

TABLE OF CONTENTS

1	INTRODUCTION.....	1
1.1	Background.....	1
1.2	Project Scope and Location.....	1
1.3	Construction Programme.....	2
1.4	Purpose of this Manual.....	2
1.5	Project Organization.....	3
2	AIR QUALITY	6
2.1	Introduction	6
2.2	Construction Phase Dust Monitoring	6
2.3	Mitigation Measures	13
2.4	Audit Requirements.....	13
3	NOISE.....	14
3.1	Introduction	14
3.2	Construction Phase Noise Monitoring.....	14
3.3	Operation Phase Road Traffic Noise Monitoring.....	17
3.4	Mitigation Measures	20
3.5	Audit Requirements.....	20
3.6	Commissioning Test for Fixed Noise Source.....	20
4	WATER QUALITY	22
4.1	Introduction	22
4.2	Monitoring Parameters.....	22
4.3	Monitoring Equipment	22
4.4	Monitoring Location.....	25
4.5	Monitoring Frequency.....	25
4.6	Event and Action Plan	26
5	WASTE MANAGEMENT	29
5.1	Introduction	29
5.2	Mitigation Measures	29
5.3	Audit Requirement.....	29
6	LAND CONTAMINATION	30
6.1	Introduction	30
6.2	Construction Phase.....	30
6.3	Operation Phase	30
7	ECOLOGY	31
7.1	Introduction	31
7.2	Mitigation Measures	31
7.3	Monitoring Requirements	31
8	CULTURAL HERITAGE	35
8.1	Impacts on Cultural Heritage	35
8.2	Mitigation Measures	35
8.3	EM&A Requirements.....	36
9	LANDSCAPE & VISUAL	38

9.1	Introduction	38
9.2	Mitigation Measures	38
9.3	Audit Requirements.....	38
10	HAZARD TO LIFE	39
10.1	Introduction	39
10.2	Mitigation Measures	39
10.3	EM&A Requirements.....	39
11	SITE ENVIRONMENTAL AUDIT.....	40
11.1	Site Inspections.....	40
11.2	Compliance with Legal and Contractual Requirements	40
11.3	Environmental Complaints.....	41
12	REPORTING	43
12.1	Introduction	43
12.2	Electronic Reporting of EM&A Information.....	43
12.3	Baseline Monitoring Report	43
12.4	Monthly EM&A Reports	44
12.5	Final EM&A Review Report for Construction Phase	49
12.6	EM&A Reports for Operation Phase.....	51
12.7	Data Keeping	52
12.8	Interim Notifications of Environmental Quality Limit Exceedances.....	52

List of Tables

Table 2.1	Proposed Construction Dust Monitoring Stations
Table 2.2	Summary of Construction Dust Monitoring Programme
Table 2.3	Action and Limit Levels for Air Quality (Construction Dust)
Table 2.4	Event and Action Plan for Air Quality (Construction Dust)
Table 3.1	Proposed Noise Monitoring Stations during Construction of the Project
Table 3.2	Action and Limit Levels for Construction Noise
Table 3.3	Event and Action Plan for Construction Noise
Table 3.4	Traffic Noise Monitoring Stations
Table 4.1	Water Quality Monitoring Parameters and Frequency during the Construction Phase
Table 4.2	Details of Water Quality Monitoring Station during the Construction Phase
Table 4.3	Action and Limit Levels for Water Quality
Table 4.4	Event and Action Plan
Table 8.1	Proposed AAA Limiting Criteria for Vibration, Settlement and Tilting Level Monitoring during Construction

List of Figures

60604728/EM&Ab/Figure 1.1	General Layout (Sheet 1 of 4)
60604728/EM&Ab/Figure 1.2	General Layout (Sheet 2 of 4)
60604728/EM&Ab/Figure 1.3	General Layout (Sheet 3 of 4)
60604728/EM&Ab/Figure 1.4	General Layout (Sheet 4 of 4)
60604728/EM&Ab/Figure 1.5	EM&A Project Organization Chart
60604728/EM&Ab/Figure 2.1	Proposed Construction Dust Monitoring Stations in Kowloon
60604728/EM&Ab/Figure 2.2	Proposed Construction Dust Monitoring Stations in Shatin (Sheet 1 of 2)
60604728/EM&Ab/Figure 2.3	Proposed Construction Dust Monitoring Stations in Shatin (Sheet 2 of 2)
60604728/EM&Ab/Figure 3.1	Locations of Construction Noise Monitoring Stations (Kowloon)
60604728/EM&Ab/Figure 3.2	Locations of Construction Noise Monitoring Stations (Shatin)
60604728/EM&Ab/Figure 3.3	Locations of Traffic Noise Monitoring Stations (Sheet 1 of 3)
60604728/EM&Ab/Figure 3.4	Locations of Traffic Noise Monitoring Stations (Sheet 2 of 3)

<u>60604728/EM&Ab/Figure 3.5</u>	<u>Locations of Traffic Noise Monitoring Stations (Sheet 3 of 3)</u>
<u>60604728/EM&Ab/Figure 4.1</u>	<u>Locations of Water Quality Monitoring Stations</u>
<u>60604728/EM&Ab/Figure 7.1</u>	<u>Indicative Location of Water-Level Monitoring Programme</u>
<u>60604728/EM&Ab/Figure 11.1</u>	<u>Complaint Response Procedure</u>

List of Appendices

<u>Appendix A</u>	<u>Tentative Construction Programme</u>
<u>Appendix B</u>	<u>Implementation Schedule of Recommended Mitigation Measures</u>
<u>Appendix C</u>	<u>Sample Record Sheet</u>
<u>Appendix D</u>	<u>Sample of Interim Notification Record Sheet</u>

LIST OF ABBREVIATIONS

The following table lists out the abbreviated titles of government bureaux, departments, offices, statutory bodies and public organizations mentioned in this Report:

Abbreviation	Full title
AFCD	Agriculture, Fisheries and Conservation Department
AMO	Antiquities and Monuments Office
CEDD	Civil Engineering and Development Department
CLP	China Light and Power Company Limited
DC	District Council
DEVB	Development Bureau
DSD	Drainage Services Department
ENB	Environment Bureau
EPD	Environmental Protection Department
FSD	Fire Services Department
GEO	Geotechnical Engineering Office of CEDD
HKSAR	Hong Kong Special Administrative Region
HyD	Highways Department
LandsD	Lands Department
LCSD	Leisure and Cultural Services Department
LegCo	Legislative Council
MTRCL	MTR Corporation Limited
PlanD	Planning Department
STDC	Sha Tin District Council
TD	Transport Department
WSD	Water Supplies Department

The following table lists out the meaning of abbreviation for expressions adopted in this report:

Abbreviation	Full Expression
DEVB TC(W)	Development Bureau Technical Circular (Works)
DR	Director's Representative
E/B	Eastbound
ETWB TC(W)	Environment, Transport and Works Bureau Technical Circular (Works)
LRT	Lion Rock Tunnel
LRTR	Lion Rock Tunnel Road
N/B	Northbound
S/B	Southbound

1 INTRODUCTION

1.1 Background

- 1.1.1 The Lion Rock Tunnel (LRT) is a trunk road linking traffic between Shatin and Kowloon. It consists of two tunnel tubes each with two traffic lanes. The Kowloon bound and Shatin bound tunnel tubes have been put in use for over 50 years and 40 years respectively. Signs of deterioration of tunnel structures have become apparent. Due to heavy traffic demand, the time slots of only a few hours during nighttime for tunnel closure cannot allow comprehensive repair and strengthening works to be undertaken.
- 1.1.2 Being an old design, the LRT does not meet the current standards in various aspects including waterproofing, dimensions (e.g. headroom and width), smoke extraction, evacuation, durability, Traffic Control and Surveillance System (TCSS), etc. Comprehensive rehabilitation of the two existing tunnel tubes is needed to bring LRT up to current standard and extend its serviceable years; thereby enhancing the tunnel environment and road safety level.
- 1.1.3 As the capacity of the LRT cannot cope with the traffic demand during peak hours now, long traffic queues appear at the connecting roads including the LRT Road on Shatin side, as well as the Lung Cheung Road and the Waterloo Road on Kowloon side. Enhancing the capacity of the LRT and the connecting roads as far as possible is therefore necessary to improve the traffic flow at this critical link between Shatin and Kowloon.
- 1.1.4 AECOM Asia Company Ltd was commissioned by Highways Department (HyD) to undertake "Agreement No. CE 48/2018(HY) Improvement of Lion Rock Tunnel - Investigation" (the Assignment). The purpose of the Assignment is to rehabilitate and improve the existing tunnel tubes of the LRT and to take this opportunity to enhance the capacity of the tunnel and the connecting roads as far as possible, with a view to extending the service life of the LRT and help alleviating the traffic congestion at the LRT during peak hours and the traffic impact during maintenance.
- 1.1.5 The Project is a Designated Project under the Environmental Impact Assessment Ordinance (EIAO). An Environmental Impact Assessment (EIA) Study for the Project has been undertaken as part of the Assignment, in accordance with the EIA Study Brief (No. ESB-323/2019) and the Technical Memorandum on Environmental Impact Assessment Process (EIAO-TM).

1.2 Project Scope and Location

- 1.2.1 The scope of the Project comprises the construction of the new tunnel tube to facilitate the subsequent rehabilitation of two existing tunnel tubes, widening of the connecting roads and the associated works. The details are as follows:-
- (a) Construction of a three-lane road tunnel of approximately 1.4 km long between the two existing tunnel tubes of the LRT;
 - (b) Enlargement of the existing Kowloon bound tunnel tube to a three-lane road tunnel, together with the construction of cross passages linking the new Kowloon bound tunnel tube with the new tunnel;
 - (c) Carry out refurbishment works on the existing Shatin bound tunnel tube and replacement/rehabilitation of the existing fire services provisions;
 - (d) Provision of equipment including Traffic Control and Surveillance Systems (TCSS) for operation of the tunnels;
 - (e) Demolish the existing toll plaza together and provision of equipment and facilities for free-flow tolling;

- (f) Re-provision of tunnel buildings including tunnel administration building (ADB), ventilation buildings (VBs) etc., construction of a vehicular crossover bridge to support tunnel operations, and construction of footbridges and any other tunnel support facilities;
- (g) Widening of LRT Road at Kowloon side to dual three-lane from slip roads of Lung Cheung Road interchange to LRT Kowloon portal and construct a single lane vehicular bridge crossing over Lung Cheung Road for Shatin bound direction;
- (h) Widening of the slip road from Lion Rock Tunnel Road southbound (S/B) to Lung Cheung Road eastbound (E/B) to two lanes, and realigning the slip road from Lung Cheung Road E/B to Lion Rock Tunnel Road northbound (N/B);
- (i) Widening of LRT Road at Shatin side to dual three-lane between the existing tunnel portal to Fung Shing Court (except a section of the northbound carriageway between the slip roads to and from Hung Mui Kuk Road which would remain two lanes);
- (j) Re-provisioning of Footbridge NF74 near Fung Shing Court;
- (k) Provision of noise barriers / enclosures to mitigate the noise impact on noise sensitive receivers; and
- (l) Ancillary works including slope works, water mains diversion, road lighting, drainage, landscaping works, etc.

1.2.2 The location plan of the Project is shown in [60604728/EM&Ab/Figure 1.1 to 1.4](#).

1.3 Construction Programme

1.3.1 The Project construction works are anticipated to commence in Q1 2025. According to the latest programme, the tentative completion year for the whole Project is 2034, with commissioning of six traffic lanes (excluding bus lanes) along LRT and LRT Road in 2034. The tentative construction programme for the Project is provided in [Appendix A](#).

1.4 Purpose of this Manual

1.4.1 The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the setups of an EM&A programme to ensure compliance with the EIA study recommendations, to assess the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action. This Manual outlines the monitoring and audit programme for the construction and operational phases of the Project. It aims to provide systematic procedures for monitoring, auditing and minimizing environmental impacts associated with construction works and operational activities.

1.4.2 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 EIAO-TM.

1.4.3 This Manual contains the following information:

- Responsibilities of the Contractor, the Engineer or Engineer's Representative (ER), Environmental Team (ET) and Independent Environment Checker (IEC) with respect to the environmental monitoring and audit requirements during the course of the Project;
- Project organisation 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.

1.4.4 For the purpose of this Manual, the ET leader, who shall be responsible for and in charge of the ET, shall refer to the person delegated the role of executing the EM&A requirements.

1.5 Project Organization

1.5.1 Involvement of relevant parties in a collaborative and interactive manner is essential for the implementation of the recommended EM&A programme. The following sections outline the primary responsibilities and duties of the key EM&A programme participants. The proposed project organization and lines of communication with respect to EM&A works are shown in 60604728/EM&Ab/Figure 1.5.

The Contractor

1.5.2 The Contractor shall report to the ER. The duties and responsibilities of the Contractor comprise the following:

- Work within the scope of the contract and other tender conditions with respect to environmental requirements;
- Operate and strictly adhere to the guidelines and requirements in this EM&A programme and contract specifications;
- Provide assistance to ET in carrying out monitoring and auditing;
- Participate in the site inspections undertaken by ET as required, and undertake correction actions;
- Provide information / advice to ET regarding works activities which may contribute, or be continuing to the generation of adverse environmental conditions;
- Submit proposals on mitigation measures in case of exceedance of Action and Limit levels in accordance with the Event / Action Plans;
- Implement measures to reduce impact where Action and Limit levels are exceeded; and
- Adhere to the procedures for carrying out complaint investigation.

Environmental Team (ET)

1.5.3 An ET shall be established before the commencement of construction of the Project. The ET shall be an independent party from the IEC and the Contractor. The ET shall be led and managed by the ET Leader. The ET Leader shall possess at least 7 years of experience in EM&A and/or environmental management. The ET Leader, or an ET Leader representative who shall be a member of the ET with at least 5 years of experience in EM&A or environmental

management, shall work full time on-site.

1.5.4 The duties and responsibilities of the ET are:

- Monitor various environmental parameters as required in this EM&A Manual;
- Analyse the environmental monitoring and audit data and review the success of EM&A programme to cost-effectively confirm the adequacy of mitigation measures implemented and the validity of the EIA predictions and to identify any adverse environmental impacts arising;
- Carry out regular site inspection to investigate and audit the Contractors' site practice, equipment and work methodologies with respect to pollution control and environmental mitigation, and effect proactive action to pre-empt problems; carry out ad hoc site inspections if significant environmental problems are identified;
- Audit and prepare monitoring and audit reports on the environmental monitoring data and site environmental conditions;
- Report on the environmental monitoring and audit results to the Independent Environmental Checker, Contractor, the ER and EPD or its delegated representative;
- Recommend suitable mitigation measures to the Contractor in the case of exceedance of Action and Limit levels in accordance with the Event and Action Plans;
- Advice to the Contractor on environmental improvement, awareness, enhancement matters, etc. on site;
- Timely submission of the EM&A report to the Project Proponent and the EPD; and
- Adhere to the procedures for carrying out complaint investigation in accordance with Section 11.3 of this EM&A Manual.

Engineer or Engineer's Representative (ER)

1.5.5 The ER is responsible for overseeing the construction works and for ensuring that the works undertaken by the Contractor in accordance with the specification and contractual requirements. The duties and responsibilities of the ER 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 impacts in accordance with the Event and Action Plans;
- Participate in joint site inspection undertaken by the ET; and
- Adhere to the procedures for carrying out complaint investigation.

Independent Environmental Checker (IEC)

1.5.6 An IEC shall be employed before commencement of construction of the Project. Appointment of IEC shall be approved by EPD. The IEC shall be an independent party from the Contractor and the ET and possess at least 7 years' experience in EM&A and/or environmental management. The IEC shall report directly to the EPD on matters relating to the EM&A programme and environmental impacts from the Project. The IEC, or an IEC representative who shall be a person with at least 5 years of experience in EM&A or environmental

management shall work full time on-site. The duties and responsibilities of the IEC are:

- Review the EM&A works performed by the ET (at least at monthly intervals);
- Carry out random sample check and audit the monitoring activities and results (at least at monthly intervals);
- Conduct random site inspection;
- Review the EM&A reports submitted by the ET;
- Review the effectiveness of environmental mitigation measures and project environmental performance;
- Review the proposal on mitigation measures submitted by the Contractor in accordance with the Event and Action Plans;
- Check the mitigation measures that have been recommended in the EIA and this Manual, and ensure they are properly implemented in a timely manner, when necessary; and
- Adhere to the procedures for carrying out complaint investigation.

1.5.7 Sufficient and suitably qualified professional and technical staff shall be employed by the respective parties to ensure full compliance with their duties and responsibilities, as required under the EM&A programme for the duration of the Project.

2 AIR QUALITY

2.1 Introduction

- 2.1.1 Potential air quality impacts associated with the construction and operation phases of the Project have been assessed in accordance with the criteria and guidelines as stated in the requirements given in Section 3.4.4 and Appendix B and B-1 of the EIA Study Brief. Results indicated that no adverse air quality impact arising from construction of the Project with the implementation of the mitigation measures. Dust monitoring is proposed to be conducted during construction.
- 2.1.2 Regular site environmental audit is recommended to be conducted during the entire construction phase of the Project so as to ensure the implementation of the proposed dust mitigation measures and the dust suppression measures stipulated in Air Pollution Control (Construction Dust) Regulation, the use of approved or exempted non-road mobile machinery stipulated in Air Pollution Control (Non-road Mobile Machinery) (Emission) Regulation, and the use of appropriate fuel stipulated in Air Pollution Control (Fuel Restriction) Regulation. Implementation schedule of mitigation measures are presented in **Appendix B**.
- 2.1.3 Potential air quality impact from operation of the Project was also assessed and no adverse impact would be anticipated during the operation phase of this Project. Therefore, environmental monitoring and audit is not recommended during operation phase of the Project.
- 2.1.4 This section presents the requirements, methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of air quality impact during the construction phase of the Project.

2.2 Construction Phase Dust Monitoring

Monitoring Parameters

- 2.2.1 The major dusty construction activities of the Project would mainly be related to site clearance, site formation, excavation, slopworks, TBM excavation for new tunnel tube, drill and break on existing tunnel tubes, superstructure construction such as administration buildings, ventilation buildings, road widening works and wind erosion, which would generate dust emissions. Therefore, 1-hour Total Suspended Particulates (TSP) is recommended to be monitored and audited at the proposed monitoring locations during construction phase.
- 2.2.2 The criteria against which ambient air quality monitoring to be assessed are 1-hour TSP limit of $500 \mu\text{g m}^{-3}$. This level is not to be exceeded at ASRs.
- 2.2.3 Monitoring and audit of the TSP levels shall be carried out by the ET to ensure that any deteriorating air quality could be readily detected and timely action shall be undertaken to rectify such situation.
- 2.2.4 1-hour TSP levels should be measured to indicate the impacts of construction dust on air quality. 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"). Upon approval of EPD and IEC, an alternative sampling method of using direct reading methods which are capable of producing comparable results as that by the high volume sampling method can be used to indicate short event impacts.
- 2.2.5 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**.

Monitoring Equipment

- 2.2.6 High volume sampler (HVS) in compliance with the following specifications should be used for carrying out the 1-hour TSP monitoring:
- 0.6 - 1.7 m³ per minute (20 - 60 standard cubic feet per minute) adjustable flow range;
 - equipped with a timing / control device with ± 5 minutes accuracy for 24 hours operation;
 - installed with elapsed-time meter with ± 2 minutes accuracy for 24 hours operation;
 - capable of providing a minimum exposed area of 406 cm²;
 - flow control accuracy: $\pm 2.5\%$ deviation over 24-hour sampling period;
 - equipped with a shelter to protect the filter and sampler;
 - incorporated with an electronic mass flow rate controller or other equivalent devices;
 - 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.
- 2.2.7 The ET shall be responsible for the provision of the monitoring equipment. He shall ensure that sufficient number of HVSs with appropriate calibration kit is available for carrying out the baseline, regular impacts monitoring and ad-hoc monitoring. The HVSs shall 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. All the equipment, calibration kit, filter papers, etc., shall be clearly labelled.
- 2.2.8 Initial calibration of the dust monitoring equipment shall be conducted upon installation and prior to commissioning at bi-monthly intervals. The transfer standard shall be traceable to the internationally recognized primary standard and be calibrated annually. The calibration data shall be properly documented for future reference by the concerned parties such as the IEC. All the data shall be converted into standard temperature and pressure condition.
- 2.2.9 The flow-rate of the sampler before and after the sampling exercise with the filter in position shall be verified to be constant and be recorded on the data sheet as shown in **Appendix C**.
- 2.2.10 If the ET Leader proposes to use a direct reading dust meter to measure 1-hour TSP levels, he shall submit sufficient information to the IEC to prove that the instrument is capable of achieving a comparable result as that of the HVS before it may be used for the 1-hour sampling. The instrument shall also be calibrated regularly, and the 1-hour sampling shall be determined periodically by HVS to check the validity and accuracy of the results measured by direct reading method.
- 2.2.11 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 and 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 should be divided into 16 sectors of 22.5 degrees each.

2.2.12 In exceptional situations, the ET may propose alternative methods to obtain representative wind data upon approval from the ER and agreement from the IEC.

Laboratory Measurement / Analysis

2.2.13 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 the Hong Kong Laboratory Accreditation Scheme (HOKLAS) accredited or other internationally accredited laboratory.

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

2.2.15 The IEC shall conduct regular audit of the measurement performed by the laboratory so as to ensure the accuracy of measurement results. The ET 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/her reference.

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

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

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

Monitoring Locations

2.2.19 The selected monitoring locations are the worst potentially affected air sensitive receivers located in the vicinity of construction sites. The proposed air quality monitoring locations during construction phase are listed in **Table 2.1** below and shown in **60604728/EM&Ab/Figure 2.1 to 2.3.**

Table 2.1 Proposed Construction Dust Monitoring Stations

Monitoring Station ID	EIA ID	Location	Shortest Distance from Site Boundary (m)
CDM1	A17	Lion Rock Baseball Field 2	10
CDM2	A13	Lung Cheung Road Park	10
CDM3	A16	Lion Rock Baseball Field 1	55
CDM4	A69	Hill Paramount	20
CDM5	A75	Laurel Court, Worldwide Gardens	5
CDM6	A90	Sha Tin Tau New Village	10
CDM7	A89	Shing Wai House, Sun Tin Wai	95
CDM8	A80	Kak Tin Village	10

2.2.20 The status and locations of the air quality sensitive receivers may change after issuing this Manual. In such case, the ET shall propose updated monitoring locations and seek approval from ER and IEC and agreement from EPD on the proposal.

2.2.21 When alternative monitoring locations are proposed, the following criteria, as far as practicable, shall be followed:

- i. at the site boundary or such locations close to the major dust emission source;
- ii. close to the air sensitive receivers as defined in the EIAO-TM;
- iii. proper position/sitting and orientation of the monitoring equipment; and
- iv. take into account the prevailing meteorological conditions.

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

- i. a horizontal platform with appropriate support to secure the samplers against gusty wind shall be provided;
- ii. two samplers shall not be placed less than 2 meter apart;
- iii. 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;
- iv. a minimum of 2 metres of separation from walls, parapets and penthouses is required for rooftop samplers;
- v. a minimum of 2 metres of separation from any supporting structure, measured horizontally is required;
- vi. no furnace or incinerator flue is nearby;
- vii. airflow around the sampler is unrestricted;
- viii. the sampler is more than 20 metres from the dripline;
- ix. any wire fence and gate, to protect the sampler, shall not cause any obstruction during monitoring;

- x. permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
- xi. a secured supply of electricity is needed to operate the samplers.

Baseline Monitoring

- 2.2.23 Baseline monitoring shall be carried out to determine the ambient 1-hour TSP levels at the monitoring locations prior to the commencement of the Project. During the baseline monitoring, there shall not be any construction or dust generating activities in the vicinity of the monitoring stations. The baseline monitoring will provide data for the determination of the appropriate Action levels with the Limit levels set against statutory or otherwise agreed limits.
- 2.2.24 Before commencing the baseline monitoring, the ET shall 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.
- 2.2.25 TSP baseline monitoring should be carried out at all of the designated monitoring locations for at least 14 consecutive days prior to the commissioning of the construction works. 1-hour TSP sampling shall be done at least three times per day at each monitoring station. During the baseline monitoring, there should not be any construction or 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**.
- 2.2.26 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 location shall be approved by the ER and agreed with IEC and approved by EPD.
- 2.2.27 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with the IEC and EPD to agree on an appropriate set of data to be used as a baseline reference and submit to ER for approval.
- 2.2.28 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. The monitoring should be at times when the Contractor's activities are not generating dust and at the designate monitoring locations. The revised baseline levels, in turn, the air quality criteria, shall be agreed with the IEC and EPD.

Impact Monitoring

- 2.2.29 The ET shall carry out impact monitoring during construction phase of the Project. 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. In case of non-compliance with the air criteria, more frequent monitoring, as specified in the Action Plan in the following section, should be conducted. This additional monitoring should be continued until the excessive dust emission or the deterioration in the air quality is rectified. The impact monitoring programme is summarized in **Table 2.2**.
- 2.2.30 The monthly schedule of the compliance and impact monitoring programme should be drawn up by the ET one month prior to the commencement of the scheduled construction period. Before commencing the impact monitoring, the ET shall inform the IEC of the impact monitoring programme such that the IEC can conduct on-site audit to ensure accuracy of the impact monitoring results.

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	1-hour TSP	3 times in every 6 days

Event and Action Plan

2.2.31 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. Should non-compliance of the air quality criteria occur, action in accordance with the Action Plan in **Table 2.4** shall be carried out.

Table 2.3 Action and Limit Levels for Air Quality (Construction Dust)

Parameter	Action Level [1]	Limit Level
TSP (1-hour average)	BL ≤ 384 µgm ⁻³ , AL = (BL * 1.3 + LL)/2 BL > 384 µgm ⁻³ , AL = LL	500 µgm ⁻³

Note: [1] BL = Baseline level, AL = Action level, LL = Limit level

Table 2.4 Event and Action Plan for Air Quality (Construction Dust)

Event	Action			
	ET	IEC	ER	Contractor
Action level being exceeded by one	<ol style="list-style-type: none"> 1. Identify source, investigate the causes of complaint and propose remedial measures; 2. Inform Contractor, IEC and ER; 3. Repeat measurement to confirm finding; and 4. Increase monitoring frequency to daily. 	<ol style="list-style-type: none"> 1. Check monitoring data submitted by ET; 2. Check Contractor's working method; and 3. Review and advise the ET and ER on the effectiveness of the proposed remedial measures. 	<ol style="list-style-type: none"> 1. Notify Contractor. 	<ol style="list-style-type: none"> 1. Identify source(s), investigate the causes of exceedance and propose remedial measures; 2. Implement remedial measures; and 3. Amend working methods agreed with the ER as appropriate.
Action level being exceeded by two or more consecutive sampling	<ol style="list-style-type: none"> 1. Identify source; 2. Inform Contractor, IEC and ER; 3. Advise the Contractor and ER on the effectiveness of the proposed remedial measures; 4. Repeat measurements to confirm findings; 5. Increase monitoring frequency to daily; 6. Discuss with IEC and Contractor on remedial actions required; 7. If exceedance continues, arrange meeting with Contractor, IEC and ER; and 8. If exceedance stops, cease additional monitoring. 	<ol style="list-style-type: none"> 1. Check monitoring data submitted by ET; 2. Check Contractor's working method; 3. Discuss with ET, ER and Contractor on possible remedial measures; 4. Advise the ET and ER on the effectiveness of the proposed remedial measures; and 5. Supervise Implementation of remedial measures. 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of exceedance in writing; 2. Notify Contractor; 3. Ensure remedial measures properly implemented. 	<ol style="list-style-type: none"> 1. Identify source and investigate the causes of exceedance; 2. Submit proposals for remedial measures to the ER with a copy to ET and IEC within three working days of notification; 3. Implement the agreed proposals; and 4. Amend proposal as appropriate.
Limit level being exceeded by one sampling	<ol style="list-style-type: none"> 1. Identify source, investigate the causes of exceedance and propose remedial measures; 2. Inform Contractor, IEC, ER, and EPD; 3. Repeat measurement to confirm finding; 4. Increase monitoring frequency to daily; and 5. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results. 	<ol style="list-style-type: none"> 1. Check monitoring data submitted by ET; 2. Check Contractor's working method; 3. Discuss with ET and Contractor on possible remedial measures; 4. Advise the ER on the effectiveness of the proposed remedial measures; and 5. Supervise implementation of remedial measures. 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of exceedance in writing; 2. Notify Contractor; 3. Ensure remedial measures properly implemented. 	<ol style="list-style-type: none"> 1. Identify source(s) and investigate the causes of exceedance; 2. Take immediate action to avoid further exceedance; 3. Submit proposals for remedial measures to ER with a copy to ET and IEC within three working days of notification; 4. Implement the agreed proposals; and 5. Amend proposal if appropriate.
Limit level being exceeded by two or more consecutive sampling	<ol style="list-style-type: none"> 1. Notify IEC, ER, Contractor and EPD; 2. Identify source; 3. Repeat measurement to confirm findings; 4. Increase monitoring frequency to daily; 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented; 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. 	<ol style="list-style-type: none"> 1. Check monitoring data submitted by the ET; 2. Discuss amongst ER, ET, and Contractor on the potential remedial actions; 3. Review Contractor's remedial actions whenever necessary to assure their effectiveness and advise the ER accordingly; and 4. Supervise the implementation of remedial measures. 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of exceedance in writing; 2. In consultation with the ET and IEC, agree with the Contractor on the remedial measures to be implemented; 3. Supervise the implementation of remedial measures; and 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. 	<ol style="list-style-type: none"> 1. Identify source(s) and investigate the causes of exceedance; 2. Take immediate action to avoid further exceedance; 3. Submit proposals for remedial measures to the ER with a copy to the IEC and ET within three working days of notification; 4. Implement the agreed proposals; 5. Revise and resubmit proposals if problem still not under control; and 6. Stop the relevant portion of works as determined by the ER until the exceedance is abated.

2.3 Mitigation Measures

- 2.3.1 Mitigation measures for construction phase air quality impact have been recommended in the EIA Report. All the recommended mitigation measures and designs are detailed in the implementation schedule as presented in **Appendix B**. The Contractor should be responsible for the design and implementation of these measures.

2.4 Audit Requirements

- 2.4.1 Regular site inspection and audit at least once per week should be conducted during the entire construction phase of the Project to ensure the recommended mitigation measures are properly implemented.

3 NOISE

3.1 Introduction

- 3.1.1 The EIA has predicted the potential construction noise impact and operation phase road traffic noise and fixed noise impact arising from this Project.
- 3.1.2 Construction noise mitigation measures would be required to reduce noise levels to the stipulated standard. A noise monitoring and audit programme should be undertaken to confirm that such mitigation measures would be implemented properly.
- 3.1.3 For road traffic noise impact, an operational phase noise monitoring should be conducted to ensure the effectiveness of the proposed noise barriers/semi-enclosures in place.
- 3.1.4 For fixed noise impact arising from proposed new tunnel ventilation building at Kowloon side, a noise commissioning test should be conducted to ensure fixed noise impact would comply with the relevant noise standards. No noise monitoring for fixed noise during operational phase is required.
- 3.1.5 In this section, the requirements, methodology, equipment, monitoring locations, criteria and protocols for the monitoring and audit of noise impacts during construction phase and operational phase of the Project are presented.

3.2 Construction Phase Noise Monitoring

Monitoring Parameters

- 3.2.1 The construction noise levels should be measured in terms of the 30-minute A-weighted equivalent continuous sound pressure level ($L_{eq(30-min)}$). $L_{eq(30-min)}$ 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. Sample noise field data sheet is shown in **Appendix C** of this Manual for reference. The ET Leader may modify the data record sheet for this EM&A programme but the format of which should be agreed by the IEC.

Monitoring Equipment

- 3.2.3 As referred to the Technical Memorandum (TM) issued under the Noise Control Ordinance (NCO), sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications shall be used for carrying out noise monitoring. Immediately prior to and following each noise measurement the accuracy of the sound level meter shall be checked using an acoustic calibrator generating a known sound pressure level at a known frequency. Measurements shall be accepted as valid only if the calibration level from before and after the noise measurement agree to within 1.0 dB.
- 3.2.4 Noise measurements shall not be made in fog, rain, wind with a steady speed exceeding 5 m/s or wind with gusts exceeding 10 m/s. The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s.
- 3.2.5 The ET is responsible for the provision of the monitoring equipment. He shall 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 shall be clearly labelled. The equipment

installation location shall be proposed by the ET Leader and agreed with the IEC and EPD.

Monitoring Locations

3.2.6 Based on the findings of the EIA Report, the designated locations for construction noise monitoring are listed in **Table 3.1** and shown in **Figures 60604728/EM&Ab/Figure 3.1 and 60604728/EM&Ab/Figure 3.2.**

Table 3.1 Proposed Noise Monitoring Stations during Construction of the Project

Noise Monitoring Point	EIA NAP ID	Location	Building Name	Monitoring Period
CM1	EH1	Kowloon	Eastland Heights	During the period when construction works being carried out in Work Zone 7 & 8
CM2	KATC1	Shatin	Ka Yin House, Ka Tin Court	During the period when construction works being carried out in Work Zone 5 & 6
CM3	WWG8	Shatin	Block 3A, World-Wide Gardens	During the period when construction works being carried out in Work Zone 3

3.2.7 The status and locations of NSRs may change after issuing this Manual. If such cases exist, the ET shall propose updated monitoring locations and seek approval from the IEC and agreement from EPD of the proposal.

3.2.8 When alternative monitoring locations are proposed, the monitoring locations shall be chosen based on the following criteria:

- i. at locations close to the major site activities which are likely to have noise impacts;
- ii. close to the NSRs; and
- iii. for monitoring locations located in the vicinity of the sensitive receivers, care shall be taken to cause minimal disturbance to the occupants during monitoring.

3.2.9 The construction noise monitoring station shall normally be at a point 1 m from the exterior of the sensitive receivers building façade and be a position 1.2 m above the ground. If there is a problem with access to the normal monitoring position, an alternative position shall be chosen, and a correction to the measurements shall be made. For reference, a correction of +3 dB(A) shall be made to the free field measurements. The ET shall 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 shall be carried out at the same positions.

Baseline Monitoring

3.2.10 Baseline noise monitoring shall be carried out daily in all of the identified monitoring stations for at least 2 weeks prior to the commissioning of the construction works. A schedule of the baseline monitoring shall be submitted to the IEC for approval before the monitoring starts.

3.2.11 During the baseline monitoring, there shall not be any construction activities in the vicinity of the monitoring stations.

3.2.12 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with EPD and in consultation with the IEC to agree on an

appropriate set of data to be used as a baseline reference.

Impact Monitoring

- 3.2.13 Construction noise monitoring should be carried out at the designated monitoring station when there are Project-related construction activities being undertaken within a radius of 300 m from the monitoring stations. The monitoring frequency should depend on the scale of the construction activities. An initial guide on the monitoring is to 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 are underway.
- 3.2.14 If construction works are extended to include works during the hours of 1900 - 0700, and/or percussive piling is be carried out, applicable permits under NCO shall be obtained by the Contractor. The monitoring requirements and conditions stipulated in the permits have to be followed.
- 3.2.15 In case of non-compliance with the construction noise criteria, more frequent monitoring, as specified in the Action Plan in **Table 3.3** shall be carried out. This additional monitoring shall be continued until the recorded noise levels are rectified or proved to be irrelevant to the construction activities.

Event and Action Plan

- 3.2.16 The Action and Limit levels for construction noise are defined in **Table 3.2**. Should non-compliance of the criteria occur, action in accordance with the Action Plan in **Table 3.3** shall be carried out.

Table 3.2 Action and Limit Levels for Construction Noise

Time Period	Action Level	Limit Level
0700 – 1900 hours on normal weekdays	When one documented complaint is received	75 dB(A)*

Notes:

- If works are to be carried out during restricted hours and/or percussive piling is carried out, the monitoring requirements and the conditions stipulated in the Construction Noise Permit (CNP) issued by the Noise Control Authority have to be followed.
- * 70 dB(A) and 65 dB(A) for schools during normal teaching periods and school examination periods, respectively.

Table 3.3 Event and Action Plan for Construction Noise

Event	Action			
	ET	IEC	ER	Contractor
Action Level	<ol style="list-style-type: none"> 1. Notify IEC and Contractor; 2. Carry out investigation; 3. Report the results of investigation to the IEC, ER and Contractor; 4. Discuss with the Contractor and formulate remedial measures; and 5. Increase monitoring frequency to check mitigation effectiveness. 	<ol style="list-style-type: none"> 1. Review the analyzed results submitted by the ET; 2. Review the proposed remedial measures by the Contractor and advise the ER accordingly; and 3. Supervise the implementation of remedial measures. 	<ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Require Contractor to propose remedial measures for the analyzed noise problem; and 4. Ensure remedial measures are 	<ol style="list-style-type: none"> 1. Submit noise mitigation proposals to IEC; and 2. Implement noise mitigation proposals.

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

3.3 Operation Phase Road Traffic Noise Monitoring

3.3.1 The ET should carry out monitoring of road traffic noise after opening of 6-lanes LRT. The road traffic noise during operation of the Project should be measured according to the requirement in Annex III (Procedures and Requirement on Measurement of Road Traffic Noise) of the EIAO Guidance Note No. 12/2010 (Road Traffic Noise Impact Assessment Under the Environmental Impact Assessment Ordinance).

Physical or Weather Conditions

3.3.2 The ET should ensure the measurements are to be made when the road surface in the measurement area is dry, that is noise measurements shall not be made in fog and/or rain. During the measurement, the average wind speed should not exceed 2 m/s in the direction from the road to the reception point and the average wind speed at the microphone in any direction should not exceed 10 m/s. The wind speed shall be checked with a portable wind

speed meter capable of measuring the wind speed in m/s. A wind shield should be used.

Monitoring Equipment

- 3.3.3 The equipment and the calibration device should meet the requirement specified in the EIAO Guidance Note No. 12/2010. Type 1 equipment complying with IEC 651 or 804 or the equivalent is required. The measurement system should be operated with a valid calibration certificate given by a laboratory with relevant accreditation, such as HOKLAS. Immediately prior to and following each session of measurements, the equipment should be checked to have a calibration levels within 1 dB(A) using an acoustic calibrator.

Monitoring Parameters and Traffic Counts

- 3.3.4 Road traffic noise should be measured in terms of the A-weighted equivalent of L_{A10} . Supplementary information for data auditing and statistical results such as L_{Aeq} , L_{Amin} , L_{Amax} and L_{A90} should also be obtained for reference.
- 3.3.5 During the traffic noise measurement, the average traffic speed, traffic flow and traffic composition should also be undertaken concurrently.

Monitoring Locations

- 3.3.6 Those most affected NSRs identified in the EIA Report are selected as the noise monitoring locations in this EM&A Manual. The traffic noise monitoring locations during operational phase are listed in **Table 3.4** and shown in **60604728/EM&Ab/Figure 3.3**, **60604728/EM&Ab/Figure 3.4** and **60604728/EM&Ab/Figure 3.5**. In addition, noise monitoring shall be carried out within one year after opening the 6-lanes LRT. The locations for operational road traffic noise monitoring shall be defined during detailed design on the basis of the status of the most up-to-date information on proposed developments surrounding the Project.

Table 3.4 Traffic Noise Monitoring Stations

Monitoring Station ID	EIA NSR ID	Location	Noise Mitigation Measures
TN01	UC1	Union Court	S-C-01, S-C-02, S-S-01
TN02	JG4	Block 3, Julimount Garden	S-C-01, S-C-02, S-S-01
TN03	WWG5	Lily Court, World-Wide Gardens	S-C-02, S-S-03, S-S-01
TN04	KTV5	36, Kak Tin Village	S-V-01
TN05	STGPS1	Shatin Government Primary School	S-S-02
TN06	STW1	Shing Wai House, San Tin Wai Estate	S-C-03, S-S-02
TN07	FSC3	Wing Shing House, Fung Shing Court	S-C-03, S-S-02
TN08	STTNV1	Sha Tin Tau New Village	S-V-02, S-V-03
TN09	FSC1	Wah Shing House, Fung Shing Court	S-C-03, S-S-02

- 3.3.7 The status and locations of NSRs may change after issuing this manual. In this event, the ET Leader shall propose updated monitoring locations and seek approval from IEC and agreement from EPD of the proposal.
- 3.3.8 When alternative monitoring locations are proposed, the monitoring locations should be

chosen based on the following criteria in that they should be:-

- At locations facing the road sections with various type of noise barriers upon commissioning of the Project;
- Close to the NSRs; and
- For monitoring locations located in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance to the occupants during monitoring.

3.3.9 The monitoring station shall normally be at a point 1 m from the exterior of the sensitive receiver building facade and be at a position 1.2 m above the ground. If there is problem with access to the normal monitoring position, an alternative position may be chosen, and a correction to the measurements shall be made. For reference, a correction of +3 dB(A) shall be made to the free field measurements. The ET shall agree with the IEC on the monitoring position and the corrections adopted before commencement of monitoring.

Monitoring Period

3.3.10 Traffic noise monitoring shall be carried out at all the designated traffic noise monitoring stations. The following is an initial guide on the traffic noise monitoring requirements during the operational phase:

- One set of measurements at the morning traffic peak hour on normal weekdays;
- One set of measurements at the evening traffic peak hour on normal weekdays;
- A concurrent census of traffic flow and percentage heavy vehicle shall be conducted for the Project roads and the existing road network in the vicinity of each measuring point;
- Average vehicle speed estimated for Project road and the existing road network in the vicinity of each measuring points; and
- The two sets of monitoring data should be obtained within the first year of operation.

Monitoring Plan and Measurement Report Submission

3.3.11 The ET should prepare and deposit to EPD, at least 6 months before the full operation of the proposed roads under the Project, a monitoring plan for the purpose of assessing the accuracy of traffic noise predictions by comparing the noise impact predictions with the actual impacts. The monitoring plan should contain monitoring locations, monitoring schedules, methodology of noise monitoring including noise measurement procedures, traffic counts and speed checks, and methodology of comparison with the predicted noise levels. The ET should implement the monitoring plan in accordance with the deposited monitoring plan unless with prior justifications. Monitoring details and results including the comparison between the measured noise levels and the predicted noise levels should be recorded in a report to be deposited with EPD within one month of the completion of the monitoring. The report should be certified by the ET Leader before submission to EPD.

3.3.12 Measured noise levels should be compared with predicted noise levels by applying appropriate conversion corrections to allow for the traffic conditions at the time of measurement.

Event and Action Plan

3.3.13 For traffic noise, the measured/monitored noise levels shall be compared with the predicted results and the predicted traffic flow conditions (calculated noise levels based on concurrent traffic census obtained). In case discrepancies are observed, explanation shall be given to

justify the discrepancies.

3.4 Mitigation Measures

Construction Phase

3.4.1 To alleviate the construction noise impact on the affected NSRs, use of Quality Powered Mechanical Equipment (QPME), quieter rock breaking equipment, movable noise barriers, purpose-built noise barriers, noise insulating fabrics and noise enclosures are recommended during construction phase.

3.4.2 In addition to the above construction noise mitigation measures, good site practices listed below and the noise control requirements stated in EPD's "Recommended Pollution Control Clauses for Construction Contracts" should be included in the Contract Specification for the Contractors to follow and implemented to further minimize the potential noise impacts during the construction phase of the Project:

- Only well-maintained plant should be operated on-site and plant should be serviced regularly during the construction program.
- Silencers or mufflers on construction equipment should be utilised and should be properly maintained during the construction program.
- Mobile plant, if any, should be sited as far away from NSRs as possible.
- Machines and plant (such as trucks) that may be in intermittent use should be shut down between works periods or should be throttled down to a minimum.
- Plant known to emit noise strongly in one direction should, wherever possible, be orientated so that the noise is directed away from the nearby NSRs.
- Material stockpiles and other structures should be effectively utilised, wherever practicable, in screening noise from on-site construction activities.

3.4.3 The implementation schedule of the good site practices is presented in **Appendix B**.

Operation Phase

3.4.4 Direct noise mitigation measures including vertical noise barriers, cantilever noise barriers, and semi-enclosures have been proposed to alleviate the traffic noise impact. **Table 4.22** of the EIA Report summarises the proposed noise mitigation measures.

3.4.5 The sound power level of the proposed Kowloon Portal ventilation building is specified by the Project Engineer as presented in **Section 4.8** of the EIA Report.

3.4.6 The implementation schedule for the recommended mitigation measures is presented in **Appendix B**.

3.5 Audit Requirements

3.5.1 Regular site environmental audit during the construction phase of the Project should be conducted at least once per week to ensure proper implementation of mitigation measures and good site practices as listed in **Appendix B** and the noise control requirements stated in EPD's "Recommended Pollution Control Clauses for Construction Contracts" so as to further minimize the potential noise nuisance during construction phase.

3.6 Commissioning Test for Fixed Noise Source

3.6.1 Commissioning test for fixed noise source (proposed new tunnel ventilation building at

Kowloon side) prior to operation is required to ensure compliance of the operational airborne noise levels with the stipulated noise standard. Commissioning test requirements should be agreed with EPD at least 1 month prior to the commissioning test.

4 WATER QUALITY

4.1 Introduction

4.1.1 In accordance with the recommendations of the EIA, mitigation measures have been proposed during the construction phase of the Project to ensure that unacceptable water quality impacts do not occur at the downstream water sensitive receivers (WSRs) as a result of the construction works. Weekly site inspection and audit will also be conducted to ensure that the recommended mitigation measures recommended in the EIA Report are properly implemented during the construction stage. Details of the mitigation measures are presented in Section 5 of the EIA Report. Relevant mitigation measures are presented in **Appendix B**.

4.1.2 In addition to the recommended mitigation measures, water quality monitoring should be undertaken during the construction phase of the Project to determine the environmental performance of the Project in terms of its water quality impacts. No water quality monitoring and audit programme specific to the operation phase is proposed for the Project. Appropriate remedial actions should be taken in case the environmental performance criteria are exceeded. Detailed monitoring requirements as presented in the following sections.

4.2 Monitoring Parameters

4.2.1 Water quality parameters are chosen for monitoring with consideration of the potential water quality impacts from the construction of the Project (i.e. release of polluted water with high suspended solids (SS) load from the construction works). This would ensure the potential impacts from construction activities of the Project can be readily detected and timely action could be undertaken to rectify the situation. Water quality parameters to be measured are shown in **Table 4.1**.

Table 4.1 Water Quality Monitoring Parameters and Frequency during the Construction Phase

Parameters	Unit	Monitoring Frequency		
		Baseline monitoring	Impact Monitoring	Post Project Monitoring
<i>In-situ</i> Measurement		3 days per week for at least 4 weeks prior to the commencement of construction works	3 days per week throughout the construction period	3 days per week for 4 weeks after the completion of construction works
pH	-			
Water Temperature	°C			
Turbidity	NTU			
Dissolved Oxygen (DO)	mg/L			
Dissolved Oxygen (DO)	% saturation			
Salinity	ppt			
Laboratory Analysis				
Suspended Solids (SS)	mg/L			

4.2.2 In addition to the water quality parameters, other relevant data should also be measured and recorded in field logs, including the coordinates of the sampling stations and the locations of construction works at the time of sampling, water depth, weather conditions, flowrate (m³/s), special phenomena (provide photographs if appropriate) and work activities undertaken around the monitoring and works area that may influence the monitoring results.

4.3 Monitoring Equipment

4.3.1 For water quality monitoring, the following equipment should be supplied and used by the

environmental contractor.

Dissolved Oxygen and Temperature Measuring Equipment

4.3.2 The instrument should be a portable, weatherproof measuring instrument complete with cable, sensor, comprehensive operation manuals, and should be operable from a DC power source. It should be capable of measuring dissolved oxygen levels in the range of 0-20 mg/L and 0-200% saturation and a temperature of 0-45 °C.

4.3.3 It should have a membrane electrode with automatic temperature compensation complete with a cable of not less than 35m in length. Sufficient stocks of spare electrodes and cable 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).

4.3.4 Should salinity compensation not be built-in in the DO equipment, *in-situ* salinity shall be measured to calibrate the DO equipment prior to each DO measurement.

Salinity Measuring Equipment

4.3.5 A portable salinometer capable of measuring salinity in the range of 0-40 ppt shall be provided for measuring salinity of the water at each monitoring location.

Turbidity Measuring Equipment

4.3.6 Turbidity should be measured *in-situ* by the nephelometric method using an instrument that is portable and weatherproof using a DC power source with cable, sensor, and comprehensive operation manuals. This instrument should have a photoelectric sensor capable of measuring turbidity between 0 - 1000 NTU (e.g. Hach model 2100P or other approved instrument of similar type). The meter should be calibrated in order to establish the relationship between NTU units and the levels of SS. The turbidity measurement should be carried out on a split water sample from the same water sample collected for suspended solids analysis.

pH Measuring Instrument

4.3.7 The instrument shall consist of a potentiometer, a glass electrode, a reference electrode and a temperature-compensating device. It shall be readable to 0.1 pH in a range of 0 to 14. Standard buffer solutions of at least pH 7 and pH 10 shall be used for calibration of the instrument before and after use. Details of the method shall comply with American Public Health Association (APHA), 19th ed. 4500-HTB or equivalent methods subject to approval of EPD.

Electromagnetic Flow Meter

4.3.8 A hand-held digital electromagnetic flow meter (e.g. model Flo-mate 2000 or other approved similar instrument) should be provided and used to measure water flow rate during water quality monitoring. The measurement should be conducted at fixed sampling points and water depth throughout the monitoring programme.

Positioning Device

4.3.9 A hand-held Global Positioning System (GPS) with way point bearing indication or other equivalent instrument of similar accuracy will be provided and used during monitoring to ensure the monitoring team is at the correct location before taking measurements.

Water Depth Detector

4.3.10 A portable, battery-operated echo sounder will be used for the determination of water depth at each designated monitoring station.

Water Sampling Equipment

4.3.11 A water sampler, consisting of a transparent PVC or glass cylinder of at least 500mL, which

can be effectively sealed with latex cups at both ends, should be used (Kahlsico Water Sampler 13SWB203 or an approved similar instrument). The sampler shall 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. Water samples for SS measurements should be contained in high density polyethylene bottles.

Back-up Equipment

- 4.3.12 Sufficient stocks of spare parts should be maintained for replacements when necessary. Back-up monitoring equipment should also be available so that monitoring can proceed uninterrupted even when some equipment is under maintenance, calibration, etc.

Sampling/Testing Protocols

- 4.3.13 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 monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use.
- 4.3.14 For on-site calibration of field equipment, the “*Guide to Field and On-Site Test Methods for the Analysis of Waters*” (BS 1427:1993) should be observed. 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.
- 4.3.15 Water samples for SS measurements should be collected in high density polythene bottles, packed in ice (cooled to 4 °C without being frozen), and delivered to a HOKLAS laboratory as soon as possible after collection.
- 4.3.16 Three replicate samples should be collected from each of the monitoring events for *in-situ* measurement and lab analysis. It is recommended to take three replicates at each sampling station from each independent sampling event for all parameters in order to ensure a robust statistically interpretable data set.

Laboratory Analysis

- 4.3.17 All laboratory work should be carried out in a HOKLAS accredited laboratory or other international accredited laboratory. Water samples of about 1,000mL should be collected at the monitoring and control stations for carrying out the laboratory determination. The detection limit shall be 1 mg/L or better. The determination work should start within 24 hours after collection of the water samples. The SS laboratory measurements should be provided within 2 days of the sampling event (48 hours). The analyses should follow the standard methods as described in APHA Standard Methods for the Examination of Water and Wastewater (APHA 2540D for SS), 21st Edition, or equivalent methods subject to approval of EPD.
- 4.3.18 The submitted information should include 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. The QA/QC details should be in accordance with requirements of HOKLAS or another internationally accredited scheme. QA/QC result shall be reported. EPD may also request the laboratory to carry out analysis of known standards provided by EPD for quality assurance. Additional duplicate samples may be required by EPD for inter laboratory calibration. Remaining samples after analysis shall 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 shall have comprehensive quality assurance and quality control programmes. The laboratory shall prepare to demonstrate the programmes to EPD or his representatives when requested.

4.4 Monitoring Location

4.4.1 The monitoring stations have been established to identify potential water quality impacts to WSRs. Locations of the monitoring stations are shown in [60604728/EM&Ab/Figure 4.1](#) with the coordinates presented on **Table 4.2**. The upstream monitoring stations will act as control stations. Monitoring at the control stations is for comparing the water quality from potentially impacted sites with the ambient water quality.

Table 4.2 Details of Water Quality Monitoring Station during the Construction Phase

Station	Description	Station Nature	Easting	Northing
C1	Upstream	Control Station	837010	825125
W1	Downstream	Impact Station	836908	825239
C2	Upstream	Control Station	836675	824942
W2	Downstream	Impact Station	836780	825232
C3	Upstream	Control Station	836332	824090
W3	Downstream	Impact Station	835991	824551
C4	Upstream	Control Station	835807	824115
W4	Downstream	Impact Station	835773	824252

4.4.2 The locations and suitability of the proposed monitoring stations above are indicative and subject to further review by the ET, and the ET leader shall propose with justification for any changes to monitoring stations and seek approval from the IEC and EPD before commencement of Baseline Monitoring. Water samples should only be taken at mid-depth. Water sampling works should be conducted with caution to avoid disturbing the bottom sediment.

4.5 Monitoring Frequency

Baseline Monitoring

4.5.1 Baseline conditions in the watercourses should be established and agreed with the EPD prior to the commencement of construction works. The purpose of the baseline monitoring is to establish ambient conditions prior to the commencement of the works and to demonstrate the suitability of the proposed monitoring stations. The baseline conditions should normally be established by measuring the water quality parameters specified in **Section 4.2**.

4.5.2 Baseline monitoring should be undertaken three times per week for at least four weeks at the designated stations prior to the commencement of the construction works. The interval between two consecutive sets of monitoring should not be less than 36 hours. Baseline monitoring schedule prepared by the ET should be submitted to the ER, the IEC and EPD one week prior to the commencement of baseline monitoring.

4.5.3 There shall not be any construction activities in the vicinity of the monitoring stations during the baseline monitoring. In exceptional cases when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall seek approval from the IEC and EPD on an appropriate set of data to be used as baseline reference.

Impact Monitoring

4.5.4 Impact monitoring should be undertaken three times per week during the course of construction works. The interval between two consecutive sets of monitoring should not be less than 36 hours except when there are exceedances of Action and/or Limit Level, in which case monitoring frequency should be increased. The proposed water quality monitoring schedule prepared by the ET should be submitted to the ER, the IEC and EPD at least one week before the first day of the monitoring month. The ER, the IEC and EPD should be notified immediately of any changes in schedule.

Post Project Monitoring

4.5.5 Post project monitoring will comprise sampling on three days a week for four weeks after completion of the construction works. The monitoring requirements will be the same as the impact monitoring stated in **Section 4.5.4** above. Post project monitoring schedule prepared by the ET should be submitted to the ER, the IEC and EPD at least one week before the first day of the post project monitoring month. The ER, the IEC and EPD should be notified immediately of any changes in schedule.

4.6 Event and Action Plan

4.6.1 Water quality monitoring results will be evaluated against Action and Limit Levels shown in **Table 4.3**.

Table 4.3 Action and Limit Levels for Water Quality

Parameter	Action Level	Limit Level
SS in mg/L ⁽¹⁾	95%-ile of baseline data, or 20% exceedance of value at any impact station compared with corresponding data from control station on the same day	99%-ile of baseline data, or 30% exceedance of value at any impact station compared with corresponding data from control station on the same day
DO in mg/L ⁽²⁾	5%-ile of baseline data	4 mg/L or 1%-ile of baseline data
Turbidity in NTU ⁽¹⁾	95%-ile of baseline data, or 20% exceedance of value at any impact station compared with corresponding data from control station on the same day	99%-ile of baseline data, or 30% exceedance of value at any impact station compared with corresponding data from control station on the same day

Notes:

- For SS and turbidity, non-compliance of the water quality limits occurs when monitoring result is higher than the limits.
- For DO, non-compliance of the water quality limits occurs when the monitoring result is lower than the limits.

4.6.2 Should the monitoring results of the water quality parameters at any designated monitoring stations indicate that the water quality criteria are exceeded, the actions in accordance with the Event and Action Plan in **Table 4.4** should be carried out.

4.6.3 In addition to monitoring, regular environmental site audit is required to ensure the proper implementation of good site practices, construction runoff pollution preventive measures, drainage and sewage control measures.

Table 4.4 Event and Action Plan

Event	ET Leader	IEC	ER	Contractor
Action level being exceeded by one sampling day	<ul style="list-style-type: none"> • Repeat <i>in-situ</i> measurement to confirm findings; • Identify source(s) of impact; • Inform IEC and Contractor; • Check monitoring data, all plant, equipment and Contractor's working methods; • Discuss mitigation measures with IEC and Contractor; 	<ul style="list-style-type: none"> • Discuss with ET and Contractor on the mitigation measures • Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly • Assess the effectiveness of the 	<ul style="list-style-type: none"> • Discuss with IEC on the proposed mitigation measures; • Make agreement on the mitigation measures to be implemented. 	<ul style="list-style-type: none"> • Inform the ER and confirm notification of the non-compliance in writing; • Rectify unacceptable practice; • Check all plant and equipment • Consider changes of working methods; • Discuss with ET and IEC and

Event	ET Leader	IEC	ER	Contractor
	<ul style="list-style-type: none"> Repeat <i>in-situ</i> measurement on next day of exceedance. 	<p>implemented mitigation measures.</p>		<p>propose mitigation measures to IEC and ER;</p> <ul style="list-style-type: none"> Implement the agreed mitigation measures.
<p>Action level being exceeded by more than one consecutive sampling days</p>	<ul style="list-style-type: none"> Repeat <i>in-situ</i> measurement to confirm findings; Identify source(s) of impact; Inform IEC and Contractor; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with IEC and Contractor; Ensure mitigation measures are implemented; Prepare to increase the monitoring frequency to daily; Repeat <i>in-situ</i> measurement on next day of exceedance. 	<ul style="list-style-type: none"> Discuss with ET and Contractor on the mitigation measures; Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; Assess the effectiveness of the implemented mitigation measures. 	<ul style="list-style-type: none"> Discuss with IEC on the proposed mitigation measures; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures. 	<ul style="list-style-type: none"> Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Discuss with ET and IEC and propose mitigation measures to IEC and ER within 3 working days; Implement the agreed mitigation measures.
<p>Limit level being exceeded by one sampling day</p>	<ul style="list-style-type: none"> Repeat <i>in-situ</i> measurement to confirm findings; Identify source(s) of impact; Inform IEC, Contractor, ER and EPD; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with IEC, ER and Contractor; Ensure mitigation measures are implemented; Increase the monitoring frequency to daily until no exceedance of Limit Level. 	<ul style="list-style-type: none"> Discuss with ET and Contractor on the mitigation measures; Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; Assess the effectiveness of the implemented mitigation measures. 	<ul style="list-style-type: none"> Discuss with IEC, ET and Contractor on the proposed mitigation measures; Request Contractor to critically review the working methods; Make agreement on the mitigation measures to be implemented; Assess the effectiveness of the implemented mitigation measures. 	<ul style="list-style-type: none"> Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Discuss with ET, IEC and ER and propose mitigation measures to IEC and ER within 3 working days; Implement the agreed mitigation measures.

Event	ET Leader	IEC	ER	Contractor
<p>Limit level being exceeded by more than one consecutive sampling days</p>	<ul style="list-style-type: none"> • Repeat <i>in-situ</i> measurement to confirm findings; • Identify source(s) of impact; • Inform IEC, Contractor, ER and EPD; • Check monitoring data, all plant, equipment and Contractor's working methods; • Discuss mitigation measures with IEC, ER and Contractor; • Ensure mitigation measures are implemented; • Increase the monitoring frequency to daily until no exceedance of Limit Level for two consecutive days. 	<ul style="list-style-type: none"> • Discuss with ET and Contractor on the mitigation measures; • Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; • Assess the effectiveness of the implemented mitigation measures. 	<ul style="list-style-type: none"> • Discuss with IEC, ET and Contractor on the proposed mitigation measures; • Request Contractor to critically review the working methods; • Make agreement on the mitigation measures to be implemented; • Assess the effectiveness of the implemented mitigation measures • Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the construction work until no exceedance of Limit level. 	<ul style="list-style-type: none"> • Inform the ER and confirm notification of the non-compliance in writing; • Rectify unacceptable practice; • Check all plant and equipment; • Consider changes of working methods; • Discuss with ET, IEC and ER and propose mitigation measures to IEC and ER within 3 working days; • Implement the agreed mitigation measures; • As directed by the Engineer, to slow down or to stop all or part of the construction activities.

5 WASTE MANAGEMENT

5.1 Introduction

5.1.1 Potential waste management implication arising from the construction and operational phases of the Project were addressed in the EIA Report. Waste management during construction phase will mainly be the contractor's responsibility to ensure that any wastes produced during the construction and demolition works are handled, stored and disposed of in accordance with good waste management practices and relevant EPD's regulations and other legislative requirements.

5.1.2 Large quantities of wastes are not expected from the operation of the Project and no adverse environmental impacts would arise with the implementation of good waste management practices. EM&A would not be necessary during the operational phase.

5.2 Mitigation Measures

Construction Phase

5.2.1 Mitigation measures for waste management recommended in the EIA Report should form the basis of the site Waste Management Plan (WMP) to be developed by the Contractor in the construction stage. A WMP, as a part of the Environmental Management Plan (EMP), should be prepared in accordance with *ETWB TC (W) No.19/2005* and submitted to the Engineer for approval. The monitoring and auditing requirement stated in *ETWB TC (W) No.19/2005* should be followed with regard to the management of C&D materials.

Operation Phase

5.2.2 Wastes produced during operation phase would mainly comprise of screening, grits, sludge, general refuse, and chemical waste. With the implementation of the recommended mitigation measures for handling, transportation and disposal of the identified waste arisings, no adverse impacts are anticipated during operation phase of the Project. Therefore, no other specific waste monitoring during operation phase is required.

5.2.3 **Appendix B** provides the implementation schedule of the recommended mitigation measures during both construction and operational phases.

5.2.4 With the appropriate handling, storage and removal of waste arisings during the construction and operation of the Project as presented in **Appendix B**, the potential to cause adverse environmental impacts would be minimized. During the site inspections, the ET shall pay special attention to the issues relating to waste management and check whether the Contractor has implemented the recommended good site practices, waste reduction measures and other mitigation measures.

5.3 Audit Requirement

5.3.1 Regular audits and site inspections should be carried out during construction phases by the ER, ET and Contractor to ensure that the recommended good site practices and the recommended mitigation measures listed 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.

5.3.2 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.

6 LAND CONTAMINATION

6.1 Introduction

6.1.1 According to the site appraisal under the EIA Study, a total of 11 facilities/areas were identified with potential land contamination concerns at the tunnel portal areas within the Project Area. As the concerned facilities of the LRT are still in operation and the demolition and construction works will not commence until 2026-2027, there could be change in site activities and land uses within the Project Area prior to development which may cause further contamination issues. Site re-appraisal should be carried out for the whole Project Area at a later stage of the Project in order to address any new contamination issues caused by the (i) changes in operation of the identified potentially contaminated site and (ii) changes in land use within the Project Area. The submission of supplementary Contamination Assessment Plan(s) (CAP(s)), associated site investigation (SI) works and any necessary remediation should be carried out at the concerned facilities and any new contaminated area identified in the site re-appraisal, prior to the commencement of construction at the potentially contaminated area(s). The recommended further assessment and remediation works, including the submission of supplementary 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 agreement, would follow relevant Guidance Manual, Guidance Note and Practice Guide.

6.2 Construction Phase

6.2.1 Remediation works, if necessary, would be carried out based on the recommended further works outlined in the EIA report. Mitigation measures for the remediation works, if necessary, as recommended in the EIA Report, **Appendix B** of this Manual and future RAP(s) should be implemented during the remediation works. EM&A should be carried out in the form of regular site inspection during construction phase to ensure the recommended mitigation measures are properly implemented and findings of the audit should be reported in the EM&A reports.

6.3 Operation Phase

6.3.1 As any contaminated soil / groundwater would be identified and properly treated prior to the construction works at the concerned facilities / areas, land contamination during the operation phase is not expected. As such, environmental monitoring and audit during operation phase for land contamination is considered not necessary.

7 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. Mitigation measures have been recommended to minimize the potential direct and indirect impacts to the recognized sites of conservation importance and natural habitats, as well as the associated wildlife. With the implementation of appropriate mitigation measures, no unacceptable adverse residual impacts would be anticipated. Nonetheless, EM&A considered necessary and the requirements are described below.

7.2 Mitigation Measures

7.2.1 The implementation of mitigation measures recommended in the EIA Report to minimize potential ecological impacts are provided in **Appendix B**. The major ecological mitigation measures proposed include avoidance/minimization impacts to recognized sites of conservation importance and natural habitats, protection of flora and fauna species of conservation importance, minimization of glare, air quality, noise, water quality and disturbance impact, minimization of groundwater infiltration, minimization of noise barriers and compensatory planting for unavoidable woodland loss. The monitoring requirements are of stated in **Section 7.3** below, while the requirements of environmental audit and reporting are provided in **Sections 11** and **12** of this Manual.

7.3 Monitoring Requirements

Monitoring of Mitigation Measures on Avoidance/Minimization of Adverse Impacts to Recognized Sites of Conservation Importance and Natural Habitats

7.3.1 To avoid unnecessary habitat loss and minimize the disturbance impact to sites of conservation importance and natural habitats, the implementation of the mitigation measures recommended in **Appendix B** should be subjected to regular site audit. Site audit and inspections should be carried out at least once per week throughout the construction phase by ET. The areas of inspection shall not be limited to the environmental situation, pollution control and mitigation measures within the site; it should also review the environmental situation outside the works area which is likely to be affected, directly or indirectly, by the site activities (**Section 11** refers). In case of non-compliance, the Contractor should be informed to strengthen the proposed mitigation measures accordingly, follows the procedures stated in **Section 11**. Regular site inspections covering the Project boundary within Lion Rock Country Park (LRCP) and the ecological compensatory plantings should be conducted at least once per week as early as possible once the Project commences to ensure that all construction activities are confined within the Project footprint and that the proposed mitigation measures are implemented appropriately and effectively. In case there are any unwanted and unforeseen ecological impacts arising from the project (e.g. unwanted construction activities or access by workers into LRCP), remedial actions (e.g. immediately stop and removal of construction activities/unintended access away from LRCP) should be recommended, where appropriate, in consultation with relevant authorities (e.g. EPD). Reinstatement works/programme should be proposed by the Contractor (e.g. reinstatement planting and associated monitoring on the affected area), in consultation with relevant authorities (e.g. EPD) where appropriate, in case unwanted ecological impact outside the Project footprint is resulted.

7.3.2 All temporarily affected areas should be reinstated after completion of the works. Reinstatement by woodland mix planting with tree whips at the affected areas (e.g. soil slopes, temporarily affected areas) according to Preliminary Reinstatement Plan should be implemented. Use of native species shall be maximized as far as possible in accordance with the Guiding Principles on Use of Native Plant Species in Public Works Projects to improve the habitat complexity and quality, particularly for the temporarily affected areas or engineered slopes at LRCP. Suitable native species of appropriate size and ecological function (e.g. provide appropriate food sources and habitats to local fauna including birds, mammals and insects) should be considered during the woodland mix planting. The reinstatement planting

should be monitored regularly during the 1-year establishment period for area outside LRCP and 3-year establishment period for areas within LRCP by a qualified ecologist / arborist with at least 10 years relevant experience. Details of post-transplantation monitoring programme such as monitoring frequency and parameters, maintenance works and possible remedial measures in case of exceedance of compliance are presented in Preliminary Reinstatement Plan (**Appendix 8.8** of the EIA Report), and would be reviewed and updated in Final Reinstatement Plan by a qualified ecologist / arborist with at least 10 years relevant experience during the detailed design phase of the Project. Agreement / approval of the Final Reinstatement Plan shall be obtained from relevant government authorities (e.g. AFCD and EPD) prior to commencement of any construction activities.

Monitoring of Mitigation Measures of Glare, Air Quality, Noise, Water Quality and Disturbance Impacts on Recognized Sites of Conservation Importance, Natural Habitats and Associated Wildlife

- 7.3.3 To minimize the indirect disturbance impact (e.g. glare, air quality, noise and water quality and disturbance) to sites of conservation importance and natural habitats and associated wildlife, the implementation of the mitigation measures for minimization of glare, air quality, noise, water quality and disturbance impact recommended in **Appendix B** should be subjected to regular site audit and inspection. Site audit and inspection should be carried out at least once per week throughout the construction phase by ET. The areas of inspection shall not be limited to the environmental situation, pollution control and mitigation measures within the site; it should also review the environmental situation outside the works area which is likely to be affected, directly or indirectly, by the site activities (**Section 11** refers). In case of non-compliance, the Contractor should be informed to strengthen the proposed mitigation measures accordingly, follows the procedures stated in **Section 11**. Regular site inspections covering the Project boundary within LRCP and the ecological compensatory plantings should be conducted as early as possible once the Project commences to ensure that all construction activities are confined within the Project footprint and that the proposed mitigation measures are implemented appropriately and effectively. In case there are any unwanted and unforeseen ecological impacts arising from the project, remedial actions (e.g. rectify unacceptable practice, check all plant and equipment) should be recommended, where appropriate, in consultation with relevant authorities. Details of monitoring programme of mitigation measures to minimize indirect impacts (e.g. locations, parameters, frequency and duration for baseline, impact and compliance monitoring, event and action plans with division of work) are presented in **Sections 2, 3, 4** and **5** of this Manual.

Monitoring of Mitigation Measures on Protection of Flora Species of Conservation Importance

- 7.3.4 Four flora species of conservation importance were recorded within the Project footprint (one individual of Incense Tree, nine individuals of Butulang Canthium and 19 individuals of Ailanthus along LRTR, and nine individuals Rhodoleia near Lung Cheung Road Park). A detailed vegetation survey within latest available Project footprint shall be conducted by a qualified ecologist/ botanist with at least 10 years relevant experience to identify and update the conditions of any flora species of conservation importance, including but not limited to the species recorded in the EIA Report, before the commencement of works and to refine the Preliminary Plant Preservation and Transplantation Proposal (PPTP) in **Appendix 8.7** of the EIA Report. As proposed in the Preliminary PPTP, some of the affected flora species of conservation importance would be preserved in-situ, relevant measures (e.g. setting up plant protection zone) stated in **Appendix 8.7** of the EIA Report should be implemented, and monthly monitoring of the conditions of the preserved plants and site audit of the recommended protection measures should be conducted. In case of unavoidable loss of flora species of conservation importance, transplantation and provision of compensation plantings should be conducted. A monitoring programme to review the health conditions of the transplanted and compensated plants at the recipient site should be conducted by a qualified local ecologist or arborist with at least 10 years relevant experience to monitor the health conditions of the transplanted and compensated plants at the recipient site, which the health conditions of the transplanted and compensated plants should be monitored during the 3-year and 9-year establishment period respectively. In case of need and if there is any unwanted / unforeseen impacts identified during the monitoring and site audit, additional mitigation and

remedial measures (such as provision and establishment of replacement plantings) should be recommended and implemented, where appropriate, in consultation with relevant authorities under the Project. Details of monitoring programme such as monitoring frequency and parameters, maintenance works and recommended remedial measures are presented in Preliminary PPTP in **Appendix 8.7** of the EIA Report, and would be reviewed and updated in Final PPTP by a qualified ecologist / botanist with at least 10 years relevant experience during the detailed design phase of the Project. Agreement / approval of the Final PPTP shall be obtained from relevant government authorities (e.g. AFCD and EPD) prior to commencement of any construction activities.

Monitoring of Mitigation Measures on Protection of Fauna Species of Conservation Importance

- 7.3.5 Although no direct impact on fauna species of conservation importance is anticipated, pre-construction survey should be conducted by a qualified ecologist with at least 10 years relevant experience to identify if any fauna species of conservation importance is presented within and in the surrounding of the Project footprint (e.g. section of S7 near the Shatin portal area). A Pre-construction Fauna Survey Report (PCFSR) prepared by a qualified ecologist with at least 10 years relevant experience would be submitted to relevant government authorities (e.g. AFCD and EPD). In case any fauna species of conservation importance recorded during the pre-construction survey would be directly impacted, protection/translocation should be proposed and carried out to avoid potential direct impact. A Protection and Translocation Proposal (PTP) should be prepared by a qualified ecologist with at least 10 years relevant experience, where appropriate, to present detailed findings of potentially affected fauna within the impacted habitats (e.g. species and number of affected individuals), propose protection and translocation methodology (e.g. protection measure, timing of the translocation, implementation programme) and monitoring and maintenance programme. The PTP should be submitted and approved by relevant government authorities (e.g. AFCD and EPD) prior to commencement of any construction activities.

Monitoring of Compensatory Planting for Unavoidable Woodland Loss

- 7.3.6 To mitigate unavoidable impacts on the woodlands within LRCP, woodland compensatory planting would be provided and potential woodland compensation area is preliminary identified at an agricultural land habitat west to the Sha Tin South Fresh Water Service Reservoir within the assessment area and near Project boundary. The compensatory planting will comprise native plant species directly affected under the Project. Upon completion of the woodland compensatory planting works, a maintenance and monitoring programme on the woodland compensatory plantings at woodland compensation area should be undertaken during the planting and establishment period which normally takes at least 9 years according to the Preliminary Woodland Compensation Plan (WCP) in **Appendix 8.10** of the EIA Report. The Project Proponent should properly establish the ecological plantings recommended by the EIA Report after the possession of the woodland compensation area until the plantings are fully established (which normally takes at least 9 years) and before hand over of the established woodland to the long-term maintenance party identified and agreed in accordance with the DEVB TCW No. 6/2015 Maintenance of Vegetation and Hard Landscape Features after the establishment period for ad hoc maintenance. The Contractor should regularly maintain the planted individuals, including watering, weeding and pest control. Subject to the health condition and the survival of the woodland compensatory plantings, replanting works should be conducted by the Contractor to replace the dead or poor health individual with same species, where necessary. A monitoring programme would be conducted by a qualified ecologist / arborist with at least 10 years relevant experience to monitor the health condition and survival of the woodland compensatory planting should be monitored. Details of monitoring programme such as monitoring frequency and parameters, and maintenance works would be recommended in the are presented in Preliminary WCP in **Appendix 8.10** of the EIA Report, and would be reviewed and updated in Final WCP by a qualified ecologist / arborist with at least 10 years relevant experience during the detailed design phase of the Project. Agreement / approval of the Final WCP shall be obtained from relevant government

authorities (e.g. AFCD and EPD) prior to commencement of any construction activities.

Monitoring on Mitigation Measures on Groundwater Infiltration

- 7.3.7 As stated in Section 5 of EIA report, it is anticipated that the underground tunnel improvement works would not have adverse groundwater infiltration impacts with proper implementation of groundwater infiltration minimization measures. Nonetheless, as an additional precautionary measure, surface water level monitoring at natural watercourses within LRCP and Beacon Hill SSSI and in the vicinity of the tunnelling works would be conducted during the construction and operation stages. In particular, monthly monitoring should be conducted at watercourses S6 to S8 to monitor parameters (including water depth and water velocity) to record and evaluate if any abnormal significant decrease of the water level i.e. which is unlikely associated with changes in weather patterns, is arising from the Project. In case of any abnormal significant decrease of the water level is arising from the Project, The Contractor should recommend and implement remedial measures (e.g. review and strengthen groundwater water control strategies), where necessary, in consultation with relevant authorities (e.g. EPD). The preliminary recommended monitoring locations is presented in the **60604728/EM&Ab/Figure 7.1** and would be refined by the Contractor during the detailed design phase of the Project. Agreement / approval from relevant government authorities (e.g. AFCD and EPD) should be obtained prior to commencement of any tunnel improvement activities.

8 CULTURAL HERITAGE

8.1 Impacts on Cultural Heritage

- 8.1.1 Ex Kowloon-Canton Railway Beacon Hill Tunnel (Government Historic Site) (hereinafter as “Ex Beacon Hill Tunnel”) is located approximately at 90m from the Project Boundary. No direct impact is anticipated to the Ex Beacon Hill Tunnel but indirect impacts including ground-borne vibration, tilting and settlement, would be anticipated during the construction phase. Mitigation measures and Environmental Monitoring and Audit (EM&A) requirements for cultural heritage are proposed to be implemented during the construction phase.
- 8.1.2 Lau Ancestral Hall (Sha Tin Tau) (Grade 3), Tsang Tai Uk (Grade 1) and High Rock Christian Camp (Grade 2) are located at considerable distance from the project site, no adverse impact would be anticipated on these historic buildings during the construction phase.
- 8.1.3 The first lion rock tunnel will be subjected to expansion during the construction phase, while the second lion rock tunnel will undergo refurbishment.
- 8.1.4 Twelve other non-graded buildings identified within the 300m assessment area contained very low cultural heritage significance. No impact is anticipated due to considerable distance from the proposed works.
- 8.1.5 On the other hand, no impact on cultural heritage would be anticipated during the operational phase. Therefore, no mitigation measure and EM&A requirement would be required for cultural heritage during the operational phase.

8.2 Mitigation Measures

- 8.2.1 The mitigation measures on cultural heritage recommended in the EIA Report are summarized as below. The implementation of the mitigation measures provided in **Appendix B**.

Construction Phase

- 8.2.2 Pre and post condition survey of Ex Beacon Hill Tunnel (Government Historic Site) should be conducted by professional qualified building surveyor or engineer before and after the construction works respectively. The survey results shall be submitted to AMO for record.
- 8.2.3 Monitoring of vibration, settlement and tilting incorporated with a set of Alert, Alarm and Action (AAA) system shall be employed for Ex Beacon Hill Tunnel (Government Historic Site) during the construction phase, measuring inside the tunnel tube at locations closest to the proposed construction works. If the alert level is exceeded, the monitoring frequency should be increased. If the alarm level is exceeded, the design of the construction may need to be amended. If the action level is exceeded, all works should be stopped. The proposed AAA limiting criteria are presented in **Table 8.1**. The actual limiting criteria should be further agreed with the AMO. A monitoring proposal, including type and frequency of monitoring, distribution of monitoring points and proposed actions to be taken when reaching respective monitoring limits, should be submitted to AMO for agreement before the commencement of works. Prior agreement and consent should be sought from the owner(s), stakeholder(s) and relevant Government department(s) for the installation of monitoring points on the built heritage before the commencement of works. Record of monitoring should be submitted regularly to AMO during the construction. AMO should be alerted in case any irregularities are observed.

Table 8.1 Proposed AAA Limiting Criteria for Vibration, Settlement and Tilting Level Monitoring during Construction

Alert, Alarm and Action (AAA) Values		
Vibration	Settlement	Tilting
5/6/7.5 mm/s	6/8/10 mm	1/2000, 1/1500, 1/1000

- 8.2.4 It is suggested that fonts on both sides of the portals of the two tunnels should be kept or replicated and placed on similar position as the current setting. The colour scheme of associated buildings is suggested to be adopted to the new administrative buildings in order to maintain the original sentiment. Moreover, the two commemorative plaques marking the opening ceremony of the tunnel should be kept at prominent position at the new administrative buildings visible to all guests. Detailed photographic recording on the Lion Rock Tunnel and its associated buildings (both exterior and interior) should be conducted before any works to commence. A copy of the photographic documentation should be provided to AMO for record.
- 8.2.5 No mitigation measure would be required for the Lau Ancestral Hall (Sha Tin Tau) (Grade 3), Tsang Tai Uk (Grade 1) and High Rock Christian Camp (Grade 2) during the construction phase.
- 8.2.6 No mitigation measure is required for the other twelve non-graded buildings identified within the 300m assessment area.
- 8.2.7 No mitigation measure would be required for archaeology during the construction phase. As a precautionary measure, AMO should be informed immediately in case of discovery of antiquities or supposed antiquities in the course of works, so that appropriate mitigation measures, if needed, can be timely formulated and implemented in agreement with AMO.

Operational Phase

- 8.2.8 No impact on cultural heritage would be anticipated during the operational phase. Therefore, no mitigation measure would be required for cultural heritage during the operational phase.

8.3 EM&A Requirements

Construction Phase

- 8.3.1 Pre and post condition survey of Ex Beacon Hill Tunnel (Government Historic Site) should be conducted by professional qualified building surveyor or engineer before and after the construction works respectively. The survey results shall be submitted to AMO for record.
- 8.3.2 Monitoring of vibration, settlement and tilting incorporated with a set of AAA system shall be employed for Ex Beacon Hill Tunnel (Government Historic Site) during the construction phase, measuring inside the tunnel tube at locations closest to the proposed construction works. The proposed AAA limiting criteria are presented in **Table 8.1**. The actual limiting criteria should be further agreed with the AMO. A monitoring proposal, including type and frequency of monitoring, distribution of monitoring points and proposed actions to be taken when reaching respective monitoring limits, should be submitted to AMO for agreement before commencement of works. Record of monitoring should be submitted regularly to AMO during the construction. AMO should be alerted in case any irregularities are observed.
- 8.3.3 It is suggested that fonts on both sides of the portals of the two tunnels, namely “Lion Rock Tunnel 獅子山隧道” and “Second Lion Rock Tunnel 第二獅子山隧道”, should be kept or replicated and placed on similar position as the current setting. The colour scheme of associated buildings is suggested to be adopted to the new administrative buildings in order to maintain the original sentiment. Moreover, the two commemorative plaques marking the opening ceremony of the tunnel should be kept at prominent position at the new administrative buildings visible to all guests.
- 8.3.4 No EM&A requirement would be required for the Lau Ancestral Hall (Sha Tin Tau) (Grade 3), Tsang Tai Uk (Grade 1) and High Rock Christian Camp (Grade 2) during the construction phase.
- 8.3.5 No EM&A requirement would be required for archaeology during the construction phase.
- 8.3.6 Notwithstanding, as a precautionary measure, AMO should be informed immediately in case

of discovery of antiquities or supposed antiquities in the course of works, so that appropriate mitigation measures, if needed, can be timely formulated and implemented in agreement with AMO.

Operational Phase

- 8.3.7 No EM&A requirement would be required for cultural heritage during the operational phase.

9 LANDSCAPE & VISUAL

9.1 Introduction

- 9.1.1 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.
- 9.1.2 Site audit on landscape and visual aspects of the Project should be carried out during the construction phase. With the mitigation measures recommended in the EIA implemented, specific auditing during the operation phase of the Project is not required.

9.2 Mitigation Measures

- 9.2.1 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 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.
- 9.2.2 Any potential conflicts among the proposed mitigation measures, the Project works, and operational requirements should also be identified and resolved at early stage. Any changes to the mitigation measures should be incorporated in the detailed design.

9.3 Audit Requirements

- 9.3.1 Site audits should be undertaken during the construction phase and the 12-month establishment period (operation phase) to check that the proposed landscape and visual mitigation measures are properly implemented and maintained as per their intended objectives. Site audit for the off-site woodland compensation should be carried out throughout the agreed establishment period with AFCD and EPD.
- 9.3.2 The ET shall audit the implementation of landscape construction works particularly during site clearance operations when the proposed tree felling and transplanting will take place and subsequent tree maintenance operations and planting works.
- 9.3.3 Site inspections should be undertaken by the ET at least once every month during the construction period, and once every two months for the 12-month establishment period during operation phase.

10 HAZARD TO LIFE

10.1 Introduction

10.1.1 The EIA study concluded that no unacceptable risk is anticipated during the construction and operation phases of the Project, and hence no mitigation measures would be required.

10.2 Mitigation Measures

10.2.1 Good safety practices are recommended to further manage and minimize the potential risks during construction phases of the Project. They are summarized in the Implementation Schedule provided in **Appendix B**.

10.3 EM&A Requirements

10.3.1 The EIA study concluded that the individual risks comply with the Hong Kong Risk Guidelines as stipulated in HKPSG. Although the societal risks partially fall within the "ALARP" region for all assessed scenarios, it is worth noting that the PLL contribution to the proposed Project works area as compared with the overall risk level is considered negligible (i.e. 2.87×10^{-8} per year). Furthermore, the proposed risk mitigation measure (i.e. installation of gas detectors) is considered economically unviable based on cost-benefit analysis. Nonetheless, good safety practices are recommended to further manage and minimize the potential risks during construction phase of the Project. No environmental monitoring and audit requirements would be required.

11 SITE ENVIRONMENTAL AUDIT

11.1 Site Inspections

11.1.1 Site inspection provides a direct means to trigger and enforce specified environmental protection and pollution control measures. These shall be undertaken regularly and routinely to inspect construction activities in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented. The site inspection is one of the most effective tools to enforce the environmental protection requirements at the works area.

11.1.2 The ET Leader shall be responsible for formulating the environmental site inspection, the deficiency and remedial action reporting system, and for carrying out the site inspection works. He shall submit a proposal for site inspection and deficiency and remedial action reporting procedures to the Contractor for agreement, and to the ER for approval. The ET's proposal for rectification would be made known to the IEC.

11.1.3 Regular site inspections shall be carried out at least once per week. The areas of inspection shall not be limited to the environmental situation, pollution control and mitigation measures within the site; it should also review the environmental situation outside the works area which is likely to be affected, directly or indirectly, by the site activities. The ET shall make reference to the following information in conducting the inspection:

- the EIA and EM&A recommendations on environmental protection and pollution control mitigation measures;
- ongoing results of the EM&A program;
- works progress and programme;
- individual works methodology proposals (which shall include proposal on associated pollution control measures);
- contract specifications on environmental protection and pollution prevention control;
- relevant environmental protection and pollution control laws; and
- previous site inspection results undertaken by the ET and others.

11.1.4 The Contractor shall keep the ET Leader updated with all relevant information on the construction contract necessary for him to carry out the site inspections. Inspection results and associated recommendations for improvements to the environmental protection and pollution control works shall be submitted to the IEC and the Contractor within 24 hours for reference and for taking immediate remedial action. The Contractor shall follow the procedures and time-frame stipulated in the environmental site inspection, and the deficiency and remedial action reporting system formulated by the ET Leader, to report on any remedial measures subsequent to the site inspections.

11.1.5 The ET shall 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 Action Plan for environmental monitoring and audit.

11.2 Compliance with Legal and Contractual Requirements

11.2.1 There are contractual environmental protection and pollution control requirements as well as environmental protection and pollution control laws in Hong Kong with which construction

activities must comply.

- 11.2.2 In order that the works are in compliance with the contractual requirements, all works method statements submitted by the Contractor to the ER for approval shall be sent to the ET Leader for vetting to see whether sufficient environmental protection and pollution control measures have been included. The implementation schedule of mitigation measures is summarized in **Appendix B**.
- 11.2.3 The ET Leader shall also review the progress and programme of the works to check that relevant environmental laws have not been violated, and that any foreseeable potential for violating laws can be prevented.
- 11.2.4 The Contractor shall regularly copy relevant documents to the ET Leader so that works checking could be carried out effectively. The document shall at least include the updated Works Progress Reports, updated Works Programme, any application letters for different licence / permits under the environmental protection laws, and copies of all valid licences / permits. The site diary shall also be available for the ET Leader's inspection upon his request.
- 11.2.5 After reviewing the documentation, the ET Leader shall advise the Contractor of any non-compliance with contractual and legislative requirements on environmental protection and pollution control for them to take follow-up actions. If the ET Leader's review concludes that the current status on licence / permit application and any environmental protection and pollution control preparation works may result in potential violation of environmental protection and pollution control requirements, he shall also advise the Contractor accordingly.
- 11.2.6 Upon receipt of the advice, the Contractor shall undertake immediate action to remedy the situation. The ER shall follow up to ensure that appropriate action has been taken in order to satisfy contractual and legal requirements.

11.3 Environmental Complaints

- 11.3.1 Complaints shall be referred to the ET Leader for action. The ET Leader shall undertake the following procedures upon receipt of any complaint:
- i. log complaint and date of receipt onto the complaint database and inform the IEC immediately;
 - ii. investigate the complaint to determine its validity, and assess whether the source of the problem is due to works activities;
 - iii. identify mitigation measures in consultation with the IEC if a complaint is valid and due to works;
 - iv. advise the Contractor if mitigation measures are required;
 - v. review the Contractor's response to identified mitigation measures, and the updated situation;
 - vi. if the complaint is transferred from the Environmental Protection Department (EPD), submit interim report to the EPD on status of the complaint investigation and follow-up action within the time frame assigned by the EPD;
 - vii. undertake additional monitoring and audit to verify the situation if necessary, and review that circumstances leading to the complaint do not recur;
 - viii. report investigation results and subsequent actions to complainant (if the source of complaint is identified through EPD, the results should be reported within the timeframe assigned by EPD); and

- ix. record the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

11.3.2 A flow chart of the complaint response procedure is shown in [60604728/EM&Ab/Figure 11.1](#).

12 REPORTING

12.1 Introduction

12.1.1 Reports can be provided in an electronic medium upon agreeing the format with the ER and EPD. This would enable a transition from a paper / historic and reactive approach to an electronic / real time proactive approach. All the monitoring data (baseline and impact) shall also be submitted in electronic format.

12.1.2 ET Leader shall submit baseline monitoring report, monthly Environmental Monitoring and Audit (EM&A) report, quarterly EM&A summary report and final EM&A review report. In accordance with Annex 21 of the EIAO-TM, a copy of the monthly, quarterly summary and final review EM&A reports shall be made available to the Director of Environmental Protection.

12.2 Electronic Reporting of EM&A Information

12.2.1 To facilitate public inspection of the baseline monitoring report and various EM&A reports via the EIAO Internet website and at the EIAO register office, electronic copies of these reports shall be prepared in Hyper Text Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF Adobe 11 Pro version or later), unless otherwise agreed by EPD and shall be submitted at the same time as the hardcopies. For the HTML version, a content page capable of providing hyperlink to each section and sub-section of these reports shall be included at the beginning of the document. Hyperlinks to all figures, drawings and tables in these reports shall be provided in the main text from where the respective references are made. All graphics in these reports shall be in interlaced GIF format unless otherwise agreed by EPD. The content of the electronic copies of these reports must be the same as the hard copies. The summary of the monitoring data taken shall be included in the various EM&A Reports to allow for public inspection via the EIAO Internet website.

12.3 Baseline Monitoring Report

12.3.1 Baseline Environmental Monitoring Report(s) shall be prepared within 10 working days of completion of the baseline monitoring and then certified by the ET Leader. Copies of the Baseline Environmental Monitoring Report shall be submitted to the Contractor, the IEC, ER and EPD. The ET Leader shall liaise with the relevant parties on the exact number of copies they require. The report format and baseline monitoring data format shall be agreed with the EPD prior to submission.

12.3.2 The baseline monitoring report shall include, but not be limited to the following:

- i. up to half a page executive summary;
- ii. brief project background information;
- iii. drawings showing locations of the baseline monitoring stations;
- iv. an updated construction programme with milestones of environmental protection / mitigation activities annotated;
- 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;
 - parameters monitored;
 - monitoring locations (and depth);
 - monitoring date, time, frequency and duration; and

- quality assurance (QA) / quality control (QC) results and detection limits.
- vi. details on influencing factors, including:
 - major activities, if any, being carried out on the site during the period;
 - weather conditions during the period; and
 - other factors which might affect results.
- vii. determination of the Action and Limit Levels (AL levels) for each monitoring parameter and statistical analysis of the baseline data, the analysis shall conclude if there is any significant difference between control and impact stations for the parameters monitored;
- viii. revisions for inclusion in the EM&A Manual; and
- ix. comments, recommendations and conclusions.

12.4 Monthly EM&A Reports

General

- 12.4.1 The results and findings of all EM&A work required in the Manual shall be recorded in the monthly EM&A reports prepared by the ET Leader. The EM&A report shall be prepared and submitted within 10 working days at the end of each reporting month, with the first report due the month after construction commences. Each monthly EM&A report shall be submitted to the following parties: the Contractor, the IEC, the ER and EPD. Before submission of the first EM&A report, the ET Leader shall liaise with the parties on the required number of copies and format of the monthly reports in both hard copy and electronic medium.
- 12.4.2 The ET leader shall 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.

First Monthly EM&A Report

- 12.4.3 The first monthly EM&A report shall include at least but not be limited to the following:
- i. executive summary (1-2 pages):
 - breaches of AL levels;
 - complaint log;
 - notifications of any summons and successful prosecutions;
 - reporting changes; and
 - future key issues.
 - ii. basic project information:
 - project organisation including key personnel contact names and telephone numbers;
 - construction programme with fine tuning of construction activities showing the inter-relationship with environmental protection/mitigation measures for the month;
 - management structure, and

- works undertaken during the month.
- iii. environmental status:
- works undertaken during the month with illustrations (such as location of works, daily dredging/filling rates, percentage of fines in the fill materials used, etc.); and
 - drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations (with co-ordinates of the monitoring locations).
- iv. a brief summary of EM&A requirements including:
- all monitoring parameters;
 - environmental quality performance limits (AL levels);
 - Event-Action Plans;
 - environmental mitigation measures, as recommended in the Final 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 Final EIA report, summarised in the updated implementation schedule.
- vi. monitoring results (in both hard and diskette 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;
 - weather conditions during the period;
 - graphical plots of the monitored parameters in the month annotated against:
 - o the major activities being carried out on site during the period;
 - o weather conditions that may affect the results; and
 - o any other factors which might affect the monitoring results;
 - any other factors which might affect the monitoring results; and
 - quality assurance (QA) / quality control (QC) results and detection limits.
- vii. report on non-compliance, complaints, notifications of summons and successful prosecutions:

- record of all non-compliance (exceedances) of the environmental quality performance limits (AL levels);
- record of all complaints received (written or verbal) for each media, 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 legislations, 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
- 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 work method statements;
- advice on the solid and liquid waste management status;
- a forecast of the works programme, impact predictions and monitoring schedule for the next three months;
- compare and contrast the EM&A data with the EIA predictions and annotate with explanation for any discrepancies; and
- comments (for examples, effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.

Subsequent monthly EM&A Reports

12.4.4 Subsequent monthly EM&A reports shall include the following:

- i. executive summary (1 - 2 pages):
 - breaches of AL levels;
 - complaints log;
 - notifications of any summons and successful prosecutions;
 - reporting changes; and
 - future key issues.
- ii. environmental status:
 - construction programme with fine tuning of construction activities showing the inter-relationship with environmental protection / mitigation measures for the month;
 - works undertaken during the month with illustrations including key personnel contact names and telephone numbers; and

- drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
- iii. implementation status:
 - advice on the implementation status of environmental protection and pollution control / mitigation measures, as recommended in the Final EIA report, summarised in the updated implementation schedule.
- iv. monitoring results (in both hard and diskette 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;
 - weather conditions during the period;
 - graphical plots of the monitored parameters in the month annotated against;
 - o the major activities being carried out on site during the period;
 - o weather conditions that may affect the results; and
 - o any other factors which might affect the monitoring results.
 - any other factors which might affect the monitoring results; and
 - quality assurance (QA) / quality control (QC) results and detection limits.
- v. report on non-compliance, complaints, and notifications of summons and successful prosecutions:
 - record of all non-compliance (exceedances) of the environmental quality performance limits (AL levels);
 - record of all complaints received (written or verbal) for each media, 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 legislations, 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
 - description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.
- vi. others:

- an account of the future key issues as reviewed from the works programme and work method statements;
 - advice on the solid and liquid waste management status;
 - a forecast of the works programme, impact predictions and monitoring schedule for the next three months;
 - compare and contrast the EM&A data with the EIA predictions and annotate with explanation for any discrepancies; and
 - comments (for examples, effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.
- vii. appendix
- AL levels;
 - graphical plots of trends of monitored parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following:
 - o major activities being carried out on site during the period;
 - o weather conditions during the period; and
 - o any other factors that might affect the monitoring results.
 - monitoring schedule for the present and next reporting period;
 - cumulative statistics on complaints, notifications of summons and successful prosecutions;
 - outstanding issues and deficiencies

Quarterly EM&A Summary Reports

12.4.5 A quarterly EM&A summary report of around five pages shall be produced by the ET Leader and shall contain at least the following information. Apart from these, the first quarterly summary report should also confirm that the monitoring work is proving effective and that it is generating data with the necessary statistical power to categorically identify or confirm the absence of impact attributable to the works. Each quarterly EM&A report shall be submitted to the following parties: the IEC, the ER and EPD.

- i. executive summary (1 - 2 pages);
- ii. basic project information including a synopsis of the project organisation, programme, contacts of key management, and a synopsis of works undertaken during the quarter;
- iii. a brief summary of EM&A requirements including:
 - monitoring parameters;
 - environmental quality performance limits (AL levels); and
 - environmental mitigation measures, as recommended in the Final EIA report.

- iv. advice on the implementation status of environmental protection and pollution control / mitigation measures, as recommended in the Final EIA report, summarised in the updated implementation schedule;
- v. drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
- vi. graphical plots of the trends of monitored parameters over the past four months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against:
 - the major activities being carried out on site during the period;
 - weather conditions during the period; and
 - any other factors which might affect the monitoring results.
- vii. advice on the solid and liquid waste management status;
- viii. a summary of non-compliance (exceedances) of the environmental quality performance limits (AL levels);
- ix. a brief review of the reasons for and the implications of non-compliance, including a review of pollution sources and working procedures;
- x. a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;
- xi. a summarised record of all complaints received (written or verbal) for each media, 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 legislations, locations and nature of the breaches, investigation, follow-up actions taken and results;
- xiii. comments (for examples, a review of the effectiveness and efficiency of the mitigation measures and the performance of the environmental management system, that is, of the overall EM&A programme); recommendations (for example, any improvement in the EM&A programme) and conclusions for the quarter; and
- xiv. proponents' contacts and any hotline telephone number for the public to make enquiries.

12.5 Final EM&A Review Report for Construction Phase

- 12.5.1 The construction phase EM&A program shall be terminated upon completion of those construction activities that have the potential to result in a significant environmental impact.
- 12.5.2 Prior to the proposed termination, it may be advisable to consult relevant local communities (such as village representatives/communities and/or District Boards). The proposed termination should only be implemented after the proposal has been endorsed by the IEC, the Engineer and the Project Proponent followed by final approval from the Director of Environmental Protection.
- 12.5.3 The final EM&A review report for construction phase should be prepared by the ET Leader and contain at least the following information. The final EM&A review report shall be submitted to the following parties: the IEC, the ER and EPD.
 - i. executive summary (1 - 2 pages);

- ii. basic project information including a synopsis of the project organisation, contacts of key management, and a synopsis of work undertaken during the course of the project or past twelve months;
- iii. a brief summary of EM&A requirements including:
 - monitoring parameters;
 - environmental quality performance limits (AL levels); and
 - environmental mitigation measures, as recommended in the Final EIA report.
- iv. advice on the implementation status of environmental protection and pollution control / mitigation measures, as recommended in the Final EIA report, summarised in the updated implementation status proformas;
- v. drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
- vi. graphical plots of the trends of monitored 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 period;
 - weather conditions during the period;
 - any other factors which might affect the monitoring results; and
 - the return of ambient environmental conditions in comparison with baseline data.
- vii. compare and contrast the EM&A data with the EIA predictions and annotate with explanation for any discrepancies;
- viii. provide clear-cut decisions on the environmental acceptability of the project with reference to the specific impact hypothesis;
- ix. advice on the solid and liquid waste management status;
- x. a summary of non-compliance (exceedances) of the environmental quality performance limits (AL levels);
- xi. a brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;
- xii. a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;
- xiii. a summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
- xiv. review monitoring methodology adopted and with the benefit of hindsight, comment on its effectiveness (including cost effectiveness);
- xv. a summary record of notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, locations and nature of breaches, investigation, follow-up actions taken and results;
- xvi. review the practicality and effectiveness of the EIA process and EM&A programme (for examples, a review of the effectiveness and efficiency of the mitigation measures and the performance of the environmental management system, that is, of the overall EM&A

programme), recommendations (for example, any improvement in the EM&A programme); and

xvii. a conclusion to state the return of ambient and / or the predicted scenario as per EIA findings.

12.6 EM&A Reports for Operation Phase

12.6.1 Unless otherwise agreed by EPD, quarterly EM&A reports shall be submitted to record the results and findings of the operational traffic noise monitoring during the first year of LRT operation, water quality monitoring during the first year of LRT operation, as well as the landscape and visual audit for the 12-month establishment period during operation phase.

12.6.2 A final EM&A review report for operation phase shall be submitted after completion of operation monitoring. The final EM&A review report for operation phase should contain at least the following information:

- i. Executive summary (1-2 pages);
- ii. Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and/or control stations;
- iii. Basic project information including a synopsis of the project organisation, contacts of key management, and a synopsis of work undertaken during the course of the project or past twelve months;
- iv. A brief summary of EM&A requirements including:
- v. Environmental mitigation measures for operation stage, as recommended in the project EIA Report;
 - environmental impact hypotheses tested;
 - environmental quality performance limits (Action and Limit levels);
 - all monitoring parameters;
 - Event and Action Plans;
- vi. A summary of the implementation status of environmental protection and pollution control / mitigation measures for operation stage, as recommended in the project EIA Report and summarised in the updated implementation schedule;
- vii. Graphical plots and the statistical analysis of the trends of monitoring parameters over the course of the project, including:
 - the major activities being carried out on site during the period;
 - weather conditions during the 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 (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up actions taken and results;
- xii. A review of the validity of EIA predictions for operation stage and identification of shortcomings in EIA recommendations;
- xiii. Comments (for example, a review of the effectiveness and efficiency of the mitigation measures, the performance of the environmental management system, and the overall EM&A programme for operation stage); and
- xiv. Recommendations and conclusions (for example, a review of success of the overall EM&A programme for operational stage to cost-effectively identify deterioration and to initiate prompt effective mitigatory 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 monthly EM&A reports. However, any such document shall be well kept by the ET Leader and be ready for inspection upon request. All relevant information shall be clearly and systematically recorded in the document. Monitoring data shall also be recorded in electronic format, and the software copy must be available upon request. Data format shall be agreed with the EPD. All documents and data shall be kept for at least one year following completion of the construction contract.

12.8 Interim Notifications of Environmental Quality Limit Exceedances

- 12.8.1 With reference to the Event and Action Plan, when the environmental quality performance limits are exceeded, the ET Leader shall immediately notify the IEC and EPD, as appropriate. The notification shall be followed up with advice to IEC 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 notifications is presented in [Appendix D](#).