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Consultancy Agreement No. C1502

# Environmental Impact Assessment Study for Tuen Mun South Extension

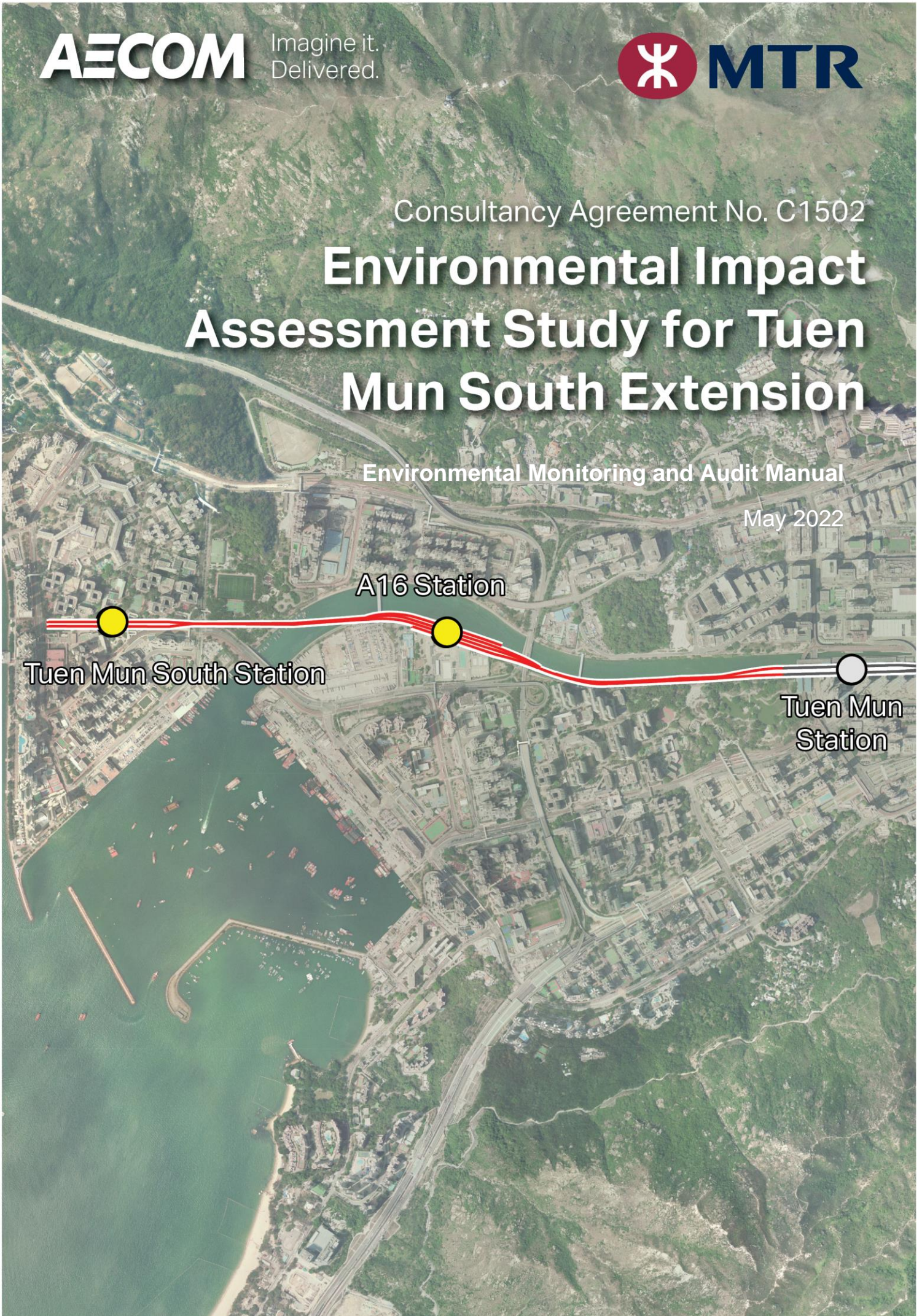
Environmental Monitoring and Audit Manual

May 2022

A16 Station

Tuen Mun South Station

Tuen Mun  
Station





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## **1 INTRODUCTION**

### **1.1 Project description**

1.1.1 The Tuen Mun South Extension (TME) (hereinafter referred to as “the Project”) is one of the seven recommended railway schemes in the Railway Development Strategy 2014 (“RDS-2014”). The Project will extend the Tuen Ma Line (TML), from Tuen Mun (TUM) Station southwards by about 2.4 km, terminating at a new station near Tuen Mun Ferry Pier (i.e. Tuen Mun South (TMS) Station) with an intermediate station at Tuen Mun Area 16 (i.e. A16 Station). The key elements of the Project (**Figure No. C1502/C/TME/ACM/M50/101** refers) as assessed in this Environmental Impact Assessment (EIA) Report are listed below:

- Construction and operation of 2.4-km extension of the viaduct structure from TUM Station to the new TMS Station;
- Construction and operation of two new stations, namely TMS Station and A16 Station;
- Construction and operation of Stations associated facilities; and
- Construction and operation of a railway siding adjacent to A16 Station.

### **1.2 Purpose of the Manual**

1.2.1 The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the set-up of an EM&A programme to check on compliance with the Environmental Impact Assessment (EIA) study recommendations of the Project, to assess the effectiveness of the recommended mitigation measures, and to identify any further need for additional mitigation measures or remedial actions.

1.2.2 This EM&A Manual, which outlines the monitoring and audit programme for the Project, aims to provide systematic procedures for monitoring, auditing and minimizing environmental impacts associated with the construction and operation activities of the Project.

1.2.3 Hong Kong environmental regulations have served as environmental standards and guidelines in the preparation of this Manual. In addition, the EM&A Manual has been prepared in accordance with the requirements stipulated in Annex 21 of the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).

1.2.4 This Manual contains the following information:

- Responsibilities of the Contractor, the Engineer or Engineer’s Representative (ER), the Environmental Team (ET), and the Independent Environmental Checker (IEC) with respect to the environmental monitoring and audit requirements during the course of the Project;
- Project organization for the EM&A works;
- The basis for, and description of the broad approach underlying the EM&A programme;
- Details of the methodologies to be adopted, including all field laboratories and analytical procedures, and details on quality assurance and quality control programme;
- The rationale on which the environmental monitoring data will be evaluated and interpreted;
- Definition of Action and Limit levels;

- Establishment of Event and Action plans;
- Requirements for reviewing pollution sources and working procedures required in the event of non-compliance with the environmental criteria and complaints; and
- Requirements for presentation of environmental monitoring and audit data and appropriate reporting procedures.

1.2.5 This EM&A Manual is a dynamic document that should be reviewed regularly and updated as necessary during the construction and operation of the Project. The Contractor should regularly review the mitigation measures and project implementation schedule in [Appendix B](#) with respect to the design developments and construction methodology.

### 1.3 Project Organisation

1.3.1 The roles and responsibilities of the various parties involved in the EM&A process and the organisational structure of the organisations who are responsible for implementing the EM&A programme are outlined below. The proposed project organisations and lines of communication with respect to environmental protection works are shown in [Appendix A](#).

#### Engineer or Engineer's Representative (ER)

1.3.2 The Engineer is responsible for overseeing the construction works and for ensuring that the works are undertaken by the Contractor in accordance with the specification and contractual requirements. The duties and responsibilities of the Engineer with respect to EM&A may include:

- Supervise the Contractor's activities and ensure that the requirements in the EM&A Manual are fully complied with;
- Inform the Contractor when action is required to reduce environmental impacts in accordance with the Event and Action Plans;
- Participate in joint site inspections and audits undertaken by the ET; and
- Adhere to the procedures for carrying out exceedance and complaint investigations.

#### The Contractor

1.3.3 The Contractor should report to the ER. The duties and responsibilities of the Contractor are:

- Implement the EIA recommendations and requirements;
- Strictly adhere to the guidelines and requirements in this EM&A Manual;
- Provide assistance to the ET in carrying out relevant environmental monitoring and auditing, and investigation related to complaints and non-compliance (**Section 11** of this Manual refers);
- Participate in the site inspections undertaken by ET, and undertake correction action(s);
- Provide information / advice to ET regarding works activities which may contribute, or be continuing to the generation of adverse environmental condition(s);

- Submit proposals on mitigation measures in case of exceedances of Action and Limit levels, in accordance with the Event and Action Plans as detailed in this EM&A Manual;
- Implement measures to reduce environmental impacts where Action and Limit levels are exceeded until the events are resolved; and
- Adhere to the procedures for carrying out environmental complaint investigation in accordance with **Section 11** of this Manual.

#### Environmental Team (ET)

1.3.4 The ET should conduct the EM&A programme and ensure the Contractor's compliance with the Project's environmental performance requirements during construction. The ET should be an independent party from the IEC and the Contractor.

1.3.5 An ET should be established before the commencement of construction of the Project. The ET should be led and managed by the ET leader. The ET leader should possess at least 7 years of experience in EM&A and/or environmental management. The ET should monitor the mitigation measures implemented by the Contractor on a regular basis to ensure the compliance with the intended aims of the measures. The duties and responsibilities of the ET are:

- Set up all the required environmental monitoring stations;
- Monitor the various environmental parameters as required in the EM&A Manual;
- Carry out regular and ad hoc site inspections to investigate and audit the Contractor's site practice, equipment and work methodologies with respect to pollution control and environmental mitigation measures, and anticipate environmental issues for proactive and practicable action before problems arise;
- Analyse the EM&A data, review the success of EM&A programme to confirm the adequacy of mitigation measures implemented and the validity of the EIA predictions, and to identify any adverse environmental impacts arising and report EM&A results to the Contractor, IEC, and the ER;
- Liaise with IEC on all environmental performance matters, and timely submission of all relevant EM&A proforma for IEC's approval;
- Audit the relevant document(s)/record(s) and prepare reports on the environmental monitoring data and the site environmental conditions;
- Review the proposals of remedial measure from the Contractor in the case of exceedances of Action and Limit levels, in accordance with the Event and Action Plans;
- Advise the Contractor on environmental improvement, awareness, enhancement matters, etc., on site;
- Submit the EM&A report(s) to the Project Proponent and the EPD timely; and
- Adhere to the procedures for carrying out environmental complaint investigation in accordance with **Section 11** of this Manual.

#### Independent Environmental Checker (IEC)

1.3.6 An IEC should be employed by the ER / Project Proponent before commencement of construction of the Project. The IEC should advise the ER on environmental issues related to the Project. The IEC should possess at least 7 years of experience in EM&A and/or environmental management. The IEC should be an independent party from the ET and the Contractor. The duties and responsibilities of the IEC are:

- Review and audit at not less than monthly intervals in an independent, objective and professional manner in all aspects of the EM&A programme;
- Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and locations of sensitive receivers;
- Audit the EIA recommendations and requirements against the status of implementation of environmental protection measures on site;
- Review the effectiveness of environmental mitigation measures and project environmental performance;
- On as-needed basis, verify and certify the environmental acceptability of the Environmental Permit (EP) holder's construction methodology (both temporary and permanent works), relevant design plans and submissions under the EP;
- Carry out random sample check and audit on monitoring data and sampling procedures, etc;
- Conduct random site inspection;
- Verify the investigation results of environmental complaint cases and the effectiveness of corrective measures;
- Verify EM&A report that has been certified by the ET leader; and
- Provide feedback on the audit results to the ET, the ER or the Project Proponent according to Event and Action Plans in the EM&A Manual.

#### **1.4 Structure of the EM&A Manual**

1.4.1 Following this introductory section, the remainder of the Manual is set out as follows:

- Section 2 –Sets out EM&A requirement for air quality;
- Section 3 –Sets out EM&A requirement for noise;
- Section 4 –Sets out EM&A requirement for water quality;
- Section 5 – Details auditing requirement for waste management;
- Section 6 – Details auditing requirement for land contamination;
- Section 7 – Sets out EM&A requirement for terrestrial ecology;
- Section 8 – Details auditing requirement for landscape and visual impact;
- Section 9 – Details auditing requirement for cultural heritage;
- Section 10 – Details auditing requirement for hazard to life;
- Section 11 – Describes scope and frequency of environmental site audits and sets out the general requirements of the EM&A programme; and
- Section 12 – Details the EM&A reporting requirements.



## **2 AIR QUALITY**

### **2.1 Introduction**

2.1.1 Potential air quality impacts arising from the construction phase of the Project were assessed in the EIA Report. The major dusty construction activities of the Project would mainly be related to construction dust from excavation, piling, materials handling, spoil removal, backfilling and wind erosion which would generate insignificant amount of small size particulates, hence, no significant Respirable Suspended Particulates (RSP) or Fine Suspended Particulates (FSP) impacts would be anticipated. No adverse air quality impact from construction of the Project would be anticipated with the implementation of dust suppression measures as stipulated under Air Pollution Control (Construction Dust) Regulation (Cap 311R) and EPD's Recommended Pollution Control Clauses for Construction Contracts. Nonetheless, dust monitoring is recommended during the construction phase to ascertain that there would be no adverse dust impacts at the nearby sensitive receivers. Monitoring of 24-hour RSP and 24-hour FSP levels are not proposed. Therefore, only 1-hour Total Suspended Particulates (TSP) is recommended to be monitored and audited at the proposed monitoring locations.

2.1.2 No adverse air quality impact is expected during the operation of the Project, and thus air quality monitoring would not be required.

2.1.3 This section presents the requirements, methodology, equipment, monitoring locations and criteria for the monitoring and audit of construction dust impact during the construction phase of the Project.

### **2.2 Monitoring Parameters and Equipment**

2.2.1 The TSP levels should be measured by following the standard method as set out in High Volume Method for Total Suspended Particulates, Part 50 Chapter 1 Appendix B, Title 40 of the Code of Federal Regulations of the USEPA (hereinafter referred to as "HVS method").

2.2.2 Dust ladened air should be drawn through a high volume sampler (HVS) fitted with a conditioned, pre-weighed filter paper, at a controlled rate. After sampling, the filter paper with retained particles is collected and returned to the laboratory for drying in a desiccator followed by accurate weighing. TSP levels are calculated from the ratio of the mass of particulates retained on the filter paper to the total volume of air sampled.

2.2.3 All relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of sampler, identification and weight of the filter paper, and other special phenomena and work progress of the concerned site, etc, should be recorded down in detail. A sample data sheet is shown in [Appendix C](#). HVS in compliance with the following specification should be used for carrying out monitoring for TSP levels. High volume sampler (HVS) in compliance with the following specifications should be used for carrying out the 1-hour monitoring:

- 0.6 - 1.7 m<sup>3</sup> per minute (20 - 60 standard cubic feet per minute) adjustable flow range;
- equipped with a timing / control device with  $\pm 5$  minutes accuracy for 24 hours operation;
- installed with elapsed-time meter with  $\pm 2$  minutes accuracy for 24 hours operation;

- capable of providing a minimum exposed area of 406 cm<sup>2</sup> (63 in<sup>2</sup>);
  - flow control accuracy:  $\pm 2.5\%$  deviation over 24-hour sampling period;
  - incorporated with an electronic mass flow rate controller or other equivalent devices;
  - equipped with a shelter to protect the filter and sampler;
  - equipped with a flow recorder for continuous monitoring;
  - provided with a peaked roof inlet;
  - incorporated with a manometer;
  - able to hold and seal the filter paper to the sampler housing at horizontal position;
  - easy to change the filter; and
  - capable of operating continuously for 24-hour period.
- 2.2.4 The ET is responsible for the provision of the monitoring equipment and should provide sufficient number of dust monitoring equipment with appropriate calibration kit for carrying out the baseline, regular impacts monitoring and ad-hoc monitoring. The HVSs should be equipped with an electronic mass flow controller and be calibrated against a traceable standard at regular intervals, in accordance with requirements stated in the manufacturers operating manual and as described below. All the equipment, calibration kit, filter papers, etc, should be clearly labelled. The instrument should also be calibrated regularly.
- 2.2.5 Initial calibration of HVSs with mass flow controller should be conducted upon installation and thereafter every six months. The transfer standard shall be traceable to the internationally recognized primary standard and be calibrated annually. The calibration data should be properly documented for future reference by the IEC. All the data should be converted into standard temperature and pressure condition.
- 2.2.6 The flow-rate of the sampler before and after the sampling exercise with the filter in position should be verified to be constant and be recorded on the data sheet as shown in [Appendix C](#).
- 2.2.7 If the ET Leader proposes to use a direct reading dust meter to measure 1-hr TSP levels, he shall submit sufficient information to the IEC to prove that the instrument is capable of achieving a comparable result as the HVS and may be used for the 1-hr sampling. The instrument shall also be calibrated regularly, and the 1-hr sampling shall be determined periodically by HVS to check the validity and accuracy of the results measured by direct reading method.
- 2.2.8 Wind data monitoring equipment shall also be provided and set up at conspicuous locations for logging wind speed and wind direction near to the dust monitoring locations. The equipment installation location shall be proposed by the ET and agreed with the ER in consultation with the IEC. For installation and operation of wind data monitoring equipment, the following points shall be observed:
- the wind sensors shall be installed on masts at an elevated level 10m above ground so that they are clear of obstructions or turbulence caused by the buildings;
  - the wind data shall be captured by a data logger. The data recorded in the data logger shall be downloaded periodically for analysis at least once a month;
  - the wind data monitoring equipment shall be re-calibrated at least once every six months; and

- wind direction shall be divided into 16 sectors of 22.5 degrees each.

2.2.9 If the ET Leader proposes alternative dust monitoring equipment / methodology (e.g. direct reading methods) after the approval of this Manual, agreement from the IEC should be sought. The instrument should also be calibrated regularly following the requirements specified by the equipment manufacturers.

**2.3 Laboratory Measurement / Analysis**

2.3.1 A clean laboratory with constant temperature and humidity control, and equipped with necessary measuring and conditioning instruments, to handle the dust samples collected, shall be available for sample analysis, and equipment calibration and maintenance. The laboratory shall be Hong Kong Laboratory Accreditation Scheme (HOKLAS) accredited or other internationally accredited laboratory.

2.3.2 If a site laboratory is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment should be verified by IEC and approved by the ER. Measurement performed by the laboratory shall be demonstrated to the satisfaction of the ER and the IEC and EPD.

2.3.3 IEC shall conduct regular audit to the measurement performed by the laboratory to ensure the accuracy of measurement results. The ET Leader shall provide the ER with one copy of the Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50), Appendix B for his reference.

2.3.4 Filter paper of size 8"x10" shall be labelled before sampling. It shall be a clean filter paper with no pin holes, and shall be conditioned in a humidity controlled chamber for over 24-hr and be pre-weighed before use for the sampling.

2.3.5 After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper is then returned to the laboratory for reconditioning in the humidity controlled chamber followed by accurate weighing by an electronic balance with a readout down to 0.1 mg. The balance shall be regularly calibrated against a traceable standard.

2.3.6 All the collected samples shall be kept in a good condition for 6 months before disposal.

**2.4 Dust Monitoring Stations**

2.4.1 The worst potentially affected locations in the vicinity of the construction activities of the Project identified for TSP monitoring are listed in **Table 2.1** and are shown in **Figure No. [C1502/C/TME/ACM/M60/201](#)**.

**Table 2.1 Proposed Dust Monitoring Stations**

Monitoring Station No. <sup>(1)</sup>	ASR ID in EIA Report	ASR Description
AM1	A7	Islamic Primary School
AM2	A9	Oi Lai House, Yau Oi Estate
AM3	A21	Yan Chai Hospital Law Chan Chor Si Primary School
AM4	A28	Wu Tsui House, Wu King Estate
AM5	A41	Tuen Mun Swimming Pool (TMSP) <sup>(2)</sup>

Note:

- (1) 1-hour TSP impact monitoring should be conducted at the monitoring stations when there are Project-related major construction activities including site formation and piling works being undertaken within a radius of 500m from the monitoring stations.
- (2) Dust monitoring at Tuen Mun Swimming Pool will be ceased when it is closed or it is demolished. Upon the commencement of demolition of TMSP, the dust monitoring will be conducted at Castle Peak Bay Ambulance Depot (ASR ID. A34).

2.4.2 The status and locations of air quality sensitive receivers may change after this Manual is issued. In such case, the ET should propose alternative monitoring stations and seek agreement from the IEC and EPD.

2.4.3 When alternative monitoring locations are proposed, the monitoring stations should be chosen based on the following criteria:

- Monitoring at ASRs close to the major site activities which are likely to have air quality impacts;
- Monitoring as close as possible to the ASRs as defined in the EIAO-TM;
- Assurance of minimal disturbance to the occupants and working under a safe condition during monitoring; and
- Take into account the prevailing meteorological conditions.

2.4.4 The ET shall agree with IEC on the position of the HVS for installation of the monitoring equipment. When positioning the HVS, the following points should be noted:

- A horizontal platform with appropriate support to secure the samplers against gusty wind should be provided;
- Two samplers should not be placed less than 2m apart;
- the distance between the sampler and an obstacle, such as buildings, must be at least twice the height that the obstacle protrudes above the sampler;
- a minimum of 2m separation from walls, parapets and penthouses is required for rooftops samplers;
- a minimum of 2m separation from any supporting structure, measures horizontally is required;
- no furnace or incinerator flue is located nearby the samplers;
- airflow around the sampler is unrestricted;
- the sampler is more than 20m from the dripline;
- any wire fence and gate to protect the sampler, should not cause any obstruction during monitoring;
- permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
- a secured supply of electricity is needed to operate the samplers.

2.4.5 Subject to site conditions and monitoring results, the ET Leader, with IEC endorsement, may decide whether additional monitoring locations shall be included or any monitoring locations could be removed / relocated during the construction phase.

## 2.5 Baseline Monitoring

2.5.1 Baseline monitoring should be carried out to determine the ambient 1-hour TSP levels at the monitoring locations prior to the commencement of the major



construction works. Before commencing the baseline monitoring, the ET should inform the IEC of the baseline monitoring programme such that the IEC can conduct on-site audit to ensure accuracy of the baseline monitoring results.

- 2.5.2 TSP baseline monitoring should be carried out for a continuous period of at least two weeks with three sets of 1-hour ambient measurements taken daily at each monitoring station. During the baseline monitoring, there should not be any dust generating activities in the vicinity of the monitoring stations. General meteorological conditions (wind speed, direction and precipitation) and notes regarding any significant adjacent dust producing sources should also be recorded throughout the baseline monitoring period. A summary of baseline monitoring is presented in **Table 2.2**.
- 2.5.3 In case the baseline monitoring cannot be carried out at the designated monitoring locations during the baseline monitoring period, the ET Leader shall carry out the monitoring at alternative locations which can effectively represent the baseline conditions at the impact monitoring locations. The alternative baseline monitoring locations should be agreed with IEC and approved by the ER and EPD prior to commencement of baseline monitoring.
- 2.5.4 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with the IEC to agree on an appropriate set of data to be used as a baseline reference and submit to EPD for approval.
- 2.5.5 If the ET Leader considers that significant changes in the ambient conditions have arisen, a repeat of the baseline monitoring may be carried out to update the baseline levels and air quality criteria, after consultation and agreement with the ER, the IEC and the EPD.

**2.6 Impact Monitoring**

- 2.6.1 The ET shall carry out impact monitoring during major construction activity of the Project being undertaken within a radius of 500m from the monitoring stations. For 1-hour TSP monitoring, the sampling frequency of at least three times in every six-days should be undertaken when the highest dust impact occurs. The impact monitoring programme is summarised in **Table 2.2**.
- 2.6.2 The monthly schedule of the impact monitoring programme should be drawn up by the ET one month prior to the commencement of the scheduled construction period. Before commencement of the monitoring, the ET should inform the IEC of the impact monitoring programme such that the IEC can conduct an on-site audit.

**Table 2.2 Summary of Construction Dust Monitoring Programme**

Monitoring Period	Duration	Sampling Parameter	Frequency
Baseline Monitoring	Consecutive days of at least 2 weeks before commencement of major construction works	1 hour TSP	3 times per day
Impact Monitoring	Throughout the construction phase <sup>(1)</sup>	1 hour TSP	3 times in every 6 days

Note:

(1) Impact monitoring should be conducted at the monitoring stations for 1-hour TSP monitoring when there are Project-related major construction activities being undertaken within a radius of 500m from the monitoring stations.

**2.7 Event and Action Plan**

2.7.1 The baseline monitoring results form the basis for determining the air quality criteria for the impact monitoring. The ET shall compare the impact monitoring results with air quality criteria set up for 1-hour TSP. **Table 2.3** shows the air quality criteria, namely Action and Limit levels to be used.

**Table 2.3 Proposed Action and Limit Levels for Impact Monitoring**

Parameter	Action Level <sup>(1)</sup>	Limit Level
1-hour TSP	<ul style="list-style-type: none"> <li>• For <math>BL \leq 384\mu\text{g m}^{-3}</math>, <math>AL = (BL * 1.3 + LL)/2</math></li> <li>• For <math>BL &gt; 384\mu\text{g m}^{-3}</math>, <math>AL = LL</math></li> </ul>	$500\mu\text{g m}^{-3}$

Note:  
 (1) BL = Baseline level, AL = Action level, LL = Limit level.

2.7.2 The Event and Action Plan prescribes procedures and actions associated with the outcome of the comparison of air quality monitoring data recorded and the agreed A/L levels. In the cases where exceedances of these A/L levels occurs, the ET, the IEC, the ER and the Contractor should strictly observe the relevant actions of the respective Event and Action Plan listed in **Table 2.4**.

**2.8 Mitigation Measures**

2.8.1 Site-specific dust mitigation measures recommended in the EIA Report include watering on active works areas, exposed areas and haul roads, good site practices and dust suppression measures stipulated in Air Pollution Control (Construction Dust) Regulation. Details of the mitigation measures are presented in [Appendix B](#). The Contractor should be responsible for the design and implementation of these measures.

**Table 2.4 Event and Action Plan for Construction Dust Monitoring**

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
<b>ACTION LEVEL</b>				
Exceedance for one sample	<ol style="list-style-type: none"> <li>Repeat measurement to confirm findings;</li> <li>If exceedance is confirmed, inform the Contractor, IEC and ER;</li> <li>Identify source(s), investigate the causes of exceedance and propose remedial measures; and</li> <li>Increase monitoring frequency.</li> </ol>	<ol style="list-style-type: none"> <li>Check monitoring data submitted by the ET;</li> <li>Check Contractor's working method; and</li> <li>Discuss with ET, ER and Contractor on possible remedial measures; and</li> <li>Review and advise the ET and ER on the effectiveness of the proposed remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>Confirm receipt of notification of exceedance in writing.</li> </ol>	<ol style="list-style-type: none"> <li>Identify source(s), investigate the causes of exceedance and propose remedial measures;</li> <li>Implement remedial measures; and</li> <li>Amend working methods agreed with the ER as appropriate.</li> </ol>
Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> <li>Repeat measurements to confirm findings;</li> <li>If exceedance is confirmed, inform Contractor, IEC and ER;</li> <li>Identify source(s), investigate the causes of exceedance and propose remedial measures;</li> <li>Increase monitoring frequency to daily;</li> <li>Advise the Contractor and ER on the effectiveness of the proposed remedial measures;</li> <li>Discuss with IEC and Contractor on remedial actions required;</li> <li>If exceedance continues, arrange meeting with Contractor, IEC and ER to discuss the remedial measures to be taken; and</li> </ol>	<ol style="list-style-type: none"> <li>Check monitoring data submitted by the ET;</li> <li>Check Contractor's working method;</li> <li>Discuss with ET, ER and Contractor on possible remedial measures;</li> <li>Review and advise the ET and ER on the effectiveness of the proposed remedial measures; and</li> <li>Supervise Implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>Confirm receipt of notification of exceedance in writing;</li> <li>In consultation with the ET and IEC agree with the Contractor on the remedial measures to be implemented; and</li> <li>Supervise implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>Identify source(s) and investigate the causes of exceedance;</li> <li>Submit proposals for remedial measures to the ER, ET and IEC within three working days of notification for agreement;</li> <li>Implement the agreed proposals; and</li> <li>Amend proposal as appropriate.</li> </ol>

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
	8. If exceedance stops, cease additional monitoring.			
<b>LIMIT LEVEL</b>				
Exceedance for one sample	<ol style="list-style-type: none"> <li>1. Repeat measurement to confirm findings;</li> <li>2. If exceedance is confirmed, inform the Contractor, IEC, EPD and ER;</li> <li>3. Identify source(s), investigate the causes of exceedance and propose remedial;</li> <li>4. Increase monitoring frequency to daily; and</li> <li>5. Discuss with the ER, IEC and Contractor on the remedial measures and assess effectiveness.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring data submitted by the ET;</li> <li>2. Check Contractor's working method;</li> <li>3. Discuss with the ET, ER and Contractor on possible remedial measures;</li> <li>4. Review and advise the ET and ER on the effectiveness of the proposed remedial measures; and</li> <li>5. Supervise implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of exceedance in writing;</li> <li>2. Review and agree on the remedial measures proposed by the Contractor; and</li> <li>3. Ensure remedial measures properly implemented.</li> </ol>	<ol style="list-style-type: none"> <li>1. Identify source(s) and investigate the causes of exceedance;</li> <li>2. Take immediate action to avoid further exceedance;</li> <li>3. Submit proposals for remedial measures to ER, ET and IEC within three working days of notification for agreement;</li> <li>4. Implement the agreed proposals; and</li> <li>5. Amend proposal if appropriate.</li> </ol>
Exceedance for two or more consecutive samples	<ol style="list-style-type: none"> <li>1. Repeat measurement to confirm findings;</li> <li>2. If exceedance is confirmed, inform IEC, ER, Contractor and EPD;</li> <li>3. Identify source(s), investigate the causes of exceedance and propose remedial measures;</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> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring data submitted by the ET;</li> <li>2. Discuss amongst ER, ET, and Contractor on the potential remedial actions;</li> <li>3. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly; and</li> <li>4. Supervise the implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of exceedance in writing;</li> <li>2. In consultation with the ET and IEC, agree with the Contractor on the remedial measures to be implemented;</li> <li>3. Supervise the implementation of remedial measures; and</li> <li>4. 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. Identify source(s) and investigate the causes of exceedance;</li> <li>2. Take immediate action to avoid further exceedance;</li> <li>3. Submit proposals for remedial measures to the ER, IEC and ET within three working days of notification for agreement;</li> <li>4. Implement the agreed proposals;</li> <li>5. Revise and resubmit proposals if problem still not under control; and</li> <li>6. Stop the relevant portion of works as determined by the</li> </ol>



EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
	6. Arrange meeting with IEC and ER to discuss the remedial actions to be taken; 7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results; and 8. If exceedance stops, cease additional monitoring.			ER until the exceedance is abated.

### 3 NOISE

#### 3.1 Introduction

3.1.1 In this section, the requirements, methodology, equipment, monitoring locations, and protocols for the monitoring and audit of airborne noise impacts during the construction and operation phases of the Project are presented.

#### 3.2 Construction Noise

##### Noise Parameters

3.2.1 The construction noise level should be measured in terms of the A-weighted equivalent continuous sound pressure level ( $L_{eq}$ ).  $L_{eq(30\text{ min})}$  should be used as the monitoring parameter for the time period between 0700 and 1900 hours on normal weekdays.

3.2.2 Supplementary information for data auditing and statistical results such as  $L_{10}$  and  $L_{90}$  should also be obtained for reference. A sample data record sheet is shown in [Appendix C](#) for reference.

##### Monitoring Equipment and Methodology

3.2.3 As referred to the requirements of the Technical Memorandum (TM) issued under the NCO, sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications should be used for carrying out the noise monitoring. Immediately prior to and following each noise measurement the accuracy of the sound level meter should be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. 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.

3.2.4 Noise measurements should be made in accordance with standard acoustic principles and practices in the relation to weather conditions. Noise measurements should 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 should be checked with a portable wind speed meter capable of measuring the wind speed in m/s.

3.2.5 The ET is responsible for the provision of the monitoring equipment and should ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the baseline monitoring, regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation should be clearly labelled.

##### Noise Monitoring Stations

3.2.6 Based on the findings of EIA Report, the designated locations for construction noise monitoring are listed in **Table 3.1** and are shown in **Figure No. C1502/C/TME/ACM/M60/301**.

**Table 3.1 Noise Monitoring Stations during Construction Phase**

Monitoring Station No. <sup>(1)</sup>	NSR ID in EIA Report	NSR Description
CN1	CG	Tower 1, Century Gateway Phase 1
CN2	IPS	Islamic Primary School
CN3	LMO	Block 13, Lung Mun Oasis
CN4	HSNPS	Yan Chai Hospital Ho Sik Nam Primary School
CN5	TCC	Taoist Ching Chung Primary School
CN6	OH	Tower 1, Oceania Heights
CN7	PG	Block 1, Pierhead Garden
CN8	WF	Wu Fai House
CN9	GG	Block 8, Glorious Garden
CN10	OL	Oi Lai House, Yau Oi Estate
CN11	WT	Wu Tsui House

Note:

(1) Construction noise impact monitoring should be conducted at the monitoring stations when there are Project-related major construction activities being undertaken within a radius of 300m from the monitoring stations.

3.2.7 The status and location of noise sensitive receivers (NSRs) may change after approval of this Manual. In such case, and if changes to the monitoring locations are considered necessary, the ET should propose alternative monitoring stations and seek approval from the ER and agreement from the IEC and EPD on the proposal. If alternative monitoring stations are proposed, these stations should be chosen based on the following criteria:

- Monitoring at locations close to the major site activities of the Project that are likely to arise noise impacts;
- Monitoring as close as possible to the NSRs as defined in the EIAO-TM; and
- Assurance of minimal disturbance to the occupants and working under a safe condition during monitoring.

3.2.8 The monitoring station should normally be at a point 1m from the exterior of the noise sensitive facade and be at a position 1.2m above ground. If there is a problem with access to the normal monitoring position, an alternative position should be chosen, and a correction to the measurement results should be made. For reference, a correction of +3dB(A) should be made to free-field measurements. The ET should agree with the IEC on the monitoring position and the corrections adopted. Once the positions for the monitoring stations are chosen, the baseline monitoring and the impact monitoring should be carried out at the same positions. If changes to the monitoring stations are required upon commencing the baseline monitoring or thereafter, the ET should propose alternative locations based on the above-mentioned criteria and seek approval from the ER and agreement from the IEC and EPD on the proposal.

Impact Monitoring

3.2.9 Noise monitoring should be carried out at all the designated monitoring stations when there are Project-related construction activities being undertaken within a radius of 300m from the monitoring stations. The monitoring should obtain one set of 30-minute measurement at each station between 0700 and 1900 hours on normal weekdays at a frequency of once a week when construction activities within 300m

from respective monitoring station are underway.

- 3.2.10 In the case of non-compliance with the construction noise criteria, more frequent monitoring, as specified in Event and Action Plan in **Table 3.3**, should be carried out. This additional monitoring should be continued until the recorded noise levels show that the non-compliance is rectified or proved to be irrelevant to the Project-related construction activities.

Event and Action Plan

- 3.2.11 The Action and Limit levels for construction noise are defined in **Table 3.2**. Should non-compliance of the noise criteria occur actions in accordance with the Event and Action Plan in **Table 3.3** should be taken.

**Table 3.2 Action and Limit Levels for Construction Noise Impact Monitoring**

Time Period	Action Level	Limit Level
0700-1900 hours on normal weekdays	When one documented complaint is received	75 dB(A) for residential premises
		70 dB(A) for schools and 65 dB(A) during examination period



**Table 3.3 Event and Action Plan for Construction Noise Monitoring**

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
<b>Action Level</b>	<ol style="list-style-type: none"> <li>1. Investigate the complaint and propose remedial measures;</li> <li>2. Discuss with the ER and Contractor on the remedial measures required; and</li> <li>3. Increase monitoring frequency to check mitigation effectiveness.</li> </ol>	<ol style="list-style-type: none"> <li>1. Review the investigation results submitted by the Contractor; and</li> <li>2. Review and advise the ET and ER on the effectiveness of the remedial measures proposed by the Contractor.</li> <li>3. Supervise the implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Notify the Contractor, ET, IEC and Confirm receipt of notification of complaint in writing;</li> <li>2. Review and agree on the remedial measures proposed by the Contractor; and</li> <li>3. Supervise implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Investigate the complaint and propose remedial measures;</li> <li>2. Report the results of investigation to the IEC, ET and ER;</li> <li>3. Submit noise mitigation proposals to the ER, IEC and ET within three working days of notification for agreement; and</li> <li>4. Implement noise mitigation proposals.</li> </ol>
<b>Limit Level</b>	<ol style="list-style-type: none"> <li>1. Notify the Contractor, IEC, EPD and ER;</li> <li>2. Repeat measurement to confirm exceedance;</li> <li>3. Identify source and investigate the causes of exceedance;</li> <li>4. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented;</li> <li>5. Arrange meeting with the IEC and ER to discuss the remedial measures to be taken;</li> <li>6. Review the effectiveness of Contractor's remedial measures and keep IEC,</li> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring data submitted by the ET;</li> <li>2. Check the Contractor's working method;</li> <li>3. Discuss with the ER, ET and Contractor on the potential remedial measures; and</li> <li>4. Review and advise the ET and ER on the effectiveness of the remedial measures proposed by the Contractor.</li> <li>5. Supervise the implementation of remedial measures.</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of exceedance in writing;</li> <li>2. In consultation with the ET and IEC, agree with the Contractor on the remedial measures to be implemented;</li> <li>3. Supervise the implementation of remedial measures; and</li> <li>4. 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. Identify source and investigate the causes of exceedance;</li> <li>2. Take immediate action to avoid further exceedance;</li> <li>3. Submit proposals for remedial measures to the ER, IEC and ET within three working days of notification for agreement;</li> <li>4. Implement the agreed proposals;</li> <li>5. Revise and resubmit proposals if problem still not under control; and</li> <li>6. Stop the relevant portion of works as determined by the ER until the exceedance is abated.</li> </ol>

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
	EPD and ER informed of the results; and 7. If exceedance stops, cease additional monitoring.			

**3.3 Operation Noise – Fixed Plant**

- 3.3.1 The maximum permissible sound power levels of the identified fixed noise sources of the Project were predicted in the EIA Report. To ensure that the noise impact associated with the fixed plant operations would comply with the noise standards stipulated in the EIAO-TM and Noise Control Ordinance (NCO), the specified sound power levels should be implemented and refined by the Contractor as appropriate. The ET should carry out fixed plant noise audit and prepare audit report showing the design of the fixed plant noise sources associated with the Project complies with the maximum sound power levels determined in the EIA Report, or otherwise approved by the Director of Environmental Protection in compliance with the requirements in EIAO-TM having due regard to the characteristics of tonality, impulsiveness and intermittency. The audit report should be certified by the ET Leader and verified by the IEC as conforming to the information and recommendations contained in the EIA Report.
- 3.3.2 No specific monitoring for the fixed plant operation is deemed necessary.

**3.4 Operation Noise – Railway Noise**

Noise Parameter and Criteria

- 3.4.1 To ensure that the operational airborne railway noise levels comply with the noise standards stipulated in the NCO, the ET should carry out commissioning tests at the proposed monitoring locations identified in this EM&A Manual. The noise commissioning test report should be certified by the ET leader and verified by the IEC as conforming to the information and recommendations contained in the EIA report.
- 3.4.2 In addition, monitoring of  $L_{eq,30min}$  train noise levels should be carried out at the proposed monitoring locations during night-time period, i.e. 2300-0700 hours on a monthly basis after the Project is in operation. It is recommended to conduct the monitoring for the initial start-up of up to 6 months. With full compliance of the noise limit and agreement from IEC, monitoring can be terminated before the end of this 6-month period.
- 3.4.3 The Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM) stipulates the appropriate acceptable noise levels (ANL) for airborne railway noise. The ANLs are dependent on area sensitivity rating (ASR) of the noise sensitive receivers and are shown in **Table 3.5**.

**Table 3.4 Acceptable Noise Levels for Airborne Railway Noise**

Time Period	Noise Criteria ( $L_{eq, 30min}$ , dB(A))		
	ASR A	ASR B	ASR C
Daytime and Evening (0700 to 2300 hours)	60	65	70
Night-time (2300 to 0700 hours)	50	55	60

Monitoring Equipment and Methodology

- 3.4.4 The monitoring equipment and methodology for operational noise monitoring should be same as those recommended for construction noise monitoring.
- 3.4.5 The monitoring station should normally be at a point 1m from the exterior of the noise sensitive façade and be at a position 1.2m above ground. If there is a problem with

access to the normal monitoring position, an alternative position should be chosen, and a correction to the measurement results should be made. For reference, a correction of +3dB(A) should be made to free-field measurements. The ET should agree with the IEC on the corrections adopted.

- 3.4.6 One set of 30-minute measurement at the designated monitoring station should be conducted during night-time (2300 – 0700 hours). Noise measurements of the A-weighted equivalent continuous sound pressure level ( $L_{eq}$ ) should be made.  $L_{eq}$  (30 minutes) should be used as the monitoring parameter. Supplementary information for data auditing, statistical results, such as  $L_{max}$ ,  $L_{10}$  and  $L_{90}$  should also be obtained for reference.

Noise Monitoring Stations

- 3.4.7 Based on the findings of EIA Report, the designated locations for railway noise monitoring are listed in **Table 3.6** and are shown in **Figure No. C1502/C/TME/ACM/M60/302**.

**Table 3.5 Noise Monitoring Stations For Railway Noise**

Monitoring Station No. <sup>(1)</sup>	NSR ID in EIA Report	NSR Description	ASR <sup>(2)</sup>
ON1	OT	Oi Tak House, Yau Oi Estate	B
ON2	WHPQ	Tuen Mun Wu Hong Police Quarters	B
ON3	WB	Wu Boon House, Wu King Estate	B

Notes:

- (1) One set of 30-minute measurement at the designated monitoring station should be conducted during night-time (2300 – 0700 hours). Relevant noise criterion should be adopted for compliance checking accordingly.
- (2) The corresponding ASR of the NSR is determined based on the best available information and is for indicative assessment only. The Noise Control Authority shall determine noise impact from concerned noise sources on the basis of prevailing legislation and practices being in force, and the ASR determined in this report should not bind the Authority when enforcing the NCO based on the contemporary conditions. The ASR would be reviewed as necessary based on the contemporary conditions/situations.

- 3.4.8 The status and location of noise monitoring station may change after approval of this Manual. In such case, and if changes to the monitoring locations are considered necessary, the ET should propose alternative monitoring stations and seek approval from the ER and agreement from the IEC and EPD on the proposal. If alternative monitoring stations are proposed, these stations should be chosen based on the following criteria:

- Monitoring at locations close to the major operation activities of the Project that are likely to arise noise impacts;
- Monitoring as close as possible to the NSRs as defined in the EIAO-TM; and
- Assurance of minimal disturbance to the occupants and working under a safe condition during monitoring.

**3.5 Mitigation Measures**

Construction Phase

- 3.5.1 The EIA Report indicates that construction activities would cause airborne noise exceedances at a few NSRs, and therefore, appropriate noise mitigation measures and good site practices are recommended. The Contractor should be responsible for the design and implementation of these measures. The implementation schedule for the recommended mitigation measures is presented in [Appendix B](#).

- 3.5.2 Construction Noise Management Plan(s) (CNMP) should be prepared before commencement of construction works, so that both the verification of the plant inventory, and the assessment of the effectiveness and practicality of all identified mitigation measures for mitigating the construction noise impact of the Project, would be performed during the design, tendering and construction stage of the Project. A clear method statement of all the recommended mitigation measures for controlling the construction noise impacts should be formulated in the CNMP(s) to be prepared by future Contractors, such that all the recommended mitigation measures will be implemented and executed properly. In case there is any change to noise mitigation measures, the Contractor should update the CNMP accordingly to demonstrate the compliance of EIAO-TM with the implementation of proposed noise mitigation measures. The CNMP(s) should be certified by the ET Leader and verified by the IEC.
- 3.5.3 In the event of exceedances or Project related complaints, the Contractor should review the effectiveness of these mitigation measures and propose, design and implement alternative or additional measures as appropriate. The Contractor should liaise with the ET and ER on alternative or additional remedial measures, if appropriate, and the proposal of the measures should be submitted to the ER and IEC for agreement. The Contractor should implement the agreed remedial measures properly.

#### Operation Phase

- 3.5.4 The mitigation measures as recommended in the EIA Report for the fixed plant and railway noise associated with the Project is presented in [Appendix B](#). These measures should be reviewed and refined by the ER and ETL if there are any major design changes during the detailed design phase such that the recommended measures are adequate for alleviating the potential operation noise impacts.

## **4 WATER QUALITY**

### **4.1 Introduction**

4.1.1 Potential water quality impacts arising from the construction and operation phases of the Project were identified and assessed in the EIA Report. With the implementation of the recommended mitigation measures, no adverse water quality impacts from the Project would be expected during the construction and operation phases of the Project. Nevertheless, water quality monitoring and site audit is recommended during construction phase to ensure that all the recommended mitigation measures are properly implemented. No monitoring or audit is required in the operation phase.

### **4.2 Construction Phase EM&A**

#### Monitoring Parameters

4.2.1 Monitoring for Dissolved Oxygen (DO), Dissolved Oxygen Saturation (DO%), temperature, pH, turbidity, salinity, suspended solid (SS) and water depth should be undertaken at all designated monitoring locations. All parameters should be measured *in-situ* whereas SS should be determined by the laboratory. DO should be presented in mg/L and in % saturation.

4.2.2 Other relevant data should also be recorded, including monitoring location / position, time, tidal stages, weather conditions and any special phenomena or work underway at the construction site during the monitoring.

#### Monitoring Schedule and Stations

4.2.3 The proposed water quality monitoring schedule should be submitted to EPD at least two weeks before the first day of the monitoring month. EPD should also be notified immediately for any changes in schedule. The monitoring stations proposed in this section are indicative and are subject to further review before commencement of construction works at Tuen Mun River Channel. The locations of monitoring stations may change after issuing this Manual. The proposed monitoring locations should be submitted four weeks before commencement of baseline monitoring for IEC and EPD approval.

4.2.4 When alternative monitoring locations are proposed, they should be chosen based on the following criteria:

- Close to the sensitive receptors which are directly or likely to be affected;
- For monitoring locations located in the vicinity of the sensitive receptors, care should be taken to cause minimal disturbance during monitoring;
- Two or more control stations which should be at representative locations of the Project site in its undisturbed condition. Control stations should be located, as far as practicable, both upstream and downstream of the works area.

4.2.5 A total of 11 water quality monitoring locations are proposed in the Tuen Mun River channel (W1 to W11) during ebb tide and flood tide. Impact stations are designated in the vicinity of piling works and pile cap construction works within the Tuen Mun River Channel to measure any elevation of pollutant levels (e.g. SS level) due to the Project. As the water flow direction in the river channel is dominated by the tidal forcing from the southern entrance of the sea channel, the upstream station (i.e. W1) and downstream station (i.e. W8) of Tuen Mun River Channel would be served as control stations according to the tidal condition to compare the water quality near the works sites with the ambient water quality during the ebb tide and flood tide. All the

proposed water quality monitoring stations are listed in **Table 4.1** and their locations are shown in **Figure No. [C1502/C/TME/ACM/M60/401](#)**.

**Table 4.1 Proposed River Water Quality Monitoring Stations for Baseline and Construction Phase Monitoring**

Station ID.	Description <sup>(1)</sup>	Easting	Northing
<i>Ebb Tide</i>			
W1	Control Station	815248	828328
W2	Impact Station	815152	827793
W3	Impact Station	814910	827397
W4	Impact Station	814842	827316
W5	Impact Station	814729	826983
W6	Impact Station	814732	826890
W7	Impact Station	814715	826771
<i>Flood Tide</i>			
W8	Control Station	814789	826682
W9	Impact Station	814693	826816
W10	Impact Station	814717	826927
W11	Impact Station	814759	827168
W3	Impact Station	814910	827397
W2	Impact Station	815152	827793
W1	Impact Station	815248	828328

Note:

(1) Monitoring will be conducted when piling works and pile cap construction works are being conducted at Tuen Mun River Channel. As impact stations are designated in the vicinity of piling works and pile cap construction works within the Tuen Mun River Channel, the water quality monitoring will only be conducted at the designated stations that are located in the vicinity of piling works and pile cap construction works.

**Monitoring Requirements**

4.2.6 Baseline, impact and post-construction monitoring should be conducted. The following requirements should be followed for baseline, impact and post-construction monitoring:

- Measurement should be taken at 3 water depths, namely, 1m below water surface, mid-depth and 1m above sea bed, except where the water depth less than 6m, the mid-depth station may be omitted. Should the water depth be less than 3m, only the mid-depth station will be monitored. The ET should agree with EPD on all the monitoring stations.
- Duplicate *in-situ* measurements and water samples collected from each independent monitoring event are required for all parameters to ensure a robust statistically interpretable dataset.
- No sampling should be carried out when typhoon signal No. 3 or above or black rainstorm signal is hoisted.
- At each measurement depth, two consecutive measurements should be taken. The probes would be retrieved out of the water after the first measurement and



then redeployed for the second measurement. When the difference in value between the first and second measurement of on-site parameters is more than 25% of the value of the first reading, the reading should be discarded and further readings should be taken.

#### Baseline monitoring

- 4.2.7 Baseline conditions for river water quality should be established and agreed with EPD prior to the commencement of works at Tuen Mun River Channel. The purpose of the baseline monitoring is to establish ambient conditions prior to the commencement of the construction works at Tuen Mun River Channel and to demonstrate the suitability of the proposed monitoring stations. The baseline monitoring report should be submitted to EPD at least 4 weeks before the commencement of construction works at Tuen Mun River Channel for agreement. The baseline monitoring report should be certified by the ET Leader and verified by IEC before submission to EPD.
- 4.2.8 The baseline conditions should be established by measuring water quality parameters as specified in **Section 4.2.1** and **4.2.2** at the designated monitoring stations as shown in **Table 4.1**. The measurement depths should follow those specified in **Section 4.2.6**. The measurements should be taken at all designated monitoring stations including control station, 3 days per week, at mid-flood and mid-ebb tides, for at least 4 weeks prior to the commencement of construction works at Tuen Mun River Channel. There should not be any construction activities in the vicinity of the stations during the baseline monitoring. The interval between 2 consecutive sets of monitoring should not be less than 36 hours.

#### Impact Monitoring

- 4.2.9 During the construction period of the bored piling works and construction of pile caps at Tuen Mun River Channel, impact monitoring should be undertaken 3 days per week, at mid-flood and mid-ebb tides, with sampling/measurement at all designated monitoring stations including control station as specified in **Table 4.1**. The interval between 2 consecutive sets of monitoring should not be less than 36 hours except where there are exceedances of Action and/or Limit levels, in which case the monitoring frequency will be increased. The monitoring parameters and measurement depths should follow those specified in **Section 4.2.1**, **4.2.2** and **4.2.6**.
- 4.2.10 If the impact monitoring data collected at the monitoring stations (i.e. Stations W2, W3, W4, W5, W6 and W7 during ebb tide; Stations W1, W2, W3, W9, W10, W11 during flood tide) exceed that the Action or Limit levels as shown in **Table 4.2**, analysis should be conducted to identify whether the exceedance is caused by Project activities. If the data analysis results indicate that the exceedance is caused by the Project, appropriate actions including lowering the working rate, or rescheduling of works should be taken and additional mitigation measures should be implemented as necessary.

#### Post-Construction Monitoring

- 4.2.11 Upon completion of all construction works at Tuen Mun River Channel, a post-project monitoring should be carried out for 4 weeks in the same manner as the impact monitoring.

#### Monitoring Equipment

- 4.2.12 The following equipment and facilities should be provided by the ET and used for the monitoring of water quality impacts.

*Monitoring Position Equipment*

- 4.2.13 A hand-held or boat-fixed type digital Differential Global Positioning System (DGPS) with way point bearing indication or other equipment instrument of similar accuracy, should be provided and used during water quality monitoring to ensure the monitoring vessel is at the correct location before taking measurements. DGPS or the equivalent instrument, calibrated at appropriate checkpoint (e.g. Quarry Bay Survey Nail at Easting 840683.49, Northing 816709.55) should be provided and used to ensure the monitoring station is at the correct position before taking measurement and water samples.

*Sampler*

- 4.2.14 A water sampler is required. It should comprise a transparent PVC cylinder, with a capacity of not less than 2 litres, which can be effectively sealed with latex cups at both ends. The sampler should have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth (for example, Kahlsico Water Sampler or an approved similar instrument).

*Water Depth Detector*

- 4.2.15 A portable, battery-operated echo sounder should be used for the determination of water depth at each designated monitoring station. This unit can either be hand held or affixed to the bottom of the work boat, if the same vessel is to be used throughout the monitoring programme.

*Dissolved Oxygen and Temperature Measuring Instrument*

- 4.2.16 The instrument should be a portable and weatherproof DO measuring instrument complete with cable and sensor, and use a DC power source. The equipment should be capable of measuring:
- a DO-level in the range of 0 - 20 mg/L and 0 - 200% saturation; and
  - a temperature of 0 - 45 degree Celsius with a capability of measuring to  $\pm 0.1$  degree Celsius.
- 4.2.17 It should have a membrane electrode with automatic temperature compensation complete with a cable. Sufficient stocks of spare electrodes and cables should be available for replacement where necessary. (For example, YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).
- 4.2.18 Should salinity compensation not be built-in to the DO equipment, in-situ salinity should be measured to calibrate the DO equipment prior to each DO measurement.

*Turbidity Measuring Instrument*

- 4.2.19 Turbidity should be measured in-situ by the nephelometric method. The instrument should be portable and weatherproof using a DC power source complete with cable, sensor and comprehensive operation manuals. It should have a photoelectric sensor capable of measuring turbidity between 0 - 1000 NTU (for example, Hach model 2100P or an approved similar instrument). The cable should not be less than 25m in length. The meter should be calibrated in order to establish the relationship between NTU units and the levels of suspended solids. The turbidity measurement should be carried out on split water sample collected from the same depths of suspended solids samples.

#### *Salinity Measuring Equipment*

- 4.2.20 A portable salinometer capable of measuring salinity in the range of 0 - 40 parts per thousand (ppt) should be provided for measuring salinity of the water at each monitoring location.

#### *pH Measuring Equipment*

- 4.2.21 The instrument should consist of a potentiometer, a glass electrode, a reference electrode and a temperature-compensating device. It should be readable to 0.1 pH in a range of 0 to 14. Standard buffer solutions of at least pH 7 and pH 10 should be used for calibration of the instrument before and after use. Details of the method should comply with APHA, 19th Edition 4500-HTB.

#### *Sample Containers and Storage*

- 4.2.22 Water samples for SS determination should be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4°C without being frozen) and delivered to the laboratory and analysed as soon as possible after collection. Sufficient volume of samples should be collected to achieve the detection limit.

#### Calibration of in-situ Instruments

- 4.2.23 All in-situ monitoring instruments should be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use and subsequently re-calibrated at three monthly intervals throughout all stages of the water quality monitoring programme. Responses of sensors and electrodes should be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter should be carried out before measurement at each monitoring location.
- 4.2.24 For the on-site calibration of field equipment, the BS 127:1993, Guide to Field and On-Site Test Methods for the Analysis of Water should be observed.
- 4.2.25 Sufficient stocks of spare parts should be maintained for replacements when necessary. Backup monitoring equipment should also be made available so that monitoring can proceed uninterrupted even when some equipment is under maintenance, calibration, etc.

#### Field Log

- 4.2.26 A sample data record sheet is shown in [Appendix C](#) for reference.

#### Laboratory Measurement / Analysis

- 4.2.27 Analysis of SS level should be carried out in a HOKLAS (or other international accredited laboratory that is HOKLAS-equivalent). Sufficient water samples of not less than 2 litres should be collected at the monitoring stations for carrying out the laboratory SS determination. All samples should be assigned a unique code and accompanied by Chain of Custody (COC) sheets.
- 4.2.28 The SS determination work should start within 24 hours after collection of the water samples. The SS analyses should follow the standard method APHA 2540D with a detection limit of 1 mg/L as described in APHA Standard Methods for the Examination of Water and Wastewater, 21st Edition, unless otherwise specified.
- 4.2.29 Detailed testing methods, pre-treatment procedures, instrument use, Quality Assurance/Quality Control (QA/QC) details (such as blank, spike recovery, number of duplicate samples per batch, etc.), detection limits and accuracy should be submitted to IEC and EPD for approval prior to the commencement of monitoring

programme. EPD may also request the laboratory to carry out analysis of known standards provided by EPD for quality assurance. The testing methods and related proposal should be checked and certified by IEC before submission to EPD for approval.

4.2.30 Additional duplicate samples may be required by EPD for inter laboratory calibration. Remaining samples after analysis should be kept by the laboratory for 3 months in case repeat analysis is required. If in-house or non-standard methods are proposed, details of the method verification may also be required to submit to EPD. In any circumstance, the sample testing should have comprehensive quality assurance and quality control programmes. The laboratory should prepare to demonstrate the programmes to EPD or his representatives when requested.

Event and Action Plan

4.2.31 The Action and Limit (AL) Levels for water quality are defined in **Table 4.2**. The actions in accordance with the Event and Action Plan in **Table 4.3** should be carried out if the defined Action and/or Limit levels for water quality are exceeded at any designated monitoring points.

**Table 4.2 Action and Limit Levels for Water Quality**

Parameters	Action Level	Limit Level
DO (mg/L)	<u>Surface, Middle and Bottom</u> 5 percentile of baseline data	<u>Surface, Middle and Bottom</u> 4 mg/L, or 1 percentile of baseline data
SS (mg/L)	<u>Depth Average</u> 95 percentile of baseline data and 120% of upstream control station at the same tide of the same day	<u>Depth Average</u> 99 percentile of baseline data and 130% of upstream control station at the same tide of the same day
Turbidity (NTU)	<u>Depth Average</u> 95 percentile of baseline data and 120% of upstream control station at the same tide of the same day	<u>Depth Average</u> 99 percentile of baseline data and 130% of upstream control station at the same tide of the same day

Notes:

- (1) "Depth Average" is calculated by taking the arithmetic means of reading of all sampling depths.
- (2) For DO, non-compliance of the water quality limits occurs when monitoring result is lower than the limits.
- (3) For turbidity and 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.

**Table 4.3 Event and Action Plan for Water Quality**

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
Action level being exceeded by one sampling day	<ol style="list-style-type: none"> <li>1. Repeat <i>in-situ</i> measurement on next day of exceedance to confirm findings;</li> <li>2. Identify reasons for non-compliance and source(s) of impact;</li> <li>3. Inform IEC and Contractor; and</li> <li>4. Check monitoring data, all plant, equipment and Contractor's working methods.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check monitoring data submitted by ET and Contractor(s)'s working methods.</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of exceedance in writing.</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. Check all plant and equipment and rectify unacceptable practice.</li> </ol>
Action level being exceeded by two or more consecutive sampling days	<ol style="list-style-type: none"> <li>1. Repeat <i>in-situ</i> measurement on next day of exceedance to confirm findings;</li> <li>2. Identify reasons for non-compliance and source(s) of impact;</li> <li>3. Inform IEC and Contractor;</li> <li>4. Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>5. Discuss additional mitigation measures with IEC and Contractor and ensure mitigation measures are implemented; and</li> <li>6. Prepare to increase the monitoring frequency to daily.</li> </ol>	<ol style="list-style-type: none"> <li>1. Discuss with ET and Contractor on the mitigation measures and advise the ER accordingly;</li> <li>2. Assess the effectiveness of the implemented mitigation measures; and</li> <li>3. Check monitoring data submitted by ET and Contractor(s)'s working methods.</li> </ol>	<ol style="list-style-type: none"> <li>1. Confirm receipt of notification of exceedance in writing</li> <li>2. Discuss with IEC on the proposed mitigation measures and agree on the mitigation measures to be implemented;</li> <li>3. Ensure additional mitigation measures are properly implemented; and</li> <li>4. 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. Check all plant and equipment and rectify unacceptable practice;</li> <li>3. Consider changes of working methods;</li> <li>4. Discuss with ET and IEC and propose mitigation measures to IEC and ER within 3 working days; and</li> <li>5. Implement the agreed mitigation measures.</li> </ol>

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
Limit level being exceeded by one sampling day	<ol style="list-style-type: none"> <li>Repeat <i>in-situ</i> measurement on next day of exceedance to confirm findings;</li> <li>Identify reasons for non-compliance and source(s) of impact;</li> <li>Inform IEC, Contractor and ER;</li> <li>Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>Discuss additional mitigation measures with IEC, ER and Contractor and ensure mitigation measures are implemented; and</li> <li>Increase the monitoring frequency to daily until no exceedance of limit level.</li> </ol>	<ol style="list-style-type: none"> <li>Discuss with ET and Contractor on the mitigation measures;</li> <li>Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly;</li> <li>Assess the effectiveness of the implemented mitigation measures.</li> </ol>	<ol style="list-style-type: none"> <li>Confirm receipt of notification of exceedance in writing</li> <li>Discuss with IEC, ET and Contractor on the proposed mitigation measures and agree on the mitigation measures to be implemented;</li> <li>Ensure additional mitigation measures are properly implemented;</li> <li>Assess the effectiveness of the implemented mitigation measures; and</li> <li>Request Contractor to critically review the working methods.</li> </ol>	<ol style="list-style-type: none"> <li>Inform the ER and confirm notification of the non-compliance in writing;</li> <li>Check all plant and equipment and rectify unacceptable practice;</li> <li>Consider changes of working methods;</li> <li>Discuss with ET and IEC and propose mitigation measures to IEC and ER within 3 working days; and</li> <li>Implement the agreed mitigation measures.</li> </ol>
Limit level being exceeded by two or more consecutive sampling days	<ol style="list-style-type: none"> <li>Repeat <i>in-situ</i> measurement on next day of exceedance to confirm findings;</li> <li>Identify reasons for non-compliance and source(s) of impact;</li> <li>Inform IEC, Contractor and ER;</li> <li>Check monitoring data, all plant, equipment and Contractor's working methods;</li> <li>Discuss additional mitigation measures with IEC, ER and</li> </ol>	<ol style="list-style-type: none"> <li>Discuss with ET and Contractor on the mitigation measures;</li> <li>Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; and</li> <li>Assess the effectiveness of the implemented mitigation measures.</li> </ol>	<ol style="list-style-type: none"> <li>Confirm receipt of notification of exceedance in writing</li> <li>Discuss with IEC, ET and Contractor on the proposed mitigation measures and agree on the mitigation measures to be implemented;</li> <li>Ensure additional mitigation measures are properly implemented;</li> <li>Assess the effectiveness of the implemented mitigation measures;</li> </ol>	<ol style="list-style-type: none"> <li>Inform ER and confirm notification of non-compliance in writing;</li> <li>Check all plant and equipment and rectify unacceptable practice;</li> <li>Consider changes of working methods;</li> <li>Discuss with ET and IEC and propose mitigation measures to IEC and ER within 3 working days;</li> <li>Implement the agreed mitigation measures; and</li> </ol>

EVENT	ACTION			
	ET	IEC	ER	CONTRACTOR
	Contractor and ensure mitigation measures are implemented; and 6. Increase the monitoring frequency to daily until no exceedance of limit level.		5. Request Contractor to critically review the working methods; and 6. 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.	6. As directed by the ER, to slow down or to stop all or part of the construction activities.



### **4.3 Mitigation Measures**

- 4.3.1 Mitigation measures for construction phase water quality impacts have been recommended in the EIA Report. The Contractor should be responsible for the design and implementation of the mitigation measures.

### **4.4 Compliance Audit**

- 4.4.1 Monitoring of the treated effluent quality from the Project site is required during the construction phase of the Project. The monitoring should be carried out at the pre-determined discharge point. Compliance audits aims to ensure that a valid discharge licence has been issued by EPD prior to the discharge of effluent from the Project site. The monitoring frequency and parameters specified in the discharge licence under WPCO should be fully considered during the monitoring.

## **5 WASTE MANAGEMENT**

### **5.1 Introduction**

5.1.1 Construction and Demolition (C&D) materials, land-based and river-based sediment, general refuse from workforce and chemical waste would be generated during the construction phase. It is the Contractor's responsibility to ensure all the waste arisen from the Project are handled, stored and disposed of in accordance with good waste management practices, relevant legislation and waste management guidelines. Provided that these wastes are handled, transported and disposed of using approved methods and that the recommended good site practices and relevant legislation are strictly followed, adverse environmental impacts would not be expected.

5.1.2 As there would be limited quantities of waste to be generated from the operation of the Project, no adverse environmental impacts would be anticipated with the implementation of good waste management practices. Monitoring and audit programme for the operation phase of the Project would not be required.

### **5.2 Audit Requirement**

5.2.1 Regular audits and site inspections should be carried out during construction phase by the ER, ET and Contractor to ensure that the recommended good site practices and the recommended mitigation measures in [Appendix B](#) are properly implemented by the Contractor. The audits should concern all aspects of on-site waste management practices including waste generation, storage, recycling, transport and disposal. Apart from site inspection, documents including licences, permits, disposal and recycling records should be reviewed and audited for compliance with the legislation and contract requirements.

5.2.2 The requirements of the environmental audit programme are set out in **Section 11** of this Manual. The audit programme will verify the implementation status and evaluate the effectiveness of the mitigation measures.

### **5.3 Mitigation Measures**

5.3.1 The mitigation measures recommended in EIA Report should form the basis of the Waste Management Plan (WMP) to be developed by the Contractor during the construction stage.

5.3.2 It is recommended that the waste generated during the construction activities should be audited regularly by the ET to determine if wastes are being managed in accordance with approved procedures and the site WMP. The audit should look at all aspects of on-site waste management practices including waste generation, storage, recycling, transport and disposal. Apart from site inspection, documents including licences, permits, disposal and recycling records should be reviewed and audited for compliance with the legislation and contract requirements. In addition, the routine site inspections should check the implementation of the recommended good site practices and other waste management mitigation measures.

5.3.3 With the appropriate handling, storage and disposal of waste arising from the construction works as recommended in [Appendix B](#), adverse environmental impacts would not be expected. During the site inspections, the ET should pay special attention to the issues relating to waste management and check whether the Contractor has implemented the recommended good site practices and mitigation measures.

## **6 LAND CONTAMINATION**

### **6.1 Introduction**

- 6.1.1 Land contamination assessment was conducted for the Project. Site appraisals, in the form of desktop review and site walkovers, had been carried out to identify the areas with potential land contamination concern within the Project Area.
- 6.1.2 As the concerned facilities / areas are still in operation and the demolition and construction works will not commence until 2023, there could be change in site activities and land uses within the Project Area prior to development which may cause further contamination issues. Further site appraisal, associated SI works and any necessary remediation action are recommended to be carried out after site operation has ceased but prior to commencement of construction works at the concerned area(s). The recommended further assessment and remediation works, including the submission of Supplementary Contaminated Assessment Plan(s) (CAP(s)), Contamination Assessment Report(s) (CAR(s)) and if necessary, Remediation Action Plan(s) (RAP(s)) and Remediation Report(s) (RR(s)) to EPD for approval, would follow relevant Guidance Manual, Guidance Note and Practice Guide.
- 6.1.3 With the implementation of the recommended follow-up works for the concerned areas, any soil / groundwater contamination would be identified and properly treated prior to construction works at the concerned areas. Specific EM&A requirement is therefore not required.

### **6.2 Mitigation Measures**

- 6.2.1 If land contamination is identified, precautionary measures are recommended in [Appendix B](#) to minimize environmental impacts arising from handling of potentially contaminated materials. The Contractor should be responsible for the implementation of these measures.

## **7 TERRESTRIAL ECOLOGY**

### **7.1 Introduction**

7.1.1 Potential ecological impacts arising from the construction and operation phases of the Project were assessed in the EIA Report. There would be no direct impact on ecological resources anticipated. Mitigation measures have been recommended to minimize the potential indirect impacts to the nearby sensitive ecological resources (e.g. ardeid night roost in Tuen Mun Park). With the implementation of appropriate mitigation measures, no unacceptable adverse residual impacts would be anticipated. Nonetheless, EM&A is considered necessary during construction and the first year of operation of the Project and the requirements are described below.

### **7.2 Mitigation Measures**

7.2.1 The mitigation measures recommended in the EIA Report to minimize potential ecological impacts are provided in [Appendix B](#).

### **7.3 Monitoring Requirements**

#### Pre-Construction Ecological Survey

7.3.1 The result of the ecological field surveys conducted for the EIA study, which were conducted monthly for a 6-month period between January and June 2021, will be adopted as the baseline for the evaluation of utilization of the night roost site by birds in Tuen Mun Park and effectiveness of the proposed mitigation measures during the ecological monitoring. The ET should review the applicability of the results of baseline surveys conducted for the EIA and conduct a verification survey as necessary to record and verify the status and location of ardeid night roost within 100m of the Project site boundary. The baseline ecological monitoring/verification surveys should be undertaken by experienced ecologist(s) with at least 7 years of relevant working experience. A Pre-Construction Ecological Survey Report including the results from baseline and verification surveys should be submitted to relevant Government departments no later than one month before the commencement of construction of the project. Subject to the findings of the survey, the Pre-Construction Survey Report should list out details of all measures to minimize the potential impacts on the ardeid night roost during the construction of the Project.

#### Ardeid Night Roost Monitoring

7.3.2 Monthly monitoring of the existing ardeid night roost in Tuen Mun Park should be conducted when the construction works are conducted within 100m of the night roost, and during dry season in the first year of the operational phase. The monthly monitoring of the operational phase should commence immediately after the project operation starts and cover at least a six-month period, or until the end of first entire dry season, whichever is later. Criteria to be monitored include the status, location and extent of ardeid night roost, the condition of trees used as the night roost, the species, abundance and the returning time of the roosting ardeids, as well as their flight height and flight line. The night roost survey should be conducted to cover the peak period of ardeid activities, starting from approximately an hour before sunset and lasted until nightfall when observation of ardeid is no longer possible. The exact time of sunset on the date of survey should be made reference to the website of Hong Kong Observatory. Direct observation should be made from an appropriate vantage point which enables view of the night roost. Any changes in site condition or disturbances detected or observed at the monitoring locations, including both construction and non-construction related activities, during each monitoring visit should also be recorded. In the event that night-time construction works would be conducted within 100m of the night roost, weekly monitoring should be conducted during the period of night-time works.

- 7.3.3 Contingency arrangement due to the uncontrollable issues (i.e. traffic jam, delay of concrete supply, breakdown of plant / equipment, etc) may result in conducting the concreting works beyond the sunset time. In the event of occurrence of contingency arrangement, a notice with valid justification documents and contingency arrangement details should be prepared and recorded in the EM&A reports. This notice should also record any change in the ardeid night roost (e.g. displacement or abandonment) observed during contingency arrangement and any mitigation measures implemented and/or to be implemented.
- 7.3.4 The ecological monitoring should be undertaken by experienced ecologist(s) with at least 7 years of relevant working experience. The usage of the ardeid night roost should be reviewed and analysed, and if any significant decline is identified, the cause of the decline, with reference to any changes in site condition or disturbances detected, should be reviewed to identify any unpredicted indirect ecological impacts arising from the proposed Project. Remedial measures should be developed and implemented by the Contractor as necessary. In the event that the active night roost is found to have relocated to 100m away from the Project boundary naturally, subject to further consultation and agreement with AFCD/EPD, restriction on working hours can be ceased. However, if the night roost is found to have relocated to a location within 100 m from the works site or new night roost is found within 100 m from the works site, buffer zone should be adjusted or new buffer zone should be included accordingly. The monitoring results and evaluation of the usage of the ardeid night roost should be reported in the monthly EM&A Reports.

#### **7.4 Audit Requirements**

- 7.4.1 Site audits should be undertaken on weekly basis to check the proper implementation and maintenance of recommended mitigation measures during construction phase of the Project.

## **8 LANDSCAPE AND VISUAL**

### **8.1 Introduction**

- 8.1.1 The EIA Report has recommended landscape and visual mitigation measures for the construction and operation phases of the Project. This section defines the audit requirements to confirm the recommended landscape and visual impact mitigation measures are effectively implemented.
- 8.1.2 Site audit on landscape and visual aspects of the Project should be carried out during the construction phase.

### **8.2 Mitigation Measures**

- 8.2.1 The landscape and visual mitigation measures should be incorporated in the detailed design. The mitigation measures during construction and operation phases as recommended in the EIA Report are presented in [Appendix B](#). Where feasible, the construction phase mitigation measures should be implemented as early as possible in order to minimize the landscape and visual impacts in the construction stage while the mitigation measures for the operation phase should be adopted during the detailed design and be built as part of the construction works so that they are in place before commissioning of the Project.
- 8.2.2 Any potential conflicts among the proposed mitigation measures, the Project works, and operational requirements should also be identified and resolved as early as practicable. Any changes to the mitigation measures should be incorporated in the detailed design.

### **8.3 Audit Requirements**

- 8.3.1 Site audits should be undertaken during the construction phase of the Project to check that the proposed landscape and visual mitigation measures are properly implemented and maintained as per their intended objectives. Site inspections should be undertaken by the ET at least once every month during the construction period.

## **9 CULTURAL HERITAGE**

### **9.1 Introduction**

9.1.1 It is anticipated that there would be no impacts to archaeological and built heritage resources during construction and operation phases of the Project.

### **9.2 Mitigation Measures**

9.2.1 The recommended mitigation measures as presented in [Appendix B](#) of this EM&A Manual should be implemented to meet the EIAO-TM requirements.



**10 HAZARD TO LIFE****10.1 Introduction**

10.1.1 The EIA study concluded that no unacceptable risk is anticipated during the construction and operational phase of the Project.

**10.2 Mitigation Measures**

10.2.1 The recommended mitigation measures as presented in [Appendix B](#) of this EM&A Manual should be implemented to meet the EIAO-TM requirements.

## **11 ENVIRONMENTAL AUDITING**

### **11.1 Site Inspection**

- 11.1.1 Site inspection is one of the most effective tools to enforce the environmental protection requirements at the works sites and works areas by providing a direct mean to trigger and enforce specified environmental protection and pollution control measures. Site inspection should be undertaken regularly during the construction phase to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented for the activities associated with the Project.
- 11.1.2 The ET Leader should be responsible for formulating the environmental site inspection programme as well as the deficiency and remedial action reporting system, and for carrying out the site inspections. The proposal for rectification, if any, should be prepared and submitted to the ET Leader and IEC by the Contractor.
- 11.1.3 Regular site inspections should be carried out and led by the ER and attended by the Contractor and ET at least once per week during the construction phase. The areas of inspection should not be limited to the environmental conditions and the pollution control and mitigation measures within the works sites and works areas, it should also review the environmental conditions of locations that are beyond the boundary of the works sites and works areas but are likely to be affected directly or indirectly by the construction site activities of the Project. During the inspection, the following information should be referred to:
- The EIA Report and EM&A recommendations on environmental protection and pollution control mitigation measures;
  - Ongoing results of the EM&A programme;
  - Works progress and programme;
  - Individual works methodology proposals (which should include the proposal on associated pollution control measures);
  - Contract specifications on environmental protection and pollution prevention control;
  - Relevant environmental protection and pollution control legislations; and
  - Previous site inspection results undertaken by the ET and others.
- 11.1.4 The Contractor should keep the ER and ET Leader updated with all relevant environmental related information on the construction contract necessary for him/her to carry out the site inspections. Site inspection results and associated recommendations for improvements to the environmental protection and pollution control efforts should be recorded and followed up by the Contractor in an agreed time-frame. The Contractor should follow the procedures and time-frame stipulated in the environmental site inspection, and the deficiency and remedial action reporting system to be formulated by the ET Leader, to report on any remedial measures subsequent to the site inspections.
- 11.1.5 The ER, ET and the Contractor should also carry out ad hoc site inspections if significant environmental problems are identified. Inspections may also be required subsequent to receipt of an environmental complaint, or as part of the investigation work, as specified in the Event and Action Plan for the EM&A programme.

## **11.2 Compliance with Legal and Contractual Requirements**

- 11.2.1 There are statutory requirements on environmental protection and pollution control with which construction activities must comply.
- 11.2.2 To ensure that the works are in compliance with the statutory requirement, all method statements of works should be submitted by the Contractor to the ER for approval and to the ET Leader for vetting to ensure sufficient environmental protection and pollution control measures have been included. The implementation schedule of mitigation measures is summarized in [Appendix B](#). Any proposed changes to the mitigation measures in [Appendix B](#) shall be certified by the ET Leader and verified by the IEC as conforming to the relevant information and recommendations contained in the EIA Report.
- 11.2.3 The ER and ET Leader should also review the progress and programme of the works to check that relevant environmental legislations have not been violated, and that any foreseeable potential for violating laws can be prevented.
- 11.2.4 The Contractor should provide the update of the relevant documents to the ET Leader so that works checking could be carried out effectively. The document should at least include the updated Works Progress Reports, updated Works Programme, method statements, any application letters for licences / permits under the environmental protection legislations, and copies of all valid licences / permits. The site diary should also be available for the inspection by the relevant parties.
- 11.2.5 After reviewing the documentation, the ET should advise the Contractor of any non-compliance with legislative requirements on environmental protection and pollution control so that they can timely take follow-up actions as appropriate. If the follow-up actions may still result in violation of environmental protection and pollution control requirements, the ER and ET should provide further advice to the Contractor to take remedial action to resolve the problem.
- 11.2.6 Upon receipt of the advice, the Contractor should undertake immediate action to remedy the situation. The ER and ET should follow up to ensure that appropriate action has been taken in order to satisfy legal requirements.

## **11.3 Choice of Construction Method**

- 11.3.1 At times during the construction phase, the Contractor may propose alternative construction method(s) that had not been assessed in the EIA Report. The Contractor is therefore required to submit a proposal which provide the details of methodology and equipment to the ER, ETL and IEC for approval before commencement of work. The Contractor's options for alternative construction method(s) may introduce adverse environmental impacts into the Project, and therefore the Contractor and ET should review and determine, in accordance with established environmental standards and guidelines, as well as EIA study recommendations and requirements, the adequacy of the environmental protection and pollution control measures in the Contractor's proposal in order to ensure no unacceptable impacts would result. To achieve this end, the ET shall provide a copy of the Proactive Environmental Protection Proforma as shown in [Appendix C](#) to the IEC for verification before commencement of work. The IEC should verify the review of the alternative construction method(s) and endorse the proposal(s) on the basis of no adverse environmental impacts.
- 11.3.2 In case the Contractor needs to update the mitigation measures and/or the project implementation schedule as a result of alternative construction method(s) or other condition (e.g. site constraint(s)), the ET should also review the latest

recommendation of mitigation measures and/or project implementation schedule by submission of a Proactive Environmental Protection Proforma as shown in [Appendix C](#). The IEC should verify the Proforma and conduct audit to confirm proper implementation of the alternative measures.

#### **11.4 Environmental Complaints**

11.4.1 The following procedures should be undertaken upon receipt of any environmental complaint ([Appendix D](#) refers):

- The Contractor to log complaint and date of receipt onto the complaint database and inform the ER, ET and IEC immediately;
- The Contractor to investigate, with the ER and ET, the complaint to determine its validity, and assess whether the source of the problem is due to construction works of the Project with the support of additional monitoring frequency and stations, if necessary;
- The Contractor to identify remedial measures in consultation with the IEC, ET and ER if a complaint is valid and due to the construction works of the Project;
- The Contractor to implement the remedial measures as required by the ER and to agree with the ET and IEC any additional monitoring frequency and stations, where necessary, for checking the effectiveness of the remedial measures;
- The ER, ET and IEC to review the effectiveness of the Contractor's remedial measures and the updated situation;
- The ET/Contractor to undertake additional monitoring if necessary and audit to verify the situation, and oversee that circumstances leading to the complaint do not recur;
- If the complaint is referred by the EPD, the Contractor to prepare interim report on the status of the complaint investigation and follow-up action stipulated above, including the details of the remedial measures and additional monitoring identified or already taken, for submission to EPD within the time frame assigned by the EPD; and
- The ET to record the details of the complaint, results of the investigation, subsequent actions taken to address the complaint and updated situation including the effectiveness of the remedial measures, supported by regular and additional monitoring results in the monthly EM&A reports.

## **12 REPORTING**

### **12.1 Introduction**

12.1.1 Types of reports that the ET should prepare and submit include Baseline Monitoring Report, Monthly EM&A Reports and Final EM&A Review Report. In accordance with Annex 21 of the EIAO-TM, a copy of the monthly and final review EM&A reports should be made available to the Director of Environmental Protection.

12.1.2 Reports can be provided in an electronic medium upon agreeing the format with the ER and EPD. All the monitoring data (baseline and impact) should be submitted in electronic medium.

### **12.2 Baseline Monitoring Report**

12.2.1 The ET should prepare and submit a Baseline Environmental Monitoring Report at least one month before commencement of construction works. Copies of the Baseline Environmental Monitoring Report should be submitted to the IEC, ER and EPD. The ET should liaise with the relevant parties on the exact number of copies require.

12.2.2 The Baseline Monitoring Report should include at least the following information:

- (i) up to half a page of executive summary;
- (ii) brief description of project background information;
- (iii) drawings showing locations of the baseline monitoring stations;
- (iv) monitoring results (in both hard and soft copies) together with the following information:
  - monitoring methodology
  - name of laboratory and types of equipment used and calibration details
  - parameters monitored
  - monitoring locations (and depth)
  - monitoring date, time, frequency and duration
  - quality assurance (QA) / quality control (QC) results and detection limits
- (v) details of influencing factors, including:
  - major activities, if any, being carried out on the Project site during the period
  - weather conditions during the period
  - other factors which might affect the monitoring results
- (vi) determination of the Action and Limit Levels (AL levels) for each monitoring parameter and statistical analysis of the baseline data;
- (vii) revisions for inclusion in the EM&A Manual; and
- (viii) comments and conclusions.

### **12.3 Monthly EM&A Reports**

- 12.3.1 The results and findings of all EM&A works required in this Manual should be recorded in the monthly EM&A reports prepared by the ET and endorsed by the IEC. The first Monthly EM&A Report should be prepared and submitted to EPD within a month after the major construction works commences with the subsequently Monthly EM&A Reports due in 10 working days of the end of each reporting month. Copies of each monthly EM&A report should be submitted to each of the three parties: ER, IEC and EPD. Before submission of the first monthly EM&A Report, the ET should liaise with the parties on the exact number of copies and format of the monthly reports in both hard copy and electronic copies.
- 12.3.2 The ET should review the number and location of monitoring stations and parameters every six months, or on as needed basis, in order to cater for any changes in the surrounding environment and the nature of works in progress.

### **12.4 First Monthly EM&A Report**

- 12.4.1 The first Monthly EM&A Report should include at least but not limited to the following:
- (i) executive summary (1-2 pages):
    - breaches of Action and Limit levels;
    - complaint log;
    - notifications of any summons and successful prosecutions;
    - reporting changes; and
    - future key issues.
  - (ii) basic project information:
    - project organization including key personnel contact names and telephone numbers;
    - construction programme;
    - management structure; and
    - works undertaken during the reporting month.
  - (iii) environmental status:
    - advice on the status of statutory environmental compliance, such as the status of compliance with the EP conditions under the EIAO, submission status under the EP and implementation status of mitigation measures;
    - works undertaken during the reporting month with illustrations (e.g. location of works, etc); and
    - drawings showing the Project area, any environmental sensitive receivers and the locations of the monitoring stations.
  - (iv) summary of EM&A requirements:
    - all monitoring parameters;
    - environmental quality performance limits (Action and Limit levels);
    - Event and Action Plans;
    - environmental mitigation measures, as recommended in the EIA Report; and
    - environmental requirements in contract documents.

- (v) implementation status:
  - advice on the implementation status of environmental protection and pollution control/mitigation measures as recommended in the EIA Report.
- (vi) monitoring results (in both hard and soft copies) together with the following information:
  - monitoring methodology;
  - name of laboratory and types of equipment used and calibration details;
  - monitoring parameters;
  - monitoring locations;
  - monitoring date, time, frequency and duration; and
  - graphical plots of the monitoring parameters in the reporting month annotated against the following:
    - a) major activities being carried out on site during the reporting period;
    - b) weather conditions during the reporting period;
    - c) any other factors which might affect the monitoring results; and
    - d) QA/QC results and detection limits.
- (vii) report on non-compliance, complaints, notifications of summons and status of prosecutions:
  - record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
  - record of all complaints received, including locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
  - record of all notification of summons and successful prosecutions for breaches of current environmental protection / pollution control legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary;
  - review of the reasons for and the implications of non-compliances, complaints, summons and prosecutions including review of pollution sources and working procedures; and
  - description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.
- (viii) others:
  - an account of the future key issues as reviewed from the works programme and method statements of works;
  - advice on the solid and liquid waste management status;
  - record of any project changes from that originally proposed as described in the EIA Report (e.g. construction methods, mitigation proposals, design changes, etc); and
  - comments (e.g. the effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.



## 12.5 Subsequent Monthly EM&A Reports

12.5.1 Subsequent monthly EM&A Reports during the construction phase should include the following information:

- (i) executive summary (1-2 pages):
  - breaches of Action and Limit levels;
  - complaint log;
  - notifications of any summons and successful prosecutions;
  - reporting changes; and
  - future key issues.
- (ii) basic project Information:
  - project organization including key personnel contact names and telephone numbers;
  - construction programme;
  - management structure;
  - works undertaken during the reporting month; and
  - any updates as needed to the scope of works, and construction methodologies.
- (iii) environmental status:
  - advice on the status of statutory environmental compliance, the status of compliance with the EP conditions under the EIAO, submission status under the EP and implementation status of mitigation measures;
  - works undertaken during the reporting month with illustrations (such as location of works, etc); and
  - drawings showing the Project area, any environmental sensitive receivers and the locations of the monitoring stations.
- (iv) implementation status:
  - advice on the implementation status of environmental protection and pollution control/mitigation measures as recommended in the EIA Report.
- (v) monitoring results (in both hard and soft copies) together with the following information:
  - monitoring methodology;
  - name of laboratory and types of equipment used and calibration details;
  - monitoring parameters;
  - monitoring locations (and depth);
  - monitoring date, time, frequency and duration; and
  - graphical plots of the monitoring parameters in the reporting month annotated against the following:
    - a) major activities being carried out on site during the reporting period;
    - b) weather conditions during the reporting period;
    - c) any other factors which might affect the monitoring results; and
    - d) QA/QC results and detection limits.

- (vi) report on non-compliance, complaints, notifications of summons and status of prosecutions:
- record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
  - record of all complaints received, including the locations and nature of complaints investigation, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
  - record of all notification of summons and successful prosecutions for breaches of current environmental protection / pollution control legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary;
  - review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
  - descriptions of the actions taken in the event of non-compliances and deficiency reporting and any follow-up procedures related to earlier non-compliance.
- (vii) others:
- an account of the future key issues as reviewed from the works programme and method statements of works;
  - advice on the solid and liquid waste management status;
  - record of any project changes from that originally proposed as described in the EIA (e.g. construction methods, mitigation proposals, design changes, etc); and
  - comments (e.g. the effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.
- (viii) appendix:
- Action and Limit levels;
  - graphical plots of trends of the monitoring parameters over the past four reporting periods for the representative monitoring stations annotated against the following:
    - a) major Project activities being carried out on site during the reporting period;
    - b) weather conditions during the reporting period; and
    - c) any other factors that might affect the monitoring results.
  - monitoring schedule for the present and next reporting period;
  - cumulative statistics on notifications of summons and successful prosecutions; and
  - outstanding issues and deficiencies.

## 12.6 Final EM&A Report - Construction Phase

- 12.6.1 The EM&A program should be terminated upon completion of those construction activities that have the potential to result in a significant environmental impact.
- 12.6.2 Prior to the proposed termination, the proposed termination should be implemented after the proposal has been endorsed by the IEC, the ER and the Project Proponent

followed by final approval from the Director of Environmental Protection.

12.6.3 The ET Leader should prepare and submit the Final EM&A Report which should contain at least the following information:

- (i) executive summary (1 - 2 pages);
- (ii) drawings showing the Project area, environmental sensitive receivers and locations of the monitoring stations;
- (iii) basic project information including a synopsis of the project organisation, contacts of key management, and a synopsis of works undertaken during the course of the Project;
- (iv) a brief summary of EM&A requirements including:
  - environmental mitigation measures, as recommended in the EIA Report;
  - environmental impact hypotheses tested;
  - environmental quality performance limits (Action and Limit levels);
  - all monitoring parameters; and
  - Event and Action Plans;
- (v) a summary of the implementation status of environmental protection and pollution control / mitigation measures, as recommended in the EIA Report, summarised in the updated implementation schedule;
- (vi) advice on the solid and liquid waste management status;
- (vii) graphical plots and the statistical analysis of the trends of monitoring parameters over the course of the Project, including the post-project monitoring for all monitoring stations annotated against:
  - the major activities being carried out on site during the reporting period;
  - weather conditions during the reporting period; and
  - any other factors which might affect the monitoring results;
- (viii) a summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- (ix) a review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures as appropriate;
- (x) a description of the actions taken in the event of non-compliance;
- (xi) a summary record of all complaints received, liaison and consultation undertaken, actions and follow-up procedures taken;
- (xii) a summary record of notifications of summons and successful prosecutions for breaches of the current environmental protection / pollution control legislation, locations and nature of the breaches, investigation follow-up actions taken and results;
- (xiii) a review of the validity of EIA predictions and identification of shortcomings of the recommendations proposed in EIA Report; and
- (xiv) comments (for example, a review of the effectiveness and efficiency of the mitigation measures and of the performance of the environmental management system, that is, of the overall EM&A programme); and

- (xv) recommendations and conclusions (for example, a review of success of the overall EM&A programme to cost-effectively identify deterioration and to initiate prompt effective mitigation action when necessary).

## **12.7 Data Keeping**

- 12.7.1 No site-based documents (such as monitoring field records, laboratory analysis records, site inspection forms, etc.) are required to be included in the EM&A reporting documents. However, any such document should be properly maintained by the ET and be ready for inspection upon request. All relevant information should be clearly and systematically recorded in the document. Monitoring data should also be recorded in magnetic media form, and the software copy must be available upon request. All documents and data should be kept for at least one year following the completion of the construction phase EM&A for each construction contract.

## **12.8 Interim Notifications of Environmental Quality Limit Exceedances**

- 12.8.1 With reference to the Event and Action Plans, when the environmental quality performance limits are exceeded and if they are proven to be valid, the ET should immediately notify the IEC, ER and EPD, as appropriate. The notification should be followed up with advice to the IEC, ER and EPD on the results of the investigation, proposed actions and success of the actions taken, with any necessary follow-up proposals. A sample template for the interim notification is presented in [Appendix E](#).

