construction phase	I
			Debris Handling ▪ Any debris should be covered entirely by impervious sheeting or stored in a debris collection area sheltered on the top and the three sides; and ▪ Before debris is dumped into a chute, water should be sprayed so that it remains wet when it is dumped	Within construction site / Duration of the construction phase	I
			Transport of Dusty Materials ▪ Vehicle used for transporting dusty materials/spoils should be covered with tarpaulin or similar material. The cover should extend over the edges of the sides and tailboards.	Within construction site / Duration of the construction phase	I
			Wheel washing ▪ Vehicle wheel washing facilities should be provided at each construction site exit. Immediately before leaving the construction site, every vehicle should be washed to remove any dusty materials from its body and wheels.	Within construction site / Duration of the construction phase	I
			Use of vehicles ▪ The speed of the trucks within the site should be controlled to about 10km/hour in order to reduce adverse dust impacts and secure the safe movement around the site; ▪ Immediately before leaving the construction site, every vehicle should be washed to remove any dusty materials from its body and wheels; and ▪ Where a vehicle leaving the construction site is carrying a load of dusty materials, the load should be covered entirely by clean impervious sheeting to ensure that the dusty materials do not leak from the vehicle.	Within construction site / Duration of the construction phase	I
			Site hoarding Where a site boundary adjoins a road, street, service lane or other area accessible to the public, hoarding of not less than 2.4m high from ground level should be provided along the entire length of that portion of the site boundary except for a site entrance or exit.	Within construction site / Duration of the construction phase	I
5.2.6.5	2.1	-	**Best Practices for Concrete Batching Plant** The relevant best practices for dust control as stipulated in the Guidance Note on the Best Practicable Means for Cement Works (Concrete Batching Plant) BPM 3/2 as well as in the future Specified Process licence should be adopted. The best practices are recommended to be applied to both the land based and floating concrete batching plants. Best practices include: Cement and other dusty materials	Within Concrete Batching Plant / Duration of the construction phase	N/A

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			▪ The loading, unloading, handling, transfer or storage of cement, pulverised fuel ash (PFA) and/or other equally dusty materials shall be carried in a totally enclosed system acceptable to EPD. All dust-laden air or waste gas generated by the process operations shall be properly extracted and vented to fabric filtering system to meet the required emission limit; ▪ Cement, PFA and/or other equally dusty materials shall be stored in storage silo fitted with audible high level alarms to warn of over-filling. The high-level alarm indicators shall be interlocked with the material filling line such that in the event of the silo approaching an overfilling condition, an audible alarm will operate, and after 1 minute or less the material filling line will be closed; ▪ Vents of all silos shall be fitted with fabric filtering system to meet the required emission limit; ▪ Vents of cement/PFA weighing scale shall be fitted with fabric filtering system to meet the required emission limit; and ▪ Seating of pressure relief valves of all silos shall be checked, and the valves re-seated if necessary, before each delivery.		
			Other raw materials ▪ The loading, unloading, handling, transfer or storage of other raw materials which may generate airborne dust emissions such as crushed rock, sand, stone aggregate, shall be carried out in such a manner to prevent or minimize dust emissions; ▪ The materials shall be adequately wetted prior to and during the loading, unloading and handling operations. Manual or automatic water spraying system shall be provided at all unloading areas, stock piles and material discharge points; ▪ All receiving hoppers for unloading relevant materials shall be enclosed on three sides up to 3 m above the unloading point. In no case shall these hoppers be used as the material storage devices; ▪ The belt conveyor for handling materials shall be enclosed on top and two sides with a metal board at the bottom to eliminate any dust emission due to wind-whipping effect. Other type of enclosure will also be accepted by EPD if it can be demonstrated that the proposed enclosure can achieve same performance; ▪ All conveyor transfer points shall be totally enclosed. Openings for the passage of conveyors shall be fitted with adequate flexible seals; ▪ Scrapers shall be provided at the turning points of all conveyors to remove dust adhered to the belt surface; ▪ Conveyors discharged to stockpiles of relevant materials shall be arranged to minimize free fall as far as practicable. All free falling transfer points from conveyors to stockpiles shall be enclosed with chute(s) and water sprayed; ▪ Aggregates with a nominal size less than or equal to 5 mm should be stored in totally enclosed structure such as storage bin and should not be handled in open area. Where there is sufficient buffer area	Within Concrete Batching Plant / Duration of the construction phase	N/A

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			surrounding the concrete batching plant, ground stockpiling may be used; ▪ The stockpile shall be enclosed at least on top and three sides and with flexible curtain to cover the entrance side; ▪ Aggregates with a nominal size greater than 5 mm should preferably be stored in a totally enclosed structure. If open stockpiling is used, the stockpile shall be enclosed on three sides with the enclosure wall sufficiently higher than the top of the stockpile to prevent wind whipping; and ▪ The opening between the storage bin and weighing scale of the materials shall be fully enclosed.		
			Loading of materials for batching ▪ Concrete truck shall be loaded in such a way as to minimise airborne dust emissions. The following control measures shall be implemented: (a) Pre-mixing the materials in a totally enclosed concrete mixer before loading the materials into the concrete truck is recommended. All dust-laden air generated by the pre-mixing process as well as the loading process shall be totally vented to fabric filtering system to meet the required emission limit; and (b) If truck mixing batching or other types of batching method is used, effective dust control measures acceptable to EPD shall be adopted. The dust control measures must have been demonstrated to EPD that they are capable to collect and vent all dust-laden air generated by the material loading/mixing to dust arrestment plant to meet the required emission limit. ▪ The loading bay shall be totally enclosed during the loading process.	Within Concrete Batching Plant / Duration of the construction phase	N/A
			Vehicles ▪ All practicable measures shall be taken to prevent or minimize the dust emission caused by vehicle movement; and ▪ All access and route roads within the premises shall be paved and adequately wetted.	Within Concrete Batching Plant / Duration of the construction phase	N/A
			Housekeeping A high standard of housekeeping shall be maintained. All spillages or deposits of materials on ground, support structures or roofs shall be cleaned up promptly by a cleaning method acceptable to EPD. Any dumping of materials at open area shall be prohibited.	Within Concrete Batching Plant / Duration of the construction phase	N/A
5.2.6.6	2.1	-	**Best Practices for Asphaltic Concrete Plant** The relevant best practices for dust control as stipulated in the Guidance Note on the Best Practicable Means for Tar and Bitumen Works (Asphaltic Concrete Plant) BPM 15 (94) as well as in the future Specified Process licence should be adopted. These include: Design of Chimney ▪ The chimney shall not be less than 3 metres plus the building height or 8 metres above ground level, whichever is the greater;	Within Concrete Batching Plant / Duration of the construction phase	N/A

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			▪ The efflux velocity of gases from the main chimney shall not be less than 12 m/s at full load condition; ▪ The flue gas exit temperature shall not be less than the acid dew point; and ▪ Release of the chimney shall be directed vertically upwards and not be restricted or deflected.		
			Cold feed side ▪ The aggregates with a nominal size less than or equal to 5 mm shall be stored in totally enclosed structure such as storage bin and shall not be handled in open area; ▪ Where there is sufficient buffer area surrounding the plant, ground stockpiling may be used. The stockpile shall be enclosed at least on top and three sides and with flexible curtain to cover the entrance side. If these aggregates are stored above the feeding hopper, they shall be enclosed at least on top and three sides and be wetted on the surface to prevent wind-whipping; ▪ The aggregates with a nominal size greater than 5 mm should preferably be stored in totally enclosed structure. Aggregates stockpile that is above the feeding hopper shall be enclosed at least on top and three sides. If open stockpiling is used, the stockpiles shall be enclosed on three sides with the enclosure wall sufficiently higher than the top of the stockpile to prevent wind whipping; ▪ Belt conveyors shall be enclosed on top and two sides and provided with a metal board at the bottom to eliminate any dust emission due to the wind-whipping effect. Other type of enclosure will also be accepted by EPD if it can be demonstrated that the proposed enclosure can be achieve the same performance; ▪ Scrapers shall be provided at the turning points of all belt conveyors inside the chute of the transfer points to remove dust adhered to the belt surface; ▪ All conveyor transfer points shall be totally enclosed. Openings for the passages of conveyors shall be fitted with adequate flexible seals; and ▪ All materials returned from dust collection system shall be transferred in enclosed system and shall be stored inside bins or enclosures.	Within Concrete Batching Plant / Duration of the construction phase	N/A
			Hot feed side ▪ The inlet and outlet of the rotary dryer shall be enclosed and ducted to a dust extraction and collection system such as a fabric filter. The particulate and gaseous concentration at the exhaust outlet of the dust collector shall not exceed the required limiting values; ▪ The bucket elevator shall be totally enclosed and the air be extracted and ducted to a dust collection system to meet the required particulates limiting value; ▪ All vibratory screens shall be totally enclosed and dust tight with close-fitted access inspection opening. Gaskets shall be installed to seal off any cracks and edges of any inspection openings; ▪ Chutes for carrying hot material shall be rigid and preferably fitted with abrasion resistant plate inside. They shall be inspected daily for leakages; ▪ All hot bins shall be totally enclosed and dust tight with close-fitted access inspection opening. Gaskets shall be installed to seal off any cracks and edges of any inspection openings. The air shall be extracted	Within Concrete Batching Plant / Duration of the construction phase	N/A

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			and ducted to a dust collection system to meet the required particulates limiting value; and ▪ Appropriate control measures shall be adopted in order to meet the required bitumen emission limit as well as the ambient odour level (2 odour units).		
			Material transportation ▪ The loading, unloading, handling, transfer or storage of other raw materials which may generate airborne dust emissions such as crushed rocks, sands, stone aggregates, reject fines, shall be carried out in such a manner as to minimize dust emissions; ▪ Roadways from the entrance of the plant to the product loading points and/or any other working areas where there are regular movements of vehicles shall be paved or hard surfaced; and ▪ Haul roads inside the Works shall be adequately wetted with water and/or chemical suppressants by water trucks or water sprayers.	Within Concrete Batching Plant / Duration of the construction phase	N/A
			Control of emissions from bitumen decanting ▪ The heating temperature of the particular bitumen type and grade shall not exceed the corresponding temperature limit of the same type listed in Appendix 1 of the Guidance Note; ▪ Tamper-free high temperature cut-off device shall be provided to shut off the fuel supply or electricity in case the upper limit for bitumen temperature is reached; ▪ Proper chimney for the discharge of bitumen fumes shall be provided at high level; ▪ The emission of bitumen fumes shall not exceed the required emission limit; and The air-to-fuel ratio shall be properly controlled to allow complete combustion of the fuel. The fuel burners, if any, shall be maintained properly and free from carbon deposits in the burner nozzles.	Within Concrete Batching Plant / Duration of the construction phase	N/A
			Liquid fuel ▪ The receipt, handling and storage of liquid fuel shall be carried out so as to prevent the release of emissions of organic vapours and/or other noxious and offensive emissions to the air.	Within Concrete Batching Plant / Duration of the construction phase	N/A
			Housekeeping ▪ A high standard of housekeeping shall be maintained. Waste material, spillage and scattered piles gathered beneath belt conveyors, inside and around enclosures shall be cleared frequently. The minimum clearing frequency is on a weekly basis.	Within Concrete Batching Plant / Duration of the construction phase	N/A
5.2.6.7	2.1	-	**Best Practices for Rock Crushing Plants** The relevant best practices for dust control as stipulated in the Guidance Note on the Best Practicable Means for Mineral Works (Stone Crushing Plant) BPM 11/1 (95) as well as in the future Specified Process licence should be adopted. These include: Crushers ▪ The outlet of all primary crushers, and both inlet and outlet of all secondary and tertiary crushers, if not	Within Concrete Batching Plant / Duration of the construction phase	N/A

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			installed inside a reasonably dust tight housing, shall be enclosed and ducted to a dust extraction and collection system such as a fabric filter; ▪ The inlet hopper of the primary crushers shall be enclosed on top and 3 sides to contain the emissions during dumping of rocks from trucks. The rock while still on the trucks shall be wetted before dumping; ▪ Water sprayers shall be installed and operated in strategic locations at the feeding inlet of crushers; and ▪ Crusher enclosures shall be rigid and be fitted with self-closing doors and close-fitting entrances and exits. Where conveyors pass through the crusher enclosures, flexible covers shall be installed at entries and exits of the conveyors to the enclosure.		
			Vibratory screens and grizzlies ▪ All vibratory screens shall be totally enclosed in a housing. Screenhouses shall be rigid and reasonably dust tight with self-closing doors or close-fitted entrances and exits for access. Where conveyors pass through the screenhouse, flexible covers shall be installed at entries and exits of the conveyors to the housing. Where containment of dust within the screenhouse structure is not successful then a dust extraction and collection system shall be provided; and ▪ All grizzlies shall be enclosed on top and 3 sides and sufficient water sprayers shall be installed at their feeding and outlet areas.	Within Concrete Batching Plant / Duration of the construction phase	N/A
			Belt conveyors ▪ Except for those conveyors which are placed within a totally enclosed structure such as a screenhouse or those erected at the ground level, all conveyors shall be totally enclosed with windshield on top and 2 sides; ▪ Effective belt scraper such as the pre-cleaner blades made by hard wearing materials and provided with pneumatic tensioner, or equivalent device, shall be installed at the head pulley of designated conveyor as required to dislodge fine dust particles that may adhere to the belt surface and to reduce carry-back of fine materials on the return belt. Bottom plates shall also be provided for the conveyor unless it has been demonstrated that the corresponding belt scraper is effective and well maintained to prevent falling material from the return belt; and ▪ Except for those transfer points which are placed within a totally enclosed structure such as a screenhouse, all transfer points to and from conveyors shall be enclosed. Where containment of dust within the enclosure is not successful, then water sprayers shall be provided. Openings for any enclosed structure for the passage of conveyors shall be fitted with flexible seals.	Within Concrete Batching Plant / Duration of the construction phase	N/A
			Storage piles and bins ▪ Where practicable, free falling transfer points from conveyors to stockpiles shall be fitted with flexible curtains or be enclosed with chutes designed to minimize the drop height. Water sprays shall also be used where required. ▪ The surface of all surge piles and stockpiles of blasted rocks or aggregates shall be kept sufficiently wet	Within Concrete Batching Plant / Duration of the construction phase	N/A

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			by water spraying wherever practicable; ▪ All open stockpiles for aggregates of size in excess of 5 mm shall be kept sufficiently wet by water spraying where practicable; or ▪ The stockpiles of aggregates 5 mm in size or less shall be enclosed on 3 sides or suitably located to minimize wind-whipping. Save for fluctuations in stock or production, the average stockpile shall stay within the enclosure walls and in no case the height of the stockpile shall exceed twice the height of the enclosure walls. ▪ Scattered piles gathered beneath belt conveyors, inside and around enclosures shall be cleared regularly.		
			Rock drilling equipment Appropriate dust control equipment such as a dust extraction and collection system shall be used during rock drilling activities.	Within Concrete Batching Plant / Duration of the construction phase	N/A
			Hazard to Human Life – Construction Phase		
Table 6.40	3.2	-	▪ Precautionary measures should be established to request barges to move away during typhoons.	Construction Site / Construction Period	I
Table 6.40	3.2	-	▪ An appropriate marine traffic management system should be established to minimize risk of ship collision.	Construction Site / Construction Period	I
Table 6.40	3.2	-	▪ Location of all existing hydrant networks should be clearly identified prior to any construction works.	Construction Site / Construction Period	N/A
			Noise Impact – Construction Phase		
7.5.6	4.3	-	**Good Site Practice** Good site practice and noise management can significantly reduce the impact of construction site activities on nearby NSRs. The following package of measures should be followed during each phase of construction: ▪ only well-maintained plant to be operated on-site and plant should be serviced regularly during the construction works; ▪ machines and plant that may be in intermittent use to be shut down between work periods or should be throttled down to a minimum; ▪ plant known to emit noise strongly in one direction, should, where possible, be orientated to direct noise away from the NSRs; ▪ mobile plant should be sited as far away from NSRs as possible; and ▪ material stockpiles and other structures to be effectively utilised, where practicable, to screen noise from on-site construction activities.	Within the Project site / During construction phase / Prior to commencement of operation	I
7.5.6	4.3	-	**Adoption of QPME** ▪ QPME should be adopted as far as applicable.	Within the Project site / During construction	I

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
				phase / Prior to commencement of operation	
7.5.6	4.3	-	**Use of Movable Noise Barriers** ▪ Movable noise barriers should be placed along the active works area and mobile plants to block the direct line of sight between PME and the NSRs.	Within the Project site / During construction phase / Prior to commencement of operation	I
7.5.6	4.3	-	**Use of Noise Enclosure/ Acoustic Shed** ▪ Noise enclosure or acoustic shed should be used to cover stationary PME such as air compressor and generator.	Within the Project site / During construction phase / Prior to commencement of operation	I
			Water Quality Impact – Construction Phase		
8.8.1.2 and 8.8.1.3	5.1	2.26	**Marine Construction Activities** <u>General Measures to be Applied to All Works Areas</u> ▪ Barges or hoppers shall not be filled to a level which will cause overflow of materials or pollution of water during loading or transportation; ▪ Use of Lean Material Overboard (LMOB) systems shall be prohibited; ▪ Excess materials shall be cleaned from the decks and exposed fittings of barges and hopper dredgers before the vessels are moved; ▪ Plants should not be operated with leaking pipes and any pipe leakages shall be repaired quickly; ▪ Adequate freeboard shall be maintained on barges to reduce the likelihood of decks being washed by wave action; ▪ All vessels shall be sized such that adequate clearance is maintained between vessels and the sea bed at all states of the tide to ensure that undue turbidity is not generated by turbulence from vessel movement or propeller wash; ▪ The works shall not cause foam, oil, grease, litter or other objectionable matter to be present in the water within and adjacent to the works site; and ▪ For ground improvement activities including DCM, the wash water from cleaning of the drilling shaft should be appropriately treated before discharge. The Contractor should ensure the waste water meets the WPCO/TM requirements before discharge. No direct discharge of contaminated water is permitted.	Within construction site / Duration of the construction phase	I
			<u>Specific Measures to be Applied to All Works Areas</u> ▪ The daily maximum production rates shall not exceed those assumed in the water quality assessment in	Within construction site / Duration of the construction phase	I

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			the EIA report; ▪ A maximum of 10 % fines content to be adopted for sand blanket and 20 % fines content for marine filling below +2.5 mPD prior to substantial completion of seawall (until end of Year 2017) shall be specified in the works contract document; ▪ An advance seawall of at least 200m to be constructed (comprising either rows of contiguous permanent steel cells completed above high tide mark or partially completed seawalls with rock core to high tide mark and filter layer on the inner side) prior to commencement of marine filling activities;		
			▪ Closed grab dredger shall be used to excavate marine sediment; ▪ Silt curtains surrounding the closed grab dredger shall be deployed in accordance with the Silt Curtain Deployment Plan; and		N/A
			▪ The Silt Curtain Deployment Plan shall be implemented.		I
			<u>Specific Measures to be Applied to Land Formation Activities prior to Commencement of Marine Filling Works</u> ▪ Double layer 'Type III' silt curtains to be applied around the active eastern works areas prior to commencement of sand blanket laying activities. The silt curtains shall be configured to minimise SS release during ebb tides. A silt curtain efficiency test shall be conducted to validate the performance of the silt curtains;	Within construction site / Duration of the construction phase	N/A *(The arrangement of silt curtain has been modified. The details can be referred to Silt Curtain Deployment Plan)
			▪ Double layer silt curtains to enclose WSRs C7a and silt screens installed at the intake points for both WSR C7a and C8 prior to commencement of construction; and		N/A
			▪ The silt curtains and silt screens should be regularly checked and maintained.		I
			<u>Specific Measures to be Applied to Land Formation Activities during Marine Filling Works</u> ▪ Double layer 'Type II' or 'Type III' silt curtains to be applied around the eastern openings between partially completed seawalls prior to commencement of marine filling activities. The silt curtains shall be configured to minimise SS release during ebb tides; ▪ Double layer silt curtains to be applied at the south-western opening prior to commencement of marine filling activities; ▪ Double layer silt curtain to enclose WSR C7a and silt screens installed at the intake points for both WSR C7a and C8 prior to commencement of marine filling activities; and ▪ The silt curtains and silt screens should be regularly checked and maintained.	Within construction site / Duration of the construction phase	N/A
			<u>Specific Measures to be Applied to the Field Joint Excavation Works for the Submarine Cable Diversion</u>	Within construction site	N/A

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			▪ Only closed grabs designed and maintained to avoid spillage shall be used and should seal tightly when operated. Excavated materials shall be disposed at designated marine disposal area in accordance with the Dumping and Sea Ordinance (DASO) permit conditions; and ▪ Silt curtains surrounding the closed grab dredger to be deployed as a precautionary measure.	/ Duration of the construction phase	
8.8.1.4	5.1	-	**Modification of the Existing Seawall** ▪ Silt curtains shall be deployed around the seawall modification activities to completely enclose the active works areas, and care should be taken to avoid splashing of rockfill / rock armour into the surrounding marine environment. For the connecting sections with the existing outfalls, works for these connection areas should be undertaken during the dry season in order that individual drainage culvert cells may be isolated for interconnection works.	At the existing northern seawall / Duration of the construction phase	N/A
8.8.1.5	5.1	-	**Construction of New Stormwater Outfalls and Modifications to Existing Outfalls** ▪ During operation of the temporary drainage channel, runoff control measures such as bunding or silt fence shall be provided on both sides of the channel to prevent accumulation and release of SS via the temporary channel. Measures should also be taken to minimise the ingress of site drainage into the culvert excavations.	Within construction site / Duration of the construction phase	N/A
8.8.1.6 8.8.1.7	5.1	2.27	**Piling Activities for Construction of New Runway Approach Lights and HKIAAA Marker Beacons** Silt curtains shall be deployed around the piling activities to completely enclose the piling works and care should be taken to avoid spillage of excavated materials into the surrounding marine environment. <u>For construction of the eastern approach lights at the CMPs</u> ▪ Ground improvement via DCM using a close-spaced layout shall be completed prior to commencement of piling works; ▪ Steel casings shall be installed to enclose the excavation area prior to commencement of excavation; ▪ The excavated materials shall be removed using a closed grab within the steel casings; ▪ No discharge of the cement mixed materials into the marine environment will be allowed; and ▪ Excavated materials shall be treated and reused on-site.	Within construction site / Duration of the construction phase	N/A
8.8.1.8	5.1	-	**Construction Site Runoff and Drainage** The site practices outlined in ProPECC Note PN 1/94 should be followed as far as practicable in order to minimise surface runoff and the chance of erosion. The following measures are recommended: ▪ Install perimeter cut-off drains to direct off-site water around the site and implement internal drainage, erosion and sedimentation control facilities. Channels, earth bunds or sand bag barriers should be provided on site to direct storm water to silt removal facilities. The design of the temporary on-site drainage system should be undertaken by the Contractors prior to the commencement of construction (for works areas located on the existing Airport island) or as soon as the new land is completed (for works	Within construction site / Duration of the construction phase	I

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			areas located on the new landform); ▪ Sand/silt removal facilities such as sand/silt traps and sediment basins should be provided to remove sand/silt particles from runoff to meet the requirements of the TM-DSS standards under the WPCO. The design of efficient silt removal facilities should make reference to the guidelines in Appendix A1 of ProPECC Note PN 1/94. Sizes may vary depending upon the flow rate. The detailed design of the sand/silt traps should be undertaken by the Contractors prior to the commencement of construction; ▪ All drainage facilities and erosion and sediment control structures should be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly during rainstorms. Deposited silt and grit should be regularly removed, at the onset of and after each rainstorm to ensure that these facilities are functioning properly; ▪ Measures should be taken to minimize the ingress of site drainage into excavations. If excavation of trenches in wet periods is necessary, they should be dug and backfilled in short sections wherever practicable. Water pumped out from foundation excavations should be discharged into storm drains via silt removal facilities; ▪ In the event that contaminated groundwater is identified at excavation areas, this should be treated on-site using a suitable wastewater treatment process. The effluent should be treated according to the requirements of the TM-DSS standards under the WPCO prior to discharge to foul sewers or collected for proper disposal off-site. No direct discharge of contaminated groundwater is permitted; ▪ All vehicles and plant should be cleaned before leaving a construction site to ensure no earth, mud, debris and the like is deposited by them on roads. An adequately designed and sited wheel washing facility should be provided at construction site exits. Wash-water should have sand and silt settled out and removed regularly to ensure the continued efficiency of the process. The section of access road leading to, and exiting from, the wheel-wash bay to the public road should be paved with sufficient backfall toward the wheel-wash bay to prevent vehicle tracking of soil and silty water to public roads and drains. All washwater should be treated according to the requirements of the TM-DSS standards under the WPCO prior to discharge;		
8.8.1.9	5.1	-	**Sewage Effluent from Construction Workforce** ▪ Temporary sanitary facilities, such as portable chemical toilets, should be employed on-site where necessary to handle sewage from the workforce. A licensed contractor should be employed to provide appropriate and adequate portable toilets and be responsible for appropriate disposal and maintenance.	Within construction site / During construction phase	I
8.8.1.10 8.8.1.11	5.1		**General Construction Activities** ▪ Construction solid waste, debris and refuse generated on-site should be collected, handled and disposed of properly to avoid entering any nearby storm water drain. Stockpiles of cement and other construction materials should be kept covered when not being used; and ▪ Oils and fuels should only be stored in designated areas which have pollution prevention facilities. To prevent spillage of fuels and solvents to any nearby storm water drain, all fuel tanks and storage areas should be provided with locks and be sited on sealed areas, within bunds of a capacity equal to 110% of	Within construction site / During construction phase	I

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			the storage capacity of the largest tank. The bund should be drained of rainwater after a rain event.		
8.8.1.12 8.8.1.13	5.1	2.28	**Drilling Activities for the Submarine Aviation Fuel Pipelines** To prevent potential water quality impacts at Sha Chau, the following measures shall be applied: ▪ A 'zero-discharge' policy shall be applied for all activities to be conducted at Sha Chau; ▪ No bulk storage of chemicals shall be permitted; and ▪ A containment pit shall be constructed around the drill holes. This containment pit shall be lined with impermeable lining and bunded on the outside to prevent inflow from off-site areas.	Within construction site / During construction phase	I
			At the airport island side of the drilling works, the following measures shall be applied for treatment of wastewater: ▪ During pipe cleaning, appropriate desilting or sedimentation device should be provided on site for treatment before discharge. The Contractor should ensure discharge water from the sedimentation tank meet the WPCO/TM requirements before discharge; and ▪ Drilling fluid used in drilling activities should be reconditioned and reused as far as possible. Temporary enclosed storage locations should be provided on-site for any unused chemicals that needs to be transported away after all the related construction activities are completed. The requirements in ProPECC Note PN 1/94 should be adhered to in the handling and disposal of bentonite slurries.	Within construction site / During construction phase	I
			Waste Management Implication – Construction Phase		
10.5.1.1	7.1	-	Opportunities to minimise waste generation and maximise the reuse of waste materials generated by the project have been incorporated where possible into the planning, design and construction stages, and the following measures have been recommended: ▪ The relevant construction methods (particularly for the tunnel works) and construction programme have been carefully planned and developed to minimise the extent of excavation and to maximise the on-site reuse of inert C&D materials generated by the project as far as practicable. Temporary stockpiling areas will also be provided to facilitate on-site reuse of inert C&D materials; ▪ Priority should be given to collect and reuse suitable inert C&D materials generated from other concurrent projects and the Government's PFRF as fill materials for the proposed land formation works; ▪ Only non-dredged ground improvement methods should be adopted in order to completely avoid the need for dredging and disposal of marine sediment for the proposed land formation work; ▪ Excavation work for constructing the APM tunnels, BHS tunnels and airside tunnels will not be down to the CMPs beneath the fill materials in order to avoid excavating any sediments; and ▪ For the marine sediments expected to be excavated from the piling works of TRC, APM & BHS tunnels, airside tunnels and other facilities on the proposed land formation area, piling work of marine sections of the approach lights and HKIAAA beacons, basement works for some of T2 expansion area and excavation works for the proposed APM depot should be treated and reused on-site as backfilling	Project Site Area / During design and construction phase	I

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			materials, although required treatment level / detail and the specific re-use mode are under development.		
10.5.1.1	7.1	-	The following good site practices should be performed during the construction activities include: ▪ Nomination of an approved person, such as a site manager, to be responsible for good site practices, arrangements for collection and effective disposal to an appropriate facility, of all wastes generated at the site; ▪ Training of site personnel in proper waste management and chemical waste handling procedures; ▪ Provision of sufficient waste disposal points and regular collection for disposal; ▪ Appropriate measures to minimise windblown litter and dust during transportation of waste by either covering trucks by tarpaulin/ similar material or by transporting wastes in enclosed containers. The cover should be extended over the edges of the sides and tailboards; ▪ Stockpiles of C&D materials should be kept wet or covered by impervious sheets to avoid wind-blown dust; ▪ All dusty materials including C&D materials should be sprayed with water immediately prior to any loading transfer operation so as to keep the dusty material wet during material handling at the barging points/ stockpile areas; ▪ C&D materials to be delivered to and from the project site by barges or by trucks should be kept wet or covered to avoid wind-blown dust; ▪ The speed of the trucks including dump trucks carrying C&D or waste materials within the site should be controlled to about 10 km/hour in order to reduce the adverse dust impact and secure the safe movement around the site; and ▪ To avoid or minimise dust emission during transport of C&D or waste materials within the site, each and every main temporary access should be paved with concrete, bituminous hardcore materials or metal plates and kept clear of dusty materials. Unpaved parts of the road should be sprayed with water or a dust suppression chemical so as to keep the entire road surface wet.	Project Site Area / Construction Phase	I
10.5.1.3	7.1	-	The following practices should be performed to achieve waste reduction include: ▪ Use of steel or aluminium formworks and falseworks for temporary works as far as practicable; ▪ Adoption of repetitive design to allow reuse of formworks as far as practicable; ▪ Segregation and storage of different types of waste in different containers, skips or stockpiles to enhance reuse or recycling of materials and their proper disposal; ▪ Encourage collection of aluminium cans, PET bottles and paper by providing separate labelled bins to enable these wastes to be segregated from other general refuse generated by the work force; ▪ Any unused chemicals or those with remaining functional capacity should be collected for reused as far as practicable; ▪ Proper storage and site practices to minimise the potential for damage or contamination of construction	Project Site Area / Construction Phase	I

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			materials; and ▪ Plan and stock construction materials carefully to minimise amount of waste generated and avoid unnecessary generation of waste.		
10.5.1.5	7.1		▪ Inert and non-inert C&D materials should be handled and stored separately to avoid mixing the two types of materials.	Project Site Area / Construction Phase	I
10.5.1.5	7.1	-	▪ Any recyclable materials should be segregated from the non-inert C&D materials for collection by reputable licensed recyclers whereas the non-recyclable waste materials should be disposed of at the designated landfill site by a reputable licensed waste collector.	Project Site Area / Construction Phase	I
10.5.1.6	7.1	-	▪ A trip-ticket system promulgated shall be developed in order to monitor the off-site delivery of surplus inert C&D materials that could not be reused on-site for the proposed land formation work at the PFRF and to control fly tipping.	Project Site Area / Construction Phase	I
10.5.1.6	7.1	2.32	▪ The Contractor should prepare and implement a Waste Management Plan detailing various waste arising and waste management practices.	Construction Phase	I
10.5.1.16	7.1	-	The following mitigation measures are recommended during excavation and treatment of the sediments: ▪ On-site remediation should be carried out in an enclosed area in order to minimise odour/dust emissions; ▪ The loading, unloading, handling, transfer or storage of treated and untreated sediment should be carried out in such a manner to prevent or minimise dust emissions; ▪ All practical measures, including but not limited to speed control for vehicles, should be taken to minimise dust emission; ▪ Good housekeeping should be maintained at all times at the sediment treatment facility and storage area; ▪ Treated and untreated sediment should be clearly separated and stored separately; and ▪ Surface runoff from the enclosed area should be properly collected and stored separately, and then properly treated to levels in compliance with the relevant effluent standards as required by the Water Pollution Control Ordinance before final discharge.	Project Site Area / Construction Phase	N/A
10.5.1.18	7.1	-	The marine sediments to be removed from the cable field joint area would be disposed of at the designated disposal sites to be allocated by the MFC. The following mitigation measures should be strictly followed to minimise potential impacts on water quality during transportation of the sediments requiring Type 1 disposal: ▪ Bottom opening of barges shall be fitted with tight fitting seals to prevent leakage of material; ▪ Monitoring of the barge loading shall be conducted to ensure that loss of material does not take place during transportation. Transport barges or vessels shall be equipped with automatic self-monitoring devices as specified by EPD; and ▪ Barges or hopper barges shall not be filled to a level that would cause the overflow of materials or sediment laden water during loading or transportation.	Project Site Area / Construction Phase	N/A
10.5.1.19	7.1	-	Contractor should register with the EPD as a chemical waste producer and to follow the relevant guidelines.	Project Site Area /	I

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			The following measures should be implemented: ▪ Good quality containers compatible with the chemical wastes should be used; ▪ Incompatible chemicals should be stored separately; ▪ Appropriate labels must be securely attached on each chemical waste container indicating the corresponding chemical characteristics of the chemical waste, such as explosive, flammable, oxidizing, irritant, toxic, harmful, corrosive, etc; and ▪ The contractor will use a licensed collector to transport and dispose of the chemical wastes at the approved Chemical Waste Treatment Centre or other licensed recycling facilities, in accordance with the Waste Disposal (Chemical Waste) (General) Regulation.	Construction Phase	
10.5.1.20	7.1	-	▪ General refuse should be stored in enclosed bins or compaction units separated from inert C&D material. A reputable waste collector should be employed by the contractor to remove general refuse from the site for disposal at designated landfill sites. An enclosed and covered area should be provided to reduce the occurrence of 'wind blown' light material.	Project Site Area / Construction Phase	I
10.5.1.21	7.1	-	▪ The construction contractors will be required to regularly check and clean any refuse trapped or accumulated along the newly constructed seawall. Such refuse will then be stored and disposed of together with the general refuse.	Project Site Area / Construction Phase	N/A
			Land Contamination – Construction Phase		
11.10.1.2 to 11.10.1.3	8.1	2.32	For areas inaccessible during site reconnaissance survey ▪ Further site reconnaissance would be conducted once the areas are accessible in order to identify any land contamination concern for the areas. ▪ Subject to further site reconnaissance findings, a supplementary Contamination Assessment Plan (CAP) for additional site investigation (SI) (if necessary) may be prepared and submitted to EPD for endorsement prior to the commencement of SI at these areas. ▪ After completion of SI, the Contamination Assessment Report (CAR) will be prepared and submitted to EPD for approval prior to start of the proposed construction works at the golf course, the underground and above-ground fuel storage tank areas, emergency power generation units, airside petrol filling station and fuel tank room. ▪ Should remediation be required, Remediation Action Plan (RAP) and Remediation Report (RR) will be prepared for EPD's approval prior to commencement of the proposed remediation and any construction works respectively.	Project Site Area inaccessible during site reconnaissance / Prior to Construction Phase	N/A
11.8.1.2	8.1	-	If contaminated soil is identified, the following mitigation measures are for the excavation and transportation of contaminated materials (if any): ▪ To minimize the incidents of construction workers coming in contact with any contaminated materials, bulk earth-moving excavation equipment should be employed;	Project Site Area / Construction Phase	N/A

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			▪ Contact with contaminated materials can be minimised by wearing appropriate clothing and personal protective equipment such as gloves and masks (especially when working directly with contaminated material), provision of washing facilities and prohibition of smoking and eating on site; ▪ Stockpiling of contaminated excavated materials on site should be avoided as far as possible; ▪ The use of any contaminated soil for landscaping purpose should be avoided unless pre-treatment was carried out; ▪ Vehicles containing any excavated materials should be suitably covered to reduce dust emissions and/or release of contaminated wastewater; ▪ Truck bodies and tailgates should be sealed to prevent any discharge; ▪ Only licensed waste haulers should be used to collect and transport contaminated material to treatment/disposal site and should be equipped with tracking system to avoid fly tipping; ▪ Speed control for trucks carrying contaminated materials should be exercised. 8km/h is the recommended speed limit; ▪ Strictly observe all relevant regulations in relation to waste handling, such as Waste Disposal Ordinance (Cap 354), Waste Disposal (Chemical Waste) (General) Regulation (Cap 354) and obtain all necessary permits where required; and ▪ Maintain records of waste generation and disposal quantities and disposal arrangements.		
			Terrestrial Ecological – Construction Phase		
12.10.1.1	9.2	2.14	**Pre-construction Egretry Survey** ▪ Conduct ecological survey for Sha Chau egretry to update the latest boundary of the egretry.	Breeding season (April - July) prior to commencement of HDD drilling works at HKIA	I
12.7.2.3 and 12.7.2.6	9.1	2.30	**Avoidance and Minimisation of Direct Impact to Egretry** ▪ The daylighting location will avoid direct encroachment to the Sheung Sha Chau egretry. The daylighting location and mooring of flat top barge, if required, will be kept away from the egretry; ▪ In any event, controls such as demarcation of construction site boundary and confining the lighting within the site will be practised to minimise disturbance to off-site habitat at Sheung Sha Chau Island; and ▪ The containment pit at the daylighting location shall be covered or camouflaged.	During construction phase at Sheung Sha Chau Island	I
12.7.2.5	9.1	2.30	**Preservation of Nesting Vegetation** ▪ The proposed daylighting location and the arrangement of connecting pipeline will avoid the need of tree cutting, therefore the trees that are used by ardeids for nesting will be preserved.	During construction phase at Sheung Sha Chau Island	I
12.7.2.4	9.1	2.30	**Timing the Pipe Connection Works outside Ardeid's Breeding Season**	During construction	I

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
and 12.7.2.6			▪ All HDD and related construction works on Sheung Sha Chau Island will be scheduled outside the ardeids' breeding season (between April and July). No night-time construction work will be allowed on Sheung Sha Chau Island during all seasons.	phase at Sheung Sha Chau Island	
12.10.1.1	9.3	-	**Ecological Monitoring** ▪ During the HDD construction works period from August to March, ecological monitoring will be undertaken monthly at the HDD daylighting location on Sheung Sha Chau Island to identify and evaluate any impacts with appropriate actions taken as required to address and minimise any adverse impact found.	at Sheung Sha Chau Island	I
			Marine Ecological Impact – Pre-construction Phase		
13.11.4.1	10.2.2	-	▪ Pre-construction phase Coral Dive Survey.	HKIAAA artificial seawall	I
			Marine Ecological Impact – Construction Phase		
13.11.1.3 to 13.11.1.6	-	-	**Minimisation of Land Formation Area** ▪ Minimise the overall size of the land formation needed for the additional facilities to minimise the overall loss of habitat for marine resources, especially the CWD population.	Land formation footprint / during detailed design phase to completion of construction	N/A
13.11.1.7 to 13.11.1.10	-	2.31	**Use of Construction Methods with Minimal Risk/Disturbance** ▪ Use of non-dredge method for the main land formation and ancillary works including the diversion of the aviation fuel pipeline to the AFRF; ▪ Use of Deep Cement Mixing (DCM) method instead of conventional seabed dredging for the land formation works to reduce the risk of negative impacts through the elevation of suspended solids and contaminants on CWDs, fisheries and the marine environment; ▪ Use of bored piling in short duration to form the new approach lights and marker beacons for the new runway; ▪ Avoid bored piling during CWD peak calving season (Mar to Jun); ▪ Prohibition of underwater percussive piling; and ▪ Use of horizontal directional drilling (HDD) method and water jetting methods for placement of submarine cables and pipelines to minimise the disturbance to the CWDs and other marine ecological resources.	During construction phase at marine works area	I
13.11.2.1 to 13.11.2.7	-	-	**Mitigation for Indirect Disturbance due to Deterioration of Water Quality** ▪ Water quality mitigation measures during construction phases include consideration of alternative construction methods, deployment of silt curtain and good site practices; ▪ Alternative construction methods including use of non-dredge methods for ground improvement (e.g. Deep Cement Mixing (DCM), prefabricated vertical drains (PVD), sand compaction piles, steel cells, stone	All works area during the construction phase	I

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			columns and vertical sand drains); ▪ Use of bored piling in short duration to form the new approach lights and marker beacons for the new runway; and ▪ Use of horizontal directional drilling (HDD) method and water jetting methods for placement of undersea cables and pipelines to minimise the disturbance to the CWDs and other marine ecological resources.		
13.11.1.12	-	-	**Strict Enforcement of No-Dumping Policy** ▪ A policy prohibiting dumping of wastes, chemicals, oil, trash, plastic, or any other substance that would potentially be harmful to dolphins and/or their habitat in the work area; ▪ Mandatory educational programme of the no-dumpling policy be made available to all construction site personnel for all project-related works; ▪ Fines for infractions should be implemented; and ▪ Unscheduled, on-site audits shall be implemented.	All works area during the construction phase	I
13.11.1.13	-	-	**Good Construction Site Practices** ▪ Regular inspection of the integrity and effectiveness of all silt curtains and monitoring of effluents to ensure that any discharge meets effluent discharge guidelines; ▪ Keep the number of working or stationary vessels present on-site to the minimum anytime; and ▪ Unscheduled, on-site audits for all good site practice restrictions should be conducted, and fines or penalties sufficient to be an effective deterrent need to be levied against violators.	All works area during the construction phase	I
13.11.1.3 to 13.11.1.6	-	-	**Minimisation of Land Formation Area** ▪ Minimise the overall size of the land formation needed for the additional facilities to minimise the overall loss of habitat for marine resources, especially the CWD population.	Land formation footprint / during detailed design phase to completion of construction	N/A
13.11.5.4 to 13.11.5.13	10.3.1	-	**SkyPier High Speed Ferries' Speed Restrictions and Route Diversions** ▪ SkyPier HSFs operating to / from Zhuhai and Macau would divert north of SCLKC Marine Park with a 15 knot speed limit to apply for the part-journeys that cross high CWD abundance grid squares as indicatively shown in **Drawing No. MCL/P132/EIA/13-023** of the EIA Report. Both the alignment of the northerly route and the portion of routings to be subject to the speed limit of 15 knots shall be finalised prior to commencement of construction based on the future review of up-to-date CWD abundance and EM&A data and taking reference to changes in total SkyPier HSF numbers; and ▪ A maximum of 10 knots will be enforced through the designated SCLKC Marine Park area at all times.	Area between the footprint and SCLKC Marine Park during construction phase	I
			Other mitigation measures ▪ The ET will audit various parameters including actual daily numbers of HSFs, compliance with the 15-knot speed limit in the speed control zone and diversion compliance for SkyPier HSFs operating to / from Zhuhai and Macau; and	Area between the footprint and SCLKC Marine Park during construction phase	I

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			▪ The effectiveness of the CWD mitigation measures after implementation of initial six month SkyPier HSF diversion and speed restriction will be reviewed.		
13.11.5.14 to 13.11.5.18	10.3.1	2.31	**Dolphin Exclusion Zone** ▪ Establishment of a 24 hr Dolphin Exclusion Zone (DEZ) with a 250 m radius around the land formation works areas; ▪ A DEZ would also be implemented during ground improvement works (e.g. DCM), water jetting works for submarine cables diversion, open trench dredging at the field joint locations and seawall construction; and ▪ A DEZ would also be implemented during bored piling work but as a precautionary measure only.	Marine waters around land formation works area during construction phase	I
13.11.5.19	10.4	2.31	**Acoustic Decoupling of Construction Equipment** ▪ Air compressors and other noisy equipment that must be mounted on steel barges should be acoustically-decoupled to the greatest extent feasible, for instance by using rubber or air-filled tyres; and ▪ Specific acoustic decoupling measures shall be specified during the detailed design of the project for use during the land formation works.	Around coastal works area during construction phase	I
13.11.5.20	10.6.1	2.29	**Spill Response Plan** ▪ An oil and hazardous chemical spill response plan is proposed to be established during the construction phase as a precautionary measure so that appropriate actions to prevent or reduce risks to CWDs can be undertaken in the event of an accidental spillage.	Construction phase	I
13.11.5.21 to 13.11.5.23	10.6.1	-	**Construction Vessel Speed Limits and Skipper Training** ▪ A speed limit of 10 knots should be strictly observed for construction vessels at areas with the highest CWD densities; and ▪ Vessels traversing through the work areas should be required to use predefined and regular routes (which would presumably become known to resident dolphins) to reduce disturbance to cetaceans due to vessel movements. Specific marine routes shall be specified by the Contractor prior to construction commencing.	All areas north and west of Lantau Island during construction phase	I
			Fisheries Impact – Construction Phase		
14.9.1.2 to 14.9.1.5	-	-	**Minimisation of Land Formation Area** ▪ Minimise the overall size of the land formation needed for the additional facilities to minimise the overall loss of habitat for fisheries resources.	Land formation footprint / during detailed design phase to completion of construction	N/A
14.9.1.6	-	-	**Use of Construction Methods with Minimal Risk/Disturbance** ▪ Use of non-dredge method for the main land formation and ancillary works including the diversion of the aviation fuel pipeline to the AFRF;	During construction phase at marine works area	I

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			▪ Use of Deep Cement Mixing (DCM) method instead of conventional seabed dredging for the land formation works to reduce the risk of negative impacts through the elevation of suspended solids and contaminants on fisheries and the marine environment; ▪ Use of bored piling in short duration to form the new approach lights and marker beacons for the new runway; and ▪ Use of horizontal directional drilling (HDD) method and water jetting methods for placement of undersea cables and pipelines to minimise the disturbance to fisheries resources.		
14.9.1.11	-		**Strict Enforcement of No-Dumping Policy** ▪ A policy prohibiting dumping of wastes, chemicals, oil, trash, plastic, or any other substance that would potentially be harmful to dolphins and/or their habitat in the work area; ▪ Mandatory educational programme of the no-dumpling policy be made available to all construction site personnel for all project-related works; ▪ Fines for infractions should be implemented; and ▪ Unscheduled, on-site audits shall be implemented.	All works area during the construction phase	I
14.9.1.12	-		**Good Construction Site Practices** ▪ Regular inspection of the integrity and effectiveness of all silt curtains and monitoring of effluents to ensure that any discharge meets effluent discharge guidelines; ▪ Keep the number of working or stationary vessels present on-site to the minimum anytime; and ▪ Unscheduled, on-site audits for all good site practice restrictions should be conducted, and fines or penalties sufficient to be an effective deterrent need to be levied against violators.	All works area during the construction phase	I
14.9.1.13 to 14.9.1.18	-		**Mitigation for Indirect Disturbance due to Deterioration of Water Quality** ▪ Water quality mitigation measures during construction phases include consideration of alternative construction methods, deployment of silt curtain and good site practices; ▪ Alternative construction methods including use of non-dredge methods for ground improvement (e.g. Deep Cement Mixing (DCM), prefabricated vertical drains (PVD), sand compaction piles, steel cells, stone columns and vertical sand drains); ▪ Use of bored piling in short duration to form the new approach lights and marker beacons for the new runway; and ▪ Use of horizontal directional drilling (HDD) method and water jetting methods for placement of undersea cables and pipelines to minimise the disturbance to fisheries resources.	All works area during the construction phase	I
			Landscape and Visual Impact – Construction Phase		
Table 15.6	12.3	-	**CM1 -** The construction area and contractor's temporary works areas should be minimised to avoid impacts on adjacent landscape.	All works areas for duration of works; Upon handover and	I

EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
				completion of works.	
Table 15.6	12.3	-	**CM2 -** Reduction of construction period to practical minimum.	All works areas for duration of works; Upon handover and completion of works.	N/A
Table 15.6	12.3	-	**CM3 -** Phasing of the construction stage to reduce visual impacts during the construction phase.	All works areas for duration of works; Upon handover and completion of works.	N/A
Table 15.6	12.3	-	**CM4 -** Construction traffic (land and sea) including construction plants, construction vessels and barges should be kept to a practical minimum.	All works areas for duration of works; Upon handover and completion of works.	I
Table 15.6	12.3	-	**CM5 -** Erection of decorative mesh screens or construction hoardings around works areas in visually unobtrusive colours.	All works areas for duration of works; Upon handover and completion of works. – may be disassembled in phases	N/A
Table 15.6	12.3	-	**CM6 -** Avoidance of excessive height and bulk of site buildings and structures.	New passenger concourse, terminal 2 expansion and other proposed airport related buildings and structures under the project; Upon handover and completion of works.	N/A
Table 15.6	12.3	-	**CM7** - Control of night-time lighting by hooding all lights and through minimisation of night working periods.	All works areas for duration of works; Upon handover and completion of works. – may be disassembled in phases	N/A
Table 15.6	12.3	-	**CM8 -** All existing trees shall be carefully protected during construction. Detailed Tree Protection	All existing trees to be	I

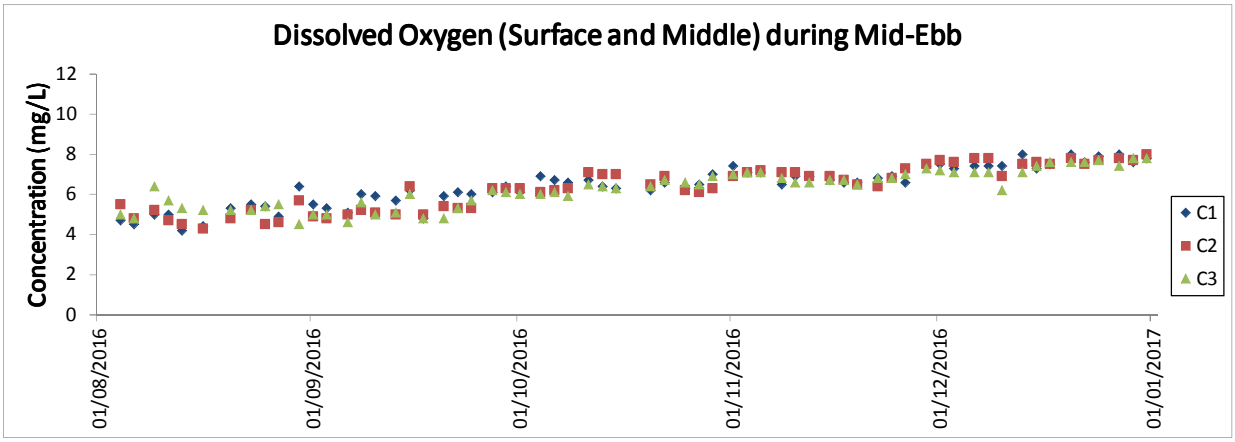
EIA Ref.	EM&A Ref.	EP Condition	Environmental Protection Measures	Location / Duration of measures Timing of completion of measures	Mitigation Measures Implemented?^
			Specification shall be provided in the Contract Specification. Under this specification, the Contractor shall be required to submit, for approval, a detailed working method statement for the protection of trees prior to undertaking any works adjacent to all retained trees, including trees in contractor's works areas.	retained; Upon handover and completion of works.	
Table 15.6	12.3	-	**CM9 -** Trees unavoidably affected by the works shall be transplanted where practical. A detailed Tree Transplanting Specification shall be provided in the Contract Specification, if applicable. Sufficient time for necessary tree root and crown preparation periods shall be allowed in the project programme.	All existing trees to be affected by the works; Upon handover and completion of works.	N/A
Table 15.6	12.3	-	**CM10 -** Land formation works shall be followed with advanced hydroseeding around taxiways and runways as soon as practical.	All affected existing grass areas around runways and verges/Duration of works; Upon handover and completion of works.	N/A
			Cultural Heritage Impact – Construction Phase		
			Not applicable.		
			Health Impact – Aircraft Emissions		
			Not applicable.		
			Health Impact – Aircraft Noise		
			Not applicable.		

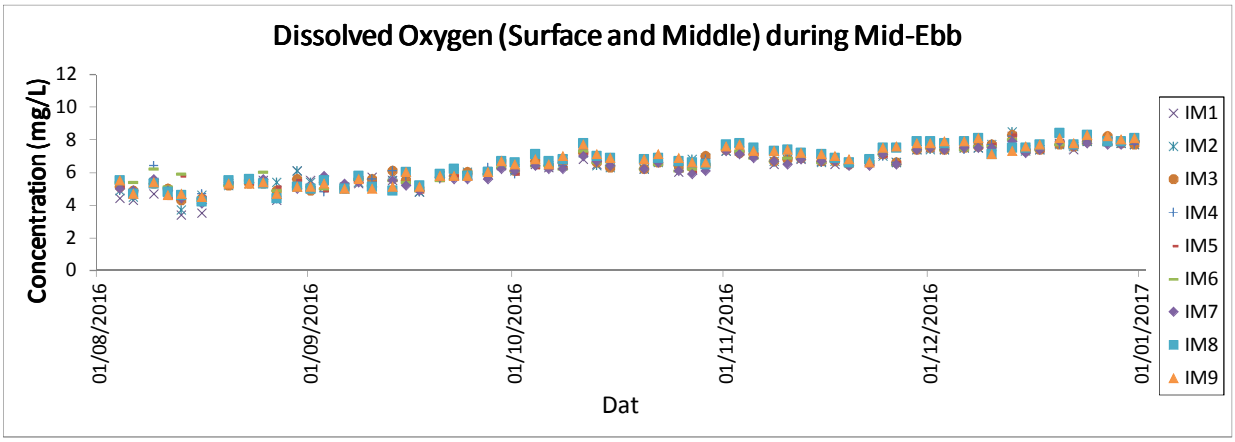
Notes:

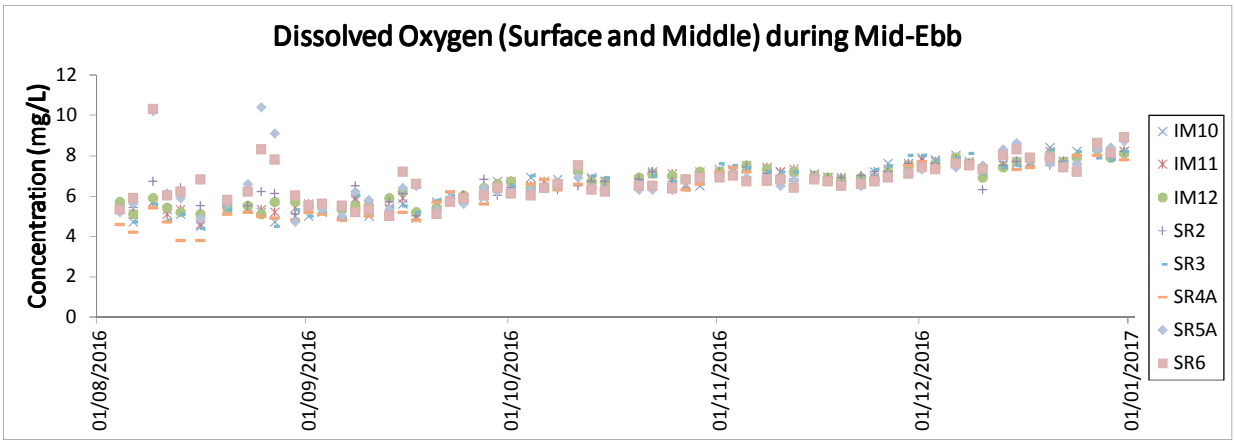
I= implemented where applicable; N/A= not applicable to the construction works implemented during the reporting month.

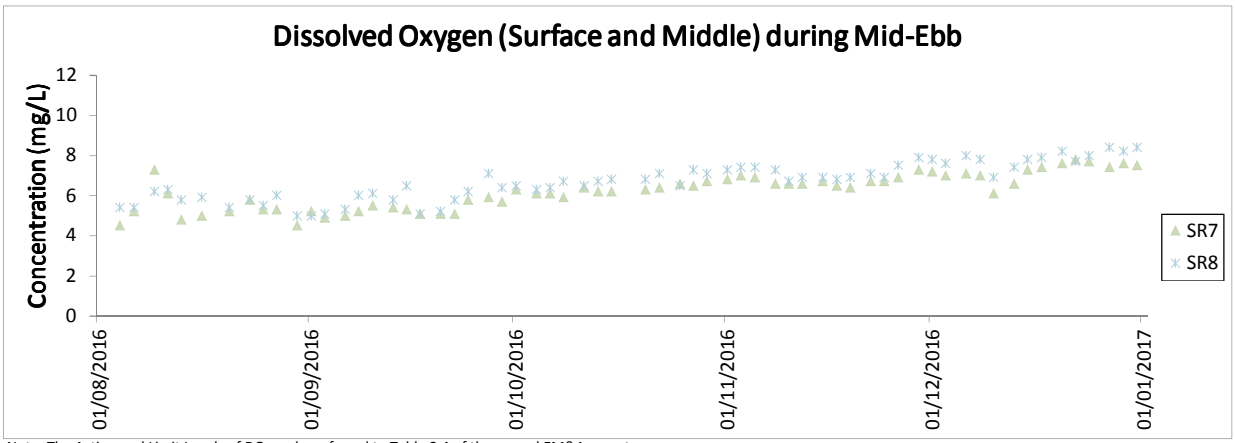
^ Checked by ET during site inspection

Appendix D. Graphical Plots of Water Quality Monitoring Results

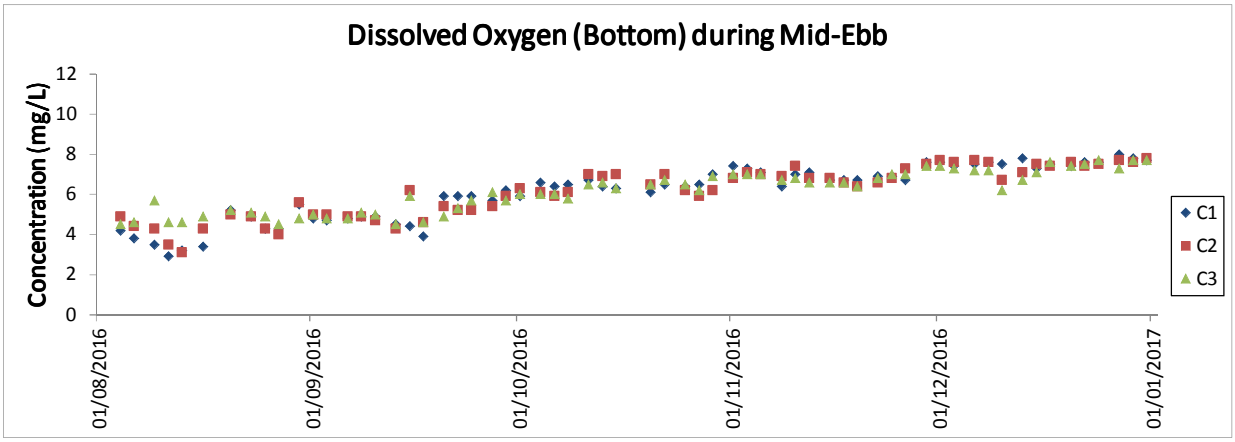


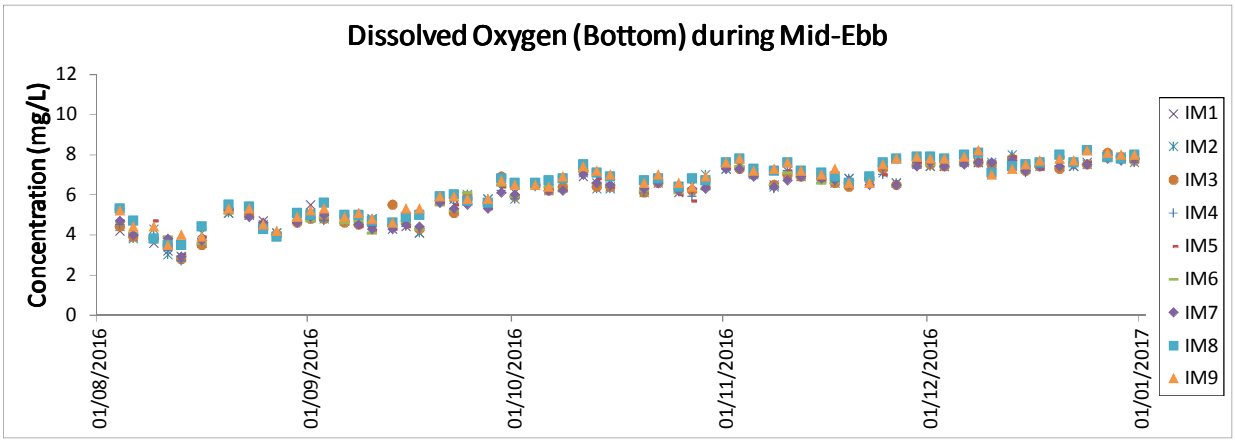


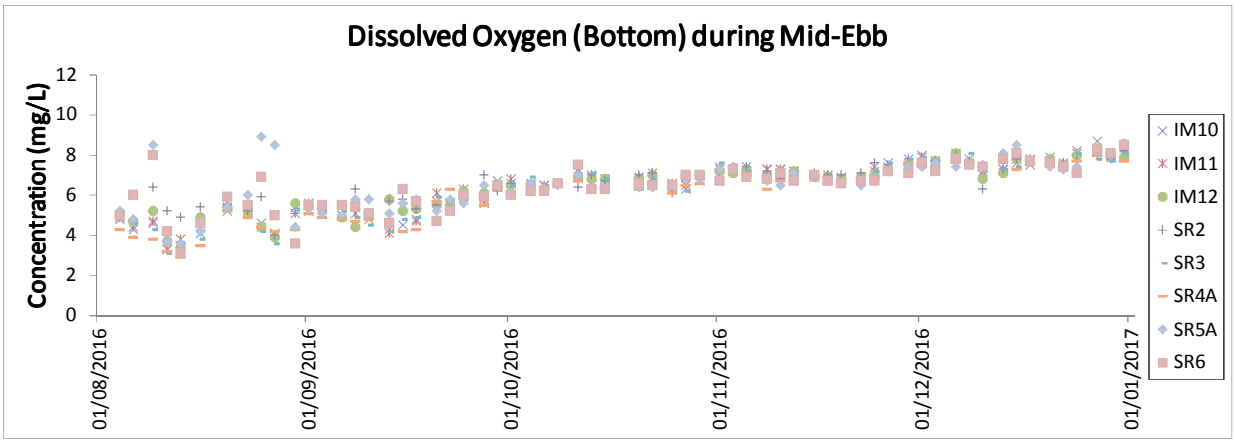


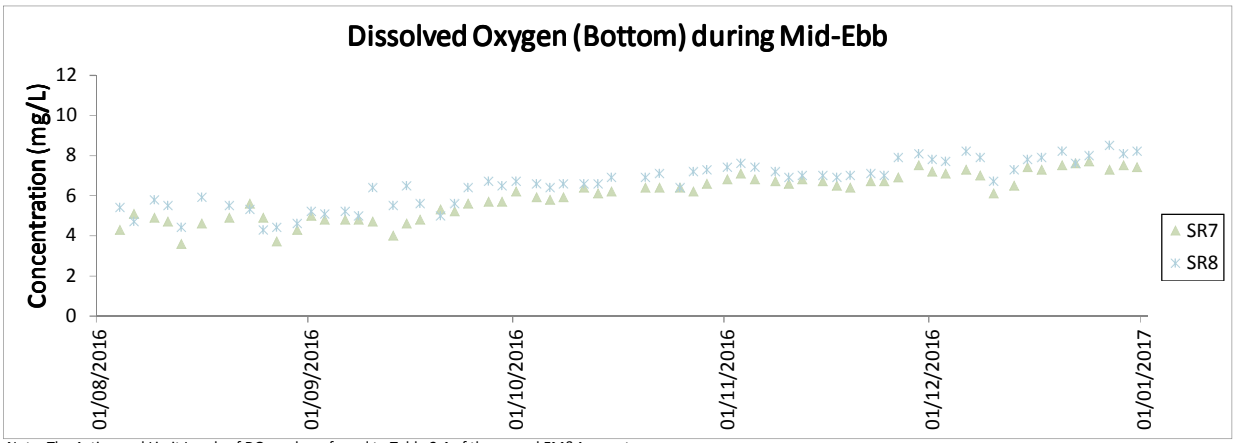


Note: The Action and Limit Levels of DO can be referred to Table 2.4 of the annual EM&A report.

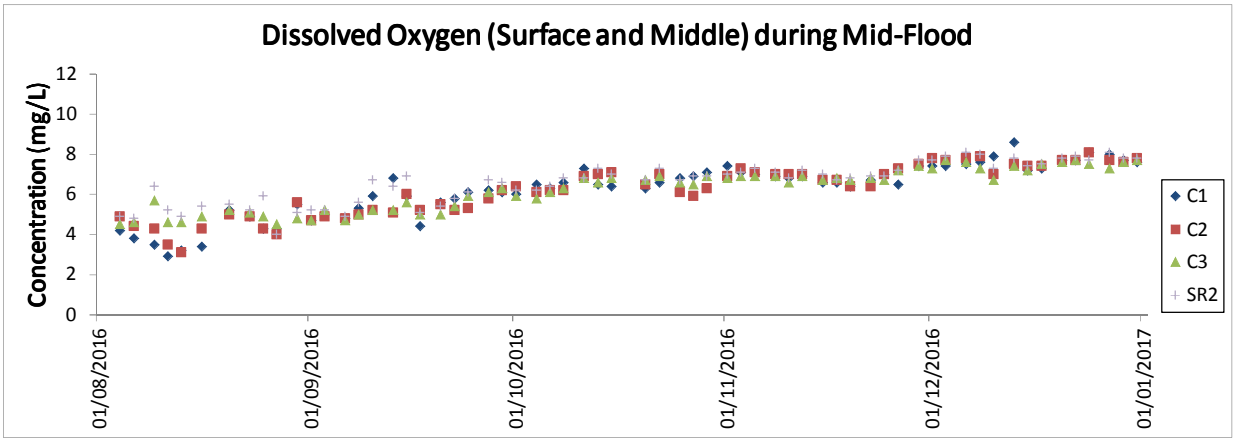


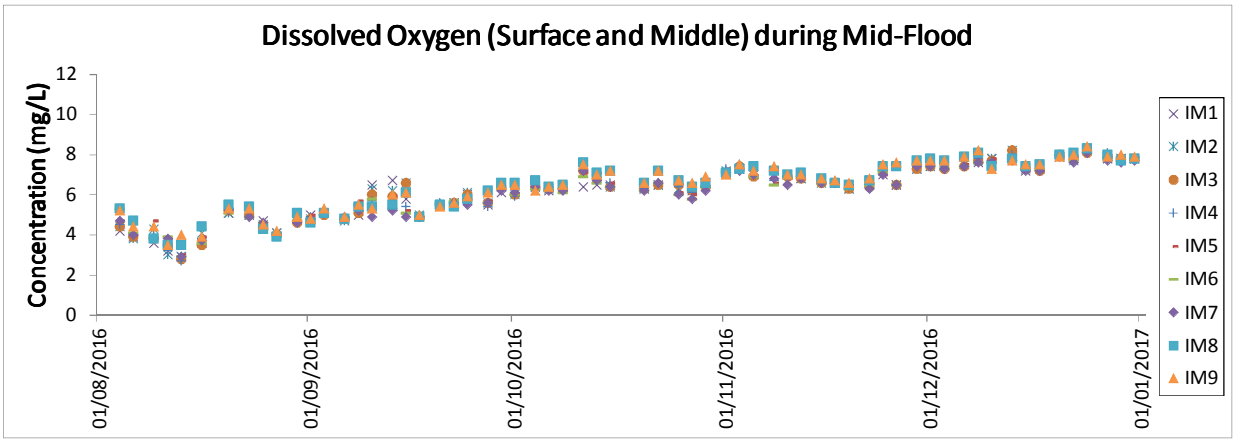


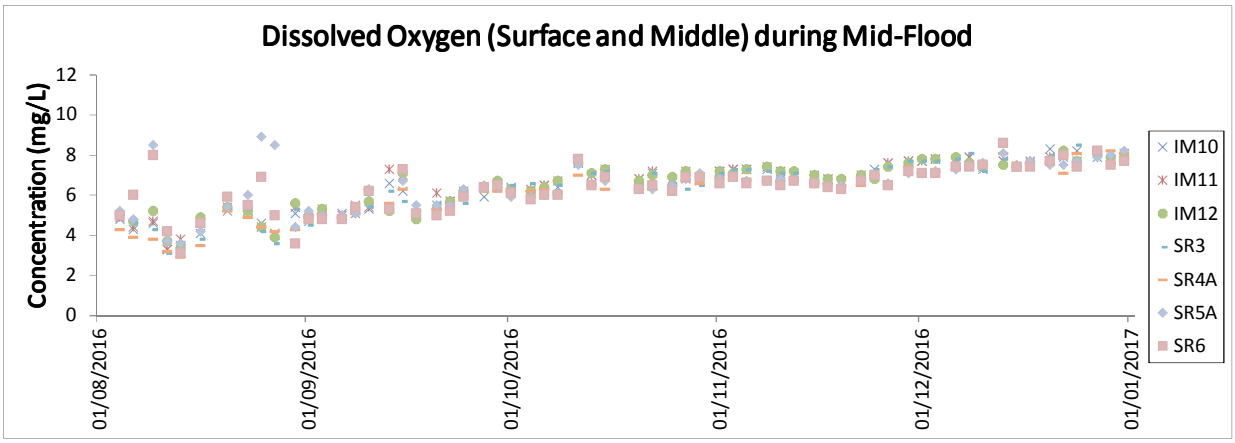


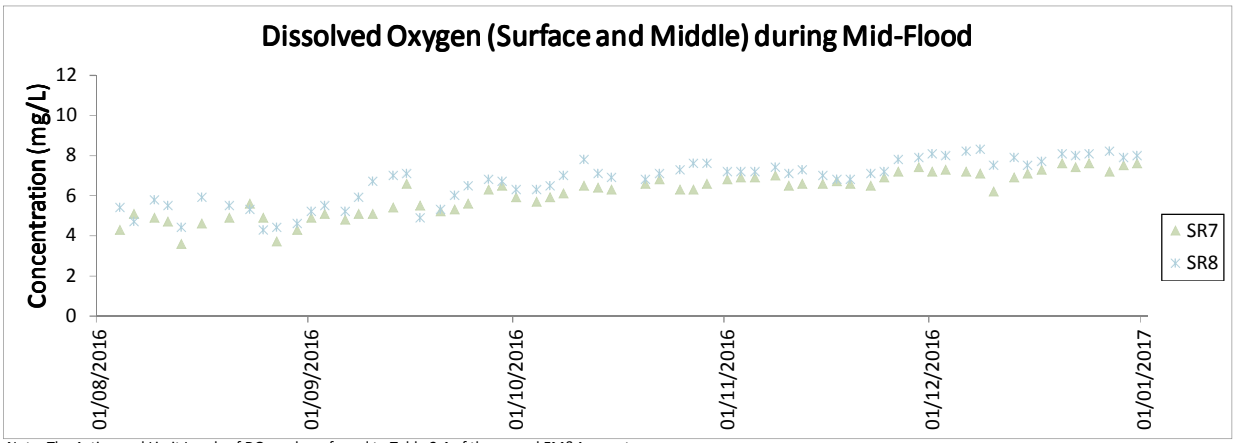


Note: The Action and Limit Levels of DO can be referred to Table 2.4 of the annual EM&A report.

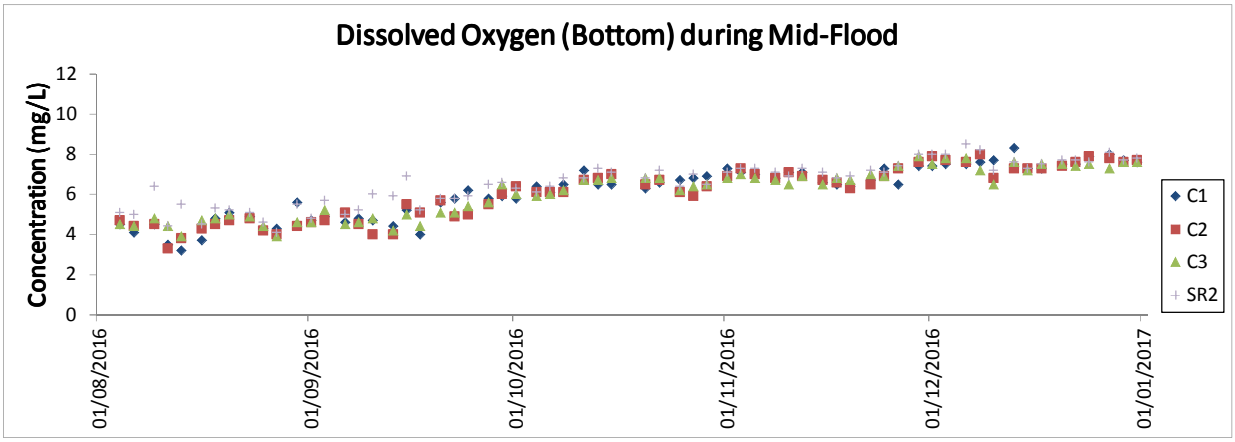


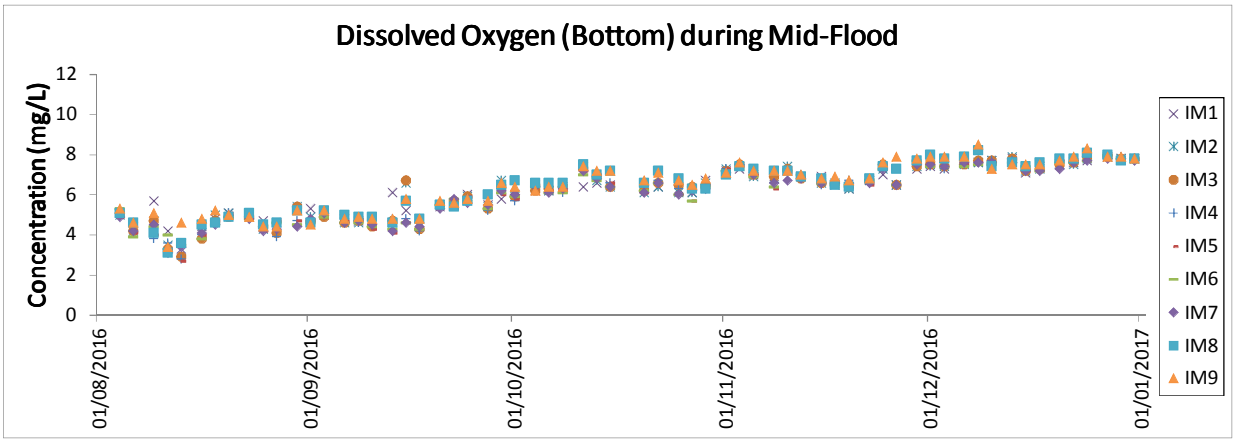


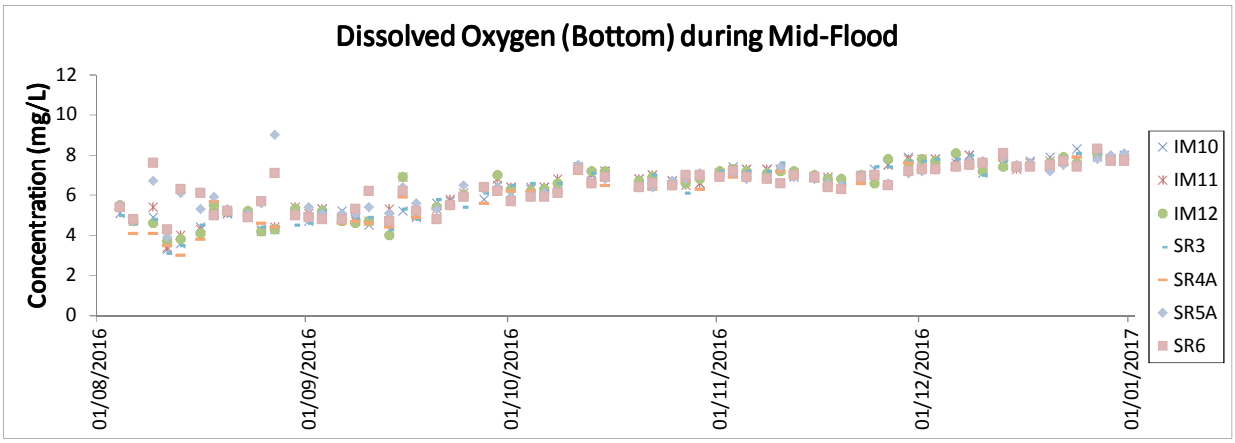


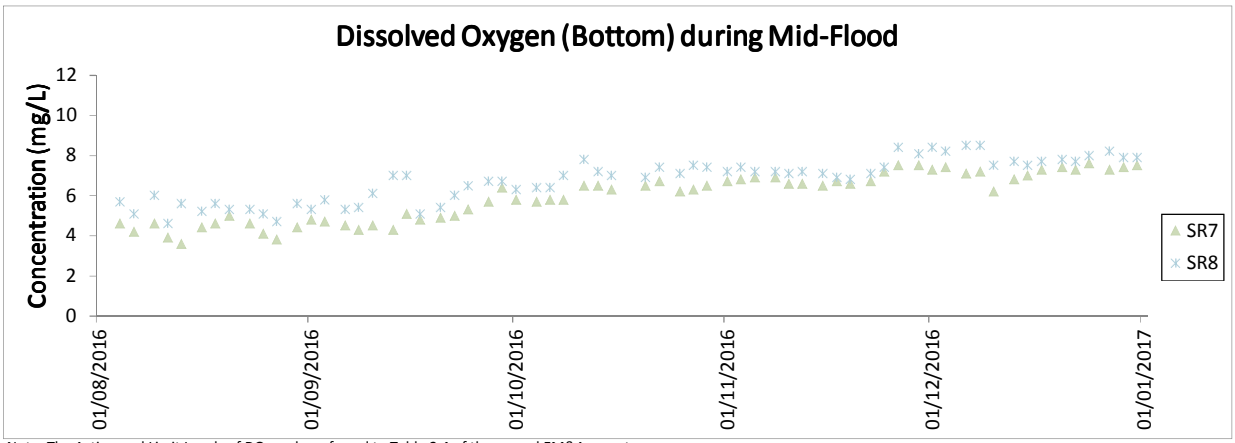


Note: The Action and Limit Levels of DO can be referred to Table 2.4 of the annual EM&A report.

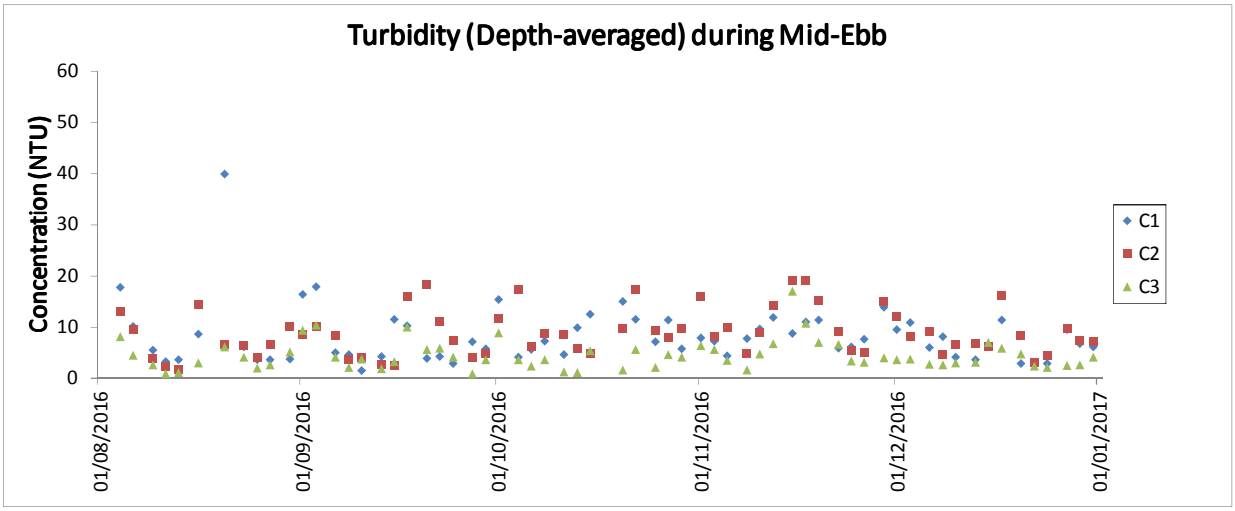


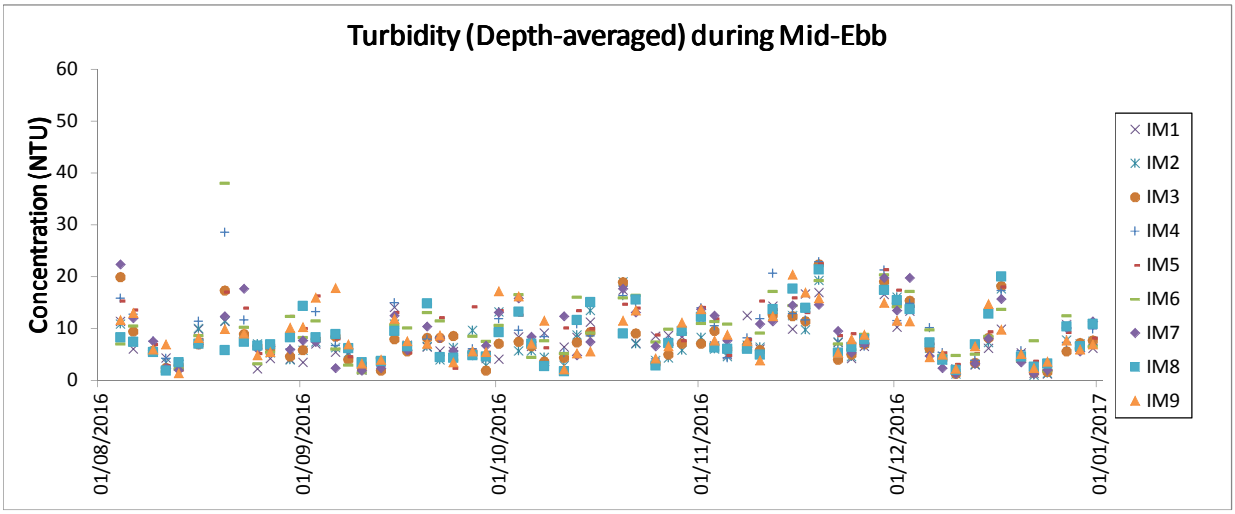


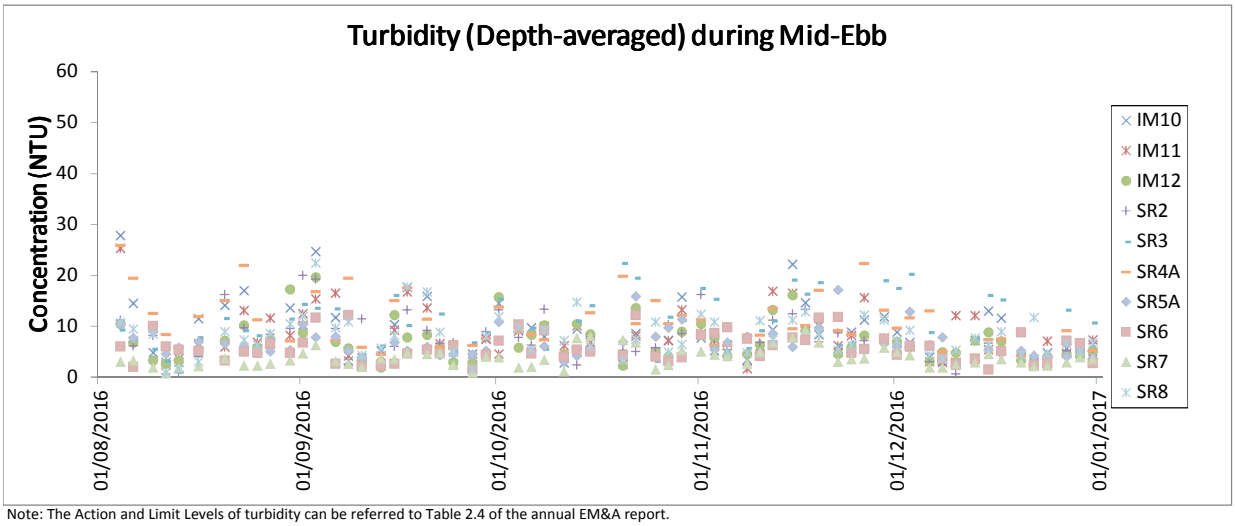




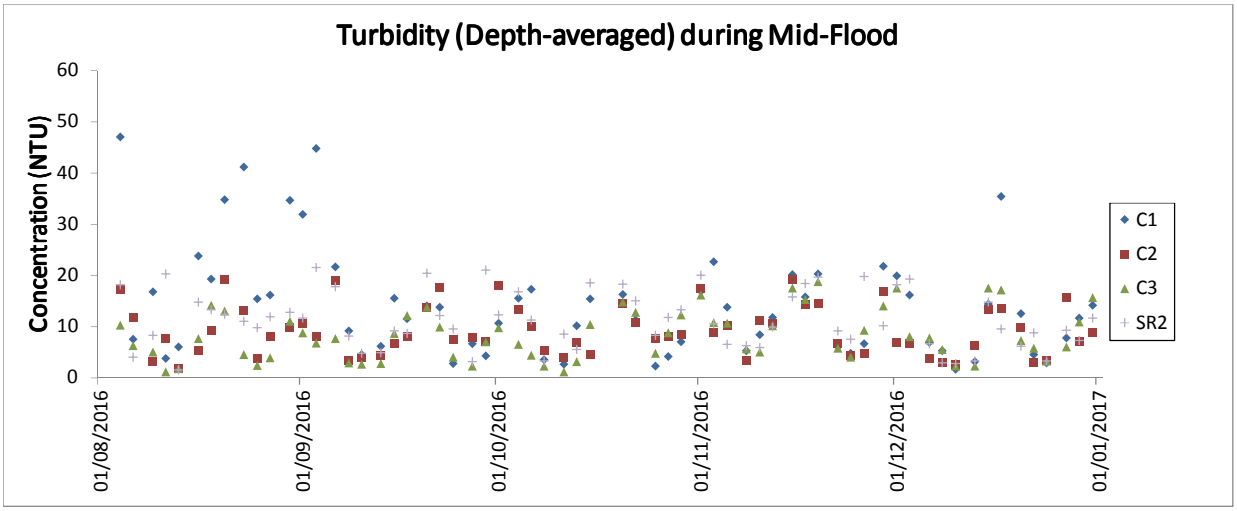
Note: The Action and Limit Levels of DO can be referred to Table 2.4 of the annual EM&A report.

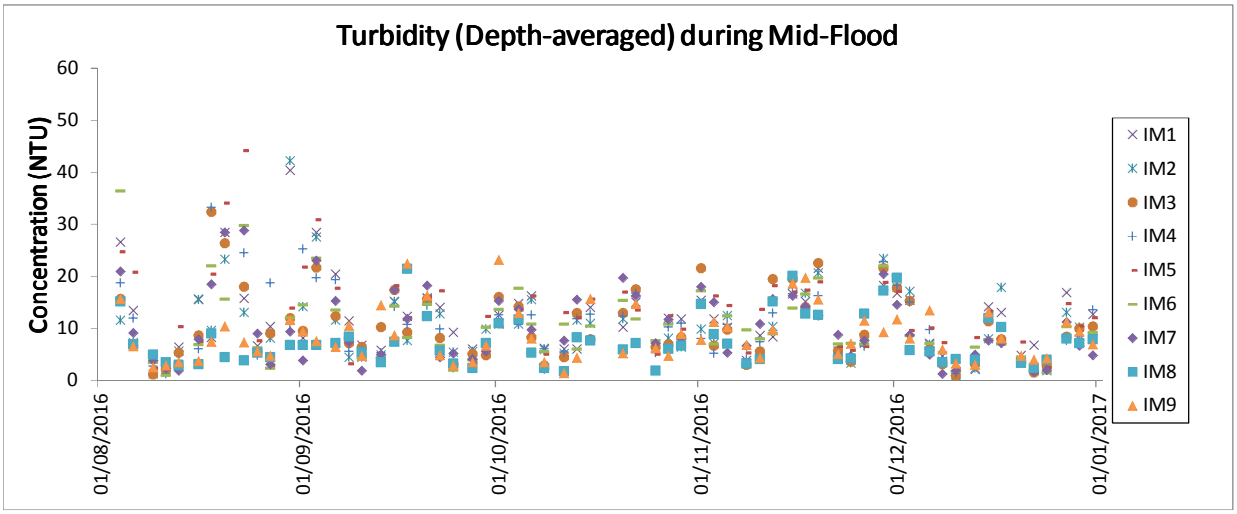


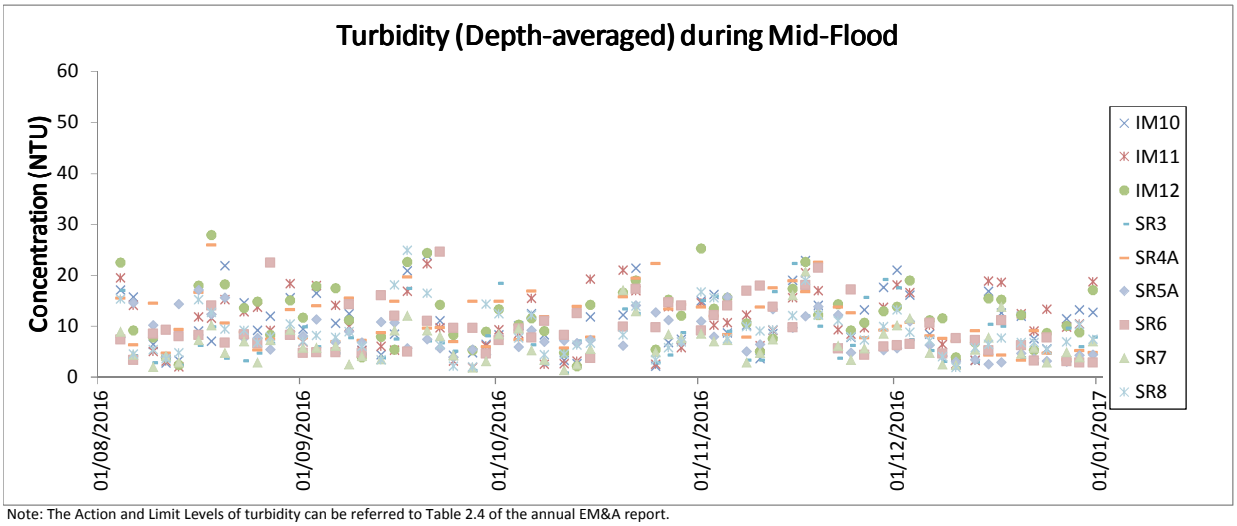




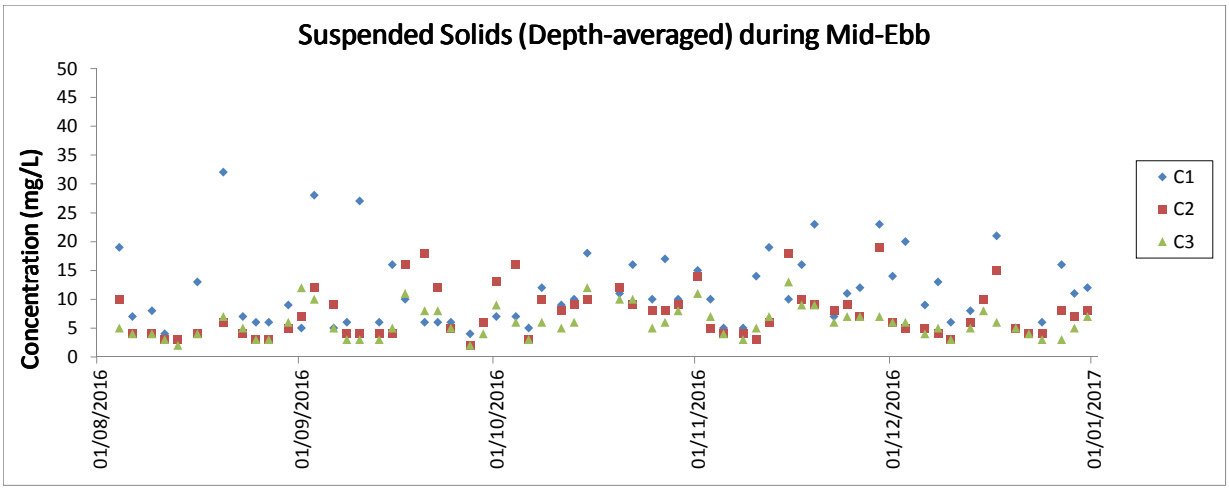
Note: The Action and Limit Levels of turbidity can be referred to Table 2.4 of the annual EM&A report.

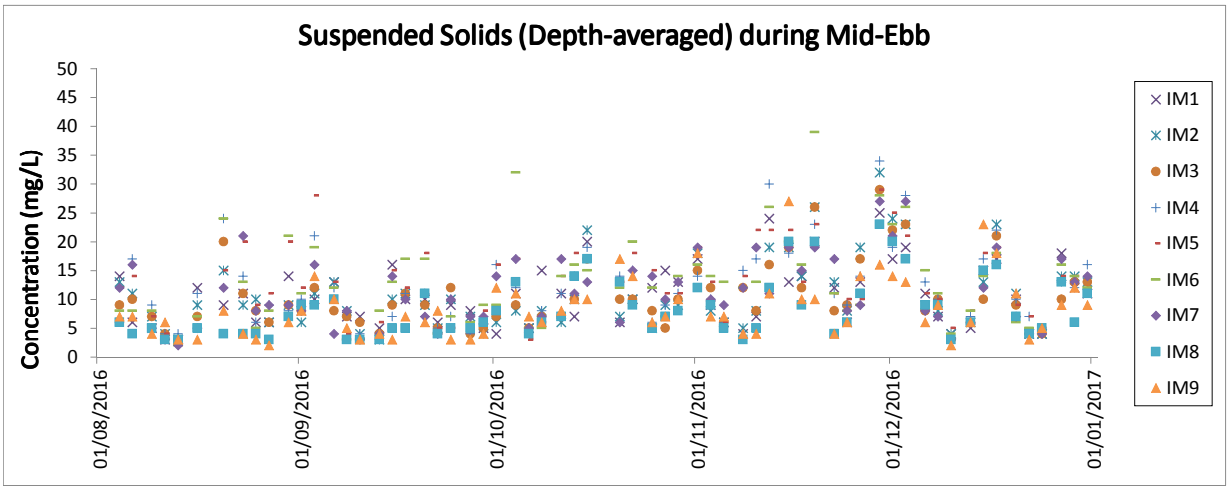


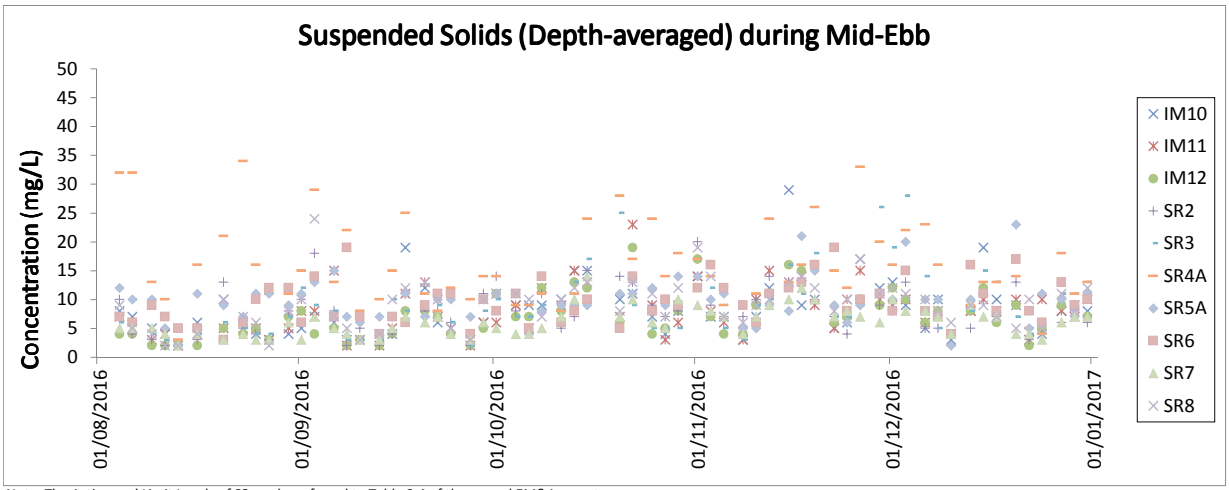




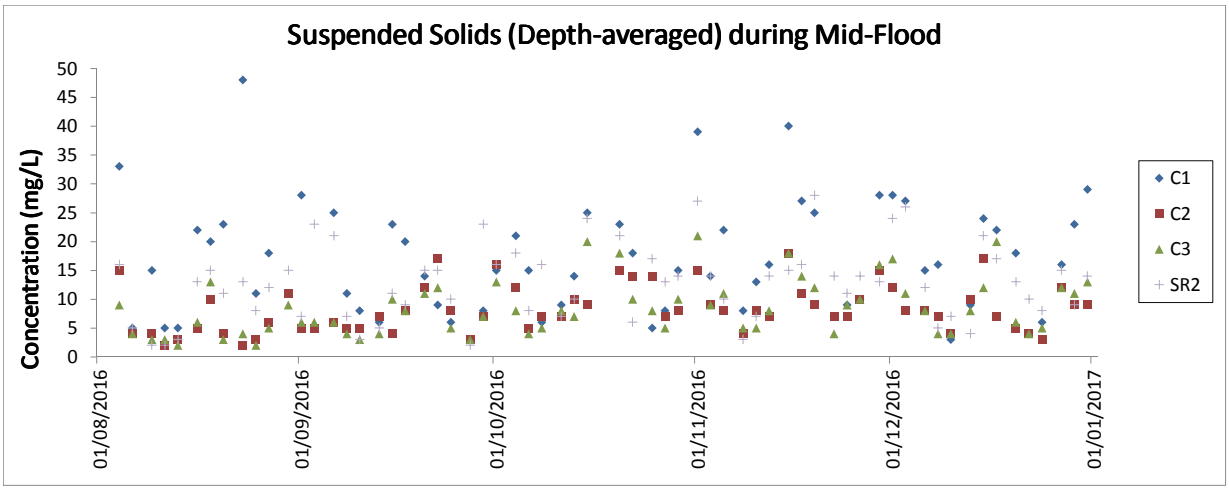
Note: The Action and Limit Levels of turbidity can be referred to Table 2.4 of the annual EM&A report.

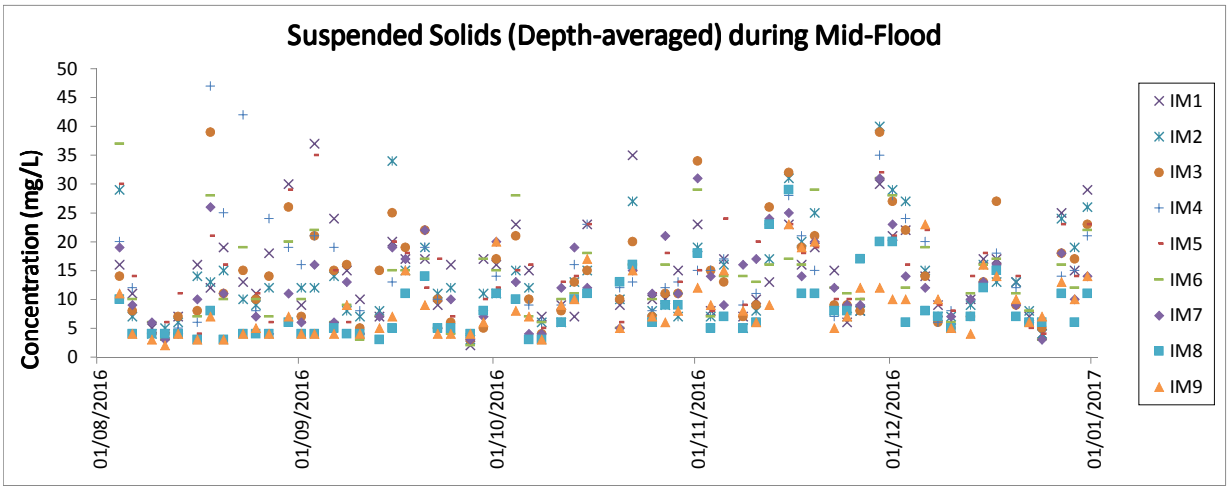


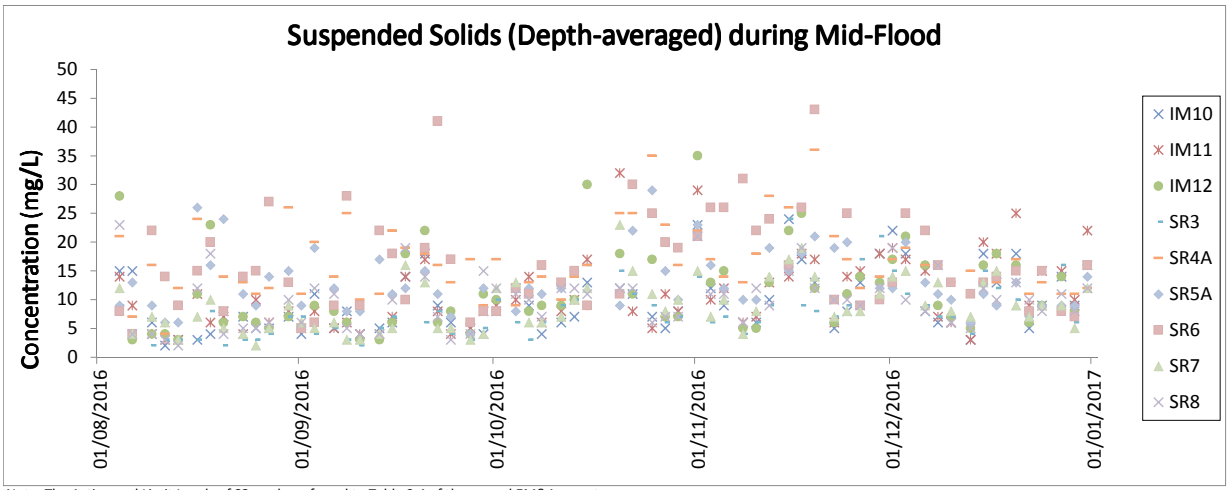




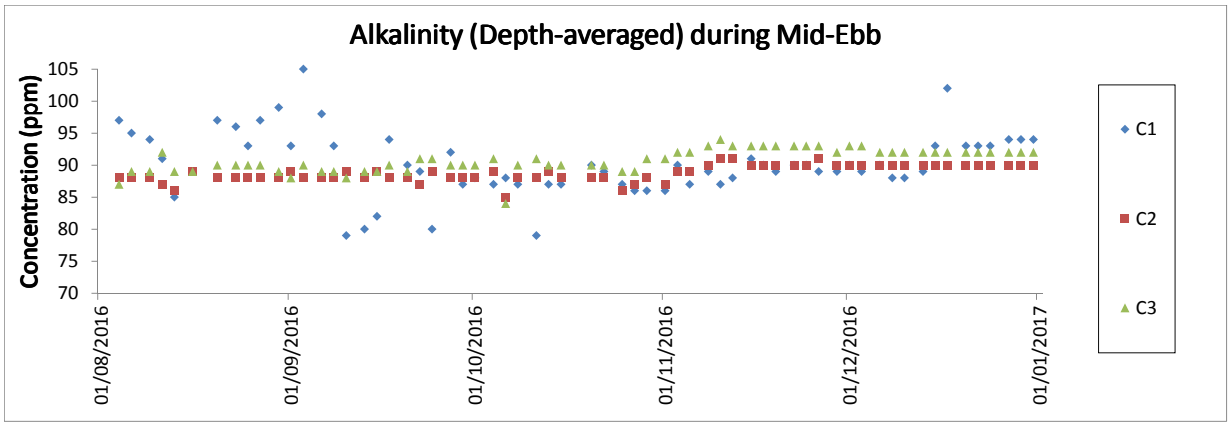
Note: The Action and Limit Levels of SS can be referred to Table 2.4 of the annual EM&A report.

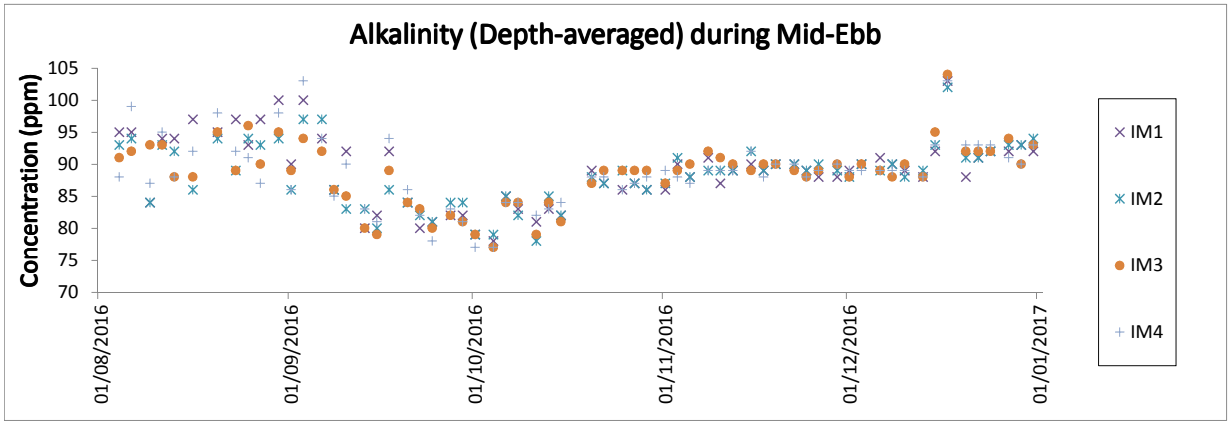


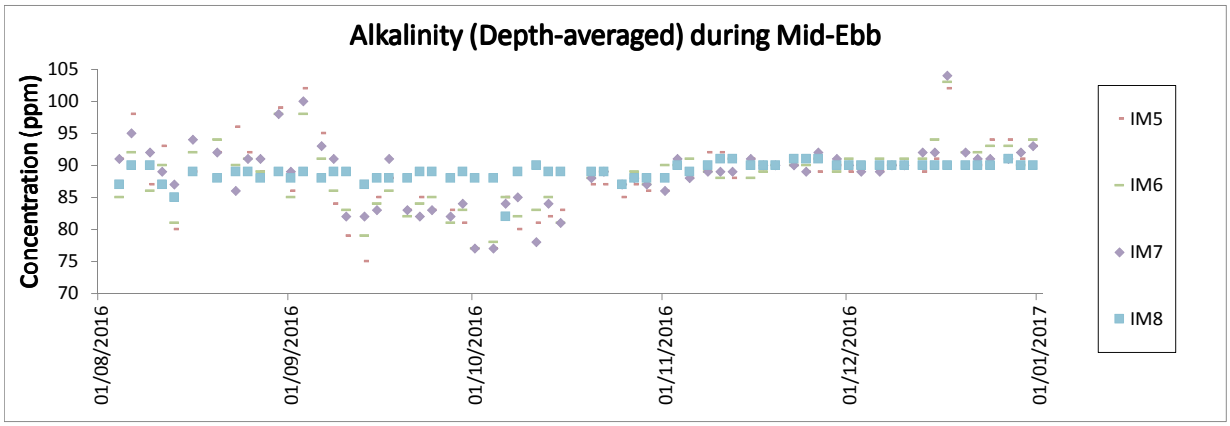


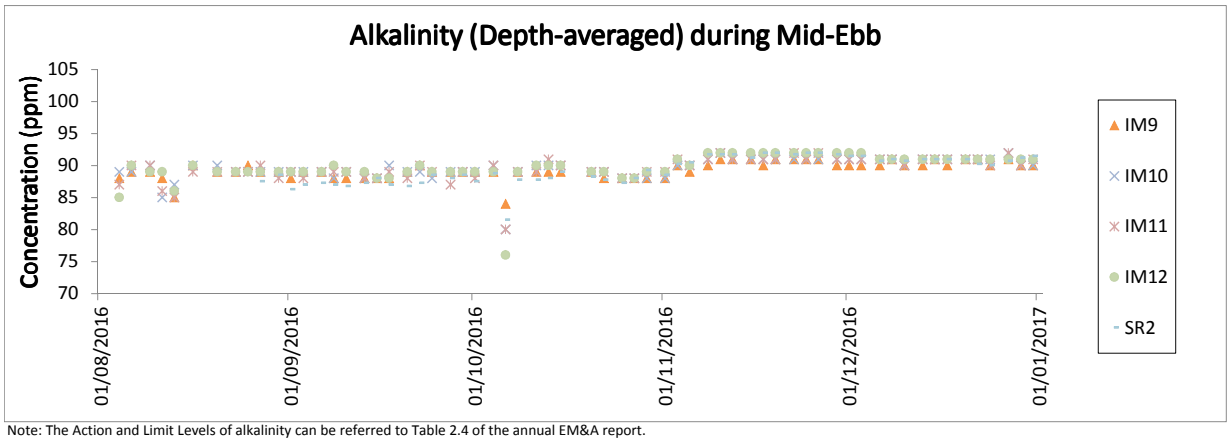


Note: The Action and Limit Levels of SS can be referred to Table 2.4 of the annual EM&A report.

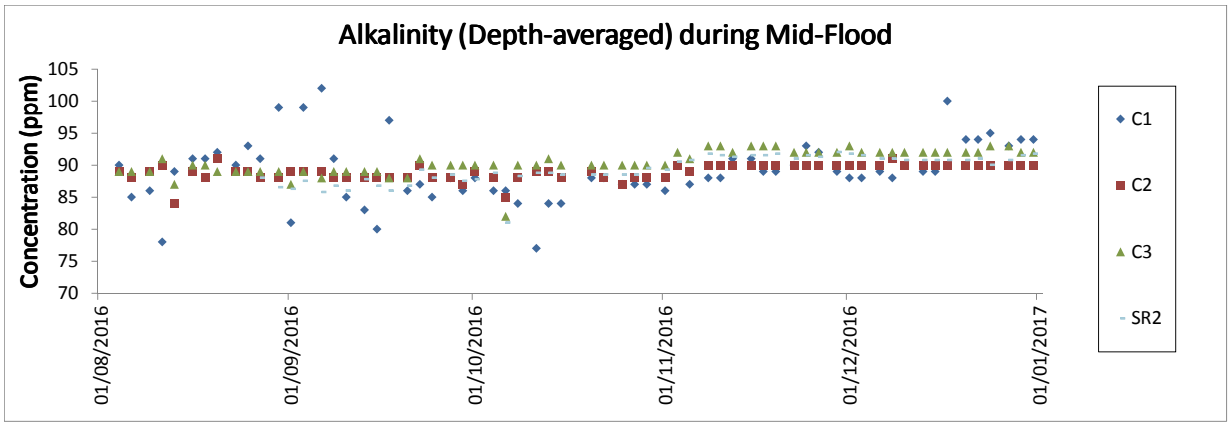


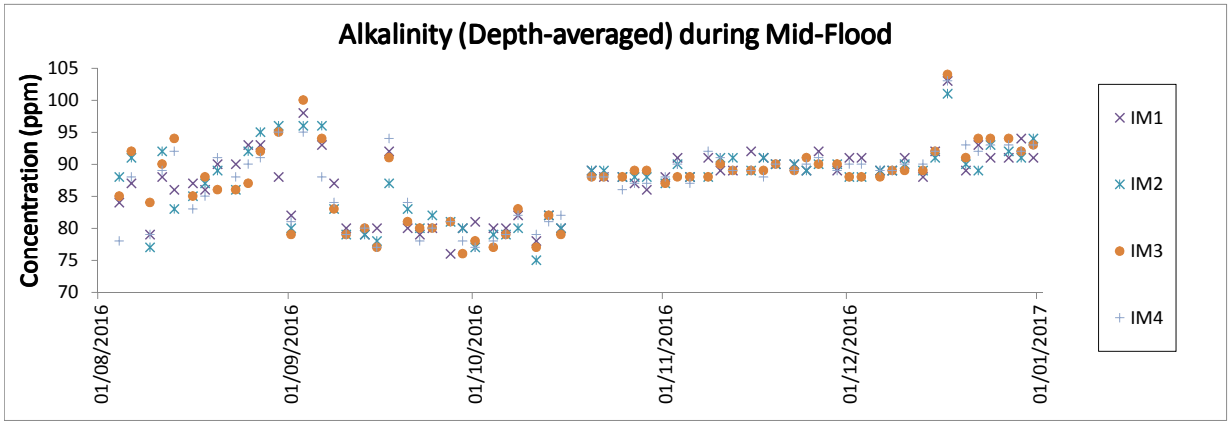


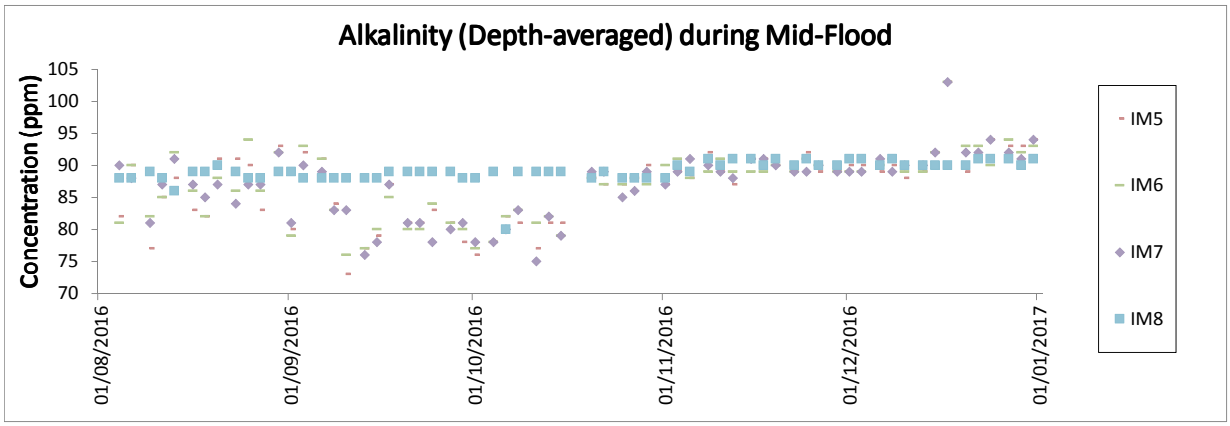


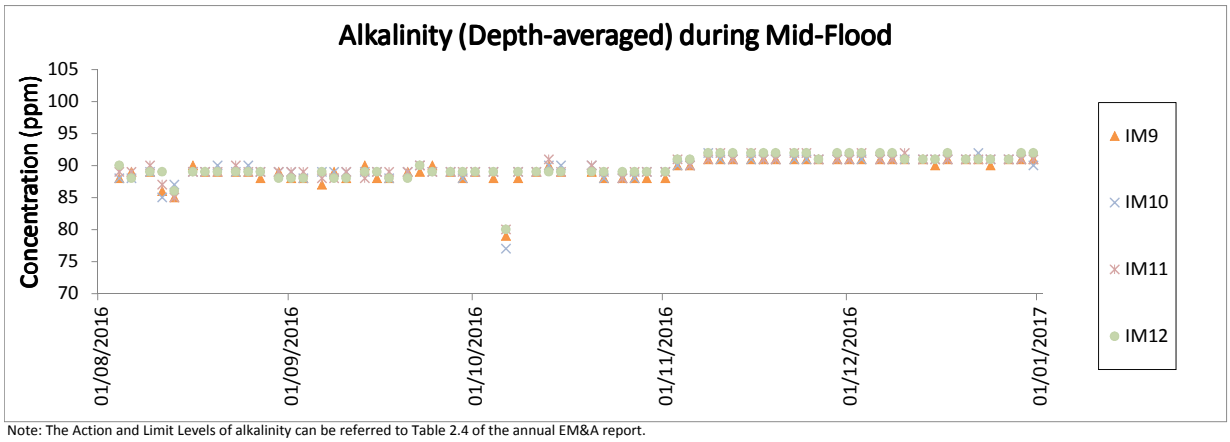


Note: The Action and Limit Levels of alkalinity can be referred to Table 2.4 of the annual EM&A report.

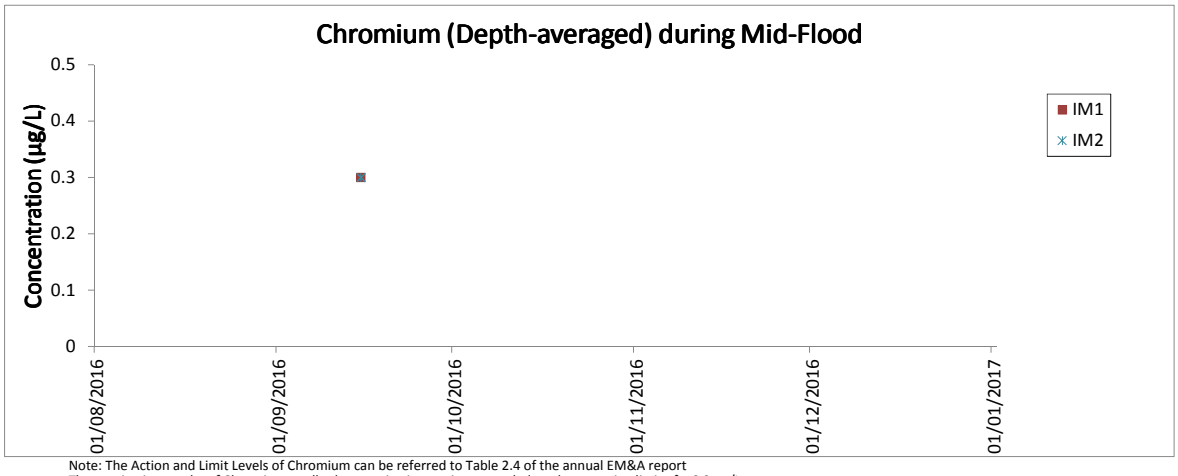




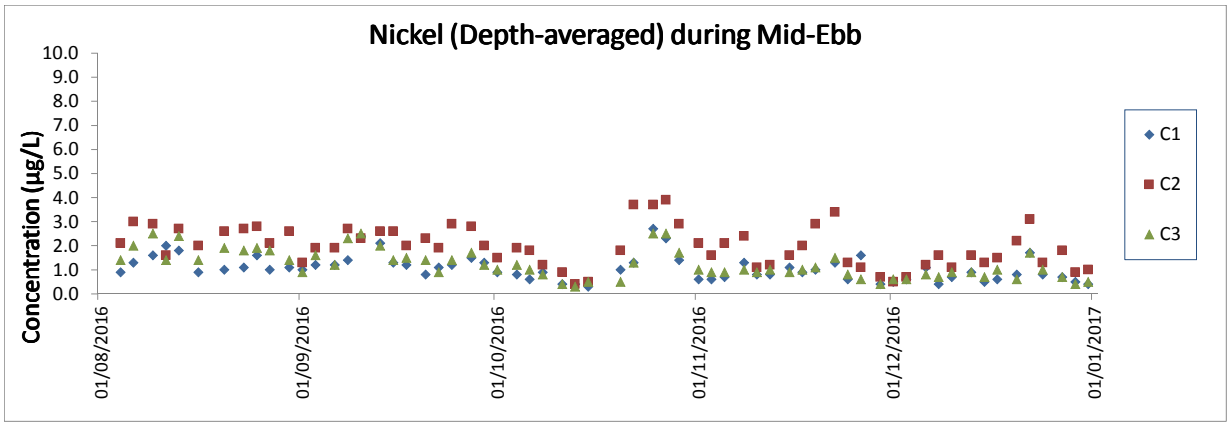


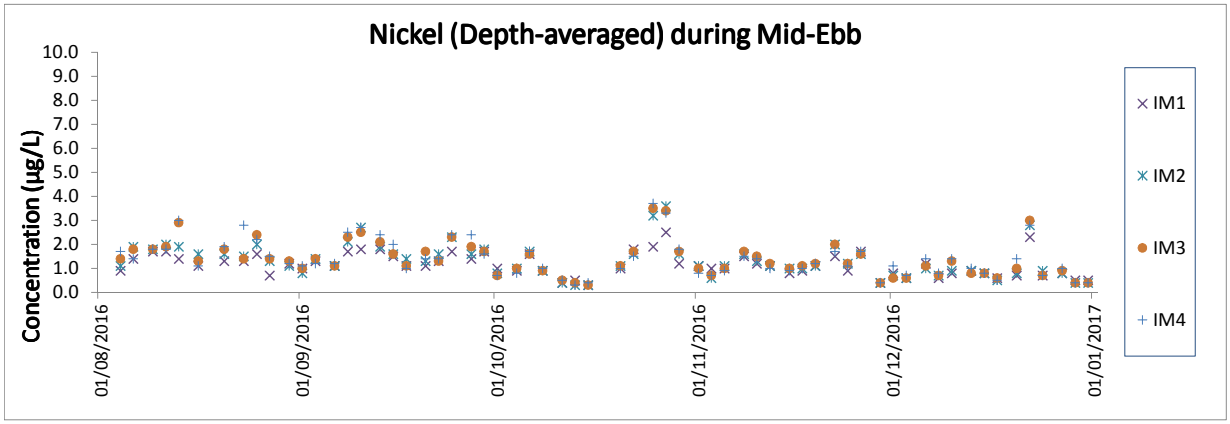


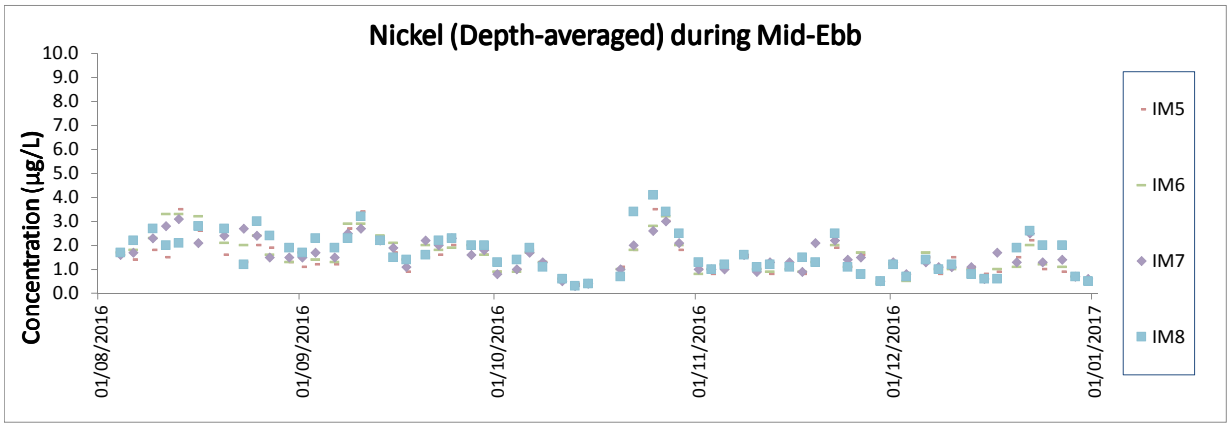
Note: The Action and Limit Levels of alkalinity can be referred to Table 2.4 of the annual EM&A report.

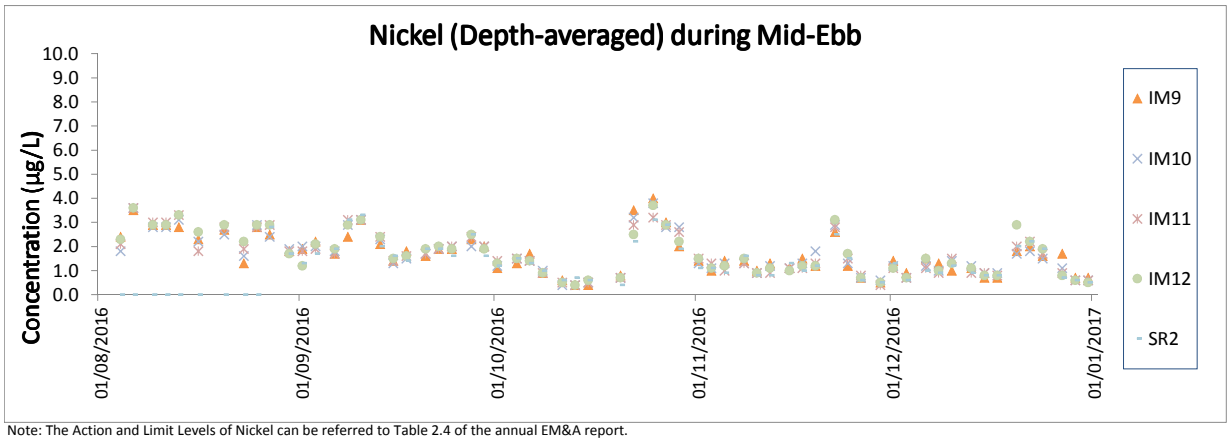


Note: The Action and Limit Levels of Chromium can be referred to Table 2.4 of the annual EM&A report
The monitoring results of Chromium at all other monitoring stations were below the reporting limit of < 0.2 µg/L

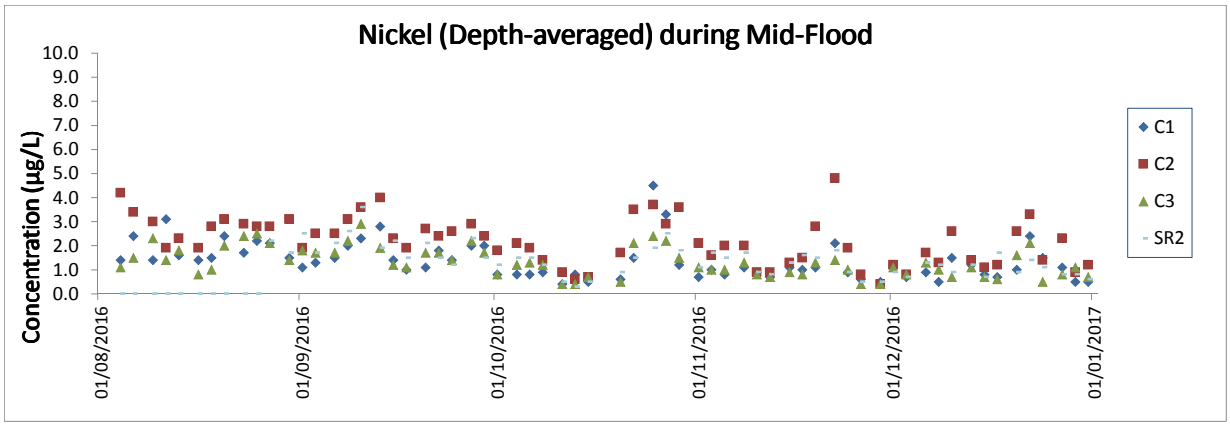


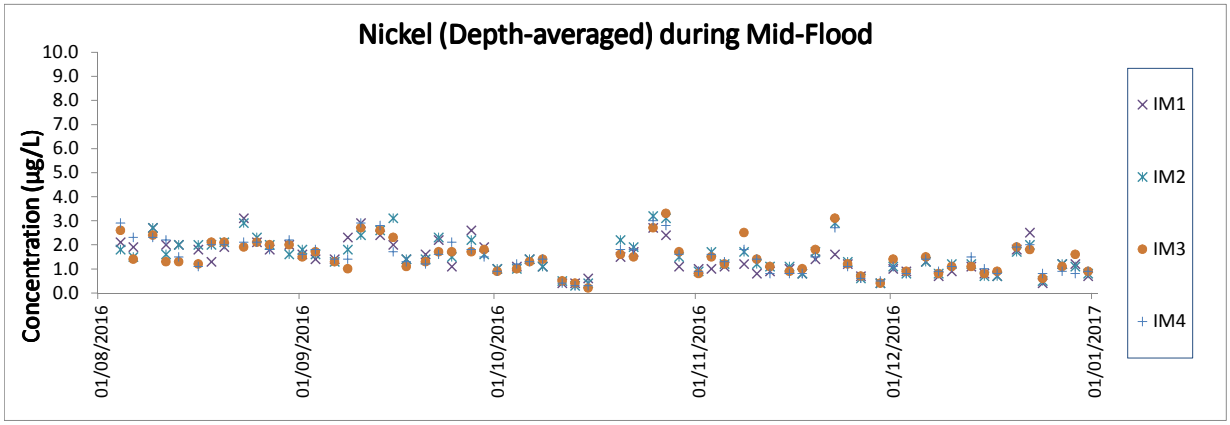


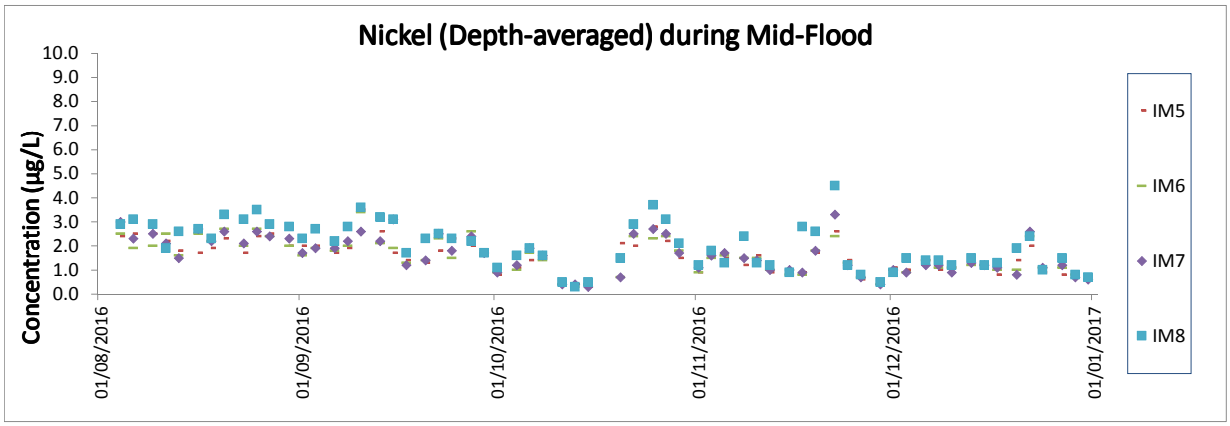


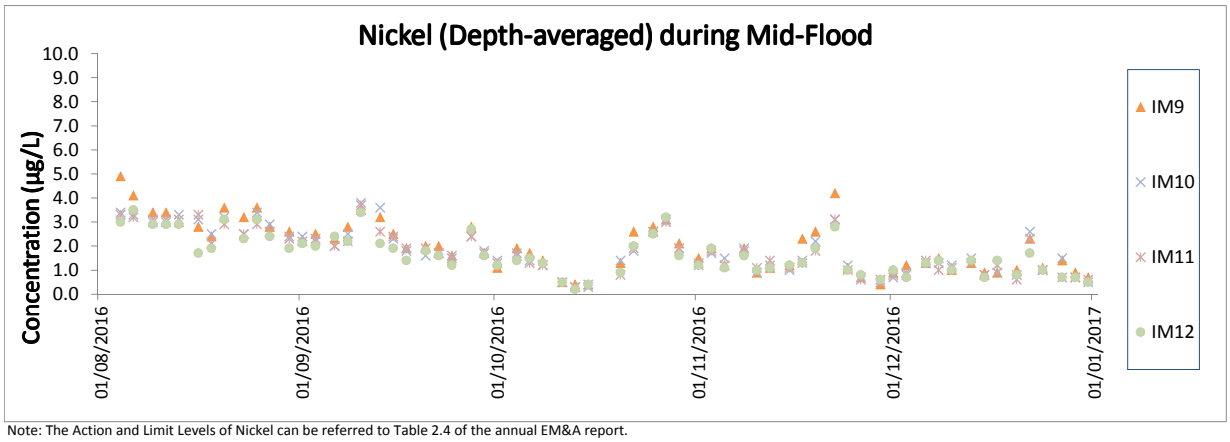


Note: The Action and Limit Levels of Nickel can be referred to Table 2.4 of the annual EM&A report.









Note: The Action and Limit Levels of Nickel can be referred to Table 2.4 of the annual EM&A report.

Appendix E. Chinese White Dolphin Monitoring Findings and Analysis

Figure 1: Sightings Distribution of Chinese White Dolphins

[Pink circle: Sighting locations of CWD, White line: Vessel survey transects, Blue polygon: Sha Chau and Lung Kwu Chau Marine Park (SCLKCMP), Green polygon: Brothers Marine Park (BMP), Red polygon: 3RS land-formation footprint]

Figure 2: Graphical Presentation of Monthly and Running Quarterly STG

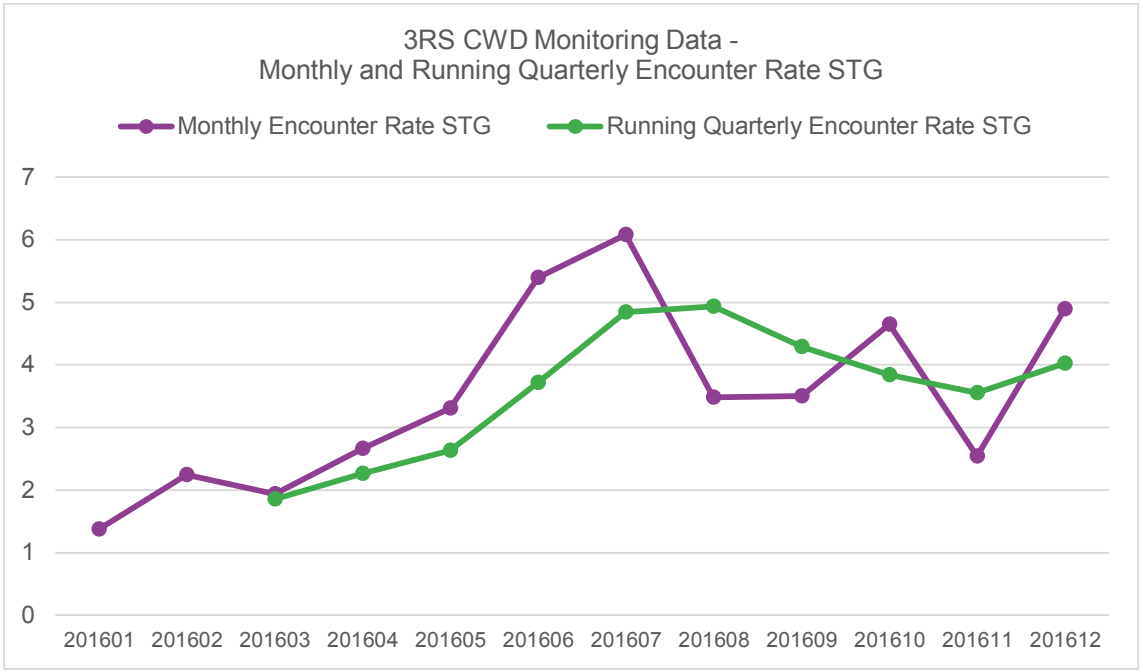


Figure 3: Graphical Presentation of Monthly and Running Quarterly ANI

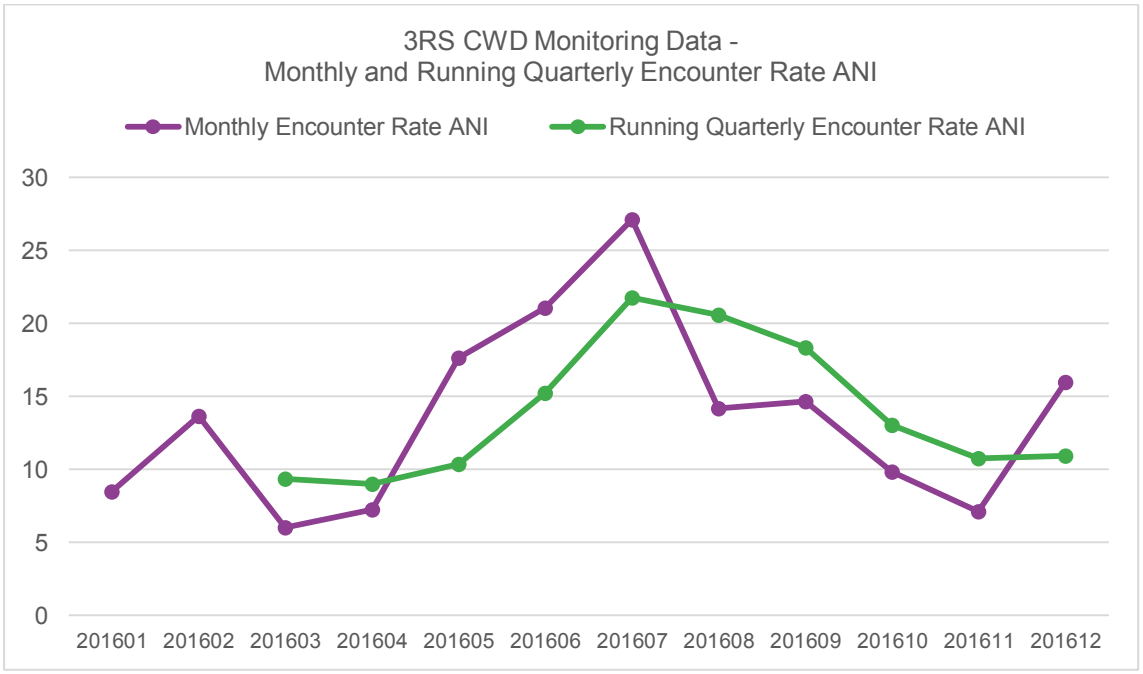


Figure 4: Quarterly Encounter Rates and Running Average Encounter Rates of AFCD's Monitoring Data

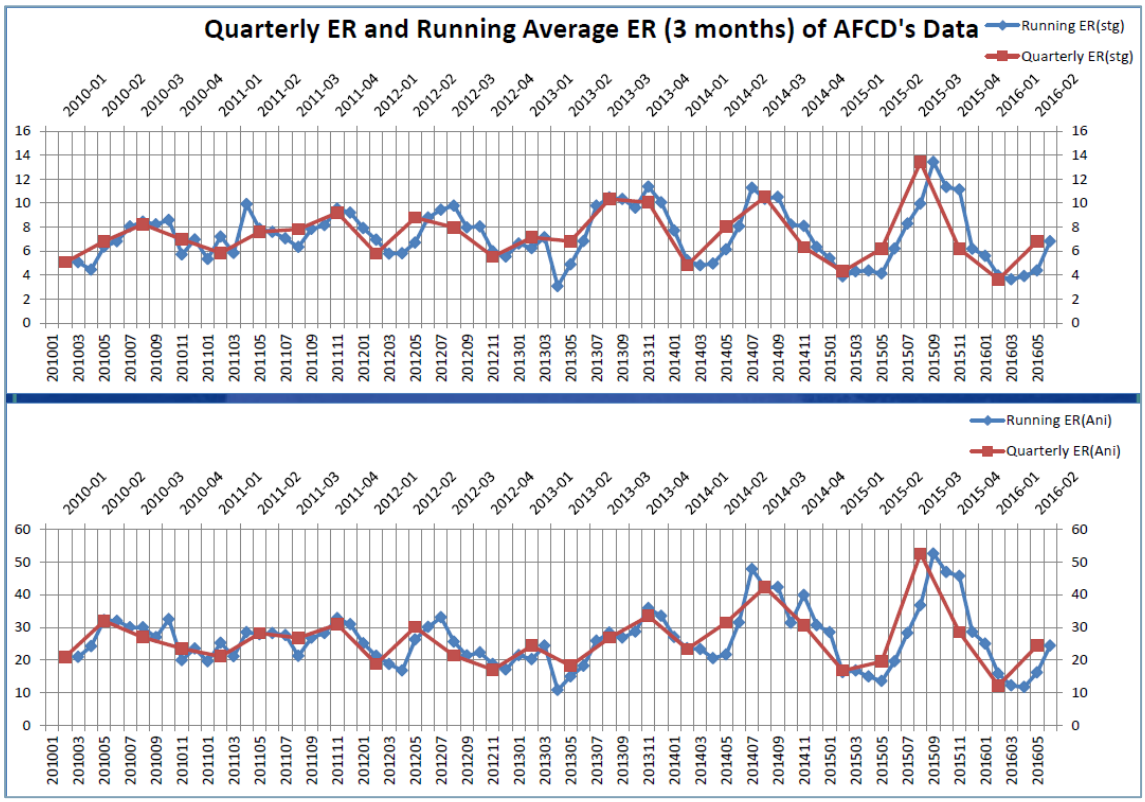


Figure 5: SPSE and DPSE of CWDs with Corrected Survey Effort per km2 from Dec 2015 to Dec 2016

[Left: SPSE = no. of on-effort dolphin sightings per 100 units of survey effort, Right: DPSE = no. of dolphins per 100 units of survey effort, Pink polygon: BMP, Blue polygon: SCLKCMP, Purple polygon: 3RS land-formation footprint, Green dotted line: 3RS temporary works area boundary]

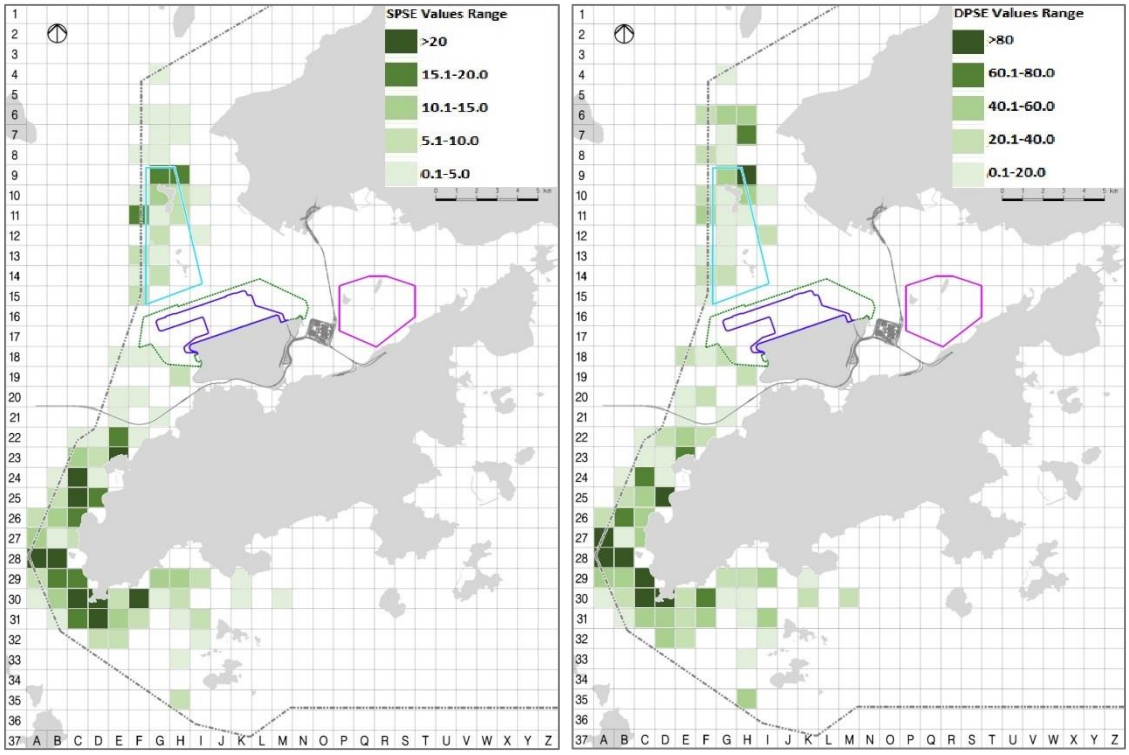


Figure 6: Sightings Distribution of Chinese White Dolphins with Different Group Sizes

[Pink circle: CWD groups with small group size (1-2 individuals), Green circle: CWD groups with medium group size (3-9 individuals), Red circle: CWD groups with large group size (10 or more individuals), White line: Vessel survey transects, Blue polygon: Sha Chau and Lung Kwu Chau Marine Park (SCLKCMP), Green polygon: Brothers Marine Park (BMP), Red polygon: 3RS land-formation footprint]

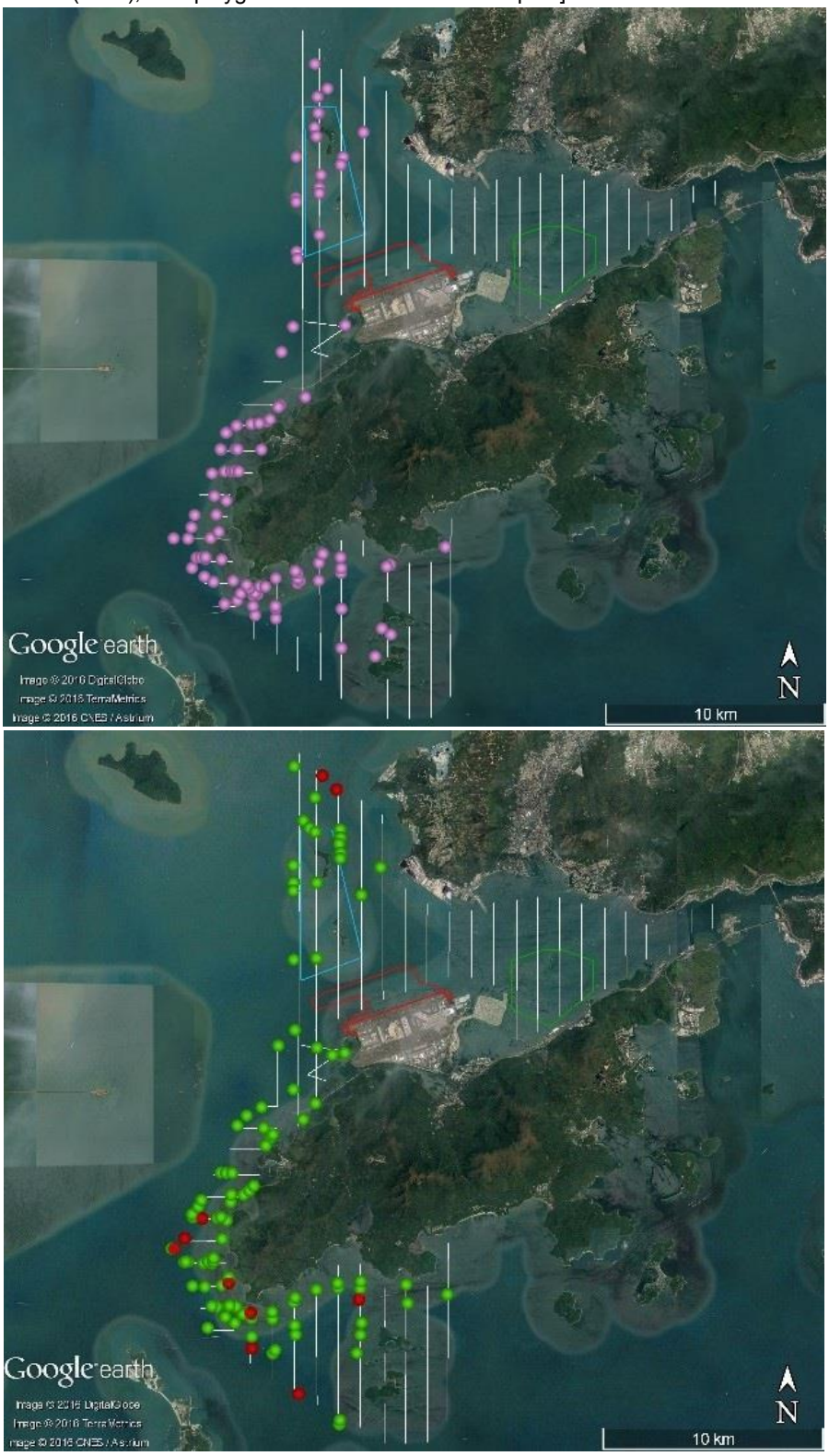


Figure 7: Sighting Locations of CWD Groups Engaged in Different Activities

[Indigo rhombus: Foraging, Green circle: Socializing, Pink square: Resting/milling, Yellow triangle: Travelling, White line: Vessel survey transects, Blue polygon: SCLKCMP, Brothers Marine Park (BMP), Red polygon: 3RS land-formation footprint]

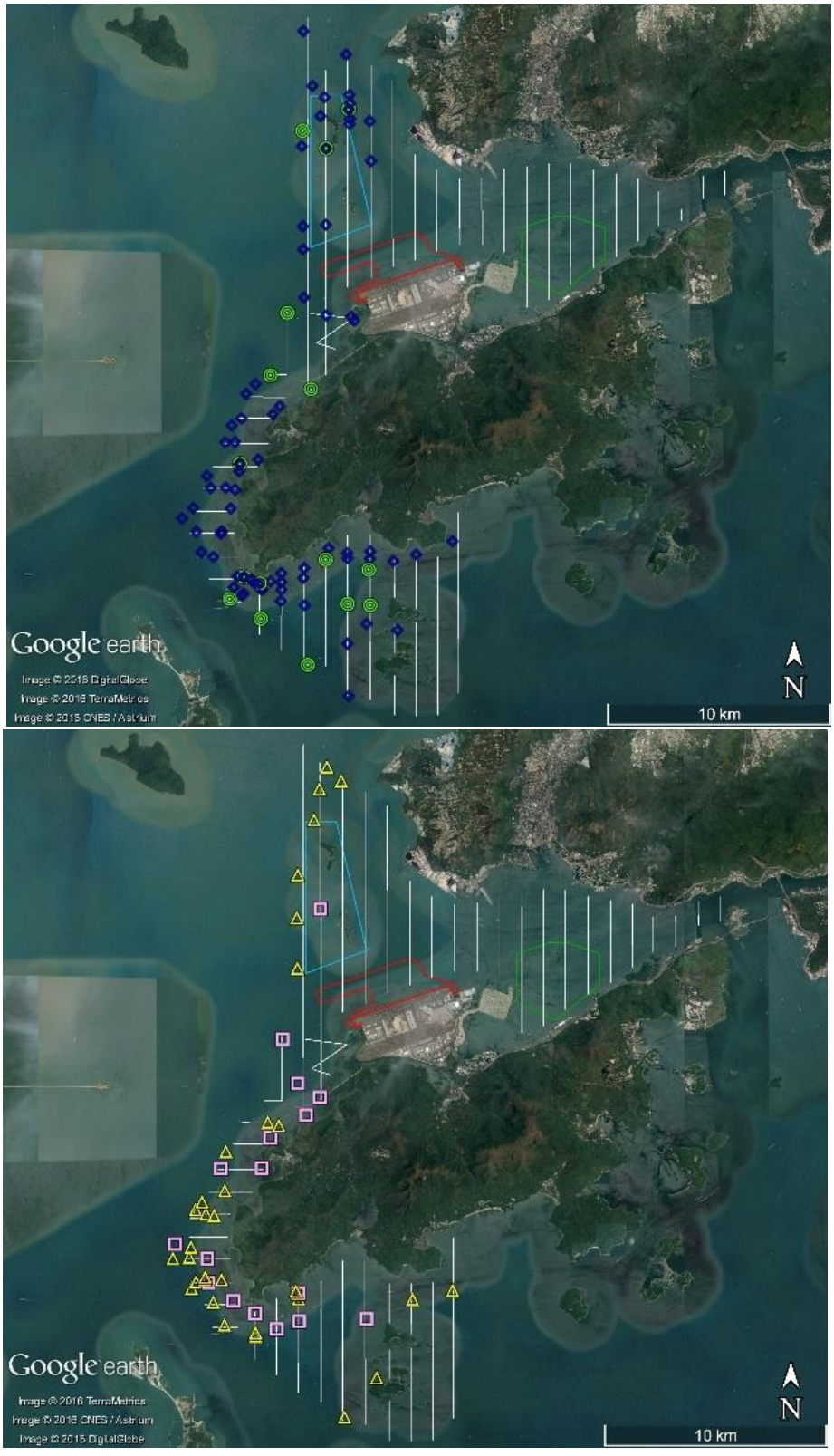


Figure 8: Sighting Locations of CWD Groups in Association with Fishing Boat

[Red hexagon: Gillnetter, Orange hexagon: Purse Seiner, Yellow hexagon: Trawler, White line: Vessel survey transects, Blue polygon: SCLKCMP, Brothers Marine Park (BMP), Red polygon: 3RS land-formation footprint]

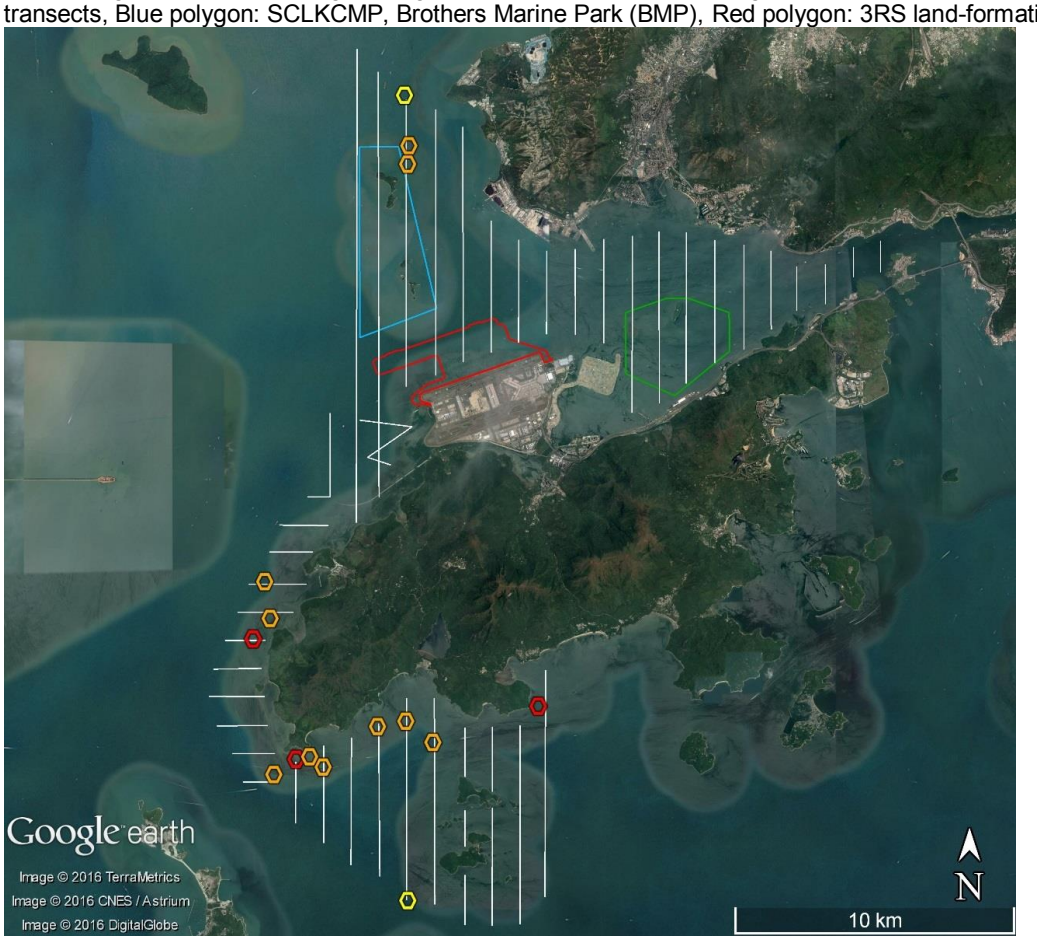


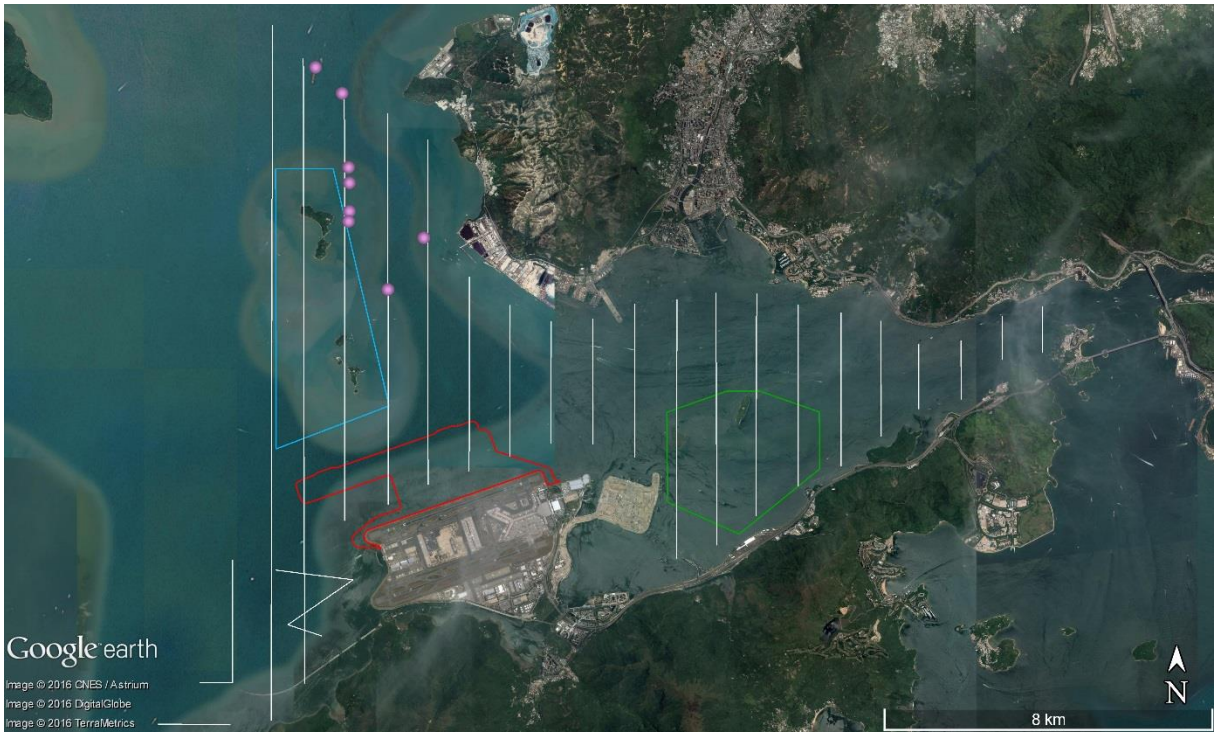
Figure 9: Sighting Locations of Mother-Calf Pairs

[Pink circle: Sighting locations of mother-calf pairs, White line: Vessel survey transects, Blue polygon: Sha Chau and Lung Kwu Chau Marine Park (SCLKCMP), Green polygon: Brothers Marine Park (BMP), Red polygon: 3RS land-formation footprint]

Figure 11 (batch): Photo Identification – Re-sighting Locations

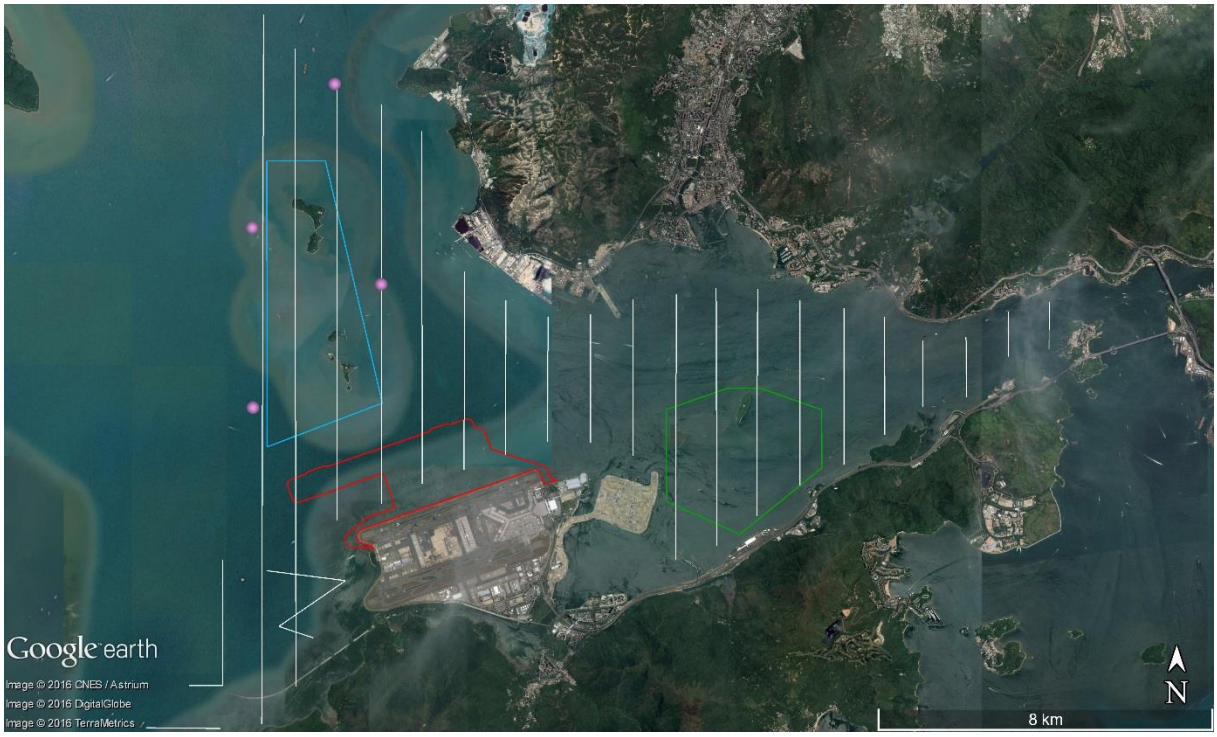
[Pink circle: Sighting locations of individual dolphin, White line: Vessel survey transects, Blue polygon: Sha Chau and Lung Kwu Chau Marine Park (SCLKCMP), Red polygon: 3RS land-formation footprint]

NLMM002



NLMM004

NLMM005



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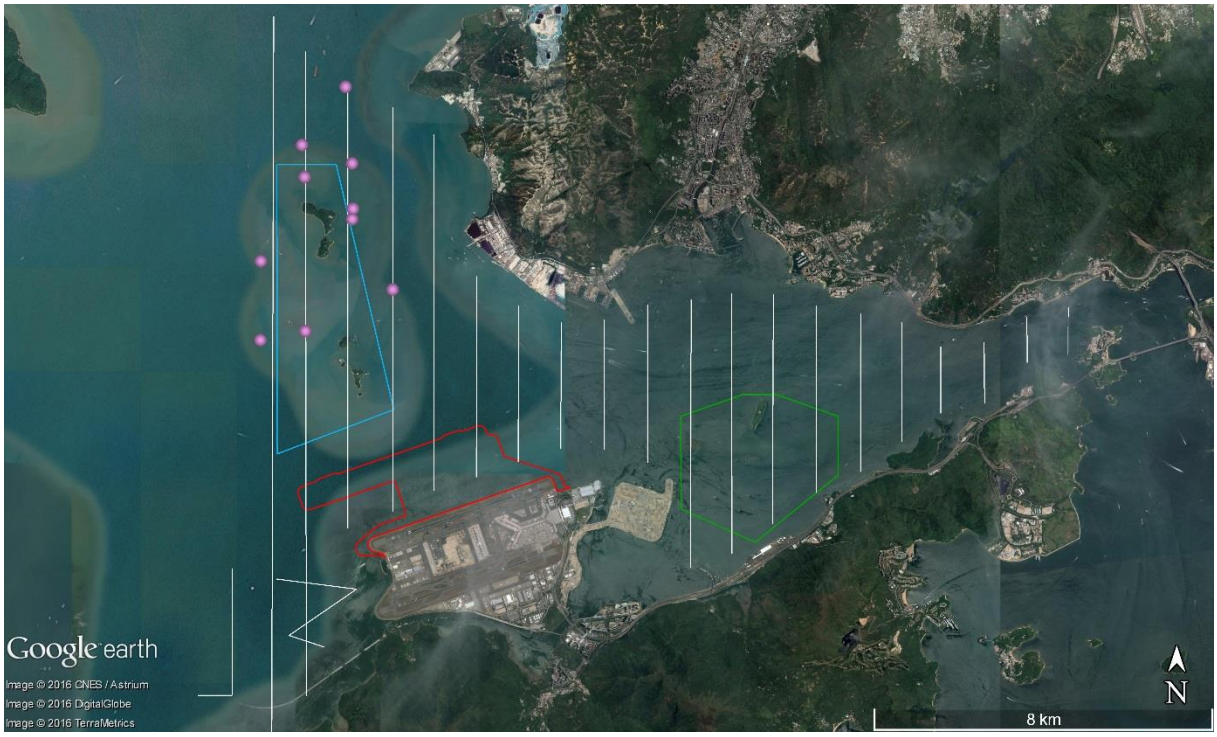

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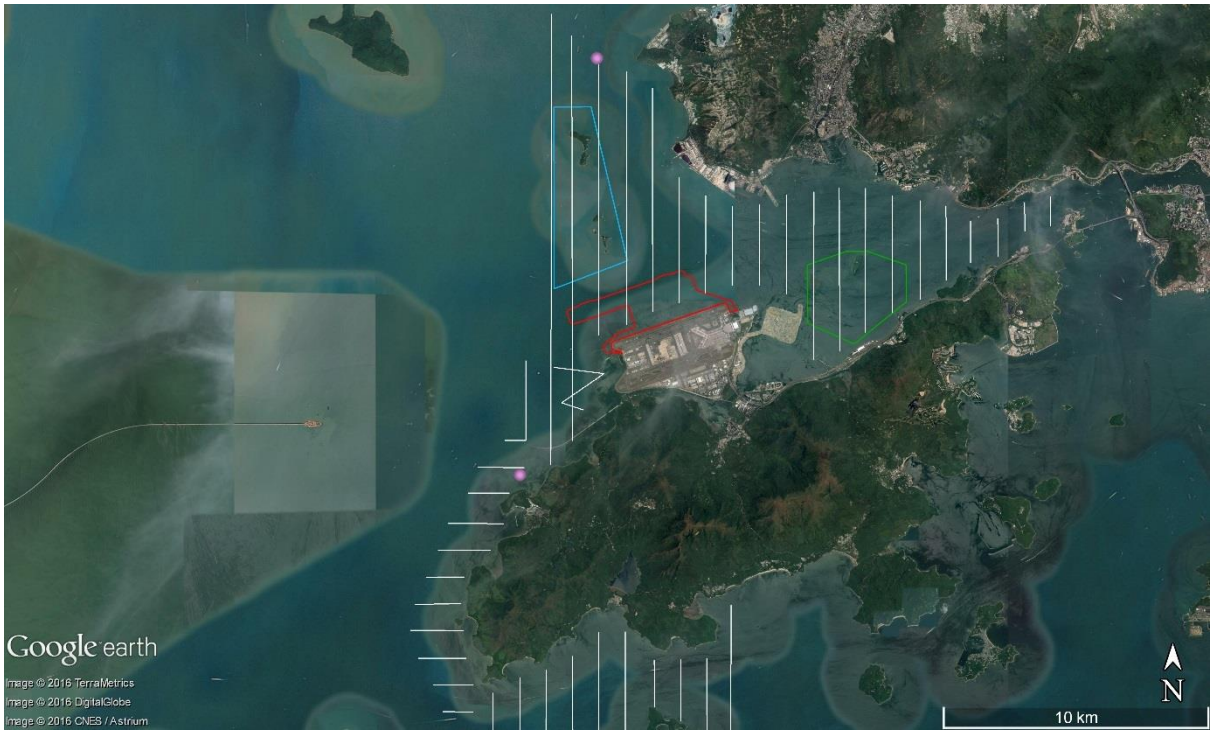
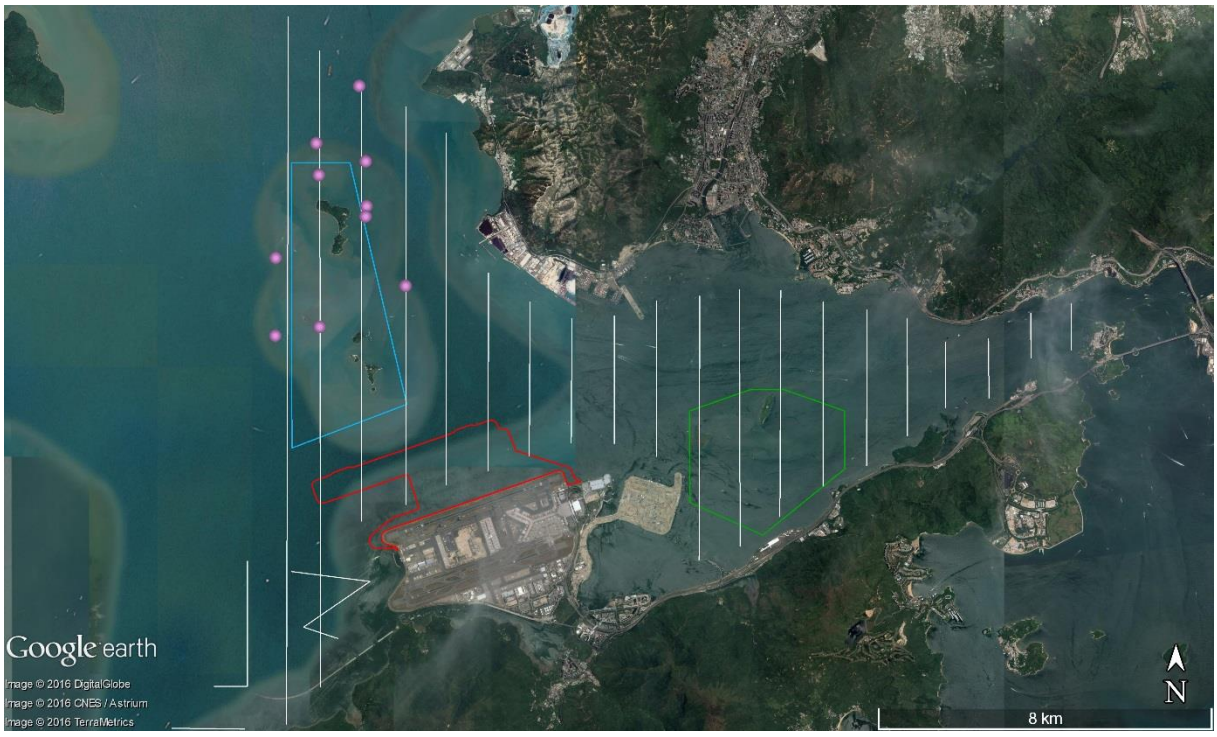


NLMM010

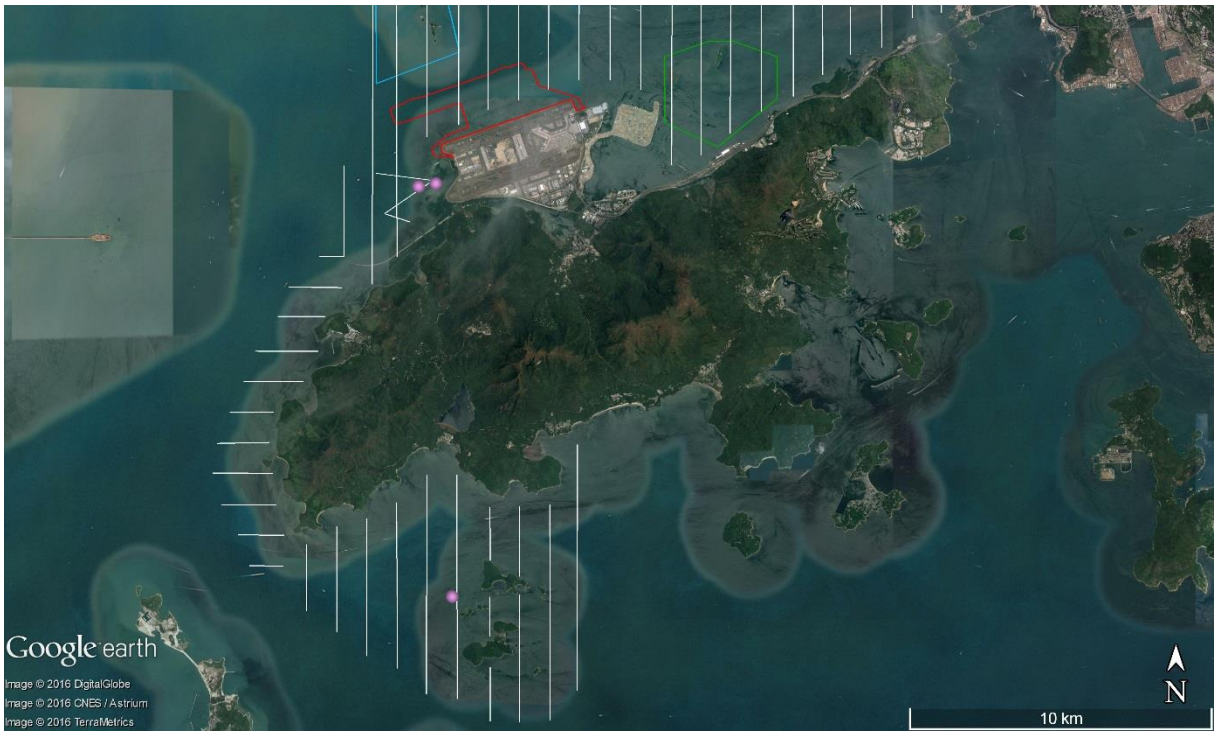
NLMM012

NLMM013



NLMM017

NLMM018



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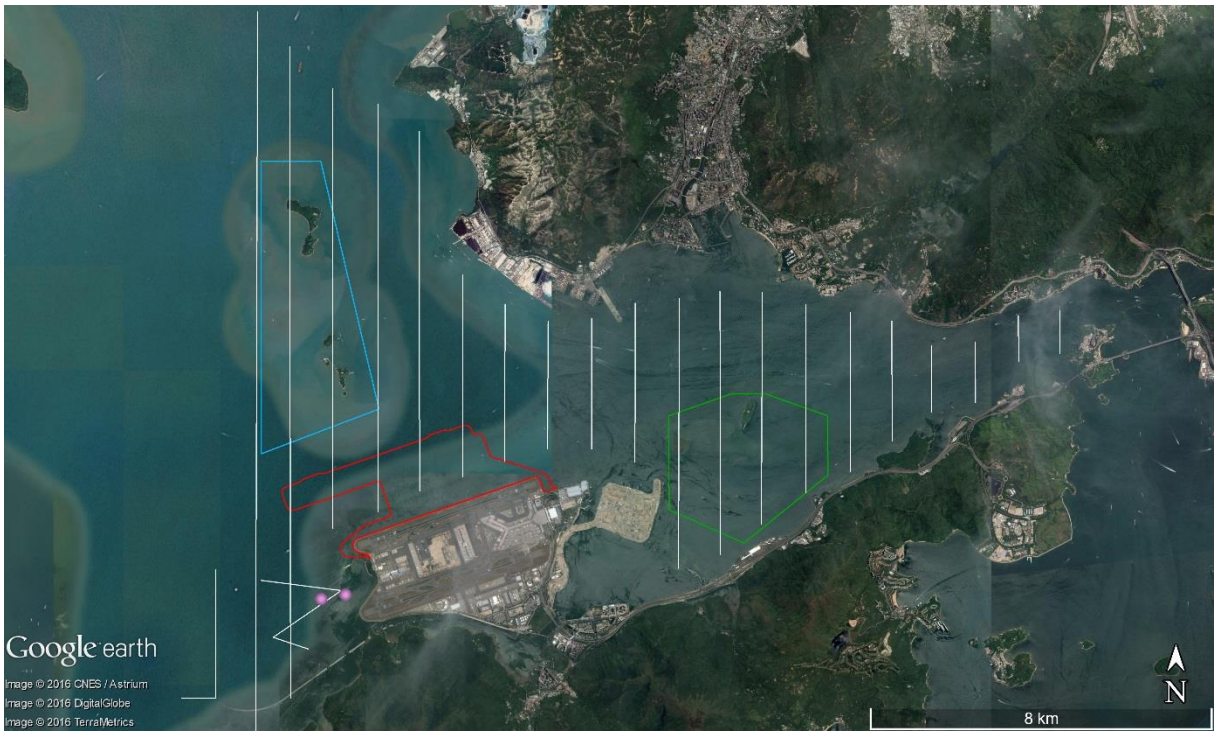
NLMM020



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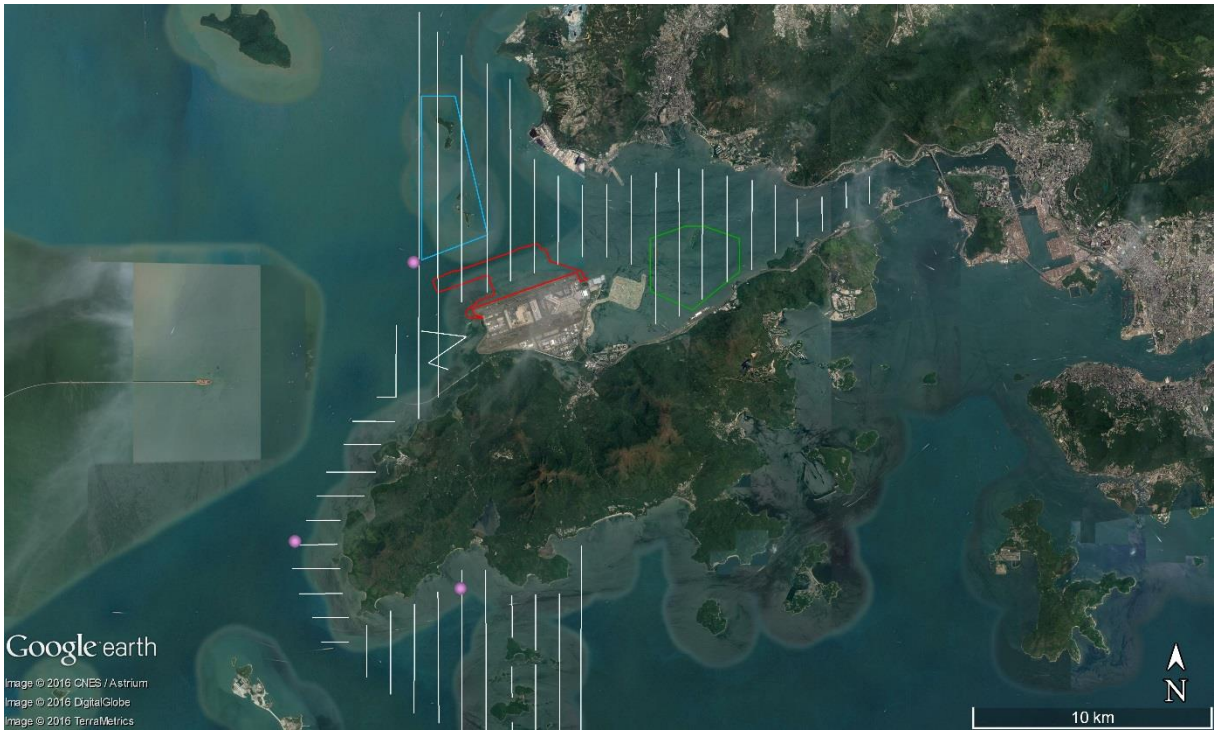
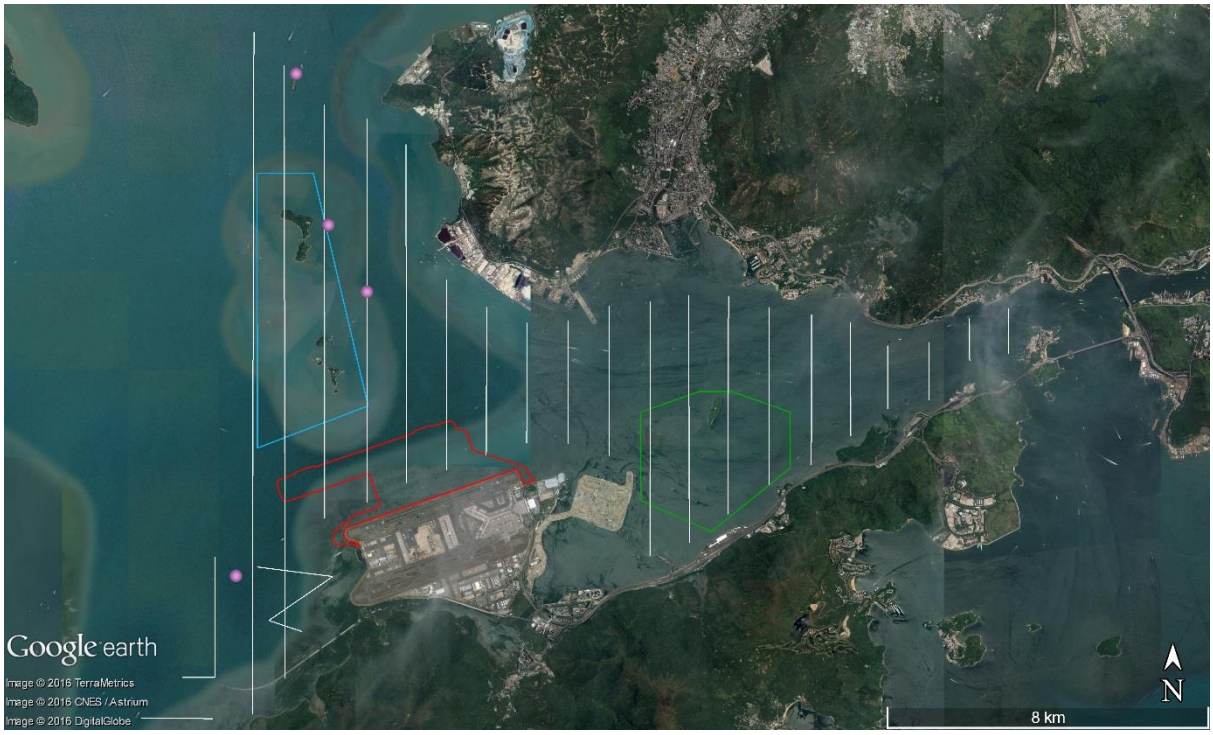


NLMM027

NLMM028



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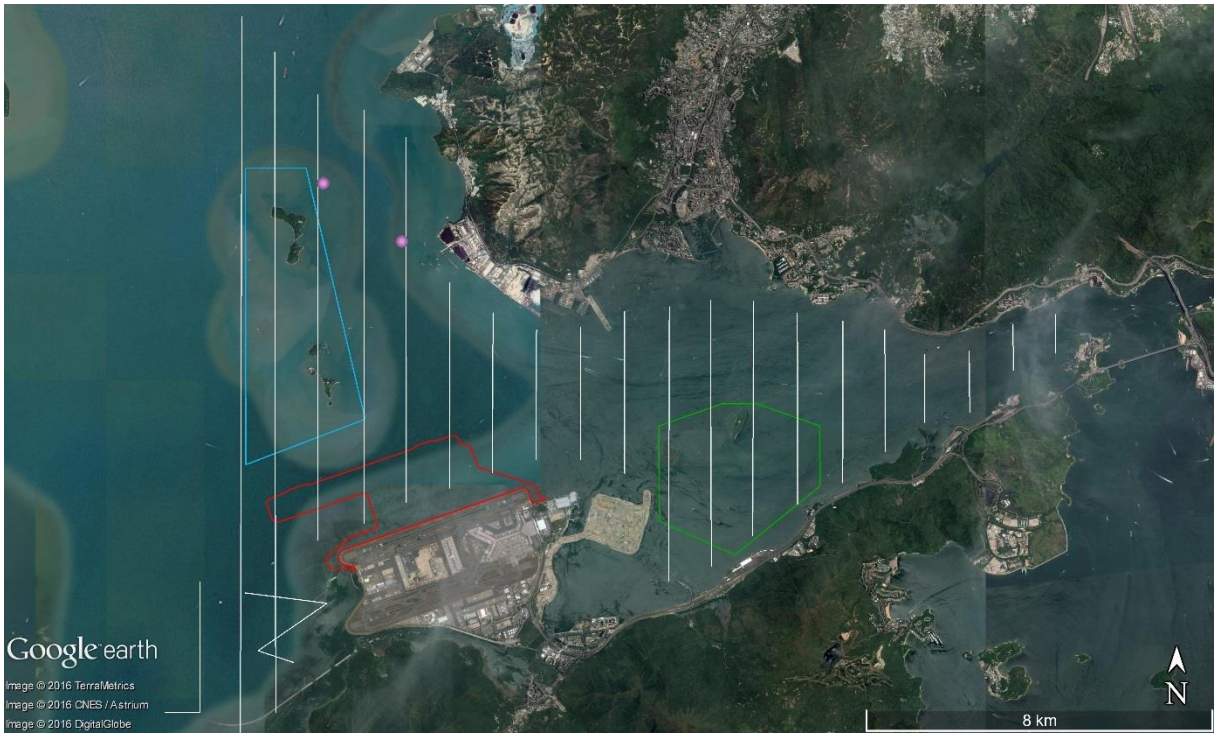

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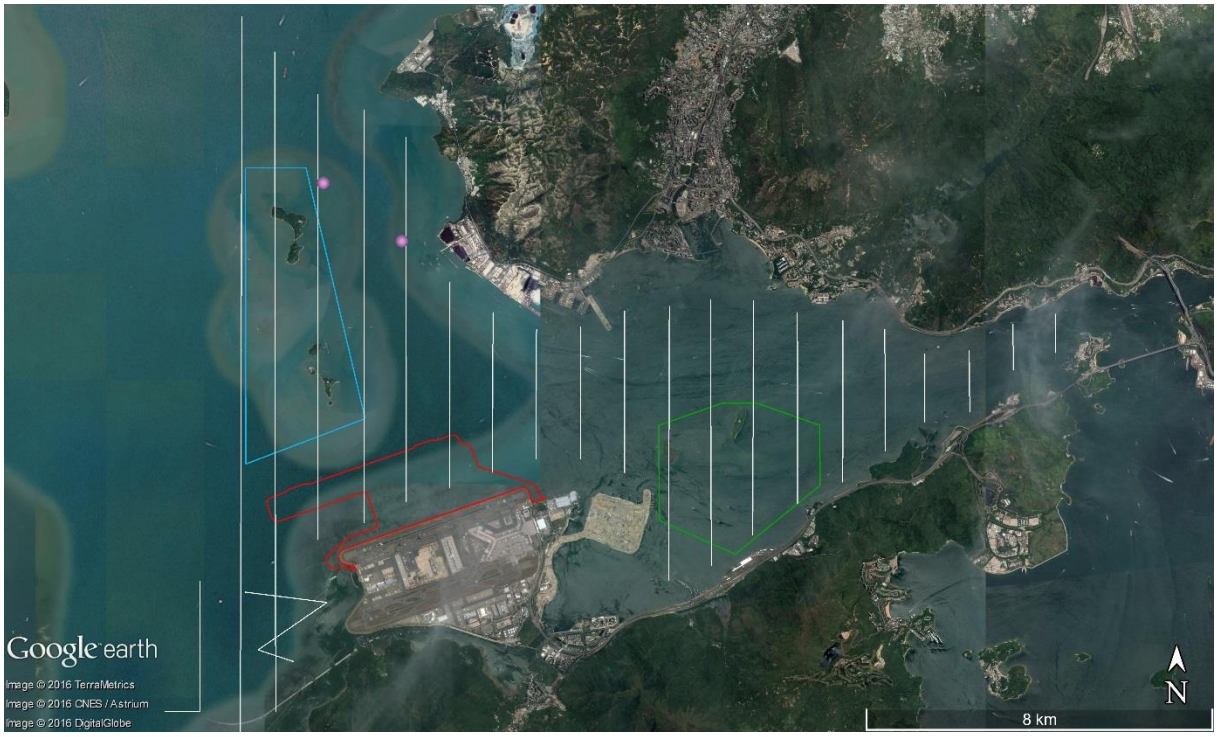

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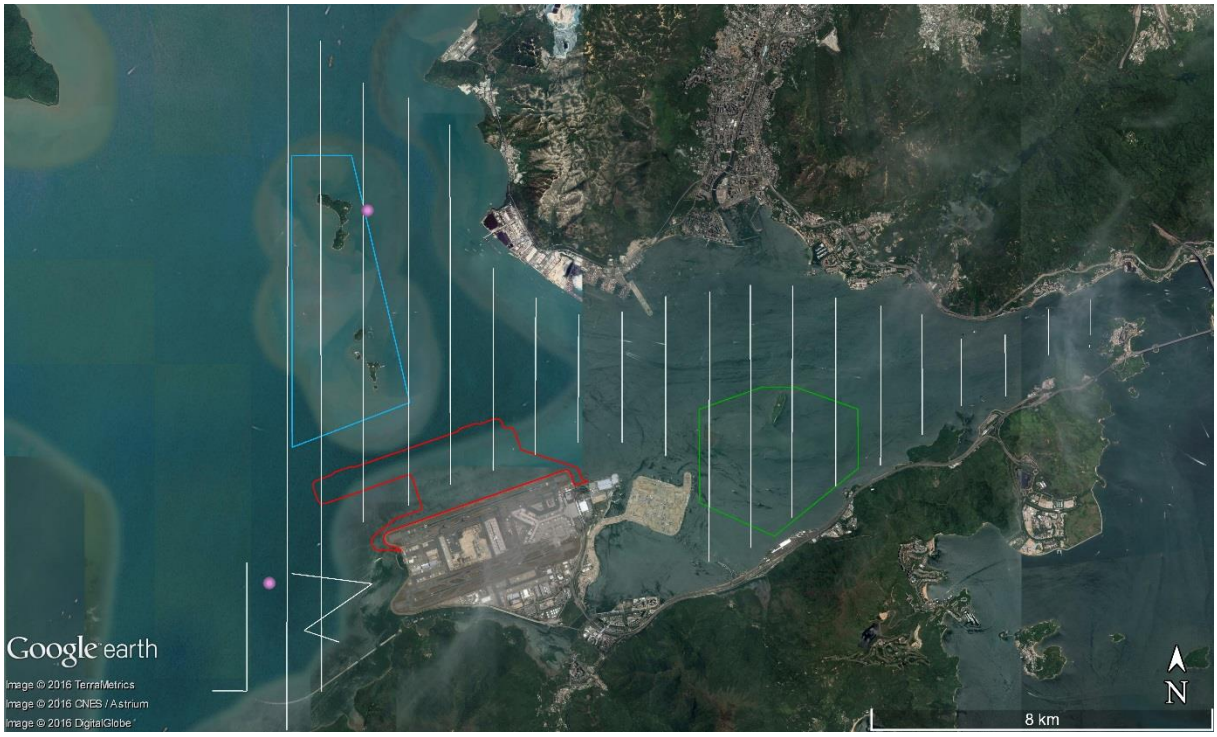

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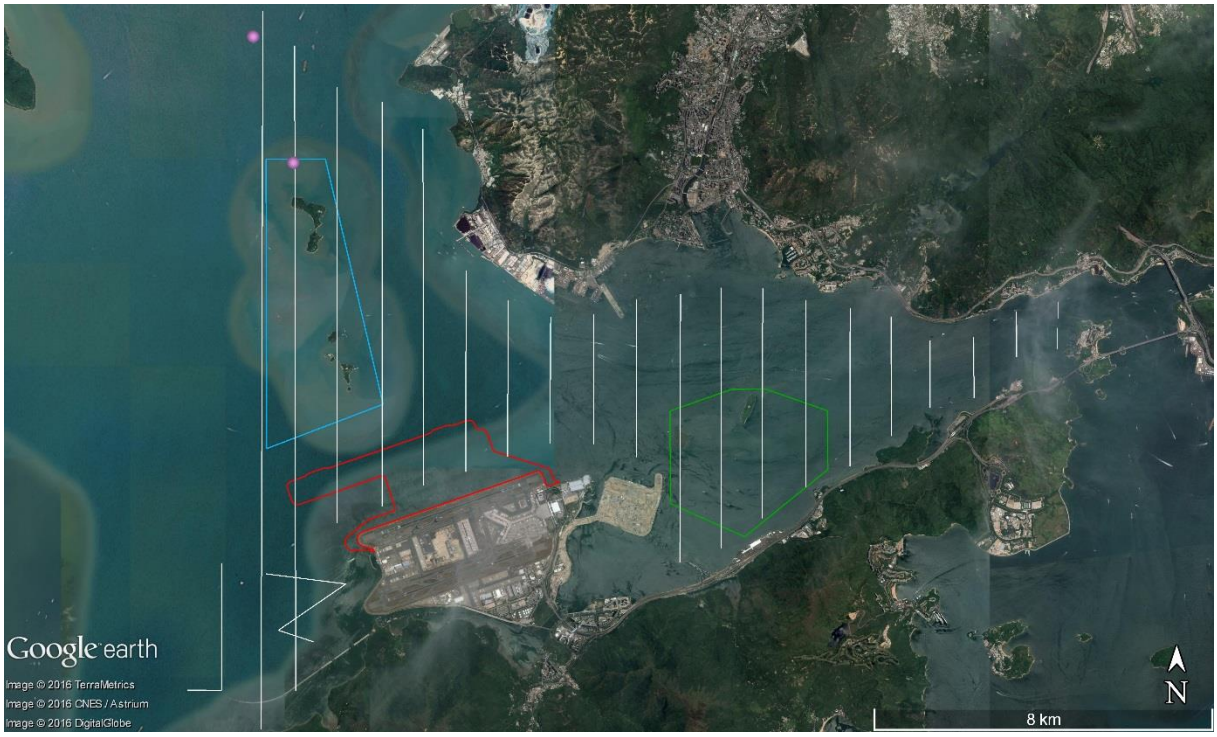
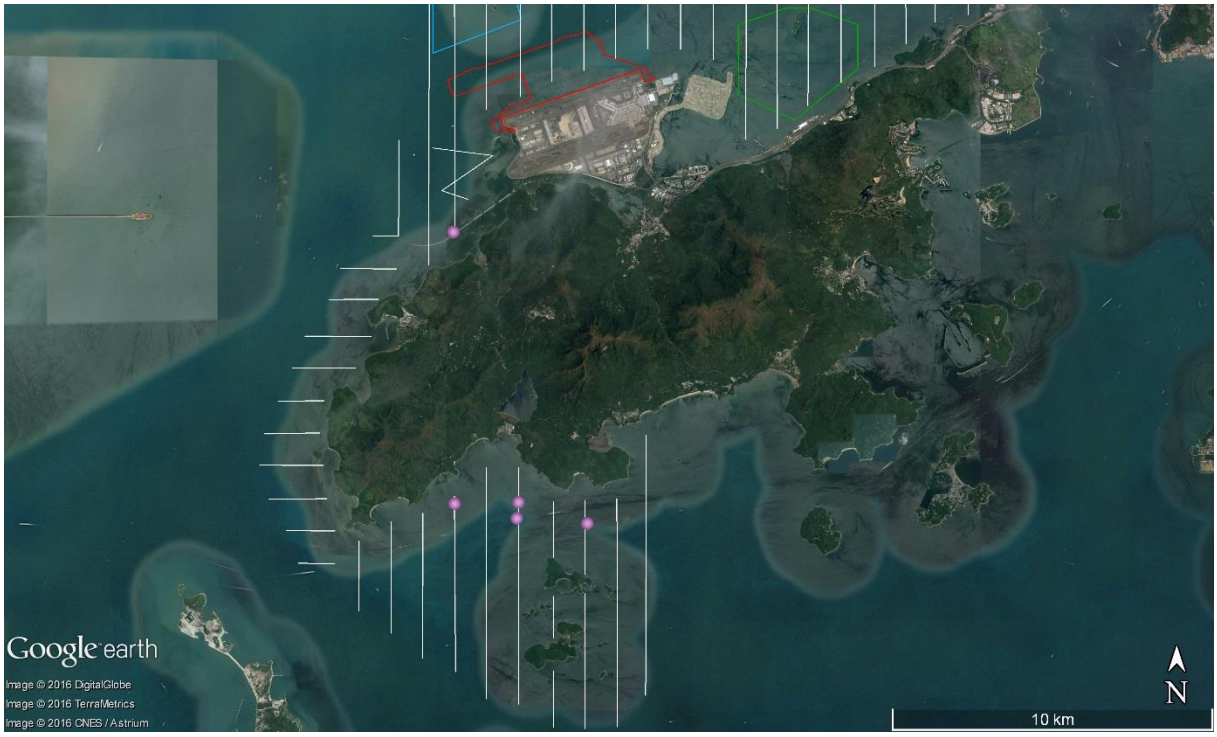
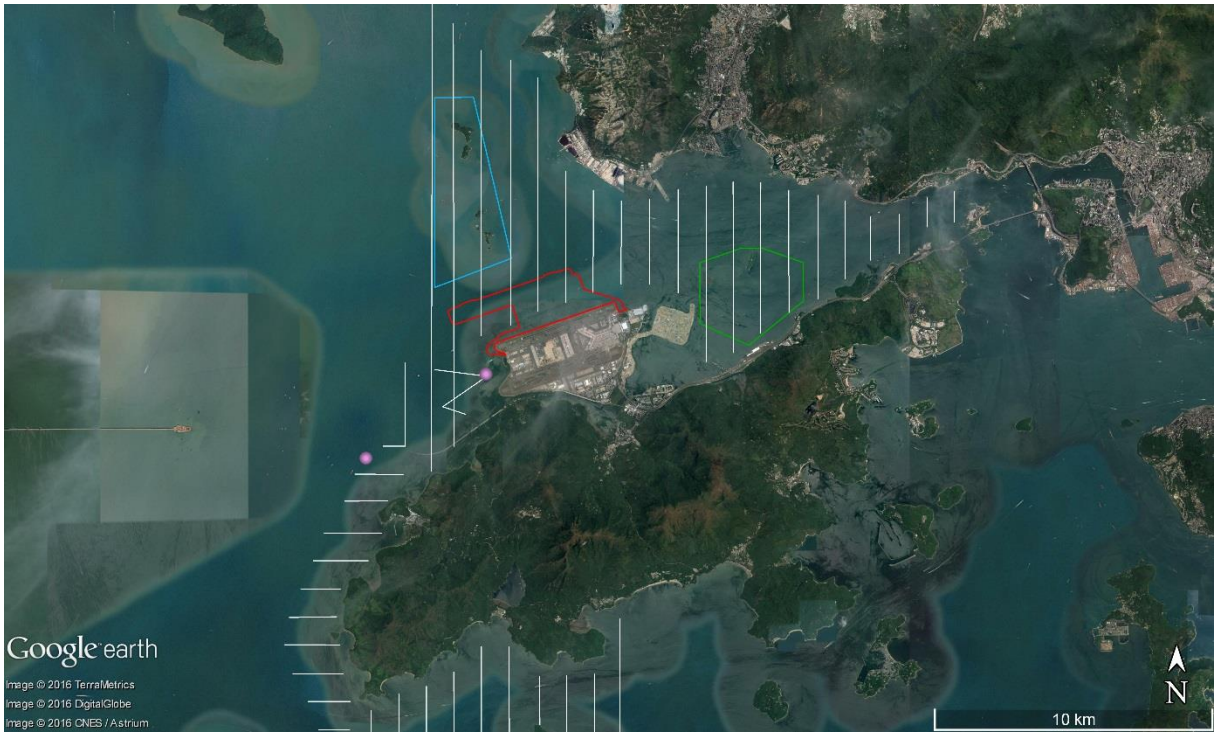


SLMM011

SLMM028



WLMM024



WLMM026

WLMM027

WLMM030

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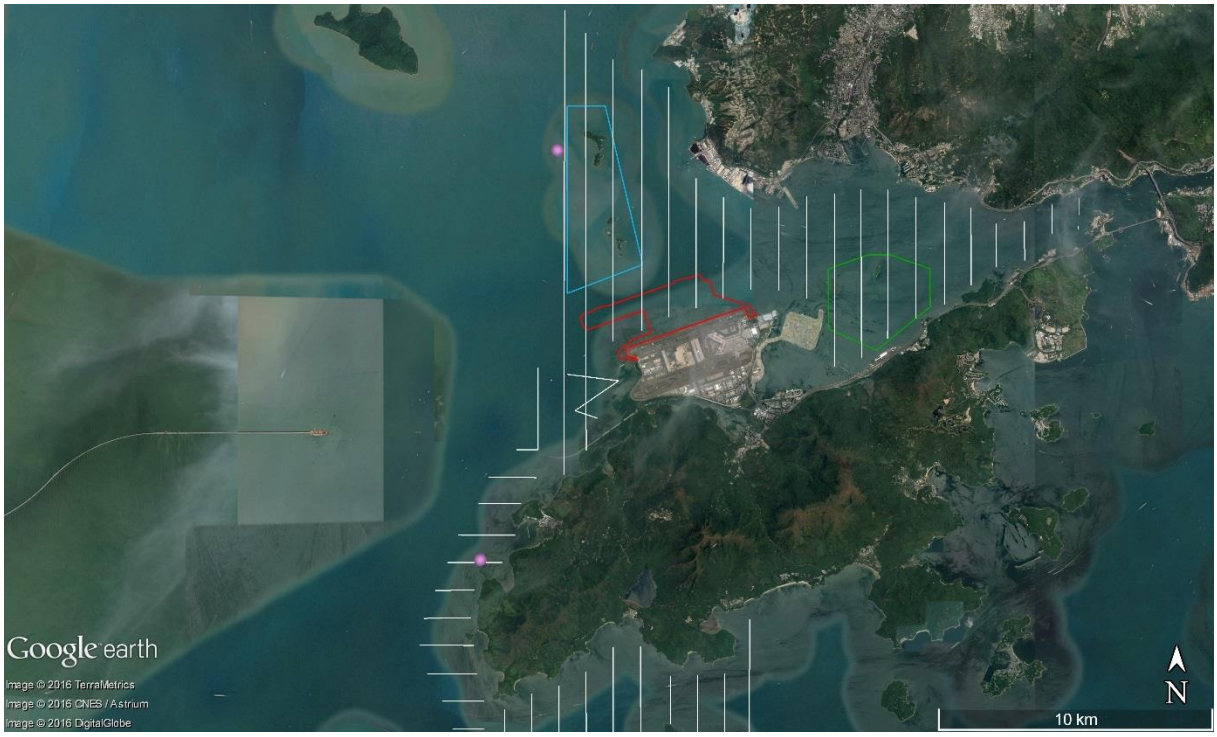


WLMM054


Google earth
Image © 2016 TerraMetrics
Image © 2016 CNES / Astrium
Image © 2016 DigitalGlobe
N
10 km

Figure 11: Plots of First Sightings of All CWD Groups (prior to filtering out short-track data) Obtained from Land-based Stations

[Large green square on land: LKC station; Small green squares: CWD groups off LKC; Large orange circle on land: SC station; small orange circle: CWD group off SC Red line: SCLKCMP boundary]

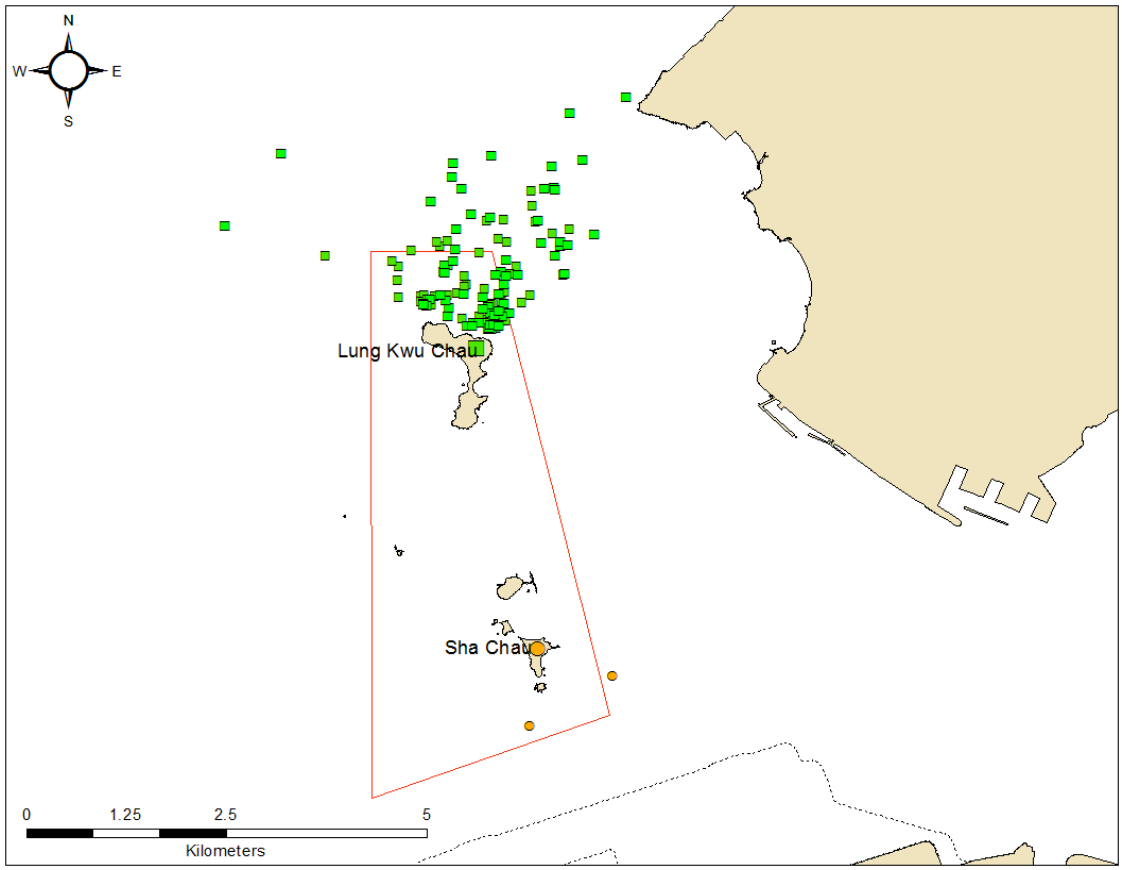


Figure 12: Total Duration of CWD Groups Tracked (per total effort time) from Lung Kwu Chau (prior to filtering short-track data) Based on Time of Day

[Time indicates the hour block during which CWD groups were tracked. The "n" in parentheses represents the number of days that survey effort was carried out during the associated hour block.]

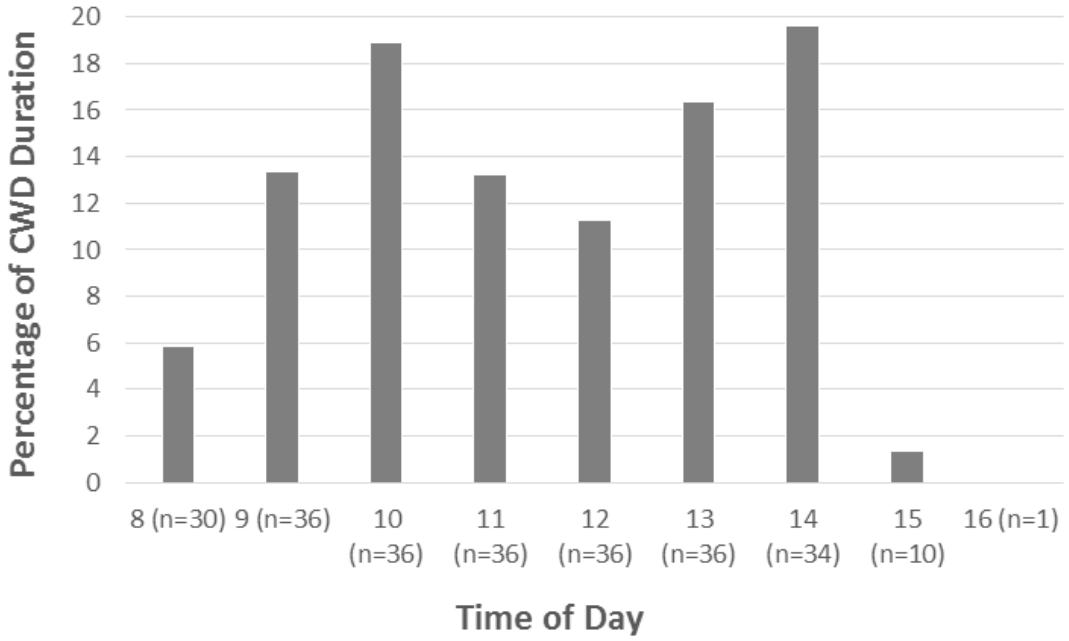
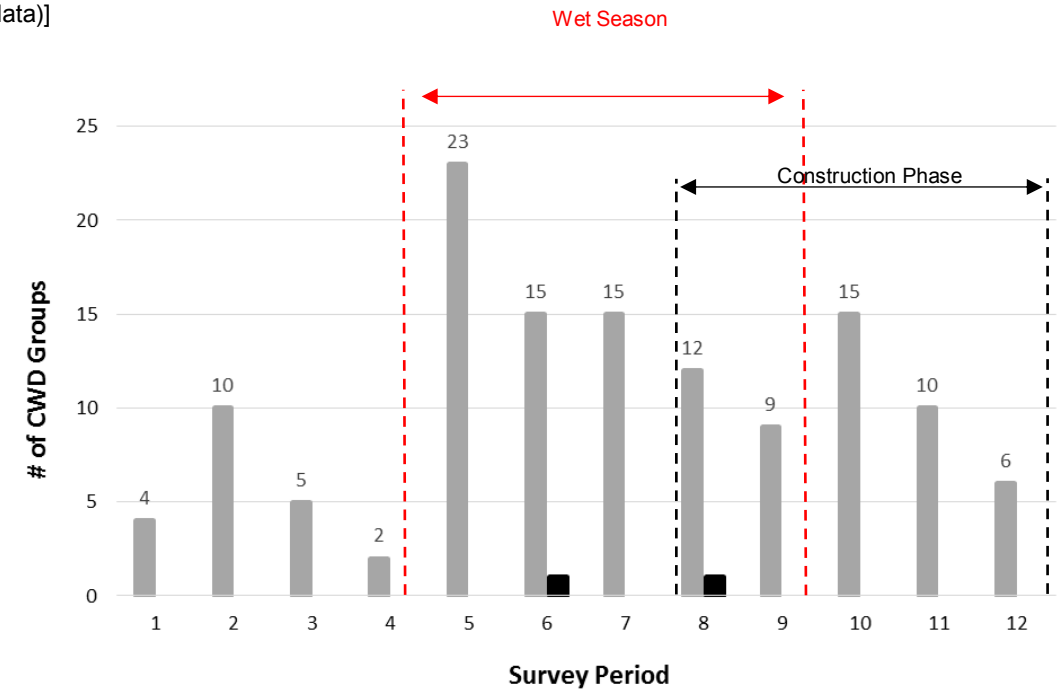


Figure 13: CWD Groups Sighted and Tracked from Lung Kwu Chau (gray bars) and Sha Chau (black bars) Based on Month of the Year

[The numbers above the bars indicate the total number of CWD groups tracked per study period (prior to filtering data)]



*Note: There was no marine construction activities in August and September 2016.

Figure 14: Plots of CWD Short-track Positions (Standardized Segments) relative to Group Size obtained from Lung Kwu Chau

[Station is indicated by large green square on land, fix positions of the CWD groups by green circles (increasing in size with CWD group size), and SCLKCMP boundary by red lines.]

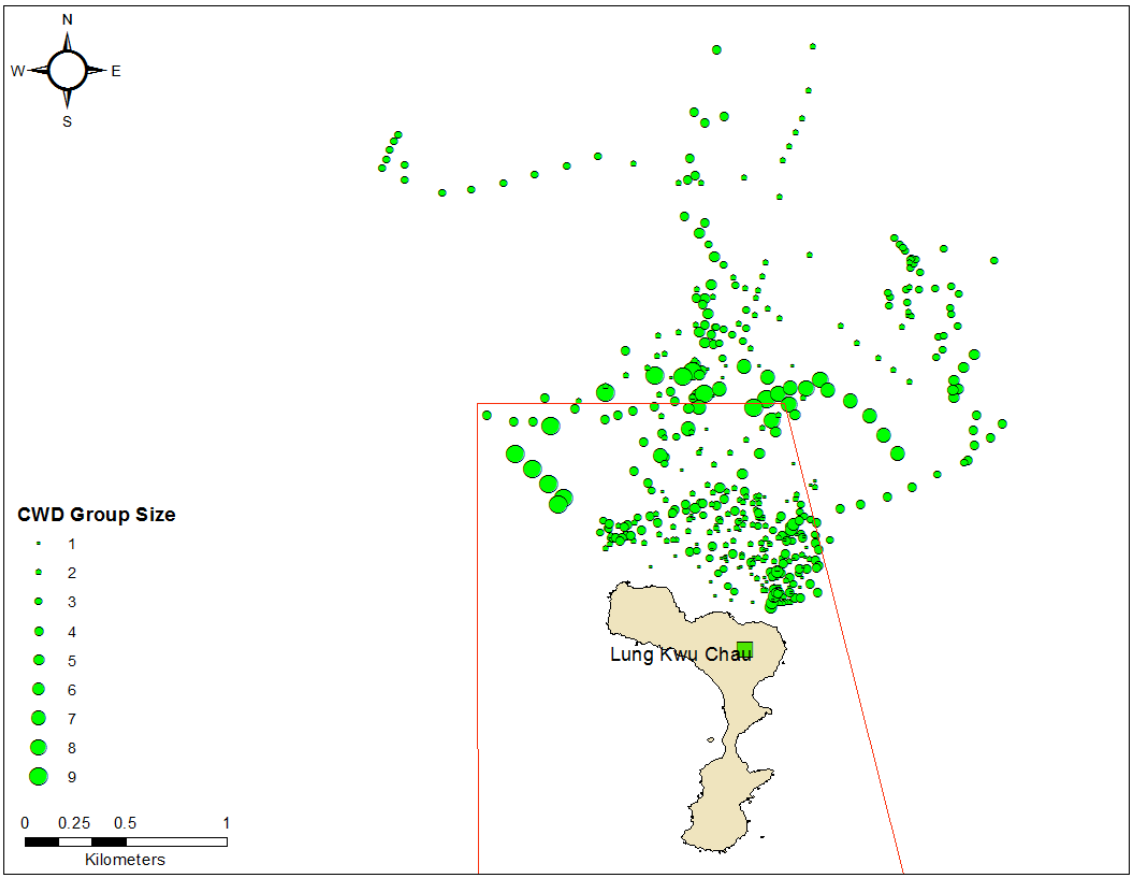


Figure 15: Plots of CWD Short-track Positions (Standardized Segments) relative to Group Size obtained from Sha Chau

[Station is indicated by large orange circle on land, fix positions of the CWD group by orange circles, SCLKCMP boundary by red lines, and proposed third runway by black dotted line.]

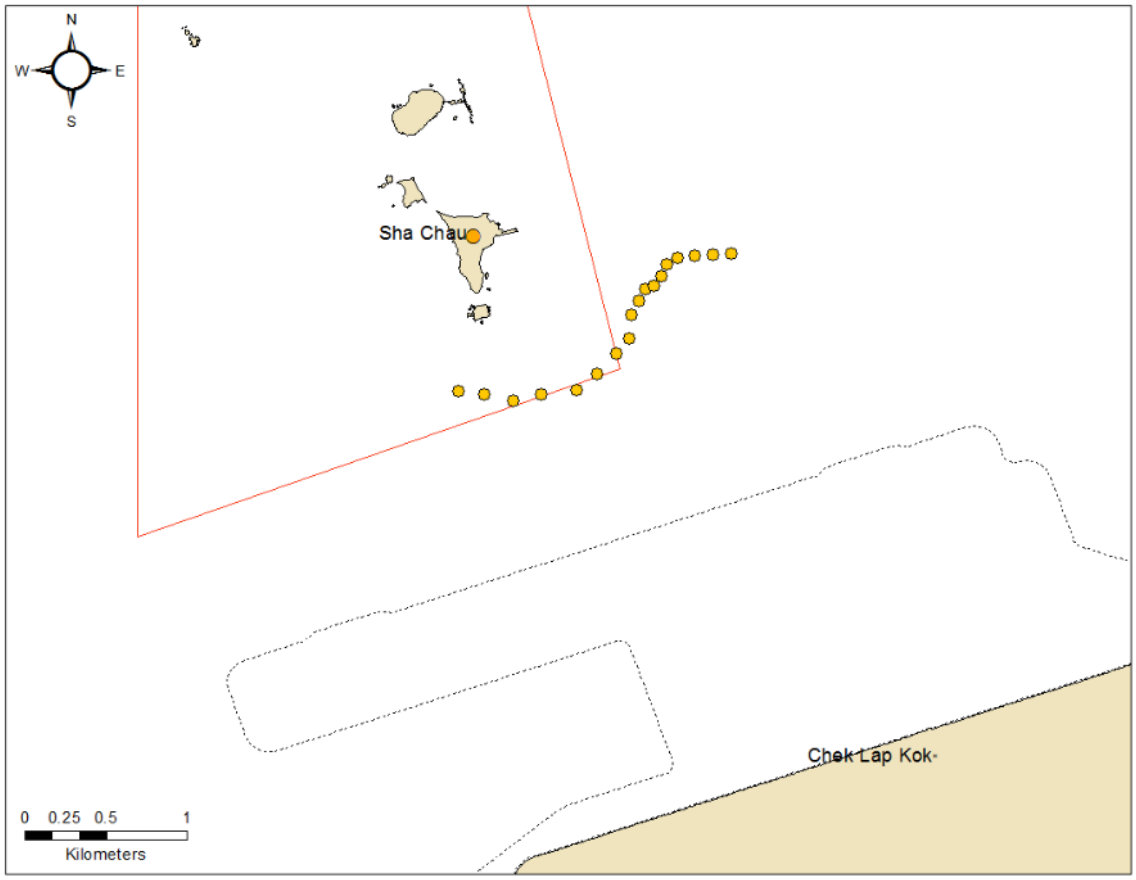


Figure 16: Percentages of CWD Behavioural States, excluding Unknown Category, recorded from Lung Kwu Chau

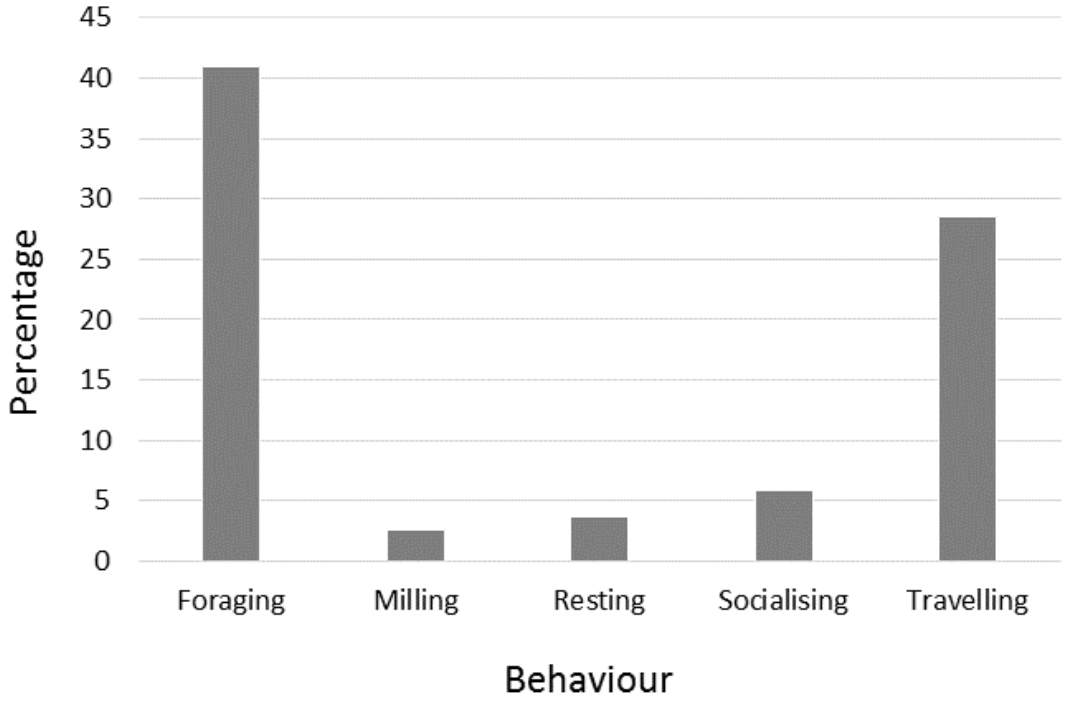


Figure 17: Dolphin Detections as Percentage of Files Per Day, 8 Jan to 28 Dec 2016
[Grey shading indicates no recording]

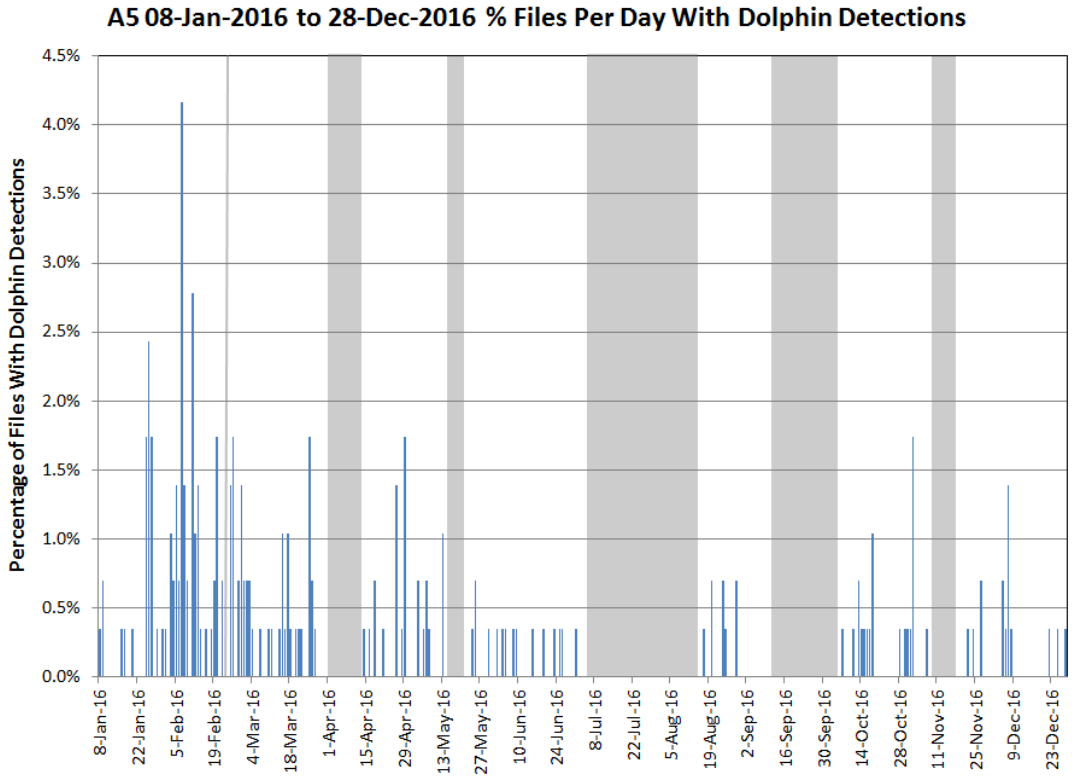


Figure 18: Dolphin Detections as Percentage of Files Per Day, 8 Jan to 7 Dec 2013
[Grey shading indicates no recording]

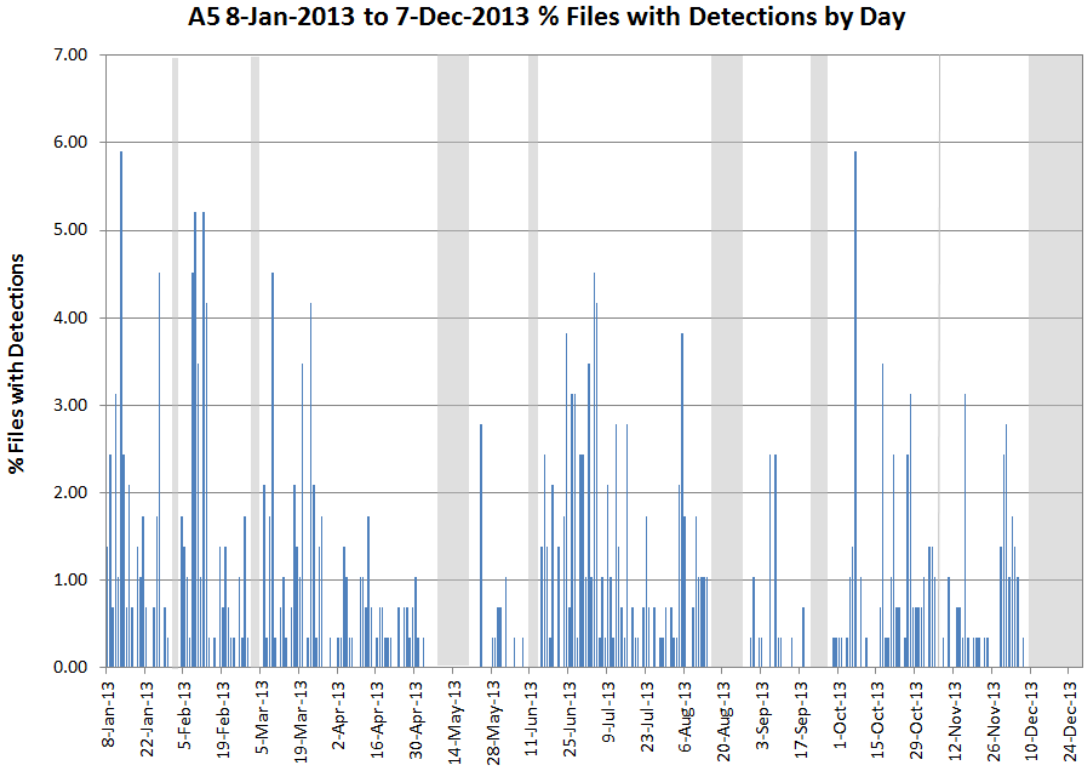


Figure 19: Dolphin Detections by Hour of Day, 8 Jan to 28 Dec 2016

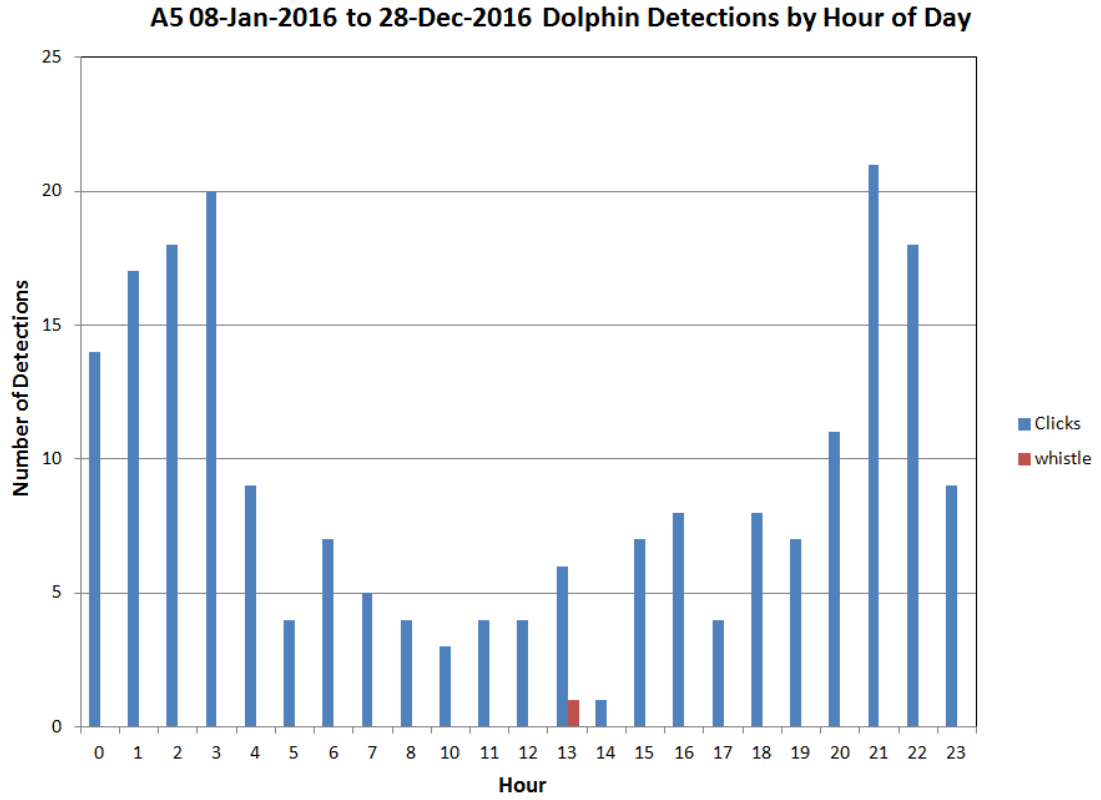


Figure 20: Dolphin Detections by Hour of Day and Solar Season, 8 Jan to 28 Dec 2016
[Winter = Dec-Jan-Feb, Spring = Mar-Apr-May, Summer = Jun-Jul-Aug, Autumn = Sep-Oct-Nov]

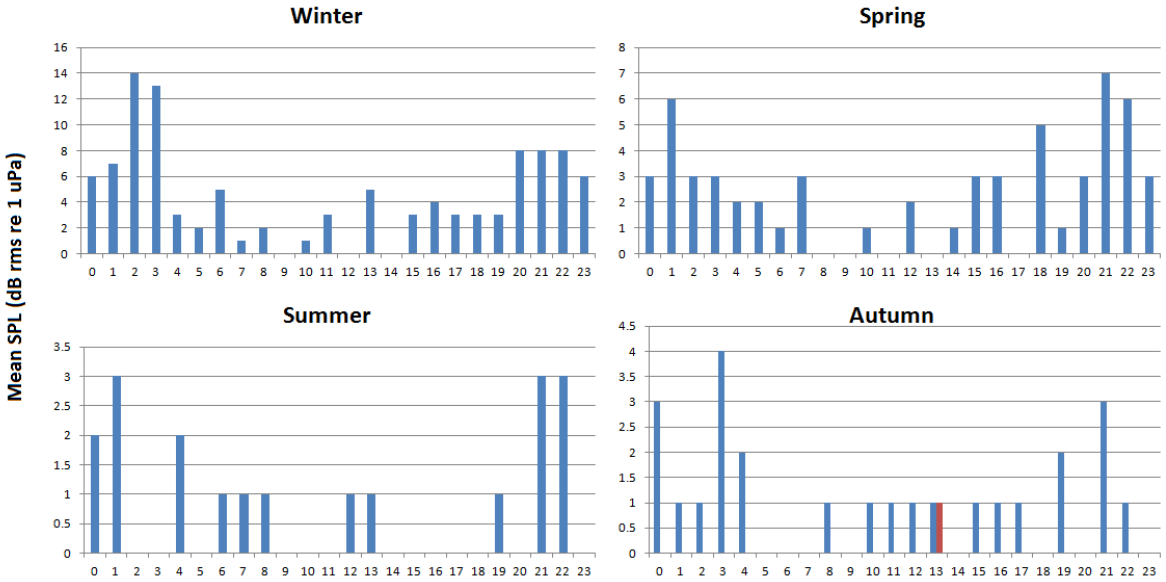


Figure 21: Daily Mean Sound Pressure Level (dB rms re 1 µPa), 8 Jan to 28 Dec 2016
[Blank area represents no recording]

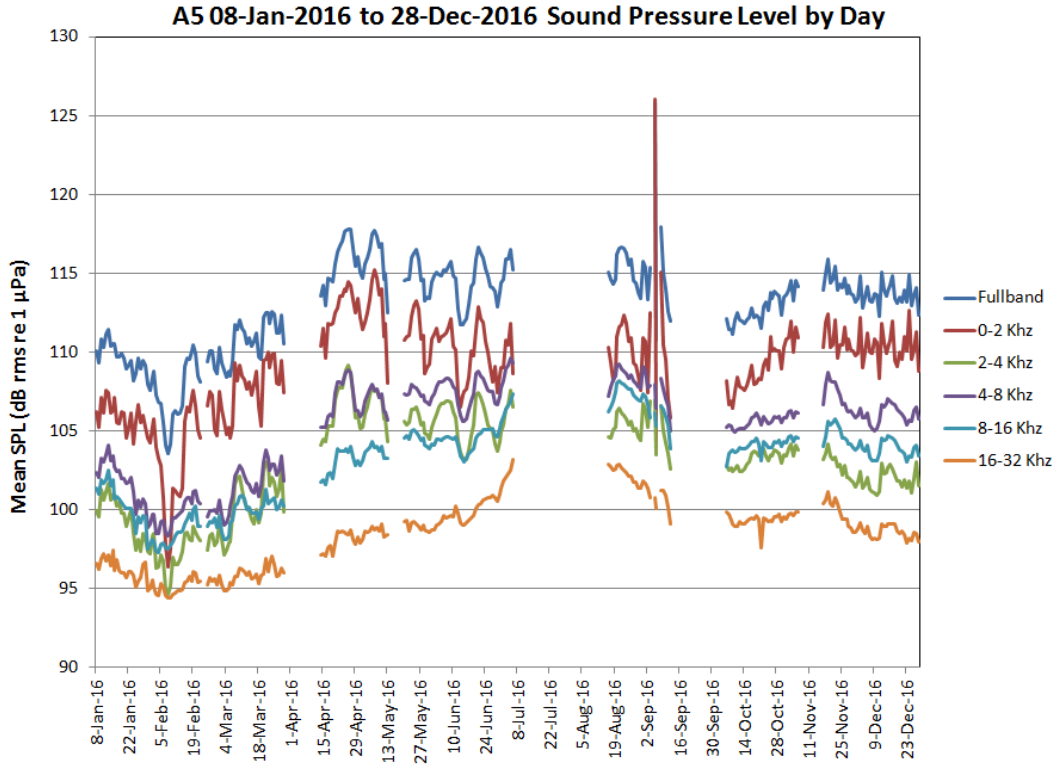


Figure 22: Daily Mean Sound Pressure Level (dB rms re 1 µPa), 6 Dec 2012 to 5 Dec 2013
[Blank area represents no recording]

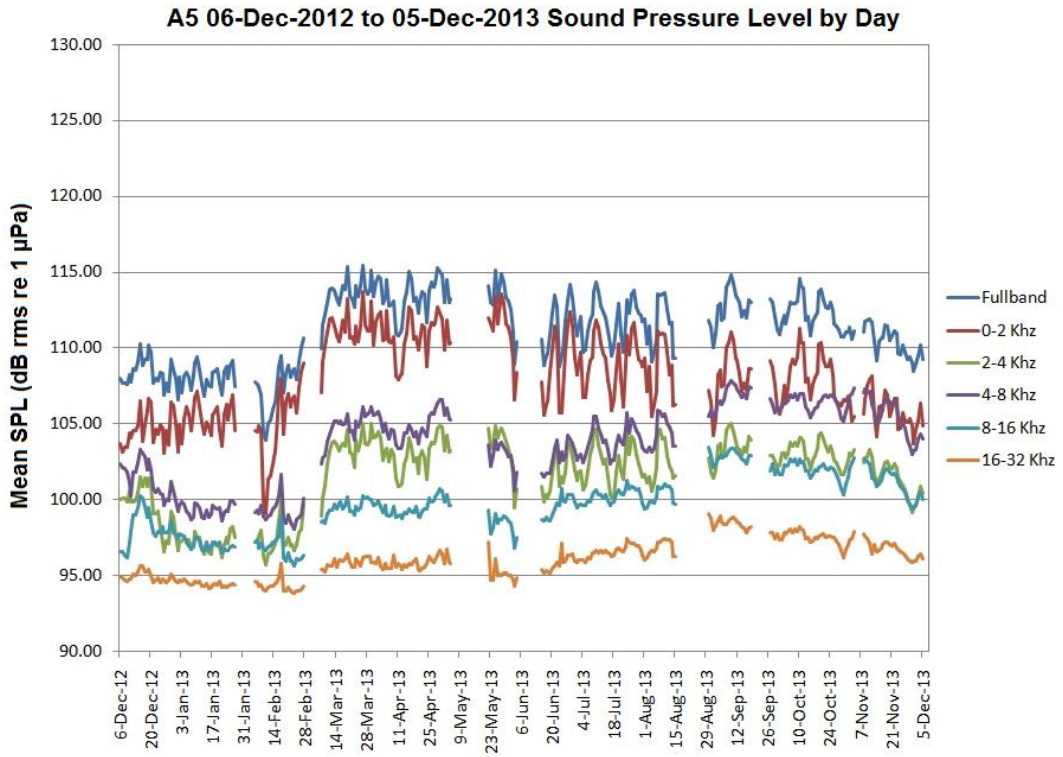


Figure 23: Sound Pressure Level (SPL) by Hour of Day, 8 Jan to 28 Dec 2016

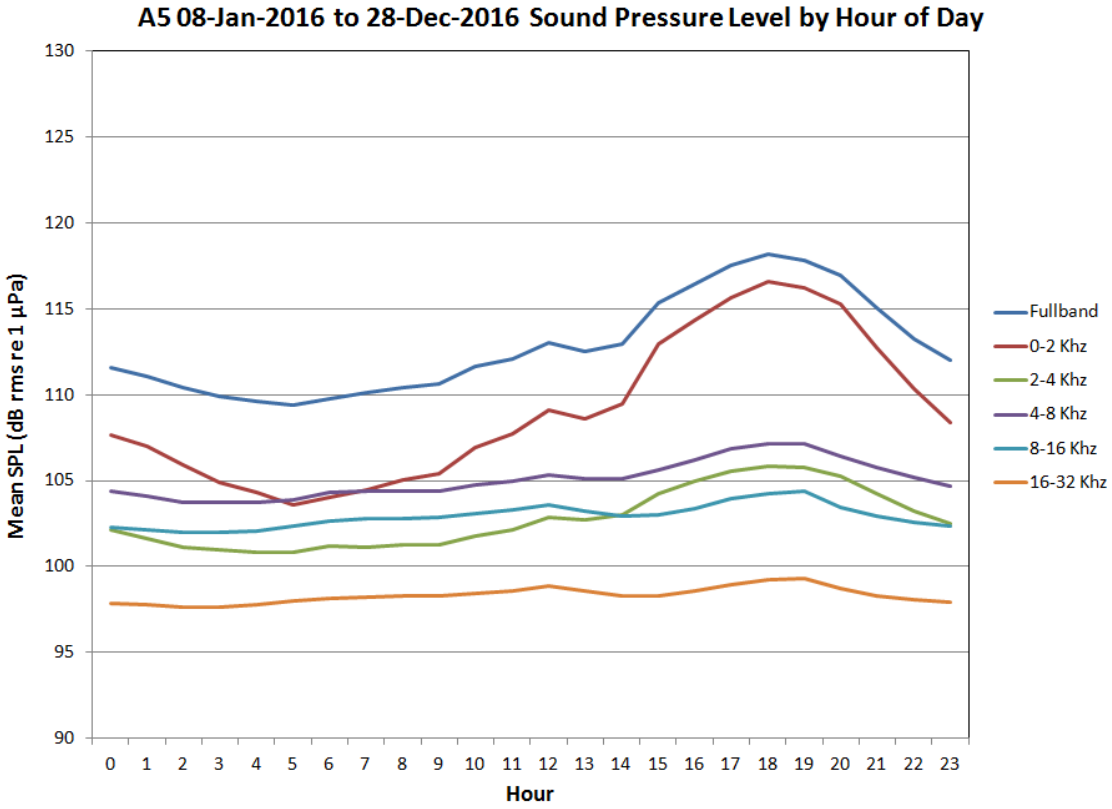


Figure 24: Sound Pressure Level (SPL) by Hour of Day and Solar Season, 8 Jan to 28 Dec 2016
[Winter = Dec-Jan-Feb, Spring = Mar-Apr-May, Summer = Jun-Jul-Aug, Autumn = Sep-Oct-Nov]

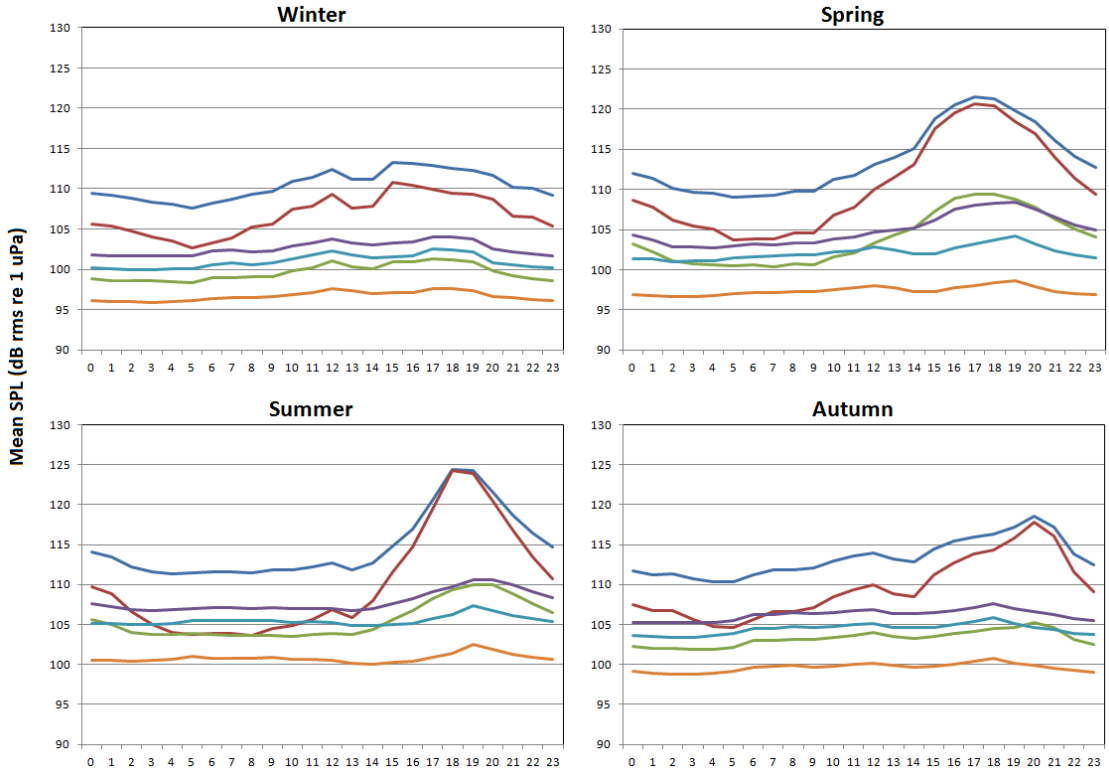


Table 1: CWD Encounter Rates by Survey Areas

Survey Area	Encounter Rate (STG)	Encounter Rate (ANI)
NEL	0	0
NWL	2.32	9.51
AW	2.81	11.23
WL	11.85	44.27
SWL	3.46	13.99
Combined	3.44	13.44

Table 2: Summary of Monthly and Running Quarterly STGs and ANIs

	Winter		Spring			Summer			Autumn			Winter
	Jan 16	Feb 16	Mar 16	Apr 16	May 16	Jun 16	Jul 16	Aug 16	Sep 16	Oct 16	Nov 16	Dec 16
Monthly STG	1.38	2.24	1.94	2.66	3.31	5.40	6.08	3.48	3.50	4.65	2.54	4.89
Monthly ANI	8.49	13.65	6.03	7.27	17.66	21.06	27.10	14.17	14.65	9.81	7.11	15.96
Running Quarterly STG	N/A	N/A	1.86	2.27	2.63	3.72	4.84	4.93	4.29	3.84	3.55	4.02
Running Quarterly ANI	N/A	N/A	9.35	8.99	10.37	15.21	21.75	20.57	18.32	13.02	10.74	10.95

Table 3: CWD Line Transects Parameters and Estimates of Density and Abundance for Western Hong Kong based on 3RS Project Data (December 2015 – December 2016)

Time Period	Stratum	No. Stgs.*	Avg. Grp. Sz.	Trackline Detection Prob. - g(0)	Individual Density (#/100km2)	Abundance	95% CI (Abund.)	%CV
Dec2015-Dec2016	AW	3	2.0	1.0	14.00	1	0-2	64.6
Dec2015-Dec2016	NEL	0	n/a	1.0	0.00	0	n/a	n/a
Dec2015-Dec2016	NWL	40	3.3	1.0	17.60	15	10-25	24.3
Dec2015-Dec2016	SWL	44	2.7	1.0	21.80	14	8-26	30.7
Dec2015-Dec2016	WL	77	3.8	1.0	109.20	30	19-48	23.3
Dec2015-Dec2016	Winter	38	2.9	1.0	19.30	51	31-83	25.0
Dec2015-Dec2016	Spring	42	4.3	1.0	30.60	81	46-141	28.6
Dec2015-Dec2016	Summer	40	3.4	1.0	31.10	83	39-178	39.1
Dec2015-Dec2016	Autumn	43	3.1	1.0	23.40	62	34-112	30.5

* Analysed using distance-sampling methodology (Buckland et al., 2001)
# From Jefferson (2000)

Table 4: Average Group Sizes of CWDs by Survey Areas

Survey Area	Average Group Size of CWDs
NEL	0
NWL	3.93
AW	4.00
WL	3.61
SWL	3.89
Overall	3.77 ± 3.09

Table 5: Average Group Sizes of CWDs by Seasons

	Spring	Summer	Autumn	Winter
Average Group Size	4.06	4.04	2.91	4.21

Table 6: Percentage of CWD Groups recorded as Exhibiting Various Behaviours/Activities, and recorded as having Association with Fishing Boat

	Activity				
Survey Area	Feeding	Traveling	Socializing	Resting/Milling	Fishing Boat Assoc.
AW	75%	-	-	-	-
NEL	-	-	-	-	-
NWL	41%	15%	9%	9%	7%
WL	33%	31%	5%	8%	4%
SWL	48%	13%	11%	8%	13%

Table 7: Summary of Photo Identification

Individual ID	Date of sighting (dd/mm/yyyy)	Sighting Group No.	Area		Individual ID	Date of sighting (dd/mm/yyyy)	Sighting Group No.	Area
NLMM001	06/01/2016	1	AW		SLMM022	19/01/2016	2	SWL
NLMM002	05/02/2016	1	NWL			21/04/2016	4	WL
	23/05/2016	1	NWL			24/05/2016	8	WL
	19/08/2016	1	NWL			19/09/2016	2	WL
		2	NWL				4	WL
	24/08/2016	1	NWL			25/10/2016	4	WL
	22/09/2016	2	NWL			05/12/2016	5	WL
	04/11/2016	2	NWL		SLMM023	19/01/2016	2	SWL
	19/12/2016	7	NWL			02/03/2016	1	WL
NLMM003	05/02/2016	1	NWL		SLMM024	19/01/2016	2	SWL
NLMM004	05/02/2016	1	NWL		SLMM025	19/01/2016	2	SWL
	23/05/2016	1	NWL		SLMM026	19/01/2016	2	SWL
	19/08/2016	2	NWL			09/05/2016	6	SWL
	19/12/2016	6	NWL		SLMM027	19/01/2016	2	SWL
NLMM005	05/02/2016	1	NWL		SLMM028	07/06/2016	1	SWL
	22/09/2016	1	NWL			18/07/2016	1	SWL
		2	NWL				3	SWL
	28/10/2016	1	NWL			25/07/2016	7	SWL
NLMM006	05/02/2016	1	NWL			04/11/2016	1	NWL
	29/02/2016	2	NWL		SLMM029	07/07/2016	13	SWL
	23/03/2016	2	NWL			05/12/2016	5	WL
		3	NWL		SLMM030	18/07/2016	1	SWL
	24/08/2016	1	NWL				3	SWL
	22/09/2016	2	NWL			19/09/2016	4	WL
	28/10/2016	2	NWL				5	WL
	04/11/2016	2	NWL		SLMM031	18/07/2016	1	SWL
	19/12/2016	3	NWL				3	SWL
		7	NWL			25/07/2016	8	SWL
NLMM007	05/02/2016	1	NWL			13/12/2016	7	SWL
NLMM008	05/02/2016	1	NWL		SLMM032	18/07/2016	3	SWL
	22/08/2016	3	WL			19/09/2016	6	SWL
NLMM009	05/02/2016	1	NWL		SLMM033	18/07/2016	3	SWL

Individual ID	Date of sighting (dd/mm/yyyy)	Sighting Group No.	Area		Individual ID	Date of sighting (dd/mm/yyyy)	Sighting Group No.	Area
NLMM010	05/02/2016	1	NWL			14/11/2016	1	SWL
	23/03/2016	1	NWL		SLMM034	18/07/2016	3	SWL
	24/08/2016	1	NWL			25/07/2016	6	SWL
	06/09/2016	1	NWL			19/09/2016	2	WL
	22/09/2016	2	NWL		SLMM035	18/07/2016	3	SWL
	19/12/2016	5	NWL		SLMM036	18/07/2016	4	SWL
		7	NWL		SLMM037	25/07/2016	6	SWL
NLMM011	05/02/2016	1	NWL				8	SWL
NLMM012	05/02/2016	1	NWL			05/12/2016	5	WL
	22/07/2016	5	NWL		SLMM038	25/07/2016	6	SWL
	08/09/2016	2	WL		SLMM039	25/07/2016	6	SWL
	28/10/2016	1	NWL		SLMM040	25/07/2016	6	SWL
NLMM013	05/02/2016	1	NWL				8	SWL
	29/02/2016	2	NWL		SLMM041	25/07/2016	6	SWL
	23/03/2016	2	NWL		SLMM042	25/07/2016	6	SWL
		3	NWL		SLMM043	25/07/2016	7	SWL
	24/08/2016	1	NWL				8	SWL
	22/09/2016	2	NWL		SLMM044	25/07/2016	7	SWL
	28/10/2016	2	NWL				8	SWL
	04/11/2016	2	NWL		SLMM045	25/07/2016	7	SWL
	19/12/2016	3	NWL				8	SWL
		7	NWL		SLMM046	25/07/2016	8	SWL
NLMM014	05/02/2016	1	NWL		SLMM047	25/07/2016	8	SWL
NLMM015	05/02/2016	2	NWL		SLMM048	25/07/2016	8	SWL
NLMM016	05/02/2016	2	NWL		SLMM049	25/07/2016	8	SWL
NLMM017	05/02/2016	2	NWL			05/12/2016	5	WL
	08/09/2016	2	WL		SLMM050	26/09/2016	3	SWL
NLMM018	18/02/2016	1	AW		SLMM051	26/09/2016	3	SWL
		2	AW		SLMM052	26/10/2016	7	SWL
	18/03/2016	4	SWL		SLMM053	13/12/2016	9	SWL
NLMM019	18/02/2016	1	AW		WLMM001	18/12/2015	2	WL
		2	AW			17/11/2016	1	WL
	06/06/2016	5	SWL		WLMM002	18/12/2015	2	WL
	22/08/2016	3	WL		WLMM003	18/12/2015	2	WL
NLMM020	18/02/2016	1	AW			19/01/2016	1	WL
		2	AW		WLMM004	18/12/2015	2	WL
NLMM021	29/02/2016	1	NWL		WLMM005	18/12/2015	2	WL
	21/04/2016	1	WL			24/05/2016	3	WL
	27/09/2016	6	SWL				6	WL
NLMM022	29/02/2016	1	NWL		WLMM006	18/12/2015	2	WL
NLMM023	05/10/2016	4	NWL			07/07/2016	11	WL
NLMM024	23/03/2016	1	NWL		WLMM007	18/12/2015	2	WL
NLMM025	23/03/2016	1	NWL			24/05/2016	3	WL
NLMM026	23/03/2016	1	NWL			19/09/2016	5	WL
NLMM027	23/05/2016	1	NWL				7	SWL
	22/09/2016	2	NWL			05/12/2016	3	WL
NLMM028	23/05/2016	1	NWL		WLMM008	18/12/2015	2	WL
	22/08/2016	1	WL			25/07/2016	8	SWL
	24/08/2016	1	NWL		WLMM009	18/12/2015	2	WL
	22/09/2016	2	NWL			07/07/2016	11	WL
NLMM029	23/05/2016	1	NWL		WLMM010	06/01/2016	2	WL
NLMM030	22/07/2016	1	NWL		WLMM011	19/01/2016	1	WL
NLMM031	22/07/2016	1	NWL		WLMM012	19/01/2016	1	WL
NLMM032	22/07/2016	1	NWL		WLMM013	19/01/2016	1	WL
NLMM033	22/07/2016	3	NWL			09/08/2016	3	WL
NLMM034	22/07/2016	4	NWL		WLMM014	19/01/2016	1	WL
NLMM035	19/08/2016	1	NWL		WLMM015	21/04/2016	1	WL
		2	NWL				5	WL

Individual ID	Date of sighting (dd/mm/yyyy)	Sighting Group No.	Area		Individual ID	Date of sighting (dd/mm/yyyy)	Sighting Group No.	Area
NLMM036	19/08/2016	1	NWL			19/09/2016	5	WL
NLMM037	19/08/2016	1	NWL		WLMM016	21/04/2016	1	WL
		2	NWL			25/07/2016	8	SWL
NLMM038	22/08/2016	1	WL		WLMM017	21/04/2016	1	WL
	24/08/2016	1	NWL			25/07/2016	7	SWL
NLMM039	28/10/2016	1	NWL		WLMM018	21/04/2016	1	WL
NLMM040	28/10/2016	1	NWL			25/07/2016	8	SWL
NLMM041	28/10/2016	1	NWL		WLMM019	21/04/2016	1	WL
NLMM042	28/10/2016	1	NWL		WLMM020	21/04/2016	1	WL
NLMM043	21/11/2016	1	NWL			19/09/2016	7	SWL
NLMM044	21/11/2016	1	NWL		WLMM021	21/04/2016	2	WL
NLMM045	02/12/2016	1	NWL				5	WL
NLMM046	19/12/2016	2	NWL			03/05/2016	8	SWL
		6	NWL			24/05/2016	11	SWL
NLMM047	19/12/2016	6	NWL		WLMM022	02/02/2016	1	WL
NLMM048	19/12/2016	7	NWL		WLMM023	18/02/2016	3	WL
NLMM049	19/12/2016	7	NWL			07/07/2016	10	WL
SLMM001	18/12/2015	3	SWL		WLMM024	02/03/2016	1	WL
SLMM002	18/12/2015	3	SWL			19/09/2016	1	AW
	06/06/2016	5	SWL		WLMM025	02/03/2016	1	WL
	19/09/2016	2	WL			19/09/2016	2	WL
		7	SWL				7	SWL
	26/09/2016	3	SWL		WLMM026	06/04/2016	1	WL
	26/10/2016	2	WL			04/11/2016	1	NWL
	05/12/2016	5	WL		WLMM027	06/04/2016	1	WL
SLMM003	18/12/2015	3	SWL			07/06/2016	1	SWL
	19/01/2016	2	SWL			18/07/2016	1	SWL
	09/05/2016	4	WL				3	SWL
	05/12/2016	5	WL			08/09/2016	3	WL
SLMM004	18/12/2015	3	SWL			27/09/2016	5	SWL
SLMM005	18/12/2015	3	SWL			05/10/2016	1	NWL
SLMM006	18/12/2015	3	SWL			24/10/2016	7	WL
SLMM007	18/12/2015	3	SWL			04/11/2016	1	NWL
	19/01/2016	2	SWL		WLMM028	06/04/2016	2	WL
	24/05/2016	3	WL			27/04/2016	4	SWL
	25/07/2016	8	SWL			28/11/2016	6	SWL
	05/12/2016	3	WL		WLMM029	06/04/2016	2	WL
SLMM008	27/04/2016	4	SWL			27/04/2016	4	SWL
	18/07/2016	3	SWL			28/11/2016	6	SWL
SLMM009	18/12/2015	3	SWL		WLMM030	06/04/2016	2	WL
SLMM010	18/12/2015	3	SWL			07/07/2016	7	WL
	21/04/2016	5	WL			09/08/2016	1	WL
	09/05/2016	6	SWL			19/12/2016	4	NWL
	24/05/2016	4	WL		WLMM031	21/04/2016	4	WL
		8	WL			07/07/2016	3	WL
	22/08/2016	7	WL				5	WL
	19/09/2016	7	SWL		WLMM032	21/04/2016	6	WL
	18/11/2016	1	WL			26/10/2016	5	WL
	05/12/2016	5	WL		WLMM033	21/04/2016	6	WL
	13/12/2016	8	SWL		WLMM034	21/04/2016	6	WL
SLMM011	04/01/2016	2	SWL		WLMM035	24/05/2016	6	WL
	07/06/2016	1	SWL			26/10/2016	5	WL
	18/07/2016	2	SWL		WLMM036	24/05/2016	6	WL
	22/08/2016	7	WL		WLMM037	24/05/2016	6	WL
	25/08/2016	1	SWL		WLMM038	06/06/2016	3	WL
	24/10/2016	7	WL			22/08/2016	2	WL
	21/11/2016	1	NWL		WLMM039	06/06/2016	3	WL
SLMM012	18/12/2015	3	SWL		WLMM040	07/07/2016	2	WL

Individual ID	Date of sighting (dd/mm/yyyy)	Sighting Group No.	Area		Individual ID	Date of sighting (dd/mm/yyyy)	Sighting Group No.	Area
	09/05/2016	4	WL		WLMM041	07/07/2016	2	WL
	28/11/2016	4	SWL				6	WL
	05/12/2016	5	WL		WLMM042	07/07/2016	7	WL
SLMM013	19/01/2016	3	SWL		WLMM043	07/07/2016	7	WL
	06/06/2016	6	SWL			09/08/2016	1	WL
	18/07/2016	1	SWL			08/09/2016	1	WL
		3	SWL		WLMM044	07/07/2016	11	WL
	25/07/2016	8	SWL		WLMM045	07/07/2016	11	WL
	26/10/2016	2	WL			25/07/2016	6	SWL
SLMM014	19/01/2016	3	SWL				8	SWL
	22/01/2016	1	SWL		WLMM046	09/08/2016	3	WL
	24/05/2016	11	SWL		WLMM047	22/08/2016	2	WL
	18/07/2016	1	SWL		WLMM048	22/08/2016	2	WL
		3	SWL		WLMM049	22/08/2016	4	WL
	25/07/2016	8	SWL			24/10/2016	1	WL
	26/10/2016	10	SWL			26/10/2016	3	WL
	13/12/2016	4	SWL		WLMM050	08/09/2016	2	WL
SLMM015	19/01/2016	3	SWL			28/10/2016	1	NWL
	27/04/2016	4	SWL		WLMM051	08/09/2016	2	WL
	03/05/2016	8	SWL		WLMM052	08/09/2016	2	WL
	22/08/2016	6	WL		WLMM053	08/09/2016	2	WL
		7	WL		WLMM054	08/09/2016	3	WL
	27/09/2016	4	SWL			27/09/2016	5	SWL
SLMM016	19/01/2016	3	SWL			05/10/2016	2	NWL
SLMM017	09/03/2016	5	SWL		WLMM055	19/09/2016	2	WL
	26/09/2016	3	SWL		WLMM056	19/09/2016	2	WL
	28/11/2016	4	SWL		WLMM057	19/09/2016	2	WL
SLMM018	18/03/2016	1	SWL		WLMM058	19/09/2016	2	WL
		4	SWL		WLMM059	19/09/2016	5	WL
	12/04/2016	2	WL		WLMM060	24/10/2016	1	WL
SLMM019	06/04/2016	3	SWL		WLMM061	26/10/2016	1	WL
	05/12/2016	1	WL				5	WL
SLMM020	06/04/2016	4	SWL		WLMM062	17/11/2016	1	WL
SLMM021	19/01/2016	2	SWL		WLMM063	05/12/2016	4	WL
	09/03/2016	5	SWL					

Table 8: Land-based Survey, Theodolite Effort and CWD Group Summary

Land-based Station	# of Survey Sessions	Survey Effort (hh:mm)	# CWD Groups Sighted	CWD Group Sighting per Survey Hr	# Groups After Filtering	# of 10-minutes segments
Sha Chau	24	144:33	2	0.014	1	3
Lung Kwu Chau	36	217:16	126	0.580	51	78
TOTAL	**60**	**361:49**	**128**	**0.354**	**52**	**81**

Table 9: CWD Groups Sighted and Tracked from Land-based Stations by Survey Month

Month	No. of Survey Days	# of CWD Groups per Sha Chau Station	# of CWD Groups per Lung Kwu Chau Station	TOTAL
1st Survey Month (18 Dec 2015 – 17 Jan 2016)	Sha Chau: 2 Lung Kwu Chau: 3	0	4	**4**
2nd Survey Month (18 Jan 2016 – 17 Feb 2016)	Sha Chau: 2 Lung Kwu Chau: 3	0	10	**10**
3rd Survey Month (18 Feb 2016 – 17 Mar 2016)	Sha Chau: 2 Lung Kwu Chau: 3	0	5	**5**
4th Survey Month (18 Mar 2016 – 17 Apr 2016)	Sha Chau: 2 Lung Kwu Chau: 3	0	2	**2**
5th Survey Month (18 Apr 2016 – 17 May 2016)	Sha Chau: 2 Lung Kwu Chau: 3	0	23	**23**
6th Survey Month (18 May 2016 – 17 Jun 2016)	Sha Chau: 2 Lung Kwu Chau: 3	1	15	**16**
7th Survey Month (Jul 2016)	Sha Chau: 2 Lung Kwu Chau: 3	0	15	**15**
Commencement of marine construction for HKIA Three-Runway System				
*8th Survey Month (Aug 206)	Sha Chau: 2 Lung Kwu Chau: 3	1	12	**13**
*9th Survey Month (Sep 2016)	Sha Chau: 2 Lung Kwu Chau: 3	0	9	**9**
10th Survey Month (Oct 2016)	Sha Chau: 2 Lung Kwu Chau: 3	0	15	**15**
11th Survey Month (Nov 2016)	Sha Chau: 2 Lung Kwu Chau: 3	0	10	**10**
12th Survey Month (Dec 2016)	Sha Chau: 2 Lung Kwu Chau: 3	0	6	**6**
TOTAL	**Sha Chau: 24** **Lung Kwu Chau: 36**	**2**	**126**	**128**

*Note: There was no marine construction activities in August and September 2016.

Table 10: Land-based CWD Focal Group Size Summary

Station	n (sample size)	Minimum # Individuals	Maximum # Individuals	Mean Grp Size	Standard Deviation
Sha Chau	3	4	4	4	0
Lung Kwu Chau	78	1	9	3.08	1.81

Table 11: Summary of PAM Data Collection and Dolphin Detections, 8 Jan to 28 Dec 2016

Site	Dep #	Data start (dd/mm/yyyy)	Data end (dd/mm/yyyy)	# recording days	# files	Analysis status	Days with dolphins (%)	Files with dolphins (%)
A5	1	08/01/2016	22/02/2016	46	13120	Complete	27 (59%)	82 (0.6%)
A5	2	25/02/2016	29/03/2016	34	9650	Complete	22 (65%)	45 (0.5%)
A5	3	14/04/2016	13/05/2016	30	8504	Complete	12 (40%)	24 (0.3%)
A5	4	20/05/2016	06/07/2016	48	13689	Complete	14 (29%)	15 (0.1%)
A5	5	16/08/2016	12/09/2016	28	7950	Complete	5 (18%)	8 (0.1%)
A5	6	06/10/2016	07/11/2016	32	9369	Complete	14 (42%)	21 (0.2%)
A5	7	17/11/2016	28/12/2016	42	11952	Complete	10 (24%)	15 (0.1%)

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