NMAR

Ocean Park Corporation, Hong Kong

Repositioning and Long Term Operation Plan of Ocean Park: *Noise Mitigation and Audit Report for Phase 1*

August 2014

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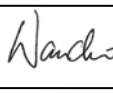
Repositioning and Long Term Operation Plan of Ocean Park: *Noise Mitigation and Audit Report for Phase 1*

August 2014

Reference 0238176

For and on behalf of ERM-Hong Kong, Limited	
Approved by:	Frank Wan
Signed:	
Position:	Partner
Date:	14 August 2014

CONTENTS

LIST OF ANNEXES

1 INTRODUCTION

1.1 BACKGROUND

Following the approval of the Repositioning and Long Term Operation Plan of Ocean Park (the Project) Environmental Impact Assessment (EIA) report (Register No.: AEIAR-101/2006) (hereafter referred to as the approved EIA Report), an Environmental Permit (EP) (EP-249/2006) was granted for the Project in July 2006 and amendments to the EP were approved in October 2006, November 2010 and December 2013. To update the opening hours of the Ocean Park (the Park) and the layout plans for the Waterfront and Summit, an application for Variation of EP (VEP) was submitted to the EPD and new EP (EP-249/2006/D) was issued on 02 July 2014.

In accordance with Condition 2.26 of the EP-249/2006/D, the Permit Holder shall deposit with the Director four hard copies and one electric copy of Noise Mitigation and Audit Report (NMAR), no later than two weeks after the completion of noise measurement and audit works are carried out. The Permit Holder shall carry out noise measurement and audit works according to the Noise Mitigation and Audit Plan(s) (NMAP) and submit a *Report on Commissioning Test Results* to the Director for approval, prior to the implementation of the specified periods of the proposed extension of opening hours.

1.2 PURPOSES OF THIS REPORT

If the results of the commissioning test demonstrate that the mitigation measures have achieved the required Sound Power Levels (SWLs), the extension of the opening hours will be implemented in three phases, as follows:

- Phase 1 – extension of the opening hours of the Park from 10:00 to 09:00 hours and from 22:00 to 23:00 hours (excluding the Sky Fair Plaza Performance Venue and attractions for special events);

- Phase 2 - extension of the opening hours of the Park during Special Events to 01:00 hours and extension of opening hours of Restaurants and Retail Shops from 09:00 to 08:00 hours and from 23:00 to 02:00 hours of the next day (excluding the Sky Fair Plaza Performance Venue); and

- Phase 3 – operation of the Sky Fair Plaza Performance Venue.

This *NMAR* presents the proposed noise measurement result for the commissioning test for Phase 1 in accordance with Condition 2.27 of the EP-249/2006/D.

2 *MEASUREMENT METHODOLOGY*

A-weighted equivalent continuous noise level (L_{Aeq}) was measured at specified distances from the plant items and compared with the commissioning requirements given in *Table 2.1* of the NMAP for Phase 1 deposited in accordance with Condition 2.25 of the EP-249/2006/D. For fixed plant items that generate relatively continuous and steady noise, such as the split-type AC unit, AC plant, chiller, fan room, and ventilation fan, the noise measurement will be over a 1-minute period. For the PA system at Aqua City, the measurement will be over a 5-minute period. For each items, three sets of measurement data will be taken.

The background (B/G) noise was measured in terms of $L_{Aeq,\ 1\ min}$ at the same measurement point when the concerned plant item is switched off. At each location, one set of background noise data will be taken. If any abnormal intrusive noise exists during background noise measurement, the measurement data will be discarded. The measured noise levels will be subject to background noise correction in accordance with standard acoustical principles.

The measurement locations are presented in *Annex A*.

The measurement noise levels, mitigation measures, details of measurement parameters and measurement distances for each of the plant items for Phase 1 are summarised in *Table 2.1* of the NMAP.

All noise measurement was supervised and endorsed by a qualified person possessing at least seven years of noise control experience and a corporate membership of Hong Kong Institute of Acoustics or equivalent.

The instruments that will be used for the noise measurements shall comply with International Electrotechnical Commission Publications 651:1979 (Type 1) and 804:1985 (Type 1).

Before and after each series of measurements, a sound calibrator was applied to each microphone to verify the calibration of the measuring system. The difference between the readings made before and after each series of measurements shall be less than or equal to 0.5 dB. If this value is exceeded, the results of this series of measurements shall be discarded.

The sound calibrator will be calibrated at intervals not exceeding 1 year and the compliance of the sound level meters with the requirements of IEC 61672-1 verified at intervals not exceeding 2 years. Sound level meters and calibrators used are listed in the *Table 3.1*. The equipment calibration certificates are shown in *Annex B*. For the above-mentioned requirement, reference was made to the approved EM&A plan for other theme park (e.g. Section 5.3 of EM&A Plan (Revision H) prepared under EP-01/059/2000/C[1]) and relevant ISO standard (e.g ISO 3746-2010, Section 5.2, 3rd paragraph).

Table 3.1 Noise Measurement Equipment

Equipment	Model	Serial Number
Sound Level Meter	01dB – Solo	65225
	01dB – Solo	65226
Calibrator	Svantek SV30A	No.7971
	01dB – CAL 21	No.34113609(2011)

The measurement parameter will be set to A-weighted sound pressure level and the time weighting was set in fast response.

[1] http://www.epd.gov.hk/eia/register/english/permit/vep3782012/documents/emarp/pdf/emarp.pdf

4 MEASUREMENT RESULTS

Noise measurement was carried out by Isaac Chu, Chris Hoi, Alvina Chau and supervised by Mandy To from ERM-Hong Kong Limited from 31 July 2014 to 8 August 2014. Noise measurement results for the fixed plant items (as listed in Table 2 of the EP) are summarized in the below sections. Measurement parameter and measurement distance for each fixed plant item followed the NMAP for Phase 1.

4.1 PA SYSTEM AT AQUA CITY (WF05)

Before the commissioning measurement carried out, a screening noise measurement was conducted for two different sound tracks (ie Announcement and Background music) to determine the worst case scenario (ie to find out which sound track generates higher noise level). Under the same volume setting (output as "-24dB"), the measured background music sound track was found to generate a higher noise level. Sound track of background music was then used for the commissioning test. The microphone was pointed toward the principle axis of the loudspeaker. The test was conducted under the output setting of "-24dB". The location of the PA cluster is shown in *Annex A1*. Measured noise levels are summarized in *Tables 4.1a* to *4.1d*.

Table 4.1a Noise Measurement Details for PA system at Aqua City (WF05)

Fixed Plant Item	Dimension (L x W x H)	Measurement distance	Before Calibration, dB(A)	After Calibration, dB(A)
PA system at Aqua City (WF05)	0.65 x 0.3 x 0.4	3m from a PA cluster	93.9	93.9

Table 4.1b Screening Noise Measurement Results for PA system at Aqua City (WF05)

Scenario	Measured Noise Levels, $L_{eq, 1\ min}$, dB(A)			Highest Level, dB(A)	B/G noise level, dB(A)	B/G corrected noise level, dB(A)
	1	2	3			
Loudspeaker playing announcement sound track	54.2	54.1	54.1	54.2	50.3	51.9
Loudspeaker playing background music sound track	54.0	54.7	54.0	54.7	50.4	52.7

Table 4.1c Noise Measurement Results for PA system at Aqua City (WF05)

Scenario	Measured Noise Levels, $L_{eq, 5\ min}$, dB(A)			Highest Level, dB(A)	B/G noise level, dB(A)	B/G corrected noise level, dB(A)
	1	2	3			
Loudspeaker playing Background music sound track	54.6	54.8	54.8	54.8	50.4	52.8

Table 4.1d Sound Power Level of PA system at Aqua City (WF05)

Fixed Plant Item	B/G corrected noise level, dB(A)	Measurement distance to the center of the fixed plant, m	SWL per PA cluster, dB(A)	No of PA cluster to be used during Phase 1	Total SWL , dB(A)	Maximum allowable SWL
PA system at Aqua City (WF05)	52.8	3	70dB(A)	53	88	90

Ocean Park Corporation (OPC) confirmed that a computerized volume control system will be used to adjust the volume of loudspeaker to the output of "-24dB"during Lagoon Show (excluding the PA used for Lagoon Show). The SWL of PA system at Aqua City of volume setting of "-24dB"complies with its maximum allowable SWL for Phase 1.

4.2 *SPLIT-TYPE A/C UNIT AT CORAL BUILDING (WF06)*

A total of 20 split-type A/C units at Coral Building that may be used during Lagoon show were measured. There are 12 split-type AC units on the ground level of the building and 8 split-type AC unit on the rooftop. The locations of the 20 split –type AC units are shown in *Annex A2*. The split–type units were measured individually during the commissioning test. The identification numbers and the measurement result are presented in *Tables 4.2a* to *4.2c*.

Table 4.2a Noise Measurement Details for the 20 split-type A/C units at Coral Building (WF06)

Fixed Plant Item	Dimension	Measurement distance	Before Calibration, dB(A)	After Calibration, dB(A)
Split-type A/C units at Coral Building (WF06)	1.1m x 0.3m x 0.5m	2.5m from the split type AC unit	93.9	93.9

Table 4.2b Noise Measurement Results for the 20 split-type A/C units at Coral Building (WF06)

Identification number of split type AC unit	Measured Noise Levels, $L_{eq, 1\ min}$, dB(A)			Highest level, dB(A)	B/G noise level, dB(A)	B/G corrected noise level, dB(A)
	1	2	3			
Ground level split-type AC units						
AC4	52.2	51.8	52.1	52.2	47.3	50.5
AC5	52.1	52.2	52.0	52.2	47.7	50.3
AC6	54.1	53.9	54.5	54.5	47.3	53.6
AC7	54.4	54.4	54.9	54.9	48.4	53.8
AC8	53.2	55.5	54.6	55.5	47.6	54.7
AC10	51.4	51.4	52.5	52.5	47.5	50.8
AC11	51.8	50.9	51.5	51.8	47.6	49.7
AC13	56.2	56.4	56.8	56.8	47.9	56.2
AC14	51.9	51.5	51.8	51.9	47.3	50.1
AC15	54.3	55.7	53.7	55.7	47.8	54.9
AC18	51.6	51.2	51.8	51.8	47.5	49.8
AC19	51.7	51.6	51.6	51.7	47.9	49.4
Rooftop level split-type AC units						
RAC1	54.5	52.0	52.5	54.5	49.2	53.0
RAC3	55.8	54.9	54.6	55.8	51.5	53.8
RAC4	56.1	55.4	54.9	56.1	49.2	55.1
RAC5	54.3	54.3	54.4	54.4	50.4	52.2
RAC6	57.1	56.5	56.6	57.1	48.4	56.5
RAC10	55.8	56.1	55.4	56.1	51.3	54.4
RAC11	56.7	57.0	56.9	57.0	53.5	54.4
RAC12	57.0	57.2	57.1	57.2	52.1	55.6

Table 4.2c Sound Power Level of split-type A/C units at Coral Building (WF06)

Identification number of split type AC unit	B/G corrected noise level, dB(A)	Measurement distance to the center of the fixed plant, m	SWL, dB(A)
Ground level split type AC unit			
AC4	50.5	2.5	66
AC5	50.3	2.5	66
AC6	53.6	2.5	70
AC7	53.8	2.5	70
AC8	54.7	2.5	71
AC10	50.8	2.5	67
AC11	49.7	2.5	66
AC13	56.2	2.5	72
AC14	50.1	2.5	66
AC15	54.9	2.5	71
AC18	49.8	2.5	66
AC19	49.4	2.5	65
Rooftop level split type AC unit			
RAC1	53.0	2.5	69
RAC2	53.8	2.5	70
RAC3	55.1	2.5	71

Identification number of split type AC unit	B/G corrected noise level, dB(A)	Measurement distance to the center of the fixed plant, m	SWL, dB(A)
RAC4	52.2	2.5	68
RAC5	56.5	2.5	72
RAC6	54.4	2.5	70
RAC7	54.4	2.5	70
RAC8	55.6	2.5	72
		Total SWL	**82**
		Maximum allowable SWL	**84**
		Compliance	**Yes**

OPC confirmed that only the measured 20 split-type A/C units will be operated during Lagoon Show, other split-type A/C units at Coral Building will be turn off by a timer system during Lagoon Show.

4.3 SPLIT-TYPE A/C UNITS AT ADMINISTRATION BUILDING (WF17)

This building is under renovation. Relevant commissioning requirements have been included in the specification for the renovation works. NMAR will be submitted to EPD for approval upon the completion of the renovation and will be operated during Lagoon Show.

4.4 AC PLANT AT EAST RETAIL (WF20)

OPC confirmed that timer system has been implemented to shut down all of the AC plant at East Retail during Lagoon Show.

4.5 AC PLANT AT OLD HONG KONG (WF23)

Two new cooling towers were installed at rooftop of the Koala attraction in old Hong Kong area to replace the old AC plant. Only 1 cooling tower will be operated at any time during Phase 1. As confirmed by representatives from Towngas and OPC, the cooling towers were set in normal operation mode during the noise measurement. Two cooling towers were measured individually during the commissioning test. The measurement locations of the cooling towers are shown in *Annex A3*. The measurement results are presented in *Tables 4.5a* to *4.5c*.

Table 4.5a Noise Measurement Details for Cooling Towers at Old Hong Kong (WF23)

Fixed Plant Item	Dimension	Measurement distance	Before Calibration, dB(A)	After Calibration, dB(A)
Cooling Towers at Old Hong Kong (WF23)	3.0 x 2.3 x 3.0	6m from the cooling tower	93.9	93.9

Table 4.5b Noise Measurement Results for Cooling Towers at Old Hong Kong (WF23)

Fixed Plant Item	Measured Noise Levels, $L_{eq, 1\ min}$, dB(A)			Highest Level, dB(A)	B/G noise level, dB(A)	B/G corrected noise level, dB(A)
	1	2	3			
Cooling Tower A (See Annex A3)	57.1	57.6	57.6	57.6	51.8	56.3
Cooling Tower B (See Annex A3)	57.1	56.8	56.8	57.1	47.7	56.6

Table 4.5c Sound Power Level of Cooling Towers at Old Hong Kong (WF23)

Fixed Plant Item	B/G corrected noise level, dB(A)	Measurement distance to the center of the fixed plant, m	SWL, dB(A)
Cooling Tower A	56.3	7.5	82
Cooling Tower B	56.6	7.5	82
		Max. SWL (only one will be operated at any time)	**82**
		Maximum allowable SWL	**84**
		Compliance	**Yes**

4.6 AC PLANT AT PANDA CAFÉ (WF24)

Two AC plants that installed at the Panda Café have been fully enclosed by acoustic enclosure with provision of acoustic louver for ventilation. As confirmed by representatives from OPC, the AC plants were set in normal operation mode during the noise measurement. Two AC plants were measured individually during the commissioning test. The measurement locations are shown in *Annex A4*. The measurement results are presented in *Tables 4.6a* to *4.6c*.

Table 4.6a Noise Measurement Details for AC plant at Panda Café (WF24)

Fixed Plant Item	Dimension	Measurement distance	Before Calibration, dB(A)	After Calibration, dB(A)
AC plant at Panda Café (WF24)	1.3 x 1.2 (size of the intake louver) 2.0 x 1.3 (size of the exhaust louver)	4m from the louvers	93.9	93.9

Table 4.6b Noise Measurement Result for AC plant at Panda Café (WF24)

Measurement Location	Measured Noise Levels, $L_{eq, 1\ min}$, dB(A)			Highest Level, dB(A)	B/G noise level, dB(A)	B/G corrected noise level, dB(A)
	1	2	3			
Point 1 – 4m from Intake Louver of AC plant A	59.4	58.9	58.7	59.4	46.4	59.2
Point 2 - 4m from the Exhaust Louver of AC plant A	62.5	62.0	62.4	62.5	49.7	62.3
Point 3 - 4m from the Intake Louver of AC plant B	56.7	57.4	56.3	57.4	48.7	56.8
Point 4 - 4m from the Exhaust Louver of AC plant B	60.4	59.9	59.9	60.4	51.5	59.8

Table 4.6c Sound Power Level of AC plant at Panda Café (WF24)

Fixed Plant Item	B/G corrected noise level, dB(A)	Measurement distance to the center of the louver, m	SWL, dB(A)
Intake Louver of AC plant A	59.2	4	79
Exhaust Louver of AC plant A	62.3	4	82
		SWL for AC Plant A	**84**
Intake Louver of AC plant B	56.8	4	77
Exhaust Louver of AC plant B	59.8	4	80
		SWL for AC Plant B	**82**
		Total SWL of two AC plant	**86**
		Maximum allowable SWL	**90**
		Compliance	**Yes**

4.7 COOLING TOWER AT THE GRAND AQUARIUM (WF26)

OPC confirmed that timer system has been implemented to shut down the cooling towers at the Grand Aquarium during Lagoon Show.

4.8 COMPRESSORS CLUSTER AT WEST RETAIL (WF27)

The compressor clusters were relocated to indoor and other locations where there is no direct line of sight to the nearby noise sensitive receivers (see *Annex A5*).

4.9 FAN ROOM AT WEST RETAIL (WF30)

Acoustic louvers have been installed at each of the Fan Room. Measurement locations are presented in *Annex A6*. As confirmed by OPC, the fan rooms were set in normal operation mode during the noise measurement. Two fan rooms were measured individually during the commissioning test. A fan unit (KEF-EP-08) in the Fan Room A and a PAU (COND-PAU-EP-M03) in the Fan Room C was not operated during the commissioning test and will not be operated during Lagoon Show (See *Annex C*). The measurement results are presented in *Tables 4.9a* to *4.9c*.

Table 4.9a Noise Measurement Details for Fan Room at West Retail (WF30)

Fixed Plant Item	Dimension	Measurement distance	Before Calibration, dB(A)	After Calibration, dB(A)
Fan Room at West Retail (WF30)	Range from 3.0 x 2.5 to 4.0 x 3.0	10m from the louvers	93.9	93.9

Table 4.9b Noise Measurement Results for Fan Room at West Retail (WF30)

Fixed Plant Item	Measured Noise Levels, $L_{eq,\ 1\ min}$, dB(A)			Highest Level, dB(A)	B/G noise level, dB(A)	B/G corrected noise level, dB(A)
	1	2	3			
Fan Room A (measured at point 1)	56.3	56.1	56.1	56.3	52.2	54.2
Fan Room B (measured at point 2)	56.1	56	56.1	56.1	52.1	53.9
Fan Room C	55.1	55.3	55.1	55.3	52.2	52.4

Table 4.9c Sound Power Level of Fan Room at West Retail (WF30)

Fixed Plant Item	B/G corrected noise level, dB(A)	Measurement distance to the center of the louver, m	SWL, dB(A)
Fan Room A	54.2	10	82.2
Fan Room B	53.9	10	81.9
Fan Room C	52.4	10	80.4
		Total SWL of Fan Rooms	**86**
		Maximum allowable SWL	**86**
		Compliance	**Yes**

4.10 VENTILATION FAN AT PANDA CAFÉ (WF35)

A silencer has been installed at the outlet of the ventilation fan. Measurement locations are presented in *Annex A7*. As confirmed by OPC, the ventilation fan was set in normal operation mode during the noise measurement. The measurement results are presented in *Tables 4.10a* to *4.10c*.

Table 4.10a Noise Measurement Details for Ventilation Fan at Panda Café (WF35)

Fixed Plant Item	Dimension	Measurement distance	Before Calibration, dB(A)	After Calibration, dB(A)
Ventilation Fan at Panda Café (WF35)	2.2 x 1.0 x 1.5	5m from the ventilation fan	93.9	93.9

Table 4.10b Noise Measurement Results for Ventilation Fan at Panda Café (WF35)

Measurement Location	Measured Noise Levels, $L_{eq, 1\ min}$, dB(A)			Highest Level, dB(A)	B/G noise level, dB(A)	B/G corrected noise level, dB(A)
	1	2	3			
1	66.4	66.3	66.0	66.4	52.7	66.2
2	64.2	64.3	64.3	64.3	51.9	64.0

Note:
Measurement location 2 is at the direction towards the nearest NSR. As a conservation approach, 66.2 dB(A) measured at location 1 was used to calculated the SWL.

Table 4.10c Sound Power Level of Ventilation Fan at Panda Café (WF35)

Fixed Plant Item	B/G corrected noise level, dB(A)	Measurement distance to the center of the vent fan, m	SWL, dB(A)
Ventilation Fan at Panda Café (WF35)	66.2	5	88
		SWL of vent fan	**88**
		Maximum allowable SWL	**90**
		Compliance	**Yes**

4.11 *CHILLER AT GIANT PANDA ADVENTURE (WF29)*

A 3m high noise barrier made of 1.2mm thick steel plate has been installed to screen noise arising from the operation of the chillers. Each chiller was turned on individually for testing. As confirmed by OPC, the chillers were set in normal operation mode during the noise measurement. Only 2 sets of chillers will be in operation in Phase 1. The measurement locations are shown in *Annex A8*. The measurement results are presented in *Tables 4.11a* to *4.11c*.

Table 4.11a Noise Measurement Details for Chiller at Giant Panda Adventure (WF29)

Fixed Plant Item	Dimension	Measurement distance	Before Calibration, dB(A)	After Calibration, dB(A)
Chiller at Giant Panda Adventure (WF29)	5.0 x 1.5 x 2	10m from the chiller	93.9	93.9

Table 4.11b Noise Measurement Results for Chiller at Giant Panda Adventure (WF29)

Chiller	Measured Noise Levels, $L_{eq, 1\ min}$, dB(A)			Highest Level, dB(A)	B/G noise level, dB(A)	B/G corrected noise level, dB(A)
	1	2	3			
Chiller 1	57.4	57.4	57.3	57.4	52.7	55.6
Chiller 2	56.3	57.0	57.2	57.2	51.9	55.7
Chiller 3	57.2	57.0	57.1	57.2	52.0	55.6
Chiller 4	57.4	57.3	57.1	57.4	52.5	55.7

Table 4.11c Sound Power Level of Chiller at Giant Panda Adventure (WF29)

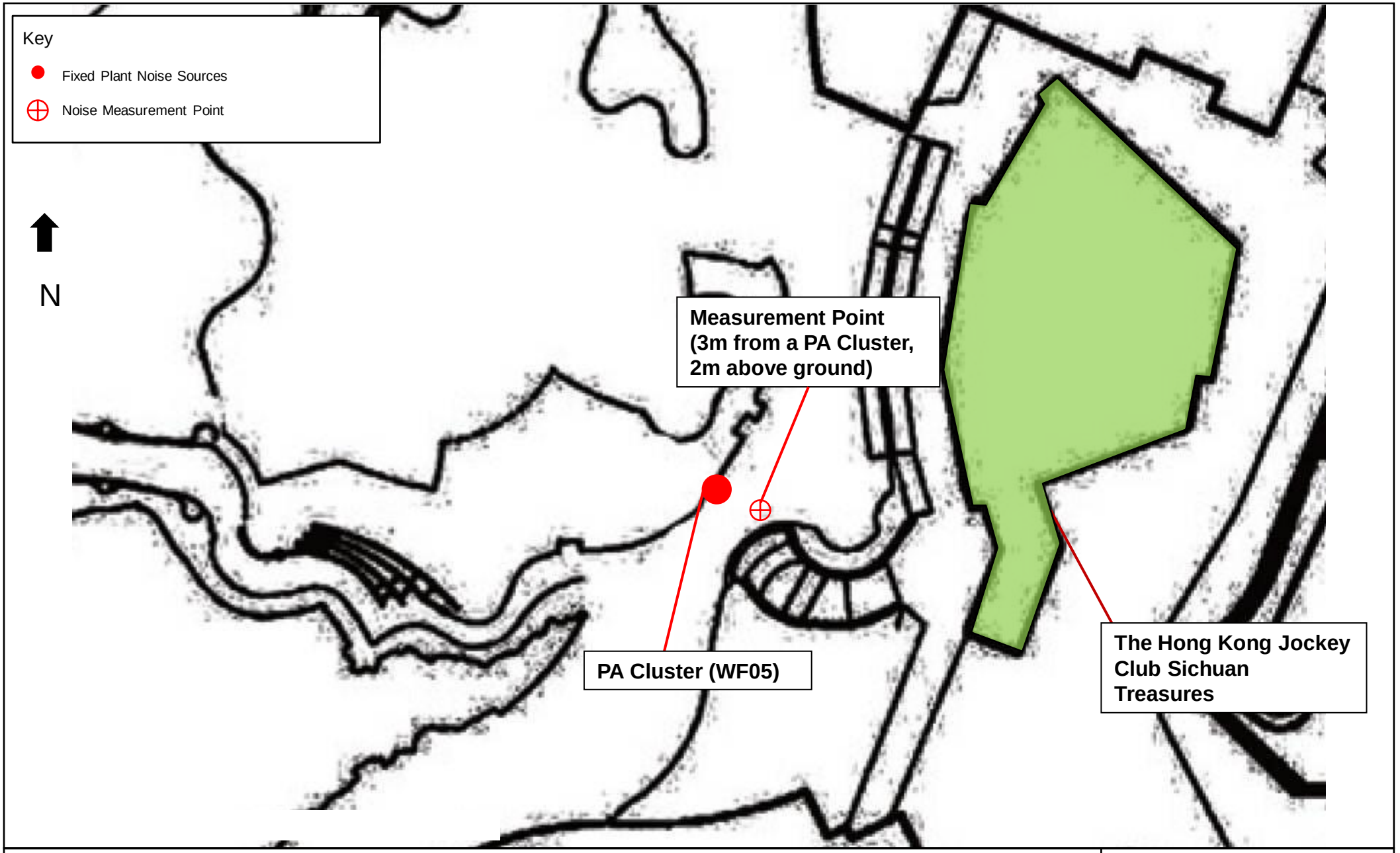
Fixed Plant Item	B/G corrected noise level, dB(A)	Measurement distance to the center of the fixed plant item, m	SWL, dB(A)
Chiller 1	55.6	11	84
Chiller 2	55.7	11	85
Chiller 3	55.6	11	84
Chiller 4	55.7	11	85
		Worst case SWL of two chillers (Chiller2+Chiller 4)	**88**
		Maximum allowable SWL	**90**
		Compliance	**Yes**

5 CONCLUSION

Noise measurements have been conducted based on the commissioning requirements given in *Table 2.1* of the NMAP for Phase 1 deposited in accordance with Condition 2.25 of the EP-249/2006/D. Results of noise measurements indicated that the design and performance of the noise mitigation measures implemented complies with the maximum SWL determined in the VEP application document (VEP-438/2014). The locations of the fixed plant items are shown in *Annex D*. All measures implemented will be properly operated and maintained during the operation for Phase 1.

Annex A

Figures



Annex A1

Measurement location for PA system at Aqua City (WF05)

DATE: 23/06/2014

Environmental Resources Management

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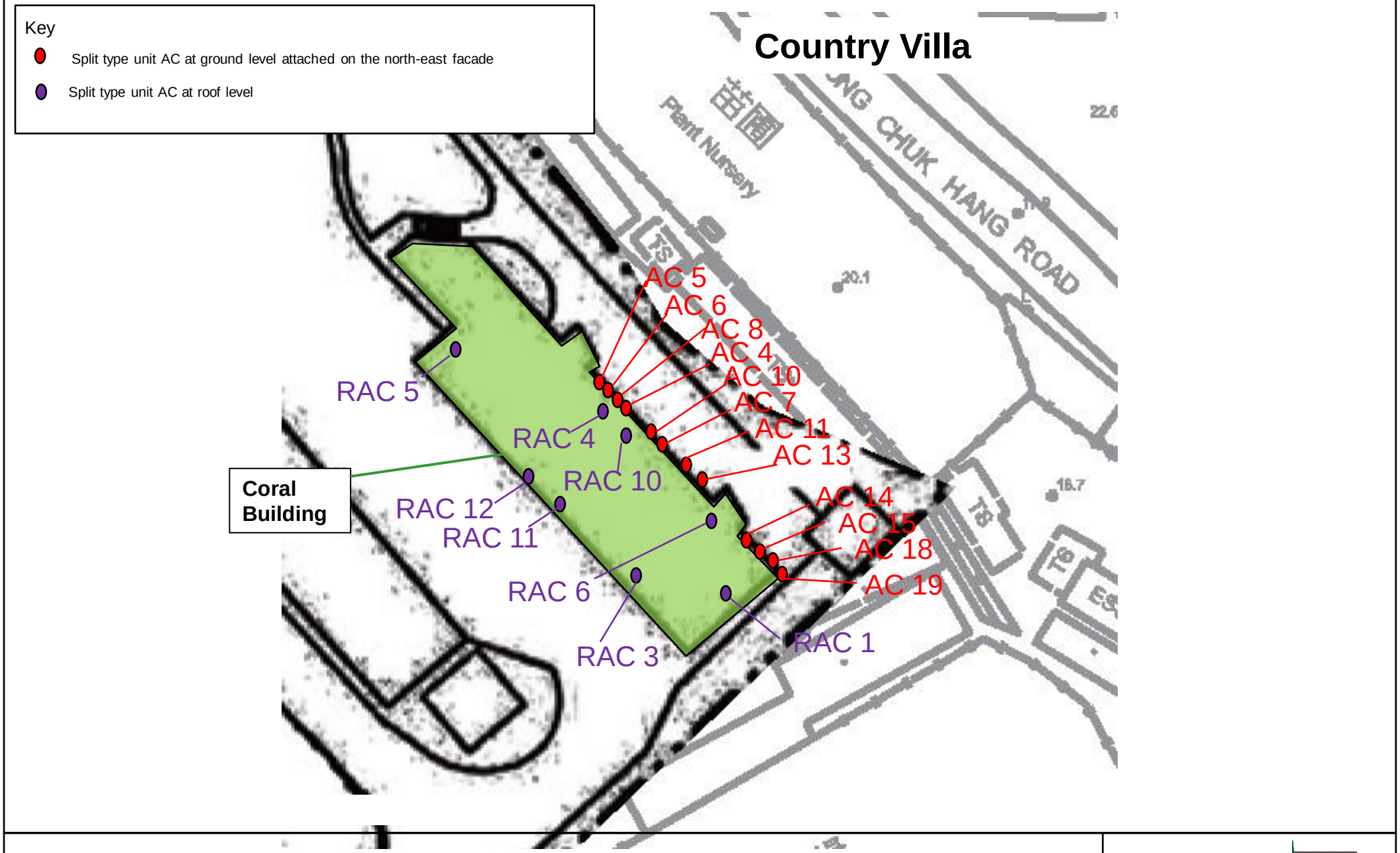

Annex A2

Location of 20 measured split-type A/C unit at Coral Building (WF06)

DATE: 23/06/2014

Environmental Resources Management

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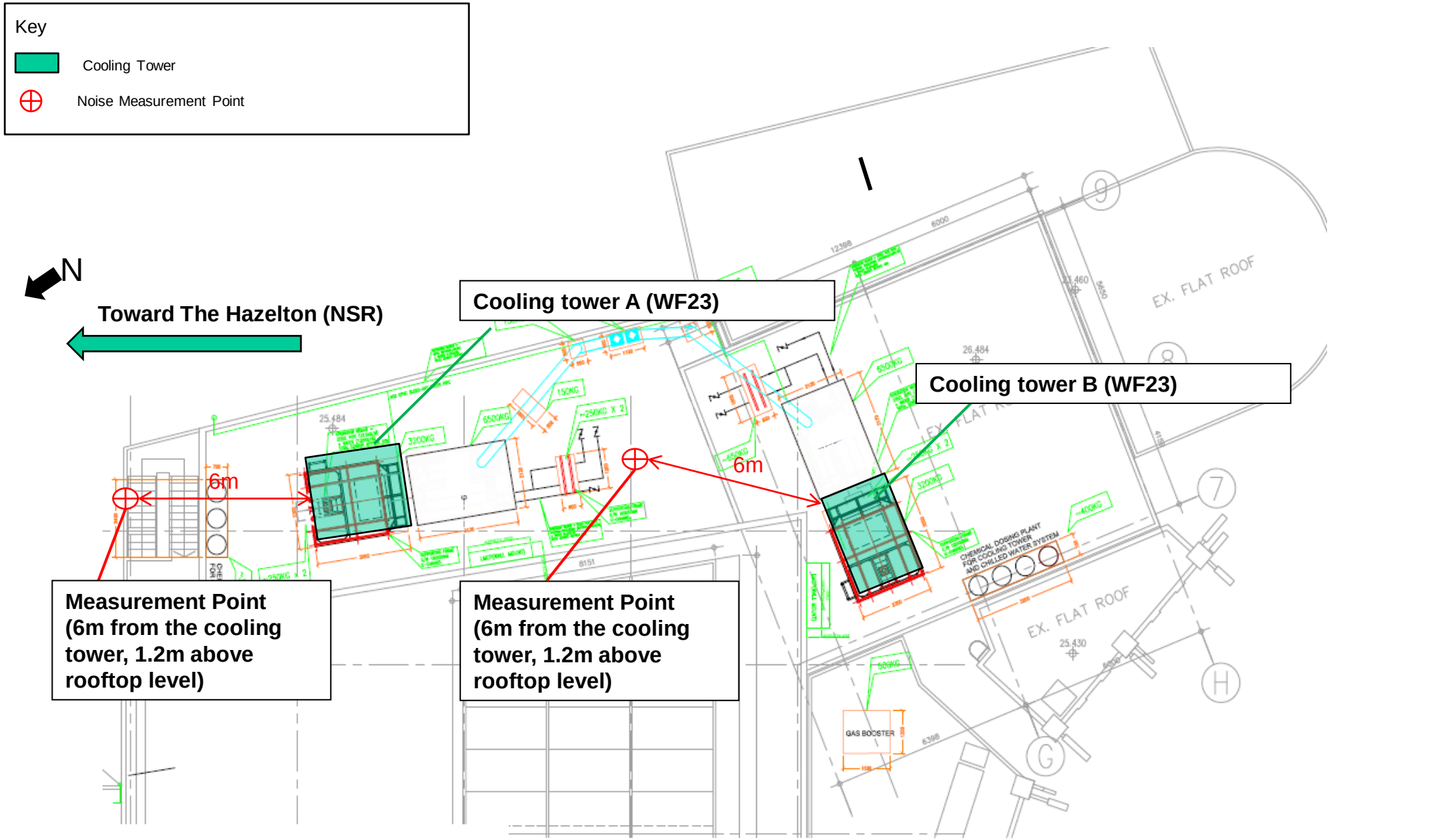

Annex A3

Measurement location for Cooling Towers at Old Hong Kong (WF23)

DATE: 23/06/2014

Environmental Resources Management

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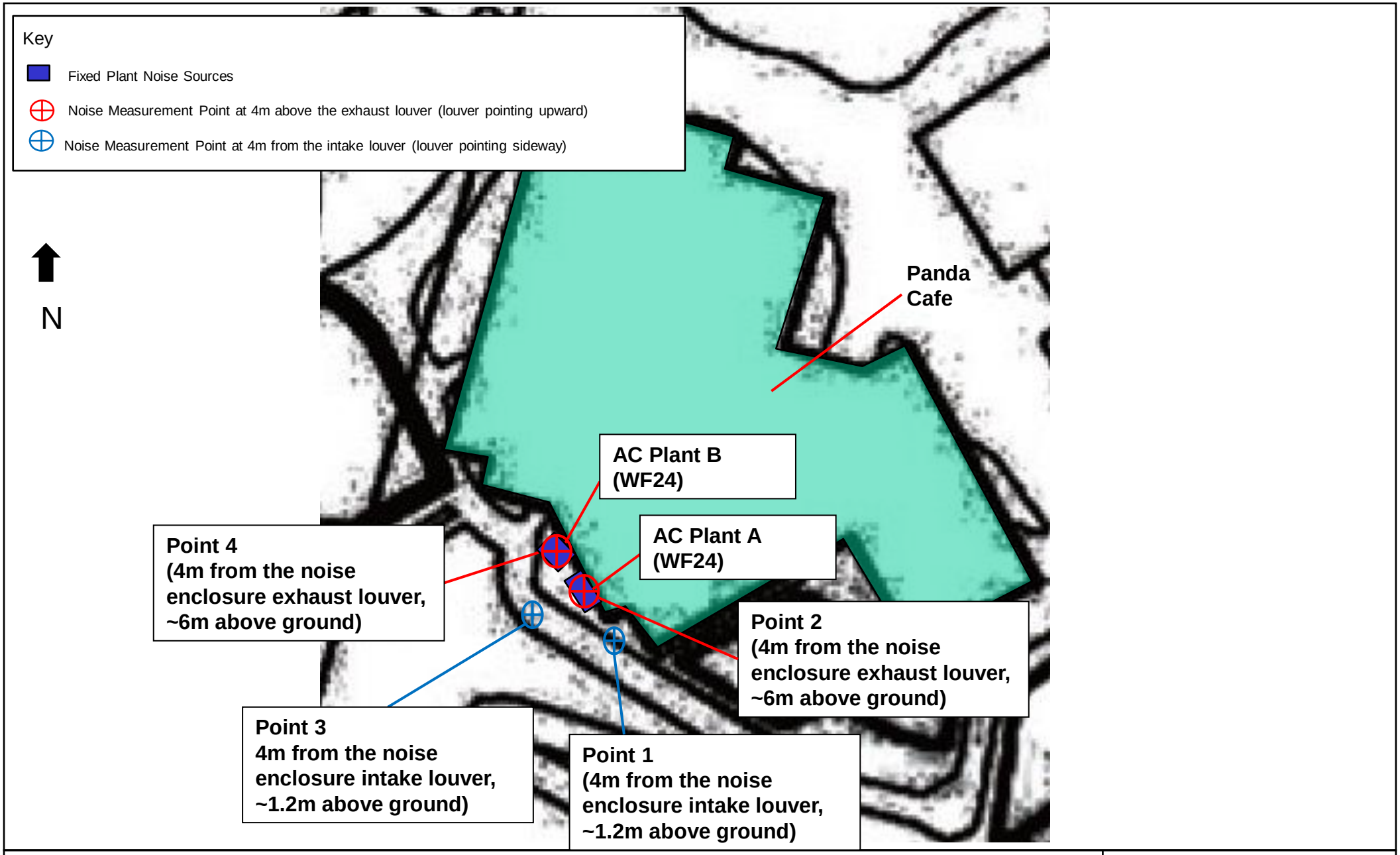

Annex A4

Measurement location for AC plant at Panda Café (WF24)

DATE: 23/06/2014

Environmental Resources Management

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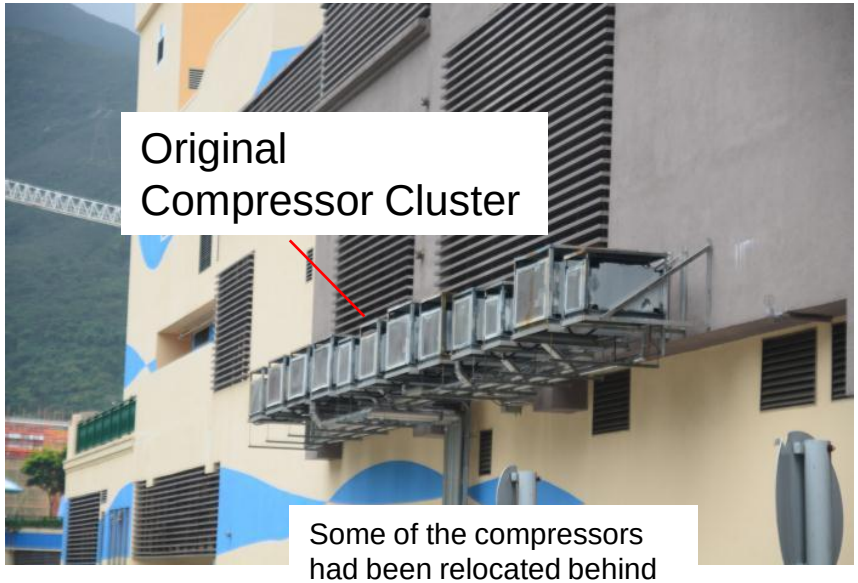
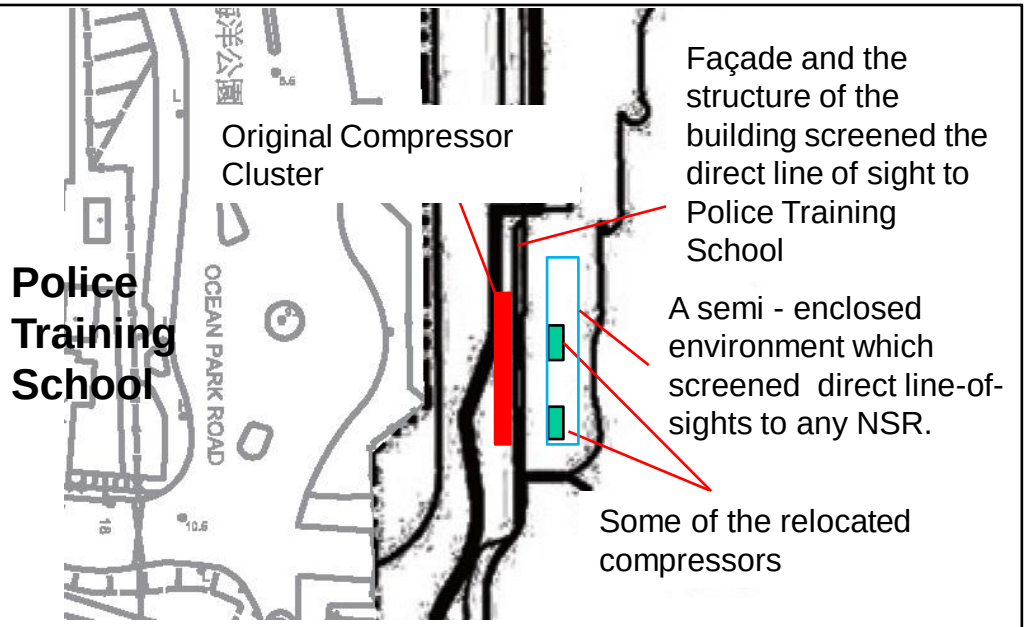


Some of the compressors had been relocated behind this façade, no direct line of sight to the police training school

All compressors were removed from the façade of West Retail



The relocated location semi enclosed environment which do not have direct line-of-sights to any NSR

Some compressors were relocated to indoor

Annex A5

Relocated position of the Compressors Cluster at West Retail (WF27)

DATE: 23/06/2014

Environmental Resources Management

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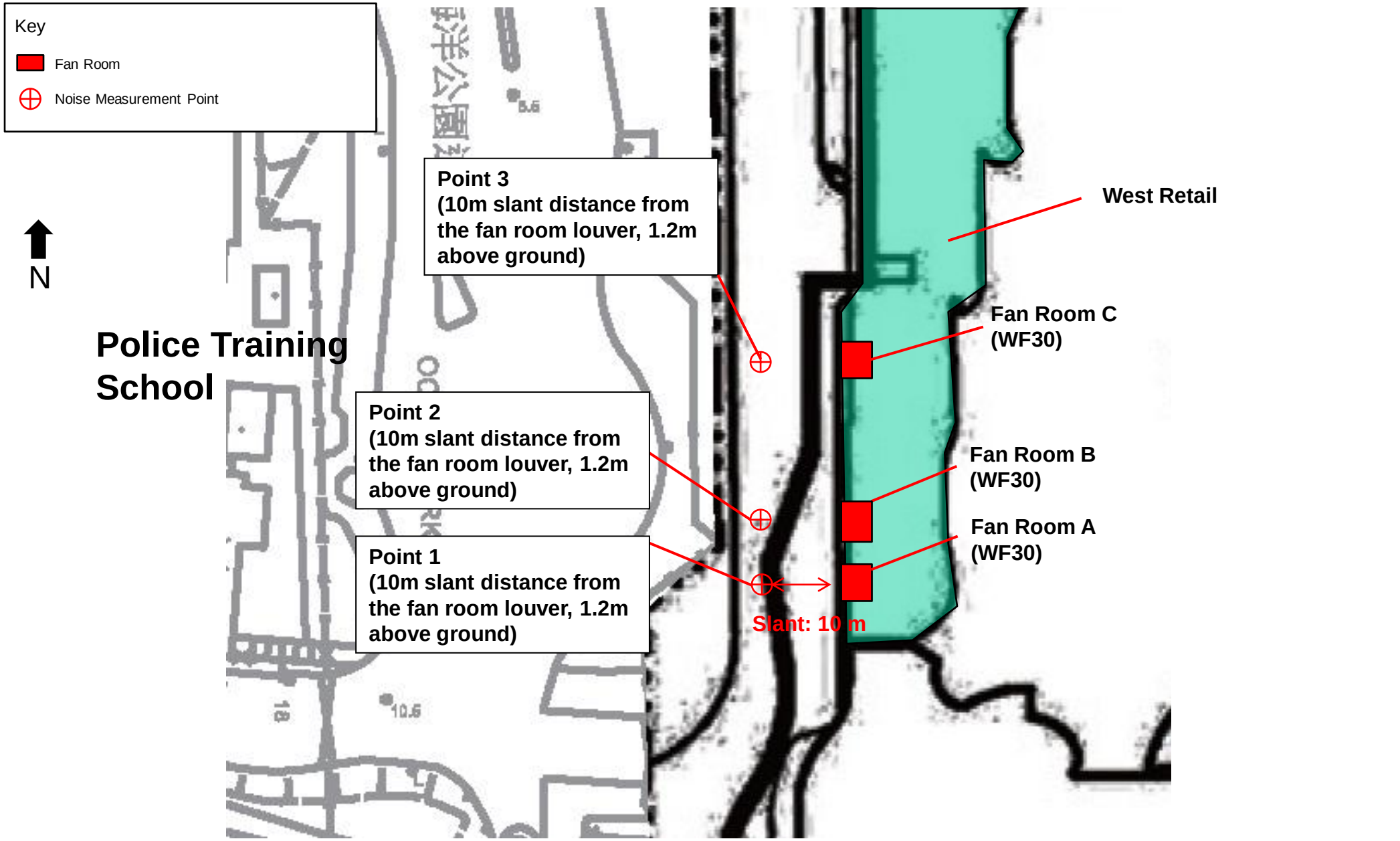


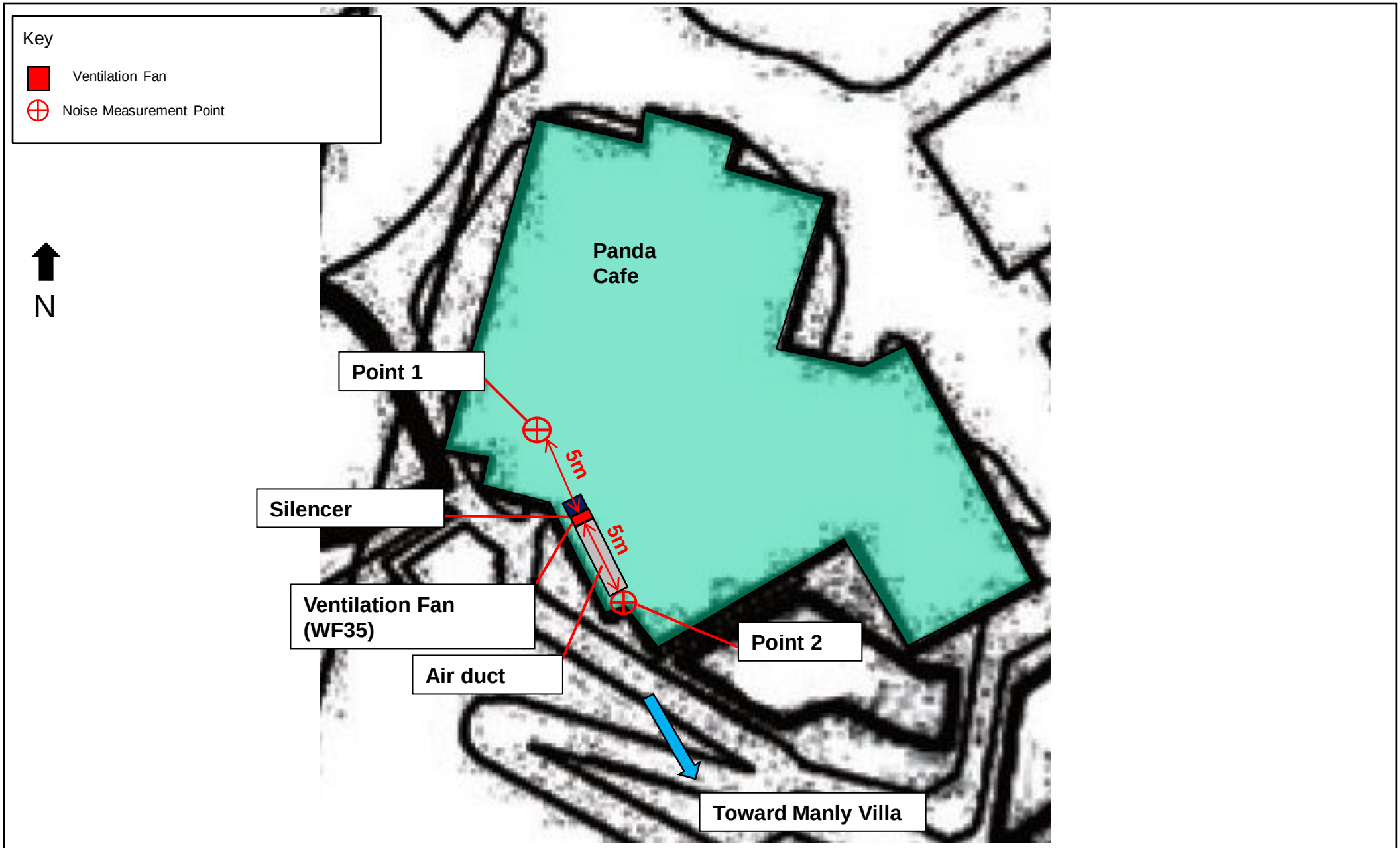
Annex A6

Measurement location for Fan Room at West Retail (WF30)

DATE: 23/06/2014

Environmental Resources Management

ERM



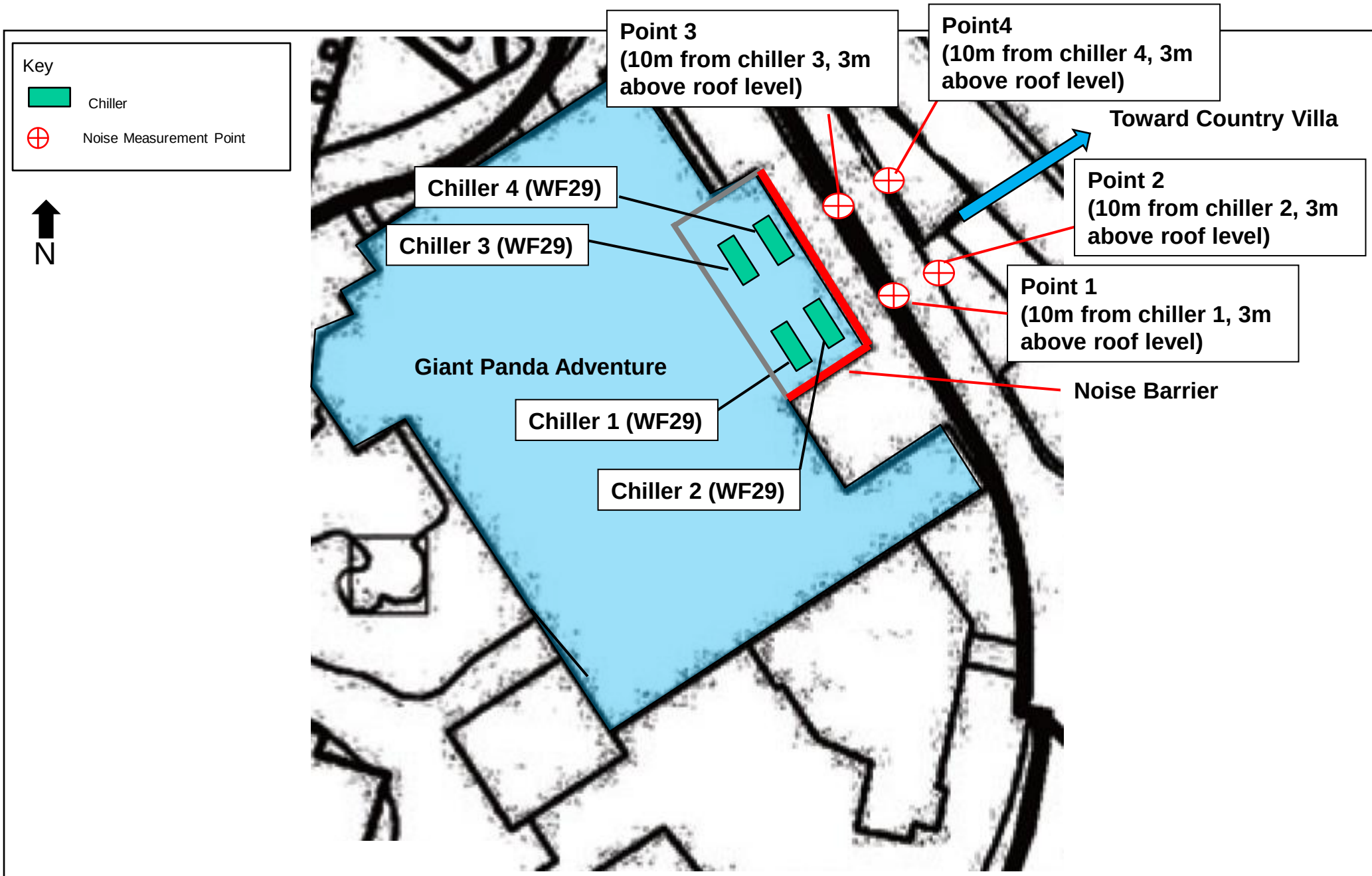
Annex A7

Measurement location for Ventilation Fan at Panda Café (WF35)

DATE: 23/06/2014

Environmental
Resources
Management

ERM



Annex A8

Measurement location for Chiller at Giant Panda Adventure (WF29)

DATE: 23/06/2014

Environmental Resources Management

ERM

Annex B

Calibration Certificates

Hong Kong Calibration Ltd.
香港校正有限公司

Calibration Certificate

Certificate No. 404228

Customer : Environmental Resources Management

Address : 16/F DCH Commercial Centre 25 Westlands Road Quarry Bay Hong Kong

Order No. : Q41594 **Date of receipt :** 20-Jun-14

Item Tested

Description : Sound Level Calibrator
Manufacturer : 01dB-Stell
Model : CAL21 **Serial No. :** 34113609(2011)

Test Conditions

Date of Test : 23-Jun-14 **Supply Voltage :** --
Ambient Temperature : (23 ± 3)°C **Relative Humidity :** (50 ± 25) %

Test Specifications

Calibration check.
Calibration procedure : Z02, IEC 942.

Test Results

All results were within the IEC 942 Class 2 specification.
The results are shown in the attached page(s).

Main Test equipment used:

Equipment No.	Description	Cert. No.	Traceable to
S205	Ref. Sound Level Calibrator	PHCO40002	SCL-HKSAR
S041	Universal Counter	34621	SCL-HKSAR
S206	Sound Level Meter	36203	SCL-HKSAR

The values given in this Calibration 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 environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. 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 International System of Units (SI).
The test results apply to the above Unit-Under-Test only

Calibrated by : Dorothy Cheuk

Approved by : Steve Kwan

Date: 23-Jun-14

This Certificate is issued by:
Hong Kong Calibration Ltd.
Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street,Kwai Chung, NT,Hong Kong.
Tel: 2425 8801 Fax: 2425 8646

Calibration Certificate

Results :

1. Level Accuracy

UUT Nominal Value (dB)	Measured Value (dB)	IEC 942 Class 1 Spec.
94	93.98	± 0.3 dB

Uncertainty : ± 0.2 dB

2. Frequency

UUT Nominal Value	Measured Value	IEC 942 Class 1 Spec.
1 kHz	1.008 kHz	± 2 %

Uncertainty : $\pm 3.6 \times 10^{-6}$

3. Level Stability : 0.0 dB
IEC 942 Class 1 Spec. : ± 0.1 dB
Uncertainty : ± 0.1 dB

4. Total Harmonic Distortion : < 1.6 %
IEC 942 Class 1 Spec. : < 3 %
Uncertainty : ± 2.3 % of reading

Remark : 1. UUT : Unit-Under-Test
2. The above measured values are the mean of 3 measurement.
3. The uncertainty claimed is for a confidence probability of not less than 95%.
4. Atmospheric Pressure : 991 hPa.

---------- END ----------

Hong Kong Calibration Ltd.
香 港 校 正 有限公司

Calibration Certificate

Certificate No. **32987** Page 1 of 3 Pages

Customer : Environmental Resources Management

Address : 21/F, Lincoln House, 979 King's Road, Taikoo Place, Island East, Hong Kong.

Order No. : Q31162 **Date of receipt :** 3-May-13

Item Tested

Description : Sound Level Meter

Manufacturer : Solo

Model : 01dB **Serial No. :** 65226

Test Conditions

Date of Test : 21-May-13 **Supply Voltage :** --

Ambient Temperature : (23 ± 3)°C **Relative Humidity :** (50 ± 25) %

Test Specifications

Calibration check.

Calibration procedure : Z01.

Test Results

All results were within the IEC 651 Type1, IEC 804 Type1 and IEC 1260 Class1 specification.

The results are shown in the attached page(s).

Test equipment used:

Equipment No.	Description	Cert. No.	Traceable to
S017	Multi-Function Generator	C127181	SCL-HKSAR
S024	Sound Level Calibrator	30620	NIM-PRC & SCL-HKSAR

The values given in this Calibration 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 environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. 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 International System of Units (SI).
The test results apply to the above Unit-Under-Test only

Calibrated by : Liam Wong

Approved by : Dorothy Cheuk

Date: 21-May-13

This Certificate is issued by:
Hong Kong Calibration Ltd.
Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street,Kwai Chung, NT,Hong Kong.
Tel: 2425 8801 Fax: 2425 8646

Calibration Certificate

Results :

1. Accuracy Check

UUT Setting			Applied Value (dB)	UUT Reading (dB)
Range (dB)	Response	Weighting		
20 - 140	Fast	L_A	94.0	93.8
	Slow			93.8
	Fast	L_C		93.9
	Slow			93.9
	Fast	L_A	114.0	113.9
	Slow			113.9
	Fast	L_C		113.9
	Slow			113.9

IEC 651 Type 1 Spec. : ± 0.7 dB
Uncertainty : ± 0.1 dB

2. Level Stability : 0.0 dB

IEC 651 Type 1 Spec. : ± 0.3 dB
Uncertainty : ± 0.1 dB

3. Linearity

Differential level linearity

UUT Range	Applied Value (dB)	UUT Reading (dB)	Variation (dB)	IEC 651 Type 1 Spec.
140	84.0	83.8	0.0	± 0.4 dB
	94.0	93.8 (Ref.)	- -	
	95.0	94.8	0.0	± 0.2 dB

Uncertainty : ± 0.1 dB

Calibration Certificate

4. Frequency Weighting

A weighting

Frequency	Attenuation (dB)	IEC 651 Type 1 Spec.
31.5 Hz	-39.5	- 39.4 dB, ± 1.5 dB
63 Hz	-26.1	- 26.2 dB, ± 1.5 dB
125 Hz	-16.1	- 16.1 dB, ± 1 dB
250 Hz	-8.6	- 8.6 dB, ± 1 dB
500 Hz	-3.3	- 3.2 dB, ± 1 dB
1 kHz	0.0 (Ref.)	0 dB, ± 1 dB
2 kHz	+1.2	+ 1.2 dB, ± 1 dB
4 kHz	+0.8	+ 1.0 dB ,± 1 dB
8 kHz	-1.8	- 1.1 dB, + 1.5 dB ~ - 3 dB
16 kHz	-12.1	- 6.6 dB, + 3 dB ~- ∞

Uncertainty : ± 0.1 dB

5. Time Averaging

Applied Burst duty Factor	Applied Leq Value (dB)	UUT Reading (dB)	IEC 804 Type 1 Spec.
continuous	40.0	- -	--
1/10	40.0	40.0	± 0.5 dB
$1/10^2$	40.0	39.9	
$1/10^3$	40.0	39.9	± 1.0 dB
$1/10^4$	40.0	39.9	

Uncertainty : ± 0.1 dB

Calibration Certificate

6. Filter Characteristics

6.1 1/1 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 (dB)
125 Hz	-74.8	< - 61
250 Hz	-55.0	< - 42
500 Hz	-24.4	< - 17.5
707 Hz	-3.0	- 2 ~ - 5
1 kHz (Ref)	--	--
1.414 kHz	-2.8	- 2 ~ - 5
2 kHz	-48.3	< - 17.5
4 kHz	-88.6	< - 42
8 kHz	-89.0	< - 61

Uncertainty : ± 0.25 dB

6.2 1/3 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 (dB)
326 Hz	-68.4	< - 61
530 Hz	-58.4	< - 42
772 Hz	-28.4	< - 17.5
891 Hz	-3.5	+ 0.3 ~ - 5.0
1 kHz (Ref)	--	--
1.122 kHz	-3.7	+ 0.3 ~ - 5.0
1.296 kHz	-31.5	< - 17.5
1.887 kHz	-66.5	< - 42
3.070 kHz	-90.0	< - 61

Uncertainty : ± 0.25 dB

Remarks : 1. UUT : Unit-Under-Test
2. The uncertainty claimed is for a confidence probability of not less than 95%.
3. Atmospheric Pressure : 996 hPa.

---------- END ----------

Hong Kong Calibration Ltd.
香 港 校 正 有限公司

Calibration Certificate

Certificate No. **34249** Page 1 of 3 Pages

Customer : Environmental Resources Management

Address : 21/F, Lincoln House, 979 King's Road, Taikoo Place, Island East, Hong Kong.

Order No. : Q31652 **Date of receipt :** 24-Jun-13

Item Tested

Description : Sound Level Meter

Manufacturer : Solo

Model : 01dB **Serial No. :** 65225

Test Conditions

Date of Test : 5-Jul-13 **Supply Voltage :** --

Ambient Temperature : (23 ± 3)°C **Relative Humidity :** (50 ± 25) %

Test Specifications

Calibration check.

Calibration procedure : Z01.

Test Results

All results were within the IEC 651 Type1, IEC 804 Type1 and IEC 1260 Class1 specification.

The results are shown in the attached page(s).

Test equipment used:

Equipment No.	Description	Cert. No.	Traceable to
S017	Multi-Function Generator	C127181	SCL-HKSAR
S024	Sound Level Calibrator	30620	NIM-PRC & SCL-HKSAR

The values given in this Calibration 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 environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. 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 International System of Units (SI).
The test results apply to the above Unit-Under-Test only

Calibrated by : Liam Wong

Approved by : Dorothy Cheuk

Date: 5-Jul-13

This Certificate is issued by:
Hong Kong Calibration Ltd.
Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street,Kwai Chung, NT,Hong Kong.
Tel: 2425 8801 Fax: 2425 8646

Calibration Certificate

Results :

1. SPL Accuracy

UUT Setting				Applied Value (dB)	UUT Reading (dB)
Level Range	Octave Filter	Weight	Time Const.		
20 – 140 dB	OFF	A	Fast	94.0	93.7
			Slow		93.7
		C	Fast		93.7
	ON (1/1)	--	Fast		93.7
	ON (1/3)	--	Fast		93.7
	OFF	A	Fast	114.0	113.7
			Slow		113.7
		C	Fast		113.7
	ON (1/1)	--	Fast		113.7
	ON (1/3)	--	Fast		113.7

IEC 651 Type 1 Spec. : ± 0.7 dB
Uncertainty : ± 0.2 dB

2. Level Stability : 0.0 dB

IEC 651 Type 1 Spec. : ± 0.3 dB
Uncertainty : ± 0.1 dB

3. Linearity

UUT Range (dB)	Applied Value (dB)	UUT Reading (dB)	Variation (dB)	IEC 651 Type 1 Spec.
20 – 140 dB	84.0	83.8	+0.1	± 0.4 dB
	94.0	93.7 (Ref.)	--	
	95.0	94.7	0.0	± 0.2 dB

Calibration Certificate

4. Frequency Weighting

A weighting

Frequency	Attenuation (dB)	IEC 651 Type 1 Spec.
31.5 Hz	-39.2	- 39.4 dB, ± 1.5 dB
63 Hz	-25.9	- 26.2 dB, ± 1.5 dB
125 Hz	-16.0	- 16.1 dB, ± 1 dB
250 Hz	-8.5	- 8.6 dB, ± 1 dB
500 Hz	-3.1	- 3.2 dB, ± 1 dB
1 kHz	0.0 (Ref.)	0 dB, ± 1 dB
2 kHz	+1.2	+ 1.2 dB, ± 1 dB
4 kHz	+0.9	+ 1.0 dB ,± 1 dB
8 kHz	-1.7	- 1.1 dB, + 1.5 dB ~ - 3 dB
16 kHz	-12.1	- 6.6 dB, + 3 dB ~- ∞

Uncertainty : ± 0.1 dB

5. Time Averaging

Applied Burst duty Factor	Applied Leq Value (dB)	UUT Reading (dB)	IEC 804 Type 1 Spec.
continuous	40.0	40.0	--
1/10	40.0	40.0	± 0.5 dB
$1/10^2$	40.0	40.0	
$1/10^3$	40.0	40.0	± 1.0 dB
$1/10^4$	40.0	40.0	

Uncertainty : ± 0.1 dB

Calibration Certificate

6. Filter Characteristics

6.1 1/1 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 (dB)
125 Hz	-74.4	< - 61
250 Hz	-55.0	< - 42
500 Hz	-24.4	< - 17.5
707 Hz	-3.0	- 2 ~ - 5
1 kHz (Ref)	--	--
1.414 kHz	-2.8	- 2 ~ - 5
2 kHz	-18.3	< - 17.5
4 kHz	-83.6	< - 42
8 kHz	-84.5	< - 61

Uncertainty : ± 0.25 dB

6.2 1/3 – Octave Filter

Frequency	Attenuation (dB)	IEC 1260 Class 1 (dB)
326 Hz	-69.1	< - 61
530 Hz	-59.8	< - 42
772 Hz	-28.4	< - 17.5
891 Hz	-3.4	+ 0.3 ~ - 5.0
1 kHz (Ref)	--	--
1.122 kHz	-3.7	+ 0.3 ~ - 5.0
1.296 kHz	-31.5	< - 17.5
1.887 kHz	-66.8	< - 42
3.070 kHz	-80.7	< - 61

Uncertainty : ± 0.25 dB

Remark : 1. UUT : Unit-Under-Test
2. The uncertainty claimed is for a confidence probability of not less than 95%.
3. Atmospheric Pressure : 1001 hPa.

---------- END ----------

Hong Kong Calibration Ltd.
香 港 校 正 有限公司

Calibration Certificate

Certificate No. 404229 Page 1 of 2 Pages

Customer : Environmental Resources Management

Address : 16/F DCH Commercial Centre 25 Westlands Road Quarry Bay Hong Kong

Order No. : Q41594 **Date of receipt :** 20-Jun-14

Item Tested

Description : Sound Level Calibrator

Manufacturer : Svantek

Model : SV30A **Serial No. :** 7971

Test Conditions

Date of Test : 23-Jun-14 **Supply Voltage :** --

Ambient Temperature : (23 ± 3)°C **Relative Humidity :** (50 ± 25) %

Test Specifications

Calibration check.

Ref. Document/Procedure : F21, Z02.

Test Results

All results were within the IEC 942 Class 1 specification.

The results are shown in the attached page(s).

Main Test equipment used:

Equipment No.	Description	Cert. No.	Traceable to
S014	Spectrum Analyzer	35730	NIM-PRC & SCL-HKSAR
S205	Ref. Sound Level Calibrator	PHCO40002	SCL-HKSAR
S041	Universal Counter	34621	SCL-HKSAR
S206	Sound Level Meter	36203	SCL-HKSAR

The values given in this Calibration 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 environmental changes, vibration and shock during transportation, overloading, mis-handling, or the capability of any other laboratory to repeat the measurement. Hong Kong Calibration Ltd. 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 International System of Units (SI).
The test results apply to the above Unit-Under-Test only

Calibrated by : Dorothy Cheuk

Approved by : Steve Kwan

Date: 23-Jun-14

This Certificate is issued by:
Hong Kong Calibration Ltd
Unit 8B, 24/F., Well Fung Industrial Centre, No. 58-76, Ta Chuen Ping Street,Kwai Chung, NT,Hong Kong.
Tel: 2425 8801 Fax: 2425 8646

E

Calibration Certificate

Results :

1. Level Accuracy

UUT Nominal Value (dB)	Measured Value (dB)	IEC 942 Class 1 Spec.
94	94.15	± 0.3 dB
114	114.17	

Uncertainty : ± 0.2 dB

2. Frequency

UUT Nominal Value	Measured Value	IEC 942 Class 1 Spec.
1 kHz	1.000 kHz	± 2 %

Uncertainty : $\pm 3.6 \times 10^{-6}$

3. Level Stability : 0.0 dB
IEC 942 Class 1 Spec. : ± 0.1 dB
Uncertainty : ± 0.01 dB

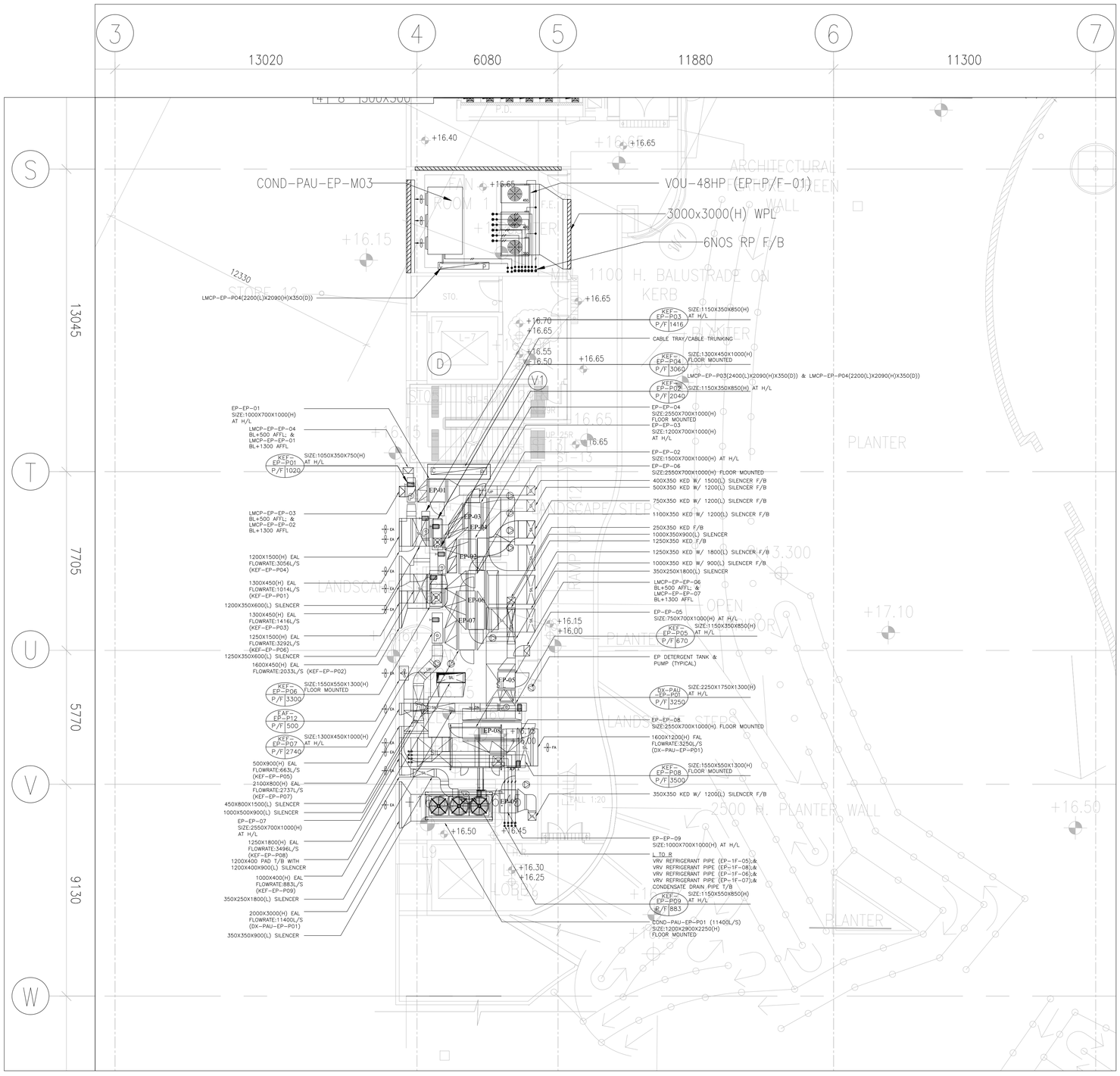
4. Total Harmonic Distortion : < 0.8 %
IEC 942 Class 1 Spec. : < 3 %
Uncertainty : ± 2.3 % of reading

Remark : 1. UUT : Unit-Under-Test
2. The above measured values are the mean of 3 measurements.
3. The uncertainty claimed is for a confidence probability of not less than 95%.
4. Atmospheric Pressure : 991 hPa.

---------- END ----------

Annex C

Equipment inside the Fan Room



REV.	DESCRIPTION	BY	DATE
–	AS-FITTED	KY	09/12

香港海洋公園 OCEAN PARK HONG KONG

OCEAN PARK REDEVELOPMENT

CONTRACT NO. CI07
ENTRY PLAZA, AQUA CITY & GRAND AQUARIUM

ENTRY PLAZA MVAC LAYOUT PLAN AT P/F (2 OF 2)

SCALE	DATE
A1 1:100	09 DEC 10
DRAWN BY	CHECKED BY
KY	AL

CONSULTANT

MAUNSELL | AECOM
Maunsell Consultants Asia Ltd.
茂盛(亞洲)工程顧問有限公司
In association with :
AEDAS EDAW LEVETT & BAILEY

MAIN CONTRACTOR

LEIGHTON 禮頓

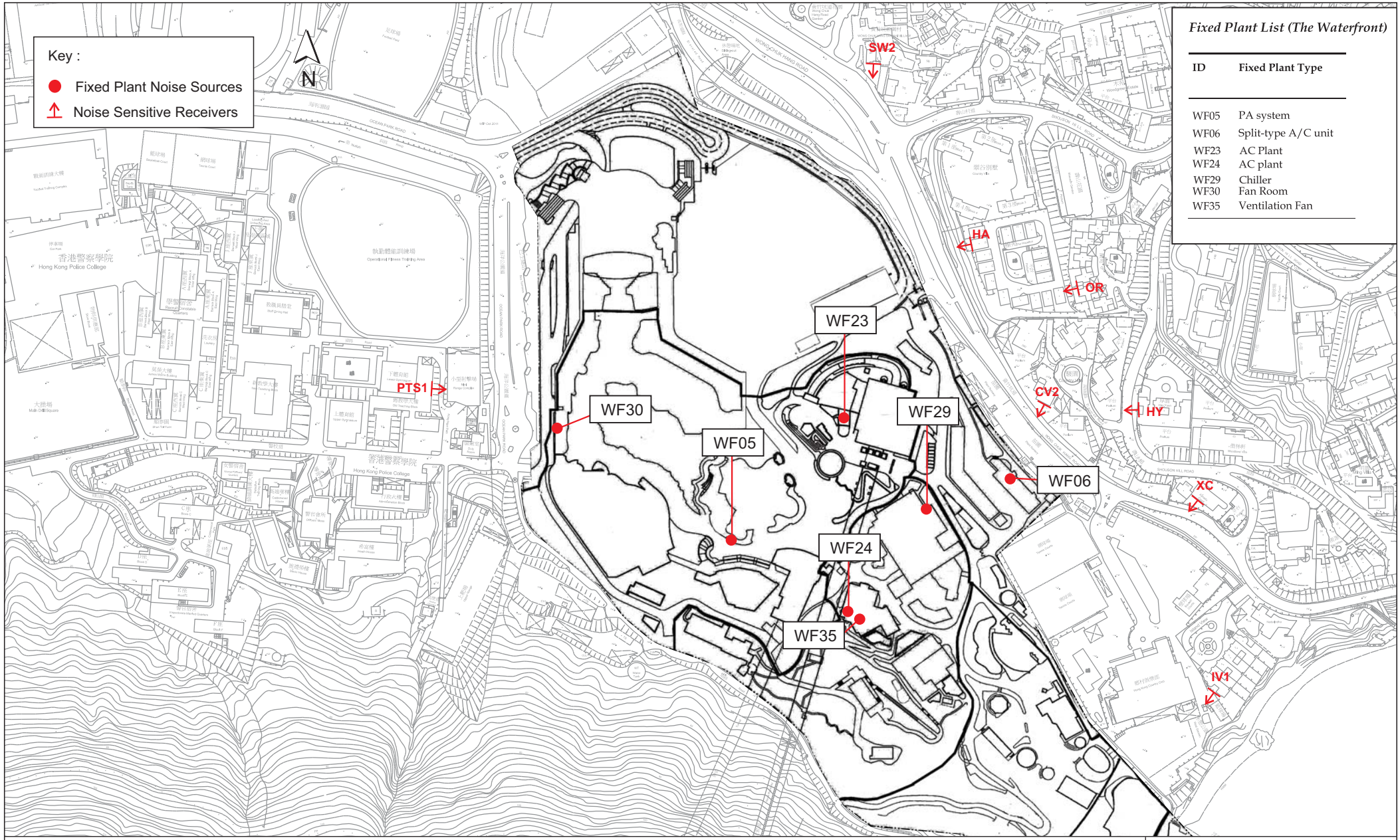
MVAC SUB-CONTRACTOR

SOUTHA TECHNICAL LIMITED
南龍機電工程有限公司

DRG. NO.	REV.
AB/H2458/EP/EM/VAC/3310	–

Annex D

Location for Fixed Plant Items (Phase 1 Commissioning Test)



Fixed Plant List (The Waterfront)

ID	Fixed Plant Type
WF05	PA system
WF06	Split-type A/C unit
WF23	AC Plant
WF24	AC plant
WF29	Chiller
WF30	Fan Room
WF35	Ventilation Fan

Annex D

Location for Fixed Plant Items (Phase 1 commissioning test)

FILE: 0200987o1
DATE: 23/06/2014

Environmental Resources Management

ERM