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**Attn:**  
**Mr. Ray Yan – Independent Environmental Checker**

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**Contract No. HY/2013/04 Hong Kong-Zhuhai-Macao Bridge (HZMB)  
Hong Kong Boundary Crossing Facilities – Infrastructure Works Stage II  
(Southern Portion)**

**Monthly EM&A Report for December 2019**

10 January 2020

**By Email**

Dear Sir,

In accordance with Condition 5.4 of the Environmental Permit (EP-353/2009/K) covering the captioned contract, we are pleased to submit the certified Monthly EM&A Report for December 2019 for your verification.

Yours faithfully  
For MOTT MACDONALD HONG KONG LIMITED



Gary Chow  
Environmental Team Leader

Encl.

cc.  
AECOM – Mr. Peter Lee (By Email)  
China State Construction Engineering (Hong Kong) Ltd. – Mr. Xavier Lam / Mr. Ng  
Ka Po (By Email)

13 January 2020

By Fax (3468 2076) and By Post

AECOM Asia Co. Ltd.  
The PRE's Office  
550 Cheung Tung Road, Lantau, Hong Kong

Attention: Mr. Peter Lee

Dear Sir,

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

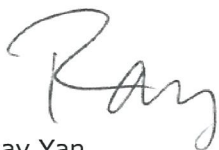
**Contract No. HY/2013/04  
HZMB HKBCF – Infrastructure Works Stage II (Southern Portion)  
Monthly Environmental Monitoring & Audit Report for December 2019**

Reference is made to the Environmental Team's submission of the Monthly EM&A Report for November 2019 certified by the ET Leader (ET's ref.: "TC/GC/al/T355861/02/02/L133" dated 10 January 2020) and provided to us via e-mail on 10 January 2020.

We are pleased to inform you that we have no adverse comments on the captioned submission. We write to verify the captioned submission in accordance with Condition 5.4 of the Environmental Permit No. EP-353/2009/K.

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



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



Ray Yan  
Independent Environmental Checker  
HZMB HKBCF

|      |      |                 |                     |
|------|------|-----------------|---------------------|
| c.c. | HyD  | Mr. Cheng Pan   | (By Fax: 3188 6614) |
|      | HyD  | Mr. Harry Louie | (By Fax: 3188 6614) |
|      | MMHK | Mr. Gary Chow   | (By Fax: 2827 1823) |
|      | CSCE | Mr. Jason Chung | (By Fax: 2459 4336) |

Internal: DY, YH, HW, ENPO Site



# Contract No. HY/2013/04 HZMB HKBCF – Infrastructure Works Stage II (Southern Portion)

Monthly EM&A Report for December 2019

January 2020

**Information class: Standard**

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# Executive summary

This Monthly Environmental Monitoring and Audit (EM&A) Report is prepared for Contract No. HY/2013/04 “Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities – Infrastructure Works Stage II (Southern Portion)” (hereafter referred to as “the Contract”) for the Highways Department of Hong Kong Special Administrative Region (HKSAR). The Contract was awarded to China State Construction Engineering (Hong Kong) Limited (hereafter referred to as “the Contractor”) and Mott MacDonald Hong Kong Limited (MMHK) was appointed as the Environmental Team (ET) by the Contractor.

The Contract is part of the “Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities” (HZMB HKBCF) Project which is a “Designated Project” under Schedule 2 of the Environmental Impact Assessment (EIA) Ordinance (Cap. 499) and for which an EIA Report (Register No. AEIAR-145/2009) was prepared and approved. The current Environmental Permit (EP) for HKBCF, namely No. EP-353/2009/K, was issued on 11 April 2016. These documents are available through the EIA Ordinance Register. Commencement of the Contract took place on 13 March 2015 and the construction works commenced on 13 July 2015.

Mott MacDonald Hong Kong 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 HKBCF (Version 1.0) and will be providing environmental team services for the Contract.

This is the 54<sup>th</sup> Monthly EM&A Report for the Contract which summarises findings of the EM&A works during the reporting period from 1 to 31 December 2019 (the “reporting period”).

## Environmental Monitoring and Audit Progress

The monthly EM&A programme was undertaken in accordance with the Updated EM&A Manual for HKBCF (Version 1.0).

The remaining air quality, noise, water quality and dolphin monitoring works under Contract No. HY/2013/01 “HZMB HKBCF – Passenger Clearance Building” were temporarily suspended from 1 October 2018. The ET of Contract No. HY/2013/04 is required and continues the full implementation of environmental monitoring commencing on 1 October 2018.

Air quality monitoring stations AMS2, AMS3C and AMS7B are covered by this Contract. It should be noted that the air quality monitoring station AMS6 is covered by Contract No. HY/2011/03 “Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road (HZMB HKLR) – Section between Scenic Hill and HKBCF”. If the impact air quality monitoring at AMS6 is no longer covered under Contract No. HY/2011/03, it is required to continue such monitoring at AMS6 as part of EM&A programme. However, this is subject to ENPO’s final decision on which ET should carry out the monitoring work at these stations.

Noise monitoring stations NMS2 and NMS3C, water quality monitoring works and dolphin monitoring works under HZMB HKBCF are covered by this Contract.

A summary of the monitoring activities during the reporting period are listed below:

- 1-hour TSP Monitoring: 2, 7, 13, 19, 24 and 30 December 2019

- 24-hour TSP Monitoring: 2, 7, 13, 19, 24 and 30 December 2019
- Noise Monitoring: Nil<sup>#</sup>
- Water Quality Monitoring: 23 December 2019<sup>^</sup>
- Chinese White Dolphin Monitoring: 3, 10, 12 and 16 December 2019
- Environmental Site Inspection: 4, 11, 16 and 23 December 2019

**Remarks:**

- <sup>#</sup> A proposal to terminate impact monitoring for noise at NMS2 and NMS3C was justified by the ET Leader of this Contract and verified by the IEC on 13 August 2019, and approved by EPD on 3 September 2019. Therefore, the last noise monitoring event at NMS2 and NMS3C to be reported under this Contract was conducted on 2 September 2019. No noise monitoring was conducted during the reporting period.
- <sup>^</sup> Monthly impact operation phase water quality monitoring in accordance with Section 9.9 of the Updated EM&A Manual for HKBCF (Version 1.0) was conducted during the reporting period.
- <sup>\*</sup> Post-construction dolphin monitoring in accordance with Section 10.7 of the Updated EM&A Manual for HKBCF was conducted during the reporting period.

**Breaches of Action and Limit Levels**

A summary of environmental exceedances for the reporting period as recorded by the Environmental Team of this Contract are listed below:

| Environmental Monitoring | Parameters               | Action Level | Limit Level |
|--------------------------|--------------------------|--------------|-------------|
| Air Quality              | 1-hour TSP               | -            | -           |
|                          | 24-hour TSP              | 1            | -           |
| Noise                    | L <sub>eq</sub> (30 min) | -            | -           |

One Action Level exceedance of 24-hour TSP for air quality at AMS7B was recorded and investigated by the ET of the Contract during the reporting period. It was concluded that the air quality exceedance was not due to the Contract.

**Complaint Log**

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

**Notifications of Summons and Successful Prosecutions**

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

**Reporting Changes**

There was no reporting change during the reporting period.

**Future Key Issues**

The future key issues to be undertaken in the upcoming month are:

- Surveying works (land-based)
- Trimming of slopes profile and hydroseeding (land-based)
- Construction of remaining U-channels (land-based)
- Maintenance of temporary traffic arrangements (TTA) associated with the commissioning of HKBCF and Tuen Mun – Chek Lap Kok Link Southern Connection (TM-CLKL-SC) (land-based), and subsequent removal of TTA upon completion of roadworks (land-based)
- Defects rectification for roads & drainage, bridge, utility drawpit and pillar box (land-based)

# 1 Introduction

## 1.1 Background

On 13 March 2015, Mott MacDonald Hong Kong Limited (MMHK) was commissioned by China State Construction Engineering (Hong Kong) Limited (also referred to as “the Contractor”) to undertake the Environmental Team (ET) services (including environmental monitoring and audit (EM&A)) for Contract No. HY/2013/04 “Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities – Infrastructure Works Stage II (Southern Portion)” (“the Contract”) for the Highways Department of Hong Kong Special Administrative Region (HKSAR).

The Contract is part of the “Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing Facilities” (HZMB HKBCF) Project which is a “Designated Project” under Schedule 2 of the Environmental Impact Assessment (EIA) Ordinance (Cap. 499) and for which an EIA Report (Register No. AEIAR-145/2009) was prepared and approved. The current Environmental Permit (EP) for HKBCF, namely No. EP-353/2009/K, was issued on 11 April 2016. These documents are available through the EIA Ordinance Register. Commencement of the Contract took place on 13 March 2015 and the construction works commenced on 13 July 2015. The works areas of the contract are shown in **Appendix A**.

This is the 54<sup>th</sup> Monthly EM&A Report summarising the findings of EM&A activities conducted under the Contract from 1 to 31 December 2019 (the “reporting period”) and is submitted to fulfil Condition 5.4 of the EP.

The Highways Department of HKSAR, the Contractor and MMHK consent to the requirements under the current EP for HZMB HKBCF to submit EM&A reports to the Environmental Protection Department (EPD) for public inspection.

## 1.2 Project Description

The Proposed works under this Contract comprise the following:

- Construction of vehicular bridge and at-grade roads at the southern portion of Hong Kong Boundary Crossing Facilities;
- Construction of associated street lighting, street furniture, road marking, road signage, box culverts and outfalls, drainage, sewerage, fresh water and flushing water supply, irrigation, landscape, electrical and mechanical (E&M), utilities and services works;
- Provisioning of civil engineering works and power supply for Traffic Control and Surveillance System (TCSS); and
- Other works in accordance with the Contract.

## 1.3 Project Organisation

The organisation chart and lines of communication with respect to the on-site environmental management structure together with the contact information of the key personnel are shown in **Appendix B**. 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       |
|--|--|-------------|--------------------------|-----------|
| Engineer or Engineer's Representative<br>(AECOM Asia Co. Ltd.)                                     | Senior Resident Engineer               | Peter Lee   | 3958 7465                | 3748 8900 |
| Environmental Project Office /<br>Independent Environmental Checker<br>(Ramboll Hong Kong Limited) | Environmental Project Office<br>Leader | Y H Hui     | 3465 2888                | 3465 2899 |
|  | Independent Environmental<br>Checker   | Ray Yan     | 3465 2836 /<br>5181 8401 | 3465 2899 |
|  | Environmental Site<br>Supervisor       | Harris Wong | 3465 2805 /<br>5181 8709 | 3465 2899 |
| Contractor<br>(China State Construction Engineering<br>(Hong Kong) Limited)                        | Site Agent                             | Jason Chung | 9127 8369                | 2459 4336 |
|  | Environmental Officer                  | Xavier Lam  | 9493 2944                | 2459 4336 |
|  |  | K P Ng      | 9626 9961                | 2459 4336 |
| Environmental Team<br>(Mott MacDonald Hong Kong Limited)   | Environmental Team Leader              | Gary Chow   | 2828 5874                | 2827 1823 |
| 24-hour Complaint Hotline  | -                                      | -           | 5236 7111                | -         |

## 1.4 Construction Programme

The Construction Works Programme of the Project is provided in **Appendix C**.

## 1.5 Construction Works undertaken during the Reporting Period

A summary of the construction activities undertaken during this reporting period is shown below:

- Surveying works (land-based)
- Trimming of slopes profile and hydroseeding (land-based)
- Construction of remaining U-channels (land-based)
- Maintenance of temporary traffic arrangements (TTA) associated with the commissioning of HKBCF and Tuen Mun – Chek Lap Kok Link Southern Connection (TM-CLKL-SC) (land-based), and subsequent removal of TTA upon completion of roadworks (land-based)
- Defects rectification for roads & drainage, bridge, utility drawpit and pillar box (land-based)
- No marine-based segment delivery (all segments stored at segment storage yard on HKBCF island site)
- No generation of excavated marine sediment

During this reporting period, temporary soft landscaping works were conducted and marine-based outfall works had not commenced.



## 2 Air Quality Monitoring

### 2.1 Introduction

In accordance with the Contract Specific EM&A Manual, baseline 1-hour and 24-hour Total Suspended Particulates (TSP) levels at air quality monitoring stations AMS6 and AMS7 were established. Also, baseline 1-hour and 24-hour Total Suspended Particulates (TSP) levels at air quality monitoring stations AMS2 and AMS3 were established under other HKBCF contracts. 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.

### 2.2 Monitoring Locations

Monitoring locations AMS2, AMS3, AMS6 and AMS7 were set up at the proposed locations in accordance with the relevant Contract Specific EM&A Manual. For monitoring location AMS3 (Ho Yu College), as proposed in the Contract Specific EM&A Manual, approval for carrying out impact monitoring could not be obtained from the principal of the school. Permission on setting up and carrying out impact monitoring works at nearby sensitive receivers, like Caribbean Coast and Coastal Skyline, was also sought. However, approvals for carrying out impact monitoring works within their premises were not obtained. Impact air quality monitoring was conducted at site boundary of the site office area in Works Area WA2 (AMS3B) before being relocated to Ying Tung Estate Market Rooftop (AMS3C) on 20 August 2018 under this Contract. The same baseline and Action Level for air quality, as derived from the baseline monitoring data recorded at Ho Yu College, was adopted for this alternative air quality location.

It should be noted that the air quality monitoring works for the Contract at AMS6 (Dragonair/CNAC (Group) Building) are covered by Contract No. HY/2011/03 “Hong Kong-Zhuhai-Macao Bridge Hong Kong Link Road (HZMB HKLR) – Section between Scenic Hill and HKBCF”.

The ET of the Contract or another ET of the HZMB project is required to conduct impact air quality monitoring at AMS6 as part of EM&A programme if this air quality monitoring station is no longer covered under Contract No. HY/2011/03.

**Table 2.1** describes the details of the monitoring stations and **Figure 2.1** shows the locations of air monitoring stations.

**Table 2.1: Construction Dust Monitoring Locations**

| Identification No.  | Location Description            |
|---|---------------------------------|
| AMS2  | Tung Chung Development Pier     |
| AMS3C   | Ying Tung Estate Market Rooftop |
| AMS6 <sup>(1)</sup>   | Dragonair/CNAC (Group) Building |
| AMS7B   | 3RS Site Offices                |
| Remarks: (1) The ET of this Contract should conduct impact air quality monitoring at station AMS6 listed in the table as part of EM&A programme according to latest notification from ENPO when the monitoring station(s) is/are no longer covered by another ET of the HZMB project. |                                 |

## 2.3 Monitoring Action and Limit Levels

The Action and Limit Levels for 1-hr TSP and 24-hr TSP are provided in **Table 2.2** and **Table 2.3** respectively. The same baseline and Action/Limit Levels for air quality, as derived from the baseline monitoring data recorded at AMS3 and AMS7, apply with the abovementioned relocations to AMS3C and AMS7B respectively.

**Table 2.2: Action and Limit Levels for 1-hour TSP**

| Monitoring Station                              | Action Level, $\mu\text{g}/\text{m}^3$ | Limit Level, $\mu\text{g}/\text{m}^3$ |
|---|--|---------------------------------------|
| AMS2 – Tung Chung Development Pier              | 374                                    | 500                                   |
| AMS3C – Ying Tung Estate Market Rooftop         | 368                                    | 500                                   |
| AMS6 – Dragonair / CNAC (Group) Building (HKIA) | 360                                    | 500                                   |
| AMS7B – 3RS Site Offices                        | 370                                    | 500                                   |

**Table 2.3: Action and Limit Levels for 24-hour TSP**

| Monitoring Station                              | Action Level, $\mu\text{g}/\text{m}^3$ | Limit Level, $\mu\text{g}/\text{m}^3$ |
|---|--|---------------------------------------|
| AMS2 – Tung Chung Development Pier              | 176                                    | 260                                   |
| AMS3C – Ying Tung Estate Market Rooftop         | 167                                    | 260                                   |
| AMS6 – Dragonair / CNAC (Group) Building (HKIA) | 173                                    | 260                                   |
| AMS7B – 3RS Site Offices                        | 183                                    | 260                                   |

The event and action plan is provided in **Appendix D**.

If exceedance(s) at these stations is/are recorded by the ET of the Contract or referred by the other ET under the HZMB project to the Contract, the ET of the Contract will carry out an investigation and findings will be reported in the monthly EM&A Report.

## 2.4 Monitoring Station AMS6

The monitoring requirements, monitoring equipment, monitoring parameters, frequency and duration, monitoring methodology and monitoring schedule for air quality monitoring station AMS6 are detailed in the monthly EM&A Reports prepared for Contract No. HY/2011/03.

## 2.5 Monitoring Schedule for the Reporting Period

The schedule for air quality monitoring at AMS2, AMS3C and AMS7B in the reporting period is presented in **Appendix I**.

## 2.6 Monitoring Equipment

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 used for air quality monitoring stations AMS2, AMS3C and AMS7B under this Contract is given in **Table 2.4**.

**Table 2.4: Air Quality Monitoring Equipment**

| Equipment                                       | Brand  | Model No. |
|---|--|-----------|
| Portable direct reading dust meter (1-hour TSP) | Sibata Digital Dust Monitor  | LD-5R     |
| High Volume Sampler (24-hour TSP)               | Tisch Environmental Mass Flow Controlled Total Suspended Particulate (TSP) High Volume Sampler | TE-5170   |

## 2.7 Monitoring Methodology

### 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  $\pm 2.5\%$  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 °C and not variable by more than  $\pm 3$  °C; the relative humidity (RH) was < 50% and not variable by more than  $\pm 5\%$ . 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<sup>3</sup>/min, and complied with

the range specified in the Updated EM&A Manual for HKBCF (Version 1.0) (i.e. 0.6-1.7 m<sup>3</sup>/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 J**.

## 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 J**.

## 2.8 Monitoring Results and Exceedance Investigation

The monitoring results for 1-hour and 24-hour TSP at AMS2, AMS3C and AMS7B are summarized in **Table 2.5** and **Table 2.6** respectively. Detailed impact air quality monitoring results are presented in **Appendix K**.

**Table 2.5: Summary of 1-hour TSP Monitoring Results During the Reporting Period**

| Monitoring Station | Average, $\mu\text{g}/\text{m}^3$ | Range, $\mu\text{g}/\text{m}^3$ | Action Level, $\mu\text{g}/\text{m}^3$ | Limit Level, $\mu\text{g}/\text{m}^3$ |
|--------------------|-----------------------------------|---------------------------------|--|---------------------------------------|
| AMS2               | 50                                | 20 – 147                        | 374                                    | 500                                   |
| AMS3C              | 82                                | 23 – 233                        | 368                                    | 500                                   |
| AMS7B              | 53                                | 22 – 127                        | 370                                    | 500                                   |

**Table 2.6: Summary of 24-hour TSP Monitoring Results During the Reporting Period**

| Monitoring Station | Average, $\mu\text{g}/\text{m}^3$ | Range, $\mu\text{g}/\text{m}^3$ | Action Level, $\mu\text{g}/\text{m}^3$ | Limit Level, $\mu\text{g}/\text{m}^3$ |
|--------------------|-----------------------------------|---------------------------------|--|---------------------------------------|
| AMS2               | 92                                | 34 – 138                        | 176                                    | 260                                   |
| AMS3C              | 103                               | 33 – 164                        | 167                                    | 260                                   |
| AMS7B              | 129                               | 39 – 198                        | 183                                    | 260                                   |

There was no Action and Limit Level exceedance of 1-hour TSP level and 24-hour TSP level recorded at station AMS2 and AMS3C, and no Action and Limit Level exceedance of 1-hour TSP level recorded at station AMS7B, by the Environmental Team of this Contract during the reporting period.

One Action Level exceedance of 24-hour TSP for air quality at AMS7B was recorded and investigated by the ET of the Contract during the reporting period.

The monitoring results for AMS6 are reported in the monthly EM&A Reports prepared for Contract No. HY/2011/03.

Summary of Action and Limit Level exceedance of 1-hour TSP level and 24-hour TSP level at AMS6 shall be referred to the monthly EM&A report prepared by Contract No. HY/2011/03.

The wind data obtained from the on-site wind station (as shown in **Figure 2.1**) during the reporting period is provided in **Appendix M**.

Air quality exceedance recorded during the reporting period is summarised in **Table 2.7**.

**Table 2.7: Action and Limit Level Exceedance for Air Quality**

| Date       | Parameter   | Station | Exceedance Recorded |
|------------|-------------|---------|---------------------|
| 2 Dec 2019 | 24-hour TSP | AMS7B   | Action Level        |

The investigation findings into the exceedance are summarised below. The full investigation reports are presented in **Appendix N**.

### 2 December 2019 (at AMS7B)

According to the Contractor of HY/2013/04, the major construction activities conducted under the Contract during the monitoring period included aggregate placement for seawall capping layer, formation of remaining works, construction of utilities cross-over frame under Bridge D9c, trimming of fill slopes, U-channel casting works and concrete defect rectification at bridge external face and deck voids.

As informed by the Contractor of HY/2013/04, watering of all main haul roads was provided in accordance with the HY/2013/04 site watering plan. This plan schedules water spraying for at least 8 times per day which follows the recommended mitigation measures in the EM&A Manual and Environmental Permit.

During ET's regular weekly site inspections on 27 November 2019 (14:45-15:45) and 4 December 2019 (14:30-15:30), one air quality observation was recorded: namely, an exposed works area was observed dry and dusty.

Photos relating to the Contractor's site watering on 1-3 December 2019 and abovementioned site inspections are presented in the investigation report.

The wind data collected at the AMS3C wind station at Ying Tung Estate and the Hong Kong Observatory wind station at Chek Lap Kok during the abovementioned 24-hour monitoring period (as presented in the investigation report) shows that winds were in the NNW to ENE range during the 24-hour TSP monitoring. This indicates that it was unlikely that the source of exceedance could be attributed to HY/2013/04.

Information available on EPD's Air Quality Health Index (AQHI) website shows that the short-term health risk of air pollution between 8:00 a.m. on 2 December 2019 and 8:00 a.m. on 3 December 2019 was low to moderate at Tung Chung (with maximum AQHI of 4 at 14:00-02:00 a.m. and 07:00-08:00 a.m.). The AQHI data is available online at:

- [http://www.aqhi.gov.hk/epd/ddata/html/history/2019/201912\\_Eng.csv](http://www.aqhi.gov.hk/epd/ddata/html/history/2019/201912_Eng.csv)

It was concluded that the exceedance was not due to HY/2013/04.

## 3 Noise Monitoring

### 3.1 Introduction

In accordance with the Contract Specific EM&A Manual, impact noise monitoring was conducted at least once per week for each noise monitoring location during the construction phase of the Contract.

### 3.2 Monitoring Locations

Approval for carrying out impact monitoring at NMS3 (Ho Yu College), as proposed in the Contract Specific EM&A Manual, could not be obtained from the principal of school. Permission on setting up and carry out impact monitoring works at nearby sensitive receivers, like Caribbean Coast and Coastal Skyline, was also sought. However, approvals for carrying out impact monitoring works within their premises were not obtained. Impact noise monitoring was conducted at site boundary of the site office area in Works Area WA2 (NMS3B) before being relocated to Ying Tung Estate Market Rooftop (NMS3C) on 20 August 2018 under this Contract. The same baseline noise level (as derived from the baseline monitoring data recorded at Ho Yu College) and Limit Level were adopted for this alternative noise monitoring location.

A proposal to terminate impact monitoring for noise at NMS2 and NMS3C was justified by the ET Leader of this Contract and verified by the IEC on 13 August 2019, and approved by EPD on 3 September 2019. Therefore, the last noise monitoring event at NMS2 and NMS3C to be reported under this Contract was conducted on 2 September 2019, and no impact noise monitoring was conducted during the reporting period.

**Table 3.1** describes the details of the monitoring stations and **Figure 3.1** shows the locations of noise monitoring stations.

**Table 3.1: Construction Noise Monitoring Locations**

| Identification No.   | Location Description                     |
|--|--|
| NMS2   | Seaview Crescent                         |
| NMS3C <sup>(1)</sup>   | Ying Tung Estate Refuse Collection Point |
| Remarks: (1) The Action and Limit Levels for schools will be applied for this alternative monitoring location. |  |

### 3.3 Monitoring Parameters, Frequency and Duration

**Table 3.2** summarises the monitoring parameters, frequency and duration of impact TSP monitoring.

**Table 3.2: Noise Monitoring Parameters, Frequency and Duration**

| Parameter  | Frequency and Duration |
|--|------------------------|
| 30-minutes measurement at each monitoring station between 0700 and 1900 on normal weekdays (Monday to Saturday).<br>L <sub>eq</sub> , L <sub>10</sub> and L <sub>90</sub> would be recorded. | At least once per week |

### 3.4 Action and Limit Levels

The Action and Limit Levels for construction noise are defined in **Table 3.3**.

**Table 3.3: Action and Limit Level for Construction Noise**

| Monitoring Station | Time Period                            | Action Level                              | Limit Level  |
|--------------------|--|---|--------------|
| NMS2               | 07:00 – 19:00 hours on normal weekdays | When one documented complaint is received | 70 dB(A)     |
| NMS3C              |  |   | 70/65 dB(A)* |

Remark: Limit Level for schools will be applied for NMS3C. Day time noise Limit Level of 70 dB(A) applies to education institutions, while 65 dB(A) applies during the school examination period.

The event and action plan is provided in **Appendix D**.

If exceedance(s) at these stations is/are recorded by the ET of the Contract or referred by the other ET under the HZMB project to the Contract, the ET of the Contract will carry out an investigation and findings will be reported in the monthly EM&A Report.

### 3.5 Monitoring Schedule for the Reporting Period

No monitoring schedule is presented for the reporting period, since impact noise monitoring has been terminated as approved by EPD on 3 September 2019.

### 3.6 Monitoring Equipment

No monitoring equipment is presented for the reporting period, since impact noise monitoring has been terminated as approved by EPD on 3 September 2019.

### 3.7 Monitoring Methodology

No monitoring methodology is presented for the reporting period, since impact noise monitoring has been terminated as approved by EPD on 3 September 2019.

### 3.8 Monitoring Results

No monitoring results are presented for the reporting period, since impact noise monitoring has been terminated as approved by EPD on 3 September 2019.



## 4 Water Quality Monitoring

### 4.1 Introduction

Upon completion of all marine-based construction activities, a post-project monitoring exercise on water quality shall be carried out for 4 weeks in the same manner as the Baseline monitoring and was conducted during May 2019. An impact operational phase monitoring exercise on water quality shall also be carried out monthly during the first year of Project operation at all designated monitoring stations including control stations; this was commenced in June 2019. For post-construction and impact operational phase water quality monitoring, measurement was taken in accordance with the Updated EM&A Manual for HKBCF (Version 1.0).

### 4.2 Monitoring Locations

During the reporting period, the impact operational phase water quality monitoring works were covered by this Contract. A total of four stations (two Sensitive Receiver Stations and two Control Stations) are covered for impact operational phase monitoring by the current EM&A programme.

The two Sensitive Receiver Stations (SR) were chosen as they are close to the key sensitive receivers and the two Control Stations (CS) were chosen to facilitate comparison of the water quality of the SR stations with less influence by the Project/ ambient water quality conditions.

During impact construction water quality monitoring, the water quality monitoring station at SR3 was not available for water sampling due to safety reason, thus, monitoring station was changed to SR3(N) (Coordinate: 810689E, 816591N) and was justified by the ET Leader of Contract No. HY/2013/01 on 8 November 2017 and verified by the IEC on 13 November 2017; and submitted to EPD on 29 November 2017 and it was approved by EPD on 22 December 2017. Also, the water quality monitoring station at CS2 (Coordinate: 805849E, 818780N) was occupied by the marine work of a designated project – “Expansion of Hong Kong International Airport into a Three-Runway System” (3RS Project) – thus, monitoring station was changed to CS2(A) (Coordinate: 805232E, 818606N) and was justified by the ET Leader of HZMB HLKR Contract No. HY/2011/09, and verified by the IEC; and submitted to EPD on 12 July 2017 and it was approved by EPD on 28 July 2017 for implementation with effect from 31 July 2017.

Application of the alternative water quality monitoring stations at SR3(N) and CS2(A) to impact operational phase water quality monitoring was justified by the ET Leader of this Contract on 14 May 2019, verified by the IEC on 15 May 2019 and submitted to EPD for record on 15 May 2019 for implementation with effect from June 2019.

**Table 4.1** and **Figure 4.1** shows the locations of water quality monitoring stations.

**Table 4.1: Impact Operational Phase Water Quality Monitoring Stations**

| Station | Description                        | East   | North  |
|---------|------------------------------------|--------|--------|
| SR2(A)  | Sensitive receivers (Sha Lo Wan)   | 807810 | 817189 |
| SR3(N)  | Sensitive receivers (San Tau SSSI) | 810689 | 816591 |
| CS2(A)  | Control Station                    | 805232 | 818606 |
| CS(Mf)5 | Control Station                    | 817990 | 821129 |

### 4.3 Monitoring Parameters, Frequency and Duration

**Table 4.2** summarizes the monitoring parameters, frequency and monitoring depths of impact operational phase water quality monitoring in the Updated EM&A Manual for HKBCF (Version 1.0).

**Table 4.2: Impact Operational Phase Water Quality Monitoring Parameters and Frequency**

| Monitoring Stations  | Parameter, Unit               | Frequency   | No. of Depths Measured   |
|--|-------------------------------|---|--|
| <b>Control Stations:</b><br>CS2(A), CS(Mf)5<br><b>Sensitive Receiver Stations:</b><br>SR2(A), SR3(N) | • Depth, m                    | Once monthly, during mid-ebb and mid-flood tides of the same monitoring day (within ±1.75 hour of the predicted time) | 3<br>(1m below water surface, mid-depth and 1m above sea bed, except where the water depth is less than 6m, in which case the mid-depth station may be omitted. Should the water depth be less than 3m, only the mid-depth station will be monitored.) |
|  | • Temperature, °C             |   |  |
|  | • Salinity, ppt               |   |  |
|  | • Dissolved Oxygen (DO), mg/L |   |  |
|  | • DO Saturation, %            |   |  |
|  | • Turbidity, NTU              |   |  |
|  | • pH                          |   |  |
|  | • Suspended Solids (SS), mg/L |   |  |

### 4.4 Monitoring Action and Limit Levels

The Action and Limit Levels for impact water quality monitoring are provided in **Table 4.3** for reference.

**Table 4.3: Action and Limit Levels for Impact Water Quality Monitoring**

| Parameters   | Action  | Limit  |
|--|---|--|
| DO in mg L <sup>-1</sup><br>(Surface, Middle & Bottom)                                       | Surface and Middle<br>5.0<br>Bottom<br>4.7  | Surface and Middle<br>4.2 (except 5 mg/L for FCZ)<br>Bottom<br>3.6   |
| SS in mg L <sup>-1</sup><br>(depth-averaged) at all monitoring stations and control stations | 23.5 and 120% of upstream control station's SS at the same tide of the same day*        | 34.4 and 130% of upstream control station's SS at the same tide of the same day and 10mg/L for WSD Seawater intakes* |
| Turbidity in NTU<br>(depth-averaged)   | 27.5 and 120% of upstream control station's turbidity at the same tide of the same day* | 47.0 and 130% of upstream control station's  |

Remarks:

\* Reference is made to EPD approval of adjustment of water quality assessment criteria issued and became effective on 18 February 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 limits occurs when monitoring result is lower than the limits.
3. For turbidity, SS, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.
4. All the figures given in the table are used for reference only and the EPD may amend the figures whenever it is considered as necessary.
5. The 1%-ile of baseline data for dissolved oxygen (surface and middle) and dissolved oxygen (bottom) are 4.2 mg/L and 3.6 mg/L respectively.

The event and action plan is provided in **Appendix D**.

### 4.5 Monitoring Schedule for the Reporting Period

Monthly impact operational phase water quality monitoring in accordance with Section 9.9 of the Updated EM&A Manual for HKBCF (Version 1.0) commenced in June 2019 and was conducted during the reporting period on 23 December 2019.

The schedule for impact operational phase water quality monitoring in the reporting period is presented in **Appendix I**.

## 4.6 Monitoring Equipment

**Table 4.4** summaries the equipment used in the impact operational phase water quality monitoring programme.

**Table 4.4: Water Quality Monitoring Equipment**

| Equipment  | Brand and Model | Serial Number |
|--|-----------------|---------------|
| DO and Temperature Meter, Salinity Meter, Turbidity Meter & pH Meter | YSI ProDSS      | 16H104233     |
|  | YSI 6920V2      | 00019CB2      |

## 4.7 Monitoring Methodology

### 4.7.1 Instrumentation

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

### 4.7.2 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, 1m below water surface, mid-depth and 1m above sea bed, except where the water depth was less than 6m, in which case the mid-depth station was omitted. Should the water depth be less than 3m, 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. For QA/QC procedures, one duplicate samples of every batch of 20 samples was analyzed.
- f. The analysis method and reporting and detection limit for SS is shown in **Table 4.5**.

**Table 4.5: Laboratory Analysis for Suspended Solids**

| Parameters            | Instrumentation | Analytical Method | Reporting Limit | Detection Limit |
|-----------------------|-----------------|-------------------|-----------------|-----------------|
| Suspended Solids (SS) | Weighting       | APHA 2540-D       | 0.5 mg/L        | 0.5 mg/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.

#### 4.7.3 Maintenance and Calibration

- a. All in situ monitoring instruments would be calibrated and calibrated by ALS Technichem (HK) Pty Ltd. before use and at 3-monthly intervals throughout all stages of the water quality monitoring programme. Calibration details are provided in **Appendix J**.
- b. The dissolved oxygen probe of YSI 6820 was calibrated by wet bulb method. Before the calibration routine, the sensor for dissolved oxygen was thermally equilibrated in water-saturated air. Calibration cup is served as a calibration chamber and it was loosened from airtight condition before it is used for the calibration. Calibration at ALS Technichem (HK) Pty Ltd. was carried out once every three months in a water sample with a known concentration of dissolved oxygen. The sensor was immersed in the water and after thermal equilibration, the known mg/L value was keyed in and the calibration was carried out automatically.
- c. The turbidity probe of YSI 6820 is calibrated two times a month. A zero check in distilled water was performed with the turbidity probe of YSI 6820 once per monitoring day. The probe will be calibrated with a solution of known NTU at ALS Technichem (HK) Pty Ltd. once every three months.

#### 4.8 Monitoring Results

Impact operational phase water quality monitoring results and graphical plots are presented in **Appendix K**.

## 5 Dolphin Monitoring

### 5.1 Introduction

Vessel based surveys for the Chinese White Dolphin (CWD), *Sousa chinensis*, are to be conducted by a dedicated team comprising a qualified marine mammal ecologist and experienced marine mammal observers (MMOs). The purpose of the surveys is to evaluate the impact of the HKBCF reclamation and, if deemed detrimental, to take appropriate action as per the EM&A Manual.

The transfer of the role of implementation of dolphin monitoring and collection of monitoring data from the ET of Contract No. HY/2011/03 to the ET of Contract No. HY/2012/08 “Tuen Mun-Chek Lap Kok Link – Northern Connection Sub-sea Tunnel Section” was justified by the ET Leader of Contract No. HY/2011/03 and verified by the IEC during August 2019, and approved by EPD during September 2019 for implementation with effect from October 2019.

During the reporting period, the ET of Contract No. HY/2012/08 continued the implementation of dolphin monitoring and collection of monitoring data, with the reporting by the ET of this Contract.

### 5.2 Monitoring Locations

#### 5.2.1 Vessel-based Line-transect Survey

According to the requirement of the updated EM&A Manual, the dolphin monitoring programme should adopt line-transect vessel survey method. The survey follows pre-set and fixed transect lines in the two areas defined by AFCD as: Northeast Lantau (NEL) survey area; and Northwest Lantau (NWL) survey area.

**Table 5.1** shows the co-ordinates for the transect lines and layout map. The layout map showing the transect lines have been provided by AFCD and are shown in **Figure 5.1**.

**Table 5.1: Post-Construction Dolphin Monitoring Line Transect Co-ordinates (Provided by AFCD)**

| Transect        | HK Grid System |        | Long Lat in WGS84 |           |
|-----------------|----------------|--------|-------------------|-----------|
|                 | X              | Y      | Long              | Lat       |
| 1 <sup>#</sup>  | 804671         | 815456 | 113.870287        | 22.277678 |
|                 | 804671         | 831404 | 113.869975        | 22.421696 |
| 2 <sup>#A</sup> | 805476         | 820800 | 113.877995        | 22.325951 |
|                 | 805476         | 826654 | 113.877882        | 22.378815 |
| 3 <sup>A</sup>  | 806464         | 821150 | 114.030267        | 22.196697 |
|                 | 806464         | 822911 | 114.047344        | 22.196712 |
| 4 <sup>A</sup>  | 807518         | 821500 | 114.033651        | 22.206219 |
|                 | 807518         | 829230 | 114.108618        | 22.206267 |
| 5 <sup>A</sup>  | 808504         | 821850 | 114.037037        | 22.215126 |
|                 | 808504         | 828602 | 114.102523        | 22.215169 |
| 6 <sup>A</sup>  | 809490         | 822150 | 114.039938        | 22.224033 |

| Transect         | HK Grid System |        | Long Lat in WGS84 |           |
|------------------|----------------|--------|-------------------|-----------|
|                  |                |        |                   |           |
|                  | 809490         | 825352 | 114.070995        | 22.224056 |
| 7 <sup>#</sup> ^ | 810499         | 822000 | 114.038474        | 22.233143 |
|                  | 810499         | 824613 | 114.063820        | 22.233163 |
| 8 <sup>#</sup>   | 811508         | 821123 | 113.936539        | 22.328966 |
|                  | 811508         | 824254 | 113.936486        | 22.357241 |
| 9 <sup>#</sup>   | 812516         | 821303 | 113.946320        | 22.330606 |
|                  | 812516         | 824254 | 113.946279        | 22.357255 |
| 10 <sup>*</sup>  | 813525         | 820827 | 113.956112        | 22.326321 |
|                  | 813525         | 824657 | 113.956066        | 22.360908 |
| 11 <sup>#</sup>  | 814556         | 818853 | 113.966155        | 22.304858 |
|                  | 814556         | 820992 | 113.966125        | 22.327820 |
| 12               | 815542         | 818807 | 113.975726        | 22.308109 |
|                  | 815542         | 824882 | 113.975647        | 22.362962 |
| 13               | 816506         | 819480 | 113.985072        | 22.314192 |
|                  | 816506         | 824859 | 113.985005        | 22.362771 |
| 14               | 817537         | 820220 | 113.995070        | 22.320883 |
|                  | 817537         | 824613 | 113.995018        | 22.360556 |
| 15               | 818568         | 820735 | 114.005071        | 22.325550 |
|                  | 818568         | 824433 | 114.005030        | 22.358947 |
| 16               | 819532         | 821420 | 114.014420        | 22.331747 |
|                  | 819532         | 824209 | 114.014390        | 22.356933 |
| 17               | 820451         | 822125 | 114.023333        | 22.338117 |
|                  | 820451         | 823671 | 114.023317        | 22.352084 |
| 18               | 821504         | 822371 | 114.033556        | 22.340353 |
|                  | 821504         | 823761 | 114.033544        | 22.352903 |
| 19               | 822513         | 823268 | 114.043340        | 22.348458 |
|                  | 822513         | 824321 | 114.043331        | 22.357971 |
| 20               | 823477         | 823402 | 114.052695        | 22.349680 |
|                  | 823477         | 824613 | 114.052686        | 22.360610 |
| 21               | 805476         | 827081 | 113.877878        | 22.382668 |
|                  | 805476         | 830562 | 113.877811        | 22.414103 |
| 22               | 806464         | 824033 | 113.887520        | 22.355164 |
|                  | 806464         | 829598 | 113.887416        | 22.405423 |
| 23               | 814559         | 821739 | 113.966142        | 22.334574 |
|                  | 814559         | 824768 | 113.966101        | 22.361920 |
| 24 <sup>^</sup>  | 805476         | 815900 | 113.979368        | 22.187721 |
|                  | 805476         | 819100 | 114.010398        | 22.187756 |

## Remarks:

- (a) \* Due to the presence of deployed silt curtain systems at the site boundaries of the Contract, some of the transect lines shown in Figure 5.1 could not be fully surveyed during the regular survey. Transect 10 is reduced from 6.4km to approximately 3.6km in length due to the HKBCF construction site. Therefore, the total transect length for both NEL and NWL combined is reduced to approximately 108km.
- (b) # Coordinates for transect lines 1, 2, 7, 8, 9 and 11 have been updated in respect to the Proposal for Alteration of Transect Line for Dolphin Monitoring approved by EPD on 19 August 2015.
- (c) ^ Due to marine works of the Expansion of Hong Kong International Airport into a Three-Runway System (3RS Project), the change of transect lines 2, 3, 4, 5, 6 and 7 and new transect line 24 were justified and verified by the ET Leader for Contract No. HY/2010/02 and the IEC respectively on 24 March 2017 and it was approved by EPD on 12 May 2017.

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 22 years of marine mammal monitoring surveys in Hong Kong developed by HKCRP (see Hung, 2017, 2018). For each monitoring vessel survey, a 15-m inboard vessel with an open upper deck (about 4.5 m above water surface) was used to make observations from the flying bridge area.

Two experienced observers (a data recorder and a primary observer) made up the on-effort survey team, and the survey vessel transited 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 Fuinon marine binoculars.

Both observers searched the sea ahead of the vessel, between 270° and 90° (in relation to the bow, which is defined as 0°). One to two additional experienced observers were available on the boat to work in shift (i.e. rotate every 30 minutes) in order to minimize fatigue of the survey team members. All observers were experienced in small cetacean survey techniques and identifying local cetacean species.

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).

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

When dolphins were sighted, the survey team would end the survey effort, and immediately record the initial sighting distance and angle of the dolphin group from the survey vessel, as well as the sighting time and position. Then the research vessel 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.

Survey effort being conducted along the parallel transect lines that were perpendicular to the coastlines was labelled as “primary” survey effort, while the survey effort conducted along the connecting lines between parallel lines was labelled as “secondary” survey effort. According to HKCRP long-term dolphin monitoring data, encounter rates of 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.

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.

### 5.2.2 Photo-identification Work

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.

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

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.

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).

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.

### 5.3 Action and Limit Levels for Dolphin Monitoring

The Action and Limit Levels for Chinese White Dolphin Monitoring are provided in **Table 5.2** and **Table 5.3**, respectively.

**Table 5.2: Action and Limit Levels for Chinese White Dolphin Monitoring - Approach to Define Action Level (AL) and Limit Level (LL)**

|              | North Lantau Social Cluster   |   |
|--------------|---|---|
|              | NEL   | NWL   |
| Action Level | (STG < 70% of baseline) & (ANI < 70% of baseline)   | (STG < 70% of baseline) & (ANI < 70% of baseline) |
| Limit Level  | [(STG < 40% of baseline) & (ANI < 40% of baseline)] AND [(STG < 40% of baseline) & (ANI < 40% of baseline)] |   |

**Table 5.3: Derived Value of Action Level (AL) and Limit Level (LL) for Chinese White 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)] |                            |

The event and action plan is provided in **Appendix D**.

If exceedance(s) at these survey transect(s) is/are recorded by the ET of the Contract or referred by the other ET under the HZMB project to the Contract, the ET of the Contract will carry out an investigation and findings will be reported in the monthly EM&A Report.

### 5.4 Monitoring Schedule for the Reporting Period

Post-construction dolphin monitoring in accordance with Section 10.7 of the Updated EM&A Manual for HKBCF commenced in March 2019 and was conducted during the reporting period.



The schedule for dolphin monitoring for the reporting period is provided in **Appendix I**.

## 5.5 Monitoring Results

### 5.5.1 Vessel-based Line-transect Survey

Two sets of systematic line-transect vessel surveys were conducted under the HKBCF dolphin monitoring programme on 3, 10, 12 and 16 December 2019, 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 L**.

A total of 262.02 km of survey effort was collected, with 100% of the total survey effort being conducted under favourable weather conditions (i.e. Beaufort Sea State 3 or below with good visibility) during the reporting period's surveys (**Annex I of Appendix L**).

Among the two areas, 95.80 km and 166.22 km of survey effort were conducted respectively. The total survey effort conducted on primary and secondary lines were 189.40 km and 72.62 km respectively (**Annex I of Appendix L**).

A total of three groups of 13 Chinese White Dolphins were sighted during the two sets of monitoring surveys conducted in NWL in December 2019, while no dolphin was sighted at all in NEL (**Annex II of Appendix L**). All three dolphin groups were sighted on primary lines during on-effort search, and they were not associated with any operating fishing vessel (**Annex II of Appendix L**).

Distribution of the three dolphin sightings made during this monitoring month is shown in **Figure 6 of Appendix L**. One large group of 11 dolphins was sighted along the HKLR09 alignment at the southwestern corner of NWL survey area, and the other two groups were two lone dolphins sighted to the west of Sha Chau and near Lung Kwu Tan respectively. All three sightings were located very far away from the HKBCF work site (**Figure 6 of Appendix L**).

During the reporting period's surveys, the 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 5.4** and **During the reporting period's surveys**, the average dolphin group size was 4.3 individuals per group. Two of the three groups were composed of lone animals, while the other one was a large group composed of 11 dolphins (**Annex II of Appendix L**).

Table 5.5.

**Table 5.4: Dolphin encounter rates deduced from the two sets of HKBCF surveys (two surveys in each set) during the reporting period in Northeast (NEL) and Northwest Lantau (NWL)**

|     |   | Encounter rate (STG)<br>(no. of on-effort dolphin sightings per 100 km of survey effort) | Encounter rate (ANI)<br>(no. of dolphins from all on-effort sightings per 100 km of survey effort) |
|-----|---|--|--|
|     |   | Primary Lines Only   | Primary Lines Only   |
| NEL | Set 1: December 3 <sup>rd</sup> / 10 <sup>th</sup>  | 0.0  | 0.0  |
|     | Set 2: December 12 <sup>th</sup> / 16 <sup>th</sup> | 0.0  | 0.0  |
| NWL | Set 1: December 3 <sup>rd</sup> / 10 <sup>th</sup>  | 0.0  | 0.0  |
|     | Set 2: December 12 <sup>th</sup> / 16 <sup>th</sup> | 5.0  | 21.8   |

During the reporting period's surveys, the average dolphin group size was 4.3 individuals per group. Two of the three groups were composed of lone animals, while the other one was a large group composed of 11 dolphins (**Annex II of Appendix L**).

**Table 5.5: Overall dolphin encounter rates (sightings per 100 km of survey effort) from all four HKBCF surveys conducted during the reporting period on primary lines only as well as both primary lines and secondary lines in NEL and NWL**

|     | Encounter rate (STG)<br>(no. of on-effort dolphin sightings per 100 km of survey effort) |                                  | Encounter rate (ANI)<br>(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 |
| NEL | 0.0  | 0.0                              | 0.0  | 0.0                              |
| NWL | 2.5  | 1.8                              | 10.9   | 7.8                              |

### 5.5.2 Photo-identification Work

During the two sets of monitoring surveys conducted in the reporting period, a total of nine known individuals were sighted nine times (**Annex III and IV of Appendix L**). All of them were re-sighted only once during the monthly surveys in the reporting period.

Notably, three identified individuals (i.e. CH108, NL120 and WL214) were sighted with their young calves during their re-sightings in the reporting period.

## 6 Environmental Site and Audit

### 6.1 Site Inspection

Site Inspections were carried out on a weekly basis to monitor the implementation of proper environmental pollution control mitigation measures for the project. During the reporting period, site inspections were carried out on 4, 11, 16 and 23 December 2019.

When permanent soft landscaping works within the site boundaries of the Contract are commenced, construction phase landscape and visual mitigation measures would be implemented in accordance with the EP, EIA and EM&A Manual. Monitoring and audit of landscape and visual mitigation measures would be conducted bi-weekly in accordance with Section 14.2 of the Updated EM&A Manual for HKBCF (Version 1.0). Permanent soft landscaping works within the Contract site had not commenced during the reporting period.

Particular observations during the site inspections and corrective actions undertaken by the Contractor are described below.

#### 30 October 2019

- a. The exposed works area was observed dry and dusty. Subsequently, as informed by the Contractor, the dry exposed works areas were handed over to another works contract. The observation was closed on 16 December 2019.

#### 6 November 2019

- a. A chemical waste storage area was observed damaged. The Contractor should repair / replace the damaged chemical waste storage area. Follow-up action for the outstanding observation will be inspected during the upcoming site inspections and reported in the coming reporting period.

#### 27 November 2019

- a. Muddy trail was observed outside the site entrance of Gate 3 works area. Subsequently, the works area at Bridge No.9 and Gate 3 was taken over by another works contract. The observation was closed on 4 December 2019.

#### 4 December 2019

- a. No new observations were made.

#### 11 December 2019

- a. No new observations were made.

#### 16 December 2019

- a. The waste skip was observed overflowing. Subsequently, the waste skip was cleared. The observation was closed on 23 December 2019.
- b. Improper NRMM label was observed on a generator. Subsequently, proper NRMM display was provided on the concerned generator. The observation was closed on 23 December 2019.

#### 23 December 2019

- a. No new observations were made.

## 6.2 Advice on the Solid and Liquid Waste Management Status

The Contractor registered as a chemical waste producer for the Contract. Sufficient numbers of receptacles were available for general refuse collection and sorting. As a practical means, the disposal operation is managed by a single HKBCF contractor who is also responsible for applying dumping permit and its subsequent extension applications from EPD. Contract No. HY/2013/03 has been assigned to coordinate and arrange for disposal of extracted marine sediment from this Contract.

There was no generation of excavated sediment for treatment during this reporting period. Any treatment of excavated marine sediment will be conducted using cement solidification/stabilization (Cement S/S) techniques and the treated sediment will be reused onsite for either backfilling or landscaping (e.g. berm material).

The monthly summary of waste flow table is detailed in **Appendix E**.

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 Practice on the Packing, Labelling and Storage of Chemical Waste.

### 6.2.1 Disposal of Marine Sediment Extracted from Bored Piling Works

#### 6.2.1.1 Background

After the acceptance of the review of the approved Sediment Quality Report (SQR) for this Project under EPD letter dated 19 August 2015, an approval to dispose the marine sediment extracted from bored piling for this Project was then approved under memo from Secretary, Marine Fill Committee of CEDD dated 20 August 2015 for the disposal of marine sediment extracted from bored piling works. The disposal sites allocated to this Project are the Mud Pit CMP2 of the Confined Marine Sediment Disposal Facility to the South of The Brothers (or at the East of Sha Chau). As advised by CEDD in the memo dated 19 February 2016, from 00:00 on 22 March 2016 onward, the disposal space at CMP2 of the South of The Brothers is closed and all disposal of contaminated sediment is to be carried out at CMP Vd to the East of Sha Chau (ESC).

As Contract No. HY/2013/01 has commenced treatment of the extracted marine sediment, treatment will continue and the treated marine sediment will be re-used within the HKBCF Island. On the other hand, Contract Nos. HY/2013/02, HY/2013/03 and HY/2013/04 have not commenced the treatment of extracted marine sediment. Therefore, the marine sediment extracted from these three Contracts will be disposed to the allocated disposal sites directly without treatment. As a practical means, the disposal operation is managed by one contractor who is also responsible for applying dumping permit and its subsequent extension applications from EPD. Contract No. HY/2013/03 has been assigned to coordinate and arrange for disposal of extracted marine sediment from all three Contracts.

The SQR was further reviewed in mid-2016. EPD has no comment to extend the validity of the SQR to August 2017 under letter dated 18 August 2016.

Based on the actual piling operation, the estimated quantity of marine sediment to be extracted has been revised from 85,000 m<sup>3</sup> to 126,000 m<sup>3</sup> (bulk volume). EPD has no comments on the request as in the letter dated 20 October 2016. The Secretary of Marine Fill Committee, CEDD approved the increasing quantity in the memo dated 10 November 2016.

During the course of reviewing the SQR, it was noted that the contamination level of the marine sediment extracted from the inner part of the HKBCF Island was not identified during the

previous sampling and testing. As requested by EPD, sampling and testing are required. The Sediment Sampling and Testing Proposal (SSTP) for the inner area of the HKBCF Island was approved by EPD on 2 June 2016.

As in the agreed SSTP for the inner area of the HKBCF Island, samples were taken from the seventeen batches of stockpiled marine sediments and from five boreholes each in one of the five sampling grids. After conducting chemical tests on samples, six batches of stockpiled samples under Contract No. HY/2013/03 and all eight batches of stockpiled samples under Contract No. HY/20013/04 are classified as Category L sediment. The Secretary of Marine Fill Committee of CEDD allocated disposal sites under memo dated 24 October 2016 and dated 22 November 2016 for disposal of a total of 9,500 m<sup>3</sup> in-situ volume of Category L sediment (using a bulk factor of 1.3). The Category L sediment was disposed in December 2016.

One sample from the batch of stockpiled marine sediment under Contract No. HY/2013/03 and samples from all five sampling grids had contamination levels exceeding the Lower Chemical Exceedance Levels (LCEL) and biological screenings were carried out. All samples passed the biological screenings and are classified as Category Mp sediment and to be disposed off site using Type II confined marine disposal method the same method used for marine sediment extracted from other part of the HKBCF Island.

#### 6.2.1.2 Dumping Arrangements

The barge for disposal of marine sediment will morn at the temporary loading and unloading at the east shore of the HKBCF Island, which has been being used by reclamation contractor (Contract No. HY/2010/02) for reclamation activities. In terms of safety consideration, each dumping date will be allocated to one Contract. The quantity of marine sediment disposed on the date is from one Contract.

During dumping, each Contractor is responsible for transporting the marine sediment from his site area to the barge. The estimated quantity of marine sediment in each truck is confirmed by Resident Site Staff of each Contract. The trip tickets for transportation and disposal of marine sediment are collected and checked. Contract No. HY/2013/03 as the dumping permit holder is responsible for reporting to EPD the quantity disposed of as the condition stipulated in the dumping permit.

#### 6.2.1.3 Reporting

AECOM has confirmed that the disposal of excavated marine sediments to allocated dumping site via Contract No. HY/2013/03 has been completed with the last batch disposal on 30 August 2017. The total quantities disposed are presented in the following table (**Table 6.1**):

**Table 6.1: Summary of Marine Sediment disposed to Dumping Site via Contract No. HY/2013/03**

|       | Type of Sediment and Quantity Disposed (m <sup>3</sup> ) |         |
|-------|--|---------|
|       | Cat. L (in Type I)                                       | Type II |
| Total | 3,570  | 39,814  |

Note: For monthly breakdown of these quantities, please refer to the waste flow table in **Appendix E**.

### 6.3 Environmental Licenses and Permits

The valid environmental licenses and permits during the reporting period are summarized in **Appendix F**.

## 6.4 Implementation Status of Environmental Mitigation Measures

In response to the site audit findings, the Contractor carried out corrective actions.

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

Implementation status of the Regular Marine Travel Route Plan (RMTRP) was checked by ET. Training of marine travel route for marine vessel operator was given to relevant staff and relevant records were kept properly.

According to the Contractor of HY/2013/04, all marine-based segment deliveries were completed in January 2018 and no marine-based works were conducted under the contract during the reporting period. The localised silt curtains under this Contract were removed on 4 January 2019.

## 6.5 Summary of Exceedance of the Environmental Quality Performance Limit

### Air Quality

There was no Action and Limit Level exceedance of 1-hour TSP level and 24-hour TSP level recorded at station AMS2 and AMS3C, and no Action and Limit Level exceedance of 1-hour TSP level recorded at station AMS7B, by the Environmental Team of this Contract during the reporting period.

One Action Level exceedance of 24-hour TSP for air quality at AMS7B was recorded and investigated by the ET of the Contract during the reporting period. It was concluded that the air quality exceedance was not due to the Contract.

The investigation findings are presented in Section 2.8 of this report.

Summary of Action and Limit Level exceedance of 1-hour TSP level and 24-hour TSP level at AMS6 shall be referred to the monthly EM&A report prepared by Contract No. HY/2011/03.

### Noise

Not applicable for the reporting period, since impact noise monitoring has been terminated as approved by EPD on 3 September 2019.

### Water Quality

Monthly impact operational phase water quality monitoring in accordance with Section 9.9 of the Updated EM&A Manual for HKBCF (Version 1.0) commenced in June 2019 and was conducted during the reporting period on 23 December 2019.

### Chinese White Dolphin

Post-construction dolphin monitoring in accordance with Section 10.7 of the Updated EM&A Manual for HKBCF (Version 1.0) commenced in March 2019.

During the reporting period, dolphin surveys were conducted on 3, 10, 12 and 16 December 2019. A total of 262.02 km of survey effort was collected, with 100% of the total survey effort being conducted under favourable weather conditions. During the two sets of monitoring surveys in the reporting period, a total of three groups of 13 Chinese White Dolphins were sighted during the two sets of monitoring surveys conducted in NWL in December 2019, while no dolphin was sighted at all in NEL (**Annex II of Appendix L**).

## 6.6 Summary of Complaints, Notification of Summons and Successful Prosecution

### Complaints

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

### Notification of Summons and Successful Prosecution

No notification of summons or prosecutions was received during the reporting period.

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

## 7 Future Key Issues

### 7.1 Construction Programme for the Coming Months

As informed by the Contractor, the major construction activities for January 2020 are summarized in **Table 7.1**.

**Table 7.1: Construction Activities for January 2020**

| Site Area | Description of Activities  |
|-----------|--|
| HKBCF     | <ul style="list-style-type: none"> <li>• Surveying works (land-based)</li> <li>• Trimming of slopes profile and hydroseeding (land-based)</li> <li>• Construction of remaining U-channels (land-based)</li> <li>• Maintenance of temporary traffic arrangements (TTA) associated with the commissioning of HKBCF and Tuen Mun - Chek Lap Kok Link Southern Connection (TM-CLKL-SC) (land-based), and subsequent removal of TTA upon completion of roadworks (land-based)</li> <li>• Defects rectification for roads &amp; drainage, bridge, utility drawpit and pillar box (land-based)</li> </ul> |

### 7.2 Environmental Site Inspection and Monitoring Schedule for the Coming Month

The tentative schedule for weekly site inspection and monitoring for air quality, water quality and Chinese White Dolphin for January 2020 is provided in **Appendix I**.



## 8 Conclusions

### 8.1 Conclusions

#### General

Commencement of the Contract took place on 13 March 2015 and the construction works of the Contract commenced on 13 July 2015.

The air quality, noise, water quality and dolphin monitoring works under Contract No. HY/2013/01 were suspended on 1 October 2018. From 1 October 2018 onwards, the ET of Contract No. HY/2013/04 has continued the same implementation of air quality, noise and water quality environmental monitoring (including air quality and noise monitoring already under its implementation) as well as the reporting of all environmental monitoring. The same implementation of dolphin monitoring was performed by the ET of Contract No. HY/2011/03 from 1 October 2018 to 30 September 2019 and is being continued by the ET of Contract No. HY/2012/08 from 1 October 2019 onwards.

Monthly impact operational phase water quality monitoring in accordance with Section 9.9 of the Updated EM&A Manual for HKBCF (Version 1.0) commenced in June 2019 and was conducted during the reporting period on 23 December 2019.

Moreover, post-construction dolphin monitoring in accordance with Section 10.7 of the Updated EM&A Manual for HKBCF (Version 1.0) commenced in March 2019 and was conducted during the reporting period.

#### Breaches of Action and Limit Levels

##### *Air Quality*

There was no Action and Limit Level exceedance of 1-hour TSP level and 24-hour TSP level recorded at station AMS2 and AMS3C, and no Action and Limit Level exceedance of 1-hour TSP level recorded at station AMS7B, by the Environmental Team of this Contract during the reporting period.

One Action Level exceedance of 24-hour TSP for air quality at AMS7B was recorded and investigated by the ET of the Contract during the reporting period. It was concluded that the air quality exceedance was not due to the Contract.

Summary of Action and Limit Level exceedance of 1-hour TSP level and 24-hour TSP level at AMS6 shall be referred to the monthly EM&A report prepared by Contract No. HY/2011/03.

##### *Noise*

Not applicable for the reporting period, since impact noise monitoring has been terminated as approved by EPD on 3 September 2019.

##### *Water Quality*

Monthly impact operational phase water quality monitoring in accordance with Section 9.9 of the Updated EM&A Manual for HKBCF (Version 1.0) commenced in June 2019 and was conducted during the reporting period on 23 December 2019.

### *Chinese White Dolphin*

Post-construction dolphin monitoring in accordance with Section 10.7 of the Updated EM&A Manual for HKBCF (Version 1.0) commenced in March 2019 and was conducted during the reporting period.

During the reporting period, dolphin surveys were conducted on 3, 10, 12 and 16 December 2019. A total of 262.02 km of survey effort was collected, with 100% of the total survey effort being conducted under favourable weather conditions. During the two sets of monitoring surveys in the reporting period, a total of three groups of 13 Chinese White Dolphins were sighted during the two sets of monitoring surveys conducted in NWL in December 2019, while no dolphin was sighted at all in NEL (**Annex II of Appendix L**).

### **Environmental Site Inspections**

Environmental site inspections were carried out on 4, 11, 16 and 23 December 2019. Recommendations on remedial actions were given to the Contractor for the deficiencies identified during the site inspections.

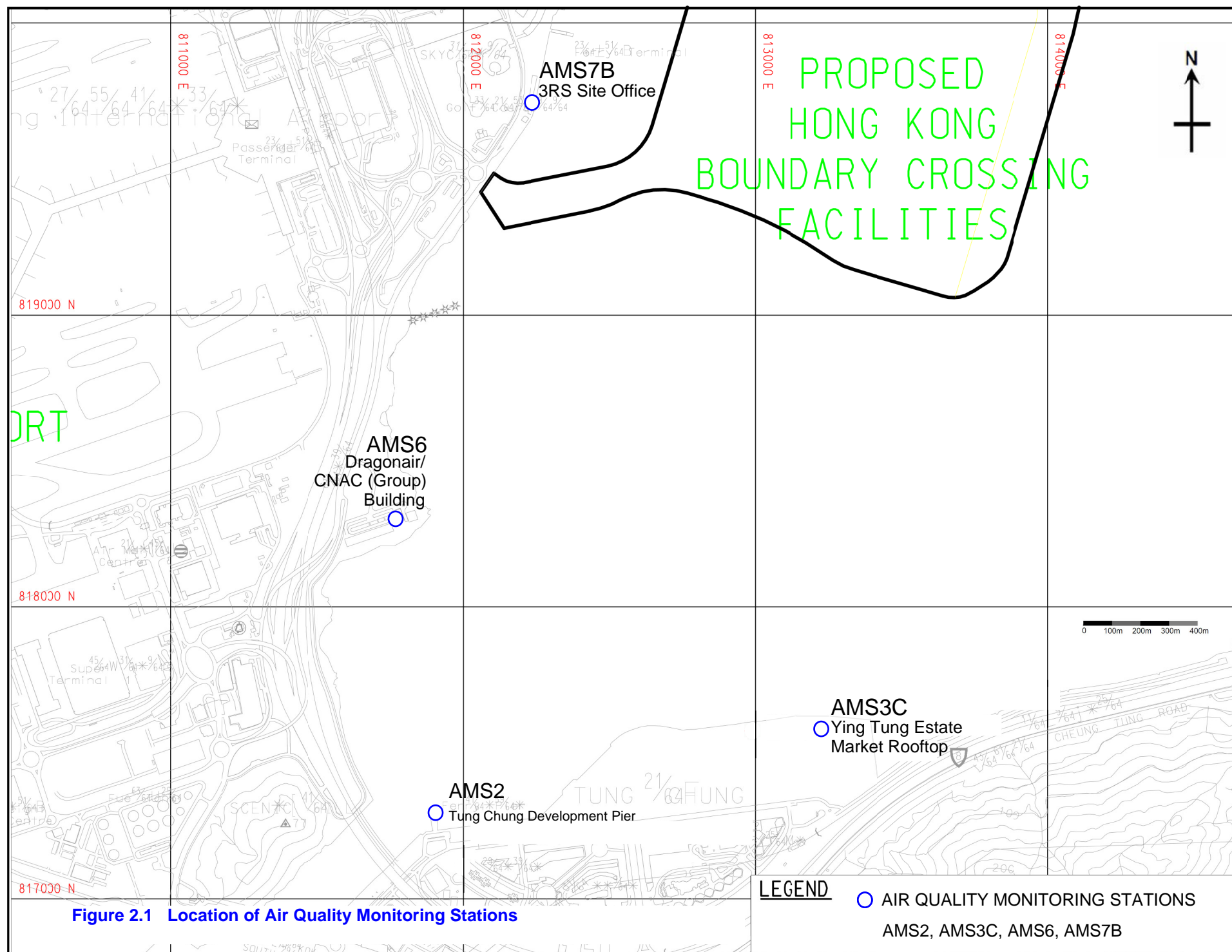
### **Complaints**

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

### **Notifications of Summons and Successful Prosecutions**

There were no notifications of summons or prosecutions received during the reporting period.

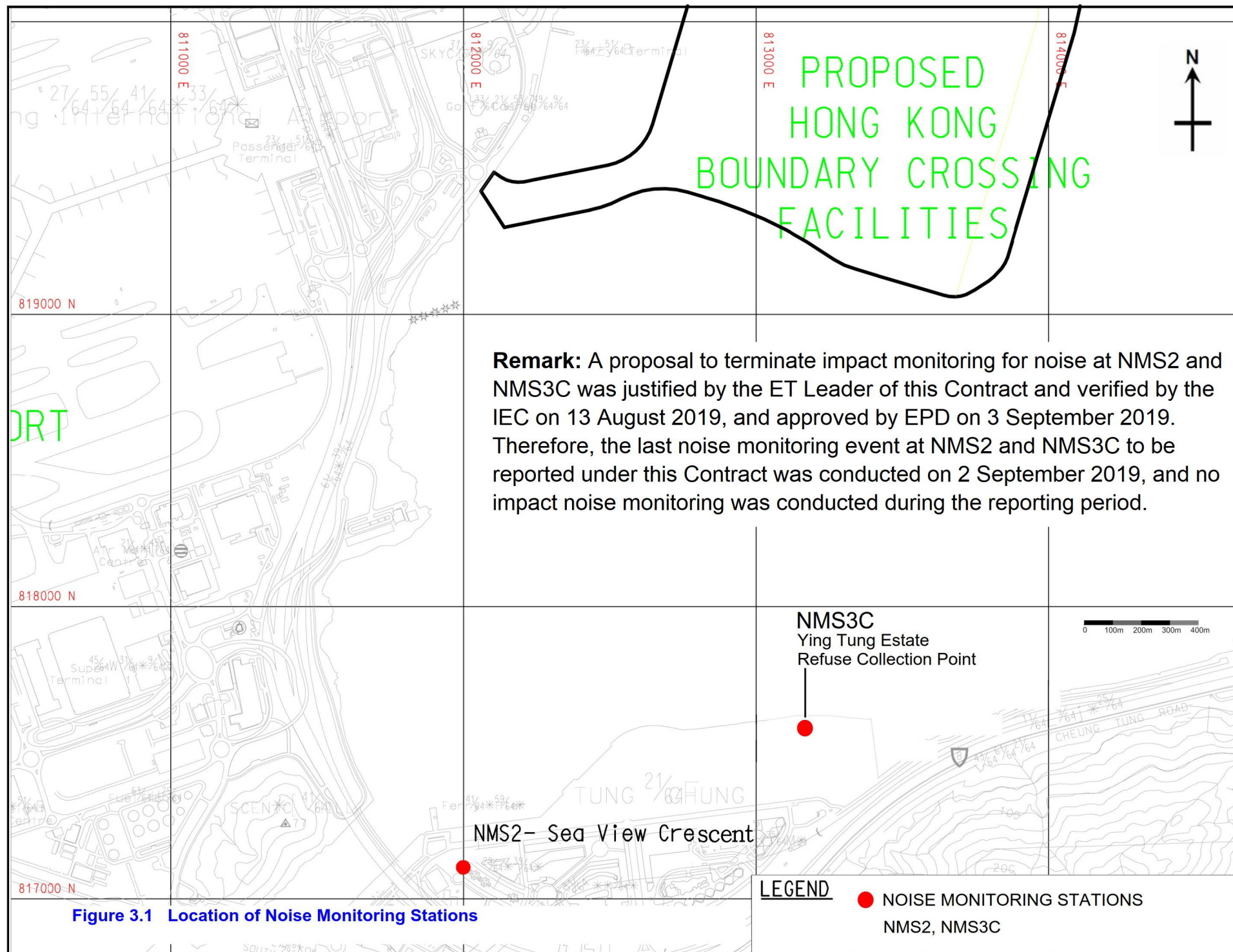
# Figures



**Figure 2.1** Location of Air Quality Monitoring Stations

**LEGEND**

- AIR QUALITY MONITORING STATIONS  
AMS2, AMS3C, AMS6, AMS7B







| Station | East   | North  |
|---------|--------|--------|
| SR2(A)  | 807810 | 817189 |
| SR3(N)  | 810689 | 816591 |
| CS2(A)  | 805232 | 818606 |
| CS(Mf)5 | 817990 | 821129 |

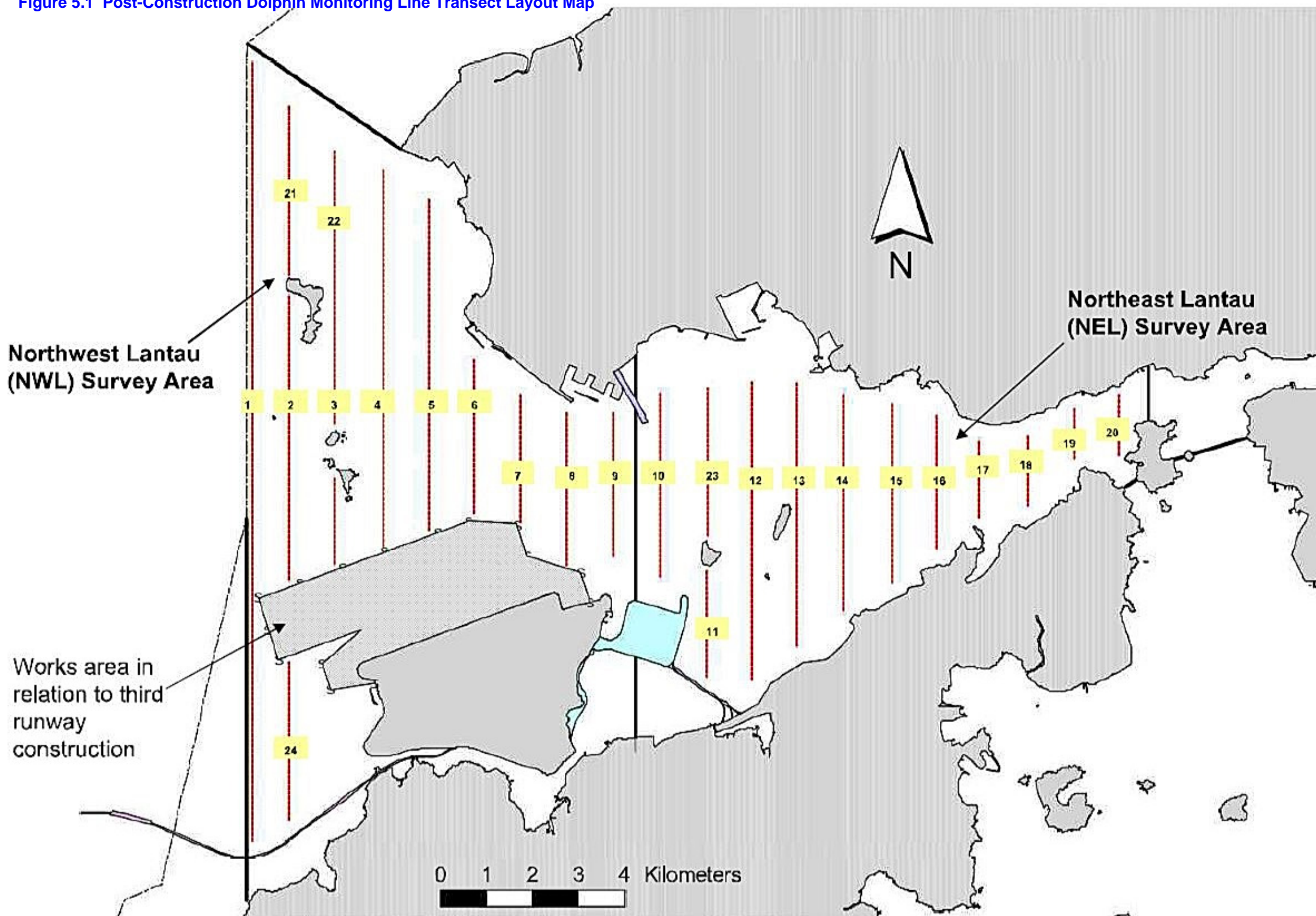
FIGURE 4.1— LOCATION  
OF WATER QUALITY  
MONITORING STATIONS

**LEGEND**

|   |    |                              |          |
|---|----|------------------------------|----------|
|  | CS | CONTROL                      | STATIONS |
|  | SR | SENSITIVE RECEIVERS STATIONS |          |

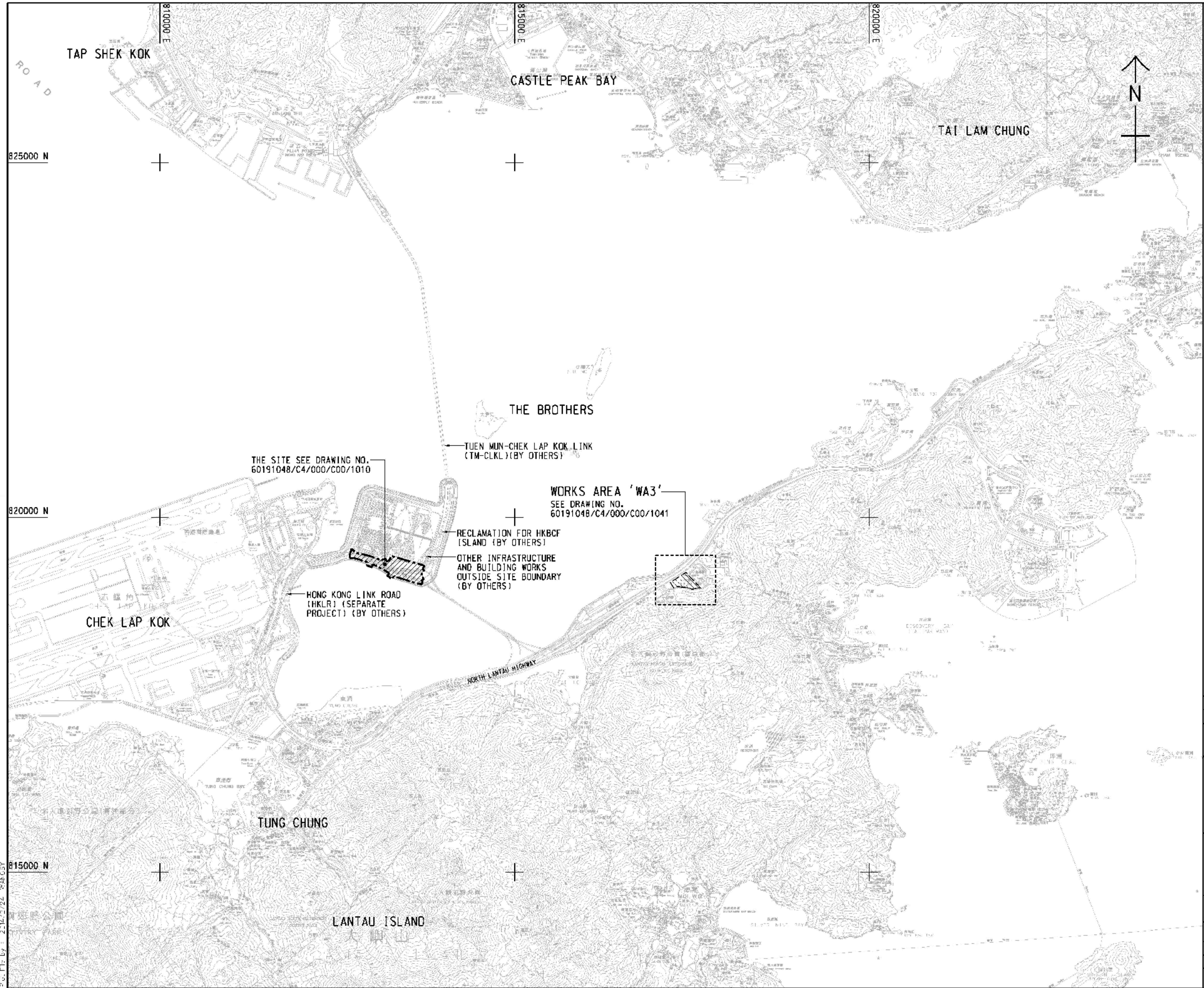


Figure 5.1 Post-Construction Dolphin Monitoring Line Transect Layout Map



## Appendix A. Location of Works Areas





NOTES:

- COORDINATES ARE RELATED TO HONG KONG METRIC GRID (1980).
- DIMENSIONS ARE IN MILLIMETER AND CHAINAGE ARE IN METRES UNLESS OTHERWISE SHOWN.

LEGEND:

- SITE BOUNDARY
- ▨ WORKS AREA

|      |                |                 |
|------|----------------|-----------------|
| REV. | DESCRIPTION    | DATE            |
| 1    | TENDER DRAWING | BHCV SCI FEB.14 |

路政處  
HIGHWAYS DEPARTMENT  
港珠澳大橋香港口岸工程處  
Hong Kong-Zhuhai-Macao Bridge Hong Kong Project Management Office

HONG KONG-ZHUHAI-MACAO BRIDGE  
HONG KONG BOUNDARY CROSSING FACILITIES  
- INFRASTRUCTURE WORKS STAGE (I) (SOUTHERN PORTION)

SITE LOCATION PLAN

**AECOM**  
Rogers Stirk Harbour + Partners  
BURO HAPPOLD ATKINS ADI

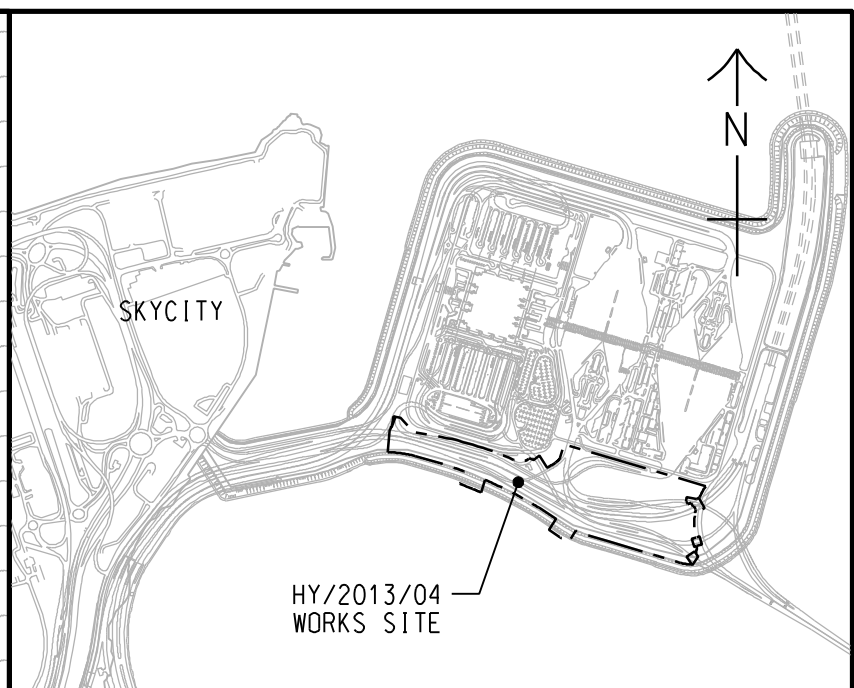
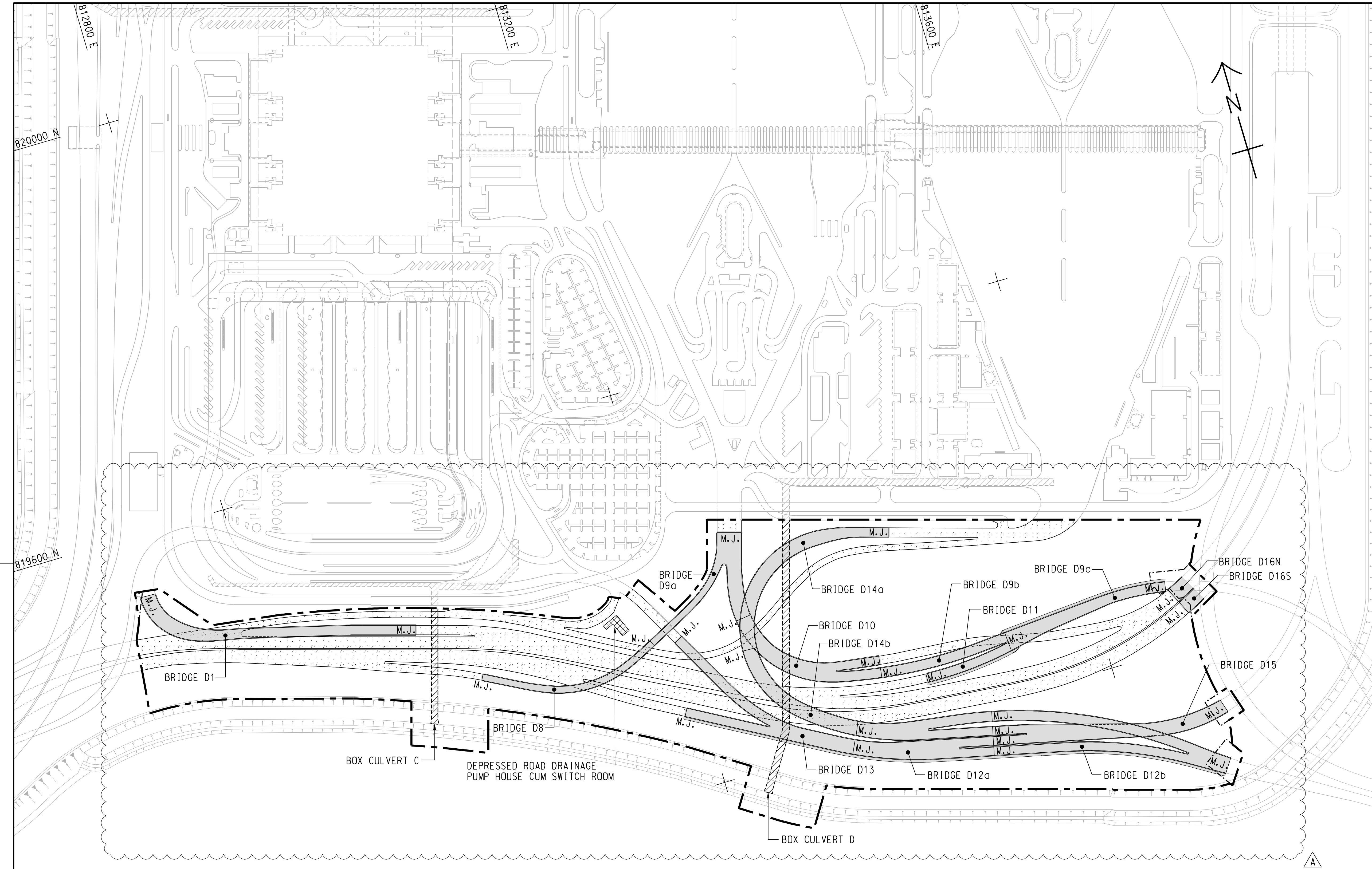
**Aedas**

DRG.NO. 60191048/C4/000/C00/1000  
圖紙編號

|                    |                   |                      |                    |
|--------------------|-------------------|----------------------|--------------------|
| DESIGNED BY<br>BHV | CHECKED BY<br>NSV | STATUS<br>HY/2013/04 | APPROVED BY<br>TKH |
|--------------------|-------------------|----------------------|--------------------|

|                       |                             |                             |
|-----------------------|-----------------------------|-----------------------------|
| SCALE<br>A1 1 : 25000 | DIMENSIONS ARE IN<br>METRES | COPYRIGHT RESERVED<br>版權所 有 |
|-----------------------|-----------------------------|-----------------------------|





LOCATION PLAN  
SCALE 1 : 25000

LEGEND:

- SITE BOUNDARY
- - - - - AT-GRADE WORKS LIMIT
- M.J. MOVEMENT JOINT
- BRIDGE
- BUILDING/FACILITIES
- AT-GRADE ROAD
- BOX CULVERT

|   |                       |          |         |
|---|-----------------------|----------|---------|
| B | WORKING DRAWING       | BWCW SCI | APR. 15 |
| A | TENDER ADDENDUM NO. 3 | BWCW SCI | MAY. 14 |
| - | TENDER DRAWING        | BWCW SCI | FEB. 14 |

| REV. | DESCRIPTION | CHECKED | DATE |
|------|-------------|---------|------|
| REV. | DESCRIPTION | CHECKED | DATE |

HONG KONG-ZHUHAI-MACAO BRIDGE  
HONG KONG BOUNDARY CROSSING FACILITIES  
- INFRASTRUCTURE WORKS STAGE II (SOUTHERN PORTION)

GENERAL ARRANGEMENT

**AECOM**  
Rogers Stirk Harbour + Partners  
BURO HAPPOLD ATKINS ADI

**Aedas**

DRG.NO. 60191048/C4/000/C00/1002B  
圖紙編號

|                   |                      |                |
|-------------------|----------------------|----------------|
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| BWCW              | HY/2013/04           | TKH            |

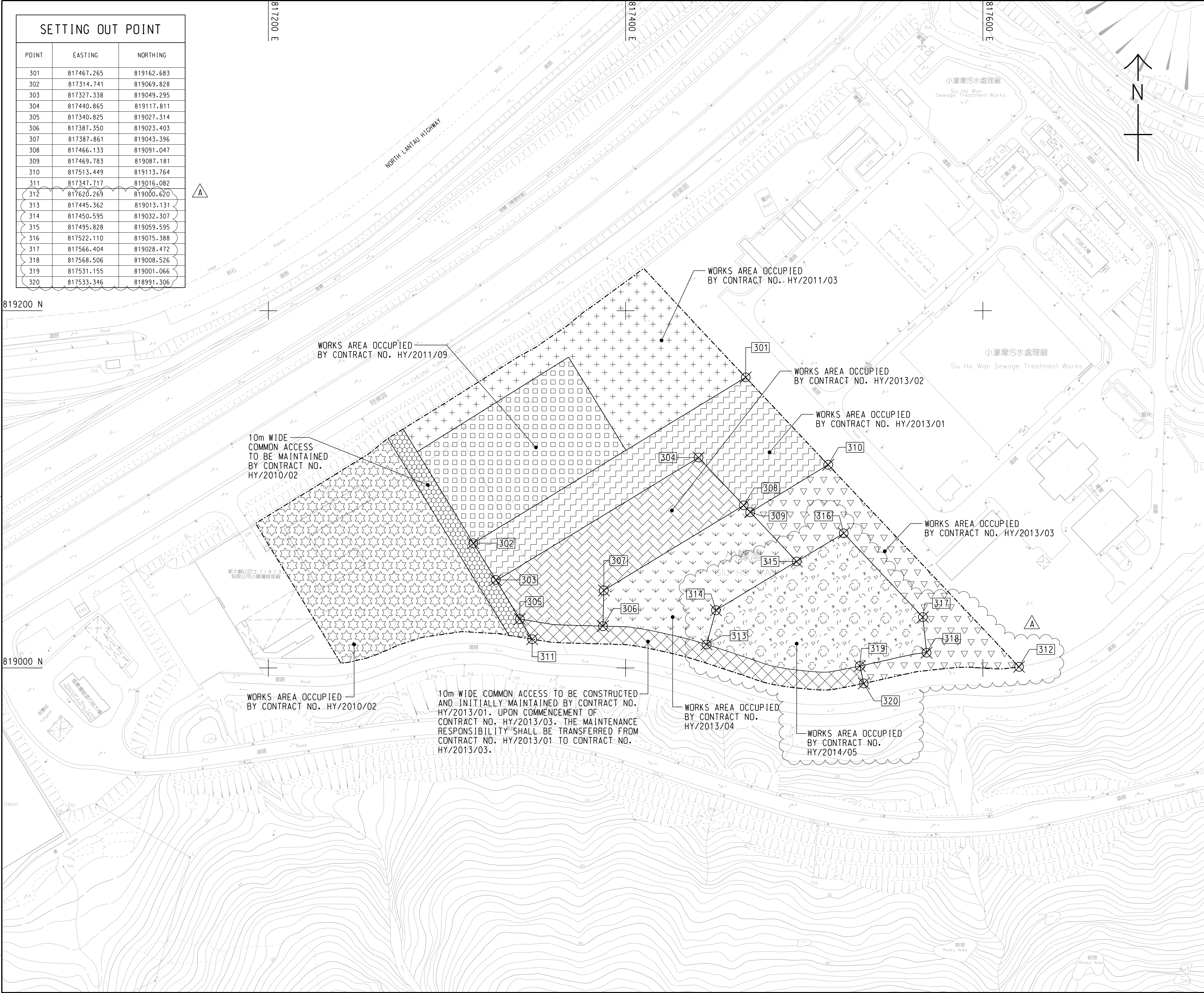
|                |                        |
|----------------|------------------------|
| DRAWN BY<br>繪圖 | STATUS<br>階段           |
| WSY            | <b>WORKING DRAWING</b> |

SCALE 1 : 2000  
比例

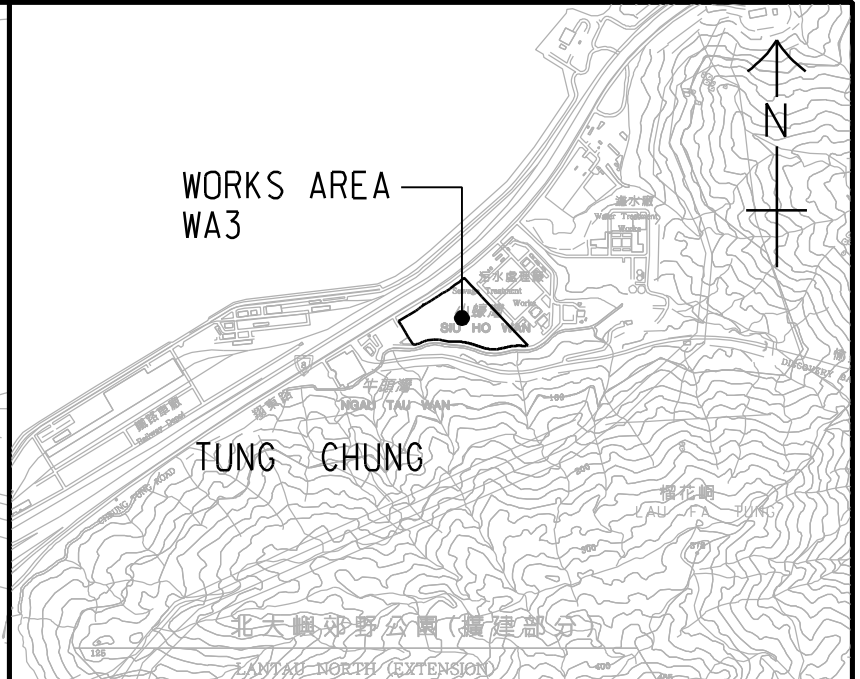
DIMENSIONS ARE IN METRES  
尺寸單位

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| SETTING OUT POINT |            |            |
|-------------------|------------|------------|
| POINT             | EASTING    | NORTHING   |
| 301               | 817467.265 | 819162.683 |
| 302               | 817314.741 | 819069.828 |
| 303               | 817327.338 | 819049.295 |
| 304               | 817440.865 | 819117.811 |
| 305               | 817340.825 | 819027.314 |
| 306               | 817387.350 | 819023.403 |
| 307               | 817387.861 | 819043.396 |
| 308               | 817466.133 | 819091.047 |
| 309               | 817469.783 | 819087.181 |
| 310               | 817513.449 | 819113.764 |
| 311               | 817347.717 | 819016.082 |
| 312               | 817620.269 | 819000.620 |
| 313               | 817445.362 | 819013.131 |
| 314               | 817450.595 | 819032.307 |
| 315               | 817495.828 | 819059.595 |
| 316               | 817522.110 | 819075.388 |
| 317               | 817566.404 | 819028.472 |
| 318               | 817568.506 | 819008.526 |
| 319               | 817531.155 | 819001.066 |
| 320               | 817533.346 | 818991.306 |



LOCATION PLAN

SCALE 1 : 25000

NOTES:

1. COORDINATES ARE RELATED TO HONG KONG METRIC GRID (1980).

2. DIMENSIONS ARE IN MILLIMETER AND CHAINAGE ARE IN METRES UNLESS OTHERWISE SHOWN.

LEGEND:

WORKS AREA BOUNDARY

PORTION 3.1

PORTION 3.2

PORTION 3.3

PORTION 3.4

PORTION 3.5

PORTION 3.6

PORTION 3.7

PORTION 3.8

PORTION 3.9

PORTION 3.10

|   |                       |          |         |
|---|-----------------------|----------|---------|
| B | WORKING DRAWING       | BWCW SCI | APR. 15 |
| A | TENDER ADDENDUM NO. 2 | BWCW SCI | APR. 14 |
| - | TENDER DRAWING        | BWCW SCI | FEB. 14 |

| REV. | DESCRIPTION       | CHECKED | DATE     |
|------|-------------------|---------|----------|
| 01   | ISSUED FOR TENDER | WY      | 14/04/14 |

HIGHWAYS DEPARTMENT

港珠澳大橋香港工程管理局

Hong Kong - Zhuhai - Macao Bridge Hong Kong Project Management Office

HONG KONG-ZHUHAI-MACAO BRIDGE

HONG KONG BOUNDARY CROSSING FACILITIES

- INFRASTRUCTURE WORKS STAGE II (SOUTHERN PORTION)

WORKS AREA WA3

AECOM

Rogers Stirk Harbour + Partners

BURO HAPPOLD ATKINS ADI

Aedas

DRG.NO. 60191048/C4/000/C00/1041B

圖紙編號

|             |              |                  |
|-------------|--------------|------------------|
| DESIGNED BY | CONTRACT NO. | P. Dir. APPROVED |
| WY          | HY/2013/04   | TKH              |

|          |                 |
|----------|-----------------|
| DRAWN BY | STATUS          |
| WSY      | WORKING DRAWING |

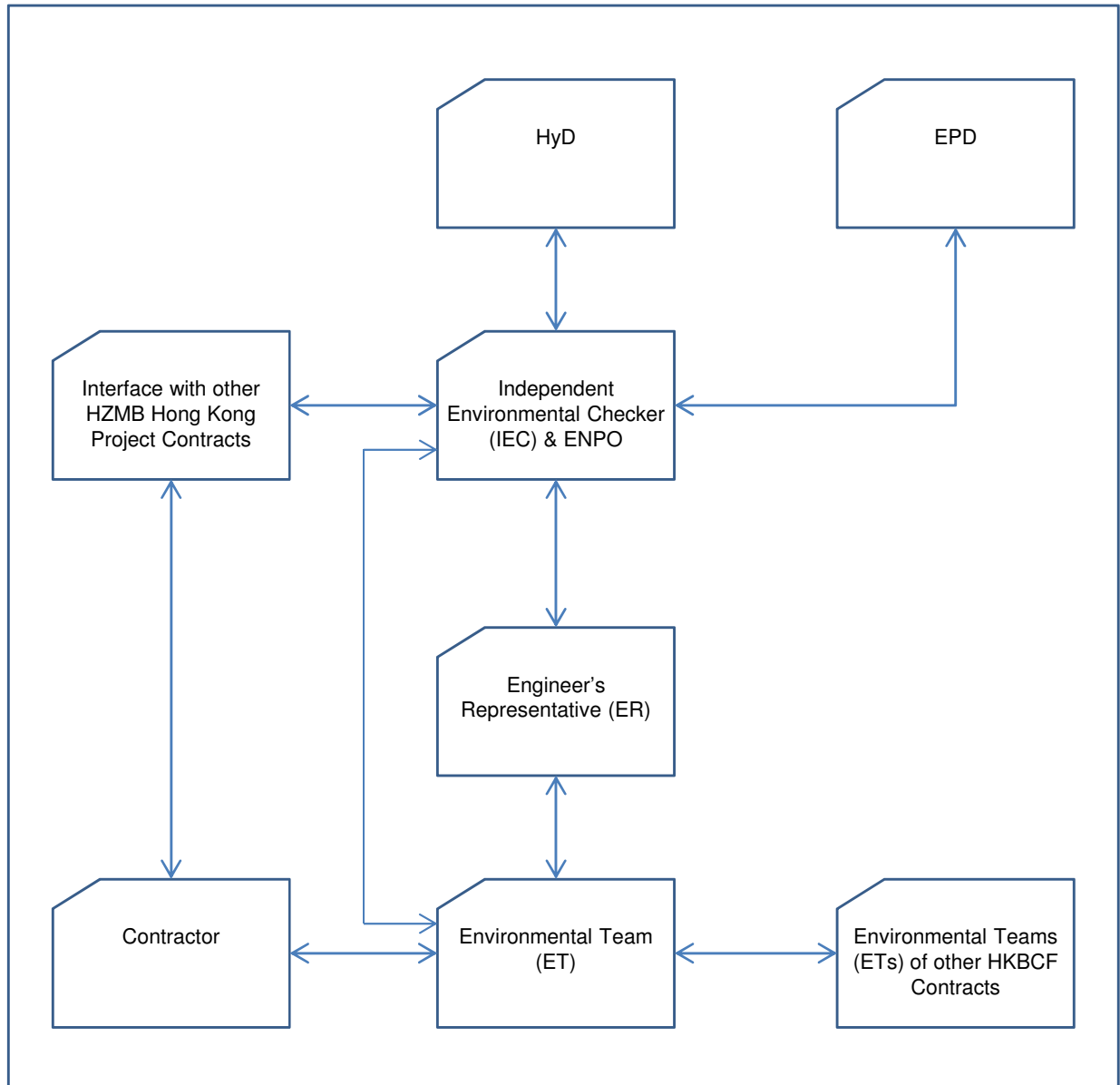
|             |                   |
|-------------|-------------------|
| SCALE       | DIMENSIONS ARE IN |
| A1 1 : 1000 | METRES            |

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## **Appendix B. Project Organization for Environmental Works**

## Project Organisation for Environmental Works



↔ Line of Communication

## Appendix C. Construction Programme









| Activity ID                          | Activity Name  |
|--------------------------------------|--|
| PROC.MA.1610                         | Detailed Design / Shop Drawings and Materials Submission     |
| PROC.MA.1615                         | Engineer's Review / Approval                                 |
| PROC.MA.1650                         | Production / Manufacturing / Fabrication                     |
| PROC.MA.1670                         | Materials Delivery (first delivery)                          |
| Precast Concrete - Segments          |  |
| PROC.MA.1760                         | Moulds Detailed Design Preparation / Submission              |
| PROC.MA.1765                         | Engineer's Review / Approval                                 |
| PROC.MA.1770                         | Mould Fabrication  |
| PROC.MA.1780                         | Cast Prototype / Inspection and Approval                     |
| PROC.MA.2570                         | Production of Precast Segments                               |
| PROC.MA.2590                         | Materials Delivery (First Delivery)                          |
| Segment Fabrication and Post Pouring |  |
| Segment Fabrication Type A           |  |
| Fab.A1.001                           | Segment Fabrication for Bridge D1 (96 nos)                   |
| Segment Fabrication Type C1          |  |
| Fab.TC1.0010                         | Segment Fabrication for Bridge D12b (91-106) 16 nos.         |
| Fab.TC1.0020                         | Segment Fabrication for Bridge D9c (1-3) 3 nos.              |
| Fab.TC1.0030                         | Segment Fabrication for Bridge D14a (1-30) 30 nos.           |
| Fab.TC1.0040                         | Segment Fabrication for Bridge D12a (66-80) 15 nos.          |
| Fab.TC1.0050                         | Segment Fabrication for Bridge D14b (14-27) 14 nos.          |
| Fab.TC1.0060                         | Segment Fabrication for Bridge D14c (1-15) 15 nos.           |
| Fab.TC1.0080                         | Segment Fabrication for Bridge D9c (4-14) 11 nos.            |
| Fab.TC2.00060                        | Segment Fabrication for Bridge D15 (48-64) 17 nos.           |
| Fab.TC3.0060                         | Segment Fabrication for Bridge D15 (31-47) 17 nos.           |
| Fab.TC4.0030                         | Segment Fabrication for Bridge D13 (103-129) 27 nos.         |
| Fab.TC4.0060                         | Segment Fabrication for Bridge D14c (46-60) 15 nos.          |
| Segment Fabrication Type C2          |  |
| Fab.TC1.0070                         | Segment Fabrication for Bridge D15 (1-15) 15 nos.            |
| Fab.TC2.00010                        | Segment Fabrication for Bridge D12b (112-127) 16 nos.        |
| Fab.TC2.00020                        | Segment Fabrication for Bridge D14a (31-59) 29 nos.          |
| Fab.TC2.00030                        | Segment Fabrication for Bridge D9c (29-42) 14 nos.           |
| Fab.TC2.00040                        | Segment Fabrication for Bridge D12a (48-65) 18 nos.          |
| Fab.TC2.00050                        | Segment Fabrication for Bridge D14c (16-30) 15 nos.          |
| Fab.TC3.0010                         | Segment Fabrication for Bridge D12b (44-84, 107-111) 46 nos. |
| Fab.TC3.0050                         | Segment Fabrication for Bridge D14c (31-45) 15 nos.          |
| Fab.TC4.0070                         | Segment Fabrication for Bridge D15 (65-78) 14 nos.           |
| Segment Fabrication Type C3          |  |
| Fab.TC3.0020                         | Segment Fabrication for Bridge D9c (15-28) 14 nos.           |
| Fab.TC3.0030                         | Segment Fabrication for Bridge D13 (43-70 & 100-102) 31 nos. |
| Fab.TC3.0040                         | Segment Fabrication for Bridge D14b (28-49) 22 nos.          |
| Fab.TC4.0010                         | Segment Fabrication for Bridge D12b (1-43,85-90) 49 nos.     |
| Fab.TC4.0020                         | Segment Fabrication for Bridge D14a (60-75) 16 nos.          |
| Fab.TC4.0040                         | Segment Fabrication for Bridge D12a (81-95) 15 nos.          |
| Fab.TC4.0050                         | Segment Fabrication for Bridge D14b (1-13) 13 nos.           |
| Segment Fabrication Type D2          |  |
| Fab.T1.0020                          | Segment Fabrication for Bridge D9a (75-86 & 92-104) 25 nos.  |
| Fab.T1.0040                          | Segment Fabrication for Bridge D13 (33-46) 14 nos.           |
| Fab.T1.0050                          | Segment Fabrication for Bridge D9a (1-15) 15 nos.            |
| Fab.T2.0010                          | Segment Fabrication for Bridge D9a (32-46) 15 nos.           |
| Fab.T2.0030                          | Segment Fabrication for Bridge D9b (1-15) 15 nos.            |
| Fab.T2.0040                          | Segment Fabrication for Bridge D10 (33-47) 14 nos.           |
| Fab.T2.0050                          | Segment Fabrication for Bridge D13 (29-41) 13 nos.           |
| Fab.T3.0030                          | Segment Fabrication for Bridge D9a (47-57, 70-74) 16 nos.    |
| Fab.T3.0040                          | Segment Fabrication for Bridge D10 (68-88 & 27-32) 27 nos.   |
| Fab.T3.0070                          | Segment Fabrication for Bridge D15 (1-14) 14 nos.            |
| Fab.T4.0020                          | Segment Fabrication for Bridge D10 (61-67 & 89-95) 14 nos.   |
| Fab.T4.0040                          | Segment Fabrication for Bridge D8 (48-62) 15 nos.            |
| Fab.T4.0050                          | Segment Fabrication for Bridge D13 (78-98) 21 nos.           |
| Fab.T4.0060                          | Segment Fabrication for Bridge D10 (96-109) 14 nos.          |
| Segment Fabrication Type D3          |  |
| Fab.T1.0010                          | Segment Fabrication for Bridge D11 (17-31) 15 nos.           |
| Fab.T1.0030                          | Segment Fabrication for Bridge D10 (1-26) 26 nos.            |
| Fab.T1.0060                          | Segment Fabrication for Bridge D8 (1-16) 16 nos.             |
| Fab.T1.0070                          | Segment Fabrication for Bridge D12a (1-16) 16 nos.           |
| Fab.T2.0020                          | Segment Fabrication for Bridge D11 (1-16) 16 nos.            |
| Fab.T2.0060                          | Segment Fabrication for Bridge D8 (17-31) 15 nos.            |

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## Appendix D. Event and Action Plan



## Event/Action Plan for Air Quality Monitoring

| EVENT   | ACTION   |   |   |  |
|---|--|---|---|--|
|   | ET   | IEC   | ER  | CONTRACTOR   |
| <b>ACTION LEVEL</b>                               |  |   |   |  |
| 1. Exceedance for one sample                      | <ol style="list-style-type: none"> <li>1. Identify source, investigate the causes of exceedance and propose remedial measures;</li> <li>2. Inform IEC and ER;</li> <li>3. Repeat measurement to confirm finding;</li> <li>4. Increase monitoring frequency to daily.</li> </ol>  | <ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET;</li> <li>2. Check Contractor's working method.</li> </ol>  | <ol style="list-style-type: none"> <li>1. Notify Contractor.</li> </ol>   | <ol style="list-style-type: none"> <li>1. Rectify any unacceptable practice;</li> <li>2. Amend working methods if appropriate.</li> </ol>  |
| 2. Exceedance for two or more consecutive samples | <ol style="list-style-type: none"> <li>1. Identify source;</li> <li>2. Inform IEC and ER;</li> <li>3. Advise the ER on the effectiveness of the proposed remedial measures;</li> <li>4. Repeat measurement s to confirm findings;</li> <li>5. Increase monitoring frequency to daily;</li> <li>6. Discuss with IEC and Contractor on remedial actions required;</li> <li>7. If exceedance continues, arrange meeting with IEC and ER;</li> <li>8. If exceedance stops, cease additional monitoring.</li> </ol> | <ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET;</li> <li>2. Check Contractor's working method;</li> <li>3. Discuss with ET and Contractor on possible remedial measures;</li> <li>4. Advise the ER on the effectiveness of the proposed remedial measures;</li> <li>5. Supervise Implementation of remedial measures.</li> </ol> | <ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Notify Contractor;</li> <li>3. Ensure remedial measures properly implemented.</li> </ol> | <ol style="list-style-type: none"> <li>1. Submit proposals for remedial to ER within 3 working days of notification;</li> <li>2. Implement the agreed proposals;</li> <li>3. Amend proposal if appropriate.</li> </ol> |



| EVENT   | ACTION   |   |  |   |
|---|--|---|--|---|
|   | ET   | IEC   | ER   | CONTRACTOR  |
| <b>LIMIT LEVEL</b>                                |  |   |  |   |
| 1. Exceedance for one sample                      | <ol style="list-style-type: none"> <li>1. Identify source, investigate the causes of exceedance and propose remedial measures;</li> <li>2. Inform ER, Contractor and EPD;</li> <li>3. Repeat measurement to confirm finding;</li> <li>4. Increase monitoring frequency to daily;</li> <li>5. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results.</li> </ol>  | <ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET;</li> <li>2. Check Contractor's working method;</li> <li>3. Discuss with ET and Contractor on possible remedial measures;</li> <li>4. Advise the ER on the effectiveness of the proposed remedial measures;</li> <li>5. Supervise implementation of remedial measures.</li> </ol> | <ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Notify Contractor;</li> <li>3. Ensure remedial measures properly implemented.</li> </ol>  | <ol style="list-style-type: none"> <li>1. Take immediate action to avoid further exceedance;</li> <li>2. Submit proposals for remedial actions to IEC within 3 working days of notification;</li> <li>3. Implement the agreed proposals;</li> <li>4. Amend proposal if appropriate.</li> </ol>  |
| 2. Exceedance for two or more consecutive samples | <ol style="list-style-type: none"> <li>1. Notify IEC, ER, Contractor and EPD;</li> <li>2. Identify source;</li> <li>3. Repeat measurement to confirm findings;</li> <li>4. Increase monitoring frequency to daily;</li> <li>5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented;</li> <li>6. Arrange meeting with IEC and ER to discuss the remedial actions to be taken;</li> <li>7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results;</li> <li>8. If exceedance stops, cease additional monitoring.</li> </ol> | <ol style="list-style-type: none"> <li>1. Discuss amongst ER, ET, and Contractor on the potential remedial actions;</li> <li>2. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly;</li> <li>3. Supervise the implementation of remedial measures.</li> </ol>                                    | <ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Notify Contractor;</li> <li>3. In consultation with the IEC, agree with the Contractor on the remedial measures to be implemented;</li> <li>4. Ensure remedial measures properly implemented;</li> <li>5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated.</li> </ol> | <ol style="list-style-type: none"> <li>1. Take immediate action to avoid further exceedance;</li> <li>2. Submit proposals for remedial actions to IEC within 3 working days of notification;</li> <li>3. Implement the agreed proposals;</li> <li>4. Resubmit proposals if problem still not under control;</li> <li>5. Stop the relevant portion of works as determined by the ER until the exceedance is abated.</li> </ol> |

## Event / Action Plan for Construction Noise Monitoring

| EVENT        | ACTION   |  |  |   |
|--------------|--|--|--|---|
|              | ET   | IEC  | ER   | CONTRACTOR  |
| Action Level | <ol style="list-style-type: none"> <li>1. Notify IEC and Contractor;</li> <li>2. Identify source, investigate the causes of exceedance and propose remedial measures;</li> <li>3. Report the results of investigation to the IEC, ER and Contractor;</li> <li>4. Discuss with the Contractor and formulate remedial measures;</li> <li>5. Increase monitoring frequency to check mitigation effectiveness.</li> </ol>  | <ol style="list-style-type: none"> <li>1. Review the analysed results submitted by the ET;</li> <li>2. Review the proposed remedial measures by the Contractor and advise the ER accordingly;</li> <li>3. Supervise the implementation of remedial measures.</li> </ol>  | <ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Notify Contractor;</li> <li>3. Require Contractor to propose remedial measures for the analysed noise problem;</li> <li>4. Ensure remedial measures are properly implemented.</li> </ol>  | <ol style="list-style-type: none"> <li>1. Submit noise mitigation proposals to IEC;</li> <li>2. Implement noise mitigation proposals.</li> </ol>  |
| Limit Level  | <ol style="list-style-type: none"> <li>1. Inform IEC, ER, EPD and Contractor;</li> <li>2. Identify source;</li> <li>3. Repeat measurements to confirm findings;</li> <li>4. Increase monitoring frequency;</li> <li>5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented;</li> <li>6. Inform IEC, ER and EPD the causes and actions taken for the exceedances;</li> <li>7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results;</li> <li>8. If exceedance stops, cease additional monitoring.</li> </ol> | <ol style="list-style-type: none"> <li>1. Discuss amongst ER, ET, and Contractor on the potential remedial actions;</li> <li>2. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly;</li> <li>3. Supervise the implementation of remedial measures.</li> </ol> | <ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Notify Contractor;</li> <li>3. Require Contractor to propose remedial measures for the analysed noise problem;</li> <li>4. Ensure remedial measures properly implemented;</li> <li>5. If exceedance continues, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated.</li> </ol> | <ol style="list-style-type: none"> <li>1. Take immediate action to avoid further exceedance;</li> <li>2. Submit proposals for remedial actions to IEC within 3 working days of notification;</li> <li>3. Implement the agreed proposals;</li> <li>4. Resubmit proposals if problem still not under control;</li> <li>5. Stop the relevant portion of works as determined by the ER until the exceedance is abated.</li> </ol> |

## Event / Action Plan for Water Quality Monitoring

| EVENT  | ACTION   |   |   |   |
|--|--|---|---|---|
|  | ET   | IEC   | ER  | CONTRACTOR  |
| Action level being exceeded by one sampling day                      | <ol style="list-style-type: none"> <li>1. Repeat in situ measurement to confirm findings;</li> <li>2. Identify source(s) of impact;</li> <li>3. Inform IEC, contractor and ER;</li> <li>4. Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>5. Discuss mitigation measures with IEC, ER and Contractor;</li> <li>6. Ensure mitigation measures are implemented;</li> <li>7. Repeat measurement on next day of exceedance to confirm findings.</li> </ol>   | <ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET and Contractor's working methods;</li> <li>2. Discuss with ET and Contractor on possible remedial actions;</li> <li>3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly;</li> <li>4. Assess the effectiveness of the implemented mitigation measures.</li> </ol> | <ol style="list-style-type: none"> <li>1. Confirm receipt of notification of non-compliance in writing;</li> <li>2. Discuss with IEC on the proposed mitigation measures;</li> <li>3. Make agreement on mitigation measures to be implemented;</li> <li>4. Ensure mitigation measures are properly implemented.</li> </ol>  | <ol style="list-style-type: none"> <li>1. Inform the ER and confirm notification of the non-compliance in writing;</li> <li>2. Rectify unacceptable practice;</li> <li>3. Check all plant and equipment and consider changes of working methods;</li> <li>4. Discuss with ET and IEC on possible remedial actions and propose mitigation measures to IEC and ER;</li> <li>5. Implement the agreed mitigation measures.</li> <li>6. Amend working methods if appropriate.</li> </ol>   |
| Action level being exceeded by two or more consecutive sampling days | <ol style="list-style-type: none"> <li>1. Repeat in situ measurement to confirm findings;</li> <li>2. Identify source(s) of impact;</li> <li>3. Inform IEC, Contractor and ER;</li> <li>4. Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>5. Discuss mitigation measures with IEC, ER and Contractor;</li> <li>6. Ensure mitigation measures are implemented;</li> <li>7. Increase the monitoring frequency to daily until no exceedance of Action level;</li> <li>8. Repeat measurement on next day of exceedance to confirm findings.</li> </ol> | <ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET and Contractor's working method;</li> <li>2. Discuss with ET and Contractor on possible remedial actions;</li> <li>3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly;</li> <li>4. Assess the effectiveness of the implemented mitigation measures.</li> </ol>  | <ol style="list-style-type: none"> <li>1. Confirm receipt of notification of non-compliance in writing;</li> <li>2. Discuss with IEC on the proposed mitigation measures;</li> <li>3. Make agreement on mitigation measures to be implemented;</li> <li>4. Ensure mitigation measures are properly implemented;</li> <li>5. Assess the effectiveness of the implemented mitigation measures.</li> </ol> | <ol style="list-style-type: none"> <li>1. Inform the Engineer and confirm notification of the non-compliance in writing;</li> <li>2. Rectify unacceptable practice;</li> <li>3. Check all plant and equipment and consider changes of working methods;</li> <li>4. Discuss with ET and IEC on possible remedial actions and propose mitigation measures to IEC and ER within 3 working days of notification;</li> <li>5. Implement the agreed mitigation measures;</li> <li>6. Amend working methods if appropriate.</li> </ol> |

| EVENT   | ACTION   |  |   |  |
|---|--|--|---|--|
|   | ET   | IEC  | ER  | CONTRACTOR   |
| Limit level being exceeded by one sampling day                      | <ol style="list-style-type: none"> <li>1. Repeat <i>in-situ</i> measurement to confirm findings;</li> <li>2. Identify source(s) of impact;</li> <li>3. Inform IEC, Contractor, ER and EPD;</li> <li>4. Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>5. Discuss mitigation measures with IEC, ER and Contractor;</li> <li>6. Ensure mitigation measures are implemented;</li> <li>7. Increase the monitoring frequency to daily until no exceedance of Limit level.</li> </ol>                          | <ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET and Contractor's working method;</li> <li>2. Discuss with ET and Contractor on possible remedial actions;</li> <li>3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly;</li> <li>4. Assess the effectiveness of the implemented mitigation measures.</li> </ol> | <ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Discuss with IEC, ET and Contractor on the proposed mitigation measures;</li> <li>3. Request Contractor to critically review the working methods;</li> <li>4. Ensure mitigation measures are properly implemented;</li> <li>5. Assess the effectiveness of the implemented mitigation measures.</li> </ol>   | <ol style="list-style-type: none"> <li>1. Inform the ER and confirm notification of the non-compliance in writing;</li> <li>2. Rectify unacceptable practice;</li> <li>3. Check all plant and equipment and consider changes of working methods;</li> <li>4. Submit proposal of mitigation measures to ER within 3 working days of notification and discuss with ET, IEC and ER;</li> <li>5. Implement the agreed mitigation measures;</li> <li>6. Amend working methods if appropriate.</li> </ol>  |
| Limit level being exceeded by two or more consecutive sampling days | <ol style="list-style-type: none"> <li>1. Repeat <i>in-situ</i> measurement to confirm findings;</li> <li>2. Identify source(s) of impact;</li> <li>3. Inform IEC, contractor, ER and EPD;</li> <li>4. Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>5. Discuss mitigation measures with IEC, ER and Contractor;</li> <li>6. Ensure mitigation measures are implemented;</li> <li>7. Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days.</li> </ol> | <ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET and Contractor's working method;</li> <li>2. Discuss with ET and Contractor on possible remedial actions;</li> <li>3. Review the Contractor's mitigation measures whenever necessary to assure their effectiveness and advise the ER accordingly.</li> </ol>   | <ol style="list-style-type: none"> <li>1. Confirm receipt of notification of failure in writing;</li> <li>2. Discuss with IEC, ET and Contractor on the proposed mitigation measures;</li> <li>3. Request Contractor to critically review the working methods;</li> <li>4. Make agreement on the mitigation measures to be implemented;</li> <li>5. Ensure mitigation measures are properly implemented;</li> <li>6. Assess the effectiveness of the implemented mitigation measures;</li> <li>7. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the construction activities until no exceedance of Limit level.</li> </ol> | <ol style="list-style-type: none"> <li>1. Inform the ER and confirm notification of the non-compliance in writing;</li> <li>2. Take immediate action to avoid further exceedance;</li> <li>3. Rectify unacceptable practice;</li> <li>4. Check all plant and equipment and consider changes of working methods;</li> <li>5. Submit proposal of mitigation measures to ER within 3 working days of notification and discuss with ET, IEC and ER;</li> <li>6. Implement the agreed mitigation measures;</li> <li>7. Resubmit proposals of mitigation measures if problem still not under control;</li> <li>8. As directed by the Engineer, to slow down or to stop all or part of the construction activities until no exceedance of Limit level.</li> </ol> |

## Event / Action Plan for Dolphin Monitoring

| EVENT        | ACTION  |   |   |  |
|--------------|---|---|---|--|
|              | ET  | IEC   | ER  | CONTRACTOR   |
| Action Level | <ol style="list-style-type: none"> <li>1. Repeat statistical data analysis to confirm findings;</li> <li>2. Review all available and relevant data, including raw data and statistical analysis results of other parameters covered in the EM&amp;A, to ascertain if differences are as a result of natural variation or previously observed seasonal differences;</li> <li>3. Identify source(s) of impact;</li> <li>4. Inform the IEC, ER/SOR and Contractor;</li> <li>5. Check monitoring data.</li> <li>6. Review to ensure all the dolphin protective measures are fully and properly implemented and advise on additional measures if necessary.</li> </ol> | <ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET and Contractor;</li> <li>2. Discuss monitoring results and finding with the ET and the Contractor.</li> </ol> | <ol style="list-style-type: none"> <li>1. Discuss monitoring with the IEC and any other measures proposed by the ET;</li> <li>2. If ER/SOR is satisfied with the proposal of any other measures, ER/SOR to signify the agreement in writing on the measures to be implemented.</li> </ol> | <ol style="list-style-type: none"> <li>1. Inform the ER/SOR and confirm notification of the non-compliance in writing;</li> <li>2. Discuss with the ET and the IEC and propose measures to the IEC and the ER/SOR;</li> <li>3. Implement the agreed measures.</li> </ol> |



| EVENT       | ACTION  |   |   |   |
|-------------|---|---|---|---|
|             | ET  | IEC   | ER  | CONTRACTOR  |
| Limit Level | <ol style="list-style-type: none"> <li>1. Repeat statistical data analysis to confirm findings;</li> <li>2. Review all available and relevant data, including raw data and statistical analysis results of other parameters covered in the EM&amp;A, to ascertain if differences are as a result of natural variation or previously observed seasonal differences;</li> <li>3. Identify source(s) of impact;</li> <li>4. Inform the IEC, ER/SOR and Contractor of findings;</li> <li>5. Check monitoring data;</li> <li>6. Repeat review to ensure all the dolphin protective measures are fully and properly implemented and advise on additional measures if necessary.</li> <li>7. If ET proves that the source of impact is caused by any of the construction activity by the works contract, ET to arrange a meeting to discuss with IEC, ER/SOR and Contractor the necessity of additional dolphin monitoring and/or any other potential mitigation measures (e.g., consider to modify the perimeter silt curtain or consider to control/temporarily stop relevant construction activity etc.) and submit to IEC a proposal of additional dolphin monitoring and/or mitigation measures where necessary.</li> </ol> | <ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET and Contractor;</li> <li>2. Discuss monitoring results and findings with the ET and the Contractor;</li> <li>3. Attend the meeting to discuss with ET, ER/SOR and Contractor the necessity of additional dolphin monitoring and any other potential mitigation measures.</li> <li>4. Review proposals for additional monitoring and any other mitigation measures submitted by ET and Contractor and advise ER/SOR of the results and findings accordingly.</li> <li>5. Supervise / Audit the implementation of additional monitoring and/or any other mitigation measures and advise ER/SOR the results and findings accordingly.</li> </ol> | <ol style="list-style-type: none"> <li>1. Attend the meeting to discuss with ET, IEC and Contractor the necessity of additional dolphin monitoring and any other potential mitigation measures.</li> <li>2. If ER/SOR is satisfied with the proposals for additional dolphin monitoring and/or any other mitigation measures submitted by ET and Contractor and verified by IEC, ER/SOR to signify the agreement in writing on such proposals and any other mitigation measures.</li> <li>3. Supervise the implementation of additional monitoring and/or any other mitigation measures.</li> </ol> | <ol style="list-style-type: none"> <li>1. Inform the ER/SOR and confirm notification of the non-compliance in writing;</li> <li>2. Attend the meeting to discuss with ET, IEC and ER/SOR the necessity of additional dolphin monitoring and any other potential mitigation measures.</li> <li>3. Jointly submit with ET to IEC a proposal of additional dolphin monitoring and/or any other mitigation measures when necessary.</li> <li>4. Implement the agreed additional dolphin monitoring and/or any other mitigation measures.</li> </ol> |

# Appendix E. Waste Flow Table

**Monthly Summary Waste Flow Table for 2019**

| Month     | Actual Quantities of Inert C&D Materials Generated Monthly |                                     |                          |  |                          |                          | Actual Quantities of C&D Wastes Generated Monthly |                            |                   |                |                             |
|-----------|--|-------------------------------------|--------------------------|--|--------------------------|--------------------------|---|----------------------------|-------------------|----------------|-----------------------------|
|           | Total Quantity Generated                                   | Hard Rock and Large Broken Concrete | Reused in the Contract   | Transported to other Projects (Note 2) | Disposed as Public Fill  | Imported Fill            | Metals  | Paper/ cardboard packaging | Plastics (Note 1) | Chemical Waste | Others, e.g. general refuse |
|           | (in '000m <sup>3</sup> )                                   | (in '000m <sup>3</sup> )            | (in '000m <sup>3</sup> ) | (in '000m <sup>3</sup> )               | (in '000m <sup>3</sup> ) | (in '000m <sup>3</sup> ) | (in '000kg)                                       | (in '000kg)                | (in '000kg)       | (in '000kg)    | (in '000m <sup>3</sup> )    |
| Jan       | 4.2740   | 0                                   | 0                        | 0                                      | 4.2740                   | 0                        | 0   | 0                          | 0                 | 0              | 0.1046                      |
| Feb       | 0.9927   | 0                                   | 0                        | 0                                      | 0.9927                   | 0                        | 0   | 0                          | 0                 | 0              | 0.0864                      |
| Mar       | 1.4638   | 0                                   | 0                        | 0                                      | 1.4638                   | 0                        | 0   | 0                          | 0                 | 0              | 0.0843                      |
| Apr       | 0.1044   | 0                                   | 0                        | 0                                      | 0.1044                   | 0                        | 0   | 0                          | 0                 | 0              | 0.0688                      |
| May       | 0.9415   | 0                                   | 0                        | 0                                      | 0.9415                   | 0                        | 0   | 0                          | 0                 | 0              | 0.0745                      |
| Jun       | 0.6075   | 0                                   | 0                        | 0                                      | 0.6075                   | 0                        | 0   | 0                          | 0                 | 0              | 0.0176                      |
| Sub-total | 8.3839   | 0                                   | 0                        | 0.000                                  | 8.3839                   | 0                        | 0   | 0                          | 0                 | 0              | 0.4362                      |
| Jul       | 0.1456   | 0                                   | 0                        | 0                                      | 0.1456                   | 0                        | 0   | 0                          | 0                 | 0              | 0.0873                      |
| Aug       | 1.4485   | 0                                   | 0                        | 0                                      | 1.4485                   | 0                        | 0   | 0                          | 0                 | 0              | 0.0383                      |
| Sep       | 0.6110   | 0                                   | 0                        | 0                                      | 0.6110                   | 0                        | 0   | 0                          | 0                 | 0              | 0.0526                      |
| Oct       | 0.4347   | 0                                   | 0                        | 0                                      | 0.4347                   | 0                        | 0   | 0                          | 0                 | 0              | 0.0358                      |
| Nov       | 1.1544   | 0                                   | 0                        | 0                                      | 1.1544                   | 0                        | 0   | 0                          | 0                 | 0              | 0.0694                      |
| Dec       | 3.1593   | 0                                   | 0                        | 0                                      | 3.1593                   | 0                        | 0   | 0                          | 0                 | 0              | 0.2649                      |
| Total     | 15.3374  | 0                                   | 0                        | 0.000                                  | 15.3374                  | 0                        | 0   | 0                          | 0                 | 0              | 0.9845                      |

Note: (1) Plastics refer to plastic bottles / containers, plastic sheets / foam from packaging material

(2) "Other Projects" refers to HKBCF Contract No. HY/2013/03

**Monthly Summary of Excavated Marine Sediment for 2019**

| Month     | a. Estimated Volume of Excavated Marine Sediment Generated | b. Estimate Volume of Accumulated Excavated Marine Sediment Treated | c. Reused in the Contract | d. Estimated Volume of Excavated Marine Sediment Transported to Other Projects (Note 1) | e. Estimated Volume of Treated Excavated Marine Sediment Stored on Site (Unused) |
|-----------|--|---|---------------------------|---|--|
|           | (in m <sup>3</sup> )                                       | (in m <sup>3</sup> )  | (in m <sup>3</sup> )      | (in m <sup>3</sup> )  | (in m <sup>3</sup> )   |
| Jan       | 0  | 0   | 0                         | 0   | 0  |
| Feb       | 0  | 0   | 0                         | 0   | 0  |
| Mar       | 0  | 0   | 0                         | 0   | 0  |
| Apr       | 0  | 0   | 0                         | 0   | 0  |
| May       | 0  | 0   | 0                         | 0   | 0  |
| Jun       | 0  | 0   | 0                         | 0   | 0  |
| Sub-total | 0  | 0   | 0                         | 0   | 0  |
| Jul       | 0  | 0   | 0                         | 0   | 0  |
| Aug       | 0  | 0   | 0                         | 0   | 0  |
| Sep       | 0  | 0   | 0                         | 0   | 0  |
| Oct       | 0  | 0   | 0                         | 0   | 0  |
| Nov       | 0  | 0   | 0                         | 0   | 0  |
| Dec       | 0  | 0   | 0                         | 0   | 0  |
| Total     | 0  | 0   | 0                         | 0   | 0  |

Note: (1) "Other Projects" refers to HKBCF Contract No. HY/2013/03. The disposal of excavated marine sediments to allocated dumping site via Contract No. HY/2013/03 has been completed with the last batch disposal on 30 August 2017.



## **Appendix F. Environmental Licences and Permits**

## Environmental Licences and Permits

| Item No. | Type of Permit / Licence   | Reference No.                                  | Application Date | Valid from  | Valid until | Remark                 |
|----------|--|--|------------------|-------------|-------------|------------------------|
| 1        | Environmental Permit under EIAO                                    | EP-353/2009/K                                  | 24 Mar 2016      | 11 Apr 2016 | N/A         | Issued                 |
| 2        | Further Environmental Permit under EIAO                            | FEP-01/353/2009/K                              | 29 Nov 2018      | 27 Dec 2018 | N/A         | Issued                 |
| 3        | Construction Dust Notification (HKBCF Southern Portion)            | 387156   | 26 Mar 2015      | 1 Apr 2015  | N/A         | Notified               |
| 4        | Construction Waste Disposal Account                                | 7022038  | 16 Mar 2015      | 1 Apr 2015  | N/A         | Account approved       |
| 5        | Registration as a Chemical Waste Producer (HKBCF Southern Portion) | Waste Producer Number (WPN): 5213-951-C3952-01 | 27 Mar 2015      | 27 Apr 2015 | N/A         | Registration completed |
| 6        | Discharge Licence under WPCO (Works Area WA3)                      | WT00022316-2015                                | 1 Jun 2015       | 14 Aug 2015 | 31 Aug 2020 | Issued                 |
| 7        | Discharge Licence under WPCO (HKBCF Works Area)                    | WT00028782-2017                                | 25 May 2017      | 19 Jul 2017 | 31 Jul 2022 | Issued                 |
| 8        | Construction Noise Permit  | GW-RS0713-19                                   | 19 Jul 2019      | 30 Sep 2019 | 4 Mar 2020  | Issued                 |

## **Appendix G. Implementation Schedule for Environmental Mitigation Measures (EMIS)**

## Appendix G – Implementation Schedule of Environmental Mitigation Measures (EMIS)

| EIA Ref.           | EM&A Log Ref. | Recommended Mitigation Measures   | Location of the measures                        | Implementation Status  |
|--------------------|---------------|---|---|--|
| <b>Air Quality</b> |               |   |   |  |
| S5.5.6.1           | A1            | 1) The Contractor shall follow the procedures and requirements given in the Air Pollution Control (Construction Dust) Regulation  | All construction sites                          | V  |
| S5.5.6.2           | A2            | 2) Proper watering of exposed spoil should be undertaken throughout the construction phase: <ul style="list-style-type: none"> <li>Any excavated or stockpile of dusty material should be covered entirely by impervious sheeting or sprayed with water to maintain the entire surface wet and then removed or backfilled or reinstated where practicable within 24 hours of the excavation or unloading;</li> <li>Any dusty materials remaining after a stockpile is removed should be wetted with water and cleared from the surface of roads;</li> <li>A stockpile of dusty material should not extend beyond the pedestrian barriers, fencing or traffic cones;</li> <li>The load of dusty materials on a vehicle leaving a construction site should be covered entirely by impervious sheeting to ensure that the dusty materials do not leak from the vehicle;</li> <li>Where practicable, vehicle washing facilities with high pressure water jet should be provided at every discernible or designated vehicle exit point. The area where vehicle washing takes place and the road section between the washing facilities and the exit point should be paved with concrete, bituminous materials or hardcores;</li> </ul>   | All construction sites                          | V  |
| S5.5.6.2           | A2            | <ul style="list-style-type: none"> <li>When there are open excavation and reinstatement works, hoarding of not less than 2.4m high should be provided as far as practicable along the site boundary with provision for public crossing. Good site practice shall also be adopted by the Contractor to ensure the conditions of the hoardings are properly maintained throughout the construction period;</li> <li>The portion of any road leading only to construction site that is within 30m of a vehicle entrance or exit should be kept clear of dusty materials;</li> <li>Surfaces where any pneumatic or power-driven drilling, cutting, polishing or other mechanical breaking operation takes place should be sprayed with water or a dust suppression chemical continuously;</li> <li>Any area that involves demolition activities should be sprayed with water or a dust suppression chemical immediately prior to, during and immediately after the activities so as to maintain the entire surface wet;</li> <li>Where a scaffolding is erected around the perimeter of a building under construction, effective dust screens, sheeting or netting should be provided to enclose the scaffolding from the ground floor level of the building, or a canopy should be provided from the first floor level up to the highest level of the scaffolding;</li> <li>Any skip hoist for material transport should be totally enclosed by impervious sheeting;</li> <li>Every stock of more than 20 bags of cement or dry pulverised fuel ash (PFA) should be covered entirely by impervious sheeting or placed in an area sheltered on the top and the 3 sides</li> </ul> | All construction sites                          | V  |
| S5.5.6.2           | A2            | <ul style="list-style-type: none"> <li>Cement or dry PFA delivered in bulk should be stored in a closed silo fitted with an audible high level alarm which is interlocked with the material filling line and no overfilling is allowed;</li> <li>Loading, unloading, transfer, handling or storage of bulk cement or dry PFA should be carried out in a totally enclosed system or facility, and any vent or exhaust should be fitted with an effective fabric filter or equivalent air pollution control system; and</li> <li>Exposed earth should be properly treated by compaction, turfing, hydroseeding, vegetation planting or sealing with latex, vinyl, bitumen, shotcrete or other suitable surface stabiliser within six months after the last construction activity on the construction site or part of the construction site where the exposed earth lies.</li> </ul>   | All construction sites                          | V  |
| S5.5.6.3           | A3            | 3) The Contractor should undertake proper watering on all exposed spoil (with at least 8 times per day) throughout the construction phase.  | All construction sites                          | V  |
| S5.5.6.4           | A4            | 4) Engineer to incorporate the controlled measures into the Particular Specification (PS) for the civil work. The PS should also draw the Contractor's attention to the relevant latest Practice Notes issued by EPD.   | All construction sites                          | V  |
| S5.5.6.4           | A5            | 5) Implement regular dust monitoring under EM&A programme during the construction stage.  | Selected representative dust monitoring station | V (impact air quality monitoring, covered by Contract No. HY/2013/04 (AMS2, AMS3C, AMS7B) & HY/2011/03 (AMS6)) |

| EIA Ref.                              | EM&A Log Ref. | Recommended Mitigation Measures  | Location of the measures  | Implementation Status |
|---------------------------------------|---------------|--|---|-----------------------|
| S5.5.7.1                              | A6            | <p>The following mitigation measures should be adopted to prevent fugitive dust emissions for concrete batching plant:</p> <ul style="list-style-type: none"> <li>• Loading, unloading, handling, transfer or storage of any dusty materials should be carried out in totally enclosed system;</li> <li>• All dust-laden air or waste gas generated by the process operations should be properly extracted and vented to fabric filtering system to meet the emission limits for TSP;</li> <li>• Vents for all silos and cement/pulverised fuel ash (PFA) weighing scale should be fitted with fabric filtering system;</li> <li>• The materials which may generate airborne dusty emissions should be wetted by water spray system;</li> <li>• All receiving hoppers should be enclosed on three sides up to 3m above unloading point;</li> <li>• All conveyor transfer points should be totally enclosed;</li> <li>• All access and route roads within the premises should be paved and wetted; and</li> <li>• Vehicle cleaning facilities should be provided and used by all concrete trucks before leaving the premises to wash off any dust on the wheels and/or body.</li> </ul> | Selected representative dust monitoring station                                   | N/A                   |
| S5.5.2.7                              | A7            | <p>The following mitigation measures should be adopted to prevent fugitive dust emissions at barging point:</p> <ul style="list-style-type: none"> <li>• All road surface within the barging facilities will be paved;</li> <li>• Dust enclosures will be provided for the loading ramp;</li> <li>• Vehicles will be required to pass through designated wheels wash facilities; and</li> <li>• Continuous water spray at the loading points.</li> </ul>   | All construction sites  | N/A                   |
| <b>Construction Noise (Air borne)</b> |               |  |   |                       |
| S6.4.10                               | N1            | <p>1) Use of good site practices to limit noise emissions by considering the following:</p> <ul style="list-style-type: none"> <li>• only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction programme;</li> <li>• machines and plant (such as trucks, cranes) that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum;</li> <li>• plant known to emit noise strongly in one direction, where possible, be orientated so that the noise is directed away from nearby NSRs;</li> <li>• silencers or mufflers on construction equipment should be properly fitted and maintained during the construction works;</li> <li>• mobile plant should be sited as far away from NSRs as possible and practicable;</li> <li>• material stockpiles, mobile container site office and other structures should be effectively utilised, where practicable, to screen noise from on-site construction activities.</li> </ul>  | All construction sites  | V                     |
| S6.4.11                               | N2            | 2) Install temporary hoarding located on the site boundaries between noisy construction activities and NSRs. The conditions of the hoardings shall be properly maintained throughout the construction period.  | All construction sites  | V                     |
| S6.4.12                               | N3            | 3) Install movable noise barriers (typically density @ 14kg/m <sup>2</sup> ), acoustic mat or full enclosure close to noisy plants including air compressor, generators, saw.  | For plant items listed in Appendix 6D of the EIA report at all construction sites | V                     |
| S6.4.13                               | N4            | 4) Select "Quiet plants" which comply with the BS 5228 Part 1 or TM standards.   | For plant items listed in Appendix 6D of the EIA report at all construction sites | V                     |
| S6.4.14                               | N5            | 5) Sequencing operation of construction plants where practicable.  | All construction sites where practicable  | V                     |
|                                       | N6            | 6) Implement a noise monitoring under EM&A programme.  | Selected representative noise monitoring station                                  | N/A                   |
| <b>Sediment</b>                       |               |  |   |                       |
| S7.3                                  | S1            | 1) The requirements as recommended in ETWB TC(W) 34/2002 Management of Dredged/Excavated Sediment shall be included in the Particular Specification as appropriate.  | All construction sites  | V                     |



| EIA Ref.                                     | EM&A Log Ref. | Recommended Mitigation Measures  | Location of the measures | Implementation Status |
|--|---------------|--|--------------------------|-----------------------|
| <b>Waste Management (Construction Noise)</b> |               |  |                          |                       |
| S8.3.8                                       | WM1           | <p><u>Construction and Demolition Material</u></p> <p>The following mitigation measures should be implemented in handling the waste:</p> <ul style="list-style-type: none"> <li>• Maintain temporary stockpiles and reuse excavated fill material for backfilling and reinstatement;</li> <li>• Carry out on-site sorting;</li> <li>• Make provisions in the Contract documents to allow and promote the use of recycled aggregates where appropriate;</li> <li>• Adopt 'Selective Demolition' technique to demolish the existing structures and facilities with a view to recovering broken concrete effectively for recycling purpose, where possible;</li> <li>• Implement a trip-ticket system for each works contract to ensure that the disposal of C&amp;D materials are properly documented and verified; and</li> <li>• Implement an enhanced Waste Management Plan similar to ETWB TC(W) No. 19/2005 – "Environmental Management on Construction Sites" to encourage on-site sorting of C&amp;D materials and to minimize their generation during the course of construction.</li> <li>• In addition, disposal of the C&amp;D materials onto any sensitive locations such as agricultural lands, etc. should be avoided. The Contractor shall propose the final disposal sites to the Project Proponent and get its approval before implementation.</li> </ul>   | All construction sites   | V                     |
| S8.3.9-<br>S8.3.11                           | WM2           | <p><u>C&amp;D Waste</u></p> <ul style="list-style-type: none"> <li>• Standard formwork or pre-fabrication should be used as far as practicable in order to minimise the arising of C&amp;D materials. The use of more durable formwork or plastic facing for the construction works should be considered. Use of wooden hoardings should not be used, as in other projects. Metal hoarding should be used to enhance the possibility of recycling. The purchasing of construction materials will be carefully planned in order to avoid over ordering and wastage.</li> <li>• The Contractor should recycle as much of the C&amp;D materials as possible on-site. Public fill and C&amp;D waste should be segregated and stored in different containers or skips to enhance reuse or recycling of materials and their proper disposal. Where practicable, concrete and masonry can be crushed and used as fill. Steel reinforcement bar can be used by scrap steel mills. Different areas of the sites should be considered for such segregation and storage.</li> </ul>   | All construction sites   | V                     |
| S8.2.12-<br>S8.3.15                          | WM3           | <p><u>Chemical Waste</u></p> <ul style="list-style-type: none"> <li>• Chemical waste that is produced, as defined by Schedule 1 of the Waste Disposal (Chemical Waste) (General) Regulation, should be handled in accordance with the Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes.</li> <li>• Containers used for the storage of chemical wastes should be suitable for the substance they are holding, resistant to corrosion, maintained in a good condition, and securely closed; have a capacity of less than 450 liters unless the specification has been approved by the EPD; and display a label in English and Chinese in accordance with instructions prescribed in Schedule 2 of the regulation.</li> <li>• The storage area for chemical wastes should be clearly labelled and used solely for the storage of chemical waste; enclosed on at least 3 sides; have an impermeable floor and bunding of sufficient capacity to accommodate 110% of the volume of the largest container or 20 % of the total volume of waste stored in that area, whichever is the greatest; have adequate ventilation; covered to prevent rainfall entering; and arranged so that incompatible materials are adequately separated.</li> <li>• Disposal of chemical waste should be via a licensed waste collector; be to a facility licensed to receive chemical waste, such as the Chemical Waste Treatment Centre which also offers a chemical waste collection service and can supply the necessary storage containers; or be to a reuser of the waste, under approval from the EPD.</li> </ul> | All construction sites   | V                     |
| S8.3.16                                      | WM4           | <p><u>Sewage</u></p> <ul style="list-style-type: none"> <li>• Adequate numbers of portable toilets should be provided for the workers. The portable toilets should be maintained in a state, which will not deter the workers from utilizing these portable toilets. Night soil should be collected by licensed collectors regularly.</li> </ul>   | All construction sites   | V                     |
| S8.3.17                                      | WM5           | <p><u>General Refuse</u></p> <ul style="list-style-type: none"> <li>• General refuse generated on-site should be stored in enclosed bins or compaction units separately from construction and chemical wastes.</li> <li>• A reputable waste collector should be employed by the Contractor to remove general refuse from the site, separately from construction and chemical wastes, on a daily basis to minimize odour, pest and litter impacts. Burning of refuse on construction sites is prohibited by law.</li> <li>• Aluminium cans are often recovered from the waste stream by individual collectors if they are segregated and made easily accessible. Separate labelled bins for their</li> </ul>  | All construction sites   | V                     |

| EIA Ref.                                  | EM&A Log Ref. | Recommended Mitigation Measures   | Location of the measures | Implementation Status |
|---|---------------|---|--------------------------|-----------------------|
|   |               | <p>deposit should be provided if feasible.</p> <ul style="list-style-type: none"> <li>• Office wastes can be reduced through the recycling of paper if volumes are large enough to warrant collection. Participation in a local collection scheme should be considered by the Contractor. In addition, waste separation facilities for paper, aluminium cans, plastic bottles etc., should be provided.</li> <li>• Training should be provided to workers about the concepts of site cleanliness and appropriate waste management procedure, including reduction, reuse and recycling of wastes.</li> </ul>   |                          |                       |
| <b>Water Quality (Construction Phase)</b> |               |   |                          |                       |
| S9.11.1.1                                 | W1            | <p><u>Mitigation during the marine works to reduce impacts to within acceptable levels have been recommended and will comprise a series of measures that restrict the method and sequencing of dredging/backfilling, as well as protection measures. Details of the measures are provided below.</u></p> <ul style="list-style-type: none"> <li>• Floating type perimeter silt curtains shall be around the HKBCF site before the commencement of marine works.</li> <li>• Silt curtain shall be fully maintained throughout the works.</li> </ul>  | Marine works             | N/A                   |
| S9.11.1.7                                 | W2            | <p><u>Land Works</u></p> <p>General construction activities on land should also be governed by standard good working practice. Specific measures to be written into the works contracts should include:</p> <ul style="list-style-type: none"> <li>• wastewater from temporary site facilities should be controlled to prevent direct discharge to surface or marine waters;</li> <li>• sewage effluent and discharges from on-site kitchen facilities shall be directed to Government sewer in accordance with the requirements of the W PCO or collected for disposal offsite. The use of soakaways shall be avoided;</li> <li>• storm drainage shall be directed to storm drains via adequately designed sand/silt removal facilities such as sand traps, silt traps and sediment basins. Channels, earth bunds or sand bag barriers should be provided on site to properly direct stormwater to such silt removal facilities. Catchpits and perimeter channels should be constructed in advance of site formation works and earthworks;</li> <li>• silt removal facilities, channels and manholes shall be maintained and any deposited silt and grit shall be removed regularly, including specifically at the onset of and after each rainstorm;</li> <li>• temporary access roads should be surfaced with crushed stone or gravel;</li> <li>• rainwater pumped out from trenches or foundation excavations should be discharged into storm drains via silt removal facilities;</li> <li>• measures should be taken to prevent the washout of construction materials, soil, silt or debris into any drainage system;</li> <li>• open stockpiles of construction materials (e.g. aggregates and sand) on site should be covered with tarpaulin or similar fabric during rainstorms;</li> <li>• manholes (including any newly constructed ones) should always be adequately covered and temporarily sealed so as to prevent silt, construction materials or debris from getting into the drainage system, and to prevent storm run-off from getting into foul sewers;</li> <li>• discharges of surface run-off into foul sewers must always be prevented in order not to unduly overload the foul sewerage system;</li> <li>• all vehicles and plant should be cleaned before they leave the construction site to ensure that no earth, mud or debris is deposited by them on roads. A wheel washing bay should be provided at every site exit;</li> <li>• wheel wash overflow shall be directed to silt removal facilities before being discharged to the storm drain;</li> <li>• the section of construction road between the wheel washing bay and the public road should be surfaced with crushed stone or coarse gravel;</li> <li>• wastewater generated from concreting, plastering, internal decoration, cleaning work and other similar activities, shall be screened to remove large objects;</li> <li>• vehicle and plant servicing areas, vehicle wash bays and lubrication facilities shall be located under roofed areas. The drainage in these covered areas shall be connected to foul sewers via a petrol interceptor in accordance with the requirements of the W PCO or collected for off site disposal;</li> <li>• the Contractors shall prepare an oil / chemical cleanup plan and ensure that leakages or spillages are contained and cleaned up immediately;</li> <li>• waste oil should be collected and stored for recycling or disposal, in accordance with the Waste Disposal Ordinance;</li> <li>• all fuel tanks and chemical storage areas should be provided with locks and be sited on sealed areas. The storage areas should be surrounded by bunds with a capacity equal to 110% of the storage capacity of the largest tank; and</li> </ul> | Land-based works areas   | V                     |

| EIA Ref.  | EM&A Log Ref. | Recommended Mitigation Measures   | Location of the measures                | Implementation Status   |
|---|---------------|---|---|---|
|   |               | <ul style="list-style-type: none"> <li>• surface run-off from bunded areas should pass through oil/grease traps prior to discharge to the stormwater system.</li> </ul>   |   |   |
| S9.14   | W3            | Implement a water quality monitoring programme  | At identified monitoring locations      | V (impact operational phase water quality monitoring programme, covered by Contract No. HY/2013/04) |
| <b>Ecology (Construction Phase)</b>                   |               |   |   |   |
| S10.7   | E2            | <ul style="list-style-type: none"> <li>• Install silt curtain during the construction.</li> <li>Limit dredging and works fronts.</li> <li>• Good site practices.</li> <li>• Site runoff control.</li> </ul>   | Marine works and Land-based works areas | N/A   |
| S10.7   | E4            | Watering to reduce dust generation; prevention of siltation of freshwater habitats; Site runoff should be desilted, to reduce the potential for suspended sediments, organics and other contaminants to enter streams and standing freshwater   | Land-based works areas                  | V   |
| S10.7   | E5            | Good site practices, including strictly following the permitted works hours, using quieter machines where practicable, and avoiding excessive lightings during night time   | Land-based works areas                  | V   |
| S10.7   | E6            | <ul style="list-style-type: none"> <li>• Dolphin Exclusion Zone;</li> <li>• Dolphin watching plan</li> </ul>  | Marine works                            | N/A   |
| S10.7   | E7            | <ul style="list-style-type: none"> <li>• Decouple compressors and other equipment on working vessels</li> <li>• Avoidance of percussive piling</li> </ul>   | Marine works                            | N/A   |
| S10.7   | E8            | <ul style="list-style-type: none"> <li>• Control vessel speed</li> <li>• Skipper training</li> <li>• Predefined and regular routes for working vessels; avoid Brother Islands.</li> </ul>   | Marine Traffic                          | N/A   |
| S10.10  | E9            | <ul style="list-style-type: none"> <li>• Dolphin vessel monitoring</li> </ul>   | North Lantau and West Lantau            | V (post-construction dolphin monitoring, covered by Contract No. HY/2012/08)                        |
| <b>Fisheries</b>                                      |               |   |   |   |
| S11.7   | F4            | <ul style="list-style-type: none"> <li>• Maritime Oil Spill Response Plan (MOSRP);</li> <li>• Contingency plan.</li> </ul>  | HKBCF                                   | V   |
| <b>Landscape &amp; Visual (Detailed Design Phase)</b> |               |   |   |   |
| S14.3.3.1   | LV1           | <p>General design measures include:</p> <ul style="list-style-type: none"> <li>• Roadside planting and planting along the edge of the HKBCF Island is proposed;</li> <li>• Transplanting of mature trees in good health and amenity value where appropriate and reinstatement of areas disturbed during construction by compensatory hydro-seeding and planting;</li> <li>• Protection measures for the trees to be retained during construction activities;</li> <li>• Optimizing the sizes and spacing of the bridge columns; Fine-tuning the location of the bridge columns to avoid visually-sensitive locations;</li> <li>• Maximizing new tree, shrub and other vegetation planting to compensate tree felled and vegetation removed;</li> <li>• Providing planting area around peripheral of HKBCF for tree planting screening effect;</li> <li>• Providing salt-tolerant native trees along the planter strip at affected seawall and newly reclaimed coastline;</li> <li>• For HKBCF, providing aesthetic architectural design on the related buildings (e.g. similar materials for PCB building facade to Airport buildings, roof planting and subtle materials for other facilities buildings and so on), and the related infrastructure (e.g. parapet planting and transparent cover for elevated footbridges) to provide harmonious atmosphere of the HKBCF; and</li> <li>• Fine-tuning the sizes of the structural members to minimize the bulkiness of buildings and adjustment of building arrangement to minimise disturbance to surrounding vegetation in the HKBCF.</li> </ul> | HKBCF                                   | V   |

| EIA Ref.   | EM&A Log Ref. | Recommended Mitigation Measures  | Location of the measures | Implementation Status |
|--|---------------|--|--------------------------|-----------------------|
| <b>Landscape &amp; Visual (Construction Phase)</b>                 |               |  |                          |                       |
| S14.3.3.3  | LV2           | <u>Mitigate both Landscape and Visual Impacts</u><br>G1. Grass-hydroseed bare soil surface and stock pile areas.<br>G2. Add planting strip and automatic irrigation system if appropriate at some portions of bridge footbridge to screen bridge and traffic.<br>G3. Not applicable as this is for HKLR.<br>G4. For HKBCF, providing aesthetic architectural design on the related buildings (e.g. similar materials for PCB building facade to Airport buildings, roof planting and subtle materials for other facilities buildings and so on), and the related infrastructure (e.g. parapet planting and transparent cover for elevated footbridges) to provide harmonious atmosphere of the HKBCF<br>G5. Vegetation reinstatement and upgrading to disturbed areas<br>G6. Maximizing new tree shrub and other vegetation planting to compensate tree felled and vegetation removed<br>G7. Providing planting area around peripheral of HKBCF for tree planting screening effect;<br>G8. Plant salt-tolerant native and shrubs etc along the planter strip at affected seawall.<br>G9. Reserve of loose natural granite rocks for re-use. Provide new coastline to adopt "natural-look" by means of using armour rocks in the form of natural rock materials and planting strip area accommodating screen buffer to enhance "natural-look" of the new coastline. | HKBCF                    | V                     |
| S14.3.3.3  | LV3           | <u>Mitigate Visual Impacts</u><br>V1. Minimize time for construction activities during construction period.<br>V2. Provide screen hoarding at the portion of the project site / works areas / storage areas near VSRs who have close low-level views to the Project during HKBCF construction.   |                          | V                     |
| <b>EM&amp;A</b>  |               |  |                          |                       |
| S15.2.2  | EM1           | An Independent Environmental Checker needs to be employed as per the EM&A Manual.  | All construction sites   | V                     |
| S15.5 - S15.6  | EM2           | 1) An Environmental Team needs to be employed as per the EM&A Manual.<br>2) Prepare a systematic Environmental Management Plan to ensure effective implementation of the mitigation measures.<br>3) An environmental impact monitoring needs to be implementing by the Environmental Team to ensure all the requirements given in the EM&A Manual are fully complied with.   | All construction sites   | V                     |
| Legend: V = implemented; x = not implemented; N/A = not applicable |               |  |                          |                       |

## **Appendix H. Statistics on Environmental Complaints, Notification of Summons and Successful Prosecutions**



## Statistics on Environmental Complaints, Notifications of Summons and Successful Prosecutions

| Reporting Period   | Complaints | Notifications of Summons | Successful Prosecutions |
|--|------------|--------------------------|-------------------------|
| This reporting period  | 0          | 0                        | 0                       |
| From commencement date of construction to end of reporting month | 11         | 0                        | 0                       |

# **Appendix I. Environmental Site Inspection and Monitoring Schedule**

Impact Environmental Monitoring Schedule for December 2019

by Mott MacDonald monitoring team

| Sun | Mon  | Tue  | Wed               | Thu  | Fri  | Sat  |
|-----|--|--|-------------------|--|--|--|
| 1   | 2  | 3  | 4                 | 5  | 6  | 7  |
|     | AMS2 - 1 & 24 hr TSP<br>AMS3C - 1 & 24 hr TSP<br>AMS7B - 1 & 24 hr TSP |  |                   |  |  | AMS2 - 1 & 24 hr TSP<br>AMS3C - 1 & 24 hr TSP<br>AMS7B - 1 & 24 hr TSP |
|     |  | Dolphin Monitoring   | Weekly Site Audit |  |  |  |
| 8   | 9  | 10   | 11                | 12   | 13   | 14   |
|     |  |  |                   |  | AMS2 - 1 & 24 hr TSP<br>AMS3C - 1 & 24 hr TSP<br>AMS7B - 1 & 24 hr TSP |  |
|     |  | Dolphin Monitoring   | Weekly Site Audit | Dolphin Monitoring   |  |  |
| 15  | 16   | 17   | 18                | 19   | 20   | 21   |
|     |  |  |                   | AMS2 - 1 & 24 hr TSP<br>AMS3C - 1 & 24 hr TSP<br>AMS7B - 1 & 24 hr TSP |  |  |
|     | Dolphin Monitoring   |  | Weekly Site Audit |  |  |  |
| 22  | 23   | 24   | 25                | 26   | 27   | 28   |
|     |  | AMS2 - 1 & 24 hr TSP<br>AMS3C - 1 & 24 hr TSP<br>AMS7B - 1 & 24 hr TSP |                   |  |  |  |
|     | Water Quality Monitoring   |  |                   |  |  |  |
|     | Weekly Site Audit  |  |                   |  |  |  |
| 29  | 30   | 31   |                   |  |  |  |
|     | AMS2 - 1 & 24 hr TSP<br>AMS3C - 1 & 24 hr TSP<br>AMS7B - 1 & 24 hr TSP |  |                   |  |  |  |

Notes:

Air Quality Monitoring Station - AMS2, AMS3C, AMS7B

WQ - Water Quality Monitoring (impact operational phase, monthly)

CWD - Chinese White Dolphin (post-construction phase, monthly); monitoring conducted and data collected by TM-CLKL Contract No. HY/2012/08

Weekly Site Audit

Tentative Impact Environmental Monitoring Schedule for January 2020

by Mott MacDonald monitoring team

| Sun | Mon   | Tue | Wed  | Thu  | Fri  | Sat   |
|-----|---|-----|--|--|--|---|
|     |   |     | 1  | 2  | 3  | 4<br>AMS2 - 1 & 24 hr TSP<br>AMS3C - 1 & 24 hr TSP<br>AMS7B - 1 & 24 hr TSP |
|     |   |     |  | Dolphin Monitoring<br>Weekly Site Audit                                      |  |   |
| 5   | 6   | 7   | 8  | 9  | 10<br>AMS2 - 1 & 24 hr TSP<br>AMS3C - 1 & 24 hr TSP<br>AMS7B - 1 & 24 hr TSP | 11  |
|     | Dolphin Monitoring                            |     | Weekly Site Audit  | Dolphin Monitoring   |  |   |
| 12  | 13  | 14  | 15   | 16<br>AMS2 - 1 & 24 hr TSP<br>AMS3C - 1 & 24 hr TSP<br>AMS7B - 1 & 24 hr TSP | 17   | 18  |
|     |   |     | Weekly Site Audit  | Dolphin Monitoring   |  |   |
| 19  | 20  | 21  | 22<br>AMS2 - 1 & 24 hr TSP<br>AMS3C - 1 & 24 hr TSP<br>AMS7B - 1 & 24 hr TSP | 23   | 24<br>AMS2 - 1 & 24 hr TSP<br>AMS3C - 1 & 24 hr TSP<br>AMS7B - 1 & 24 hr TSP | 25  |
|     | Water Quality Monitoring<br>Weekly Site Audit |     |  |  |  |   |
| 26  | 27  | 28  | 29   | 30<br>AMS2 - 1 & 24 hr TSP<br>AMS3C - 1 & 24 hr TSP<br>AMS7B - 1 & 24 hr TSP | 31   |   |
|     |   |     | Weekly Site Audit  |  |  |   |

Notes:

Air Quality Monitoring Station - AMS2, AMS3C, AMS7B

WQ - Water Quality Monitoring (impact operational phase, monthly)

CWD - Chinese White Dolphin (post-construction phase, monthly); monitoring conducted and data collected by TM-CLKL Contract No. HY/2012/08

Weekly Site Audit

## Appendix J. Calibration Certificates





## ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

### SUB-CONTRACTING REPORT

|         |   |                |               |
|---------|---|----------------|---------------|
| CONTACT | : MR K.W. FAN   | WORK ORDER     | : HK1943780   |
| CLIENT  | : ENVIROTECH SERVICES CO.   |                |               |
| ADDRESS | : RM113, 1/F, MY LOFT, 9 HOI WING ROAD,<br>TUEN MUN, N.T. HONG KONG | SUB-BATCH      | : 1           |
|         |   | DATE RECEIVED  | : 9-OCT-2019  |
|         |   | DATE OF ISSUE  | : 22-OCT-2019 |
| PROJECT | : ----  | NO. OF SAMPLES | : 1           |
|         |   | CLIENT ORDER   | : ----        |

#### General Comments

- Sample(s) were received in ambient condition.
- Sample(s) analysed and reported on an as received basis.
- Sample information (Project name, Sample ID, Sampling date/ time) is provided by client.
- Calibration was subcontracted to and analysed by Action United Enviro Services.

#### Signatories

This document has been signed by those names that appear on this report and are the authorised signatories

Signatories

Position

Richard Fung

General Manager

This is the Final Report and supersedes any preliminary report with this batch number.

Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

ALS Technichem (HK) Pty Ltd  
Part of the ALS Laboratory Group

11/F, Chung Shun Knitting Centre 1 - 3 Wing Yip Street, Kwai Chung, N.T., Hong Kong  
Tel. +852 2610 1044 Fax +852 2610 2021 [www.alsglobal.com](http://www.alsglobal.com)

WORK ORDER : HK1943780  
SUB-BATCH : 1  
CLIENT : ENVIROTECH SERVICES CO.  
PROJECT : ----



| ALS Lab ID    | Client's Sample ID | Sample Type | Sample Date | External Lab Report No. |
|---------------|--------------------|-------------|-------------|-------------------------|
| HK1943780-001 | S/N: 831656        | Equipments  | 09-Oct-2019 | S/N: 831656             |

## Equipment Verification Report (TSP)

### Equipment Calibrated:

Type: Laser Dust monitor  
Manufacturer: Sibata LD-5R  
Serial No. 831656  
Equipment Ref: Nil  
Job Order HK1943780

### Standard Equipment:

Standard Equipment: Higher Volume Sampler  
Location & Location ID: AUES office (calibration room)  
Equipment Ref: HVS 018  
Last Calibration Date: 22 August 2019

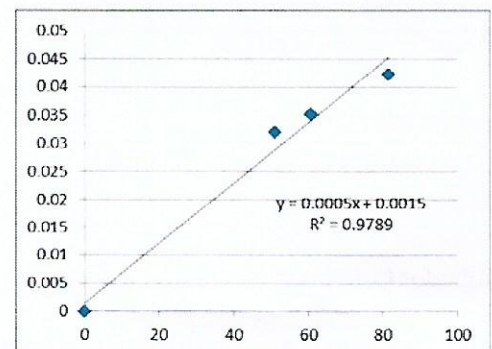
### Equipment Verification Results:

Testing Date: 14 October 2019

| Hour     | Time          | Mean Temp °C | Mean Pressure (hPa) | Concentration in mg/m <sup>3</sup> (Standard Equipment) | Total Count (Calibrated Equipment) | Count/Minute (Total Count/min) |
|----------|---------------|--------------|---------------------|---|------------------------------------|--------------------------------|
| 2hr02min | 09:13 ~ 11:15 | 25.8         | 1017.6              | 0.042   | 9927                               | 81.5                           |
| 2hr      | 11:20 ~ 13:20 | 25.8         | 1017.6              | 0.035   | 7282                               | 60.7                           |
| 2hr01min | 13:24 ~ 15:25 | 25.8         | 1017.6              | 0.032   | 6163                               | 51.1                           |

### Linear Regression of Y or X

Slope (K-factor): 0.0005  
Correlation Coefficient 0.9894  
Date of Issue 22 October 2019



### Remarks:

1. Strong Correlation ( $R > 0.8$ )
2. Factor 0.0005 should be applied for TSP monitoring

\*If  $R < 0.5$ , repair or re-verification is required for the equipment

Operator: Fai So Signature:  Date: 22 October 2019

QC Reviewer: Ben Tam Signature:  Date: 22 October 2019



## TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Location : Gold King Industrial Building, Kwai Chung  
 Location ID : Calibration Room

Date of Calibration: 22-Aug-19  
 Next Calibration Date: 22-Nov-19

### CONDITIONS

Sea Level Pressure (hPa) 1005.5  
 Temperature (°C) 29.2

Corrected Pressure (mm Hg) 754.125  
 Temperature (K) 302

### CALIBRATION ORIFICE

Make-> TISCH  
 Model-> 5025A  
 Calibration Date-> 5-Feb-19

Qstd Slope -> 2.0968  
 Qstd Intercept -> -0.00065  
 Expiry Date-> 5-Feb-20

### CALIBRATION

| Plate No. | H2O (L) (in) | H2O (R) (in) | H2O (in) | Qstd (m3/min) | I (chart) | IC corrected | LINEAR REGRESSION     |
|-----------|--------------|--------------|----------|---------------|-----------|--------------|-----------------------|
| 18        | 6.6          | 6.6          | 13.2     | 1.714         | 56        | 55.39        | Slope = 37.1811       |
| 13        | 5.2          | 5.2          | 10.4     | 1.522         | 50        | 49.46        | Intercept = -7.4343   |
| 10        | 4.1          | 4.1          | 8.2      | 1.351         | 44        | 43.52        | Corr. coeff. = 0.9969 |
| 8         | 2.6          | 2.6          | 5.2      | 1.076         | 34        | 33.63        |                       |
| 5         | 1.7          | 1.7          | 3.4      | 0.870         | 24        | 23.74        |                       |

#### Calculations :

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta))-b]$$

$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate

IC = corrected chart responses

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration ( deg K )

Pstd = actual pressure during calibration ( mm Hg )

#### For subsequent calculation of sampler flow:

$$1/m((I) [\text{Sqrt}(298/Tav)(Pav/760)]-b)$$

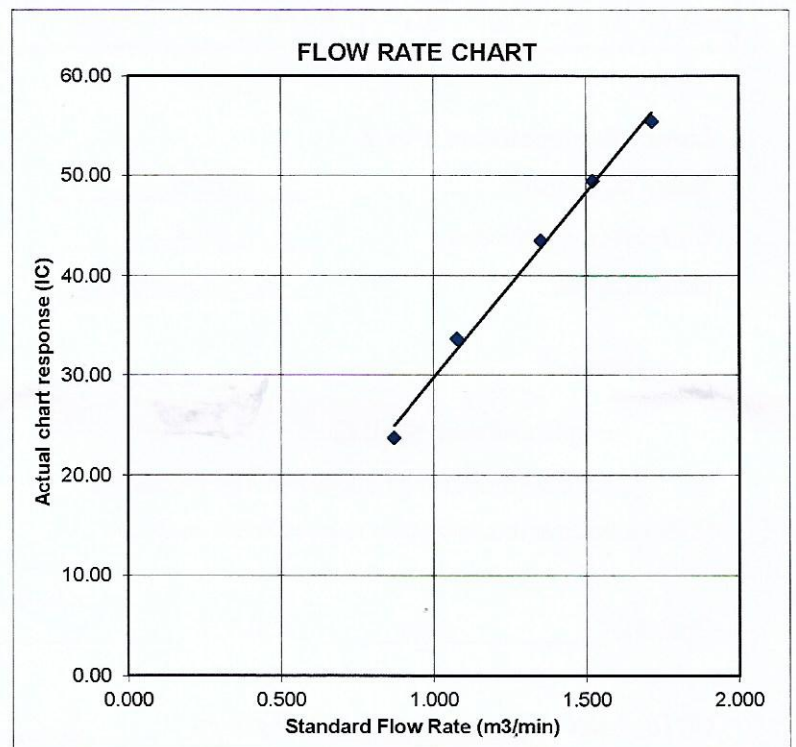
m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure





## Certificate of Calibration

### Calibration Certification Information

|                               |                             |                 |
|-------------------------------|-----------------------------|-----------------|
| Cal. Date: February 5, 2019   | Rootsmeter S/N: 438320      | Ta: 293 °K      |
| Operator: Jim Tisch           |                             | Pa: 753.1 mm Hg |
| Calibration Model #: TE-5025A | Calibrator S/N: <b>1941</b> |                 |

| Run | Vol. Init (m3) | Vol. Final (m3) | ΔVol. (m3) | ΔTime (min) | ΔP (mm Hg) | ΔH (in H2O) |
|-----|----------------|-----------------|------------|-------------|------------|-------------|
| 1   | 1              | 2               | 1          | 1.4830      | 3.2        | 2.00        |
| 2   | 3              | 4               | 1          | 1.0430      | 6.4        | 4.00        |
| 3   | 5              | 6               | 1          | 0.9300      | 7.9        | 5.00        |
| 4   | 7              | 8               | 1          | 0.8870      | 8.7        | 5.50        |
| 5   | 9              | 10              | 1          | 0.7320      | 12.7       | 8.00        |

### Data Tabulation

| Vstd (m3)   | Qstd (x-axis) | $\sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)}$ (y-axis) | Va        | Qa (x-axis) | $\sqrt{\Delta H \left( \frac{Ta}{Pa} \right)}$ (y-axis) |
|-------------|---------------|--|-----------|-------------|---|
| 1.0036      | 0.6767        | 1.4197   | 0.9958    | 0.6714      | 0.8821  |
| 0.9993      | 0.9581        | 2.0078   | 0.9915    | 0.9506      | 1.2475  |
| 0.9973      | 1.0723        | 2.2448   | 0.9895    | 1.0640      | 1.3947  |
| 0.9962      | 1.1231        | 2.3544   | 0.9884    | 1.1144      | 1.4628  |
| 0.9908      | 1.3536        | 2.8395   | 0.9831    | 1.3431      | 1.7642  |
| <b>QSTD</b> | m=            | <b>2.09680</b>   | <b>QA</b> | m=          | <b>1.31298</b>  |
|             | b=            | <b>-0.00065</b>  |           | b=          | <b>-0.00040</b>   |
|             | r=            | <b>0.99999</b>   |           | r=          | <b>0.99999</b>  |

### Calculations

|  |   |   |                                |
|--|---|---|--------------------------------|
| Vstd=  | $\Delta Vol((Pa-\Delta P)/Pstd)(Tstd/Ta)$ | Va=   | $\Delta Vol((Pa-\Delta P)/Pa)$ |
| Qstd=  | Vstd/ΔTime                                | Qa=   | Va/ΔTime                       |
| For subsequent flow rate calculations:   |   |   |                                |
| <b>Qstd=</b> $1/m \left( \left( \sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)} \right) - b \right)$ |   | <b>Qa=</b> $1/m \left( \left( \sqrt{\Delta H \left( \frac{Ta}{Pa} \right)} \right) - b \right)$ |                                |

### Standard Conditions

|   |           |
|---|-----------|
| Tstd:                                     | 298.15 °K |
| Pstd:                                     | 760 mm Hg |
| <b>Key</b>                                |           |
| ΔH: calibrator manometer reading (in H2O) |           |
| ΔP: rootsmeter manometer reading (mm Hg)  |           |
| Ta: actual absolute temperature (°K)      |           |
| Pa: actual barometric pressure (mm Hg)    |           |
| b: intercept                              |           |
| m: slope                                  |           |

### RECALIBRATION

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30





## ALS Laboratory Group

ANALYTICAL CHEMISTRY & TESTING SERVICES

### SUB-CONTRACTING REPORT

CONTACT : MR K.W. FAN

CLIENT : ENVIROTECH SERVICES CO.

ADDRESS : RM113, 1/F, MY LOFT, 9 HOI WING ROAD,  
TUEN MUN, N.T. HONG KONG

PROJECT : ----

WORK ORDER : **HK1943793**

SUB-BATCH : 1

DATE RECEIVED : 9-OCT-2019

DATE OF ISSUE : 22-OCT-2019

NO. OF SAMPLES : 1

CLIENT ORDER : ----

### General Comments

- Sample(s) were received in ambient condition.
- Sample(s) analysed and reported on an as received basis.
- Water sample(s) analysed and reported on as received basis.
- Sample information (Project name, Sample ID, Sampling date/ time) is provided by client.
- Calibration was subcontracted to and analysed by Action United Enviro Services.

### Signatories

This document has been signed by those names that appear on this report and are the authorised signatories

Signatories

Position

Richard Fung

General Manager

This is the Final Report and supersedes any preliminary report with this batch number.

Results apply to sample(s) as submitted. All pages of this report have been checked and approved for release.

ALS Technichem (HK) Pty Ltd  
Part of the ALS Laboratory Group

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Tel. +852 2610 1044 Fax: +852 2610 2021 www.alsglobal.com

WORK ORDER : HK1943793  
SUB-BATCH : 1  
CLIENT : ENVIROTECH SERVICES CO.  
PROJECT : ----



| ALS Lab ID    | Client's Sample ID | Sample Type | Sample Date | External Lab Report No. |
|---------------|--------------------|-------------|-------------|-------------------------|
| HK1943793-001 | S/N: 831657        | Equipments  | 09-Oct-2019 | S/N: 831657             |

## Equipment Verification Report (TSP)

### Equipment Calibrated:

Type: Laser Dust monitor  
Manufacturer: Sibata LD-5R  
Serial No. 831657  
Equipment Ref: Nil  
Job Order HK1943793

### Standard Equipment:

Standard Equipment: Higher Volume Sampler  
Location & Location ID: AUES office (calibration room)  
Equipment Ref: HVS 018  
Last Calibration Date: 22 August 2019

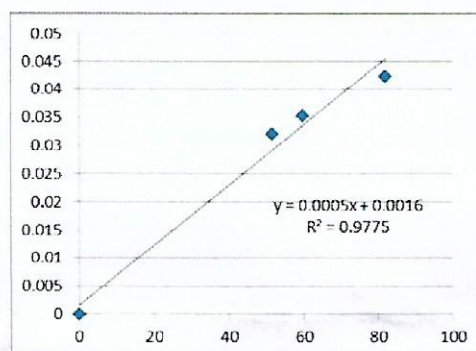
### Equipment Verification Results:

Testing Date: 14 October 2019

| Hour     | Time          | Mean Temp °C | Mean Pressure (hPa) | Concentration in mg/m <sup>3</sup> (Standard Equipment) | Total Count (Calibrated Equipment) | Count/Minute (Total Count/min) |
|----------|---------------|--------------|---------------------|---|------------------------------------|--------------------------------|
| 2hr02min | 09:13 ~ 11:15 | 25.8         | 1017.6              | 0.042   | 9976                               | 81.9                           |
| 2hr      | 11:20 ~ 13:20 | 25.8         | 1017.6              | 0.035   | 7177                               | 59.8                           |
| 2hr01min | 13:24 ~ 15:25 | 25.8         | 1017.6              | 0.032   | 6211                               | 51.5                           |

### Linear Regression of Y or X

Slope (K-factor): 0.0005  
Correlation Coefficient 0.9887  
Date of Issue 22 October 2019




### Remarks:

1. Strong Correlation ( $R > 0.8$ )
2. Factor 0.0005 should be applied for TSP monitoring

\*If  $R < 0.5$ , repair or re-verification is required for the equipment

Operator: Fai So Signature:  Date: 22 October 2019

QC Reviewer: Ben Tam Signature:  Date: 22 October 2019



## TSP SAMPLER CALIBRATION CALCULATION SPREADSHEET

Location : Gold King Industrial Building, Kwai Chung  
 Location ID : Calibration Room  
 Date of Calibration: 22-Aug-19  
 Next Calibration Date: 22-Nov-19

### CONDITIONS

|                          |        |                            |         |
|--------------------------|--------|----------------------------|---------|
| Sea Level Pressure (hPa) | 1005.5 | Corrected Pressure (mm Hg) | 754.125 |
| Temperature (°C)         | 29.2   | Temperature (K)            | 302     |

### CALIBRATION ORIFICE

|                    |          |                   |          |
|--------------------|----------|-------------------|----------|
| Make->             | TISCH    | Qstd Slope ->     | 2.0968   |
| Model->            | 5025A    | Qstd Intercept -> | -0.00065 |
| Calibration Date-> | 5-Feb-19 | Expiry Date->     | 5-Feb-20 |

### CALIBRATION

| Plate No. | H2O (L) (in) | H2O (R) (in) | H2O (in) | Qstd (m3/min) | I (chart) | IC corrected | LINEAR REGRESSION     |
|-----------|--------------|--------------|----------|---------------|-----------|--------------|-----------------------|
| 18        | 6.6          | 6.6          | 13.2     | 1.714         | 56        | 55.39        | Slope = 37.1811       |
| 13        | 5.2          | 5.2          | 10.4     | 1.522         | 50        | 49.46        | Intercept = -7.4343   |
| 10        | 4.1          | 4.1          | 8.2      | 1.351         | 44        | 43.52        | Corr. coeff. = 0.9969 |
| 8         | 2.6          | 2.6          | 5.2      | 1.076         | 34        | 33.63        |                       |
| 5         | 1.7          | 1.7          | 3.4      | 0.870         | 24        | 23.74        |                       |

#### Calculations :

$$Qstd = 1/m[\text{Sqrt}(H2O(Pa/Pstd)(Tstd/Ta)) - b]$$

$$IC = I[\text{Sqrt}(Pa/Pstd)(Tstd/Ta)]$$

Qstd = standard flow rate

IC = corrected chart responses

I = actual chart response

m = calibrator Qstd slope

b = calibrator Qstd intercept

Ta = actual temperature during calibration ( deg K )

Pstd = actual pressure during calibration ( mm Hg )

#### For subsequent calculation of sampler flow:

$$1/m((I) [\text{Sqrt}(298/Tav)(Pav/760)] - b)$$

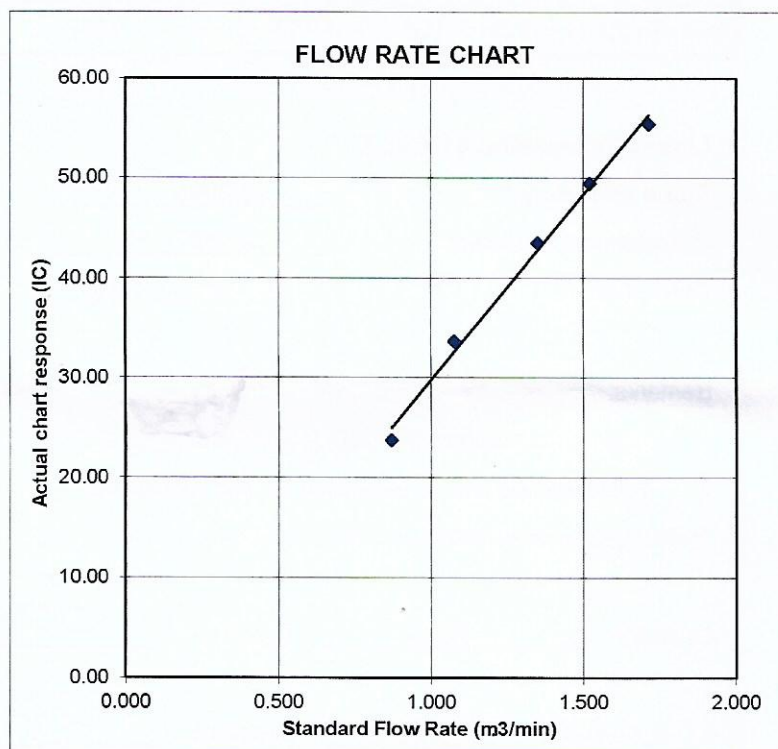
m = sampler slope

b = sampler intercept

I = chart response

Tav = daily average temperature

Pav = daily average pressure





## Certificate of Calibration

### Calibration Certification Information

|                               |                             |                 |
|-------------------------------|-----------------------------|-----------------|
| Cal. Date: February 5, 2019   | Rootsmeter S/N: 438320      | Ta: 293 °K      |
| Operator: Jim Tisch           |                             | Pa: 753.1 mm Hg |
| Calibration Model #: TE-5025A | Calibrator S/N: <b>1941</b> |                 |

| Run | Vol. Init (m3) | Vol. Final (m3) | ΔVol. (m3) | ΔTime (min) | ΔP (mm Hg) | ΔH (in H2O) |
|-----|----------------|-----------------|------------|-------------|------------|-------------|
| 1   | 1              | 2               | 1          | 1.4830      | 3.2        | 2.00        |
| 2   | 3              | 4               | 1          | 1.0430      | 6.4        | 4.00        |
| 3   | 5              | 6               | 1          | 0.9300      | 7.9        | 5.00        |
| 4   | 7              | 8               | 1          | 0.8870      | 8.7        | 5.50        |
| 5   | 9              | 10              | 1          | 0.7320      | 12.7       | 8.00        |

### Data Tabulation

| Vstd (m3)   | Qstd (x-axis) | $\sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)}$ (y-axis) | Va        | Qa (x-axis) | $\sqrt{\Delta H \left( \frac{Ta}{Pa} \right)}$ (y-axis) |
|-------------|---------------|--|-----------|-------------|---|
| 1.0036      | 0.6767        | 1.4197   | 0.9958    | 0.6714      | 0.8821  |
| 0.9993      | 0.9581        | 2.0078   | 0.9915    | 0.9506      | 1.2475  |
| 0.9973      | 1.0723        | 2.2448   | 0.9895    | 1.0640      | 1.3947  |
| 0.9962      | 1.1231        | 2.3544   | 0.9884    | 1.1144      | 1.4628  |
| 0.9908      | 1.3536        | 2.8395   | 0.9831    | 1.3431      | 1.7642  |
| <b>QSTD</b> | m=            | <b>2.09680</b>   | <b>QA</b> | m=          | <b>1.31298</b>  |
|             | b=            | <b>-0.00065</b>  |           | b=          | <b>-0.00040</b>   |
|             | r=            | <b>0.99999</b>   |           | r=          | <b>0.99999</b>  |

### Calculations

|   |  |
|---|--|
| Vstd= $\Delta Vol \left( \frac{Pa - \Delta P}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)$                                 | Va= $\Delta Vol \left( \frac{Pa - \Delta P}{Pa} \right)$                                 |
| Qstd= $Vstd / \Delta Time$  | Qa= $Va / \Delta Time$   |
| For subsequent flow rate calculations:  |  |
| Qstd= $1/m \left( \left( \sqrt{\Delta H \left( \frac{Pa}{Pstd} \right) \left( \frac{Tstd}{Ta} \right)} \right) - b \right)$ | Qa= $1/m \left( \left( \sqrt{\Delta H \left( \frac{Ta}{Pa} \right)} \right) - b \right)$ |

### Standard Conditions

|   |           |
|---|-----------|
| Tstd:                                     | 298.15 °K |
| Pstd:                                     | 760 mm Hg |
| <b>Key</b>                                |           |
| ΔH: calibrator manometer reading (in H2O) |           |
| ΔP: rootsmeter manometer reading (mm Hg)  |           |
| Ta: actual absolute temperature (°K)      |           |
| Pa: actual barometric pressure (mm Hg)    |           |
| b: intercept                              |           |
| m: slope                                  |           |

### RECALIBRATION

US EPA recommends annual recalibration per 1998 40 Code of Federal Regulations Part 50 to 51, Appendix B to Part 50, Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere, 9.2.17, page 30



High-Volume TSP Sampler  
5-Point Calibration Record

Location : AMS3C (Ying Tung Estate)  
Calibrated by : P.F.Yeung  
Date : 17/12/2019

Sampler

Model : TE-5170  
Serial Number : S/N 3977

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
Service Date : 25 February 2019  
Slope (m) : 2.07076  
Intercept (b) : -0.02917  
Correlation Coefficient(r) : 1.00000

Standard Condition

Pstd (hpa) : 1013  
Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1016  
Ta(K) : 296

| Resistance Plate |          | dH [green liquid]<br>(inch water) | Z     | X=Qstd<br>(cubic meter/min) | IC<br>(chart) | Y<br>(corrected) |
|------------------|----------|-----------------------------------|-------|-----------------------------|---------------|------------------|
| 1                | 18 holes | 12.0                              | 3.481 | 1.695                       | 55            | 55.27            |
| 2                | 13 holes | 9.2                               | 3.048 | 1.486                       | 50            | 50.24            |
| 3                | 10 holes | 6.6                               | 2.582 | 1.261                       | 45            | 45.22            |
| 4                | 7 holes  | 4.5                               | 2.132 | 1.043                       | 38            | 38.18            |
| 5                | 5 holes  | 2.4                               | 1.557 | 0.766                       | 30            | 30.15            |

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 27.140                      Intercept(b): 9.881                      Correlation Coefficient(r): 0.9987

Checked by: Magnum Fan

Date: 22/12/2019

High-Volume TSP Sampler  
5-Point Calibration Record

Location : AMS7B  
Calibrated by : P.F.Yeung  
Date : 17/12/2019

Sampler

Model : TE-5170  
Serial Number : S/N 1060

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
Service Date : 25 February 2019  
Slope (m) : 2.07076  
Intercept (b) : -0.02917  
Correlation Coefficient(r) : 1.00000

Standard Condition

Pstd (hpa) : 1013  
Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1016  
Ta(K) : 296

| Resistance Plate |          | dH [green liquid]<br>(inch water) | Z     | X=Qstd<br>(cubic meter/min) | IC<br>(chart) | Y<br>(corrected) |
|------------------|----------|-----------------------------------|-------|-----------------------------|---------------|------------------|
| 1                | 18 holes | 11.6                              | 3.422 | 1.674                       | 54            | 54.26            |
| 2                | 13 holes | 9.2                               | 3.048 | 1.492                       | 50            | 50.24            |
| 3                | 10 holes | 6.4                               | 2.542 | 1.245                       | 45            | 45.22            |
| 4                | 7 holes  | 4.6                               | 2.155 | 1.057                       | 37            | 37.18            |
| 5                | 5 holes  | 2.3                               | 1.524 | 0.749                       | 28            | 28.14            |

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 28.664                      Intercept(b): 7.364                      Correlation Coefficient(r): 0.9925

Checked by: Magnum Fan

Date: 22/12/2019

High-Volume TSP Sampler  
5-Point Calibration Record

Location : AMS2  
Calibrated by : P.F.Yeung  
Date : 17/12/2019

Sampler

Model : TE-5170  
Serial Number : S/N 3976

Calibration Orifice and Standard Calibration Relationship

Serial Number : 2454  
Service Date : 25 February 2019  
Slope (m) : 2.07076  
Intercept (b) : -0.02917  
Correlation Coefficient(r) : 1.00000

Standard Condition

Pstd (hpa) : 1013  
Tstd (K) : 298.18

Calibration Condition

Pa (hpa) : 1016  
Ta(K) : 296

| Resistance Plate |          | dH [green liquid]<br>(inch water) | Z     | X=Qstd<br>(cubic meter/min) | IC<br>(chart) | Y<br>(corrected) |
|------------------|----------|-----------------------------------|-------|-----------------------------|---------------|------------------|
| 1                | 18 holes | 11.4                              | 3.393 | 1.653                       | 52            | 52.25            |
| 2                | 13 holes | 9                                 | 3.015 | 1.470                       | 48            | 48.23            |
| 3                | 10 holes | 6.4                               | 2.542 | 1.242                       | 43            | 43.21            |
| 4                | 7 holes  | 4.2                               | 2.059 | 1.009                       | 37            | 37.18            |
| 5                | 5 holes  | 2.2                               | 1.490 | 0.734                       | 28            | 28.14            |

Notes:  $Z = \sqrt{dH(Pa/Pstd)(Tstd/Ta)}$ ,  $X = Z/m - b$ ,  $Y(\text{Corrected Flow}) = IC * \{\sqrt{Pa/Pstd}(Tstd/Ta)\}$

Sampler Calibration Relationship (Linear Regression)

Slope(m): 25.948                      Intercept(b): 10.112                      Correlation Coefficient(r): 0.9969

Checked by: Magnum Fan

Date: 22/12/2019

## ENVIROTECH SERVICES CO.

### Calibration Report of Wind Meter

Date of Calibration : 24 July 2019

Brand of Test Meter: Davis

Model: Vantage Pro 2 ( s/n: BB180328020)

Location : AMS3C

#### Procedures :

1. Wind Still Test: The wind speed sensor was hold by hand until it keep still
2. Wind Speed Test: The wind meter was on-site calibrated against the Anemometer
3. Wind Direction Test : The wind meter was on-site calibrated against the marine compass at four directions

#### Results:

##### Wind Still Test


| Wind Speed (m/s) |
|------------------|
| 0.00             |


##### Wind Speed Test

| Davis (m/s) | Anemometer (m/s) |
|-------------|------------------|
| 1.3         | 1.4              |
| 2.2         | 1.9              |
| 4.5         | 5.1              |

##### Wind Direction Test

| Davis (o) | Marine Compass (o) |
|-----------|--------------------|
| 271       | 270                |
| 1         | 0                  |
| 89        | 90                 |
| 180       | 180                |

Calibrated by:   
Yeung Ping Fai  
(Technical Officer)

Checked by :   
Ho Kam Fat  
(Senior Technical Officer)

## ENVIROTECH SERVICES CO.

### Calibration Report of Wind Meter

Date of Calibration : 30 December 2019

Brand of Test Meter: Davis

Model: Vantage Pro 2 ( s/n: BB180328020)

Location : AMS3C

#### Procedures :

1. Wind Still Test: The wind speed sensor was hold by hand until it keep still
2. Wind Speed Test: The wind meter was on-site calibrated against the Anemometer
3. Wind Direction Test : The wind meter was on-site calibrated against the marine compass at four directions

#### Results:

##### Wind Still Test

| Wind Speed (m/s) |
|------------------|
| 0.00             |

##### Wind Speed Test

| Davis (m/s) | Anemometer (m/s) |
|-------------|------------------|
| 1.8         | 1.6              |
| 2.5         | 2.2              |
| 3.2         | 3.6              |

##### Wind Direction Test

| Davis (o) | Marine Compass (o) |
|-----------|--------------------|
| 269       | 270                |
| 359       | 0                  |
| 91        | 90                 |
| 179       | 180                |

Calibrated by: 

Yeung Ping Fai  
(Technical Officer)

Checked by : 

Ho Kam Fat  
(Senior Technical Officer)





輝創工程有限公司

Sun Creation Engineering Limited

Calibration & Testing Laboratory

# Certificate of Calibration

## 校正證書

Certificate No. : C193443

證書編號

ITEM TESTED / 送檢項目 (Job No. / 序引編號 : IC19-1283)

Date of Receipt / 收件日期 : 21 June 2019

Description / 儀器名稱 : Anemometer

Manufacturer / 製造商 : Lutron

Model No. / 型號 : AM-4201

Serial No. / 編號 : AF.27513

Supplied By / 委託者 : Envirotech Services Co.

Room 113, 1/F, My Loft, 9 Hoi Wing Road, Tuen Mun,  
New Territories, Hong Kong

### TEST CONDITIONS / 測試條件

Temperature / 溫度 :  $(23 \pm 2)^{\circ}\text{C}$

Relative Humidity / 相對濕度 :  $(50 \pm 25)\%$

Line Voltage / 電壓 : ---

### TEST SPECIFICATIONS / 測試規範

Calibration check

DATE OF TEST / 測試日期 : 2 July 2019

### TEST RESULTS / 測試結果

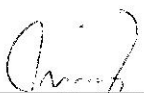
The results apply to the particular unit-under-test only.

The results are detailed in the subsequent page(s).

The test equipment used for calibration are traceable to National Standards via :

- Testo Industrial Services GmbH, Germany

Tested By  
測試

  
T F Lee  
Assistant Engineer

Certified By  
核證

  
H C Chan  
Engineer

Date of Issue  
簽發日期

5 July 2019

The test equipment used for calibration are traceable to the Nation Standards as specified in this certificate. This certificate shall not be reproduced except in full, without the prior written approval of this laboratory.

本證書所載校正用之測試器材均可溯源至國際標準。局部複印本證書需先獲本實驗室所書面批准。

Sun Creation Engineering Limited - Calibration & Testing Laboratory

c/o 4/F, 1 Hing On Lane, Tuen Mun, New Territories, Hong Kong

輝創工程有限公司 - 校正及檢測實驗室

c/o 香港新界屯門興安里一號四樓

Tel/電話: (852) 2927 2606

Fax/傳真: (852) 2744 8986

E-mail/電郵: callab@suncreation.com

Website/網址: www.suncreation.com

# Certificate of Calibration

## 校正證書

Certificate No. : C193443  
證書編號

- The unit-under-test (UUT) was allowed to stabilize in the laboratory for over 12 hours before the commencement of the test.
- The results presented are the mean of 10 measurements at each calibration point.
- Test equipment :

Equipment ID  
CL386

Description  
Multi-function Measuring Instrument

Certificate No.  
S16493

- Test procedure : MA130N.

- Results :

### Air Velocity

| Applied Value (m/s) | UUT Reading (m/s) | Measured Correction |                            |                 |
|---------------------|-------------------|---------------------|----------------------------|-----------------|
|                     |                   | Value (m/s)         | Measurement Uncertainty    |                 |
|                     |                   |                     | Expanded Uncertainty (m/s) | Coverage Factor |
| 2.0                 | 1.8               | +0.2                | 0.2                        | 2.0             |
| 4.0                 | 3.8               | +0.2                | 0.3                        | 2.0             |
| 6.0                 | 5.8               | +0.2                | 0.3                        | 2.0             |
| 8.1                 | 7.9               | +0.2                | 0.3                        | 2.0             |
| 10.1                | 10.0              | +0.1                | 0.4                        | 2.0             |

Remarks : - The Measured Corrections are defined as :  
Value = Applied Value - UUT Reading

- The expanded uncertainties are for a level of confidence of 95 %.

### Note :

Only the original copy or the laboratory's certified true copy is valid.

The values given in this Certificate only relate to the values measured at the time of the test and any uncertainties quoted will not include allowance for the equipment long term drift, variations with environment changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Sun Creation Engineering Limited shall not be liable for any loss or damage resulting from the use of the equipment.

The test equipment used for calibration are traceable to the Nation Standards as specified in this certificate. This certificate shall not be reproduced except in full, without the prior written approval of this laboratory.

本證書所載校正用之測試器材均可溯源至國際標準。局部複印本證書需先獲本實驗室書面批准。

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Website/網址: www.suncreation.com



## REPORT OF EQUIPMENT PERFORMANCE CHECK/ CALIBRATION

Report No. : AI090154  
Date of Issue : 02 October 2019  
Page No. : 1 of 2

### PART A – CUSTOMER INFORMATION

Enovative Environmental Service Ltd.  
Flat 2207, Yu Fun House,  
Yu Chui Court, Shatin  
New Territories, Hong Kong  
Attn: Mr. Thomas WONG

### PART B – DESCRIPTION

Name of Equipment : YSI ProDSS (Multi-Parameters)  
Manufacturer : YSI (a xylem brand)  
Serial Number : 16H104233  
Date of Received : Sep 27, 2019  
Date of Calibration : Sep 27, 2019  
Date of Next Calibration<sup>(a)</sup> : Dec 26, 2019

### PART C – REFERENCE METHODS/ DOCUMENTS FOR THE CALIBRATION

| Parameter            | Reference Method  |
|----------------------|---|
| pH at 25°C           | APHA 21e 4500-H <sup>+</sup> B  |
| Dissolved Oxygen     | APHA 21e 4500-O G   |
| Conductivity at 25°C | APHA 21e 2510 B   |
| Salinity             | APHA 21e 2520 B   |
| Turbidity            | APHA 21e 2130 B   |
| Temperature          | Section 6 of international Accreditation New Zealand Technical<br>Guide no. 3 Second edition March 2008: Working Thermometer Calibration Procedure. |

### PART D – CALIBRATION RESULTS<sup>(b,c)</sup>

#### (1) pH at 25°C

| Target (pH unit) | Displayed Reading <sup>(d)</sup> (pH Unit) | Tolerance <sup>(e)</sup> (pH Unit) | Results      |
|------------------|--|------------------------------------|--------------|
| 4.00             | 4.03                                       | 0.03                               | Satisfactory |
| 7.42             | 7.44                                       | 0.02                               | Satisfactory |
| 10.01            | 10.06                                      | 0.05                               | Satisfactory |

Tolerance of pH should be less than  $\pm 0.20$  (pH unit)

#### (2) Temperature

| Reading of Ref. thermometer (°C) | Displayed Reading (°C) | Tolerance (°C) | Results      |
|----------------------------------|------------------------|----------------|--------------|
| 10.0                             | 10.0                   | 0.0            | Satisfactory |
| 22.0                             | 22.1                   | 0.1            | Satisfactory |
| 42.0                             | 42.2                   | 0.2            | Satisfactory |

Tolerance limit of temperature should be less than  $\pm 2.0$  (°C)

~ CONTINUED ON NEXT PAGE ~

#### Remark(s): -

- <sup>(a)</sup> The "Date of Next Calibration" is recommended according to best practice principals as practiced by QPT or quoted from relevant international standards.  
<sup>(b)</sup> The results relate only to the calibrated equipment as received  
<sup>(c)</sup> The performance of the equipment stated in this report is checked with independent reference material and results compared against a calibrated secondary source.  
<sup>(d)</sup> "Displayed Reading" denotes the figure shown on item under calibration/ checking regardless of equipment precision or significant figures.  
<sup>(e)</sup> The "Tolerance Limit" mentioned is referenced to YSI product specifications.

  
LEE Chun-ning, Desmond  
Senior Chemist



專業化驗有限公司

QUALITY PRO TEST-CONSULT LIMITED

Unit 10, 14/F, Wah Wai Centre, 38-40 Au Pui Wan St., Fotan, Hong Kong

Email: info@qualityprotest.com; Website: www.qualityprotest.com

Tel: (852) 3956 8717; Fax: (852) 3956 3928

## REPORT OF EQUIPMENT PERFORMANCE CHECK/ CALIBRATION

Report No. : AI090154  
Date of Issue : 02 October 2019  
Page No. : 2 of 2

### PART D – CALIBRATION RESULTS (Cont'd)

#### (3) Dissolved Oxygen

| Expected Reading (mg/L) | Displayed Reading (mg/L) | Tolerance (mg/L) | Results      |
|-------------------------|--------------------------|------------------|--------------|
| 0.78                    | 0.75                     | -0.03            | Satisfactory |
| 3.69                    | 3.98                     | 0.29             | Satisfactory |
| 5.77                    | 5.4                      | -0.37            | Satisfactory |
| 7.68                    | 7.82                     | 0.14             | Satisfactory |

Tolerance limit of dissolved oxygen should be less than  $\pm 0.50$  (mg/L)

#### (4) Conductivity at 25°C

| Conc. of KCl (M) | Expected Reading ( $\mu\text{S}/\text{cm}$ ) | Displayed Reading ( $\mu\text{S}/\text{cm}$ ) | Tolerance (%) | Results      |
|------------------|--|---|---------------|--------------|
| 0.001            | 146.9  | 138.9   | -5.45         | Satisfactory |
| 0.01             | 1412   | 1380  | -2.27         | Satisfactory |
| 0.1              | 12890  | 12834   | -0.43         | Satisfactory |
| 0.5              | 58670  | 57663   | -1.72         | Satisfactory |
| 1.0              | 111900                                       | 109858  | -1.82         | Satisfactory |

Tolerance limit of conductivity should be less than  $\pm 10.0$  (%)

#### (5) Salinity

| Expected Reading (g/L) | Displayed Reading (g/L) | Tolerance (%) | Results      |
|------------------------|-------------------------|---------------|--------------|
| 10                     | 10.16                   | 1.60          | Satisfactory |
| 20                     | 20.38                   | 1.90          | Satisfactory |
| 30                     | 30.47                   | 1.57          | Satisfactory |

Tolerance limit of salinity should be less than  $\pm 10.0$  (%)

#### (6) Turbidity

| Expected Reading (NTU) | Displayed Reading <sup>(f)</sup> (NTU) | Tolerance <sup>(g)</sup> (%) | Results      |
|------------------------|--|------------------------------|--------------|
| 0                      | 0.11                                   | --                           | Satisfactory |
| 10                     | 9.89                                   | -1.1                         | Satisfactory |
| 20                     | 19.82                                  | -0.9                         | Satisfactory |
| 100                    | 97.25                                  | -2.8                         | Satisfactory |
| 800                    | 780.16                                 | -2.5                         | Satisfactory |

Tolerance limit of turbidity should be less than  $\pm 10.0$  (%)

~ END OF REPORT ~

#### Remark(s): -

<sup>(f)</sup> "Displayed Reading" presents the figures shown on item under calibration/ checking regardless of equipment precision or significant figures.

<sup>(g)</sup> The "Tolerance Limit" mentioned is the acceptance criteria applicable for similar equipment used by Quality Pro Test-Consult Ltd. or quoted from relevant international standards.





專業化驗有限公司

QUALITY PRO TEST-CONSULT LIMITED

Unit 10, 14/F, Wah Wai Centre, 38-40 Au Pui Wan St., Fotan, Hong Kong

Email: info@qualityprotest.com; Website: www.qualityprotest.com

Tel: (852) 3956 8717; Fax: (852) 3956 3928

## REPORT OF EQUIPMENT PERFORMANCE CHECK/ CALIBRATION

Report No. : AI100183  
Date of Issue : 30 October 2019  
Page No. : 1 of 2

### PART A – CUSTOMER INFORMATION

Enovative Environmental Service Ltd.  
Flat 2207, Yu Fun House,  
Yu Chui Court, Shatin  
New Territories, Hong Kong  
Attn: Mr. Thomas WONG

### PART B – DESCRIPTION

Name of Equipment : YSI 6920V2 (Multi-Parameters)  
Manufacturer : YSI (a xylem brand)  
Serial Number : 00019CB2  
Date of Received : Oct 28, 2019  
Date of Calibration : Oct 28, 2019  
Date of Next Calibration<sup>(a)</sup> : Jan 27, 2020

### PART C – REFERENCE METHODS/ DOCUMENTS FOR THE CALIBRATION

| Parameter            | Reference Method  |
|----------------------|---|
| pH at 25°C           | APHA 21e 4500-H <sup>+</sup> B  |
| Dissolved Oxygen     | APHA 21e 4500-O G   |
| Conductivity at 25°C | APHA 21e 2510 B   |
| Salinity             | APHA 21e 2520 B   |
| Turbidity            | APHA 21e 2130 B   |
| Temperature          | Section 6 of international Accreditation New Zealand Technical<br>Guide no. 3 Second edition March 2008: Working Thermometer Calibration Procedure. |

### PART D – CALIBRATION RESULTS<sup>(b,c)</sup>

#### (1) pH at 25°C

| Target (pH unit) | Displayed Reading <sup>(d)</sup> (pH Unit) | Tolerance <sup>(e)</sup> (pH Unit) | Results      |
|------------------|--|------------------------------------|--------------|
| 4.00             | 3.95                                       | -0.05                              | Satisfactory |
| 7.42             | 7.36                                       | -0.06                              | Satisfactory |
| 10.01            | 9.93                                       | -0.08                              | Satisfactory |

Tolerance of pH should be less than  $\pm 0.20$  (pH unit)

#### (2) Temperature

| Reading of Ref. thermometer (°C) | Displayed Reading (°C) | Tolerance (°C) | Results      |
|----------------------------------|------------------------|----------------|--------------|
| 15.0                             | 15.1                   | 0.1            | Satisfactory |
| 25.0                             | 24.9                   | -0.1           | Satisfactory |
| 35.0                             | 34.9                   | -0.1           | Satisfactory |

Tolerance limit of temperature should be less than  $\pm 2.0$  (°C)

~ CONTINUED ON NEXT PAGE ~

#### Remark(s): -

- <sup>(a)</sup> The "Date of Next Calibration" is recommended according to best practice principals as practiced by QPT or quoted from relevant international standards.  
<sup>(b)</sup> The results relate only to the calibrated equipment as received  
<sup>(c)</sup> The performance of the equipment stated in this report is checked with independent reference material and results compared against a calibrated secondary source.  
<sup>(d)</sup> "Displayed Reading" denotes the figure shown on item under calibration/ checking regardless of equipment precision or significant figures.  
<sup>(e)</sup> The "Tolerance Limit" mentioned is referenced to YSI product specifications.

  
LEE Chun-ning, Desmond  
Senior Chemist





## REPORT OF EQUIPMENT PERFORMANCE CHECK/ CALIBRATION

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Date of Issue : 30 October 2019  
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### PART D – CALIBRATION RESULTS (Cont'd)

#### (3) Dissolved Oxygen

| Expected Reading (mg/L) | Displayed Reading (mg/L) | Tolerance (mg/L) | Results      |
|-------------------------|--------------------------|------------------|--------------|
| 1.04                    | 0.80                     | -0.24            | Satisfactory |
| 4.10                    | 4.34                     | 0.24             | Satisfactory |
| 5.92                    | 5.94                     | 0.02             | Satisfactory |
| 7.81                    | 8.07                     | 0.26             | Satisfactory |

Tolerance limit of dissolved oxygen should be less than  $\pm 0.50$  (mg/L)

#### (4) Conductivity at 25°C

| Conc. of KCl (M) | Expected Reading ( $\mu\text{S/cm}$ ) | Displayed Reading ( $\mu\text{S/cm}$ ) | Tolerance (%) | Results      |
|------------------|---------------------------------------|--|---------------|--------------|
| 0.001            | 146.9                                 | 140.0                                  | -4.70         | Satisfactory |
| 0.01             | 1412                                  | 1394                                   | -1.27         | Satisfactory |
| 0.1              | 12890                                 | 12780                                  | -0.85         | Satisfactory |
| 0.5              | 58670                                 | 57927                                  | -1.27         | Satisfactory |
| 1.0              | 111900                                | 110880                                 | -0.91         | Satisfactory |

Tolerance limit of conductivity should be less than  $\pm 10.0$  (%)

#### (5) Salinity

| Expected Reading (g/L) | Displayed Reading (g/L) | Tolerance (%) | Results      |
|------------------------|-------------------------|---------------|--------------|
| 10                     | 9.90                    | -1.00         | Satisfactory |
| 20                     | 19.88                   | -0.60         | Satisfactory |
| 30                     | 29.89                   | -0.37         | Satisfactory |

Tolerance limit of salinity should be less than  $\pm 10.0$  (%)

#### (6) Turbidity

| Expected Reading (NTU) | Displayed Reading <sup>(f)</sup> (NTU) | Tolerance <sup>(g)</sup> (%) | Results      |
|------------------------|--|------------------------------|--------------|
| 0                      | 0.20                                   | --                           | Satisfactory |
| 10                     | 9.98                                   | -0.2                         | Satisfactory |
| 20                     | 19.88                                  | -0.6                         | Satisfactory |
| 100                    | 100.20                                 | 0.2                          | Satisfactory |
| 800                    | 798.82                                 | -0.1                         | Satisfactory |

Tolerance limit of turbidity should be less than  $\pm 10.0$  (%)

~ END OF REPORT ~

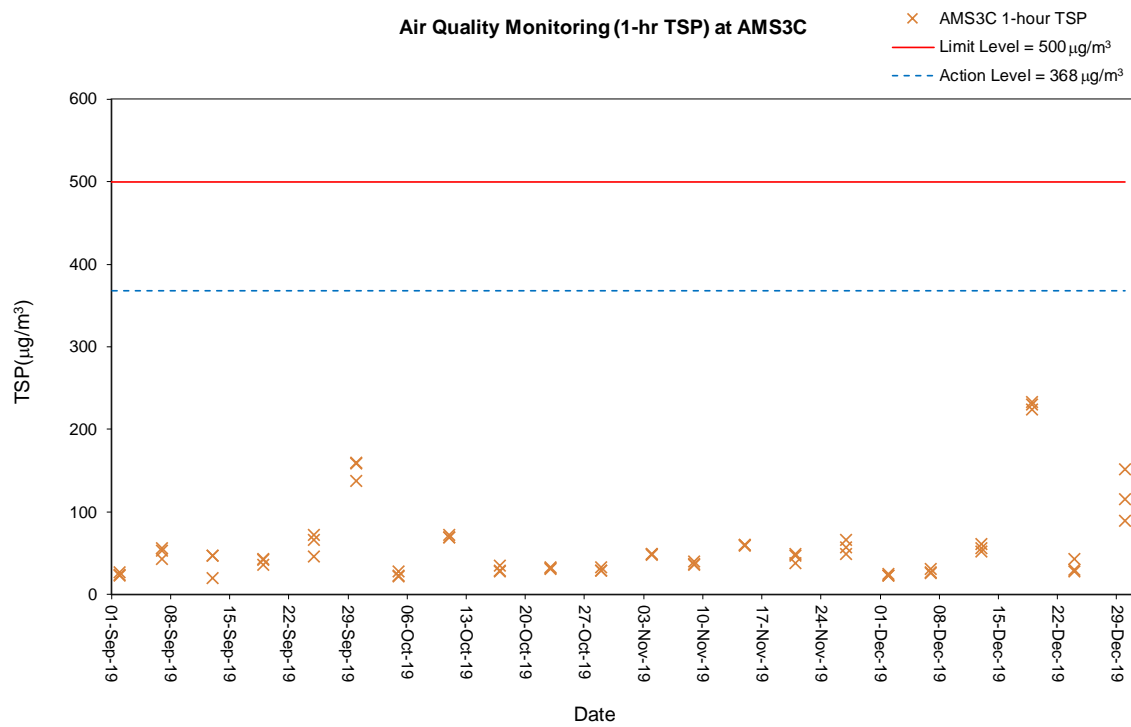
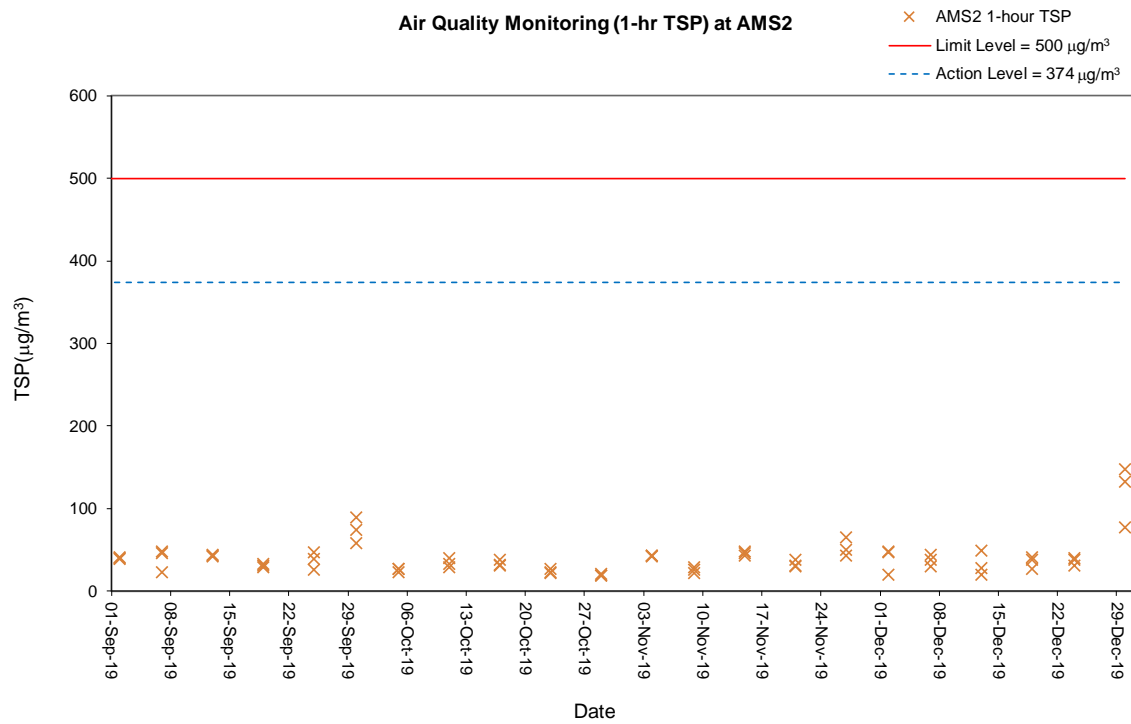
#### Remark(s): -

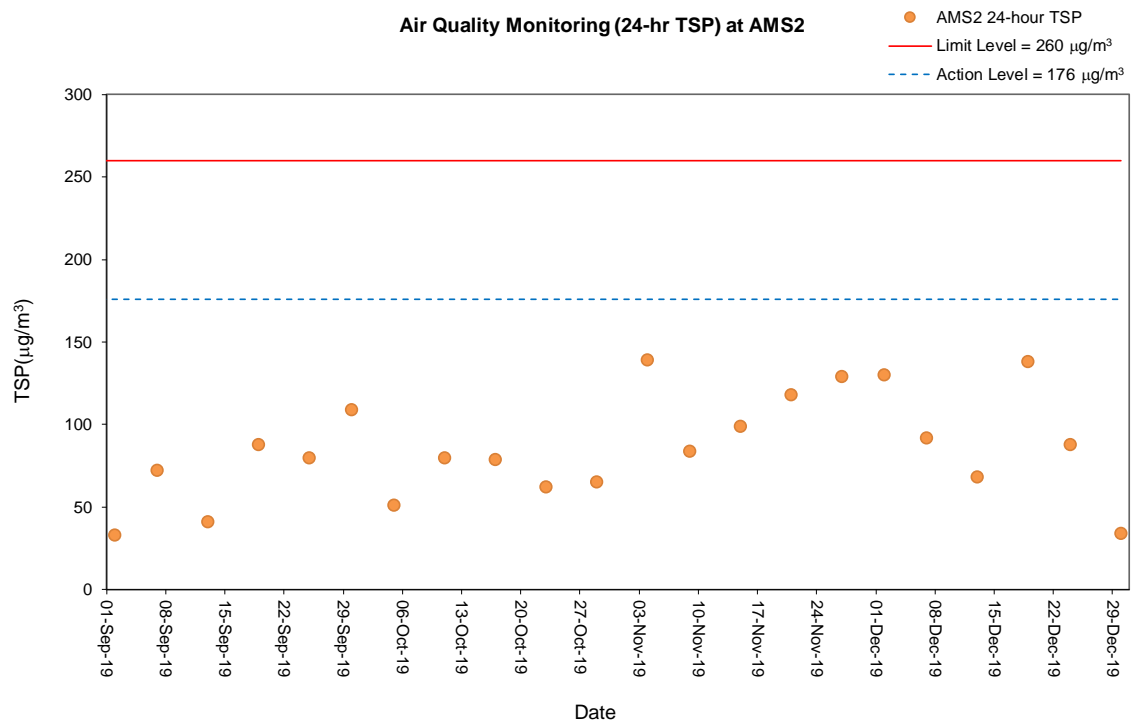
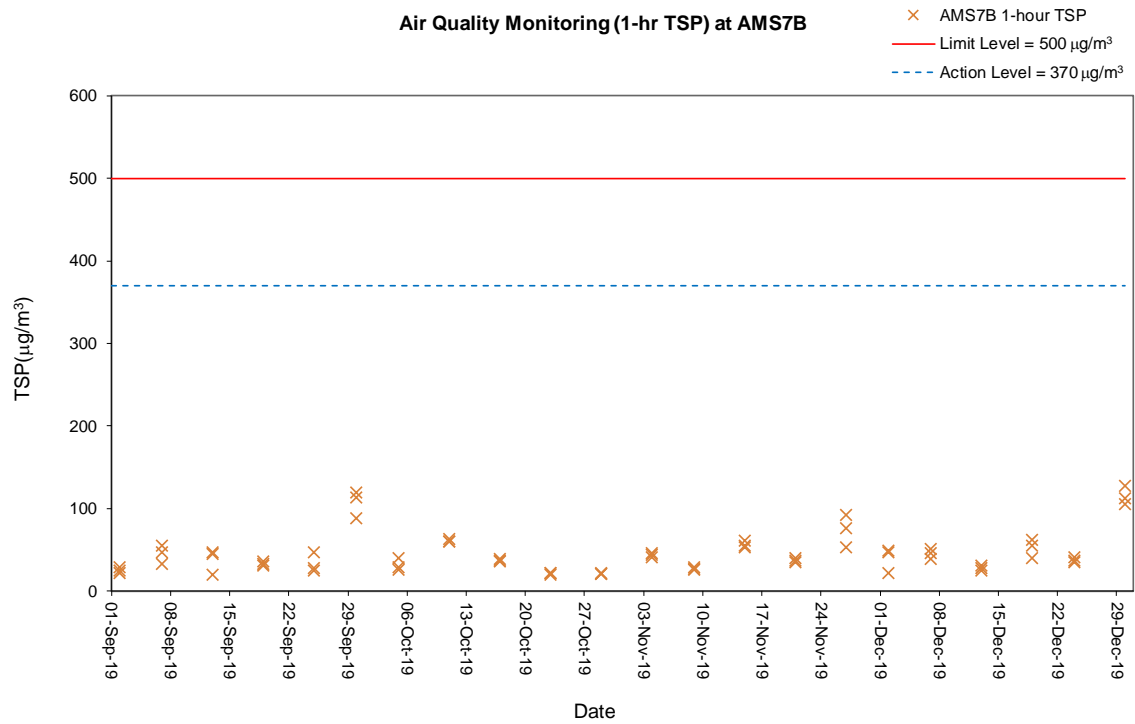
<sup>(f)</sup> "Displayed Reading" presents the figures shown on item under calibration/ checking regardless of equipment precision or significant figures.

<sup>(g)</sup> The "Tolerance Limit" mentioned is the acceptance criteria applicable for similar equipment used by Quality Pro Test-Consult Ltd. or quoted from relevant international standards.

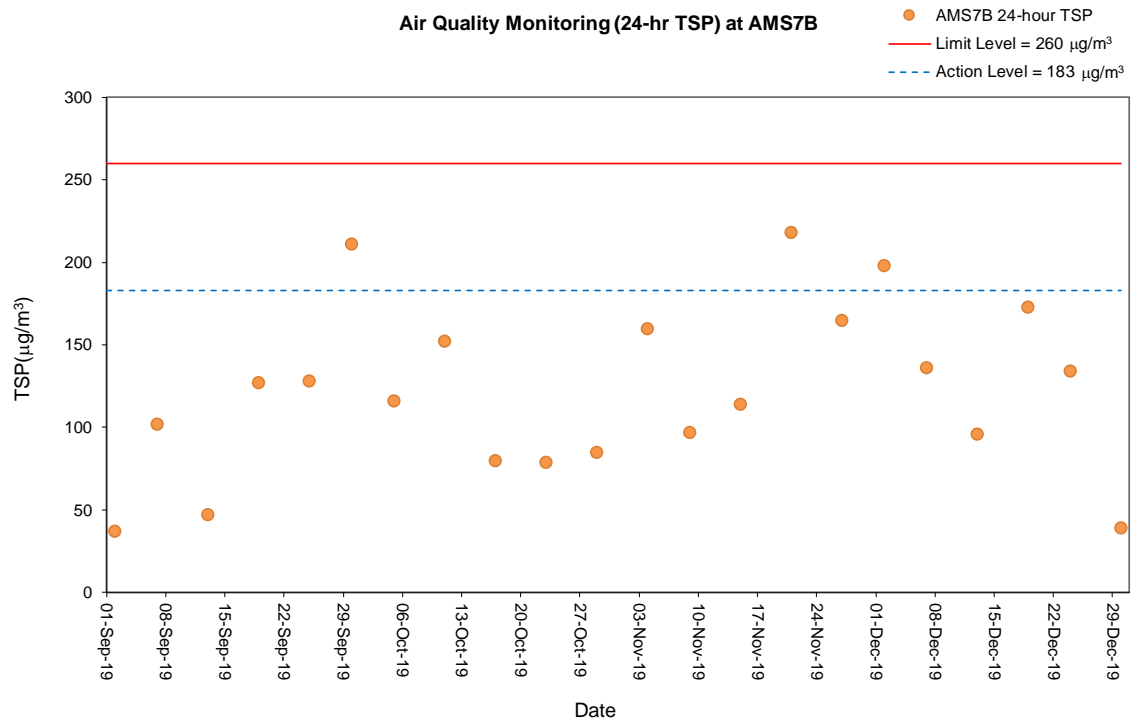
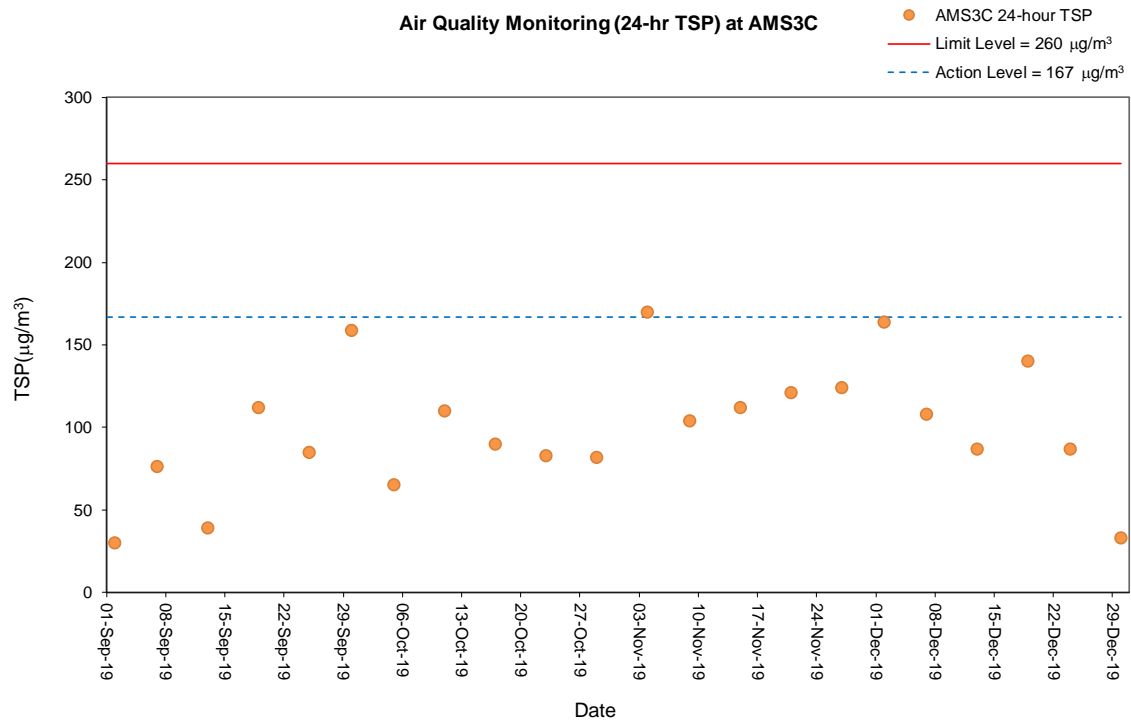
## **Appendix K. Monitoring Data and Graphical Plots (Air Quality, Noise and Water Quality)**

| Project | Contract   | Station                               | Date      | Parameter | Start Time | Result     | Unit              |
|---------|------------|---------------------------------------|-----------|-----------|------------|------------|-------------------|
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 02-Dec-19 | 1-hr TSP  | 09:11      | 47         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 02-Dec-19 | 1-hr TSP  | 10:11      | 48         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 02-Dec-19 | 1-hr TSP  | 11:11      | 20         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 07-Dec-19 | 1-hr TSP  | 09:02      | 44         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 07-Dec-19 | 1-hr TSP  | 10:02      | 38         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 07-Dec-19 | 1-hr TSP  | 11:02      | 30         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 13-Dec-19 | 1-hr TSP  | 11:56      | 28         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 13-Dec-19 | 1-hr TSP  | 12:56      | 20         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 13-Dec-19 | 1-hr TSP  | 13:56      | 49         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 19-Dec-19 | 1-hr TSP  | 09:09      | 38         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 19-Dec-19 | 1-hr TSP  | 10:09      | 27         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 19-Dec-19 | 1-hr TSP  | 11:09      | 41         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 24-Dec-19 | 1-hr TSP  | 09:04      | 40         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 24-Dec-19 | 1-hr TSP  | 10:04      | 38         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 24-Dec-19 | 1-hr TSP  | 11:04      | 31         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 30-Dec-19 | 1-hr TSP  | 09:07      | 147        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 30-Dec-19 | 1-hr TSP  | 10:07      | 132        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 30-Dec-19 | 1-hr TSP  | 11:07      | 77         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 02-Dec-19 | 1-hr TSP  | 12:41      | 23         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 02-Dec-19 | 1-hr TSP  | 13:41      | 25         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 02-Dec-19 | 1-hr TSP  | 14:41      | 23         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 07-Dec-19 | 1-hr TSP  | 12:46      | 31         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 07-Dec-19 | 1-hr TSP  | 13:46      | 27         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 07-Dec-19 | 1-hr TSP  | 14:46      | 26         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 13-Dec-19 | 1-hr TSP  | 08:06      | 61         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 13-Dec-19 | 1-hr TSP  | 09:06      | 56         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 13-Dec-19 | 1-hr TSP  | 10:06      | 52         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 19-Dec-19 | 1-hr TSP  | 12:58      | 224        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 19-Dec-19 | 1-hr TSP  | 13:58      | 230        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 19-Dec-19 | 1-hr TSP  | 14:58      | 233        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 24-Dec-19 | 1-hr TSP  | 12:32      | 30         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 24-Dec-19 | 1-hr TSP  | 13:32      | 43         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 24-Dec-19 | 1-hr TSP  | 14:32      | 28         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 30-Dec-19 | 1-hr TSP  | 12:36      | 151        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 30-Dec-19 | 1-hr TSP  | 13:36      | 115        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 30-Dec-19 | 1-hr TSP  | 14:36      | 89         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 02-Dec-19 | 1-hr TSP  | 08:28      | 47         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 02-Dec-19 | 1-hr TSP  | 09:28      | 49         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 02-Dec-19 | 1-hr TSP  | 10:28      | 22         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 07-Dec-19 | 1-hr TSP  | 08:15      | 51         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 07-Dec-19 | 1-hr TSP  | 09:15      | 46         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 07-Dec-19 | 1-hr TSP  | 10:15      | 39         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 13-Dec-19 | 1-hr TSP  | 12:47      | 31         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 13-Dec-19 | 1-hr TSP  | 13:47      | 28         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 13-Dec-19 | 1-hr TSP  | 14:47      | 25         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 19-Dec-19 | 1-hr TSP  | 08:09      | 62         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 19-Dec-19 | 1-hr TSP  | 09:09      | 55         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 19-Dec-19 | 1-hr TSP  | 10:09      | 40         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 24-Dec-19 | 1-hr TSP  | 08:14      | 41         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 24-Dec-19 | 1-hr TSP  | 09:14      | 37         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 24-Dec-19 | 1-hr TSP  | 10:14      | 35         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 30-Dec-19 | 1-hr TSP  | 08:24      | 112        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 30-Dec-19 | 1-hr TSP  | 09:24      | 127        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 30-Dec-19 | 1-hr TSP  | 10:24      | 105        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 02-Dec-19 | 24-hr TSP | 09:18      | 130        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 07-Dec-19 | 24-hr TSP | 09:12      | 92         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 13-Dec-19 | 24-hr TSP | 13:38      | 68         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 19-Dec-19 | 24-hr TSP | 09:17      | 138        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 24-Dec-19 | 24-hr TSP | 09:17      | 88         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS2 Tung Chung Development Pier      | 30-Dec-19 | 24-hr TSP | 09:17      | 34         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 02-Dec-19 | 24-hr TSP | 12:43      | 164        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 07-Dec-19 | 24-hr TSP | 12:57      | 108        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 13-Dec-19 | 24-hr TSP | 08:12      | 87         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 19-Dec-19 | 24-hr TSP | 13:06      | 140        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 24-Dec-19 | 24-hr TSP | 12:39      | 87         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS3C Ying Tung Estate Market Rooftop | 30-Dec-19 | 24-hr TSP | 12:46      | 33         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 02-Dec-19 | 24-hr TSP | 08:34      | <b>198</b> | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 07-Dec-19 | 24-hr TSP | 08:23      | 136        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 13-Dec-19 | 24-hr TSP | 12:55      | 96         | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 19-Dec-19 | 24-hr TSP | 08:19      | 173        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 24-Dec-19 | 24-hr TSP | 08:23      | 134        | µg/m <sup>3</sup> |
| HKBCF   | HY/2013/04 | AMS7B 3RS Site Office                 | 30-Dec-19 | 24-hr TSP | 08:21      | 39         | µg/m <sup>3</sup> |





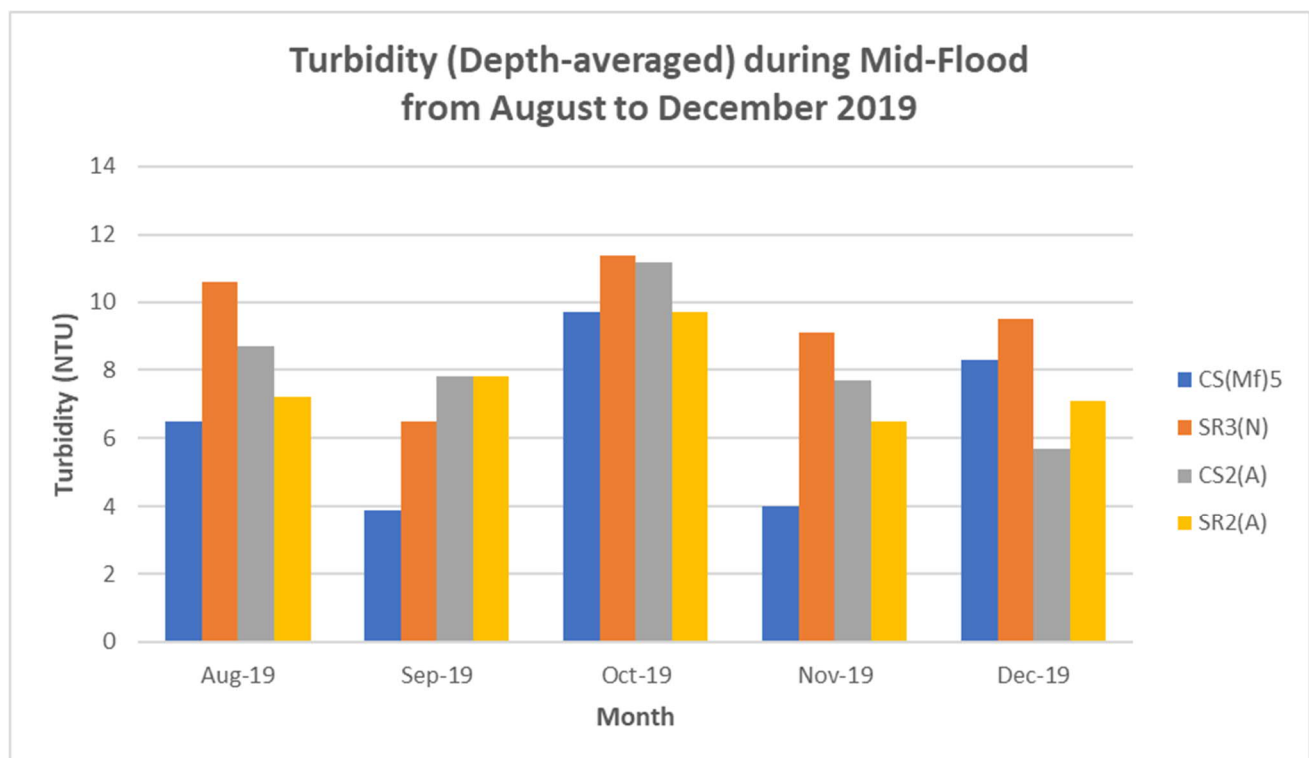
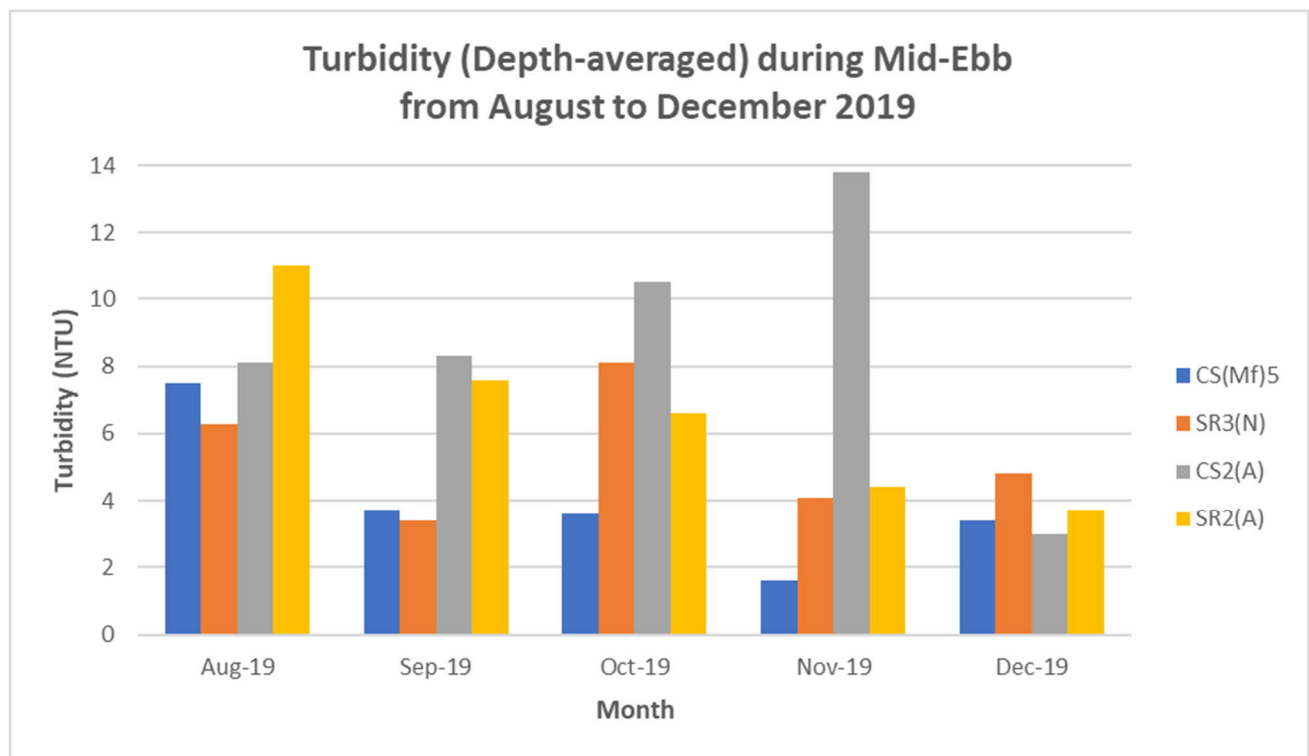




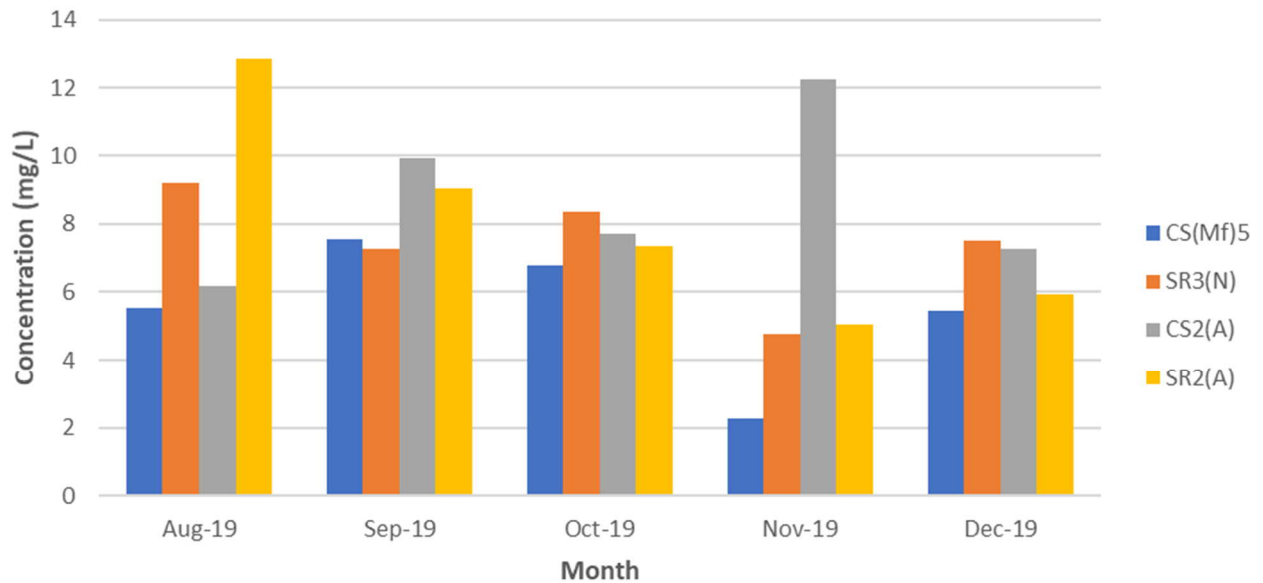
No monitoring results are presented for the reporting period.

Remark: A proposal to terminate impact monitoring for noise at NMS2 and NMS3C was justified by the ET Leader of this Contract and verified by the IEC on 13 August 2019, and approved by EPD on 3 September 2019. Therefore, the last impact noise monitoring event for this Contract was conducted on 2 September 2019. No noise monitoring was conducted during the reporting period.

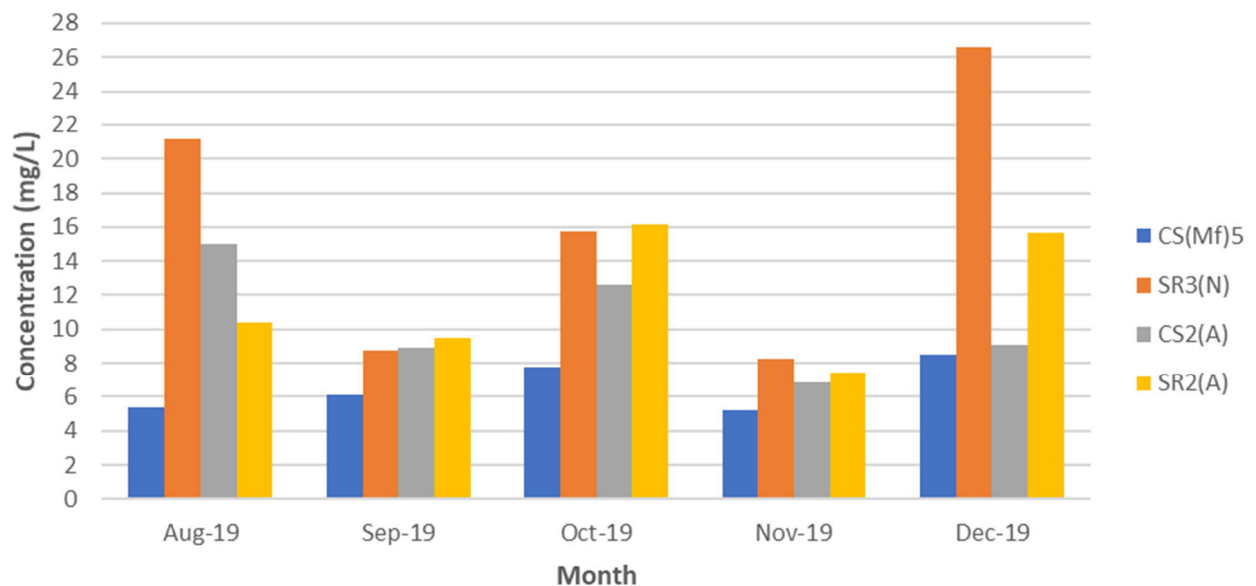
| Date<br>(yyyy-mm-dd) | Tide      | Station | Weather | Sea<br>condition | Sampling<br>Time | Water Depth<br>(m) | Sampling Water<br>Level | Replicate | Water<br>Temperature<br>(°C) | pH  | Salinity<br>(ppt) | DO (mg/L) | Average of DO<br>(mg/L) | DO<br>Saturation<br>(%) | Turbidity<br>(NTU) | Turbidity (NTU)<br>(depth-<br>averaged) | SS   | SS (mg/L) (depth-<br>averaged) |
|----------------------|-----------|---------|---------|------------------|------------------|--------------------|-------------------------|-----------|------------------------------|-----|-------------------|-----------|-------------------------|-------------------------|--------------------|---|------|--------------------------------|
| 2019-12-23           | Mid-Ebb   | CS(M)5  | Cloudy  | Rough            | 9:21:00          | 13.1               | Surface                 | 1st       | 20.4                         | 7.7 | 33.6              | 6.5       | 6.4                     | 88.0                    | 2.9                | 3.4                                     | 5.4  | 5.5                            |
|                      | Mid-Ebb   | CS(M)5  |         |                  |                  |                    | Surface                 | 2nd       | 20.4                         | 7.7 | 33.6              | 6.5       |                         | 87.8                    | 2.8                |   | 5.1  |                                |
|                      | Mid-Ebb   | CS(M)5  |         |                  |                  |                    | Middle                  | 1st       | 20.5                         | 7.7 | 33.8              | 6.3       |                         | 85.3                    | 2.7                |   | 5.6  |                                |
|                      | Mid-Ebb   | CS(M)5  |         |                  |                  |                    | Middle                  | 2nd       | 20.5                         | 7.7 | 33.8              | 6.3       | 6.3                     | 85.4                    | 2.6                |   | 5.1  |                                |
|                      | Mid-Ebb   | CS(M)5  |         |                  |                  |                    | Bottom                  | 1st       | 20.5                         | 7.7 | 33.9              | 6.3       |                         | 85.0                    | 4.4                |   | 5.6  |                                |
|                      | Mid-Ebb   | CS(M)5  |         |                  |                  |                    | Bottom                  | 2nd       | 20.5                         | 7.7 | 33.9              | 6.3       |                         | 84.7                    | 5.0                |   | 6    |                                |
| 2019-12-23           | Mid-Ebb   | SR3(N)  | Cloudy  | Calm             | 10:41:00         | 4.2                | Surface                 | 1st       | 20.7                         | 7.8 | 33.2              | 7.0       | 7.0                     | 94.3                    | 4.2                | 4.8                                     | 6.8  | 7.5                            |
|                      | Mid-Ebb   | SR3(N)  |         |                  |                  |                    | Surface                 | 2nd       | 20.7                         | 7.8 | 33.2              | 7.0       |                         | 94.2                    | 4.0                |   | 6.7  |                                |
|                      | Mid-Ebb   | SR3(N)  |         |                  |                  |                    | Middle                  | 1st       |                              |     |                   |           |                         |                         |                    |   |      |                                |
|                      | Mid-Ebb   | SR3(N)  |         |                  |                  |                    | Middle                  | 2nd       |                              |     |                   |           | 7.0                     |                         |                    |   |      |                                |
|                      | Mid-Ebb   | SR3(N)  |         |                  |                  |                    | Bottom                  | 1st       | 20.6                         | 7.8 | 33.2              | 7.0       |                         | 94.3                    | 5.4                |   | 8    |                                |
|                      | Mid-Ebb   | SR3(N)  |         |                  |                  |                    | Bottom                  | 2nd       | 20.6                         | 7.8 | 33.2              | 7.0       |                         | 94.2                    | 5.4                |   | 8.6  |                                |
| 2019-12-23           | Mid-Ebb   | CS2(A)  | Cloudy  | Moderate         | 11:13:00         | 7.2                | Surface                 | 1st       | 20.2                         | 7.8 | 33.2              | 7.3       | 7.2                     | 97.5                    | 2.4                | 3.0                                     | 8.3  | 7.3                            |
|                      | Mid-Ebb   | CS2(A)  |         |                  |                  |                    | Surface                 | 2nd       | 20.2                         | 7.8 | 33.2              | 7.2       |                         | 97.0                    | 2.3                |   | 8.2  |                                |
|                      | Mid-Ebb   | CS2(A)  |         |                  |                  |                    | Middle                  | 1st       | 20.1                         | 7.8 | 33.4              | 7.2       |                         | 96.9                    | 3.0                |   | 7.6  |                                |
|                      | Mid-Ebb   | CS2(A)  |         |                  |                  |                    | Middle                  | 2nd       | 20.1                         | 7.8 | 33.4              | 7.2       | 7.3                     | 96.9                    | 3.0                |   | 7.1  |                                |
|                      | Mid-Ebb   | CS2(A)  |         |                  |                  |                    | Bottom                  | 1st       | 20.1                         | 7.8 | 33.6              | 7.3       |                         | 97.4                    | 3.5                |   | 5.6  |                                |
|                      | Mid-Ebb   | CS2(A)  |         |                  |                  |                    | Bottom                  | 2nd       | 20.1                         | 7.8 | 33.6              | 7.3       |                         | 97.4                    | 3.6                |   | 6.7  |                                |
| 2019-12-23           | Mid-Ebb   | SR2(A)  | Cloudy  | Calm             | 10:57:00         | 8.2                | Surface                 | 1st       | 20.2                         | 7.8 | 33.3              | 7.2       | 7.2                     | 97.0                    | 3.1                | 3.7                                     | 5.7  | 5.9                            |
|                      | Mid-Ebb   | SR2(A)  |         |                  |                  |                    | Surface                 | 2nd       | 20.2                         | 7.8 | 33.3              | 7.2       |                         | 97.1                    | 3.0                |   | 5.3  |                                |
|                      | Mid-Ebb   | SR2(A)  |         |                  |                  |                    | Middle                  | 1st       | 20.1                         | 7.8 | 33.5              | 7.2       |                         | 96.4                    | 3.9                |   | 6.1  |                                |
|                      | Mid-Ebb   | SR2(A)  |         |                  |                  |                    | Middle                  | 2nd       | 20.1                         | 7.8 | 33.5              | 7.2       | 7.2                     | 96.6                    | 3.8                |   | 5.9  |                                |
|                      | Mid-Ebb   | SR2(A)  |         |                  |                  |                    | Bottom                  | 1st       | 20.2                         | 7.8 | 33.6              | 7.2       |                         | 96.7                    | 4.0                |   | 6.6  |                                |
|                      | Mid-Ebb   | SR2(A)  |         |                  |                  |                    | Bottom                  | 2nd       | 20.2                         | 7.8 | 33.6              | 7.2       |                         | 96.3                    | 4.1                |   | 6    |                                |
| 2019-12-23           | Mid-Flood | CS(M)5  | Cloudy  | Moderate         | 17:12:00         | 12.9               | Surface                 | 1st       | 20.6                         | 7.7 | 33.8              | 6.4       | 6.4                     | 86.1                    | 5.4                | 8.3                                     | 7.5  | 8.5                            |
|                      | Mid-Flood | CS(M)5  |         |                  |                  |                    | Surface                 | 2nd       | 20.6                         | 7.7 | 33.8              | 6.4       |                         | 86.1                    | 5.4                |   | 7.4  |                                |
|                      | Mid-Flood | CS(M)5  |         |                  |                  |                    | Middle                  | 1st       | 20.6                         | 7.7 | 33.8              | 6.3       |                         | 86.0                    | 9.4                |   | 9.2  |                                |
|                      | Mid-Flood | CS(M)5  |         |                  |                  |                    | Middle                  | 2nd       | 20.6                         | 7.7 | 33.8              | 6.4       | 6.5                     | 86.2                    | 9.0                |   | 8.7  |                                |
|                      | Mid-Flood | CS(M)5  |         |                  |                  |                    | Bottom                  | 1st       | 20.6                         | 7.6 | 33.8              | 6.5       |                         | 88.0                    | 10.3               |   | 9.2  |                                |
|                      | Mid-Flood | CS(M)5  |         |                  |                  |                    | Bottom                  | 2nd       | 20.6                         | 7.6 | 33.8              | 6.5       |                         | 87.6                    | 10.2               |   | 8.8  |                                |
| 2019-12-23           | Mid-Flood | SR3(N)  | Cloudy  | Calm             | 15:49:00         | 4.0                | Surface                 | 1st       | 20.9                         | 7.7 | 33.1              | 7.0       | 7.0                     | 94.4                    | 8.5                | 9.5                                     | 26.2 | 26.6                           |
|                      | Mid-Flood | SR3(N)  |         |                  |                  |                    | Surface                 | 2nd       | 20.9                         | 7.7 | 33.1              | 6.9       |                         | 94.4                    | 8.5                |   | 25.8 |                                |
|                      | Mid-Flood | SR3(N)  |         |                  |                  |                    | Middle                  | 1st       |                              |     |                   |           |                         |                         |                    |   |      |                                |
|                      | Mid-Flood | SR3(N)  |         |                  |                  |                    | Middle                  | 2nd       |                              |     |                   |           | 7.0                     |                         |                    |   |      |                                |
|                      | Mid-Flood | SR3(N)  |         |                  |                  |                    | Bottom                  | 1st       | 20.9                         | 7.7 | 33.1              | 7.0       |                         | 95.6                    | 10.4               |   | 18.8 |                                |
|                      | Mid-Flood | SR3(N)  |         |                  |                  |                    | Bottom                  | 2nd       | 20.9                         | 7.7 | 33.1              | 7.0       |                         | 95.2                    | 10.5               |   | 35.7 |                                |
| 2019-12-23           | Mid-Flood | CS2(A)  | Cloudy  | Moderate         | 15:14:00         | 6.7                | Surface                 | 1st       | 20.5                         | 7.8 | 32.9              | 7.2       | 7.2                     | 97.0                    | 4.2                | 5.7                                     | 9.2  | 9.1                            |
|                      | Mid-Flood | CS2(A)  |         |                  |                  |                    | Surface                 | 2nd       | 20.5                         | 7.8 | 32.8              | 7.2       |                         | 97.1                    | 4.2                |   | 8.6  |                                |
|                      | Mid-Flood | CS2(A)  |         |                  |                  |                    | Middle                  | 1st       | 20.2                         | 7.8 | 33.3              | 7.2       |                         | 96.4                    | 5.3                |   | 8.9  |                                |
|                      | Mid-Flood | CS2(A)  |         |                  |                  |                    | Middle                  | 2nd       | 20.2                         | 7.8 | 33.3              | 7.2       | 7.2                     | 96.2                    | 5.2                |   | 9.1  |                                |
|                      | Mid-Flood | CS2(A)  |         |                  |                  |                    | Bottom                  | 1st       | 20.2                         | 7.8 | 33.4              | 7.2       |                         | 96.4                    | 7.5                |   | 9.1  |                                |
|                      | Mid-Flood | CS2(A)  |         |                  |                  |                    | Bottom                  | 2nd       | 20.2                         | 7.8 | 33.4              | 7.2       |                         | 96.6                    | 7.5                |   | 9.5  |                                |
| 2019-12-23           | Mid-Flood | SR2(A)  | Cloudy  | Moderate         | 15:31:00         | 7.9                | Surface                 | 1st       | 20.8                         | 7.7 | 33.3              | 7.1       | 7.1                     | 95.9                    | 6.2                | 7.1                                     | 14.1 | 15.6                           |
|                      | Mid-Flood | SR2(A)  |         |                  |                  |                    | Surface                 | 2nd       | 20.8                         | 7.7 | 33.3              | 7.1       |                         | 95.9                    | 6.2                |   | 13.9 |                                |
|                      | Mid-Flood | SR2(A)  |         |                  |                  |                    | Middle                  | 1st       | 20.7                         | 7.7 | 33.4              | 7.1       |                         | 95.8                    | 7.7                |   | 16.3 |                                |
|                      | Mid-Flood | SR2(A)  |         |                  |                  |                    | Middle                  | 2nd       | 20.7                         | 7.7 | 33.4              | 7.1       | 7.1                     | 96.1                    | 7.6                |   | 15.9 |                                |
|                      | Mid-Flood | SR2(A)  |         |                  |                  |                    | Bottom                  | 1st       | 20.6                         | 7.8 | 33.4              | 7.1       |                         | 96.4                    | 7.4                |   | 17   |                                |
|                      | Mid-Flood | SR2(A)  |         |                  |                  |                    | Bottom                  | 2nd       | 20.6                         | 7.8 | 33.4              | 7.1       |                         | 96.5                    | 7.5                |   | 16.6 |                                |



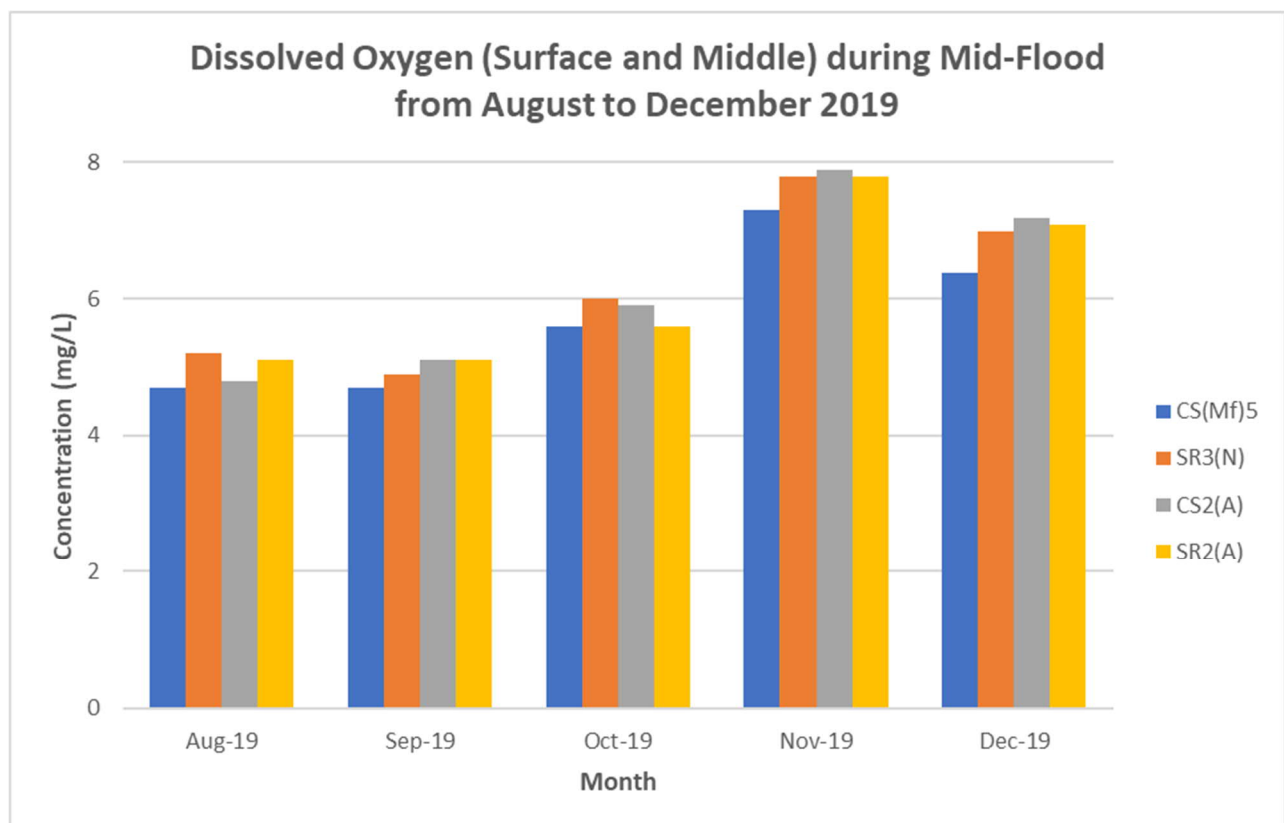
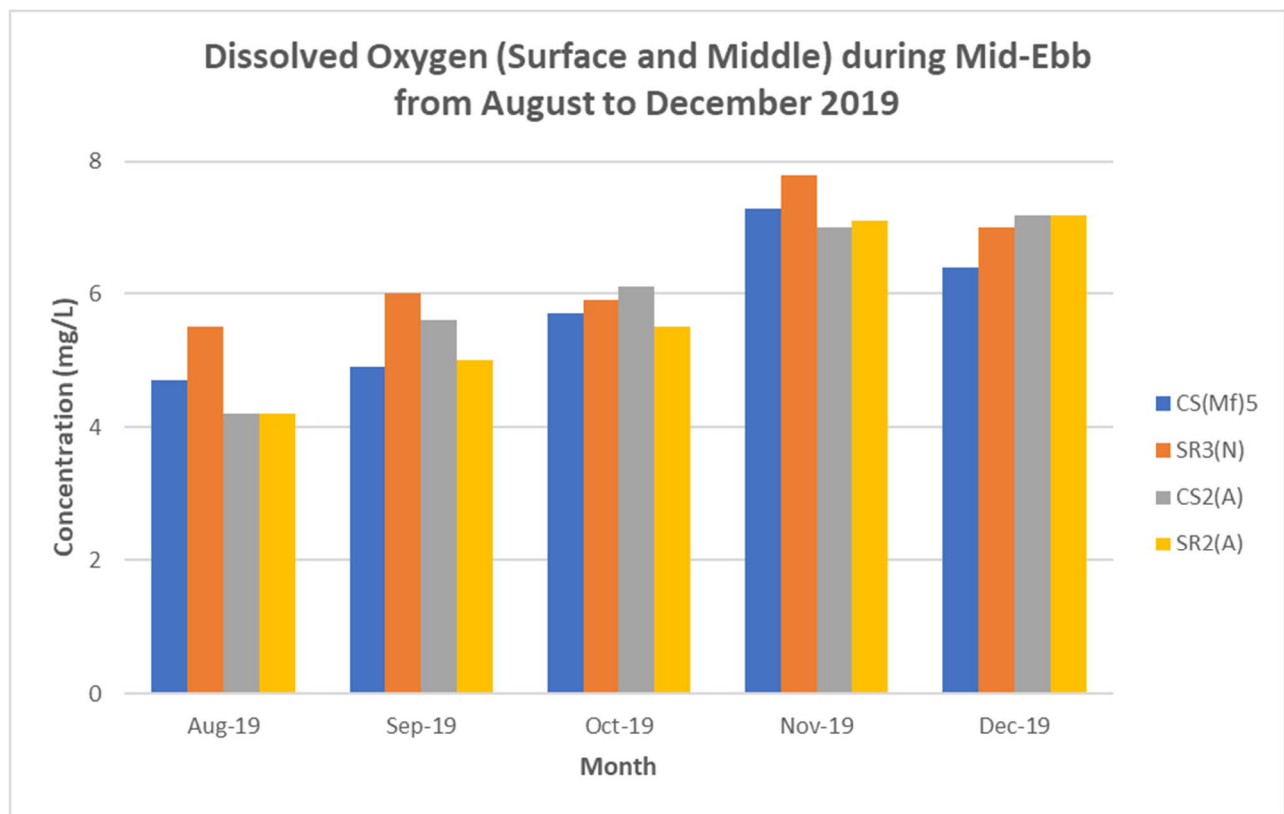
### Suspended Solids (Depth-averaged) during Mid-Ebb from August to December 2019

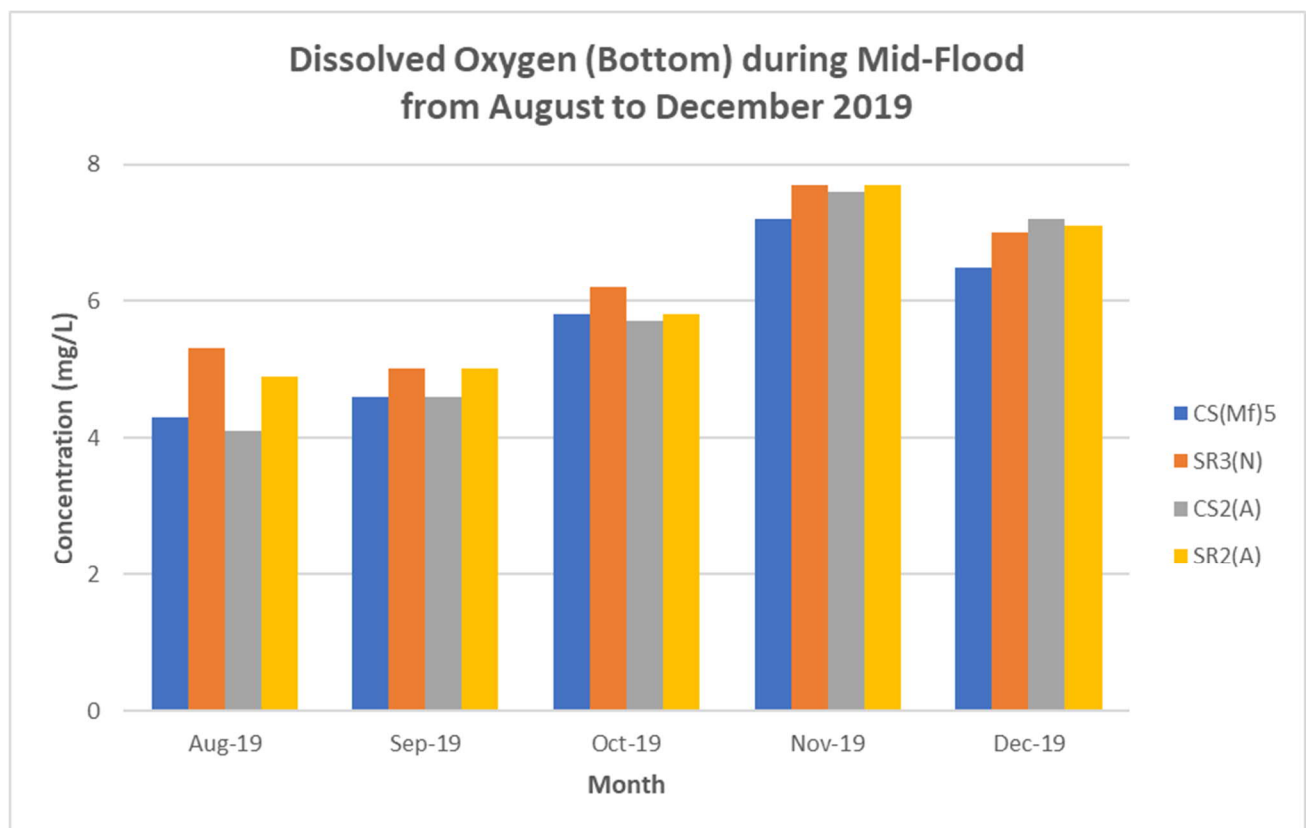
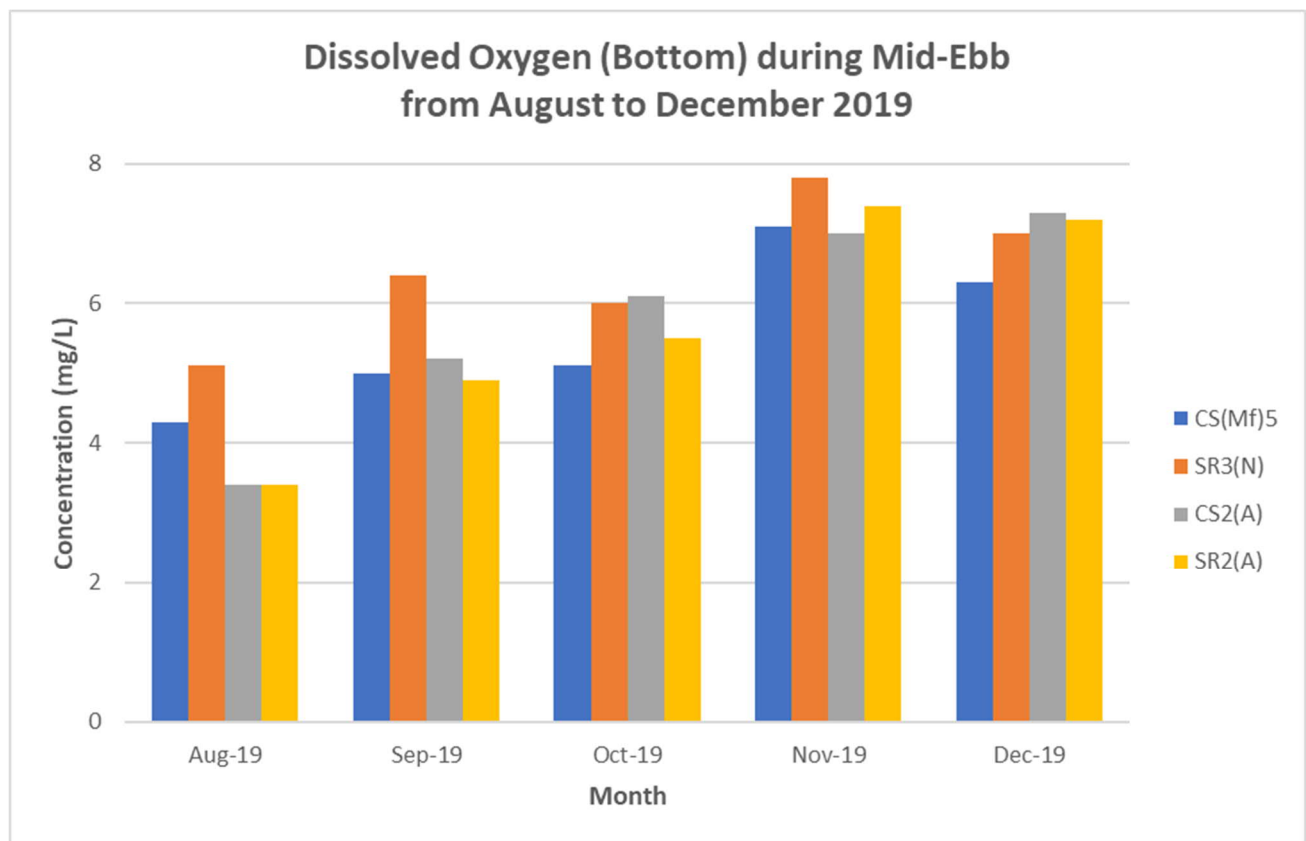


### Suspended Solids (Depth-averaged) during Mid-Flood from August to December 2019









## **Appendix L. Dolphin Monitoring Results**

**CONTRACT NO. HY/2013/04**

**Hong Kong-Zhuhai-Macao Bridge Hong Kong Boundary Crossing  
Facilities – Infrastructure Works Stage II (Southern Portion)  
Dolphin Monthly Monitoring (Operational Phase)**

*10<sup>th</sup> Monthly Progress Report (December 2019)*

*Submitted to Mott MacDonald Hong Kong Limited &  
China State Construction Engineering (Hong Kong) Limited*

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

18 December 2019

**1. Introduction**

- 1.1. For the Hong Kong-Zhuhai-Macao Bridge (HZMB) Hong Kong Boundary Crossing Facilities (HKBCF), its operation requires the contractor (i.e. China State Construction Engineering (Hong Kong) Limited) and the associated Environmental Team, Mott MacDonald Hong Kong Limited, to implement the Environmental Monitoring and Audit (EM&A) programme during the operational phase.
- 1.2. According to the HKBCF EM&A Manual, monthly line-transect vessel surveys for Chinese White Dolphins should be conducted to cover the Northwest (NWL) and Northeast Lantau (NEL) survey areas, which should be the same as in AFCD annual marine mammal monitoring programme. However, as such monitoring surveys have been undertaken by the TMCLKL08 EM&A project (i.e. Contract No. HY/2012/08 HZMB Tuen Mun – Chek Lap Kok Link (Northern Connection Sub-sea Tunnel Section)) in the same areas (i.e. NWL and NEL), a combined monitoring approach is recommended by the Highways Department, that the HKBCF EM&A project should utilize the monitoring data collected by TMCLKL08 EM&A project to avoid any redundancy in monitoring effort.
- 1.3. In April 2019, the Director of Hong Kong Cetacean Research Project (HKCRP), Dr.

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Samuel Hung, has been appointed by the ET as the dolphin specialist for the operational phase of the HKBCF EM&A project. He is responsible for the dolphin monitoring study, including the collection and collation of dolphin monitoring data from the TMCLKL08 EM&A project to examine any potential impacts of HKBCF during the operational phase on the dolphins. From the monitoring results, any changes in dolphin occurrence within the study area will be reviewed for possible causes, and appropriate actions and additional mitigation measures will be recommended as necessary.

- 1.4. This 10<sup>th</sup> monthly progress report of the HKBCF operational phase dolphin monitoring programme is submitted to the environmental team and the contractor, summarizing the results of the survey findings during the month of December 2019 by utilizing the survey data collected from the TMCLKL08 EM&A project.

## 2. Monitoring Methodology

### 2.1. Vessel-based Line-transect Survey

- 2.1.1. According to the requirement of the updated EM&A manual, the dolphin monitoring programme should cover all transect lines in NEL and NWL survey areas (see Figure 1) twice per month throughout the entire operational monitoring period. The co-ordinates of all transect lines are shown in Table 1.

Table 1. Co-ordinates of transect lines

| Line No. |             | Easting | Northing |  | Line No. |             | Easting | Northing |
|----------|-------------|---------|----------|--|----------|-------------|---------|----------|
| 1        | Start Point | 804671  | 815456   |  | 13       | Start Point | 816506  | 819480   |
| 1        | End Point   | 804671  | 831404   |  | 13       | End Point   | 816506  | 824859   |
| 2        | Start Point | 805476  | 820800   |  | 14       | Start Point | 817537  | 820220   |
| 2        | End Point   | 805476  | 826654   |  | 14       | End Point   | 817537  | 824613   |
| 3        | Start Point | 806464  | 821150   |  | 15       | Start Point | 818568  | 820735   |
| 3        | End Point   | 806464  | 822911   |  | 15       | End Point   | 818568  | 824433   |
| 4        | Start Point | 807518  | 821500   |  | 16       | Start Point | 819532  | 821420   |
| 4        | End Point   | 807518  | 829230   |  | 16       | End Point   | 819532  | 824209   |
| 5        | Start Point | 808504  | 821850   |  | 17       | Start Point | 820451  | 822125   |
| 5        | End Point   | 808504  | 828602   |  | 17       | End Point   | 820451  | 823671   |



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|    |             |        |        |  |    |             |        |        |
|----|-------------|--------|--------|--|----|-------------|--------|--------|
| 6  | Start Point | 809490 | 822150 |  | 18 | Start Point | 821504 | 822371 |
| 6  | End Point   | 809490 | 825352 |  | 18 | End Point   | 821504 | 823761 |
| 7  | Start Point | 810499 | 822000 |  | 19 | Start Point | 822513 | 823268 |
| 7  | End Point   | 810499 | 824613 |  | 19 | End Point   | 822513 | 824321 |
| 8  | Start Point | 811508 | 821123 |  | 20 | Start Point | 823477 | 823402 |
| 8  | End Point   | 811508 | 824254 |  | 20 | End Point   | 823477 | 824613 |
| 9  | Start Point | 812516 | 821303 |  | 21 | Start Point | 805476 | 827081 |
| 9  | End Point   | 812516 | 824254 |  | 21 | End Point   | 805476 | 830562 |
| 10 | Start Point | 813525 | 821176 |  | 22 | Start Point | 806464 | 824033 |
| 10 | End Point   | 813525 | 824657 |  | 22 | End Point   | 806464 | 829598 |
| 11 | Start Point | 814556 | 818853 |  | 23 | Start Point | 814559 | 821739 |
| 11 | End Point   | 814556 | 820992 |  | 23 | End Point   | 814559 | 824768 |
| 12 | Start Point | 815542 | 818807 |  | 24 | Start Point | 805476 | 815900 |
| 12 | End Point   | 815542 | 824882 |  | 24 | End Point   | 805476 | 819100 |

2.1.2. The TMCLKL08 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 22 years of marine mammal monitoring surveys in Hong Kong developed by HKCRP (see Hung 2019). For each monitoring vessel survey, a 15-m inboard vessel with an open upper deck (about 4.5 m above water surface) was used to make observations from the flying bridge area.

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

2.1.4. During on-effort survey periods, the survey team recorded effort data including time,

position (latitude and longitude), weather conditions (Beaufort sea state and visibility), and distance traveled in each series (a continuous period of search effort) with the assistance of a handheld GPS (*Garmin eTrex Legend*).

- 2.1.5. Data including time, position and vessel speed were also automatically and continuously logged by handheld GPS throughout the entire survey for subsequent review.
- 2.1.6. When dolphins were sighted, the survey team would end the survey effort, and immediately record the initial sighting distance and angle of the dolphin group from the survey vessel, as well as the sighting time and position. Then the research vessel was diverted from its course to approach the animals for species identification, group size estimation, assessment of group composition, and behavioural observations. The perpendicular distance (PSD) of the dolphin group to the transect line was later calculated from the initial sighting distance and angle.
- 2.1.7. Survey effort being conducted along the parallel transect lines that were perpendicular to the coastlines (as indicated in Figure 1) was labeled as “primary” survey effort, while the survey effort 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.
- 2.1.8. 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.

## 2.2. Photo-identification Work

- 2.2.1. When a group of Chinese White Dolphins were sighted during the line-transect survey, the TMCLKL08 survey team would end effort and approach the group slowly from the side and behind to take photographs of them. Every attempt was made to photograph every dolphin in the group, and even photograph both sides of the dolphins, since the colouration and markings on both sides may not be symmetrical.

- 2.2.2. A professional digital camera (*Canon* EOS 7D model), equipped with long telephoto lenses (100-400 mm zoom), were available on board for researchers to take sharp, close-up photographs of dolphins as they surfaced. The images were shot at the highest available resolution and stored on Compact Flash memory cards for downloading onto a computer.
- 2.2.3. All digital images taken in the field were first examined, and those containing potentially identifiable individuals were sorted out. These photographs would then be examined in greater detail, and were carefully compared to the existing Chinese White Dolphin photo-identification catalogue maintained by HKCRP since 1995.
- 2.2.4. Chinese White Dolphins can be identified by their natural markings, such as nicks, cuts, scars and deformities on their dorsal fin and body, and their unique spotting patterns were also used as secondary identifying features (Jefferson 2000).
- 2.2.5. All photographs of each individual were then compiled and arranged in chronological order, with data including the date and location first identified (initial sighting), re-sightings, associated dolphins, distinctive features, and age classes entered into a computer database.

### 3. Monitoring Results

#### 3.1. Vessel-based Line-transect Survey

- 3.1.1. Under the TMCLKL08 dolphin monitoring programme, two sets of systematic line-transect vessel surveys were conducted on the 3<sup>rd</sup>, 10<sup>th</sup>, 12<sup>th</sup> and 16<sup>th</sup> of December 2019, to cover all transect lines in NWL and NEL survey areas twice during the monitoring month. The survey routes of each survey day are presented in Figures 2-5.
- 3.1.2. From the two sets of TMCLKL08 monitoring surveys conducted in December, 262.02 km of survey effort was collected, with 100% of the total survey effort being conducted under favourable weather conditions (i.e. Beaufort Sea State 3 or below with good visibility) (Appendix I).
- 3.1.3. Among the NEL and NWL survey areas, 95.80 km and 166.22 km of survey effort were conducted respectively. Moreover, the total survey effort conducted on primary and secondary lines were 189.40 km and 72.62 km respectively (Appendix I).
- 3.1.4. A total of three groups of 13 Chinese White Dolphins were sighted during the two sets of

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TMCLKL08 monitoring surveys conducted in NWL in December 2019, while no dolphin was sighted at all in NEL (Appendix II). All three dolphin groups were sighted on primary lines during on-effort search, and they were not associated with any operating fishing vessel (Appendix II).

- 3.1.5. Distribution of the three dolphin sightings made during this monitoring month is shown in Figure 6. One large group of 11 dolphins was sighted along the HKLR09 alignment at the southwestern corner of NWL survey area, and the other two groups were two lone dolphins sighted to the west of Sha Chau and near Lung Kwu Tan respectively. All three sightings were located very far away from the HKBCF work site (Figure 6).
- 3.1.6. From the TMCLKL08 surveys conducted in December 2019, the encounter rates of Chinese White Dolphins deduced from the survey effort and on-effort sighting data made under favourable conditions (Beaufort 3 or below) are shown in Tables 2 & 3.

Table 2. Dolphin encounter rates deduced from the two sets of TMCLKL08 surveys (two surveys in each set) conducted in December 2019 in Northeast (NEL) and Northwest Lantau (NWL)

|     |   | Encounter rate (STG)<br>(no. of on-effort dolphin sightings<br>per 100 km of survey effort) | Encounter rate (ANI)<br>(no. of dolphins from all on-effort<br>sightings per 100 km of survey effort) |
|-----|---|---|---|
|     |   | Primary Lines Only  | Primary Lines Only  |
|     |   |   |   |
| NEL | Set 1: December 3 <sup>rd</sup> / 10 <sup>th</sup>  | 0.0   | 0.0   |
|     | Set 2: December 12 <sup>th</sup> / 16 <sup>th</sup> | 0.0   | 0.0   |
| NWL | Set 1: December 3 <sup>rd</sup> / 10 <sup>th</sup>  | 0.0   | 0.0   |
|     | Set 2: December 12 <sup>th</sup> / 16 <sup>th</sup> | 5.0   | 21.8  |

Table 3. Overall dolphin encounter rates (sightings per 100 km of survey effort) from the two sets of TMCLKL08 surveys conducted in December 2019 on primary lines only as well as both primary lines and secondary lines in Northeast (NEL) and Northwest Lantau (NWL)

|                  | Encounter rate (STG)<br>(no. of on-effort dolphin sightings per<br>100 km of survey effort) |                                     | Encounter rate (ANI)<br>(no. of dolphins from all on-effort<br>sightings per 100 km of survey effort) |                                     |
|------------------|---|-------------------------------------|---|-------------------------------------|
|                  | Primary<br>Lines Only   | Both Primary and<br>Secondary Lines | Primary<br>Lines Only   | Both Primary and<br>Secondary Lines |
|                  |   |                                     |   |                                     |
| Northeast Lantau | 0.0   | 0.0                                 | 0.0   | 0.0                                 |
| Northwest Lantau | 2.5   | 1.8                                 | 10.9  | 7.8                                 |

- 3.1.7. During the December's surveys, the average dolphin group size was 4.3 individuals per group. Two of the three groups were composed of lone animals, while the other one was a large group composed of 11 dolphins (Appendix II).

### 3.2. *Photo-identification Work*

- 3.2.1. During the two sets of TMCLKL08 monitoring surveys conducted in December 2019, a total of nine known individuals were sighted nine times (Appendix III and IV). All of them were re-sighted only once during the monthly surveys in December.
- 3.2.2. Notably, three identified individuals (i.e. CH108, NL120 and WL214) were sighted with their young calves during their re-sightings in December 2019.

## 4. Conclusion

- 4.1. During this month of dolphin monitoring, no adverse impact from the operation of HKBCF on Chinese White Dolphins was noticeable from general observations.
- 4.2. Due to the 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 in relation to the operation of HKBCF in the quarterly EM&A reports, where comparison on distribution, group size and encounter rates of dolphins between the quarterly operational monitoring period, impact monitoring period and baseline monitoring period will be made.

## 5. References

- 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.
- Hung, S. K. 2019. Monitoring of Marine Mammals in Hong Kong waters: final report (2018-19). An unpublished report submitted to the Agriculture, Fisheries and Conservation Department, 140 pp.
- Jefferson, T. A. 2000. Population biology of the Indo-Pacific hump-backed dolphin in Hong Kong waters. Wildlife Monographs 144:1-65.



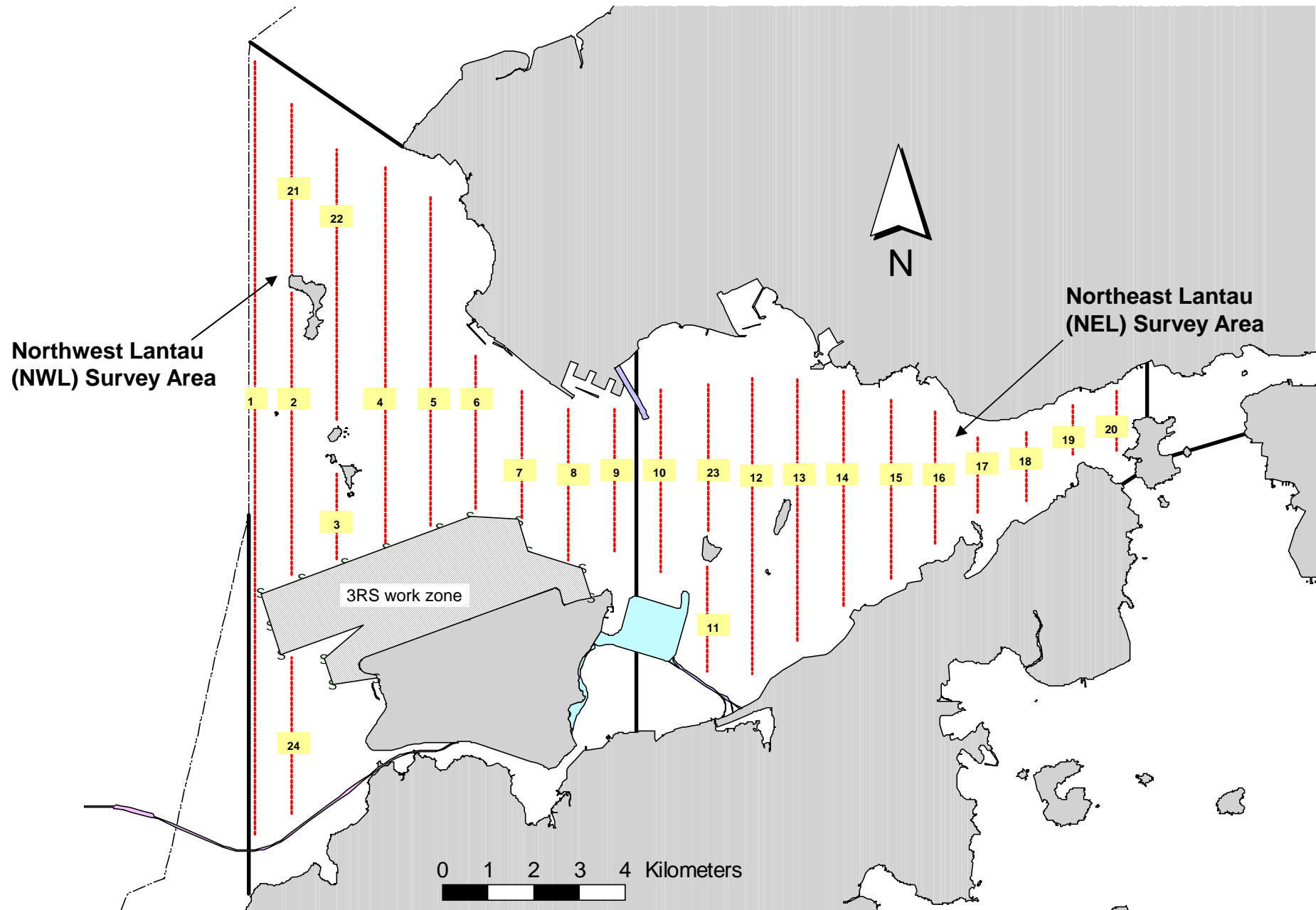


Figure 1. Transect Line Layout in Northwest and Northeast Lantau Survey Areas

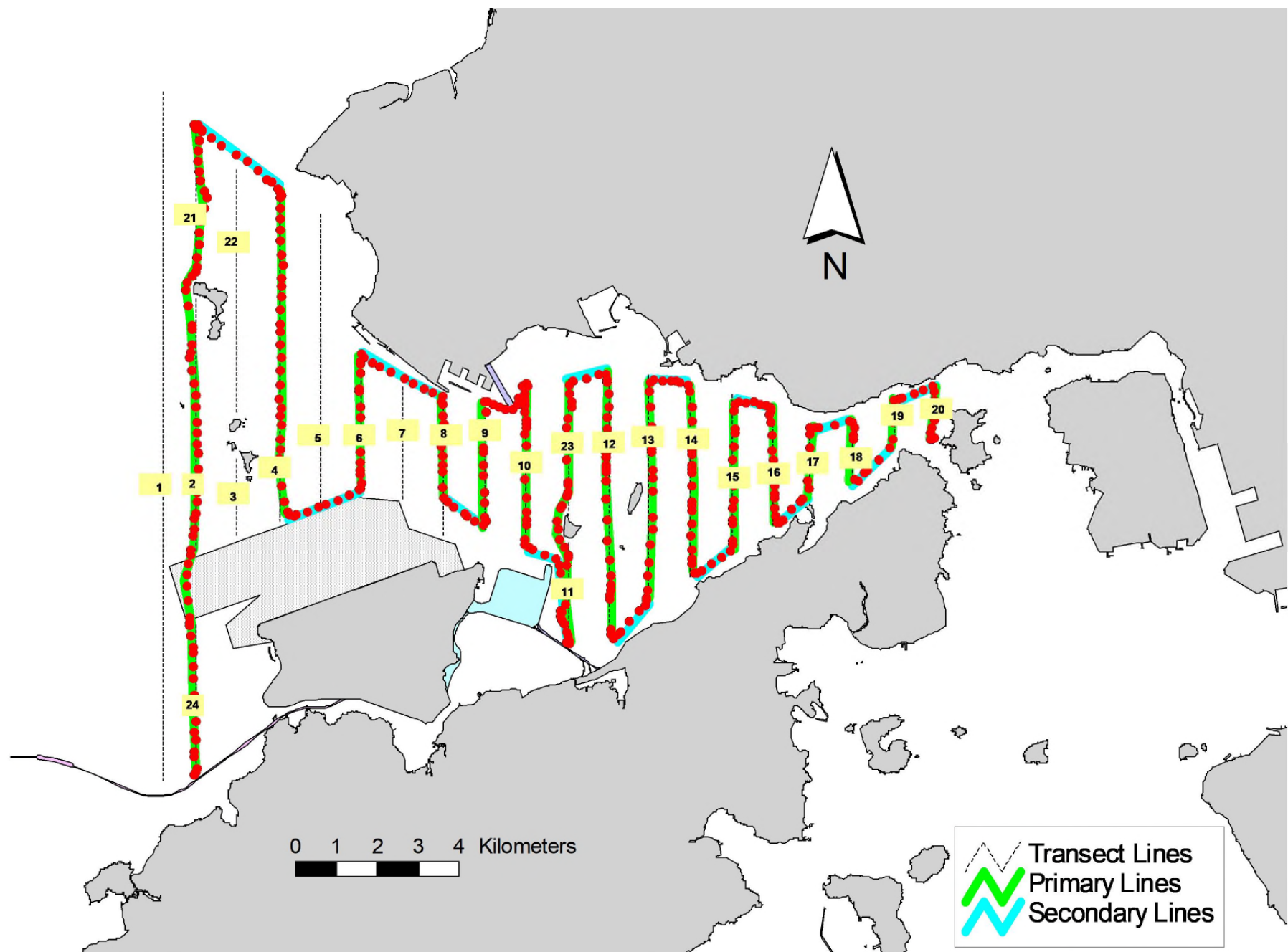


Figure 2. Survey Route on December 3<sup>rd</sup>, 2019 (from TMCLKL08 surveys)

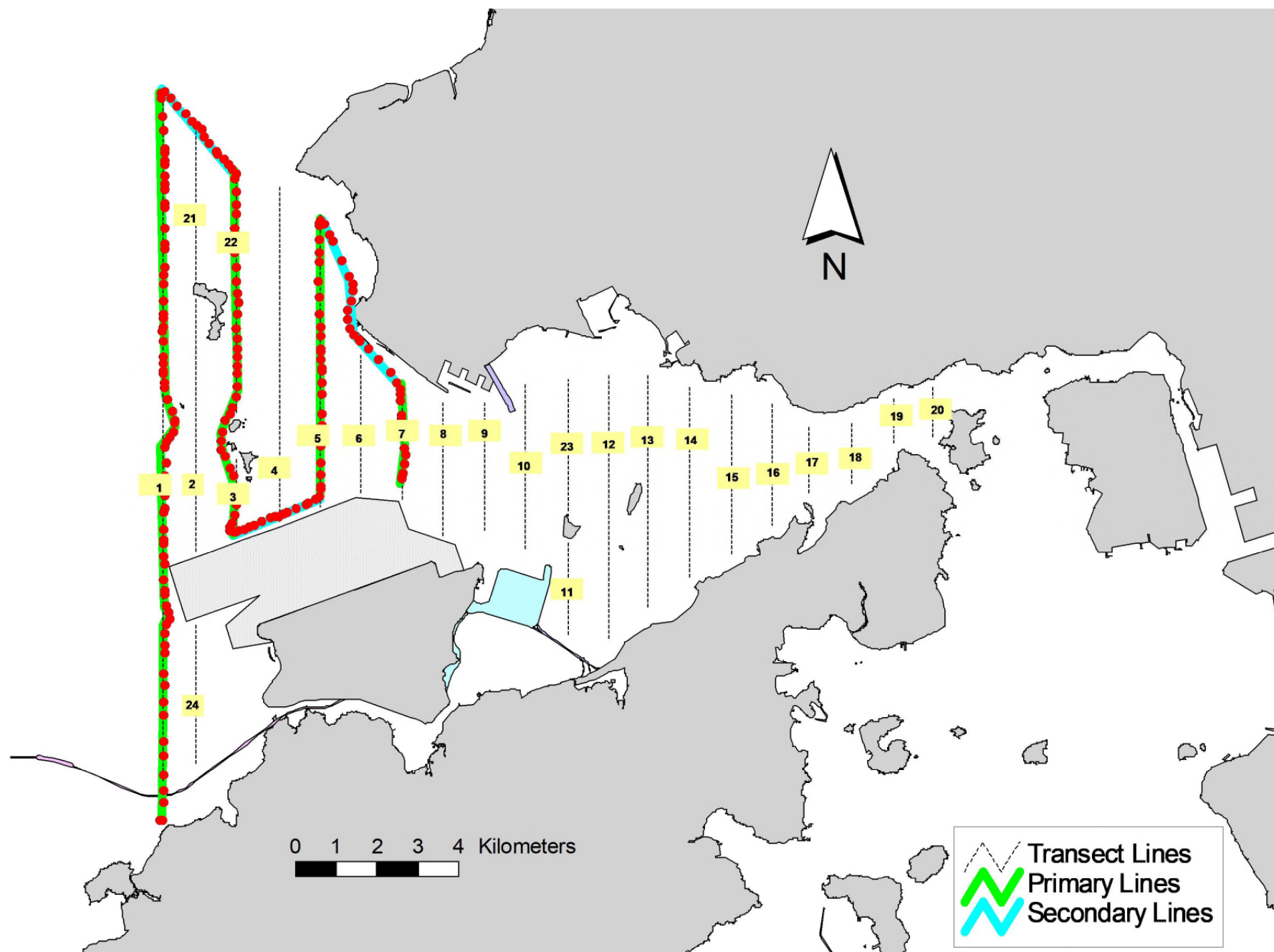


Figure 3. Survey Route on December 10<sup>th</sup>, 2019 (from TMCLKL08 surveys)

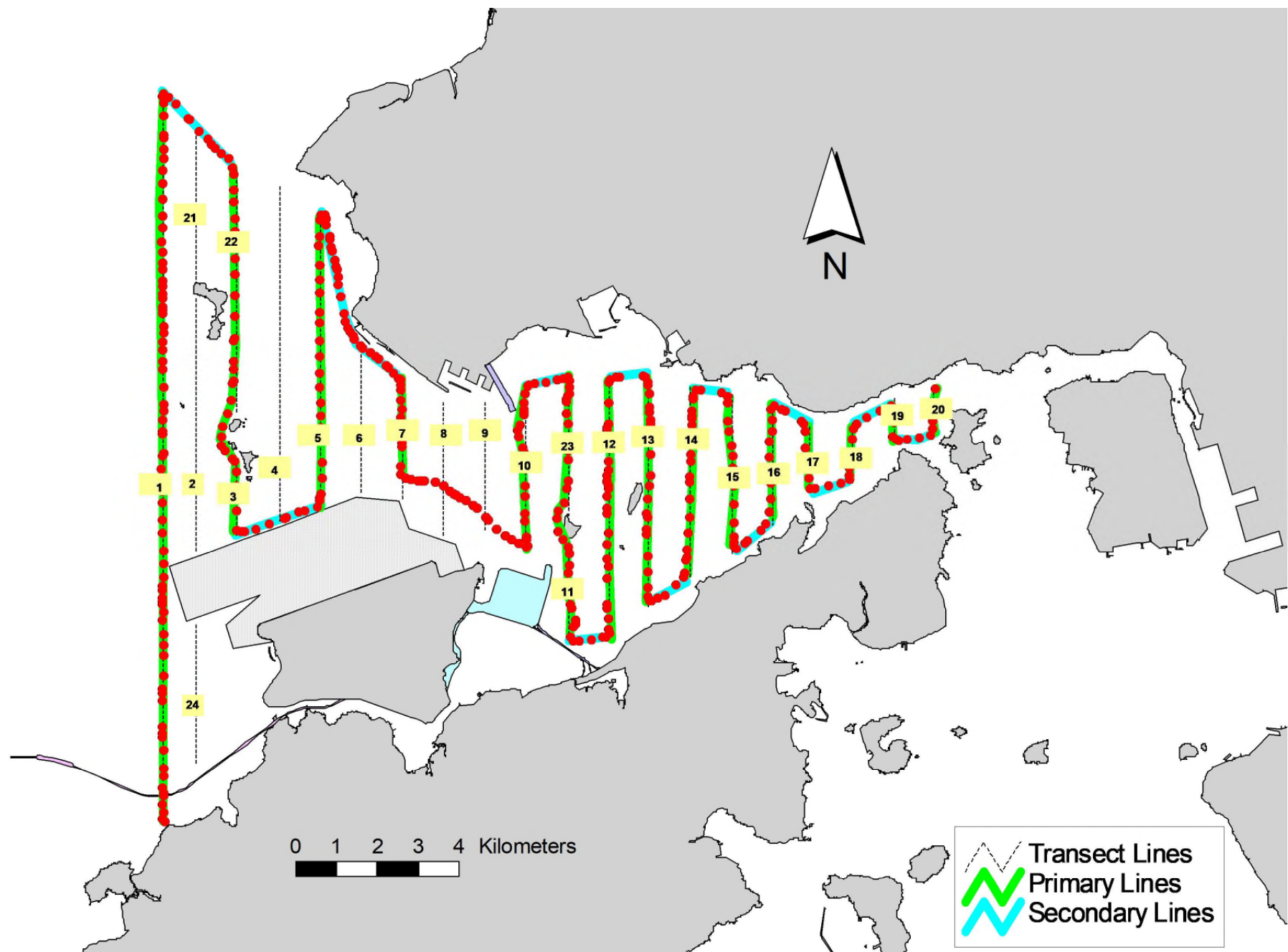


Figure 4. Survey Route on December 12<sup>th</sup>, 2019 (from TMCLKL08 surveys)



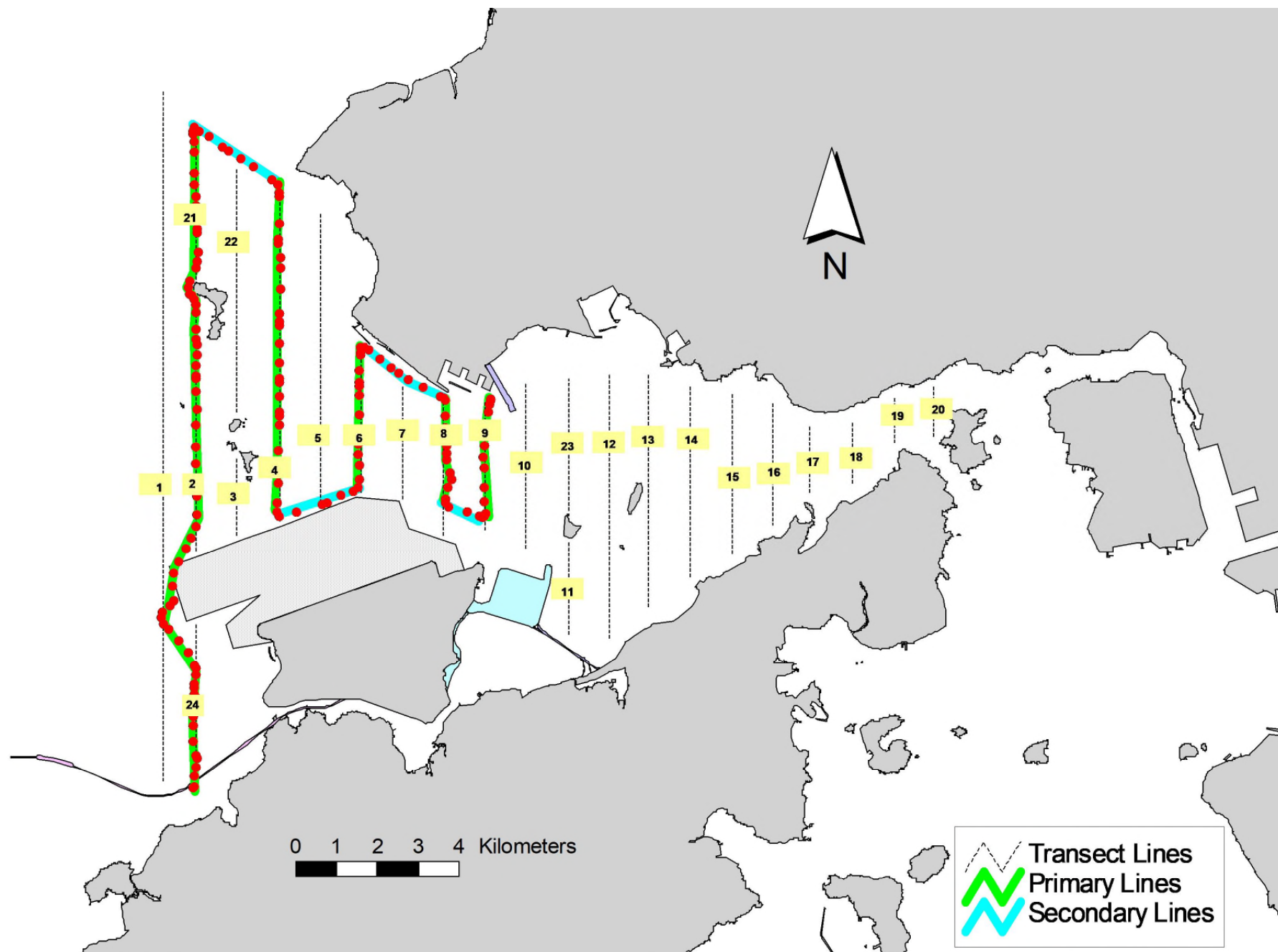


Figure 5. Survey Route on December 16<sup>th</sup>, 2019 (from TMCLKL08 surveys)



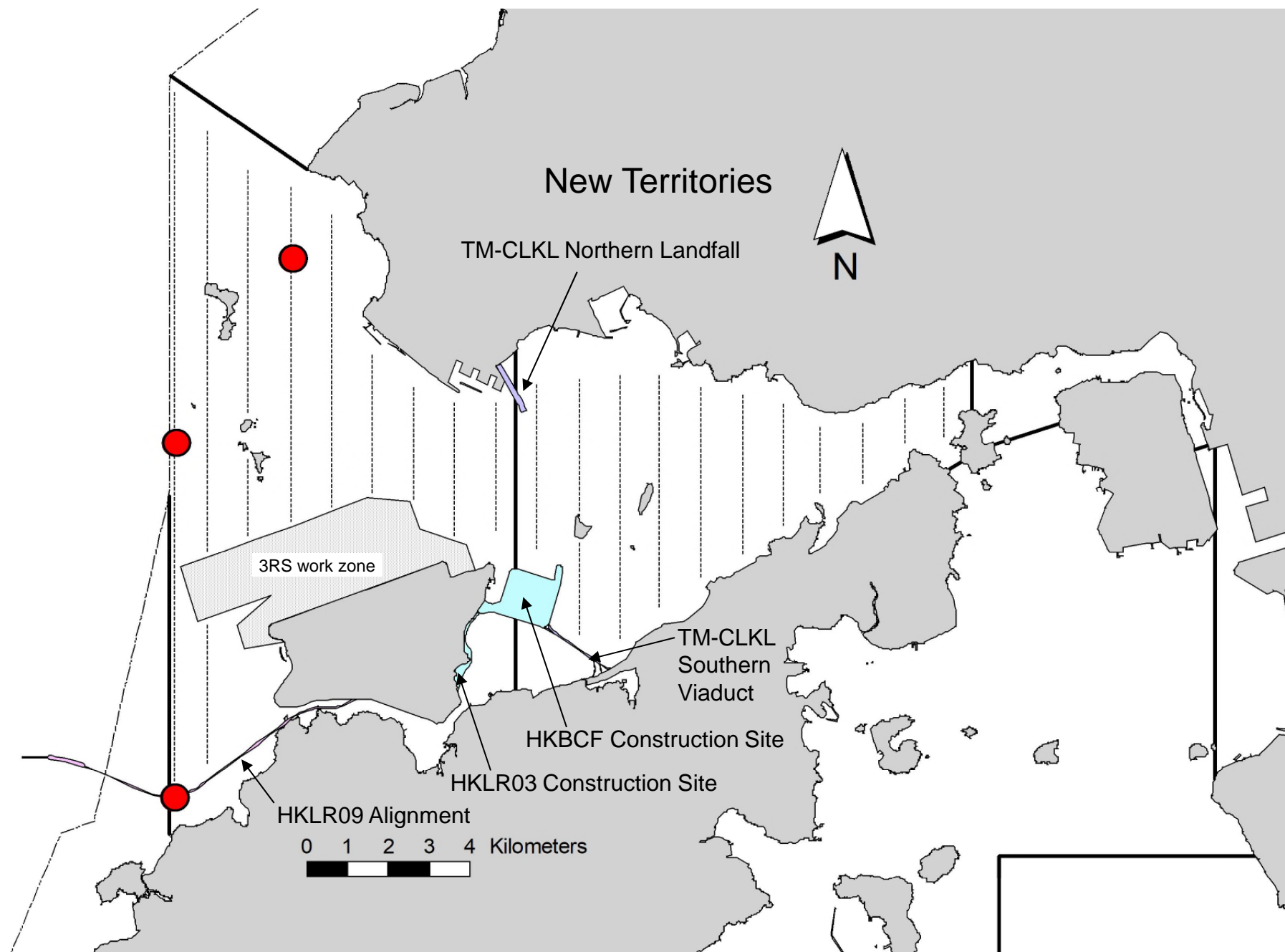


Figure 6. Distribution of Chinese White Dolphin Sightings during December 2019 TMCLKL08 Monitoring Surveys

## Appendix I. TMCLKL Survey Effort Database (December 2019)

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

| DATE      | AREA      | BEAU | EFFORT | SEASON | VESSEL        | TYPE   | P/S |
|-----------|-----------|------|--------|--------|---------------|--------|-----|
| 3-Dec-19  | NW LANTAU | 2    | 12.20  | WINTER | STANDARD36826 | TMCLKL | P   |
| 3-Dec-19  | NW LANTAU | 3    | 14.35  | WINTER | STANDARD36826 | TMCLKL | P   |
| 3-Dec-19  | NW LANTAU | 2    | 2.10   | WINTER | STANDARD36826 | TMCLKL | S   |
| 3-Dec-19  | NW LANTAU | 3    | 10.85  | WINTER | STANDARD36826 | TMCLKL | S   |
| 3-Dec-19  | NE LANTAU | 2    | 35.34  | WINTER | STANDARD36826 | TMCLKL | P   |
| 3-Dec-19  | NE LANTAU | 2    | 13.06  | WINTER | STANDARD36826 | TMCLKL | S   |
| 3-Dec-19  | NE LANTAU | 3    | 1.20   | WINTER | STANDARD36826 | TMCLKL | S   |
| 10-Dec-19 | NW LANTAU | 1    | 2.21   | WINTER | STANDARD36826 | TMCLKL | P   |
| 10-Dec-19 | NW LANTAU | 2    | 30.56  | WINTER | STANDARD36826 | TMCLKL | P   |
| 10-Dec-19 | NW LANTAU | 1    | 1.72   | WINTER | STANDARD36826 | TMCLKL | S   |
| 10-Dec-19 | NW LANTAU | 2    | 9.41   | WINTER | STANDARD36826 | TMCLKL | S   |
| 12-Dec-19 | NW LANTAU | 1    | 1.88   | WINTER | STANDARD36826 | TMCLKL | P   |
| 12-Dec-19 | NW LANTAU | 2    | 20.64  | WINTER | STANDARD36826 | TMCLKL | P   |
| 12-Dec-19 | NW LANTAU | 3    | 9.32   | WINTER | STANDARD36826 | TMCLKL | P   |
| 12-Dec-19 | NW LANTAU | 2    | 9.59   | WINTER | STANDARD36826 | TMCLKL | S   |
| 12-Dec-19 | NW LANTAU | 3    | 1.29   | WINTER | STANDARD36826 | TMCLKL | S   |
| 12-Dec-19 | NE LANTAU | 2    | 35.13  | WINTER | STANDARD36826 | TMCLKL | P   |
| 12-Dec-19 | NE LANTAU | 2    | 11.07  | WINTER | STANDARD36826 | TMCLKL | S   |
| 16-Dec-19 | NW LANTAU | 0    | 1.25   | WINTER | STANDARD36826 | TMCLKL | P   |
| 16-Dec-19 | NW LANTAU | 1    | 7.14   | WINTER | STANDARD36826 | TMCLKL | P   |
| 16-Dec-19 | NW LANTAU | 2    | 19.38  | WINTER | STANDARD36826 | TMCLKL | P   |
| 16-Dec-19 | NW LANTAU | 1    | 1.60   | WINTER | STANDARD36826 | TMCLKL | S   |
| 16-Dec-19 | NW LANTAU | 2    | 10.73  | WINTER | STANDARD36826 | TMCLKL | S   |

**Appendix II. TMCLKL Chinese White Dolphin Sighting Database (December 2019)**

(Abberviations: STG# = Sighting Number; HRD SZ = Dolphin Herd Size; BEAU = Beaufort Sea State; PSD = Perpendicular Distance;  
BOAT ASSOC. = Fishing Boat Association; P/S: Sighting Made on Primary/Secondary Lines)

| DATE      | STG # | TIME | HRD SZ | AREA      | BEAU | PSD | EFFORT | TYPE   | NORTHING | EASTING | SEASON | BOAT ASSOC. | P/S |
|-----------|-------|------|--------|-----------|------|-----|--------|--------|----------|---------|--------|-------------|-----|
| 12-Dec-19 | 1     | 1016 | 11     | NW LANTAU | 2    | 55  | ON     | TMCLKL | 815115   | 804650  | WINTER | NONE        | P   |
| 12-Dec-19 | 2     | 1112 | 1      | NW LANTAU | 3    | 36  | ON     | TMCLKL | 823299   | 804678  | WINTER | NONE        | P   |
| 16-Dec-19 | 1     | 1126 | 1      | NW LANTAU | 2    | 674 | ON     | TMCLKL | 827556   | 807529  | WINTER | NONE        | P   |

**Appendix III. Individual dolphins identified during TMCLKL monitoring surveys in (December 2019)**

| <b>ID#</b> | <b>DATE</b> | <b>STG#</b> | <b>AREA</b> |
|------------|-------------|-------------|-------------|
| CH108      | 12/12/19    | 1           | NW LANTAU   |
| NL33       | 12/12/19    | 1           | NW LANTAU   |
| NL120      | 12/12/19    | 1           | NW LANTAU   |
| NL123      | 16/12/19    | 1           | NW LANTAU   |
| WL100      | 12/12/19    | 1           | NW LANTAU   |
| WL145      | 12/12/19    | 1           | NW LANTAU   |
| WL214      | 12/12/19    | 1           | NW LANTAU   |
| WL268      | 12/12/19    | 2           | NW LANTAU   |
| WL284      | 12/12/19    | 1           | NW LANTAU   |



Appendix IV. Photographs of Identified Individual Dolphins in December 2019 (TMCLKL)



## Appendix M. Wind Data

## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 01/12/2019 | 12:00 AM | 0                | WNW            |
| 01/12/2019 | 1:00 AM  | 0                | ---            |
| 01/12/2019 | 2:00 AM  | 0                | ---            |
| 01/12/2019 | 3:00 AM  | 0                | WSW            |
| 01/12/2019 | 4:00 AM  | 0                | SW             |
| 01/12/2019 | 5:00 AM  | 0                | ---            |
| 01/12/2019 | 6:00 AM  | 0                | SSW            |
| 01/12/2019 | 7:00 AM  | 0                | SSW            |
| 01/12/2019 | 8:00 AM  | 0                | SSE            |
| 01/12/2019 | 9:00 AM  | 0.4              | NE             |
| 01/12/2019 | 10:00 AM | 0.4              | N              |
| 01/12/2019 | 11:00 AM | 0.4              | NW             |
| 01/12/2019 | 12:00 PM | 0.9              | NW             |
| 01/12/2019 | 1:00 PM  | 0.9              | S              |
| 01/12/2019 | 2:00 PM  | 1.3              | S              |
| 01/12/2019 | 3:00 PM  | 1.3              | S              |
| 01/12/2019 | 4:00 PM  | 1.3              | S              |
| 01/12/2019 | 5:00 PM  | 1.3              | S              |
| 01/12/2019 | 6:00 PM  | 1.3              | S              |
| 01/12/2019 | 7:00 PM  | 1.8              | NNW            |
| 01/12/2019 | 8:00 PM  | 1.8              | N              |
| 01/12/2019 | 9:00 PM  | 1.8              | NNE            |
| 01/12/2019 | 10:00 PM | 1.8              | N              |
| 01/12/2019 | 11:00 PM | 1.8              | N              |
| 02/12/2019 | 12:00 AM | 1.3              | NW             |
| 02/12/2019 | 1:00 AM  | 1.3              | NNW            |
| 02/12/2019 | 2:00 AM  | 1.8              | N              |
| 02/12/2019 | 3:00 AM  | 1.3              | N              |
| 02/12/2019 | 4:00 AM  | 1.3              | NNW            |
| 02/12/2019 | 5:00 AM  | 2.7              | NNE            |
| 02/12/2019 | 6:00 AM  | 2.2              | NNE            |
| 02/12/2019 | 7:00 AM  | 3.1              | NE             |
| 02/12/2019 | 8:00 AM  | 3.1              | NNE            |
| 02/12/2019 | 9:00 AM  | 2.7              | N              |
| 02/12/2019 | 10:00 AM | 2.2              | N              |
| 02/12/2019 | 11:00 AM | 2.2              | N              |
| 02/12/2019 | 12:00 PM | 2.2              | NNW            |
| 02/12/2019 | 1:00 PM  | 2.2              | N              |
| 02/12/2019 | 2:00 PM  | 2.2              | NNW            |
| 02/12/2019 | 3:00 PM  | 2.2              | N              |
| 02/12/2019 | 4:00 PM  | 3.1              | NNE            |
| 02/12/2019 | 5:00 PM  | 2.7              | NNE            |
| 02/12/2019 | 6:00 PM  | 3.1              | NE             |
| 02/12/2019 | 7:00 PM  | 3.1              | NE             |
| 02/12/2019 | 8:00 PM  | 2.7              | NE             |
| 02/12/2019 | 9:00 PM  | 3.6              | NE             |
| 02/12/2019 | 10:00 PM | 2.7              | ENE            |
| 02/12/2019 | 11:00 PM | 2.2              | NE             |
| 03/12/2019 | 12:00 AM | 1.3              | NE             |

## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 03/12/2019 | 1:00 AM  | 2.2              | NE             |
| 03/12/2019 | 2:00 AM  | 2.7              | NE             |
| 03/12/2019 | 3:00 AM  | 1.8              | NE             |
| 03/12/2019 | 4:00 AM  | 1.3              | NE             |
| 03/12/2019 | 5:00 AM  | 0.4              | N              |
| 03/12/2019 | 6:00 AM  | 0.9              | E              |
| 03/12/2019 | 7:00 AM  | 1.8              | E              |
| 03/12/2019 | 8:00 AM  | 0.9              | NNE            |
| 03/12/2019 | 9:00 AM  | 0.9              | NE             |
| 03/12/2019 | 10:00 AM | 1.3              | NE             |
| 03/12/2019 | 11:00 AM | 1.8              | NE             |
| 03/12/2019 | 12:00 PM | 0.9              | NNW            |
| 03/12/2019 | 1:00 PM  | 0.4              | S              |
| 03/12/2019 | 2:00 PM  | 0.9              | NW             |
| 03/12/2019 | 3:00 PM  | 1.3              | NNE            |
| 03/12/2019 | 4:00 PM  | 2.2              | NE             |
| 03/12/2019 | 5:00 PM  | 1.3              | ENE            |
| 03/12/2019 | 6:00 PM  | 2.2              | ENE            |
| 03/12/2019 | 7:00 PM  | 0.9              | NE             |
| 03/12/2019 | 8:00 PM  | 0.4              | W              |
| 03/12/2019 | 9:00 PM  | 0.9              | NNW            |
| 03/12/2019 | 10:00 PM | 1.8              | NE             |
| 03/12/2019 | 11:00 PM | 1.3              | ENE            |
| 04/12/2019 | 12:00 AM | 2.2              | E              |
| 04/12/2019 | 1:00 AM  | 1.8              | E              |
| 04/12/2019 | 2:00 AM  | 1.8              | ENE            |
| 04/12/2019 | 3:00 AM  | 2.7              | ENE            |
| 04/12/2019 | 4:00 AM  | 2.7              | NE             |
| 04/12/2019 | 5:00 AM  | 2.7              | ENE            |
| 04/12/2019 | 6:00 AM  | 2.2              | NE             |
| 04/12/2019 | 7:00 AM  | 2.7              | NE             |
| 04/12/2019 | 8:00 AM  | 2.2              | NE             |
| 04/12/2019 | 9:00 AM  | 2.2              | NNE            |
| 04/12/2019 | 10:00 AM | 2.7              | NNE            |
| 04/12/2019 | 11:00 AM | 1.8              | NE             |
| 04/12/2019 | 12:00 PM | 2.2              | NE             |
| 04/12/2019 | 1:00 PM  | 2.7              | NE             |
| 04/12/2019 | 2:00 PM  | 2.2              | NE             |
| 04/12/2019 | 3:00 PM  | 2.2              | N              |
| 04/12/2019 | 4:00 PM  | 2.7              | NNE            |
| 04/12/2019 | 5:00 PM  | 2.2              | NE             |
| 04/12/2019 | 6:00 PM  | 1.8              | NE             |
| 04/12/2019 | 7:00 PM  | 2.2              | ENE            |
| 04/12/2019 | 8:00 PM  | 2.2              | E              |
| 04/12/2019 | 9:00 PM  | 2.7              | E              |
| 04/12/2019 | 10:00 PM | 3.1              | ENE            |
| 04/12/2019 | 11:00 PM | 3.6              | ENE            |
| 05/12/2019 | 12:00 AM | 3.1              | ENE            |
| 05/12/2019 | 1:00 AM  | 3.1              | ENE            |

## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 05/12/2019 | 2:00 AM  | 3.1              | ENE            |
| 05/12/2019 | 3:00 AM  | 3.6              | NE             |
| 05/12/2019 | 4:00 AM  | 3.1              | ENE            |
| 05/12/2019 | 5:00 AM  | 3.6              | ENE            |
| 05/12/2019 | 6:00 AM  | 2.7              | ENE            |
| 05/12/2019 | 7:00 AM  | 3.1              | ENE            |
| 05/12/2019 | 8:00 AM  | 1.8              | ENE            |
| 05/12/2019 | 9:00 AM  | 1.3              | ENE            |
| 05/12/2019 | 10:00 AM | 2.7              | E              |
| 05/12/2019 | 11:00 AM | 3.1              | ENE            |
| 05/12/2019 | 12:00 PM | 2.2              | E              |
| 05/12/2019 | 1:00 PM  | 2.7              | E              |
| 05/12/2019 | 2:00 PM  | 2.2              | E              |
| 05/12/2019 | 3:00 PM  | 2.2              | E              |
| 05/12/2019 | 4:00 PM  | 2.7              | E              |
| 05/12/2019 | 5:00 PM  | 3.1              | E              |
| 05/12/2019 | 6:00 PM  | 3.6              | E              |
| 05/12/2019 | 7:00 PM  | 4                | E              |
| 05/12/2019 | 8:00 PM  | 3.1              | E              |
| 05/12/2019 | 9:00 PM  | 2.2              | E              |
| 05/12/2019 | 10:00 PM | 3.1              | E              |
| 05/12/2019 | 11:00 PM | 4.5              | ENE            |
| 06/12/2019 | 12:00 AM | 4.9              | ENE            |
| 06/12/2019 | 1:00 AM  | 4                | ENE            |
| 06/12/2019 | 2:00 AM  | 3.6              | NE             |
| 06/12/2019 | 3:00 AM  | 4                | ENE            |
| 06/12/2019 | 4:00 AM  | 2.7              | NE             |
| 06/12/2019 | 5:00 AM  | 3.1              | NE             |
| 06/12/2019 | 6:00 AM  | 2.7              | NE             |
| 06/12/2019 | 7:00 AM  | 2.7              | NE             |
| 06/12/2019 | 8:00 AM  | 3.1              | NE             |
| 06/12/2019 | 9:00 AM  | 3.6              | NE             |
| 06/12/2019 | 10:00 AM | 3.1              | NNE            |
| 06/12/2019 | 11:00 AM | 2.7              | NNE            |
| 06/12/2019 | 12:00 PM | 2.7              | NNE            |
| 06/12/2019 | 1:00 PM  | 3.1              | NNE            |
| 06/12/2019 | 2:00 PM  | 3.6              | NNE            |
| 06/12/2019 | 3:00 PM  | 3.6              | NNE            |
| 06/12/2019 | 4:00 PM  | 3.1              | NE             |
| 06/12/2019 | 5:00 PM  | 2.7              | NE             |
| 06/12/2019 | 6:00 PM  | 2.2              | NE             |
| 06/12/2019 | 7:00 PM  | 2.7              | E              |
| 06/12/2019 | 8:00 PM  | 2.7              | E              |
| 06/12/2019 | 9:00 PM  | 3.6              | ENE            |
| 06/12/2019 | 10:00 PM | 3.6              | ENE            |
| 06/12/2019 | 11:00 PM | 3.1              | ENE            |
| 07/12/2019 | 12:00 AM | 4                | ENE            |
| 07/12/2019 | 1:00 AM  | 4                | E              |
| 07/12/2019 | 2:00 AM  | 3.6              | ENE            |

## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 07/12/2019 | 3:00 AM  | 1.3              | NE             |
| 07/12/2019 | 4:00 AM  | 0.9              | ESE            |
| 07/12/2019 | 5:00 AM  | 1.8              | NNE            |
| 07/12/2019 | 6:00 AM  | 3.1              | NE             |
| 07/12/2019 | 7:00 AM  | 2.7              | NE             |
| 07/12/2019 | 8:00 AM  | 3.1              | NE             |
| 07/12/2019 | 9:00 AM  | 3.1              | NE             |
| 07/12/2019 | 10:00 AM | 3.6              | NE             |
| 07/12/2019 | 11:00 AM | 4                | NE             |
| 07/12/2019 | 12:00 PM | 3.6              | NE             |
| 07/12/2019 | 1:00 PM  | 3.1              | ENE            |
| 07/12/2019 | 2:00 PM  | 2.7              | ENE            |
| 07/12/2019 | 3:00 PM  | 3.1              | ENE            |
| 07/12/2019 | 4:00 PM  | 3.1              | ENE            |
| 07/12/2019 | 5:00 PM  | 2.7              | ENE            |
| 07/12/2019 | 6:00 PM  | 1.3              | ENE            |
| 07/12/2019 | 7:00 PM  | 0                | E              |
| 07/12/2019 | 8:00 PM  | 0.4              | WSW            |
| 07/12/2019 | 9:00 PM  | 0.4              | NNW            |
| 07/12/2019 | 10:00 PM | 1.3              | E              |
| 07/12/2019 | 11:00 PM | 1.8              | E              |
| 08/12/2019 | 12:00 AM | 1.3              | E              |
| 08/12/2019 | 1:00 AM  | 0.9              | E              |
| 08/12/2019 | 2:00 AM  | 0.9              | NNW            |
| 08/12/2019 | 3:00 AM  | 0.4              | SW             |
| 08/12/2019 | 4:00 AM  | 0.4              | SSW            |
| 08/12/2019 | 5:00 AM  | 2.7              | E              |
| 08/12/2019 | 6:00 AM  | 1.8              | E              |
| 08/12/2019 | 7:00 AM  | 1.8              | E              |
| 08/12/2019 | 8:00 AM  | 1.8              | ENE            |
| 08/12/2019 | 9:00 AM  | 2.2              | E              |
| 08/12/2019 | 10:00 AM | 2.2              | ENE            |
| 08/12/2019 | 11:00 AM | 1.3              | NNE            |
| 08/12/2019 | 12:00 PM | 0.9              | ESE            |
| 08/12/2019 | 1:00 PM  | 0.4              | N              |
| 08/12/2019 | 2:00 PM  | 0.9              | NW             |
| 08/12/2019 | 3:00 PM  | 0.9              | S              |
| 08/12/2019 | 4:00 PM  | 0.4              | W              |
| 08/12/2019 | 5:00 PM  | 0.4              | S              |
| 08/12/2019 | 6:00 PM  | 0                | ---            |
| 08/12/2019 | 7:00 PM  | 0                | S              |
| 08/12/2019 | 8:00 PM  | 0                | S              |
| 08/12/2019 | 9:00 PM  | 0.4              | NNE            |
| 08/12/2019 | 10:00 PM | 0.4              | NNE            |
| 08/12/2019 | 11:00 PM | 0                | ENE            |
| 09/12/2019 | 12:00 AM | 0                | ENE            |
| 09/12/2019 | 1:00 AM  | 0                | ---            |
| 09/12/2019 | 2:00 AM  | 0                | ---            |
| 09/12/2019 | 3:00 AM  | 0                | ---            |



## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 09/12/2019 | 4:00 AM  | 0                | ---            |
| 09/12/2019 | 5:00 AM  | 0                | ---            |
| 09/12/2019 | 6:00 AM  | 0.4              | SSE            |
| 09/12/2019 | 7:00 AM  | 0.9              | E              |
| 09/12/2019 | 8:00 AM  | 0.4              | E              |
| 09/12/2019 | 9:00 AM  | 1.3              | E              |
| 09/12/2019 | 10:00 AM | 0.9              | ENE            |
| 09/12/2019 | 11:00 AM | 0.9              | NW             |
| 09/12/2019 | 12:00 PM | 0.9              | NW             |
| 09/12/2019 | 1:00 PM  | 0.9              | NNW            |
| 09/12/2019 | 2:00 PM  | 0.4              | NNW            |
| 09/12/2019 | 3:00 PM  | 0.4              | NE             |
| 09/12/2019 | 4:00 PM  | 0.4              | NE             |
| 09/12/2019 | 5:00 PM  | 0.4              | S              |
| 09/12/2019 | 6:00 PM  | 0                | S              |
| 09/12/2019 | 7:00 PM  | 0                | ---            |
| 09/12/2019 | 8:00 PM  | 0                | S              |
| 09/12/2019 | 9:00 PM  | 0                | S              |
| 09/12/2019 | 10:00 PM | 0                | ---            |
| 09/12/2019 | 11:00 PM | 0                | ---            |
| 10/12/2019 | 12:00 AM | 0.4              | SSE            |
| 10/12/2019 | 1:00 AM  | 0.4              | ENE            |
| 10/12/2019 | 2:00 AM  | 0                | ENE            |
| 10/12/2019 | 3:00 AM  | 0                | SE             |
| 10/12/2019 | 4:00 AM  | 0                | ---            |
| 10/12/2019 | 5:00 AM  | 0                | SSW            |
| 10/12/2019 | 6:00 AM  | 0.4              | S              |
| 10/12/2019 | 7:00 AM  | 0                | S              |
| 10/12/2019 | 8:00 AM  | 0.4              | ENE            |
| 10/12/2019 | 9:00 AM  | 0.9              | ENE            |
| 10/12/2019 | 10:00 AM | 0.9              | E              |
| 10/12/2019 | 11:00 AM | 1.8              | ENE            |
| 10/12/2019 | 12:00 PM | 0.9              | NE             |
| 10/12/2019 | 1:00 PM  | 0.9              | NW             |
| 10/12/2019 | 2:00 PM  | 0.9              | NW             |
| 10/12/2019 | 3:00 PM  | 0.4              | NW             |
| 10/12/2019 | 4:00 PM  | 0                | NW             |
| 10/12/2019 | 5:00 PM  | 0                | NW             |
| 10/12/2019 | 6:00 PM  | 0                | ---            |
| 10/12/2019 | 7:00 PM  | 0                | ---            |
| 10/12/2019 | 8:00 PM  | 0                | ---            |
| 10/12/2019 | 9:00 PM  | 0                | ---            |
| 10/12/2019 | 10:00 PM | 0                | ---            |
| 10/12/2019 | 11:00 PM | 0                | ---            |
| 11/12/2019 | 12:00 AM | 0                | ---            |
| 11/12/2019 | 1:00 AM  | 0                | ---            |
| 11/12/2019 | 2:00 AM  | 0                | ---            |
| 11/12/2019 | 3:00 AM  | 0                | ---            |
| 11/12/2019 | 4:00 AM  | 0                | SSW            |

## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 11/12/2019 | 5:00 AM  | 0                | SSW            |
| 11/12/2019 | 6:00 AM  | 0                | SSW            |
| 11/12/2019 | 7:00 AM  | 0.4              | SSW            |
| 11/12/2019 | 8:00 AM  | 0                | SSW            |
| 11/12/2019 | 9:00 AM  | 0                | SSW            |
| 11/12/2019 | 10:00 AM | 0.4              | N              |
| 11/12/2019 | 11:00 AM | 0.4              | N              |
| 11/12/2019 | 12:00 PM | 0.4              | N              |
| 11/12/2019 | 1:00 PM  | 0.9              | NNW            |
| 11/12/2019 | 2:00 PM  | 0.9              | SSW            |
| 11/12/2019 | 3:00 PM  | 0.4              | NW             |
| 11/12/2019 | 4:00 PM  | 0.4              | ESE            |
| 11/12/2019 | 5:00 PM  | 0.9              | NNE            |
| 11/12/2019 | 6:00 PM  | 0.9              | NW             |
| 11/12/2019 | 7:00 PM  | 1.3              | E              |
| 11/12/2019 | 8:00 PM  | 0.4              | SE             |
| 11/12/2019 | 9:00 PM  | 1.3              | SSE            |
| 11/12/2019 | 10:00 PM | 1.8              | NNW            |
| 11/12/2019 | 11:00 PM | 1.8              | N              |
| 12/12/2019 | 12:00 AM | 1.3              | NNW            |
| 12/12/2019 | 1:00 AM  | 1.3              | N              |
| 12/12/2019 | 2:00 AM  | 1.3              | N              |
| 12/12/2019 | 3:00 AM  | 1.3              | N              |
| 12/12/2019 | 4:00 AM  | 1.3              | N              |
| 12/12/2019 | 5:00 AM  | 0.9              | NNW            |
| 12/12/2019 | 6:00 AM  | 0.4              | NNW            |
| 12/12/2019 | 7:00 AM  | 0.9              | S              |
| 12/12/2019 | 8:00 AM  | 1.3              | NE             |
| 12/12/2019 | 9:00 AM  | 2.2              | NE             |
| 12/12/2019 | 10:00 AM | 2.2              | E              |
| 12/12/2019 | 11:00 AM | 1.8              | N              |
| 12/12/2019 | 12:00 PM | 1.3              | NNW            |
| 12/12/2019 | 1:00 PM  | 1.3              | ENE            |
| 12/12/2019 | 2:00 PM  | 1.3              | NNW            |
| 12/12/2019 | 3:00 PM  | 1.3              | NNW            |
| 12/12/2019 | 4:00 PM  | 1.8              | NNW            |
| 12/12/2019 | 5:00 PM  | 1.8              | NW             |
| 12/12/2019 | 6:00 PM  | 1.8              | NNW            |
| 12/12/2019 | 7:00 PM  | 2.2              | NW             |
| 12/12/2019 | 8:00 PM  | 1.8              | N              |
| 12/12/2019 | 9:00 PM  | 2.7              | SE             |
| 12/12/2019 | 10:00 PM | 2.2              | N              |
| 12/12/2019 | 11:00 PM | 2.7              | N              |
| 13/12/2019 | 12:00 AM | 3.1              | N              |
| 13/12/2019 | 1:00 AM  | 3.1              | N              |
| 13/12/2019 | 2:00 AM  | 2.2              | N              |
| 13/12/2019 | 3:00 AM  | 2.2              | N              |
| 13/12/2019 | 4:00 AM  | 2.2              | N              |
| 13/12/2019 | 5:00 AM  | 2.2              | N              |

## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 13/12/2019 | 6:00 AM  | 2.2              | N              |
| 13/12/2019 | 7:00 AM  | 2.2              | NW             |
| 13/12/2019 | 8:00 AM  | 2.2              | N              |
| 13/12/2019 | 9:00 AM  | 2.7              | N              |
| 13/12/2019 | 10:00 AM | 3.1              | NNW            |
| 13/12/2019 | 11:00 AM | 1.8              | NNW            |
| 13/12/2019 | 12:00 PM | 1.8              | N              |
| 13/12/2019 | 1:00 PM  | 1.8              | N              |
| 13/12/2019 | 2:00 PM  | 1.8              | NNW            |
| 13/12/2019 | 3:00 PM  | 1.8              | N              |
| 13/12/2019 | 4:00 PM  | 1.3              | N              |
| 13/12/2019 | 5:00 PM  | 0.9              | NNW            |
| 13/12/2019 | 6:00 PM  | 0                | NNW            |
| 13/12/2019 | 7:00 PM  | 0                | ---            |
| 13/12/2019 | 8:00 PM  | 0                | ---            |
| 13/12/2019 | 9:00 PM  | 0                | ---            |
| 13/12/2019 | 10:00 PM | 0.4              | NNW            |
| 13/12/2019 | 11:00 PM | 1.3              | NNW            |
| 14/12/2019 | 12:00 AM | 1.3              | NW             |
| 14/12/2019 | 1:00 AM  | 1.3              | NNW            |
| 14/12/2019 | 2:00 AM  | 1.8              | NNW            |
| 14/12/2019 | 3:00 AM  | 1.3              | NW             |
| 14/12/2019 | 4:00 AM  | 1.3              | NW             |
| 14/12/2019 | 5:00 AM  | 0.9              | N              |
| 14/12/2019 | 6:00 AM  | 0.4              | NNW            |
| 14/12/2019 | 7:00 AM  | 0.4              | E              |
| 14/12/2019 | 8:00 AM  | 0.9              | E              |
| 14/12/2019 | 9:00 AM  | 1.3              | N              |
| 14/12/2019 | 10:00 AM | 1.3              | NNW            |
| 14/12/2019 | 11:00 AM | 0.9              | NNW            |
| 14/12/2019 | 12:00 PM | 1.3              | N              |
| 14/12/2019 | 1:00 PM  | 1.3              | NNW            |
| 14/12/2019 | 2:00 PM  | 0.9              | NW             |
| 14/12/2019 | 3:00 PM  | 1.3              | NE             |
| 14/12/2019 | 4:00 PM  | 0.9              | NE             |
| 14/12/2019 | 5:00 PM  | 0                | ---            |
| 14/12/2019 | 6:00 PM  | 0                | ---            |
| 14/12/2019 | 7:00 PM  | 0.9              | N              |
| 14/12/2019 | 8:00 PM  | 2.2              | NNW            |
| 14/12/2019 | 9:00 PM  | 1.8              | NW             |
| 14/12/2019 | 10:00 PM | 1.3              | NNW            |
| 14/12/2019 | 11:00 PM | 1.3              | N              |
| 15/12/2019 | 12:00 AM | 1.3              | N              |
| 15/12/2019 | 1:00 AM  | 1.3              | NNW            |
| 15/12/2019 | 2:00 AM  | 1.3              | N              |
| 15/12/2019 | 3:00 AM  | 1.8              | NW             |
| 15/12/2019 | 4:00 AM  | 1.8              | NW             |
| 15/12/2019 | 5:00 AM  | 1.8              | NNW            |
| 15/12/2019 | 6:00 AM  | 1.3              | NNW            |

## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 15/12/2019 | 7:00 AM  | 2.2              | N              |
| 15/12/2019 | 8:00 AM  | 2.2              | N              |
| 15/12/2019 | 9:00 AM  | 1.8              | N              |
| 15/12/2019 | 10:00 AM | 1.8              | E              |
| 15/12/2019 | 11:00 AM | 1.8              | E              |
| 15/12/2019 | 12:00 PM | 1.8              | NW             |
| 15/12/2019 | 1:00 PM  | 1.3              | N              |
| 15/12/2019 | 2:00 PM  | 1.3              | NNW            |
| 15/12/2019 | 3:00 PM  | 1.3              | NNW            |
| 15/12/2019 | 4:00 PM  | 1.3              | N              |
| 15/12/2019 | 5:00 PM  | 1.3              | NNW            |
| 15/12/2019 | 6:00 PM  | 1.3              | N              |
| 15/12/2019 | 7:00 PM  | 0.9              | N              |
| 15/12/2019 | 8:00 PM  | 1.3              | N              |
| 15/12/2019 | 9:00 PM  | 1.8              | N              |
| 15/12/2019 | 10:00 PM | 1.8              | N              |
| 15/12/2019 | 11:00 PM | 2.2              | N              |
| 16/12/2019 | 12:00 AM | 3.1              | N              |
| 16/12/2019 | 1:00 AM  | 2.7              | N              |
| 16/12/2019 | 2:00 AM  | 2.7              | N              |
| 16/12/2019 | 3:00 AM  | 1.8              | N              |
| 16/12/2019 | 4:00 AM  | 2.2              | NNW            |
| 16/12/2019 | 5:00 AM  | 2.2              | NNW            |
| 16/12/2019 | 6:00 AM  | 2.2              | NNW            |
| 16/12/2019 | 7:00 AM  | 2.2              | NW             |
| 16/12/2019 | 8:00 AM  | 1.8              | NNW            |
| 16/12/2019 | 9:00 AM  | 2.2              | NNW            |
| 16/12/2019 | 10:00 AM | 1.8              | ENE            |
| 16/12/2019 | 11:00 AM | 1.8              | N              |
| 16/12/2019 | 12:00 PM | 1.3              | E              |
| 16/12/2019 | 1:00 PM  | 0.9              | NNE            |
| 16/12/2019 | 2:00 PM  | 0.9              | NNE            |
| 16/12/2019 | 3:00 PM  | 0.9              | NNW            |
| 16/12/2019 | 4:00 PM  | 0.4              | NW             |
| 16/12/2019 | 5:00 PM  | 1.3              | NNW            |
| 16/12/2019 | 6:00 PM  | 0.4              | NW             |
| 16/12/2019 | 7:00 PM  | 0.9              | NNW            |
| 16/12/2019 | 8:00 PM  | 0.4              | NW             |
| 16/12/2019 | 9:00 PM  | 0                | SSE            |
| 16/12/2019 | 10:00 PM | 0.4              | NNW            |
| 16/12/2019 | 11:00 PM | 0.9              | NNW            |
| 17/12/2019 | 12:00 AM | 0.9              | NW             |
| 17/12/2019 | 1:00 AM  | 0.4              | SSE            |
| 17/12/2019 | 2:00 AM  | 0.4              | NNE            |
| 17/12/2019 | 3:00 AM  | 0.9              | SE             |
| 17/12/2019 | 4:00 AM  | 0.9              | NNW            |
| 17/12/2019 | 5:00 AM  | 0.9              | NNW            |
| 17/12/2019 | 6:00 AM  | 0.4              | NW             |
| 17/12/2019 | 7:00 AM  | 0.4              | NNW            |

## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 17/12/2019 | 8:00 AM  | 0                | W              |
| 17/12/2019 | 9:00 AM  | 0.4              | NNW            |
| 17/12/2019 | 10:00 AM | 0.4              | NNW            |
| 17/12/2019 | 11:00 AM | 0.9              | WNW            |
| 17/12/2019 | 12:00 PM | 0.9              | NW             |
| 17/12/2019 | 1:00 PM  | 0.4              | NW             |
| 17/12/2019 | 2:00 PM  | 0.4              | WNW            |
| 17/12/2019 | 3:00 PM  | 0.4              | NW             |
| 17/12/2019 | 4:00 PM  | 0.4              | ENE            |
| 17/12/2019 | 5:00 PM  | 0.4              | ENE            |
| 17/12/2019 | 6:00 PM  | 0.9              | E              |
| 17/12/2019 | 7:00 PM  | 0                | N              |
| 17/12/2019 | 8:00 PM  | 0                | N              |
| 17/12/2019 | 9:00 PM  | 0                | ---            |
| 17/12/2019 | 10:00 PM | 0                | ---            |
| 17/12/2019 | 11:00 PM | 0                | WNW            |
| 18/12/2019 | 12:00 AM | 0.4              | E              |
| 18/12/2019 | 1:00 AM  | 0                | NE             |
| 18/12/2019 | 2:00 AM  | 0                | ---            |
| 18/12/2019 | 3:00 AM  | 0                | NE             |
| 18/12/2019 | 4:00 AM  | 0                | ---            |
| 18/12/2019 | 5:00 AM  | 0                | ---            |
| 18/12/2019 | 6:00 AM  | 0                | SSE            |
| 18/12/2019 | 7:00 AM  | 0                | SSE            |
| 18/12/2019 | 8:00 AM  | 0                | ---            |
| 18/12/2019 | 9:00 AM  | 0.4              | NE             |
| 18/12/2019 | 10:00 AM | 0.9              | E              |
| 18/12/2019 | 11:00 AM | 1.3              | E              |
| 18/12/2019 | 12:00 PM | 1.3              | ENE            |
| 18/12/2019 | 1:00 PM  | 1.8              | NE             |
| 18/12/2019 | 2:00 PM  | 0.9              | NW             |
| 18/12/2019 | 3:00 PM  | 1.3              | N              |
| 18/12/2019 | 4:00 PM  | 1.8              | N              |
| 18/12/2019 | 5:00 PM  | 1.8              | E              |
| 18/12/2019 | 6:00 PM  | 1.8              | ENE            |
| 18/12/2019 | 7:00 PM  | 2.2              | SSE            |
| 18/12/2019 | 8:00 PM  | 2.7              | E              |
| 18/12/2019 | 9:00 PM  | 2.2              | SE             |
| 18/12/2019 | 10:00 PM | 2.7              | SE             |
| 18/12/2019 | 11:00 PM | 2.7              | N              |
| 19/12/2019 | 12:00 AM | 2.2              | N              |
| 19/12/2019 | 1:00 AM  | 2.2              | N              |
| 19/12/2019 | 2:00 AM  | 1.8              | N              |
| 19/12/2019 | 3:00 AM  | 1.8              | N              |
| 19/12/2019 | 4:00 AM  | 2.2              | N              |
| 19/12/2019 | 5:00 AM  | 1.8              | ENE            |
| 19/12/2019 | 6:00 AM  | 1.3              | NNE            |
| 19/12/2019 | 7:00 AM  | 1.3              | N              |
| 19/12/2019 | 8:00 AM  | 0.9              | NE             |



## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 19/12/2019 | 9:00 AM  | 0.9              | N              |
| 19/12/2019 | 10:00 AM | 1.3              | N              |
| 19/12/2019 | 11:00 AM | 2.2              | N              |
| 19/12/2019 | 12:00 PM | 2.2              | ENE            |
| 19/12/2019 | 1:00 PM  | 2.2              | S              |
| 19/12/2019 | 2:00 PM  | 2.2              | S              |
| 19/12/2019 | 3:00 PM  | 1.8              | S              |
| 19/12/2019 | 4:00 PM  | 1.8              | S              |
| 19/12/2019 | 5:00 PM  | 0.4              | NW             |
| 19/12/2019 | 6:00 PM  | 0.9              | NW             |
| 19/12/2019 | 7:00 PM  | 0.9              | N              |
| 19/12/2019 | 8:00 PM  | 0.9              | N              |
| 19/12/2019 | 9:00 PM  | 0.9              | N              |
| 19/12/2019 | 10:00 PM | 1.3              | ENE            |
| 19/12/2019 | 11:00 PM | 0.9              | ENE            |
| 20/12/2019 | 12:00 AM | 1.3              | NE             |
| 20/12/2019 | 1:00 AM  | 1.3              | NE             |
| 20/12/2019 | 2:00 AM  | 1.8              | NE             |
| 20/12/2019 | 3:00 AM  | 1.3              | ENE            |
| 20/12/2019 | 4:00 AM  | 0.9              | E              |
| 20/12/2019 | 5:00 AM  | 1.3              | NE             |
| 20/12/2019 | 6:00 AM  | 1.3              | NE             |
| 20/12/2019 | 7:00 AM  | 1.3              | ENE            |
| 20/12/2019 | 8:00 AM  | 1.3              | ENE            |
| 20/12/2019 | 9:00 AM  | 1.3              | E              |
| 20/12/2019 | 10:00 AM | 1.3              | NE             |
| 20/12/2019 | 11:00 AM | 1.8              | ENE            |
| 20/12/2019 | 12:00 PM | 1.3              | ENE            |
| 20/12/2019 | 1:00 PM  | 0.9              | NW             |
| 20/12/2019 | 2:00 PM  | 0.9              | NW             |
| 20/12/2019 | 3:00 PM  | 1.3              | S              |
| 20/12/2019 | 4:00 PM  | 0.9              | SSW            |
| 20/12/2019 | 5:00 PM  | 0.4              | S              |
| 20/12/2019 | 6:00 PM  | 0                | S              |
| 20/12/2019 | 7:00 PM  | 0                | S              |
| 20/12/2019 | 8:00 PM  | 0.4              | E              |
| 20/12/2019 | 9:00 PM  | 0.4              | N              |
| 20/12/2019 | 10:00 PM | 0.4              | NE             |
| 20/12/2019 | 11:00 PM | 0.9              | ENE            |
| 21/12/2019 | 12:00 AM | 0.4              | ENE            |
| 21/12/2019 | 1:00 AM  | 1.3              | E              |
| 21/12/2019 | 2:00 AM  | 1.3              | ENE            |
| 21/12/2019 | 3:00 AM  | 1.3              | ENE            |
| 21/12/2019 | 4:00 AM  | 0.4              | N              |
| 21/12/2019 | 5:00 AM  | 0.9              | NE             |
| 21/12/2019 | 6:00 AM  | 0.9              | ENE            |
| 21/12/2019 | 7:00 AM  | 0.9              | ENE            |
| 21/12/2019 | 8:00 AM  | 1.3              | ENE            |
| 21/12/2019 | 9:00 AM  | 0.9              | NE             |

## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 21/12/2019 | 10:00 AM | 0.4              | NW             |
| 21/12/2019 | 11:00 AM | 1.3              | N              |
| 21/12/2019 | 12:00 PM | 1.3              | NW             |
| 21/12/2019 | 1:00 PM  | 1.3              | NW             |
| 21/12/2019 | 2:00 PM  | 0.9              | NW             |
| 21/12/2019 | 3:00 PM  | 0.4              | NW             |
| 21/12/2019 | 4:00 PM  | 0                | NW             |
| 21/12/2019 | 5:00 PM  | 0                | NW             |
| 21/12/2019 | 6:00 PM  | 0.4              | N              |
| 21/12/2019 | 7:00 PM  | 0.4              | NE             |
| 21/12/2019 | 8:00 PM  | 0.4              | NE             |
| 21/12/2019 | 9:00 PM  | 0.4              | NW             |
| 21/12/2019 | 10:00 PM | 0.4              | SSE            |
| 21/12/2019 | 11:00 PM | 0                | S              |
| 22/12/2019 | 12:00 AM | 0                | ---            |
| 22/12/2019 | 1:00 AM  | 0                | ---            |
| 22/12/2019 | 2:00 AM  | 0                | ---            |
| 22/12/2019 | 3:00 AM  | 0                | ---            |
| 22/12/2019 | 4:00 AM  | 0                | ---            |
| 22/12/2019 | 5:00 AM  | 0                | ---            |
| 22/12/2019 | 6:00 AM  | 0                | ---            |
| 22/12/2019 | 7:00 AM  | 0                | ---            |
| 22/12/2019 | 8:00 AM  | 0                | ---            |
| 22/12/2019 | 9:00 AM  | 0.9              | E              |
| 22/12/2019 | 10:00 AM | 1.3              | S              |
| 22/12/2019 | 11:00 AM | 0.9              | S              |
| 22/12/2019 | 12:00 PM | 0.9              | NW             |
| 22/12/2019 | 1:00 PM  | 0.4              | NNW            |
| 22/12/2019 | 2:00 PM  | 0.9              | NW             |
| 22/12/2019 | 3:00 PM  | 0.4              | NW             |
| 22/12/2019 | 4:00 PM  | 0.4              | WNW            |
| 22/12/2019 | 5:00 PM  | 0.4              | S              |
| 22/12/2019 | 6:00 PM  | 0                | S              |
| 22/12/2019 | 7:00 PM  | 0                | S              |
| 22/12/2019 | 8:00 PM  | 0                | ---            |
| 22/12/2019 | 9:00 PM  | 0                | ---            |
| 22/12/2019 | 10:00 PM | 0                | ---            |
| 22/12/2019 | 11:00 PM | 0                | ---            |
| 23/12/2019 | 12:00 AM | 0                | ---            |
| 23/12/2019 | 1:00 AM  | 0                | S              |
| 23/12/2019 | 2:00 AM  | 0                | S              |
| 23/12/2019 | 3:00 AM  | 0                | ---            |
| 23/12/2019 | 4:00 AM  | 0                | S              |
| 23/12/2019 | 5:00 AM  | 0                | ---            |
| 23/12/2019 | 6:00 AM  | 0.4              | ENE            |
| 23/12/2019 | 7:00 AM  | 1.8              | N              |
| 23/12/2019 | 8:00 AM  | 2.7              | N              |
| 23/12/2019 | 9:00 AM  | 1.8              | NNW            |
| 23/12/2019 | 10:00 AM | 1.8              | N              |

## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 23/12/2019 | 11:00 AM | 1.8              | ENE            |
| 23/12/2019 | 12:00 PM | 2.7              | E              |
| 23/12/2019 | 1:00 PM  | 1.8              | E              |
| 23/12/2019 | 2:00 PM  | 1.8              | N              |
| 23/12/2019 | 3:00 PM  | 1.8              | N              |
| 23/12/2019 | 4:00 PM  | 1.8              | N              |
| 23/12/2019 | 5:00 PM  | 1.3              | N              |
| 23/12/2019 | 6:00 PM  | 1.8              | N              |
| 23/12/2019 | 7:00 PM  | 1.3              | NW             |
| 23/12/2019 | 8:00 PM  | 1.8              | NNW            |
| 23/12/2019 | 9:00 PM  | 1.8              | N              |
| 23/12/2019 | 10:00 PM | 2.7              | E              |
| 23/12/2019 | 11:00 PM | 1.8              | NE             |
| 24/12/2019 | 12:00 AM | 1.8              | N              |
| 24/12/2019 | 1:00 AM  | 2.2              | N              |
| 24/12/2019 | 2:00 AM  | 1.8              | N              |
| 24/12/2019 | 3:00 AM  | 1.3              | NNW            |
| 24/12/2019 | 4:00 AM  | 1.3              | NW             |
| 24/12/2019 | 5:00 AM  | 1.8              | NNW            |
| 24/12/2019 | 6:00 AM  | 1.3              | N              |
| 24/12/2019 | 7:00 AM  | 1.8              | NNW            |
| 24/12/2019 | 8:00 AM  | 1.8              | NNW            |
| 24/12/2019 | 9:00 AM  | 1.3              | E              |
| 24/12/2019 | 10:00 AM | 1.3              | NE             |
| 24/12/2019 | 11:00 AM | 1.3              | ENE            |
| 24/12/2019 | 12:00 PM | 1.3              | ENE            |
| 24/12/2019 | 1:00 PM  | 1.3              | NE             |
| 24/12/2019 | 2:00 PM  | 0.9              | N              |
| 24/12/2019 | 3:00 PM  | 0.9              | NW             |
| 24/12/2019 | 4:00 PM  | 0.4              | W              |
| 24/12/2019 | 5:00 PM  | 0.4              | S              |
| 24/12/2019 | 6:00 PM  | 0.4              | S              |
| 24/12/2019 | 7:00 PM  | 0                | S              |
| 24/12/2019 | 8:00 PM  | 0                | ---            |
| 24/12/2019 | 9:00 PM  | 0                | ---            |
| 24/12/2019 | 10:00 PM | 0                | NNW            |
| 24/12/2019 | 11:00 PM | 0.4              | NW             |
| 25/12/2019 | 12:00 AM | 0.4              | SSE            |
| 25/12/2019 | 1:00 AM  | 0.4              | ENE            |
| 25/12/2019 | 2:00 AM  | 0.9              | N              |
| 25/12/2019 | 3:00 AM  | 1.3              | NNE            |
| 25/12/2019 | 4:00 AM  | 1.3              | SSE            |
| 25/12/2019 | 5:00 AM  | 1.3              | NNE            |
| 25/12/2019 | 6:00 AM  | 1.3              | N              |
| 25/12/2019 | 7:00 AM  | 1.3              | NNE            |
| 25/12/2019 | 8:00 AM  | 1.8              | SSE            |
| 25/12/2019 | 9:00 AM  | 2.2              | E              |
| 25/12/2019 | 10:00 AM | 1.3              | N              |
| 25/12/2019 | 11:00 AM | 0.9              | NE             |

## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 25/12/2019 | 12:00 PM | 1.3              | ENE            |
| 25/12/2019 | 1:00 PM  | 0.9              | NW             |
| 25/12/2019 | 2:00 PM  | 0.9              | NW             |
| 25/12/2019 | 3:00 PM  | 0.4              | ENE            |
| 25/12/2019 | 4:00 PM  | 0.4              | NE             |
| 25/12/2019 | 5:00 PM  | 0.4              | NE             |
| 25/12/2019 | 6:00 PM  | 0                | ---            |
| 25/12/2019 | 7:00 PM  | 0                | ---            |
| 25/12/2019 | 8:00 PM  | 0                | ---            |
| 25/12/2019 | 9:00 PM  | 0                | ---            |
| 25/12/2019 | 10:00 PM | 0                | ---            |
| 25/12/2019 | 11:00 PM | 0                | ---            |
| 26/12/2019 | 12:00 AM | 0                | ---            |
| 26/12/2019 | 1:00 AM  | 0                | ---            |
| 26/12/2019 | 2:00 AM  | 0                | ---            |
| 26/12/2019 | 3:00 AM  | 0                | ---            |
| 26/12/2019 | 4:00 AM  | 0                | ---            |
| 26/12/2019 | 5:00 AM  | 0                | SSW            |
| 26/12/2019 | 6:00 AM  | 0                | SSW            |
| 26/12/2019 | 7:00 AM  | 0.4              | S              |
| 26/12/2019 | 8:00 AM  | 0.4              | SW             |
| 26/12/2019 | 9:00 AM  | 0                | WSW            |
| 26/12/2019 | 10:00 AM | 0.4              | SW             |
| 26/12/2019 | 11:00 AM | 0.9              | SW             |
| 26/12/2019 | 12:00 PM | 1.8              | S              |
| 26/12/2019 | 1:00 PM  | 1.3              | S              |
| 26/12/2019 | 2:00 PM  | 1.8              | S              |
| 26/12/2019 | 3:00 PM  | 1.8              | S              |
| 26/12/2019 | 4:00 PM  | 1.8              | S              |
| 26/12/2019 | 5:00 PM  | 2.7              | S              |
| 26/12/2019 | 6:00 PM  | 2.2              | S              |
| 26/12/2019 | 7:00 PM  | 2.7              | NNE            |
| 26/12/2019 | 8:00 PM  | 2.7              | NE             |
| 26/12/2019 | 9:00 PM  | 3.1              | ENE            |
| 26/12/2019 | 10:00 PM | 2.2              | NE             |
| 26/12/2019 | 11:00 PM | 1.3              | NE             |
| 27/12/2019 | 12:00 AM | 1.8              | ENE            |
| 27/12/2019 | 1:00 AM  | 1.3              | ENE            |
| 27/12/2019 | 2:00 AM  | 1.3              | N              |
| 27/12/2019 | 3:00 AM  | 1.3              | NE             |
| 27/12/2019 | 4:00 AM  | 1.8              | N              |
| 27/12/2019 | 5:00 AM  | 1.3              | N              |
| 27/12/2019 | 6:00 AM  | 0.4              | NNE            |
| 27/12/2019 | 7:00 AM  | 0.4              | S              |
| 27/12/2019 | 8:00 AM  | 0.9              | N              |
| 27/12/2019 | 9:00 AM  | 0.9              | N              |
| 27/12/2019 | 10:00 AM | 0.9              | NNE            |
| 27/12/2019 | 11:00 AM | 0.4              | E              |
| 27/12/2019 | 12:00 PM | 0.9              | N              |

## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 27/12/2019 | 1:00 PM  | 1.3              | NNE            |
| 27/12/2019 | 2:00 PM  | 0.9              | NW             |
| 27/12/2019 | 3:00 PM  | 0.4              | NW             |
| 27/12/2019 | 4:00 PM  | 0.4              | S              |
| 27/12/2019 | 5:00 PM  | 0.4              | S              |
| 27/12/2019 | 6:00 PM  | 0                | WNW            |
| 27/12/2019 | 7:00 PM  | 1.3              | N              |
| 27/12/2019 | 8:00 PM  | 0.9              | NW             |
| 27/12/2019 | 9:00 PM  | 0.4              | ENE            |
| 27/12/2019 | 10:00 PM | 0                | NNW            |
| 27/12/2019 | 11:00 PM | 0                | ---            |
| 28/12/2019 | 12:00 AM | 0.4              | E              |
| 28/12/2019 | 1:00 AM  | 0.4              | N              |
| 28/12/2019 | 2:00 AM  | 0.9              | E              |
| 28/12/2019 | 3:00 AM  | 1.8              | ENE            |
| 28/12/2019 | 4:00 AM  | 1.3              | ENE            |
| 28/12/2019 | 5:00 AM  | 0                | ENE            |
| 28/12/2019 | 6:00 AM  | 0.9              | E              |
| 28/12/2019 | 7:00 AM  | 0.4              | NE             |
| 28/12/2019 | 8:00 AM  | 1.3              | E              |
| 28/12/2019 | 9:00 AM  | 1.8              | ENE            |
| 28/12/2019 | 10:00 AM | 1.3              | ENE            |
| 28/12/2019 | 11:00 AM | 1.8              | NE             |
| 28/12/2019 | 12:00 PM | 1.3              | ENE            |
| 28/12/2019 | 1:00 PM  | 1.8              | N              |
| 28/12/2019 | 2:00 PM  | 1.3              | NW             |
| 28/12/2019 | 3:00 PM  | 0.9              | NNW            |
| 28/12/2019 | 4:00 PM  | 0.4              | NW             |
| 28/12/2019 | 5:00 PM  | 0                | SW             |
| 28/12/2019 | 6:00 PM  | 0                | S              |
| 28/12/2019 | 7:00 PM  | 0                | S              |
| 28/12/2019 | 8:00 PM  | 0                | ---            |
| 28/12/2019 | 9:00 PM  | 0                | ---            |
| 28/12/2019 | 10:00 PM | 0                | E              |
| 28/12/2019 | 11:00 PM | 0                | ---            |
| 29/12/2019 | 12:00 AM | 0.4              | NNW            |
| 29/12/2019 | 1:00 AM  | 0.9              | ENE            |
| 29/12/2019 | 2:00 AM  | 0.9              | ENE            |
| 29/12/2019 | 3:00 AM  | 0                | ---            |
| 29/12/2019 | 4:00 AM  | 0                | NNE            |
| 29/12/2019 | 5:00 AM  | 0.4              | ENE            |
| 29/12/2019 | 6:00 AM  | 0.4              | ENE            |
| 29/12/2019 | 7:00 AM  | 0.9              | N              |
| 29/12/2019 | 8:00 AM  | 0.4              | N              |
| 29/12/2019 | 9:00 AM  | 0.9              | ENE            |
| 29/12/2019 | 10:00 AM | 0.4              | ENE            |
| 29/12/2019 | 11:00 AM | 0                | NNW            |
| 29/12/2019 | 12:00 PM | 0                | ---            |
| 29/12/2019 | 1:00 PM  | 0                | ---            |



## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 29/12/2019 | 2:00 PM  | 0                | ---            |
| 29/12/2019 | 3:00 PM  | 0.4              | NNW            |
| 29/12/2019 | 4:00 PM  | 0.4              | NNE            |
| 29/12/2019 | 5:00 PM  | 0.4              | E              |
| 29/12/2019 | 6:00 PM  | 0.4              | E              |
| 29/12/2019 | 7:00 PM  | 0                | SE             |
| 29/12/2019 | 8:00 PM  | 0.4              | E              |
| 29/12/2019 | 9:00 PM  | 1.3              | NNW            |
| 29/12/2019 | 10:00 PM | 1.3              | NNE            |
| 29/12/2019 | 11:00 PM | 0                | ENE            |
| 30/12/2019 | 12:00 AM | 0                | ---            |
| 30/12/2019 | 1:00 AM  | 0.4              | ENE            |
| 30/12/2019 | 2:00 AM  | 0.4              | ENE            |
| 30/12/2019 | 3:00 AM  | 0                | ENE            |
| 30/12/2019 | 4:00 AM  | 0.4              | ENE            |
| 30/12/2019 | 5:00 AM  | 0.4              | E              |
| 30/12/2019 | 6:00 AM  | 0.4              | E              |
| 30/12/2019 | 7:00 AM  | 0                | E              |
| 30/12/2019 | 8:00 AM  | 0.4              | E              |
| 30/12/2019 | 9:00 AM  | 0.4              | E              |
| 30/12/2019 | 10:00 AM | 0.4              | NE             |
| 30/12/2019 | 11:00 AM | 0.9              | NE             |
| 30/12/2019 | 12:00 PM | 0.9              | E              |
| 30/12/2019 | 1:00 PM  | 0.9              | NW             |
| 30/12/2019 | 2:00 PM  | 1.3              | NW             |
| 30/12/2019 | 3:00 PM  | 1.3              | NNW            |
| 30/12/2019 | 4:00 PM  | 1.3              | NNW            |
| 30/12/2019 | 5:00 PM  | 2.2              | NNW            |
| 30/12/2019 | 6:00 PM  | 2.2              | N              |
| 30/12/2019 | 7:00 PM  | 1.8              | N              |
| 30/12/2019 | 8:00 PM  | 2.2              | NNW            |
| 30/12/2019 | 9:00 PM  | 2.7              | NNW            |
| 30/12/2019 | 10:00 PM | 1.8              | NW             |
| 30/12/2019 | 11:00 PM | 1.3              | NW             |
| 31/12/2019 | 12:00 AM | 1.8              | NNW            |
| 31/12/2019 | 1:00 AM  | 1.8              | NNW            |
| 31/12/2019 | 2:00 AM  | 2.2              | NNW            |
| 31/12/2019 | 3:00 AM  | 2.2              | NNW            |
| 31/12/2019 | 4:00 AM  | 1.8              | NNW            |
| 31/12/2019 | 5:00 AM  | 0.9              | S              |
| 31/12/2019 | 6:00 AM  | 0.9              | E              |
| 31/12/2019 | 7:00 AM  | 0.9              | E              |
| 31/12/2019 | 8:00 AM  | 0.9              | NNW            |
| 31/12/2019 | 9:00 AM  | 0.9              | NNW            |
| 31/12/2019 | 10:00 AM | 1.3              | NNW            |
| 31/12/2019 | 11:00 AM | 1.3              | NNW            |
| 31/12/2019 | 12:00 PM | 1.8              | N              |
| 31/12/2019 | 1:00 PM  | 1.8              | NNW            |
| 31/12/2019 | 2:00 PM  | 1.3              | NNW            |

## Wind Data

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 31/12/2019 | 3:00 PM  | 1.3              | NNW            |
| 31/12/2019 | 4:00 PM  | 0.9              | NW             |
| 31/12/2019 | 5:00 PM  | 1.8              | NNW            |
| 31/12/2019 | 6:00 PM  | 1.8              | NNW            |
| 31/12/2019 | 7:00 PM  | 1.8              | NW             |
| 31/12/2019 | 8:00 PM  | 1.3              | NNW            |
| 31/12/2019 | 9:00 PM  | 1.3              | NW             |
| 31/12/2019 | 10:00 PM | 0.9              | NNW            |
| 31/12/2019 | 11:00 PM | 1.3              | NNW            |

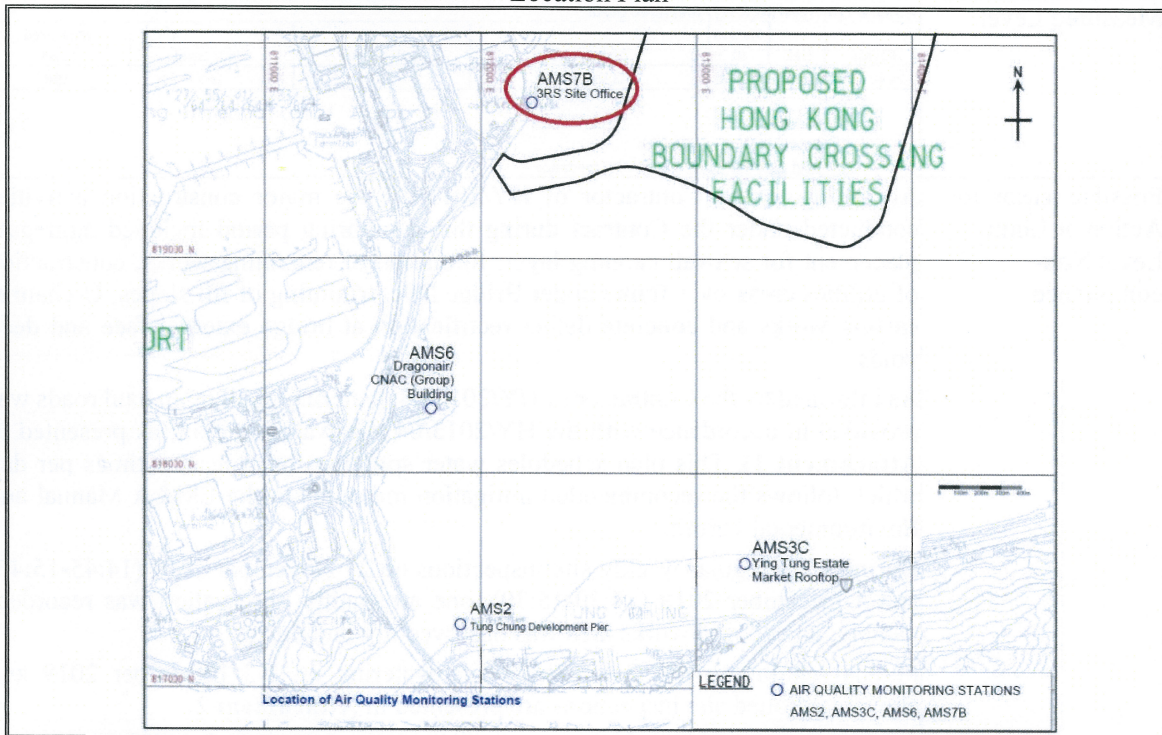
# Appendix N. Investigation Report

**Incident Report on Action Level or Limit Level Non-compliance**

| Contract   | Contract No. HY/2013/04<br>HZMB HKBCF – Infrastructure Works Stage II (Southern Portion)   |            |                 |              |             |                |  |        |      |            |             |              |             |                |           |                          |       |                 |     |     |     |
|--|--|------------|-----------------|--------------|-------------|----------------|--|--------|------|------------|-------------|--------------|-------------|----------------|-----------|--------------------------|-------|-----------------|-----|-----|-----|
| Ref. No.   | E105   |            |                 |              |             |                |  |        |      |            |             |              |             |                |           |                          |       |                 |     |     |     |
| Date   | 2 December 2019  |            |                 |              |             |                |  |        |      |            |             |              |             |                |           |                          |       |                 |     |     |     |
| Time (hh:mm)   | Start time: 08:34 (a.m.)   |            |                 |              |             |                |  |        |      |            |             |              |             |                |           |                          |       |                 |     |     |     |
| Monitoring Location                                      | AMS7B  |            |                 |              |             |                |  |        |      |            |             |              |             |                |           |                          |       |                 |     |     |     |
| Parameter  | Air Quality – 24-hour TSP ( $\mu\text{g}/\text{m}^3$ )   |            |                 |              |             |                |  |        |      |            |             |              |             |                |           |                          |       |                 |     |     |     |
| Action Level   | See below  |            |                 |              |             |                |  |        |      |            |             |              |             |                |           |                          |       |                 |     |     |     |
| Limit Level  | See below  |            |                 |              |             |                |  |        |      |            |             |              |             |                |           |                          |       |                 |     |     |     |
| Measured Level   | <p>Action &amp; Limit Level (AL &amp; LL) / Measured Level:</p> <table border="1"> <thead> <tr> <th>Param.</th><th>Unit</th><th>Station ID</th><th>Description</th><th>Action Level</th><th>Limit Level</th><th>Measured Level</th></tr> </thead> <tbody> <tr> <td>24-hr TSP</td><td><math>\mu\text{g}/\text{m}^3</math></td><td>AMS7B</td><td>3RS Site Office</td><td>183</td><td>260</td><td>198</td></tr> </tbody> </table> <p>Remarks:<br/>Bold means AL exceedance<br/>Bold with underline means LL exceedance</p>  |            |                 |              |             |                |  | Param. | Unit | Station ID | Description | Action Level | Limit Level | Measured Level | 24-hr TSP | $\mu\text{g}/\text{m}^3$ | AMS7B | 3RS Site Office | 183 | 260 | 198 |
| Param.   | Unit   | Station ID | Description     | Action Level | Limit Level | Measured Level |  |        |      |            |             |              |             |                |           |                          |       |                 |     |     |     |
| 24-hr TSP  | $\mu\text{g}/\text{m}^3$   | AMS7B      | 3RS Site Office | 183          | 260         | 198            |  |        |      |            |             |              |             |                |           |                          |       |                 |     |     |     |
| Possible reason for Action or Limit Level Non-compliance | <p>According to the Contractor of HY/2013/04, the major construction activities conducted under the Contract during the monitoring period included aggregate placement for seawall capping layer, formation of remaining works, construction of utilities cross-over frame under Bridge D9c, trimming of fill slopes, U-channel casting works and concrete defect rectification at bridge external face and deck voids.</p> <p>As informed by the Contractor of HY/2013/04, watering of all main haul roads was provided in accordance with the HY/2013/04 site watering plan (as presented in <b>Attachment 1</b>). This plan schedules water spraying for at least 8 times per day which follows the recommended mitigation measures in the EM&amp;A Manual and Environmental Permit.</p> <p>During ET's regular weekly site inspections on 27 November 2019 (14:45-15:45) and 4 December 2019 (14:30-15:30), one air quality observation was recorded: namely, an exposed works area was observed dry and dusty.</p> <p>Photos relating to the Contractor's site watering on 1-3 December 2019 and abovementioned site inspections are presented in <b>Attachment 2</b>.</p> <p>The wind data collected at the AMS3C wind station at Ying Tung Estate and the Hong Kong Observatory wind station at Chek Lap Kok during the abovementioned 24-hour monitoring period (as presented in <b>Attachment 3</b>) shows that winds were in the NNW to ENE range during the 24-hour TSP monitoring. This indicates that it was unlikely that the source of exceedance could be attributed to HY/2013/04.</p> <p>Information available on EPD's Air Quality Health Index (AQHI) website shows that the short-term health risk of air pollution between 8:00 a.m. on 2 December 2019 and 8:00 a.m. on 3 December 2019 was low to moderate at Tung Chung (with maximum AQHI of 4 at 14:00-02:00 a.m. and 07:00-08:00 a.m.). The AQHI data is available online at:</p> <ul style="list-style-type: none"> <li><a href="http://www.aqhi.gov.hk/epd/ddata/html/history/2019/201912_Eng.csv">http://www.aqhi.gov.hk/epd/ddata/html/history/2019/201912_Eng.csv</a></li> </ul> <p>It was concluded that the exceedance was not due to HY/2013/04.</p> |            |                 |              |             |                |  |        |      |            |             |              |             |                |           |                          |       |                 |     |     |     |

|                             |  |
|-----------------------------|--|
| Actions taken / to be taken | Although the exceedance was considered not due to HY/2013/04, the Contractor is reminded to continue the proper implementation of the site watering plan for the Contract and implement all necessary air quality mitigation measures identified in the EM&A Manual.   |
| Remarks                     | <p>ET of HY/2013/04 issued notification of exceedance (NOE) as follows:</p> <ul style="list-style-type: none"> <li>• <u>24-hour TSP</u>: 20 December 2019 (Notification No. 20191202_Air_24hr).</li> </ul> <p>Attachments to this report are as follows:</p> <ol style="list-style-type: none"> <li>1. Site watering plan for HY/2013/04.</li> <li>2. Photos of Contractor's site watering on 1-3 December 2019, plus site mitigation measures and air quality observations on 27 November and 4 December 2019.</li> <li>3. Wind data during the 24-hour TSP monitoring period at AMS3C wind station at Ying Tung Estate and Hong Kong Observatory Chek Lap Kok wind station.</li> </ol> |

Location Plan

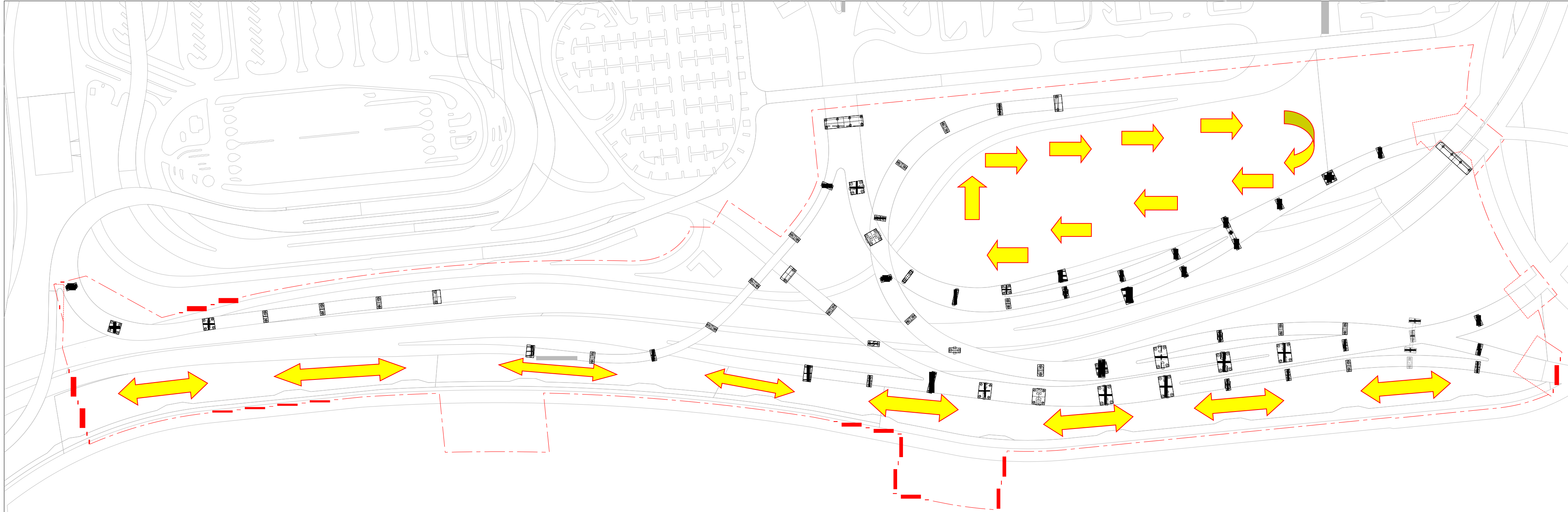


Prepared by: Gary Chow  
Designation: Environmental Team Leader (Contract No. HY/2013/04)  
Signature:

Date: 8 January 2020



## **Attachment 1**



1:500 ( A0 Banner )

**HY/2013/04 Site Watering Plan**

## **Attachment 2**

## Photos of dust mitigation measures









**Photo record of site mitigation measures and air quality observations  
during weekly environmental site inspection**

**27 November 2019**



1. Air quality observation: The exposed works area was observed dry and dusty.

**4 December 2019**



1. Air quality observation: The exposed works area was observed dry and dusty.

## **Attachment 3**

### Wind Data at AMS3C

| Date       | Time     | Wind Speed (m/s) | Wind Direction |
|------------|----------|------------------|----------------|
| 02/12/2019 | 8:00 AM  | 3.1              | NE             |
| 02/12/2019 | 9:00 AM  | 3.1              | NNE            |
| 02/12/2019 | 10:00 AM | 2.7              | N              |
| 02/12/2019 | 11:00 AM | 2.2              | N              |
| 02/12/2019 | 12:00 PM | 2.2              | N              |
| 02/12/2019 | 1:00 PM  | 2.2              | NNW            |
| 02/12/2019 | 2:00 PM  | 2.2              | N              |
| 02/12/2019 | 3:00 PM  | 2.2              | NNW            |
| 02/12/2019 | 4:00 PM  | 2.2              | N              |
| 02/12/2019 | 5:00 PM  | 3.1              | NNE            |
| 02/12/2019 | 6:00 PM  | 2.7              | NNE            |
| 02/12/2019 | 7:00 PM  | 3.1              | NE             |
| 03/12/2019 | 8:00 PM  | 3.1              | NE             |
| 03/12/2019 | 9:00 PM  | 2.7              | NE             |
| 03/12/2019 | 10:00 PM | 3.6              | NE             |
| 03/12/2019 | 11:00 PM | 2.7              | ENE            |
| 03/12/2019 | 12:00 AM | 2.2              | NE             |
| 03/12/2019 | 1:00 AM  | 1.3              | NE             |
| 03/12/2019 | 2:00 AM  | 2.2              | NE             |
| 03/12/2019 | 3:00 AM  | 2.7              | NE             |
| 03/12/2019 | 4:00 AM  | 1.8              | NE             |
| 03/12/2019 | 5:00 AM  | 1.3              | NE             |
| 03/12/2019 | 6:00 AM  | 0.4              | N              |
| 03/12/2019 | 7:00 AM  | 0.9              | E              |
| 03/12/2019 | 8:00 AM  | 1.8              | E              |

**Wind Data at Chek Lap Kok Collected by the Hong Kong Observatory**

| <b>Date &amp; Time</b> | <b>Wind Speed<br/>(km/h)</b> | <b>Wind Speed<br/>(m/s)</b> | <b>Wind Direction<br/>(degrees)</b> |
|------------------------|------------------------------|-----------------------------|-------------------------------------|
| 02/12/2019 08:00       | 20.9                         | 5.8                         | 24                                  |
| 02/12/2019 09:00       | 22.7                         | 6.3                         | 21                                  |
| 02/12/2019 10:00       | 28.1                         | 7.8                         | 352                                 |
| 02/12/2019 11:00       | 26.6                         | 7.4                         | 1                                   |
| 02/12/2019 12:00       | 24.1                         | 6.7                         | 346                                 |
| 02/12/2019 13:00       | 24.5                         | 6.8                         | 342                                 |
| 02/12/2019 14:00       | 26.6                         | 7.4                         | 340                                 |
| 02/12/2019 15:00       | 25.6                         | 7.1                         | 347                                 |
| 02/12/2019 16:00       | 23.8                         | 6.6                         | 350                                 |
| 02/12/2019 17:00       | 24.5                         | 6.8                         | 351                                 |
| 02/12/2019 18:00       | 29.9                         | 8.3                         | 360                                 |
| 02/12/2019 19:00       | 22.3                         | 6.2                         | 21                                  |
| 02/12/2019 20:00       | 24.5                         | 6.8                         | 19                                  |
| 02/12/2019 21:00       | 18.7                         | 5.2                         | 32                                  |
| 02/12/2019 22:00       | 23.0                         | 6.4                         | 27                                  |
| 02/12/2019 23:00       | 20.5                         | 5.7                         | 35                                  |
| 03/12/2019 00:00       | 20.9                         | 5.8                         | 23                                  |
| 03/12/2019 01:00       | 19.8                         | 5.5                         | 25                                  |
| 03/12/2019 02:00       | 19.8                         | 5.5                         | 23                                  |
| 03/12/2019 03:00       | 14.0                         | 3.9                         | 34                                  |
| 03/12/2019 04:00       | 16.9                         | 4.7                         | 28                                  |
| 03/12/2019 05:00       | 13.7                         | 3.8                         | 25                                  |
| 03/12/2019 06:00       | 15.8                         | 4.4                         | 30                                  |
| 03/12/2019 07:00       | 26.3                         | 7.3                         | 43                                  |
| 03/12/2019 08:00       | 23.8                         | 6.6                         | 45                                  |