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HIGHWAYS DEPARTMENT
港珠澳大橋香港工程管理處
Hong Kong - Zhuhai - Macao Bridge
Hong Kong Project Management Office

Contract No. HY/2011/03

Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road Section between Scenic Hill and Hong Kong Boundary Crossing Facilities

Monthly EM&A Report No.33 (June 2015)

14 July 2015

Revision 1

Main Contractor

中國建築工程(香港)有限公司
CHINA STATE CONSTRUCTION ENGINEERING (HONG KONG) LTD.

Designer

ATKINS

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Executive Summary

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

The HKLR project has been separated into two contracts. They are Contract No. HY/2011/03 Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road-Section between Scenic Hill and Hong Kong Boundary Crossing Facilities (hereafter referred to as the Contract) and Contract No. HY/2011/09 Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road-Section between HKSAR Boundary and Scenic Hill.

China State Construction Engineering (Hong Kong) Ltd. was awarded by Highways Department as the Contractor to undertake the construction works of Contract No. HY/2011/03. The main works of the Contract include land tunnel at Scenic Hill, tunnel underneath Airport Road and Airport Express Line, reclamation and tunnel to the east coast of the Airport Island, at-grade road connecting to the HKBCF and highway works of the HKBCF within the Airport Island and in the vicinity of the HKLR reclamation. The Contract is part of the HKLR Project and HKBCF Project, these projects are considered to be "Designated Projects", under Schedule 2 of the Environmental Impact Assessment (EIA) Ordinance (Cap 499) and Environmental Impact Assessment (EIA) Reports (Register No. AEIAR-144/2009 and AEIAR-145/2009) were prepared for the Project. The current Environmental Permit (EP) EP-352/2009/D for HKLR and EP-353/2009/H for HKBCF were issued on 22 December 2014 and 19 January 2015, respectively. These documents are available through the EIA Ordinance Register. The construction phase of Contract was commenced on 17 October 2012.

BMT Asia Pacific Limited has been appointed by the Contractor to implement the Environmental Monitoring & Audit (EM&A) programme for the Contract in accordance with the Updated EM&A Manual for HKLR (Version 1.0) and will be providing environmental team services to the Contract.

This is the thirty-third Monthly EM&A report for the Contract which summaries the monitoring results and audit findings of the EM&A programme during the reporting period from 1 to 30 June 2015.

Environmental Monitoring and Audit Progress

The monthly EM&A programme was undertaken in accordance with the Updated EM&A Manual for HKLR (Version 1.0). A summary of the monitoring activities in this reporting month is listed below:

1-hr TSP Monitoring	2, 8, 12, 18, 24 and 29 June 2015
24-hr TSP Monitoring	1, 5, 11, 17, 23 and 26 June 2015
Noise Monitoring	2, 8, 18, 24 and 29 June 2015
Water Quality Monitoring	1, 3, 5, 8, 10, 12, 15, 17, 19, 22, 24, 26 and 29 June 2015
Chinese White Dolphin Monitoring	2, 10, 24 and 26 June 2015
Mudflat Monitoring (Ecology)	6, 14,15, 16, 17 and 20 June 2015
Mudflat Monitoring (Sedimentation Rate)	14 June 2015
Site Inspection	3, 10, 17 and 26 June 2015

Due to the change of tide pattern and weather condition, mudflat monitoring (ecology) was rescheduled from 13 to 15 June 2015 and from 21 to 17 June 2015.

Due to the boat availability issue, the dolphins monitoring was rescheduled from 16 June to 24 June 2015 and from 23 June 2015 to 26 June 2015.

Breaches of Action and Limit Levels

A summary of environmental exceedances for this reporting month is as follows:

Environmental Monitoring	Parameters	Action Level (AL)	Limit Level (LL)
Air Quality	1-hr TSP	0	0
	24-hr TSP	0	0
Noise	$L_{eq\ (30\ min)}$	0	0
Water Quality	Suspended solids level (SS)	0	0
	Turbidity level	0	0
	Dissolved oxygen level (DO)	0	0

Complaint Log

There were no complaints received in relation to the environmental impacts during the reporting period.

Notifications of Summons and Prosecutions

There were no notifications of summons or prosecutions received during this reporting month.

Reporting Changes

This report has been developed in compliance with the reporting requirements for the subsequent EM&A reports as required by the Updated EM&A Manual for HKLR (Version 1.0).

The proposal for the change of Action Level and Limit Level for suspended solid and turbidity was approved by EPD on 25 March 2013.

The revised Event and Action Plan for dolphin Monitoring was approved by EPD on 6 May 2013.

The original monitoring station at IS(Mf)9 (Coordinate- East:813273, North 818850) was observed inside the perimeter silt curtain of Contract HY/2010/02 on 1 July 2013, as such the original impact water quality monitoring location at IS(Mf)9 was temporarily shifted outside the silt curtain. As advised by the Contractor of HY/2010/02 in August 2013, the perimeter silt curtain was shifted to facilitate safe anchorage zone of construction barges/vessels until end of 2013 subject to construction progress. Therefore, water quality monitoring station IS(Mf)9 was shifted to 813226E and 818708N since 1 July 2013. According to the water quality monitoring team's observation on 24 March 2014, the original monitoring location of IS(Mf)9 was no longer enclosed by the perimeter silt curtain of Contract HY/2010/02. Thus, the impact water quality monitoring works at the original monitoring location of IS(Mf)9 has been resumed since 24 March 2014.

Future Key Issues

The future key issues include potential noise, air quality, water quality and ecological impacts and waste management arising from the following construction activities to be undertaken in the upcoming month:

- Dismantling/trimming of Temporary 40mm Stone Platform for Construction of Seawall at Portion X;
- Filling Works behind Stone Platform at Portion X;
- Construction of Seawall at Portion X;
- Loading and Unloading Filling Material at Portion X;
- Temporary Stone Platform Construction at Portion X;
- Pipe Piling at Portion X;
- Excavation and Lateral Support Works at Scenic Hill Tunnel (Cut & Cover Tunnel) at Portion X;
- Laying blinding layer for tunnel box structure at Scenic Hill Tunnel (Cut & Cover Tunnel) at Portion

X;

- Construction of tunnel box structure at Scenic Hill Tunnel (Cut & Cover Tunnel) at Portion X.
- Socket H-Piling work at Scenic Hill Tunnel (Cut & Cover Tunnel) at Portion X;
- Excavation Works for HKBCF to Airport Tunnel at Portion X;
- Socket H-Piling work for HKBCF to Airport Tunnel East (Cut &Cover Tunnel) at Portion X;
- Pipe Piling works for HKBCF to Airport Tunnel East (Cut &Cover Tunnel) at Portion X;
- Works for Diversion of Airport Road;
- Utilities Detection at Airport Road / Airport Express Line/ East Coast Road;
- Establishment of Site Access at Airport Road / Airport Express Line/East Coast Road;
- Canopy Pipe Drilling underneath Airport Express Line;
- Excavation and Lateral Support Works at shaft 3 extension north shaft & south shaft at Kwo Lo Wan Road;
- Excavation and Lateral Support Works for HKBCF to Airport Tunnel West (Cut & Cover Tunnel) at Airport Road;
- Utility Culvert Excavation at Portion Y;
- Highway Operation and Maintenance Area Building Foundation Works at Portion Y;
- Excavation for Scenic Hill Tunnel at West Portal; and
- Ventilation Building Foundation Works at West Portal.

1 Introduction

1.1 Basic Project Information

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

1.1.2 The HKLR project has been separated into two contracts. They are Contract No. HY/2011/03 Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road-Section between Scenic Hill and Hong Kong Boundary Crossing Facilities (hereafter referred to as the Contract) and Contract No. HY/2011/09 Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road-Section between HKSAR Boundary and Scenic Hill.

1.1.3 China State Construction Engineering (Hong Kong) Ltd. was awarded by Highways Department (HyD) as the Contractor to undertake the construction works of Contract No. HY/2011/03. The Contract is part of the HKLR Project and HKBCF Project, these projects are considered to be "Designated Projects", under Schedule 2 of the Environmental Impact Assessment (EIA) Ordinance (Cap 499) and Environmental Impact Assessment (EIA) Reports (Register No. AEIAR-144/2009 and AEIAR-145/2009) were prepared for the Project. The current Environmental Permit (EP) EP-352/2009/D for HKLR and EP-353/2009/H for HKBCF were issued on 22 December 2014 and 19 January 2015, respectively. These documents are available through the EIA Ordinance Register. The construction phase of Contract was commenced on 17 October 2012. **Figure 1.1** shows the project site boundary. The works areas are shown in **Appendix O**.

1.1.4 The Contract includes the following key aspects:

- New reclamation along the east coast of the approximately 23 hectares.
- Tunnel of Scenic Hill (Tunnel SHT) from Scenic Hill to the new reclamation, of approximately 1km in length with three (3) lanes for the east bound carriageway heading to the HKBCF and four (4) lanes for the westbound carriageway heading to the HZMB Main Bridge.
- An abutment of the viaduct portion of the HKLR at the west portal of Tunnel SHT and associated road works at the west portal of Tunnel SHT.
- An at grade road on the new reclamation along the east coast of the HKIA to connect with the HKBCF, of approximately 1.6 km along dual 3-lane carriageway with hard shoulder for each bound.
- Road links between the HKBCF and the HKIA including new roads and the modification of existing roads at the HKIA, involving viaducts, at grade roads and a Tunnel HAT.
- A highway operation and maintenance area (HMA) located on the new reclamation, south of the Dragonair Headquarters Building, including the construction of buildings, connection roads and other associated facilities.
- Associated civil, structural, building, geotechnical, marine, environmental protection, landscaping, drainage and sewerage, tunnel and highway electrical and mechanical works, together with the installation of street lightings, traffic aids and sign gantries, water mains and fire hydrants, provision of facilities for installation of traffic control and surveillance system (TCSS), reprovisioning works of affected existing facilities, implementation of transplanting, compensatory planting and protection of existing trees, and implementation of an environmental monitoring and audit (EM&A) program.

1.1.5 This is the thirty-third Monthly EM&A report for the Contract which summarizes the monitoring results and audit findings of the EM&A programme during the reporting period from 1 to 30 June 2015.

1.1.6 BMT Asia Pacific Limited has been appointed by the Contractor to implement the EM&A programme for the Contract in accordance with the Updated EM&A Manual for HKLR (Version 1.0) for HKLR and will be providing environmental team services to the Contract. Ramboll Environ Hong Kong Ltd. was employed by HyD as the Independent Environmental Checker (IEC) and Environmental Project Office (ENPO) for the Project. The project organization with regard to the environmental works is as follows.

1.2 Project Organisation

1.2.1 The project organization structure and lines of communication with respect to the on-site environmental management structure is shown in **Appendix A**. The key personnel contact names and numbers are summarized in **Table 1.1**.

Table 1.1 Contact Information of Key Personnel

Party	Position	Name	Telephone	Fax
Supervising Officer's Representative (Ove Arup & Partners Hong Kong Limited)	(Chief Resident Engineer, CRE)	Robert Antony Evans	3968 0801	2109 1882
Environmental Project Office / Independent Environmental Checker (Ramboll Environ Hong Kong Limited)	Environmental Project Office Leader	Y. H. Hui	3465 2888	3465 2899
	Independent Environmental Checker	Antony Wong	3465 2888	3465 2899
Contractor (China State Construction Engineering (Hong Kong) Ltd)	Project Manager	S. Y. Tse	3968 7002	2109 2588
	Environmental Officer	Federick Wong	3968 7117	2109 2588
Environmental Team (BMT Asia Pacific)	Environmental Team Leader	Claudine Lee	2241 9847	2815 3377
24 hours complaint hotline	---	---	5699 5730	---

1.3 Construction Programme

1.3.1 A copy of the Contractor's construction programme is provided in **Appendix B**.

1.4 Construction Works Undertaken During the Reporting Month

1.4.1 A summary of the construction activities undertaken during this reporting month is shown in **Table 1.2.**

Table 1.2 Construction Activities During Reporting Month

Description of Activities	Site Area
Dismantling/trimming of temporary 40mm stone platform for construction of seawall	Portion X
Filling works behind stone platform	Portion X
Construction of seawall	Portion X
Loading and unloading of filling materials	Portion X
Temporary stone platform construction	Portion X
Excavation and lateral support works for Scenic Hill Tunnel (Cut & Cover Tunnel)	Portion X
Socket H-Piling work for Scenic Hill Tunnel (Cut & Cover Tunnel)	Portion X
Laying blinding layer for tunnel box structure at Scenic Hill Tunnel (Cut & Cover Tunnel)	Portion X
Construction of tunnel box structure at Scenic Hill Tunnel (Cut & Cover Tunnel) at Portion X	Portion X
Excavation for HKBCF to Airport Tunnel	Portion X
Excavation for Scenic Hill Tunnel	West Portal
Ventilation building foundation works	West Portal
Works for diversion of Airport Road	Airport Road
Utilities detection	Airport Road/ Airport Express Line/ East Coast Road
Establishment of Site Access	Airport Road/ Airport Express Line/ East Coast Road
Canopy pipe drilling underneath Airport Express Line	Airport Express Line
Excavation and lateral support works at shaft 3 extension north shaft & south shaft	Kwo Lo Wan Road
Excavation and Lateral Support Works for HKBCF to Airport Tunnel West (Cut & Cover Tunnel)	Airport Road
Utility culvert excavation	Portion Y
Highway Operation and Maintenance Area Building Foundation Works	Portion Y

2 Air Quality Monitoring

2.1 Monitoring Requirements

2.1.1 In accordance with the Contract Specific EM&A Manual, baseline 1-hour and 24-hour TSP levels at two air quality monitoring stations were established. Impact 1-hour TSP monitoring was conducted for at least three times every 6 days, while impact 24-hour TSP monitoring was carried out for at least once every 6 days. The Action and Limit Level for 1-hr TSP and 24-hr TSP are provided in **Table 2.1** and **Table 2.2**, respectively.

Table 2.1 Action and Limit Levels for 1-hour TSP

Monitoring Station	Action Level, μg/m^3	Limit Level, μg/m^3
AMS 5 – Ma Wan Chung Village (Tung Chung)	352	500
AMS 6 – Dragonair / CNAC (Group) Building (HKIA)	360	

Table 2.2 Action and Limit Levels for 24-hour TSP

Monitoring Station	Action Level, μg/m^3	Limit Level, μg/m^3
AMS 5 – Ma Wan Chung Village (Tung Chung)	164	260
AMS 6 – Dragonair / CNAC (Group) Building (HKIA)	173	260

2.2 Monitoring Equipment

2.2.1 24-hour TSP air quality monitoring was performed using High Volume Sampler (HVS) located at each designated monitoring station. The HVS meets all the requirements of the Contract Specific EM&A Manual. Portable direct reading dust meters were used to carry out the 1-hour TSP monitoring. Brand and model of the equipment is given in **Table 2.3**.

Table 2.3 Air Quality Monitoring Equipment

Equipment	Brand and Model
Portable direct reading dust meter (1-hour TSP)	Sibata Digital Dust Monitor (Model No. LD-3B)
High Volume Sampler (24-hour TSP)	Tisch Environmental Mass Flow Controlled Total Suspended Particulate (TSP) High Volume Air Sampler (Model No. TE-5170)

2.3 Monitoring Locations

2.3.1 Monitoring locations AMS5 and AMS6 were set up at the proposed locations in accordance with Contract Specific EM&A Manual.

2.3.2 **Figure 2.1** shows the locations of monitoring stations. **Table 2.4** describes the details of the monitoring stations.

Table 2.4 Locations of Impact Air Quality Monitoring Stations

Monitoring Station	Location
AMS5	Ma Wan Chung Village (Tung Chung)
AMS6	Dragonair / CNAC (Group) Building (HKIA)

2.4 Monitoring Parameters, Frequency and Duration

2.4.1 **Table 2.5** summarizes the monitoring parameters, frequency and duration of impact TSP monitoring.

Table 2.5 Air Quality Monitoring Parameters, Frequency and Duration

Parameter	Frequency and Duration
1-hour TSP	Three times every 6 days while the highest dust impact was expected
24-hour TSP	Once every 6 days

2.5 Monitoring Methodology

2.5.1 24-hour TSP Monitoring

(a) The HVS was installed in the vicinity of the air sensitive receivers. The following criteria were considered in the installation of the HVS.

(i) A horizontal platform with appropriate support to secure the sampler against gusty wind was provided.

(ii) The distance between the HVS and any obstacles, such as buildings, was at least twice the height that the obstacle protrudes above the HVS.

(iii) A minimum of 2 meters separation from walls, parapets and penthouse for rooftop sampler was provided.

(iv) No furnace or incinerator flues are nearby.

(v) Airflow around the sampler was unrestricted.

(vi) Permission was obtained to set up the samplers and access to the monitoring stations.

(vii) A secured supply of electricity was obtained to operate the samplers.

(viii) The sampler was located more than 20 meters from any dripline.

(ix) Any wire fence and gate, required to protect the sampler, did not obstruct the monitoring process.

(x) Flow control accuracy was kept within ±2.5% deviation over 24-hour sampling period.

(b) Preparation of Filter Papers

(i) Glass fibre filters, G810 were labelled and sufficient filters that were clean and without pinholes were selected.

(ii) All filters were equilibrated in the conditioning environment for 24 hours before weighing. The conditioning environment temperature was around 25 ℃ and not variable by more than ±3 ℃; the relative humidity (RH) was < 50% and not variable by more than ±5%. A convenient working RH was 40%.

(iii) All filter papers were prepared and analysed by ALS Technichem (HK) Pty Ltd., which is a HOKLAS accredited laboratory and has comprehensive quality assurance and quality control programmes.

(c) Field Monitoring

(i) The power supply was checked to ensure the HVS works properly.

(ii) The filter holder and the area surrounding the filter were cleaned.

(iii) The filter holder was removed by loosening the four bolts and a new filter, with stamped number upward, on a supporting screen was aligned carefully.

(iv) The filter was properly aligned on the screen so that the gasket formed an airtight seal on the outer edges of the filter.

(v) The swing bolts were fastened to hold the filter holder down to the frame. The pressure applied was sufficient to avoid air leakage at the edges.

(vi) Then the shelter lid was closed and was secured with the aluminium strip.

(vii) The HVS was warmed-up for about 5 minutes to establish run-temperature conditions.

(viii) A new flow rate record sheet was set into the flow recorder.

(ix) On site temperature and atmospheric pressure readings were taken and the flow rate of the HVS was checked and adjusted at around 1.1 m^3/min, and complied with the range specified in the Updated EM&A Manual for HKLR (Version 1.0) (i.e. 0.6-1.7 m^3/min).

(x) The programmable digital timer was set for a sampling period of 24 hours, and the starting time, weather condition and the filter number were recorded.

(xi) The initial elapsed time was recorded.

(xii) At the end of sampling, on site temperature and atmospheric pressure readings were taken and the final flow rate of the HVS was checked and recorded.

(xiii) The final elapsed time was recorded.

(xiv) The sampled filter was removed carefully and folded in half length so that only surfaces with collected particulate matter were in contact.

(xv) It was then placed in a clean plastic envelope and sealed.

(xvi) All monitoring information was recorded on a standard data sheet.

(xvii) Filters were then sent to ALS Technichem (HK) Pty Ltd. for analysis.

(d) Maintenance and Calibration

(i) The HVS and its accessories were maintained in good working condition, such as replacing motor brushes routinely and checking electrical wiring to ensure a continuous power supply.

(ii) 5-point calibration of the HVS was conducted using TE-5025A Calibration Kit prior to the commencement of baseline monitoring. Bi-monthly 5-point calibration of the HVS will be carried out during impact monitoring.

(iii) Calibration certificate of the HVSs are provided in **Appendix C**.

2.5.2 1-hour TSP Monitoring

(a) Measuring Procedures

The measuring procedures of the 1-hour dust meter were in accordance with the Manufacturer's Instruction Manual as follows:-

(i) Turn the power on.

(ii) Close the air collecting opening cover.

(iii) Push the "TIME SETTING" switch to [BG].

(iv) Push "START/STOP" switch to perform background measurement for 6 seconds.

(v) Turn the knob at SENSI ADJ position to insert the light scattering plate.

(vi) Leave the equipment for 1 minute upon "SPAN CHECK" is indicated in the display.

(vii) Push "START/STOP" switch to perform automatic sensitivity adjustment. This measurement takes 1 minute.

(viii) Pull out the knob and return it to MEASURE position.

(ix) Push the "TIME SETTING" switch the time set in the display to 3 hours.

(x) Lower down the air collection opening cover.

(xi) Push "START/STOP" switch to start measurement.

(b) Maintenance and Calibration

(i) The 1-hour TSP meter was calibrated at 1-year intervals against a Tisch Environmental Mass Flow Controlled Total Suspended Particulate (TSP) High Volume Air Sampler. Calibration certificates of the Laser Dust Monitors are provided in **Appendix C**.

2.6 Monitoring Schedule for the Reporting Month

2.6.1 The schedule for air quality monitoring June 2015 is provided in **Appendix D**.

2.7 Monitoring Results

2.7.1 The monitoring results for 1-hour TSP and 24-hour TSP are summarized in **Tables 2.6** and **2.7** respectively. Detailed impact air quality monitoring results and relevant graphical plots are presented in **Appendix E**.

Table 2.6 Summary of 1-hour TSP Monitoring Results During the Reporting Month

Monitoring Station	Average (μg/m^3)	Range (μg/m^3)	Action Level (μg/m^3)	Limit Level (μg/m^3)
AMS5	66	55 - 92	352	500
AMS6	65	55 - 76	360	500

Table 2.7 Summary of 24-hour TSP Monitoring Results During the Reporting Month

Monitoring Station	Average (μg/m^3)	Range (μg/m^3)	Action Level (μg/m^3)	Limit Level (μg/m^3)
AMS5	18	13 - 23	164	260
AMS6	37	26 - 46	173	260

2.7.2 No Action and Limit Level exceedances of 1-hour TSP and 24-hour TSP were recorded at AMS5 and AMS6 during the reporting month.

2.7.3 The event action plan is annexed in **Appendix F**.

2.7.4 The wind data obtained from the on-site weather station during the reporting month is shown in **Appendix G**.

3 Noise Monitoring

3.1 Monitoring Requirements

3.1.1 In accordance with the Contract Specific EM&A Manual, impact noise monitoring was conducted for at least once per week during the construction phase of the Project. The Action and Limit level of the noise monitoring is provided in **Table 3.1**.

Table 3.1 Action and Limit Levels for Noise during Construction Period

Monitoring Station	Time Period	Action Level	Limit Level
NMS5 – Ma Wan Chung Village (Ma Wan Chung Resident Association) (Tung Chung)	0700-1900 hours on normal weekdays	When one documented complaint is received	75 dB(A)

3.2 Monitoring Equipment

3.2.1 Noise monitoring was performed using sound level meters at each designated monitoring station. The sound level meters deployed comply with the International Electrotechnical Commission Publications (IEC) 651:1979 (Type 1) and 804:1985 (Type 1) specifications. Acoustic calibrator was deployed to check the sound level meters at a known sound pressure level. Brand and model of the equipment are given in **Table 3.2**.

Table 3.2 Noise Monitoring Equipment

Equipment	Brand and Model
Integrated Sound Level Meter	B&K 2238
Acoustic Calibrator	B&K 4231

3.3 Monitoring Locations

3.3.1 Monitoring location NMS5 was set up at the proposed locations in accordance with Contract Specific EM&A Manual.

3.3.2 **Figure 2.1** shows the locations of monitoring stations. **Table 3.3** describes the details of the monitoring stations.

Table 3.3 Locations of Impact Noise Monitoring Stations

Monitoring Station	Location
NMS5	Ma Wan Chung Village (Ma Wan Chung Resident Association) (Tung Chung)

3.4 Monitoring Parameters, Frequency and Duration

3.4.1 **Table 3.4** summarizes the monitoring parameters, frequency and duration of impact noise monitoring.

Table 3.4 Noise Monitoring Parameters, Frequency and Duration

Parameter	Frequency and Duration
30-mins measurement at each monitoring station between 0700 and 1900 on normal weekdays (Monday to Saturday). L_{eq}, L_{10} and L_{90} would be recorded.	At least once per week

3.5 Monitoring Methodology

3.5.1 Monitoring Procedure

(a) The sound level meter was set on a tripod at a height of 1.2 m above the podium for free-field measurements at NMS5. A correction of +3 dB(A) shall be made to the free field measurements.

(b) The battery condition was checked to ensure the correct functioning of the meter.

(c) Parameters such as frequency weighting, the time weighting and the measurement time were set as follows:-

(i) frequency weighting: A

(ii) time weighting: Fast

(iii) time measurement: $L_{eq(30\text{-minutes})}$ during non-restricted hours i.e. 07:00 – 1900 on normal weekdays

(e) Prior to and after each noise measurement, the meter was calibrated using the acoustic calibrator for 94.0 dB(A) at 1000 Hz. If the difference in the calibration level before and after measurement was more than 1.0 dB(A), the measurement would be considered invalid and repeat of noise measurement would be required after re-calibration or repair of the equipment.

(f) During the monitoring period, the L_{eq}, L_{10} and L_{90} were recorded. In addition, site conditions and noise sources were recorded on a standard record sheet.

(g) Noise measurement was paused during periods of high intrusive noise (e.g. dog barking, helicopter noise) if possible. Observations were recorded when intrusive noise was unavoidable.

(h) Noise monitoring was cancelled in the presence of fog, rain, wind with a steady speed exceeding 5m/s, or wind with gusts exceeding 10m/s. The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s.

3.5.2 Maintenance and Calibration

(a) The microphone head of the sound level meter was cleaned with soft cloth at regular intervals.

(b) The meter and calibrator were sent to the supplier or HOKLAS laboratory to check and calibrate at yearly intervals.

(c) Calibration certificates of the sound level meters and acoustic calibrators are provided in **Appendix C**.

3.6 Monitoring Schedule for the Reporting Month

3.6.1 The schedule for construction noise monitoring in June 2015 is provided in **Appendix D**.

3.7 Monitoring Results

3.7.1 The monitoring results for construction noise are summarized in **Table 3.5** and the monitoring results and relevant graphical plots are provided in **Appendix E.**

Table 3.5 Summary of Construction Noise Monitoring Results During the Reporting Month

Monitoring Station	Average $L_{eq\ (30\ mins)}$, dB(A)	Range of $L_{eq\ (30\ mins)}$, dB(A)	Limit Level $L_{eq\ (30\ mins)}$, dB(A)
NMS5	68	64 – 70	75

*A correction factor of +3dB(A) from free field to facade measurement was included.

3.7.2 There were no Action and Limit Level exceedances for noise during daytime on normal weekdays of the reporting month.

3.7.3 Major noise sources during the noise monitoring included construction activities of the Contract, nearby traffic and insect noise.

3.7.4 The event action plan is annexed in **Appendix F.**

4 Water Quality Monitoring

4.1 Monitoring Requirements

4.1.1 Impact water quality monitoring was carried out to ensure that any deterioration of water quality was detected, and that timely action was taken to rectify the situation. For impact water quality monitoring, measurements were taken in accordance with the Contract Specific EM&A Manual. **Table 4.1** shows the established Action/Limit Levels for the environmental monitoring works. The ET proposed to amend the Acton Level and Limit Level for turbidity and suspended solid and EPD approved ET's proposal on 25 March 2013. Therefore, Action Level and Limit Level for the Contract have been changed since 25 March 2013.

4.1.2 The original and revised Action Level and Limit Level for turbidity and suspended solid are shown in **Table 4.1**.

Table 4.1 Action and Limit Levels for Water Quality

Parameter (unit)	Water Depth	Action Level	Limit Level
Dissolved Oxygen (mg/L) (surface, middle and bottom)	Surface and Middle	5.0	4.2 except 5 for Fish Culture Zone
	Bottom	4.7	3.6
Turbidity (NTU)	Depth average	27.5 or 120% of upstream control station's turbidity at the same tide of the same day; The action level has been amended to "27.5 ***and*** 120% of upstream control station's turbidity at the same tide of the same day" since 25 March 2013.	47.0 or 130% of turbidity at the upstream control station at the same tide of same day; The limit level has been amended to "47.0 ***and*** 130% of turbidity at the upstream control station at the same tide of same day" since 25 March 2013.
Suspended Solid (SS) (mg/L)	Depth average	23.5 or 120% of upstream control station's SS at the same tide of the same day; The action level has been amended to "23.5 ***and*** 120% of upstream control station's SS at the same tide of the same day" since 25 March 2013.	34.4 or 130% of SS at the upstream control station at the same tide of same day and 10mg/L for Water Services Department Seawater Intakes; The limit level has been amended to "34.4 ***and*** 130% of SS at the upstream control station at the same tide of same day and 10mg/L for Water Services Department Seawater Intakes" since 25 March 2013

Notes:
(1) Depth-averaged is calculated by taking the arithmetic means of reading of all three depths.
(2) For DO, non-compliance of the water quality limit occurs when monitoring result is lower that the limit.
(3) For SS & turbidity non-compliance of the water quality limits occur when monitoring result is higher

than the limits.

(4) The change to the Action and limit Levels for Water Quality Monitoring for the EM&A works was approved by EPD on 25 March 2013.

4.2 Monitoring Equipment

4.2.1 **Table 4.2** summarises the equipment used in the impact water quality monitoring programme.

Table 4.2 Water Quality Monitoring Equipment

Equipment	Brand and Model
DO and Temperature Meter, Salinity Meter, Turbidimeter and pH Meter	YSI Model 6820 V2-M, 650
Positioning Equipment	DGPS – KODEN : KGP913MkII, KBG3
Water Depth Detector	Layin Associates: SM-5 & SM5A
Water Sampler	Wildlife Supply Company : 5487-10

4.3 Monitoring Parameters, Frequency and Duration

4.3.1 **Table 4.3** summarises the monitoring parameters, frequency and monitoring depths of impact water quality monitoring as required in the Contract Specific EM&A Manual.

Table 4.3 Impact Water Quality Monitoring Parameters and Frequency

Monitoring Stations	Parameter, unit	Frequency	No. of depth
Impact Stations: IS5, IS(Mf)6, IS7, IS8, IS(Mf)9 & IS10, Control/Far Field Stations: CS2 & CS(Mf)5, Sensitive Receiver Stations: SR3, SR4, SR5, SR10A & SR10B	• Depth, m • Temperature, °C • Salinity, ppt • Dissolved Oxygen (DO), mg/L • DO Saturation, % • Turbidity, NTU • pH • Suspended Solids (SS), mg/L	Three times per week during mid-ebb and mid-flood tides (within ± 1.75 hour of the predicted time)	3 (1 m below water surface, mid-depth and 1 m above sea bed, except where the water depth is less than 6 m, in which case the mid-depth station may be omitted. Should the water depth be less than 3 m, only the mid-depth station will be monitored).

4.4 Monitoring Locations

4.4.1 In accordance with the Contract Specific EM&A Manual, thirteen stations (6 Impact Stations, 5 Sensitive Receiver Stations and 2 Control Stations) were designated for impact water quality monitoring. The six Impact Stations (IS) were chosen on the basis of their proximity to the reclamation and thus the greatest potential for water quality impacts, the five Sensitive Receiver Stations (SR) were chosen as they are close to the key sensitive receives and the two Control Stations (CS) were chosen to facilitate comparison of the water quality of the IS stations with less influence by the Project/ ambient water quality conditions.

4.4.2 The locations of these monitoring stations are summarized in **Table 4.4** and shown in **Figure 2.1**.

Table 4.4 Impact Water Quality Monitoring Stations

Monitoring Stations	Description	Coordinates	
		Easting	Northing
IS5	Impact Station (Close to HKLR construction site)	811579	817106
IS(Mf)6	Impact Station (Close to HKLR construction site)	812101	817873
IS7	Impact Station (Close to HKBCF construction site)	812244	818777
IS8	Impact Station (Close to HKBCF construction site)	814251	818412
IS(Mf)9	Impact Station (Close to HKBCF construction site)	813273	818850
IS10	Impact Station (Close to HKBCF construction site)	812577	820670
SR3	Sensitive receivers (San Tau SSSI)	810525	816456
SR4	Sensitive receivers (Tai Ho Inlet)	814760	817867
SR5	Sensitive receivers (Artificial Reef In NE Airport)	811489	820455
SR10A	Sensitive receivers (Ma Wan Fish Culture Zone)	823741	823495
SR10B	Sensitive receivers (Ma Wan Fish Culture Zone)	823686	823213
CS2	Control Station (Mid-Ebb)	805849	818780
CS(Mf)5	Control Station (Mid-Flood)	817990	821129

4.5 Monitoring Methodology

4.5.1 Instrumentation

(a) The in-situ water quality parameters including dissolved oxygen, temperature, salinity and turbidity, pH were measured by multi-parameter meters.

4.5.2 Operating/Analytical Procedures

(a) Digital Differential Global Positioning Systems (DGPS) were used to ensure that the correct location was selected prior to sample collection.

(b) Portable, battery-operated echo sounders were used for the determination of water depth at each designated monitoring station.

(c) All in-situ measurements were taken at 3 water depths, 1 m below water surface, mid-depth and 1 m above sea bed, except where the water depth was less than 6 m, in which case the mid-depth station was omitted. Should the water depth be less than 3 m, only the mid-depth station was monitored.

(d) At each measurement/sampling depth, two consecutive in-situ monitoring (DO concentration and saturation, temperature, turbidity, pH, salinity) and water sample for SS. The probes were retrieved out of the water after the first measurement and then re-deployed for the second measurement. Where the difference in the value between the first and second readings of DO or turbidity parameters was more than 25% of the value of the first reading, the reading was discarded and further readings were taken.

(e) Duplicate samples from each independent sampling event were collected for SS measurement. Water samples were collected using the water samplers and the samples were stored in high-density polythene bottles. Water samples collected were well-mixed in the water sampler prior to pre-rinsing and transferring to sample bottles. Sample bottles were pre-rinsed with the same water samples. The sample bottles were then be packed in cool-boxes (cooled at 4°C without being frozen), and delivered to ALS Technichem (HK) Pty Ltd. for the analysis of suspended solids concentrations. The laboratory determination work would be started within 24 hours after collection of the water samples. ALS Technichem (HK) Pty Ltd. is a HOKLAS accredited laboratory and has comprehensive quality assurance and quality control programmes.

(f) The analysis method and detection limit for SS is shown in **Table 4.5**.

Table 4.5 Laboratory Analysis for Suspended Solids

Parameters	Instrumentation	Analytical Method	Detection Limit
Suspended Solid (SS)	Weighting	APHA 2540-D	0.5mg/L

(g) Other relevant data were recorded, including monitoring location / position, time, water depth, tidal stages, weather conditions and any special phenomena or work underway at the construction site in the field log sheet for information.

4.5.3 Maintenance and Calibrations

(a) All in situ monitoring instruments would be calibrated by ALS Technichem (HK) Pty Ltd. before use and at 3-monthly intervals throughout all stages of the water quality monitoring programme. The procedures of performance check of sonde and testing results are provided in **Appendix C.**

4.6 Monitoring Schedule for the Reporting Month

4.6.1 The schedule for impact water quality monitoring in June 2015 is provided in **Appendix D.**

4.7 Monitoring Results

4.7.1 Impact water quality monitoring was conducted at all designated monitoring stations during the reporting month. Impact water quality monitoring results and relevant graphical plots are provided in **Appendix E.**

4.7.2 For marine water quality monitoring, no Action Level and Limit Level exceedance of turbidity level, dissolved oxygen level and suspended solid level were recorded during the reporting month.

4.7.1 Water quality impact sources during the water quality monitoring were the construction activities of the Contract, nearby construction activities by other parties and nearby operating vessels by other parties.

4.7.2 The event action plan is annexed in **Appendix F**.

5 Dolphin Monitoring

5.1 Monitoring Requirements

5.1.1 Impact dolphin monitoring is required to be conducted by a qualified dolphin specialist team to evaluate whether there have been any effects on the dolphins.

5.1.2 The Action Level and Limit Level for dolphin monitoring are shown in **Table 5.1**.

Table 5.1 Action and Limit Levels for Dolphin Monitoring

	North Lantau Social Cluster	
	NEL	**NWL**
Action Level	STG < 4.2 & ANI < 15.5	STG < 6.9 & ANI < 31.3
Limit Level	(STG < 2.4 & ANI < 8.9) and (STG < 3.9 & ANI < 17.9)	

Remarks:

1. STG means quarterly encounter rate of number of dolphin sightings.
2. ANI means quarterly encounter rate of total number of dolphins.
3. For North Lantau Social Cluster, AL will be trigger if either NEL **or** NWL fall below the criteria; LL will be triggered if both NEL **and** NWL fall below the criteria.

5.1.3 The revised Event and Action Plan for dolphin Monitoring was approved by EPD in 6 May 2013. The revised Event and Action Plan is annexed in **Appendix F.**

5.2 Monitoring Methodology

Vessel-based Line-transect Survey

5.2.1 According to the requirements of the Updated EM&A Manual for HKLR (Version 1.0), dolphin monitoring programme should cover all transect lines in NEL and NWL survey areas (see **Figure 1 of Appendix H**) twice per month. The co-ordinates of all transect lines are shown in **Table 5.2**.

Table 5.2 Co-ordinates of Transect Lines

Line No.		Easting	Northing		Line No.		Easting	Northing
1	Start Point	804671	814577		13	Start Point	816506	819480
1	End Point	804671	831404		13	End Point	816506	824859
2	Start Point	805475	815457		14	Start Point	817537	820220
2	End Point	805477	826654		14	End Point	817537	824613
3	Start Point	806464	819435		15	Start Point	818568	820735
3	End Point	806464	822911		15	End Point	818568	824433
4	Start Point	807518	819771		16	Start Point	819532	821420
4	End Point	807518	829230		16	End Point	819532	824209
5	Start Point	808504	820220		17	Start Point	820451	822125
5	End Point	808504	828602		17	End Point	820451	823671
6	Start Point	809490	820466		18	Start Point	821504	822371
6	End Point	809490	825352		18	End Point	821504	823761
7	Start Point	810499	820690		19	Start Point	822513	823268

Line No.		Easting	Northing		Line No.		Easting	Northing
7	End Point	810499	824613		19	End Point	822513	824321
8	Start Point	811508	820847		20	Start Point	823477	823402
8	End Point	811508	824254		20	End Point	823477	824613
9	Start Point	812516	820892		21	Start Point	805476	827081
9	End Point	812516	824254		21	End Point	805476	830562
10	Start Point	813525	820872		22	Start Point	806464	824033
10	End Point	813525	824657		22	End Point	806464	829598
11	Start Point	814556	818449		23	Start Point	814559	821739
11	End Point	814556	820992		23	End Point	814559	824768
12	Start Point	815542	818807					
12	End Point	815542	824882					

5.2.2 The survey team used standard line-transect methods (Buckland et al. 2001) to conduct the systematic vessel surveys, and followed the same technique of data collection that has been adopted over the last 16 years of marine mammal monitoring surveys in Hong Kong developed by HKCRP (see Hung 2012, 2013). For each monitoring vessel survey, a 15-m inboard vessel with an open upper deck (about 4.5 m above water surface) was used to make observations from the flying bridge area.

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

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

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

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

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

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

Photo-identification Work

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

5.2.10 A professional digital cameras (Canon EOS 7D and 60D models), equipped with long telephoto lenses (100-400 mm zoom), were available on board for researchers to take sharp, close-up photographs of dolphins as they surfaced. The images were shot at the highest available resolution and stored on Compact Flash memory cards for downloading onto a computer.

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

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

5.2.13 All photographs of each individual were then compiled and arranged in chronological order, with data including the date and location first identified (initial sighting), re-sightings, associated dolphins, distinctive features, and age classes entered into a computer database. Detailed information on all identified individuals will be further presented as an appendix in quarterly EM&A reports.

5.3 Monitoring Results

Vessel-based Line-transect Survey

5.3.1 During the month of June 2015, two sets of systematic line-transect vessel surveys were conducted on 2nd, 10th, 24th and 26th to cover all transect lines in NWL and NEL survey areas twice. The survey routes of each survey day are presented in **Figures 2 to 5 of Appendix H**.

5.3.2 From these surveys, a total of 301.30 km of survey effort was collected, with 91.6% of the total survey effort being conducted under favourable weather conditions (i.e. Beaufort Sea State 3 or below with good visibility) (**Annex I of Appendix H**). Among the two areas, 115.90 km and 185.40 km of survey effort were collected from NEL and NWL survey areas respectively. Moreover, the total survey effort conducted on primary lines was 220.07 km, while the effort on secondary lines was 81.23 km.

5.3.3 During the two sets of monitoring surveys in June 2015, three groups of 15 Chinese White Dolphins were sighted. (**Annex II of Appendix H**). Two sightings were made in NWL, while one sighting of a lone dolphin was made in NEL. In fact, this lone dolphin was the only one sighted in NEL waters since July 2014.

5.3.4 During June's surveys, all three dolphin sightings were made on primary lines during on-effort search, and none of the dolphin groups was associated with operating fishing vessel.

5.3.5 Distribution of these dolphin sightings made in June 2015 is shown in **Figure 6 of Appendix H**. Both sightings made in NWL were located near Lung Kwu Chau, while the lone dolphin sighted in NEL was found to the east of Siu Mo To (**Figure 6 of Appendix H**).

5.3.6 Notably, none of the three sightings was made in the proximity of the HKLR03 and HKBCF reclamation sites, as well as the HKLR09 and TMCLKL alignments (**Figure 6 of Appendix H**).

5.3.7 During June's surveys, encounter rates of Chinese White Dolphins deduced from the survey effort and on-effort sighting data made under favourable conditions (Beaufort 3 or below) are shown in **Table 5.3** and **Table 5.4**.

5.3.8 The average group size of Chinese White Dolphins in June 2015 was 5.00 individuals per group. This average was higher than previous months of dolphin monitoring, which was mainly attributed by the large group of 10 dolphins sighted during the first monitoring survey in June near Lung Kwu Chau.

Table 5.3 Individual Survey Event Encounter Rates

		Encounter rate (STG) (no. of on-effort dolphin sightings per 100 km of survey effort)	Encounter rate (ANI) (no. of dolphins from all on-effort sightings per 100 km of survey effort)
		Primary Lines Only	Primary Lines Only
NEL	Set 1: June 2nd / 10th	0.0	0.0
	Set 2: June 24th / 26th	2.6	2.6
NWL	Set 1: June 2nd / 10th	1.5	15.2
	Set 2: June 24th / 26th	0.0	0.0

Remarks:

1. Dolphin Encounter Rates Deduced from the Two Sets of Surveys (Two Surveys in Each Set) in June 2015 in Northeast (NEL) and Northwest Lantau (NWL).

Table 5.4 Monthly Average Encounter Rates

	Encounter rate (STG) (no. of on-effort dolphin sightings per 100 km of survey effort)		Encounter rate (ANI) (no. of dolphins from all on-effort sightings per 100 km of survey effort)	
	Primary Lines Only	Both Primary and Secondary Lines	Primary Lines Only	Both Primary and Secondary Lines
Northeast Lantau	1.3	0.9	1.3	0.9
Northwest Lantau	0.8	0.6	7.8	6.2

Remarks:

1. Monthly Average Dolphin Encounter Rates (Sightings Per 100 km of Survey Effort) from All Four Surveys Conducted in June 2015 on Primary Lines only as well as Both Primary Lines and Secondary Lines in Northeast (NEL) and Northwest Lantau (NWL).

Photo-identification Work

5.3.9 Eleven individual dolphins were sighted 13 times during June's surveys. Almost all of them were sighted only once, except two individuals (NL202 and NL286) that were sighted twice during the monitoring month (**Annex III and IV of Appendix H**).

5.3.10 Notably, two of the 11 individual dolphins (NL104 and NL202) were accompanied with their calves during their re-sightings. These mother-calf pairs have been sighted repeatedly throughout the HKLR03 construction period.

Conclusion

5.3.11 During this month of dolphin monitoring, no adverse impact from the activities of this construction project on Chinese White Dolphins was noticeable from general observations.

5.3.12 Due to monthly variation in dolphin occurrence within the study area, it would be more appropriate to draw conclusion on whether any impacts on dolphins have been detected related to the construction activities of this project in the quarterly EM&A report, where comparison on distribution, group size and encounter rates of dolphins between the quarterly impact monitoring period (June – August 2015) and baseline monitoring period (3-month period) will be made.

5.4 Reference

5.4.1 Buckland, S. T., Anderson, D. R., Burnham, K. P., Laake, J. L., Borchers, D. L., and Thomas, L. 2001. Introduction to distance sampling: estimating abundance of biological populations. Oxford University Press, London.

5.4.2 Hung, S. K. 2012. Monitoring of Marine Mammals in Hong Kong waters: final report (2011-12). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department, 171 pp.

5.4.3 Hung, S. K. 2013. Monitoring of Marine Mammals in Hong Kong waters: final report (2012-13). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department, 168 pp.

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

6 Mudflat Monitoring

6.1 Sedimentation Rate Monitoring

Methodology

6.1.1 To avoid disturbance to the mudflat and nuisance to navigation, no fixed marker/monitoring rod was installed at the monitoring stations. A high precision Global Navigation Satellite System (GNSS) real time location fixing system (or equivalent technology) was used to locate the station in the precision of 1mm, which is reasonable under flat mudflat topography with uneven mudflat surface only at micro level. This method has been used on Agricultural Fisheries and Conservation Department's (AFCD) project, namely Baseline Ecological Monitoring Programme for the Mai Po Inner Deep Bay Ramsar Site for measurement of seabed levels.

6.1.2 Measurements were taken directly on the mudflat surface. The Real Time Kinematic GNSS (RTK GNSS) surveying technology was used to measure mudflat surface levels and 3D coordinates of a survey point. The RTK GNSS survey was calibrated against a reference station in the field before and after each survey. The reference station is a survey control point established by the Lands Department of the HKSAR Government or traditional land surveying methods using professional surveying instruments such as total station, level and/or geodetic GNSS. The coordinates system was in HK1980 GRID system. For this contract, the reference control station was surveyed and established by traditional land surveying methods using professional surveying instruments such as total station, level and RTK GNSS. The accuracy was down to mm level so that the reference control station has relatively higher accuracy. As the reference control station has higher accuracy, it was set as true evaluation relative to the RTK GNSS measurement. All position and height correction were adjusted and corrected to the reference control station. Reference station survey result and professional land surveying calibration is shown as Table 6.1:

Table 6.1 Reference Station Survey result and GNSS RTK calibration result of Round 1

Reference Station	Easting (m)	Northing (m)	Baseline reference elevation (mPD) (A)	Round 1 Survey (mPD) (B)	Calibration Adjustment (B-A)
T1	811248.660mE	816393.173mN	3.840	3.817	-0.023
T2	810806.297mE	815691.822mN	4.625	4.653	+0.028
T3	810778.098mE	815689.918mN	4.651	4.660	+0.009
T4	810274.783mE	816689.068mN	2.637	2.709	+0.072

6.1.3 The precision of the measured mudflat surface level reading (vertical precision setting) was within 10 mm (standard deviation) after averaging the valid survey records of the XYZ HK1980 GRID coordinates. Each survey record at each station was computed by averaging at least three measurements that are within the above specified precision setting. Both digital data logging and written records were collected in the field. Field data on station fixing and mudflat surface measurement were recorded.

Monitoring Locations

6.1.4 Four monitoring stations were established based on the site conditions for the sedimentation monitoring and are shown in **Figure 6.1**.

Monitoring Results

6.1.5 The baseline sedimentation rate monitoring was in September 2012 and impact sedimentation rate monitoring was undertaken on 14 June 2015. The mudflat surface levels at the four established monitoring stations and the corresponding XYZ HK1980 GRID coordinates are presented in **Table 6.2 and Table 6.3.**

Table 6.2 Measured Mudflat Surface Level Results

	Baseline Monitoring (September 2012)			Impact Monitoring (June 2015)		
Monitoring Station	Easting (m)	Northing (m)	Surface Level (mPD)	Easting (m)	Northing (m)	Surface Level (mPD)
S1	810291.160	816678.727	0.950	810291.164	816678.734	1.033
S2	810958.272	815831.531	0.864	810958.282	815831.519	0.953
S3	810716.585	815953.308	1.341	810716.562	815953.324	1.440
S4	811221.433	816151.381	0.931	811221.466	816151.504	1.094

Table 6.3 Comparison of measurement

	Comparison of measurement			Remarks and Recommendation
Monitoring Station	Easting (m)	Northing (m)	Surface Level (mPD)	
S1	0.004	0.006	0.083	Level continuously increased
S2	0.010	-0.012	0.089	Level continuously increased
S3	-0.023	0.016	0.099	Level continuously increased
S4	0.033	0.122	0.163	Level continuously increased

6.1.6 This measurement result was generally and relatively higher than the baseline measurement at S1, S2, S3 and S4. The mudflat level is continuously increased.

6.2 Water Quality Monitoring

6.2.1 The mudflat monitoring covered water quality monitoring data. Reference was made to the water quality monitoring data of the representative water quality monitoring station (i.e. SR3) as in the EM&A Manual. The water quality monitoring location (SR3) is shown in **Figure 2.1**.

6.2.2 Impact water quality monitoring in San Tau (monitoring station SR3) was conducted in June 2015. The monitoring parameters included dissolved oxygen (DO), turbidity and suspended solids (SS).

6.2.3 The Impact monitoring results for SR3 were extracted and summarised below:

Table 6.4 Impact Water Quality Monitoring Results (Depth Average)

Date	Mid Ebb Tide			Mid Flood Tide		
	DO (mg/L)	Turbidity (NTU)	SS (mg/L)	DO (mg/L)	Turbidity (NTU)	SS (mg/L)
1-Jun-15	6.65	8.70	7.50	6.55	8.50	6.05
3-Jun-15	6.31	13.10	17.00	6.33	5.00	4.75
5-Jun-15	5.86	9.55	10.65	6.74	6.20	5.20
8-Jun-15	6.98	5.40	8.05	7.07	3.15	7.15
10-Jun-15	7.07	4.55	4.75	8.10	3.90	5.05
12-Jun-15	7.53	5.55	9.35	9.96	2.75	7.40
15-Jun-15	6.56	7.80	3.30	8.98	6.05	9.10
17-Jun-15	7.29	6.15	4.25	7.38	4.95	4.30
19-Jun-15	6.75	6.60	6.40	6.79	7.15	4.45
22-Jun-15	6.76	6.45	8.45	7.06	3.85	5.25
24-Jun-15	6.48	7.30	5.15	6.33	4.80	3.95
26-Jun-15	5.88	5.15	3.20	6.68	3.90	3.10
29-Jun-15	8.20	6.65	3.65	10.29	7.30	3.90
Average	6.79	7.15	7.05	7.56	5.19	5.36

6.3 Mudflat Ecology Monitoring Methodology

Sampling Zone

6.3.1 In order to collect baseline information of mudflats in the study site, the study site was divided into three sampling zones (labeled as TC1, TC2, TC3) in Tung Chung Bay and one zone in San Tau (labeled as ST) (**Figure 2.1 of Appendix I**). The horizontal length of sampling zones TC1, TC2, TC3 and ST were about 250 m, 300 m, 300 m and 250 m, respectively. Survey of horseshoe crabs, seagrass beds and intertidal communities were conducted in every sampling zone. The present survey was conducted in June 2015 (totally 6 sampling days between 6th and 20th June 2015).

Horseshoe Crabs

6.3.2 Active search method was conducted for horseshoe crab monitoring by two experienced surveyors at every sampling zone. During the search period, any accessible and potential area would be investigated for any horseshoe crab individuals within 2-3 hours in low tide period (tidal level below 1.2 m above Chart Datum (C.D.)). Once a horseshoe crab individual was found, the species was identified referencing to Li (2008). The prosomal width, inhabiting substratum and respective GPS coordinate were recorded. A photographic record was taken for future investigation. Any grouping behavior of individuals, if found, was recorded. The horseshoe crab surveys were conducted on 16th (for TC3 and ST) and 17th (for TC1 and TC2) June 2015. The weather was hot and sunny on both survey days.

Seagrass Beds

6.3.3 Active search method was conducted for seagrass bed monitoring by two experienced surveyors at every sampling zone. During the search period, any accessible and potential area would be investigated for any seagrass beds within 2-3 hours in low tide period. Once seagrass bed was found, the species, estimated area, estimated coverage percentage and respective GPS coordinate were recorded. A photographic record was taken for future investigation. The seagrass beds surveys were conducted on 16th (for TC3 and ST) and 17th (for TC1 and TC2) June 2015. The weather was hot and sunny on both survey days.

Intertidal Soft Shore Communities

6.3.4 The intertidal soft shore community surveys were conducted in low tide period on 6th (for ST), 14th (for TC2), 15st (for TC3) and 20th June 2015 (for TC1). At each sampling zone, three 100 m horizontal transects were laid at high tidal level (H: 2.0 m above C.D.), mid tidal level (M: 1.5 m above C.D.) and low tidal level (L: 1.0 m above C.D.). Along every horizontal transect, ten random quadrats (0.5 m x 0.5m) were placed.

6.3.5 Inside a quadrat, any visible epifauna were collected and were in-situ identified to the lowest practical taxonomical resolution. Whenever possible a hand core sample (10 cm internal diameter × 20 cm depth) of sediments was collected in the quadrat. The core sample was gently washed through a sieve of mesh size 2.0 mm *in-situ*. Any visible infauna were collected and identified. Finally the top 5 cm surface sediments were dug for visible infauna in the quadrat regardless of hand core sample was taken.

6.3.6 All collected fauna were released after recording except some tiny individuals that are too small to be identified on site. These tiny individuals were taken to laboratory for identification under dissecting microscope.

6.3.7 The taxonomic classification was conducted in accordance to the following references: Polychaetes: Fauchald (1977), Yang and Sun (1988); Arthropods: Dai and Yang (1991), Dong (1991); Mollusks: Chan and Caley (2003), Qi (2004).

Data Analysis

6.3.8 Data collected from direct search and core sampling was pooled in every quadrat for data analysis. Shannon-Weaver Diversity Index (H') and Pielou's Species Evenness (J) were calculated for every quadrat using the formulae below,

$H' = -\Sigma (Ni / N) \ln (Ni / N)$ (Shannon and Weaver, 1963)
$J = H' / \ln S$, (Pielou, 1966)

where S is the total number of species in the sample, N is the total number of individuals, and Ni is the number of individuals of the i^{th} species.

6.4 Event and Action Plan for Mudflat Monitoring

6.4.1 In the event of the impact monitoring results indicating that the density or the distribution pattern of intertidal fauna and seagrass is found to be significant different to the baseline condition (taking into account natural fluctuation in the occurrence and distribution pattern such as due to seasonal change), appropriate actions should be taken and additional mitigation measures should be implemented as necessary. Data should then be re-assessed and the need for any further monitoring should be established. The action plan, as given in **Table 6.5** should be undertaken within a period of 1 month after a significant difference has been determined.

Table 6.5 Event and Action Plan for Mudflat Monitoring

Event	ET Leader	IEC	SO	Contractor
Density or the distribution pattern of horseshoe crab, seagrass or intertidal soft shore communities recorded in the impact or post-construction monitoring are significantly lower than or different from those recorded in the baseline monitoring.	Review historical data to ensure differences are as a result of natural variation or previously observed seasonal differences; Identify source(s) of impact; Inform the IEC, SO and Contractor; Check monitoring data; Discuss additional monitoring and any other measures, with the IEC and Contractor.	Discuss monitoring with the ET and the Contractor; Review proposals for additional monitoring and any other measures submitted by the Contractor and advise the SO accordingly.	Discuss with the IEC additional monitoring requirements and any other measures proposed by the ET; Make agreement on the measures to be implemented.	Inform the SO and in writing; Discuss with the ET and the IEC and propose measures to the IEC and the ER; Implement the agreed measures.

Notes:
ET – Environmental Team
IEC – Independent Environmental Checker
SO – Supervising Officer

6.5 Mudflat Ecology Monitoring Results and Conclusion

Horseshoe Crabs

6.5.1 In general, two species of horseshoe crab *Carcinoscorpius rotundicauda* (total 66 ind.) and *Tachypleus tridentatus* (total 18 ind.) were recorded in the survey area. All individuals were mainly found on fine sand or soft mud substrata. The group size varied from 2 to 8 individuals for every sight record. Although less number of *Tachypleus tridentatus* was recorded, the average body size was larger than that of *Carcinoscorpius rotundicauda*. Photo records were shown in **Figure 3.1 of Appendix I** while the complete records of horseshoe crab survey in every sampling zone were shown in **Annex II of Appendix I**.

6.5.2 **Table 3.1 of Appendix I** summarizes the survey results of horseshoe crab in present survey. For *Carcinoscorpius rotundicauda,* it could be found in all sampling zones while more individuals were recorded in TC1 and TC3 (TC1: 24 ind., TC2: 1 ind., TC3: 34 ind., ST: 7 ind.). The search record was 6.0 ind. hr^{-1} $person^{-1}$, 0.3 ind. hr^{-1} $person^{-1}$, 5.7 ind. hr^{-1} $person^{-1}$, 1.2 ind. hr^{-1} $person^{-1}$ in TC1, TC2, TC3 and ST respectively. Relatively TC3 was highest in number of individuals but lots of individuals were smaller in size (mean prosomal width: 27.81 mm). Less numbers of individuals were found in TC1 and ST but most of them were larger in size (TC1: 40.01 mm, ST: 48.96 mm). The largest individual reached 92.05 mm in TC1.

6.5.3 For *Tachypleus tridentatus,* it could be found in TC3 and ST only. There were 9 individuals found in both sampling zones while search record was 1.5 ind. hr^{-1} $person^{-1}$. The mean prosomal widths were similar between two sampling zones (TC3: 50.31 mm, ST: 63.67 mm). The largest individual reached 118.34 mm in ST **(Figure 3.1 of Appendix I)**.

6.5.4 In the previous survey of Mar. 2015, there was one important finding that a mating pair of *Carcinoscorpius rotundicauda* was found in ST (prosomal width: male 155.1 mm, female 138.2 mm) **(Figure 3.2 of Appendix I)**. It indicated the importance of ST as a breeding ground of horseshoe crab. Moreover, two moults of *Carcinoscorpius rotundicauda* were found in TC1 with similar prosomal width 130-140 mm **(Figure 3.2 of Appendix I)**. It reflected that a certain numbers of moderately sized individuals inhabited the sub-tidal habitat of Tung Chung Wan after its nursery period on soft shore. These individuals might move onto soft shore during high tide for feeding, moulting and breeding. Then it would return to sub-tidal habitat during low tide. Because the mating pair should be inhabiting sub-tidal habitat in most of the time. The record was excluded from the data analysis to avoid mixing up with juvenile population living on soft shore.

6.5.5 No marked individual of horseshoe crab was recorded in present survey. Some marked individuals were found in previous surveys conducted in September 2013, March 2014 and September 2014. All of them were released through a conservation programme conducted by Prof. Paul Shin (Department of Biology and Chemistry, The City University of Hong Kong (CityU)). It was a re-introduction trial of artificial bred horseshoe crab juvenile at selected sites. So that the horseshoe crabs population might be restored in the natural habitat. Through a personal conversation with Prof. Shin, about 100 individuals were released in the sampling zone ST on 20 June 2013. All of them were marked with color tape and internal chip detected by specific chip sensor. There should be second round of release between June and September 2014 since new marked individuals were found in the survey of September 2014.

6.5.6 The artificial bred individuals, if found, would be excluded from the results of present monitoring programme in order to reflect the changes of natural population. However, the mark on their prosoma might have been detached during moulting after a certain period of release. The artificially released individuals were no longer distinguishable from the natural population without the specific chip sensor. The survey data collected would possibly cover both natural population and artificially bred individuals.

Population difference among the sampling zones

6.5.7 **Figures 3.3 and 3.4 of Appendix I** show the changes of number of individuals, mean prosomal width and search record of horseshoe crabs *Carcinoscorpius rotundicauda* and *Tachypleus tridentatus* respectively in every sampling zone along the sampling months. In general, higher search records (i.e. number of individuals) of both species were always found in ST followed by TC3 from September 2012 to September 2014. Then the search record in TC3 was even higher than that in ST from March 2015 to June 2015. For TC1, the search record was at low to medium level and fluctuated slightly along the sampling months. In contrast, much lower search record was found in TC2 (2 ind. in Sep. 2013, 1 ind. in Mar., Jun., Sep. 2014, Mar. and Jun 2015). Although there was no obvious spatial difference of horseshoe crab size (prosomal width) among the sampling zones, larger individuals (prosomal width > 80 mm) were usually found in TC1 and ST.

6.5.8 Throughout the monitoring period conducted, it was obvious that TC3 and ST (western shore of Tung Chung Wan) was an important nursery ground for horseshoe crab especially newly hatched individuals due to larger area of suitable substratum (fine sand or soft mud) and less human disturbance (far from urban district). Relatively, other sampling zones were not a suitable nursery ground especially TC2. Possible factors were less area of suitable substratum (especially TC1) and higher human disturbance (TC1 and TC2: close to urban district and easily accessible). In TC2, large daily salinity fluctuation was a possible factor either since it was flushed by two rivers under tidal inundation. The individuals found in TC1 and TC2 were believed migrating from TC3 and ST during high tide while it might leave over a certain period of time. It accounted for the variable search records in the sampling zones along the sampling months. For example, few individuals of *Tachypleus tridentatus* were found in TC1 only between September 2012 and September 2013. However it no longer appeared while few individuals of *Carcinoscorpius rotundicauda* were found after March 2014..

Seasonal variation of horseshoe crab population

6.5.9 Throughout the monitoring period conducted, the search record of horseshoe crab declined obviously during dry season especially December (**Figures 3.3 and 3.4 of Appendix I**). No individual of horseshoe crabwas found in the survey of December 2013. Next year, 2 individuals of *Carcinoscorpius rotundicauda* and 8 individuals of *Tachypleus tridentatus* were found only in December 2014. As mentioned, the horseshoe crabs were inactive and burrowed in the sediments during cold weather (<15 ºC). Similar results of low search record in dry season were reported in a previous territory-wide survey of horseshoe crab. For example, the search records in Tung Chung Wan were 0.17 ind. hr^{-1} $person^{-1}$and 0 ind. hr^{-1} $person^{-1}$in wet season and dry season respectively (details see Li, 2008). After the dry season, the search record increased with the warmer climate.

6.5.10 Between the sampling months September 2012 and December 2013, *Carcinoscorpius rotundicauda* was a less common species relative to *Tachypleus tridentatus*. Only 4 individuals were ever recorded in ST in December 2012. This species had ever been believed of very low density in ST hence the encounter rate was very low. Since March 2014, it was found in all sampling zones with higher abundance in ST. Based on its average size (mean prosomal width 39.28-49.81 mm), it indicated that breeding and spawning of this species had occurred 3-4 years ago along the coastline of Tung Chun Wan. However, these individuals were still small while their walking trails were inconspicuous. Hence there was no search record in previous sampling months. From March 2014 to June 2015, more individuals were recorded due to larger size and higher activity. Focused on June 2015 (present survey), more small sized individuals (prosomal width 10-20 mm) were found in TC3 (specifically soft mud area between TC3 and ST), it indicated another round of successful breeding and spawning of *Carcinoscorpius rotundicauda* along the western shore of Tung Chung Wan. It matched with the previous mating record in March 2015.

6.5.11 For *Tachypleus tridentatus,* sharp increase of number of individuals was recorded in ST with wet season (from March to September 2013). According to a personal conversation with Prof. Shin (CityU), his monitoring team had recorded similar increase of horseshoe crab population during wet season. It was believed that the suitable ambient temperature increased its conspicuousness. However similar pattern was not recorded during the wet season of 2014. The number of individuals increased in March and June 2014 followed by a rapid decline in September 2014. The number of individuals showed a general decreasing trend from March 2014 to June 2015. Apart from natural mortality, migration from nursery soft shore to subtidal habitat was another possible cause. Since the mean prosomal width of *Tachypleus tridentatus* continued to grow and reached about 50 mm in March 2014. Then it varied slightly between 50-65 mm from September 2014 to June 2015. Most of the individuals might have reached a suitable size strong enough to forage in sub-tidal habitat.

6.5.12 Since TC3 and ST were regarded as important nursery ground for horseshoe crab, box plots of prosomal width of two horseshoe crab species were constructed to investigate the changes of population in details.

Box plot of horseshoe crab populations in TC3

6.5.13 **Figure 3.5 of Appendix I** shows the changes of prosomal width of *Carcinoscorpius rotundicauda* and *Tachypleus tridentatus* in TC3. As mentioned above, *Carcinoscorpius rotundicauda* was rarely found between September 2012 and December 2013 hence the data were lacking. In March 2014, the major size (50% of individual records between upper and lower quartile) ranged 40-60 mm while only few individuals were found. From June 2014 to June 2015, the size of major population decreased and ranged 20-40 mm while more individuals were recorded. Such decline was possibly due to variable encounter rate influenced by weather.

6.5.14 For *Tachypleus tridentatus,* the major size ranged 20-50 mm while the number of individuals found fluctuated from September 2012 to June 2014. Then a slight but consistent growing trend was observed. The prosomal width increased from 25-35 mm in September 2014 to 35-65 mm in June 2015. As mentioned, the large individuals might have reached a suitable size for migrating from the nursery soft shore to subtidal habitat. It accounted for the declined population in TC3.

Box plot of horseshoe crab populations in ST

6.5.15 **Figure 3.6 of Appendix I** shows the changes of prosomal width of *Carcinoscorpius rotundicauda* and *Tachypleus tridentatus* in ST. As mentioned above, *Carcinoscorpius rotundicauda* was rarely found between September 2012 and December 2013 hence the data were lacking. From March 2014 to June 2015, the size of major population (50% records between upper and lower quartile) fluctuated between 30-40 mm and 45-60 mm. Similar to TC3, such fluctuation should be due to variable encounter rate influenced by weather.

6.5.16 For *Tachypleus tridentatus,* a consistent growing trend was observed for the major population from December 2012 to December. 2014 regardless of change of search record. The prosomal width increased from 15-30 mm to 55-70 mm. As mentioned, the large individuals might have reached a suitable size for migrating from the nursery soft shore to subtidal habitat. From March to June 2015, the size of major population decreased slightly with prosomal width 40-60 mm. It further indicated some of order individuals might have migrated to sub-tidal habitat.

Impact of the HKLR project

6.5.17 The present survey was the 11th time of the EM&A programme during the construction period. Based on the results, impact of the HKLR project could not be detected on horseshoe crabs considering the factor of natural, seasonal variation. In case, abnormal phenomenon (e.g. very few numbers of horseshoe crab individuals in warm weather, large number of dead individuals on the shore) is observed, it would be reported as soon as possible.

Seagrass Beds

6.5.18 In general, two species of seagrass *Halophila ovalis* and *Zostera japonica* were recorded in ST only. Both species were found on sandy substratum nearby the seaward side of mangrove vegetation at 2.0 m above C.D. Photo records were shown in **Figure 3.7 of Appendix I** while the complete records of seagrass beds survey were shown in **Annex III of Appendix I.**

6.5.19 **Table 3.2 of Appendix I** summarize the results of seagrass beds survey in ST. Two long strands (11.8-24.2 m) of *Zostera japonica* were found. The total seagrass bed area was about 90.0 m^2 (average area 45.0 m^2) while the estimated vegetation coverage was 50-80%. For *Halophila ovalis*, three small patches (1.0-3.4 m^2) were found coinhabiting with the long strand of *Zostera japonica*. The total seagrass bed area was 6.8 m^2 (average area 2.3 m^2) while the estimated vegetation coverage was 50-80%.

Temporal variation of seagrass beds

6.5.20 **Figure 3.8 of Appendix I** shows the changes of estimated total area of seagrass beds in ST along the sampling months. For *Zostera japonica*, it was not recorded in the 1st and 2nd surveys of monitoring programme. Seasonal recruitment of few, small patches (total seagrass area: 10 m^2) was found in March 2013 that grew within the large patch of seagrass *Halophila ovalis*. Then the patch size increased and merged gradually with the warmer climate from March to June 2013 (15 m^2). However the patch size decreased sharply and remained similar from September 2013 (4 m^2) to March 2014 (3 m^2). In June 2014, the patch size increased obviously again (41 m^2) with warmer climate. Similar to previous year, the patch size decreased again and remained similar September 2014 (2 m^2) to December 2014 (5 m^2). From March to June 2015, the patch size increased sharply again (90.0 m^2) and became the dominant seagrass in ST. It might be due to the disappearance of the originally dominant seagrass *Halophila ovalis* resulting in less competition for substratum and nutrients.

6.5.21 For *Halophila ovalis*, it was recorded as 3-4 medium to large patches (area 18.9-251.7 m^2; vegetation coverage 50-80%) beside the mangrove vegetation at tidal level 2 m above C.D in the September 2012 (First survey). The total seagrass bed area grew steadily from 332.3 m^2 in September 2012 to 727.4 m^2 in December 2013. Flowers could be observed in the largest patch during its flowering period in December 2013. In March 2014, 31 small to medium patches were newly recorded (variable area 1-72 m^2 per patch, vegetation coverage 40-80% per patch) in lower tidal zone between 1.0 and 1.5 m above C.D. The total seagrass area increased further to 1350 m^2. In June 2014, these small and medium patches grew and extended to each others. These patches were no longer distinguishable and were covering a significant mudflat area of ST. It was generally grouped into 4 large areas (1116 – 2443 m^2) of seagrass beds characterized of patchy distribution, variable vegetable coverage (40-80%) and smaller leaves. The total seagrass bed area increased sharply to 7629 m^2. In September 2014, the total seagrass area declined sharply to 1111 m^2. There were only 3-4 small to large patches (6-253 m^2) at high tidal level and 1 patch at low tidal level (786 m^2). Typhoon or strong water current was a possible cause (Fong, 1998). In September 2014, there were two tropical cyclone records in Hong Kong (7th-8th September: no cyclone name, maximum signal number 1; 14th-17th September: Kalmaegi maximum signal number 8SE) before the seagrass survey dated 21st September 2014. The strong water current caused by the cyclone, Kalmaegi especially, might have given damage to the seagrass beds. In addition, natural heat stress and grazing force were other possible causes reducing seagrass beds area. Besides, *Halophila ovalis* could be found in other mud flat area surrounding the single patch. But it was hardly distinguished into patches due to very low coverage (10-20%) and small leaves.

6.5.22 In December 2014, all the seagrass patches of *Halophila ovalis* disappeared in ST. **Figure 3.9 of Appendix I** shows the difference of the original seagrass beds area nearby the mangrove vegetation at high tidal level between June 2014 and December 2014. Such rapid loss would not be seasonal phenomenon because the seagrass beds at higher tidal level (2.0 m above C.D.) were present and normal in December 2012 and 2013. According to Fong (1998), similar incident had occurred in ST in the past. The original seagrass area had declined significantly during the commencement of the construction and reclamation works for the international airport at Chek Lap Kok in 1992. The seagrass almost disappeared in 1995 and recovered gradually after the completion of reclamation works. Moreover, incident of rapid loss of seagrass area was also recorded in another intertidal mudflat in Lai Chi Wo in 1998 with unknown reason. Hence *Halophila ovalis* was regarded as a short-lived and *r*-strategy seagrass that can colonize areas in short period but disappears quickly under unfavourable conditions (Fong, 1998).

<u>Unfavourable conditions to seagrass *Halophila ovalis*</u>

6.5.23 Typhoon or strong water current was suggested as one unfavourable condition to *Halophila ovalis* (Fong, 1998). As mentioned above, there were two tropical cyclone records in Hong Kong in September 2014. The strong water current caused by the cyclones might have given damage to the seagrass beds.

6.5.24 Prolonged light deprivation due to turbid water would be another unfavouable condition. Previous studies reported that *Halophila ovalis* had little tolerance to light deprivation. During experimental darkness, seagrass biomass declined rapidly after 3-6 days and seagrass died completely after 30 days. The rapid death might be due to shortage of available carbohydrate under limited photosynthesis or accumulation of phytotoxic end products of anaerobic respiration (details see Longstaff *et al*., 1999). Hence the seagrass bed of this species was susceptible to temporary light deprivation events such as flooding river runoff (Longstaff and Dennison, 1999).

6.5.25 In order to investigate any deterioration of water quality (e.g. more turbid) in ST, the water quality measurement results at two closest monitoring stations SR3 and IS5 of the EM&A programme were obtained from the water quality monitoring team. Based on the results from June to December 2014, the overall water quality was in normal fluctuation except there was one exceedance of suspended solids (SS) at both stations in September. On 10th September, 2014, the SS concentrations measured at mid-ebb tide at stations SR3 (27.5 mg/L) and IS5 (34.5 mg/L) exceeded the Action Level (≤23.5 mg/L and 120% of upstream control station's reading) and Limit Level (≤34.4 mg/L and 130% of upstream control station's reading) respectively. The turbidity readings at SR3 and IS5 reached 24.8-25.3 NTU and 22.3-22.5 NTU respectively. The temporary turbid water should not be caused by the runoff from upstream rivers. Because there was no rain or slight rain from 1st to 10th September 2014 (daily total rainfall at the Hong Kong International Airport: 0-2.1 mm; extracted from the climatological data of Hong Kong Observatory). The effect of upstream runoff on water quality should be neglectable in that period. Moreover the exceedance of water quality was considered unlikely to be related to the contract works of HKLR according to the 'Notifications of Environmental Quality Limits Exceedances' provided by the respective environmental team. The respective construction of seawall and stone column works, which possibly caused turbid water, were carried out within silt curtain as recommended in the EIA report. Moreover there was no leakage of turbid water, abnormity or malpractice recorded during water sampling. In general, the exceedance of suspended solids concentration was considered to be attributed to other external factors, rather than the contract works.

6.5.26 Based on the weather condition and water quality results in ST, the co-occurrence of cyclone hit and turbid waters in September 2014 might have combined the adverse effects on *Halophila ovalis* that leaded to disappearance of this short-lived and *r*-strategy seagrass species. Fortunately *Halophila ovalis* was a fast-growing species (Vermaat *et al*., 1995). Previous studies showed that the seagrass bed could be recovered to the original sizes in 2 months through vegetative propagation after experimental clearance (Supanwanid, 1996). Moreover it was reported to recover rapidly in less than 20 days after dugong herbivory (Nakaoka and Aioi, 1999). As mentioned, the disappeared seagrass in ST in 1995 could recover gradually after the completion of reclamation works for international airport (Fong, 1998). The seagrass beds of *Halophila ovalis* might recolonize the mudflat of ST through seed reproduction as long as there was no unfavourable condition in the coming months.

6.5.27 From March to June 2015, 2-3 small patches of *Halophila ovalis* were newly found coinhabiting with another seagrass species *Zostera japonica*. But its total patch area was still very low relative to the previous records. The recolonization rate was low while cold weather and insufficient sunlight were possible factors between December 2014 and March 2015. Moreover, it would need to complete with more abundant seagrass *Zostera japonica* for substratum and nutrient. Since *Zostera japonica* had extended and had covered the original seagrass bed of *Halophila ovalis* at certain degree. Therefore it was too early to conclude if *Halophila ovalis* would recolonize to its original size. Or the dominance of seagrass bed would be replaced by *Zostera japonica*. Regular monitoring was necessary.

6.5.28 In previous survey of Mar. 2015, labelled sticks were inserted in the area where used to be the seagrass patch of highest coverage. Through informal enquiry with AFCD staffs on site, the sticks were used to trace the recolonization pattern of seagrass after the rapid disappearance reported in December 2014. However, all labeled sticks were removed and were no longer seen in present survey (June 2015)

<u>Impact of the HKLR project</u>

6.5.29 The present survey was the 11th survey of the EM&A programme during the construction period. According to the results of present survey, there was recolonization of both seagrass species *Halophila ovalis* and *Zostera japonica* in ST. The seagrass patches were predicted to increase in the coming warm season. Hence the negative impact of HKLR project on the seagrass was not significant. In case, adverse phenomenon (e.g. reduction of seagrass patch size, abnormal change of leave colour) is observed again, it would be reported as soon as possible.

<u>Intertidal Soft Shore Communities</u>

6.5.30 **Table 3.3 and figure 3.10 of Appendix I** show the types of substratum along the horizontal transect at every tidal level in every sampling zone. The relative distribution of different substrata was estimated by categorizing the substratum types (Gravels & Boulders / Sands / Soft mud) of the ten random quadrats along the horizontal transect. The distribution of substratum types varied among tidal levels and sampling:

- In TC1, high percentage of 'Gravels and Boulders' was recorded (80-100%) at high and mid tidal levels. But the substratum type was diverse relatively at low tidal level. Higher percentage of 'Sands' (50%) was recorded followed by 'Gravels and Boulders' (30%) and 'Soft mud' (20%).
- In TC2, the substratum distribution was similar at high and mid tidal levels. Higher percentage of 'Sands' (60%) was recorded followed by 'Gravels and Boulders' (30%). At low tidal level, the major substratum was 'Soft mud' (90%).
- In TC3, the substratum type was clearly different between high-mid tidal level and low tidal level. 'Sands' was the main substratum type (100%) at high and mid tidal levels while 'Gravels and Boulders' was the main substratum type (90%) at low tidal level.
- In ST, the substratum type was clearly different between high-mid tidal level and low tidal level. 'Gravels and Boulders' (100%) was the main substratum at high and mid tidal levels. The main substratum type was either 'Soft mud' (50%) and 'Sands' (40%) at low tidal level.

6.5.31 There was neither consistent vertical nor horizontal zonation pattern of substratum type in all sampling zones. Such heterogeneous variation should be caused by different hydrology (e.g. wave in different direction and intensity) received by the four sampling zones.

6.5.32 **Table 3.4 of Appendix I** lists the total abundance, density and number of taxon of every phylum in this survey. A total of 13359 individuals were recorded. Mollusca was significantly the most abundant phylum (total individuals 12895, density 430 ind. m^{-2}, relative abundance 96.5%). The second abundant phylum was Arthropoda (272 ind., 9 ind. m^{-2}, 2.0%). The third and fourth abundant phyla were Annelida (84 ind., 3 ind. m^{-2}, 0.6%) and Sipuncula (62 ind., 2 ind. m^{-2}, 0.5%). Relatively other phyla were very low in abundances (density ≤1 ind. m^{-2}, relative abundance ≤0.2%). Moreover, the most diverse phylum was Mollusca (37 taxa) followed by Arthropoda (12 taxa) and Annelida (8 taxa). There were 1-2 taxa recorded only for other phyla. The complete list of collected specimens is shown in **Annex V of Appendix I**.

6.5.33 **Table 3.5 of Appendix I** show the number of individual, relative abundance and density of each phylum in every sampling zone. The total abundance (3194-4481 ind.) varied among the four sampling zones while the phyla distributions were similar. In general, Mollusca was the most dominant phylum (no. of individuals: 3119-4357 ind.; relative abundance 96.6-97.7%; density 416-581 ind. m^{-2}). Other phyla were significantly lower in number of individuals. Arthropoda was the second abundant phylum (23-90 ind.; 0.7-2.6%; 3-12 ind. m^{-2}). Annelida was the third abundant phylum (20-31 ind.; 0.5-0.9%; 3-4 ind. m^{-2}) in TC1, TC2 and TC3. Sipuncula was the third or fourth abundant phylum (20-24 ind.; 0.6-0.7%; 3 ind. m^{-2}) in TC3 and ST. Cnidaria (sea anemone) was the fourth abundant phylum (14 ind.; 0.4%; 2 ind. m^{-2}) in ST. Relatively, other phyla were low in abundance among the four sampling zones (≤ 0.3%).

Dominant species in every sampling zone

6.5.34 **Table 3.6 of Appendix I** lists the abundant species (relative abundance >10%) in every sampling zone. In TC1, gastropod *Batillaria multiformis* was the most abundant clearly (698 ind. m^{-2}, relative abundance 82%) at high tidal level (major substratum: 'Gravels and Boulders'). It was also the most abundant species at moderate-high density (264 ind. m^{-2}, 45%) at mid tidal level (major substratum: 'Gravels and Boulders'). Gastropod *Monodonta labio* (60-117 ind. m^{-2}, 17-20%) was the second abundant species at low to moderate density at mid and low tidal levels. Gastropod *Cerithidea djadjariensis* (80 ind. m^{-2}, 13%) was the third abundant species at low density at mid tidal level. At low tidal level (major substratum: 'Sands'), rock oyster *Saccostrea cucullata* (111 ind. m^{-2}, 32%, attached on boulders) was the most abundant at moderate density at low tidal level. Gastropod *Batillaria zonalis* (41 ind. m^{-2}, 12%) was the third abundant species at low density at low tidal level.

6.5.35 At TC2, gastropod *Cerithidea djadjariensis* (198 ind. m^{-2}, 45%) was the most abundant at moderate density at high tidal level (major substratum: 'Sands'). Rock oyster *Saccostrea cucullata* (70 ind. m^{-2}, 16%) and gastropod *Cerithidea cingulata* (58 ind. m^{-2}, 13%) were the second and third abundant species at low density. Relative to high tidal level, the density of every taxon was much lower and similar at mid and low tidal levels. No dominant species was determined. At mid tidal level (major substratum: 'Sands'), rock oyster *Saccostrea cucullata* (66 ind. m^{-2}, 25%), gastropods *Cerithidea djadjariensis* (57 ind. m^{-2}, 21%) and *Batillaria zonalis* (35 ind. m^{-2}, 13%) were commonly occurring at low density. At low tidal level (major substratum: 'Soft mud'), rock oyster *Saccostrea cucullata* (27 ind. m^{-2}, 21%), gastropods *Cerithidea djadjariensis* (30 ind. m^{-2}, 23%), *Batillaria zonalis* (25 ind. m^{-2}, 19%) and barnacle *Balanus amphitrite* (13 ind. m^{-2}, 10%, attached on boulders) were commonly occurring at low density.

6.5.36 At TC3, gastropod *Cerithidea djadjariensis* was the most abundant at moderate-high density (192-298 ind. m^{-2}, 60-64%) at high and mid tidal levels (major substratum: 'Sands') followed by gastropod *Cerithidea cingulata* (58-116 ind. m^{-2}, 19-24%) at low to moderate density. Besides *Batillaria multiformis* (52 ind. m^{-2}, 11%) was the third abundant species at high tidal level at low density. At low tidal level (major substratum: 'Gravels and Boulders'), gastropod *Monodonta labio* (255 ind. m^{-2}, 40%) and rock oyster *Saccostrea cucullata* (229 ind. m^{-2}, 36%) were both dominant and at moderate-high density.

6.5.37 At ST, gastropod *Batillaria multiformis* was most abundant (276 ind. m^{-2}, 42%) at high tidal level (major substratum: 'Gravels and Boulders') followed by gastropod *Monodonta labio* (194 ind. m^{-2}, 17%). Both dominant species were at moderate-high density. At mid tidal level (major substratum: 'Gravels and Boulders'), gastropod *Monodonta labio* (154 ind. m^{-2}, 31%) was the most abundant at moderate density. Other less abundant species were rock oyster *Saccostrea cucullata* (89 ind. m^{-2}, 18%) and gastropod *Lunella coronata* (56 ind. m^{-2}, 11%) at low densities. At low tidal level (major substrata: 'Sands' and 'Soft mud'), gastropods *Lunella coronata* (30 ind. m^{-2}, 22%), *Batillaria zonalis* (21 ind. m^{-2}, 15%), *Cerithidea djadjariensis* (16 ind. m^{-2}, 12%), *Batillaria bornii* (13 ind. m^{-2}, 10%) and rock oyster *Saccostrea cucullata* (20 ind. m^{-2}, 15%) were common taxa at low densities.

6.5.38 There was no consistent zonation pattern of species distribution observed across all sampling zones and tidal levels. The species distribution should be affected by the type of substratum primarily. In general, gastropods *Batillaria multiformis* (total number of individuals: individuals: 3454 ind., relative abundance 25.9%), *Cerithidea djadjariensis* (2395 ind., 17.9%) and *Cerithidea cingulata* (781 ind., 5.8%) were the most commonly occurring species on sandy and soft mud substrata. Rock oyster *Saccostrea cucullata* (1923 ind., 14.4%) and gastropod *Monodonta labio* (2227 ind., 16.7%) were commonly occurring species inhabiting gravel and boulders substratum.

Biodiversity and abundance of soft shore communities

6.5.39 **Table 3.7 of Appendix I** shows the mean values of number of species, density, biodiversity index *H'* and species evenness *J* of soft shore communities at every tidal level and in every sampling zone. Among the sampling zones, the number of species (7-13 spp. 0.25 m^{-2}) in ST was relatively higher than other sampling zones (6-11 spp. 0.25 m^{-2}). The mean *H'* (1.66) and *J* (0.74) in ST were relatively higher than that in TC1, TC2 and TC3 (*H'*: 1.08-1.48; *J*: 0.54-0.76). The mean densities were highly variable and ranged 129-849 ind. m^{-2}. No general difference was observed among the sampling zones.

6.5.40 Across the tidal levels, there was no consistent difference of the mean number of species, *H'* and *J* in all sampling zones. For the mean density, a general decreasing trend was observed from high tidal level to low tidal level at TC1, TC2 and ST. At TC3, the mean density at low tidal level was higher than that at high and mid tidal levels. As mentioned, the variation of mean density should be determined by the type of substratum primarily.

6.5.41 **Figures 3.11 to 3.14 of Appendix I** show the temporal changes of mean number of species, mean density, *H'* and *J* at every tidal level and in every sampling zone along the sampling months. No consistent temporal change of any biological parameters was observed. All the parameters were under slight and natural fluctuation with the seasonal variation.

Impact of the HKLR project

6.5.42 The present survey was the 11th survey of the EM&A programme during the construction period. Based on the results, impacts of the HKLR project were not detected on intertidal soft shore community. In case, abnormal phenomenon (e.g. large reduction of fauna densities and species number) is observed, it would be reported as soon as possible.

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7 Environmental Site Inspection and Audit

7.1 Site Inspection

7.1.1 Site Inspections were carried out on a weekly basis to monitor the implementation of proper environmental pollution control and mitigation measures for the Project. During the reporting month, four site inspections were carried out on 3, 10, 17 and 26 June 2015.

7.1.2 Particular observations during the site inspections and the follow up actions taken by the Contractor are described below.

3 June 2015

(a) A few patches of concrete waste was observed on the ground at N20. This observation was found on 30 April 2015. The Contractor was reminded to remove the concrete waste at N20 as soon as possible.

(b) The length of wheel washing bay at N20 is too short. This observation was found on 29 May 2015. The Contractor was reminded to modify the wheel washing bay.

(c) Gap was found at the silt curtain. The gap was filled with an additional silt curtain at Portion X. This observation was found on 29 May 2015 and closed on 3 June 2015.

(d) Chemical containers were not properly stored on Vessel Shun Tat 82. The chemical containers were removed at Shun Tat 82. This observation was found on 29 May 2015 and closed on 3 June 2015.

(e) Sand bags along the water barrier at Airport Road were insufficient. Sand bags were provided along the entire site boundary at Airport Road to avoid water seepage at N20. This observation was found on 29 May 2015 and closed on 3 June 2015.

(f) Stagnant water was observed at the surface channel at N20. The stagnant water was removed at the surface channel at N20. This observation was found on 29 May 2015 and closed on 3 June 2015.

(g) The gully was exposed at N20. A cover was provided for the gully at N20 to avoid washing away of silt or other objects into the drainage system. This observation was found on 29 May 2015 and closed on 3 June 2015.

(h) Muddy water was discharged without any treatment at S7. The muddy water was cleaned at S7. This observation was found on 3 June 2015 and closed on 10 June 2015.

(i) Rubbish was accumulated at S16. The rubbish was removed by a truck at S16. This observation was found on 3 June 2015 and closed on 10 June 2015.

(j) Construction waste near abandoned cement mixing plant was not removed at S15. The construction waste near abandoned cement mixing plant was removed at S15. This observation was found on 3 June 2015 and closed on 10 June 2015.

(k) Abandoned water barriers and rubbish were placed near the resting station at N4. The abandoned water barriers and rubbish were removed at N4. This observation was found on 3 June 2015 and closed on 10 June 2015.

(l) Silt curtains were not maintained in accordance with the design plan at Portion X. The silt curtains were maintained in accordance with the design plan at Portion X. This observation was found on 3 June 2015 and closed on 10 June 2015.

(m) A diesel container was observed without a drip tray at N4. The diesel container was removed at N4. This observation was found on 3 June 2015 and closed on 10 June 2015.

10 June 2015

(a) A few patches of concrete waste was observed on the ground at N20. This observation was found on 30 April 2015. The Contractor was reminded to remove the concrete waste at N20 as soon as possible.

(b) The length of wheel washing bay at N20 is too short. This observation was found on 29 May 2015. The Contractor was reminded to modify the wheel washing bay.

(c) A green screen used to cover sand stockpile was broken at N1. A new green screen of sand stockpile was provided at N1. This observation was found on 10 June 2015 and closed on 17 June 2015.

(d) Unpaved road and stockpiles were observed to be dry at S15. The unpaved road and stockpiles were sprayed with water at S15. This observation was found on 10 June 2015 and closed on 17 June 2015.

(e) A sand stockpile was observed to be dry at S22. The sand stockpile was removed at S22. This observation was found on 10 June 2015 and closed on 17 June 2015.

(f) No water spraying was provided for the percussive activity at S8-9. Water spraying was provided for the percussive activity at S8-9. This observation was found on 10 June 2015 and closed on 17 June 2015.

(g) Silt curtains were not maintained in accordance with the design plan at Portion X. The silt curtains were maintained in accordance with the design plan at Portion X. This observation was found on 10 June 2015 and closed on 26 June 2015.

17 June 2015

(a) A few patches of concrete waste was observed on the ground at N20. This observation was found on 30 April 2015. The Contractor was reminded to remove the concrete waste at N20 as soon as possible.

(b) The length of wheel washing bay at N20 is too short. This observation was found on 29 May 2015. The Contractor was reminded to modify the wheel washing bay.

(c) An inadequate wheel washing facility was provided at the entrance/exit of N1. This observation was found on 17 June 2015. The Contractor was reminded to provide standard wheel washing facility at N1.

(d) Concrete waste was observed on the ground at N1. This observation was found on 17 June 2015. The Contractor was reminded to remove the concrete waste at N1.

(e) Water spraying system did not function at S15. Water spraying system was used at S15. This observation was found on 17 June 2015 and closed on 26 June 2015.

(f) Rubbish was accumulated at S16. Accumulated rubbish at S16 was cleared. This observation was found on 17 June 2015 and closed on 26 June 2015.

(h) Silt curtains were not maintained in accordance with the design plan at Portion X. The silt curtains were maintained in accordance with the design plan at Portion X. This observation was found on 17 June 2015 and closed on 26 June 2015.

26 June 2015

(a) A few patches of concrete waste was observed on the ground at N20. This observation was found on 30 April 2015. The Contractor was reminded to remove the concrete waste at N20 as soon as possible.

(b) The length of wheel washing bay at N20 is too short. This observation was found on 29 May 2015. The Contractor was reminded to modify the wheel washing bay.

(c) An inadequate wheel washing facility was provided at the entrance/exit of N1. This observation was found on 17 June 2015. The Contractor was reminded to provide standard wheel washing facility at N1.

(d) Concrete waste was observed on the ground at N1. This observation was found on 17 June 2015. The Contractor was reminded to remove the concrete waste at N1.

(e) Construction materials along the deck of barge was observed at Harbour Sky No. 68 at Portion X. The Contractor was reminded to clean up the construction materials at Harbour Sky No. 68.

(f) Stagnant water was found at surface channel at site access of N1. The Contractor was reminded to remove stagnant water at site access of N1.

(g) Uneven ground was observed at N1. The Contractor was reminded to level the ground to avoid accumulation of water at N1.

(h) Uneven ground was observed at S19 site access. The Contractor was reminded to level the ground to avoid accumulation of water at S19 site access.

The Contractor has rectified most of the observations as identified during environmental site inspections during the reporting month. Follow-up actions for outstanding observations will be inspected during the next site inspections.

7.2 Advice on the Solid and Liquid Waste Management Status

7.2.1 The Contractor registered as a chemical waste producer for the Project. Sufficient numbers of receptacles were available for general refuse collection and sorting.

7.2.2 Monthly summary of waste flow table is detailed in **Appendix J**.

7.2.3 The Contractor was reminded that chemical waste containers should be properly treated and stored temporarily in designated chemical waste storage area on site in accordance with the Code of Practise on the Packaging, Labelling and Storage of Chemical Wastes.

7.3 Environmental Licenses and Permits

7.3.1 The valid environmental licenses and permits during the reporting month are summarized in **Appendix L**.

7.4 Implementation Status of Environmental Mitigation Measures

7.4.1 In response to the site audit findings, the Contractors have rectified most of the observations as identified during environmental site inspections during the reporting month. Follow-up actions for outstanding observations will be inspected during the next site inspections.

7.4.2 A summary of the Implementation Schedule of Environmental Mitigation Measures (EMIS) is presented in **Appendix M**. Most of the necessary mitigation measures were implemented properly.

7.4.3 Regular marine travel route for marine vessels were implemented properly in accordance to the submitted plan and relevant records were kept properly.

7.4.4 Dolphin Watching Plan was implemented during the reporting month. No dolphins inside the silt curtain were observed. The relevant records were kept properly.

7.5 Summary of Exceedances of the Environmental Quality Performance Limit

7.5.1 No Action and Limit Level exceedances of 1-hour TSP and 24-hour TSP were recorded at AMS5 and AMS6 during the reporting month.

7.5.2 For construction noise, no Action and Limit Level exceedances were recorded at the monitoring stations during the reporting month.

7.5.3 For marine water quality monitoring, no Action Level and Limit Level exceedances of turbidity level, dissolved oxygen level and suspended solid level were recorded during the reporting month.

7.6 Summary of Complaints, Notification of Summons and Successful Prosecution

7.6.1 There were no complaints received during the reporting month. The details of cumulative statistics of Environmental Complaints are provided in **Appendix K**.

7.6.2 No notification of summons and prosecution was received during the reporting period.

7.6.3 Statistics on notifications of summons and successful prosecutions are summarized in **Appendix N**.

8 Future Key Issues

8.1 Construction Programme for the Coming Months

8.1.1 As **informed by** the Contractor, the major construction activities for July 2015 are summarized in **Table 8.1**.

Table 8.1 Construction Activities for July 2015

Site Area	Description of Activities
Portion X	Dismantling/Trimming of Temporary 40mm Stone Platform for Construction of Seawall
Portion X	Filling Works behind Stone Platform
Portion X	Construction of Seawall
Portion X	Loading and Unloading of Filling Material
Portion X	Temporary Stone Platform Construction
Portion X	Pipe Piling
Portion X	Excavation and Lateral Support Works at Scenic Hill Tunnel (Cut & Cover Tunnel)
Portion X	Laying blinding layer for tunnel box structure at Scenic Hill Tunnel (Cut & Cover Tunnel)
Portion X	Construction of tunnel box structure at Scenic Hill Tunnel (Cut & Cover Tunnel)
Portion X	Socket H-Piling work at Scenic Hill Tunnel (Cut & Cover Tunnel
Portion X	Excavation works for HKBCF to Airport Tunnel
Portion X	Socket H-Piling work for HKBCF to Airport Tunnel East (Cut & Cover Tunnel)
Portion X	Pipe Piling works for HKBCF to Airport Tunnel East (Cut &Cover Tunnel)
Airport Road	Works for Diversion of Airport Road
Airport Road / Airport Express Line/East Coast Road	Utilities Detection
Airport Road / Airport Express Line/East Coast Road	Establishment of Site Access
Airport Express Line	Canopy Pipe Drilling underneath Airport Express Line
Kwo Lo Wan Road	Excavation and Lateral Support Works at shaft 3 extension north shaft & south shaft
Airport Road	Excavation and Lateral Support Works for HKBCF to Airport Tunnel West (Cut & Cover Tunnel)
Portion Y	Utility Culvert Excavation
Portion Y	Highway Operation and Maintenance Area Building Foundation Works
West Portal	Excavation for Scenic Hill Tunnel
West Portal	Ventilation Building Foundation Works

8.2 Environmental Monitoring Schedule for the Coming Month

8.2.1 The tentative schedule for environmental monitoring in July 2015 is provided in **Appendix D**.

9 Conclusions

9.1 Conclusions

9.1.1 The construction phase and EM&A programme of the Contract commenced on 17 October 2012.

Air Quality

9.1.2 No Action and Limit Level exceedances of 1-hour TSP and 24-hr TSP level were recorded at AMS5 and AMS6 during the reporting month.

Noise

9.1.3 For construction noise, no Action and Limit Level exceedances were recorded at the monitoring stations during the reporting month.

Water Quality

9.1.4 For marine water quality monitoring, no Action Level and Limit Level exceedances of turbidity level, dissolved oxygen level and suspended solid level were recorded during the reporting month.

Dolphin

9.1.5 During the June's surveys of the Chinese White Dolphin, no adverse impact from the activities of this construction project on Chinese White Dolphins was noticeable from general observations.

9.1.6 Due to monthly variation in dolphin occurrence within the study area, it would be more appropriate to draw conclusion on whether any impacts on dolphins have been detected related to the construction activities of this project in the quarterly EM&A report, where comparison on distribution, group size and encounter rates of dolphins between the quarterly impact monitoring period (June 2015 – August 2015) and baseline monitoring period (3-month period) will be made.

Mudflat

9.1.7 This measurement result was generally and relatively higher than the baseline measurement at S1, S2, S3 and S4. The mudflat level is continuously increased.

9.1.8 The June 2015 survey results indicate that the impacts of the HKLR project could not be detected on horseshoe crabs and intertidal soft shore community. Based on the results, there was recolonization of both seagrass species *Halophila ovalis* and *Zostera japonica* in ST. The seagrass patches were predicted to increase in the coming warm season. Hence the negative impact of HKLR project on the seagrass was not significant.

Environmental Site Inspection and Audit

9.1.9 Environmental site inspection was carried out on 3, 10, 17, and 26 June 2015. Recommendations on remedial actions were given to the Contractors for the deficiencies identified during the site inspections.

9.1.10 There were no complaints received in relation to the environmental impact during the reporting period.

9.1.11 No notification of summons and prosecution was received during the reporting period.

FIGURES

APPENDIX A

Environmental Management Structure

APPENDIX B

Construction Programme

APPENDIX C

Calibration Certificates

APPENDIX D

Monitoring Schedule

APPENDIX E

Monitoring Data

APPENDIX F

Event and Action Plan

APPENDIX G

Wind Data

APPENDIX H

Dolphin Monitoring Results

APPENDIX I

Mudflat Monitoring Results

APPENDIX J

Waste Flow Table

APPENDIX K

Cumulative Statistic on Complaints

APPENDIX L

Environmental Licenses and Permits

APPENDIX M

Implementation Schedule of Environmental Mitigation Measures

APPENDIX N

Record of "Notification of Summons and Prosecutions"

APPENDIX O

Location of Works Areas