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# Pre-construction Survey Report of Ardeid Night Roost

Contract No. SPW 07/2020 Environmental Team for Construction of Yuen Long Effluent Polishing Plant Stage 1

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Final

**Drainage Services Department**



# Document Control

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## Executive Summary

Fugro Technical Services Limited (FTS) has been appointed as the Environmental Team (ET) by Drainage Services Department (DSD) under Contract No. SPW 07/2020 Environmental Team for Construction of Yuen Long Effluent Polishing Plant Stage 1. As the ET, part of the scope, is to carry out a pre-construction survey for ardeid night roost in accordance with the requirements of **EP Condition 2.11** and **Section 7.3.5 of the approved EM&A Manual** of the Yuen Long Effluent Polishing Plant ("the Project").

Pre-construction surveys for ardeid roosts were conducted on January 2021, where initial survey was carried out on 12 January and confirmatory survey on 25 January. The surveys were undertaken in areas within 100 m from the Project boundary ("the Survey Area").

Two active night roost areas were observed within the Survey Area during the surveys, i.e. one at the mangrove strip located east of the Project boundary and the other at the northeast side of the Project boundary. Four ardeid species including the Chinese Pond Heron *Ardeola bacchus*, Great Egret *Ardea alba*, Little Egret *Egretta garzetta*, and Grey Heron *Ardea cinerea* were observed utilizing the roosting sites. The roosting substrates were the mangrove species *Sonneratia apetala* and *S. caseolaris*. For the Pre-roosting aggregation (PRA), only one species, the Chinese Pond Heron was observed with the behaviour which started as early as 17:38, while during this time, final roosting activities for other ardeid species were concurrently noted already. No breeding activity was noted in both roosting areas as the breeding season of the ardeids have not begun yet.

Based on the findings of the surveys, it is recommended that use of powered mechanical equipment within 100 m buffer zone from the active night roosting sites after 17:30 during dry season will be restricted. Time restrictions during wet season (after 18:00) shall follow **Section 7.3.11 of the approved EM&A Manual**. Noise monitoring in stations as close as practicable to the active night roosts will be conducted concurrent with the construction phase monthly monitoring of the active night roosts.

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## Abbreviations

<b>DSD</b>	Drainage Services Department
<b>EIA</b>	Environmental Impact Assessment
<b>EIAO</b>	Environmental Impact Assessment Ordinance
<b>EM&amp;A</b>	Environmental Monitoring and Audit
<b>EPD</b>	Environmental Protection Department
<b>EP</b>	Environmental Permit
<b>ET</b>	Environmental Team
<b>FTS</b>	Fugro Technical Services Limited
<b>HKO</b>	Hong Kong Observatory
<b>PRA</b>	Pre-roost Aggregate
<b>PRP</b>	Pre-roost Period
<b>YLEPP</b>	Yuen Long Effluent Polishing Plant

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# 1. INTRODUCTION

## 1.1 Background

- 1.1.1 The Yuen Long Effluent Polishing Plant (YLEPP) (“the Project”) is implemented to cope with the forecast increase in sewage flow upon completion of sewerage under interfacing projects, extension of village sewerage in area as planned by Environmental Protection Department (EPD), as well as the proposed housing developments in the region.
- 1.1.2 The Project is a designated project under Schedule 2 of the Environmental Impact Assessment Ordinance (EIAO) (Cap. 499) for which Environmental Impact Assessment (EIA) report and Environmental Monitoring and Audit (EM&A) Manual was approved by EPD (Register No.: AEIAR-220/2019) on 25 April 2019. The Environmental Permit (EP) (EP No. EP-565/2019) was issued by EPD on 26 April 2019.
- 1.1.3 Fugro Technical Services Limited (FTS) has been appointed as the Environmental Team (ET) by Drainage Services Department (DSD) under the Contract No. SPW 07/2020 Environmental Team for Construction of Yuen Long Effluent Polishing Plant Stage 1. As the ET, part of the scope, is to submit a Pre-construction Survey Report (“the Report”) after the conduct of the Pre-construction Survey within 100 m from the project boundary.

## 1.2 Scope and Objectives of the Survey

As described in **Section 8.5.2.7** of the **EIA Report**, ardeid species of conservation importance (i.e. Little Egret, Great Egret, and Chinese Pond Heron) were observed roosting at night in the mangrove habitat northeast to the Project site during night-time surveys in June 2017 (**Appendix A.1**). The ardeid night roost observed, was not however, found during night-time surveys in July 2017. Further site checks in July 2018 showed that ardeids utilized again the mangrove habitat northeast to the Project site. Ardeids (over 60 individuals) were also observed roosting at the mangrove strip east of the Project site (**Appendix A.1**) in December 2018 but the ardeid night roost northeast to the Project site was not observed during the site visits.

In connection to this, the survey conducted with reference to **EP Condition 2.11** and **Section 7.3.5** of the **EM&A Manual** had the following objectives:

- Confirm the location (s) and status of any active ardeid night roost (s) within 100 m of the Project site boundary with reference to **EP Condition 2.11** and **Section 7.3.5** of the **EM&A Manual**; and
- Subject to survey findings, suggest a location as close to the night roost as practicable for monitoring of noise level during construction **Section 7.3.5** of the **EM&A Manual**.

## 1.3 Structure of the Report

1.3.1 Succeeding this Section 1 Introduction, the remainder of this Report is presented as follows:

- Section 2 details the methodology of the Survey;
- Section 3 details the Survey results;
- Section 4 presents the summary, conclusion, and recommendations based on the Survey results.

## 2. METHODOLOGY

This section presents the methodology and approach of the Survey during the pre-construction stage of the Project. The Survey was conducted in accordance with the Method Statement that was agreed upon with the Agriculture, Fisheries and Conservation Department prior to the commencement of the Survey.

### 2.1 Survey Area

With reference from **EP Condition 2.11** and **Section 7.3.5** of the **EM&A Manual**, the Survey was conducted in areas within 100 m from the Project boundary (“the Survey Area”). The Survey Area and vantage points for direct observation of any active night roosts are shown in **Appendix A.1**.

### 2.2 Field Surveys

- 2.2.1 Surveys focused on any active ardeid roosts within the Survey Area particularly on the mangrove strips located east and northeast of the Project site along the banks of the tidally influenced Shan Pui River with reference to **EIA Report sections 8.5.1.16** and **8.5.1.17**. Primary data collection with the use of 7x and 10x binoculars; and field guides including the Avifauna of Hong Kong (Carey et al., 2001) and The Birds of Hong Kong and South China (Viney et al., 2005), was from about one hour before sunset time until about half an hour after sunset, the period when most ardeids return to a night roosting site. Sunset time was according to Hong Kong Observatory (HKO). An initial field survey of the area was conducted on 12 January 2021 and followed by an additional survey on 25 January 2021 to confirm the initial survey results.
- 2.2.2 Species composition, abundance and locations of night roosts were recorded. Species composition, abundance and location of pre-roosting aggregations (PRA) were also noted. PRAs are gatherings of avian individuals prior to flying into a night roost (Moore and Switzer, 1997). The time of return of the ardeids to the pre-roost and the final night roost were also recorded. Direct observations were made from vantage points adjacent the Project site with clear and unobstructed view of any active roosting location (s) within the Survey Area. However, aside from the established vantage points for the focused mangrove strips along Shan Pui River, observations were also conducted throughout the whole 100 m study site to cover other areas aside from the mangrove strips.
- 2.2.3 Observations such as bird droppings on the ground which may possibly indicate presence of night roosts were noted in addition to noting of the roosting substrate (i.e. substrate species and approximate height). Any breeding activity usage of the roosting locations within the Survey Area was also noted.



### 3. SURVEY RESULTS

Two active night roosts (NR) locations were observed within the Survey Area, 100 m study from the Project boundary (**Appendix A.1**). One NR was confirmed to be still present on the EIA pre-identified mangrove strip located approximately 40 m east of the Project boundary (**Appendix B.1a**) and a new NR several meters away from the pre-identified one and approximately 45 m northeast (**Appendix B.1b**) of the Project boundary along the Shan Pui River.

A total of four ardeid species, i.e. Chinese Pond Heron *Ardeola bacchus*, Great Egret *Ardea alba*, Little Egret *Egretta garzetta* and Grey Heron *Ardea cinerea*, was observed utilizing the aforementioned roosting sites.

The mangrove species *Sonneratia apetala* (**Appendix B.2a**) and *S. caseolaris* (**Appendix B.2b**) were utilized as roosting substrates. Both *Sonneratia* species located east of the Project boundary had an approximate height of five meters while same species were of an approximate height of 3 to 4 meters on the northeast of the Project boundary.

#### 3.1 Initial Survey

During the pre-roost period (PRP), the period when avian individuals gather first before flying into a night roost, in this case at around 17:38 of the survey, only PRA of the Chinese Pond Heron (**Appendix B.3**) with five individuals (ind.) was observed. The aggregate was noted on the exposed mudflat contiguous to their final roosting substrate the mangrove species *S. apetala* and *S. caseolaris*. The mudflat was exposed due to the low tide condition during that period. No PRAs of other ardeid species was recorded.

For the final night roost, different times were observed for the different species such that it started as early as around 17:38 onwards for the Great Egret and Little Egret; while a little later at around 18:03 for the Chinese Pond Heron. A total of 20 Great Egret individuals were observed utilizing the emergent to canopy layers of the aforementioned mangrove species at the roosting site northeast of the Project boundary while another 20 ind. of the Little Egret which arrived in flock also utilized the canopy to emergent layers of these roosting substrate, at the same site, for their final roost. On the other hand, at around 18:03, eight ind. of the Chinese Pond Heron were observed at the roosting site east of the Project boundary. These were roosting on the inner portion of the understory layer of the roosting substrate. Bird droppings were noted within the vicinity (**Appendix B.4**).

Summary of results is presented in **Table 3.1**.

#### 3.2 Confirmatory Survey

During the PRP, the period with reference to the initial survey results, no PRA of the Chinese Pond Heron nor of any other ardeid species was observed within the survey area.

For the final night roost, unlike the results of the initial survey, all the four ardeid species (i.e. Chinese Pond Heron, Grey Heron, Great Egret and Little Egret) were observed to arrive at their

respective final roost sites at around 18:15. A total of three ind. of Chinese Pond Heron and one ind. of Grey Heron were noted at the roosting site east of the Project boundary. Similar with the initial survey results, individuals of Chinese Pond Heron were still observed roosting on the inner portion of the understory layer of the roosting substrate. Meanwhile, the solitary Grey Heron was observed roosting at the exposed branch of the substrate's understory layer. Bird droppings were noted within the vicinity. On the other hand, several ardeid species including Great Egret (seven ind.), Little Egret (12 ind.), Chinese Pond Heron (10 ind.) and Grey Heron (1 ind.) were noted roosting at the mangrove strip northeast of the Project boundary. Similar with initial survey results, individuals of Great Egret and Little Egret were observed utilizing the emergent to canopy layers of the roosting substrate; while the Chinese Pond Heron individuals utilized the inner understory portion of the substrate and Grey Heron used the outer portion of the understory layer.

Summary of results is presented in **Table 3.2**.

Table 3.1: Initial Survey Findings

Date: 12 January 2021					
Tidal Condition: Low Tide					
Pre-roost Period			Final roost Period		
Time of Return:	17:38 (Chinese Pond Heron)		Time of Return:	17:38 (Great Egret and Little Egret); 18:03 (Chinese Pond Heron)	
Parameters	Location		Parameters	Location	
	ANR1	ANR2		ANR1	ANR2
Pre-roost Aggregation (Y/N):	Y	N	Substrate Species:	<i>Sonneratia apetala</i> and <i>S. caseolaris</i>	<i>Sonneratia apetala</i> and <i>S. caseolaris</i>
Substrate Species:	<i>Sonneratia apetala</i> and <i>S. caseolaris</i>	<i>Sonneratia apetala</i> and <i>S. caseolaris</i>	Substrate Height (m):	Approximately 5 m.	Approximately 3-4 m.
Substrate Height (m):	Approximately 5 m.	Approximately 3-4 m.			
Ardeid Species Composition	Abundance (individuals)		Ardeid Species Composition	Abundance (individuals)	
	ANR1	ANR2		ANR1	ANR2
Chinese Pond Heron <i>Ardeola bacchus</i>	5*	-	Chinese Pond Heron <i>Ardeola bacchus</i>	8	-
			Great Egret <i>Ardea alba</i>	-	20
			Little Egret <i>Egretta garzetta</i>	-	20
Breeding Activity (Y/N):	ANR1	N			
	ANR2	N			
Notes: Pre-roost Period: Period when avian individuals gather first before flying into a night roost ANR1: Active ardeid night roost area east of the Project boundary ANR2: Active ardeid night roost area northeast of the Project boundary *: individuals aggregated on the exposed mudflat contiguous to their final mangrove roosting substrate -: not recorded					

Table 3.2: Confirmatory Survey Findings

Date: 25 January 2021					
Tidal Condition: High Tide					
Pre-roost Period			Final roost Period		
Time of Return:	-		Time of Return:	18:15	
Parameters	Location		Parameters	Location	
	ANR1	ANR2		ANR1	ANR2
Pre-roost Aggregation (Y/N):	N	N	Substrate Species:	<i>Sonneratia apetala</i> and <i>S. caseolaris</i>	<i>Sonneratia apetala</i> and <i>S. caseolaris</i>
Substrate Species:	<i>Sonneratia apetala</i> and <i>S. caseolaris</i>	<i>Sonneratia apetala</i> and <i>S. caseolaris</i>	Substrate Height (m):	Approximately 5 m.	Approximately 3-4 m.
Substrate Height (m):	Approximately 5 m.	Approximately 3-4 m.			
Ardeid Species Composition	Abundance (individuals)		Ardeid Species Composition	Abundance (individuals)	
	ANR1	ANR2		ANR1	ANR2
-	-	-	Chinese Pond Heron <i>Ardeola bacchus</i>	3	10
			Grey Heron <i>Ardea cinerea</i>	1	1
			Great Egret <i>Ardea alba</i>		7
			Little Egret <i>Egretta garzetta</i>		12
Breeding Activity (Y/N):	ANR1	N			
	ANR2	N			
Notes: Pre-roost Period: Period when avian individuals gather first before flying into a night roost ANR1: Active ardeid night roost area east of the Project boundary ANR2: Active ardeid night roost area northeast of the Project boundary *: individuals aggregated on the exposed mudflat contiguous to their final mangrove roosting substrate -: not recorded					

## 4. SUMMARY, CONCLUSION, AND RECOMMENDATION

Two active night roost sites were observed within the Survey Area, 100 m from the Project boundary. One site was located in the mangrove strip east of the Project boundary and the other in the northeast portion of the Project boundary. Four ardeid species including the Chinese Pond Heron, Great Egret, Little Egret and Grey Heron were observed utilizing the aforementioned roosting sites. The mangrove species *S. apetala* and *S. caseolaris* were utilized as roosting substrate. For the Pre-roosting aggregation (PRA), only one species, the Chinese Pond Heron was observed with the behaviour which started as early as 17:38, while during this time, final roosting activities for other ardeid species were concurrently noted already. No breeding activity was noted in both roosting areas as the breeding season of the ardeids have not begun yet.

According to the findings of the current survey, it is suggested that use of powered mechanical equipment within 100 m buffer zone from the active night roosting sites after 17:30 during dry season will be restricted. Time restrictions during wet season (after 18:00) shall follow **Section 7.3.11 of the approved EM&A Manual**. The relevant buffer zone is shown in **Appendix A.1**. The night roosts pre-identified in the EIA report were also considered in determining the maximum buffer zones to account for the dynamic roosting activities within the vicinity. Furthermore, noise monitoring will be conducted in stations (NMS1 and NMS2) (**Appendix A.1**) as close as practicable to these night roosts during the construction phase of the Project.

### 4.1 Recommended Noise Monitoring Activities

#### 4.1.1 Monitoring Locations, Frequency, Time and Parameters

The recommended noise monitoring locations shall be established at 22°28'4.25"N, 114°1'41.32"E; and 22°28'10.43"N, 114°1'42.17"E for NMS1 and NMS2 stations, respectively. Monitoring frequency shall be once a month in concurrence with the construction phase monthly monitoring of the active night roosts for correlation. Monitoring time for both stations shall start around 17:38, the earliest pre-roost period recorded during the survey, and shall last for 30 minutes. **Table 4.1** presents the monitoring parameters.

Table 4.1: Noise Monitoring Parameters

Parameter	Frequency and Period
LAeq (30 min) (L10 and L90 will be recorded for reference)	Monthly in concurrence with the construction phase monthly monitoring of the active night roosts

**4.1.2 Proposed Action Level and Limit Level and Corresponding Responses in case/s of exceedance/s**

**4.1.2.1 Proposed Action Level and Limit Level**

As there are no specific guidelines on noise thresholds for roosting egrets, the Action and limit specified in were based on study conducted on exploring behavioural responses of shorebirds to impulsive noise (Wright et al. 2010).

Table 4.2: Action Level and Limit Level

Time Period	Action Level	Limit Level
after 17:30 during dry season after 18:00 during wet season	65.5 dB(A) <sup>1</sup>	72.2 dB(A) <sup>2</sup>
Notes: 1. behavioural response of some kind more likely to occur 2. flight with abandonment of the site becomes the most likely outcome of the disturbance		

Exceedances to the limit level shall be prevented by the full implementation of mitigation measures (Section 4.2 of this report) during the construction phase.

**4.1.2.2 Proposed Event and Action Plan**

In instances of exceedance/s in the proposed action and/or limit levels, the different measures as specified in **Table 3.3 Event and Action Plan for Construction Noise of the approved EM&A Manual** and presented in **Table 4.3** of this report shall be implemented as responses.

Table 4.3: Event and Action Plan

Event	Action			
	ET	IEC	ER	Contractor
<b>Action Level</b>	1. Notify IEC and Contractor; 2. Carry out investigation; 3. Report the results of investigation to the IEC, ER and Contractor; 4. Discuss with the Contractor and formulate remedial measures; and 5. Increase monitoring frequency to check mitigation effectiveness.	1. Review the analyzed results submitted by the ET; 2. Review the proposed remedial measures by the Contractor and advise the ER accordingly; and 3. Supervise the implementation of remedial measures.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Require Contractor to propose remedial measures for the analyzed noise problem; and 4. Ensure remedial measures are properly implemented.	1. Submit noise mitigation proposals to IEC; and 2. Implement noise mitigation proposals.

Event	Action			
	ET	IEC	ER	Contractor
Limit Level	<ol style="list-style-type: none"> <li>1. Identify source;</li> <li>2. Inform IEC, ER, EPD and Contractor;</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; and</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; and</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; and</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; and</li> <li>5. Stop the relevant portion of works as determined by the ER until the exceedance is abated.</li> </ol>

### 4.1.3 Monitoring Equipment

With reference to the requirements of the Technical Memorandum (TM) issued under the NCO, the sound level meters for the monitoring activities shall be in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications. Immediately prior to and following each noise measurement, the accuracy of

the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. The measurements may be accepted as valid only if the difference between calibration levels obtained before and after the noise measurement is less than 1.0 dB. The equipment specifications are presented in **Table 4.4**.

Table 4.4: Noise Monitoring Equipment Specifications

Item	Brand	Model	Equipment
1	Casella	CEL-63X Series	Integrating Sound Level Meter
2	Casella	CEL-120/1	Calibrator
3	Benetech	GM816	Wind Speed Anemometer

The catalogue of the noise monitoring equipment is presented in **Appendix C.1**.

Current calibration certificates are presented in **Appendix C.2**.

#### 4.1.4 Monitoring Procedure

- The battery condition shall be checked to ensure good functioning of the meter.
- Parameters such as frequency weighting, the time weighting and the measurement time shall be set as follows:
  - frequency weighting: A
  - time weighting: Fast
  - measurement time: continuous 5 minutes interval
- Prior to and after noise measurement, each meter shall be calibrated using the calibrator for 94.0 dB at 1000 Hz. If the difference in the calibration level before and after measurement is more than 1.0 dB, the measurement shall be considered invalid and repeat of noise measurement is required after re-calibration or repair of the equipment.
- Noise measurements shall not be made in fog, rain, wind with a steady speed exceeding 5 m/s or wind with gusts exceeding 10 m/s. The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s.

## 4.2 Recommended Measures to Minimize Impact on the Ardeid Night Roosts during Project Construction

### 4.2.1 Recommended Measure to Minimize Noise Impact

Restriction on the use of powered mechanical equipment within 100 m buffer zone from the active night roosting sites after 17:30 during dry season and after 18:00 during wet season throughout the construction phase of the Project as described in **Section 7.3.11 of the approved EM&A Manual**. For additional protection of the nearby night roosts, noise barriers with absorptive materials of at least 4m high shall be erected along the periphery of the Project Site including at its northern and eastern sides as required by **EP Condition 2.10 (iii)** where the night roosts are located. Moreover, noise mitigation measures as mentioned in **Section 3.8 of the approved EM&A Manual** shall be strictly implemented.



However, in instances when night-time works will be inevitable, in addition to provision of noise barriers, measures such as use of low-noise technology and equipment; acoustic mats and enclosures as specified in the Noise Mitigation Measures Plan shall also be fully implemented as required by **EP Condition 2.12** to minimize construction noise impacts on nearby night roosts.

#### 4.2.2 Recommended Measure to Minimize Light Overspill

There shall be no construction works with PME within 100m from the night roost after 18:00 during wet season and after 17:30 during dry season as described in **Section 7.3.11 of the approved EM&A Manual** to prevent light glare from the construction site to the nearby night roosts.

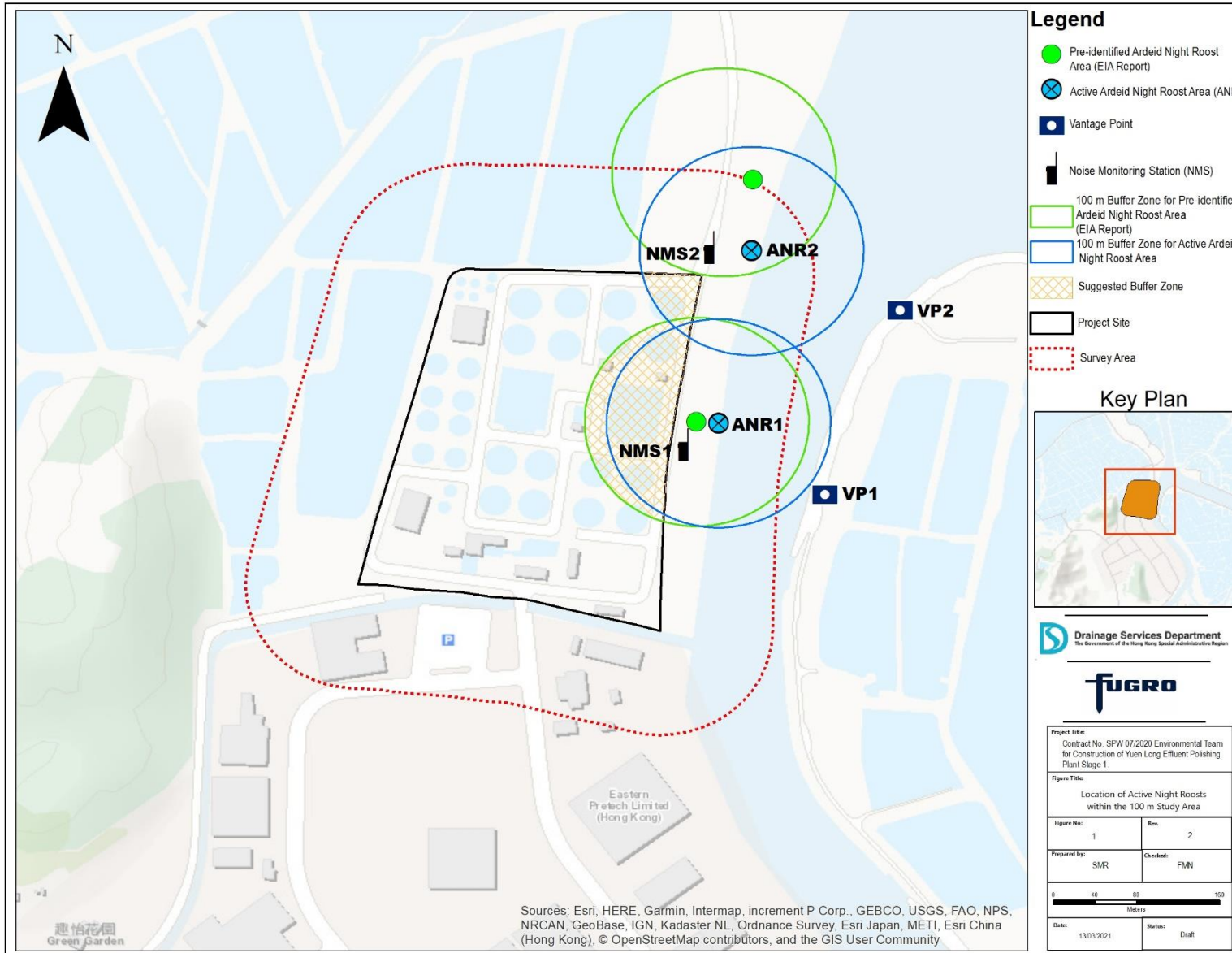
However, in instances when night-time works will be inevitable, directional down lighting and control of lighting periods and intensity shall be implemented as required by **EP Condition 2.13** to minimize overspill of light to the roosting areas. All measures as recommended in the Proposal for Minimization of Overspill Light to Ecological Sensitive Area shall be fully implemented. No light glare shall illuminate towards the night roost areas and this shall be accomplished through preservation of *Ficus microcarpa* trees located at the Site boundary that shall act as barrier for light flow to the night roosts; and the establishment of noise barriers to also act as light barrier to roosting areas.

## 5. REFERENCES

- Moore, J.E. and P.V. Switzer. 1997. Pre-roosting aggregations in the American crow, *Corvus brachyrhyncos*. *Can. J. Zool.* 76: 508-512.
- Wright, M.D., P. Goodman, and T.C. Cameron. 2010. Exploring behavioural responses of shorebirds to impulsive noise. *Wildfowl.* 60: 150–167.

## Appendix A

Survey area, vantage points for observation of active night roosts; and suggested noise monitoring station



Appendix A.1: Map of the Survey Area, Vantage Points for Observation of Active Night Roosts and Suggested Noise Monitoring Station

# Appendix B

Survey photos

## B.1 Active Night Roosting Sites



Appendix B.1a: Active night roost located east of the Project boundary observed on 12 January 2021 around 18:03



Appendix B.1b: Active night roost located east of the Project boundary observed on 12 January 2021 around 18:15

## B.2 Roosting Substrates



Appendix B.2a: Photo of the mangrove *Sonneratia caseolaris* utilized by ardeids as roosting site taken on 25 January 2021 around 16:20



Appendix B.2b: Photo of the mangrove species *Sonneratia apetala* utilized by ardeids as roosting site taken on 25 January 2021 around 16:20

### B.3 Pre-roosting Aggregate



Appendix B.3: Pre-roost aggregate of Chinese Pond Heron *Ardeola bacchus* east of the Project boundary observed on 12 January 2021 around 17:38

### B.4 Indicator of Presence of Night Roosts



Appendix B.4: Bird droppings on leaf surfaces of the undergrowth species Spiny Bears Breech *Acanthus ilicifolius* within the vicinity of the mangrove strip east of the Project boundary observed on 12 January 2021 around 20:02

# Appendix C

Noise Monitoring Equipment  
Catalogue and Current  
Calibration Certificates



## C.1 Catalogue of the Noise Monitoring Equipment

# CASELLA

# 63x series

## Casella 63x Digital Sound Level Meter

With advanced functionality and simple user interface, the 63x range is designed to make occupational and environmental noise measurements quickly and easily.



[www.casellasolutions.com](http://www.casellasolutions.com)

# 63xseries

## Applications

### Occupational Noise Measurement

- Workplace noise assessments according to ISO9612, OSHA 29CFR 1910.95
- Selection of hearing protection
- Calculation of noise exposure
- Ensuring compliance with workplace noise legislation

### Environmental Noise Measurement

- Boundary noise assessments
- Noise nuisance complaints
- Measurements according to ISO1996, BS4142
- UK Construction Section 61 notices

## Key Features

- Ideal for environmental or occupational monitoring
- Easy to use switch-on-and-go functionality
- Latest digital technology with a high resolution colour TFT display
- Pre-configured set-ups for occupational and environmental measurements
- Voice notes to annotate measurements
- Audio (WAV) recording
- Single measurement range up to 140dB, no range adjustment required
- Data markers, back erase function and audio recording
- Level triggered events for transient measurements
- Real-time octave and 1/3 octave measurements
- Simultaneous measurement of all parameters with all frequency and time weightings
- Class 1 or Class 2 models available
- 2GB memory for more than 1 year of data storage
- Removable pre-amp
- Environmental outdoor kit available

## Occupational Noise Measurements

The CEL-630 Series is designed to make workplace noise measurements as quick and simple as possible. The displayed information can be made as simple or comprehensive as required and all measurement parameters are stored simultaneously, so no incorrect measurements can be made.

When the unit is calibrated with the CEL-120 calibrator, the calibration dates and times are stored and downloaded to Casella insight software, validating the accuracy of measurements.

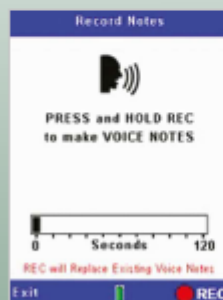
Average, peak, and octave band measurements are performed at the same time, so only one measurement needs to be made for all workplace noise applications.

- Simultaneous measurements of all workplace noise parameters
- Standard set-ups for workplace noise legislation
- Measures parameters for hearing protection selection by the SNR, HML and octave band method
- Analyse time history of noise levels
- Optional high range microphone, up to 165dB



Lightweight with a bright colour display, the 63x makes workplace noise measurements easy

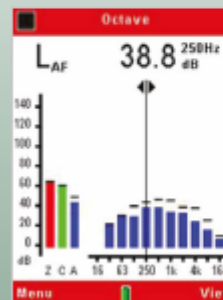
### Simple User Interface...



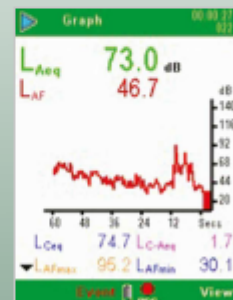
Record voice notes to easily identify measurements



Simple icon based user interface



Octave measurements for the selection of PPE



See the time history of noise levels

# 63xseries

## Environmental Noise Measurements

Data can be marked to signify any significant events, the data from which can be removed afterwards in insight software.

Up to 60 hours of audio files can be stored, commonly used for noise source identification. Stored audio can be played back on the instrument using headphones or downloaded to Casella insight software.

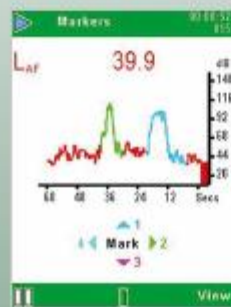
For unattended monitoring, event mode (CEL-633) allows trigger levels (dB) to be set, so additional data (e.g.  $L_{Aeq}$ ,  $L_{max}$ ) is stored together with the audio file for later play back or analysis, as well as a profile down to 10ms intervals.

An environmental noise monitoring kit is available which protects the instrument and microphone from the weather and allows unattended monitoring for up to 10 days.

- Simultaneous broadband and frequency measurement
- Data markers
- Back erase function
- Real-time frequency analysis
- Single measurement range
- Triggered 'event' capture



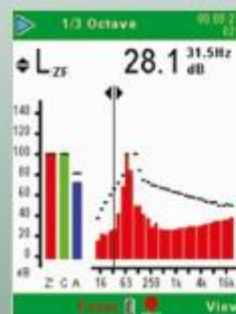
A dedicated environmental kit is available



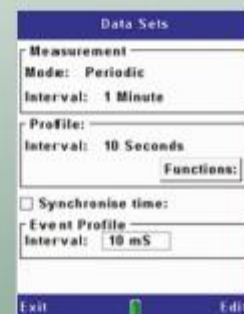
Significant noise events can be marked



Listen to audio files from the 63x Series with headphones



Realtime frequency analysis and single measurement range



Set 2 levels of time history storage

## 63x Series Model Selection

### Model Functionality

There are 2 models available, please see the model selection table below for the one you require (e.g. CEL-632). Then select your frequency analysis requirements by adding 'A' for broadband, 'B' adds octave band and 'C' adds 1/3 octave e.g. CEL-632C. Then add either a 1 or a 2 to denote the accuracy class e.g. CEL-632C1. Each instrument comes complete with a standard kit case, windshield and calibration certificate.

### Instrument Kits

For an instrument kit add /K1 to the instrument part number e.g. CEL-632C1/K1. Instrument kits include the relevant instrument, acoustic calibrator (CEL-120), USB download cable, batteries, calibration certificates and an executive kit case.

63xseries	632	633
Cumulative Results	•	•
Period Results	•	•
Profile Results	•	•
Statistical Values [Ln%]	•	•
Audio Voice Notes	•	•
Marker Events	•	•
Level Events	•	•
External Events	•	•

### Accessories

CEL-6840	Standard kit case*	CEL-6718	Lightweight tripod
196030C	Executive kit case**	CMC73	Portable printer kit (fits in 196030 kit case)
CEL-251	Microphone Class 1*	MIC1	High range microphone (to 165dB)
CEL-252	Microphone Class 2*	MPA1	High range microphone adaptor (for use with MIC1)
CEL-120/1	Acoustic Calibrator Class 1**		
CEL-120/2	Acoustic Calibrator Class 2**		
PC18	Universal power supply		
CMC51	USB download cable*		

\* Included with instrument

\*\*Included with instrument kit (with CEL-630Y/K1 where 'X' and 'Y' represent the model numbers)

**Insight Management Software**

Casella Insight data management software is a powerful yet simple tool to download, analyse and report from either workplace or environmental noise data.

- Analysis of noise level time history
- Replay voice notes and event audio
- Intuitive user interface
- Remove anomalous data from results
- Analysis of time history
- Generate comprehensive reports
- Store data by, person, place, location
- Manage multiple instruments and calibration

Switch between managing data or instruments with simple tabs

Simple tree structure to manage data e.g. person, place, etc.

Time history may be viewed, analysed and annotated as required

Sort data by person, process, etc.

Multiple parameters can be displayed and sorted simultaneously

Data can be dragged and dropped to the tree structure as required

Data may be graphed and copied to other applications

For more detail on Casella Insight Data Management Software, please visit the 'Products' section of [casellasolutions.com](http://casellasolutions.com)

### Technical Specification

**Standards:** IEC61672: 2002 Class 1 and 2, ANSI S1.4: Type 1 and 2 (1983)

**Filters:** IEC61260: Class 0, ANSI S1.43: (1996)

**Note:** IEC61672 replaces 2 obsolete standards, IEC60651 and IEC60804

**General**

**Measurement range:** 20-140dB RMS (143.3dB peak)

**Total Noise floor:** 19dB(A) Class 1, 25dB(A) Class 2

**Time weightings:** Fast, Slow and Impulse simultaneously

**Frequency weightings:** A, C and Z (un-weighted) simultaneously

**Frequency bands:** 11 Octave bands 16Hz-16kHz (B&C models)  
33 Octave bands 12.5Hz-20kHz (C models)

**Amplitude weighting (Q):** 3, 4 and 5 simultaneously

**Back erase:** Last 10s in cumulative mode (all models)

**Timers:** Duration 1s-24h,

**On/Off timers:** 6 sets with selectable times and a repeat function

**Physical**

**Tripod mount:** 3/4" Whitworth socket

**Batteries:** 3x AA Alkaline, 10-15 hours dependent on backlight

**External power:** 9-14V DC at 150mA

**Weight:** 332g including batteries

**Size:** 230x72x31mm inc preamp and microphone

### Measured Parameters

**Broadband:**  $L_{eq}, L_{eqmax}, L_{eqmin}, L_{eqsp}, L_{eqpeak}, L_{eqp}, LC-LA, L_{day}, L_{even}, L_{night}, L_{off}$   
Workplace dose values are calculated within insight software.

**Octaves and 1/3 octaves:**  $L_{eq}, L_{eqmax}, L_{eqmin}, 5x Ln\%$  (on C&Z-633). Where X is the frequency weighting A, C or Z and Y represents time weighting Fast (F), Slow (S) or Impulse (I). All weightings simultaneously measured where appropriate.

C&Z-633 model additionally stores  $5x L_{eq}$  values in broadband and octave modes.

For time history data, all parameters are logged for period times plus 6 selectable profile parameters (plus  $5x L_{eq}$  values on C&Z-633).

**Memory**

Memory: 2GB (>1 year logging when set to 1 second interval, 999 runs). All parameters stored and accessible via Casella insight. Total measurement runs: 999.

Events: 999 events/run. 10 hours of audio recording in high quality mode, 60 hours in low quality mode. For long term unattended monitoring the C&Z-633 takes a new run daily for up to a total of 400 days.

**Audio Recording**

Low Quality: 8,000 samples/s @ 8bit (64kb/s), up to 4kHz

High Quality: 24,000 samples/s @ 8 bit (192kb/s), up to 12kHz

**Environmental**

Operating 0 to 90%RH in the absence of condensation

Conditions: Temperature of -10 to +50°C (Class 1) and 0 to 40°C (Class 2)

Atmospheric pressure of 65 to 108kPa.

**Languages**

User interface can be changed via the menu: English, French, German, Spanish, Italian, Portuguese, Chinese.

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Casella reserves the right to amend the specification without notice

SM10006 v6









## Casella 120 Acoustic Calibrator

**The Smallest Acoustic  
Calibrator in the World**



Actual Size

### System Features

- Compliant with IEC 60942: 2003 and ANSI S1.40:2006

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- Class 1 & 2 accuracy versions

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- Digital technology ensures highly stable acoustic performance

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- Dual calibration level (Class 1 version) of 94dB and 114dB at 1kHz

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- Rugged, ergonomic design

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- Simple to use with incorrect microphone insertion warning

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- Automatic power off to conserve life of battery, typically 2 years

### Overview

The Casella 120 Acoustic Calibrator is the smallest of its type in the world; with a rugged, over-moulded design for use in field environments.

The field calibration of Sound Level Meters is an essential procedure when carrying out any type of noise survey both before and after each measurement sequence. This ensures that instruments are providing consistently accurate readings necessary for monitoring to ensure compliance with workplace and environmental noise regulations.

The 120 is therefore designed and manufactured to comply with the requirements of IEC 60942: 2003 and ANSI S1.40: 2006. These standards stipulate accurate calibration over a wide range of temperature, humidity and pressure conditions, typical of field work, ensuring accurate calibration in all conditions.

# CASELLA 120 SERIES

## Digital technology for optimum accuracy

The 120 is compact and ergonomically designed with simplicity and ease of use being the highest priorities. Key features include a simple keypad for intuitive control, permitting calibration level changes when required. When used with instruments like the-62X series, calibration routines commence automatically as soon as a calibration tone is detected to further simplify the task.

The 120 uses a MEMS microphone and a digital feedback loop to maintain the acoustic pressure in the cavity at the required level. An indicator shows if the sound level meter microphone is incorrectly inserted into the cavity, removing any potential for calibration error.

The microprocessor control detects when the microphone is removed and automatically switches off the calibration tone. This conserves battery power, allowing batteries to last for up to 2 years of operation.

Both the CEL-120/1 and CEL-120/2 calibrator accept all industry standard 1/2" microphone capsules. Smaller 1/4" microphones may be accommodated using the 1/2" to 1/4" adaptor (CEL-4726). The relevant 120 also comes as standard with our range of noise monitoring kits.

## Technical Specification

### General

Type:	CEL-120/1: Calibrator to EN (IEC) 60942: 2003, ANSI S1.40: 2006 Class 1 CEL-120/2: Calibrator to EN (IEC) 60942: 2003, ANSI S1.40: 2006 Class 2
Calibration sound pressure level (over environmental range):	CEL-120/1: 114.0dB ±0.4dB and 94.0dB ±0.4dB CEL-120/2: 114.0dB ±0.6dB
Calibration level (at reference conditions):	CEL-120/1: 114.0 dB ±0.25 dB and 94.0 dB ±0.25 dB, CEL-120/2: 114.0 dB ±0.35 dB
Calibration Frequency:	1kHz ±1Hz
Harmonic Distortion:	Less than 1.0%
Battery:	2 x 1.5V AAA (LR03)
Battery life:	A typical operational life of 2 years
Dimensions:	75.5 x 54.0 x 37.0mm (2.9 x 2.1 x 1.4")
Weight:	85g (0.19lb) including batteries

## Ordering Information

CEL-120/1 Dual level (94dB and 114dB) Class 1 Calibrator. Including batteries, operating instructions and calibration certificate.

CEL-120/2 114dB Class 2 Calibrator. Including batteries, operating instructions and calibration certificate.

### Optional

CEL-4726 1/4" to 1/2" coupler for CEL-120 calibrator.



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## C.2 Current Calibration Certificates of the Noise Monitoring Equipment