Highways Department

Route 11 (Section between Yuen Long and North Lantau)

Environmental Monitoring and Audit Manual

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1 Introduction

1.1 Project Background

1.1.1.1 The objective of Route 11 (Section between Yuen Long and North Lantau) (hereinafter called "the Project") is to enhance the connectivity between the Northwest New Territories (NWNT) and North Lantau to meet the future traffic demands generated by the future developments in both regions and also the increasing cross-boundary activities. The Project will be a strategic highway to support the proposed developments in the NWNT. It will also provide the third vehicular access to Lantau in addition to the existing Tsing Ma and Kap Shui Mun Bridges and the Tuen Mun-Chek Lap Kok Link (TM-CLKL).

1.1.1.2 In September 2021, Highways Department (HyD) commissioned Arup to carry out the investigation study of the Project to examine and review the Preferred Alignment developed under the feasibility study for the Project, formulate a Recommended Alignment for the Project, and work out the preliminary design details of the Recommended Alignment of the Project and the associated works.

1.2 Purpose of the Manual

1.2.1.1 The purposes of this Environmental Monitoring and Audit (EM&A) Manual (the Manual) are to:

- Guide the set up of an EM&A programme to ensure compliance with the environmental impact assessment (EIA) recommendations;
- Specify the requirements for monitoring equipment;
- Propose environmental monitoring points, monitoring frequency, etc.;
- Propose Action and Limit Levels; and
- Propose Event and Action Plans.

1.2.1.2 This Manual outlines the monitoring and audit programme for the construction and operation of the Project and provides systematic procedures for monitoring, auditing and minimizing environmental impacts.

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

1.2.1.4 This Manual contains the following information:

- Responsibilities of the Contractor, the Project Manager or Project Manager's Representative (PMR), Environmental Team (ET), and the Independent Environmental Checker (IEC) under the context of EM&A;
- Project organization for the EM&A works;
- The basis for, and description of the broad approach underlying the EM&A programme;

- Details of the methodologies to be adopted, including all laboratories and analytical procedures, and details on quality assurance and quality control programme;
- The rationale on which the environmental monitoring data will be evaluated and interpreted;
- Definition of Action and Limit Levels;
- Establishment of Event and Action Plans;
- Requirements for reviewing pollution sources and working procedures required in the event of non-compliance with the environmental criteria and complaints; and
- Requirements for presentation of environmental monitoring and audit data and appropriate reporting procedures.

1.2.1.5 For the purpose of this Manual, the PMR shall refer to the Project Manager as defined in the Construction Contract, in cases where the Project Manager's powers have been delegated to the PMR, in accordance with the Construction Contract. 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 environmental monitoring and audit requirements.

2 Project Description

2.1 General Description of the Project

2.1.1.1 Section 2 of the EIA Report has described the approaches adopted to avoid and mitigate against adverse environmental consequences throughout the design and construction process. The design and construction have therefore been taken forward as the basis for this EIA to demonstrate that all statutory requirements under the EIA Study Brief (No.: ESB-352/2022) and the EIAO are complied with. A brief of the key elements of the Project is given below:

- Lam Tei Tunnel of 4.2km long dual 3-lane carriageway tunnel;
- So Kwun Wat Link Road of 2.0 km long dual 2-lane carriageway tunnel;
- Tai Lam Chung Tunnel (North Section) of 0.4km long dual 4-lane carriageway tunnel and Tai Lam Chung Tunnel (South Section) of 1.7km long dual 4-lane carriageway tunnel;
- Tsing Lung Bridge of 1.9km long dual 4-lane carriageway suspension bridge;
- Lam Tei Quarry Interchange, So Kwun Wat Interchange, Tsing Lung Tau Interchange and North Lantau Interchange;
- Associated slip roads and viaducts;
- Tunnel operation related facilities (e.g. administration areas, ventilation buildings, etc.);
- Reprovision of local roads, access roads and footpath;
- Reclamation at Tsing Lung Tau;
- Ground investigation works; and
- Temporary works areas, explosives magazines and barging facilities, etc.

2.1.1.2 The location of the Project is shown in **Figure 2.1**.

2.2 Designated Project

2.2.1.1 The Project comprises the construction and operation of a new road. The Project is a Designated Project (DP) under Schedule 2, Part I of the EIAO.

- Item A.1 - A carriageway for motor vehicles that is an expressway, trunk road, primary distributor road or district distributor road;
- Item A.7 - A road tunnel or railway tunnel more than 800 m in length between portals;
- Item K.10 - A depot for the storage of, or manufacturing plant for the manufacture of, explosives (as defined by section 2 of the Dangerous Goods Ordinance (Cap. 295)); and
- Item Q.1 - All projects involving earthworks partly or wholly in an existing country park.

2.3 Implementation Programme

2.3.1.1 According to the latest programme, the construction phase of the Project including advance construction works will be tentatively commenced in 2026 Q1 and completed in 2033 Q4.

3 Project Organization

3.1 Project Organization

3.1.1.1 The proposed project organization and lines of communication with respect to environmental protection works are shown in **Appendix 3.1**.

3.1.1.2 The responsibilities of respective parties are:

Project Manager or Project Manager's Representative (PMR) or Project Proponent

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

The Contractor

- Implement the EIA recommendations and requirements;
- Provide assistance to ET in carrying out monitoring and auditing;
- Submit proposals on mitigation measures in case of exceedances of Action and Limit Levels in accordance with the Event and Action Plans;
- Implement measures to reduce impact where Action and Limit Levels are exceeded; and
- Adhere to the agreed procedures for carrying out compliant investigation.

Environmental Team (ET)

- Set up all the required environmental monitoring stations;
- Monitor various environmental parameters as required in the Manual;
- Analyse the environmental monitoring and audit data, review the success of EM&A programme, confirm the adequacy of mitigation measures implemented and the validity of the EIA predictions, and to identify any adverse environmental impacts arising;
- Carry out site inspection to investigate and audit the Contractors' site practice, equipment and work methodologies with respect to pollution control and environmental mitigation measures, and take proactive actions to pre-empt problems;
- Prepare reports on the environmental monitoring data and site environmental conditions;

- Report on the environmental monitoring and audit results to the IEC, Contractor, the PMR and Environmental Protection Department (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;
- Undertake regular on-site audits / inspections and report to the Contractor and the PMR of any potential non-compliance;
- Follow up and close out non-compliance actions;
- Advise the Contractor on environmental improvement, awareness, enhancement matters, etc. on site;
- Adhere to the procedures for carrying out environmental complaint investigation;
- Liaise with Independent Environmental Checker (IEC) on all the performance matters, and timely submission of all the EM&A performa for IEC's approval;
- On as-needed basis, verify and certify the environmental acceptability of the Environmental Permit (EP) holder's construction methodology (both temporary and permanent works), relevant design plans and submissions under the EP; and
- Timely submit the EM&A report to the Director of Environmental Protection.

Independent Environmental Checker (IEC)

- Review the EM&A works performed by the ET (at not less than monthly intervals);
- Audit the monitoring activities and results (at not less than monthly intervals);
- Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and location of sensitive receivers;
- Report the audit results to the PMR and EPD;
- Review and verify the EM&A reports (monthly and quarterly summary reports) submitted by the ET;
- Review the proposal on mitigation measures submitted by the Contractor in accordance with the Event and Action Plans;
- Check the 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;

- Report the findings of site inspections and other environmental performance reviews to PMR and EPD;
- Carry out random sample check and audit on monitoring data and sampling procedures, etc.;
- Conduct random site inspection;
- On as-needed basis, verify and certify the environmental acceptability of the Environmental Permit (EP) holder's construction methodology (both temporary and permanent works), relevant design plans and submissions under the EP; and
- Verify the investigation results of the environmental complaint cases and the effectiveness of corrective measures.

3.1.1.3 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.

4 Air Quality Impact

4.1 Introduction

4.1.1.1 The EIA has considered the potential air quality impacts during construction and operational phases of the Project. With the implementation of recommended good site practices and mitigation measures, adverse construction dust impact is not anticipated. Continuous construction dust monitoring and regular site environmental audit at least once per week are also recommended to check the implementation of good site practices and mitigation measures, and ensure no adverse dust impact on the nearby air sensitive receivers. The EIA has also concluded that there will be no adverse air quality impacts during operational phase and hence environmental monitoring and site inspections during operational phase are not required.

4.2 Mitigation Measures

4.2.1.1 In order to reduce the construction dust emission from the Project, regular watering and other good site practices should be implemented. In addition, mitigation measures to control the exhaust emissions from construction plant and equipment are also required. All the recommended good practices are summarised in the Environmental Mitigation Implementation Schedule (EMIS) in **Appendix 4.1**.

4.3 Air Quality Monitoring Parameters

4.3.1.1 Monitoring and audit of the Respirable Suspended Particulate (RSP) and Fine Suspended Particulate (FSP) levels shall be carried out by the ET to ensure that any deteriorating air quality could be readily detected and timely actions could be taken to rectify the situation.

4.3.1.2 1-hour and 24-hour average RSP, and 24-hour average FSP levels shall be measured continuously to indicate the impacts of construction dust on air quality. The hourly RSP and FSP levels shall be measured by Particulate Matter (PM) sensors.

4.3.1.3 All relevant data including temperature, pressure, weather conditions, wind direction and speed, reading from the monitoring equipment, and any other local atmospheric factors affecting or affected by site conditions, etc., shall be recorded down in detail. A sample data sheet is shown in **Appendix 4.2**.

4.4 Monitoring Equipment

4.4.1.1 PM sensor complying with the following specifications shall be used for carrying out the 1-hour and 24-hour average RSP, and 24-hour average FSP monitoring:

- Capable of real-time monitoring for RSP and FSP
- Averaging period: 1 hour and 24 hour
- Concentration range: 0 – 300μg/m^3
- Resolution: at least 1μg/m^3
- Accuracy: ± 10% to standard particles
- Equipped with a shelter to protect the sensor

- Capable of operating continuously for a 7 days period

4.5 Monitoring Methodology

4.5.1 Measuring Procedure

4.5.1.1 The ET is responsible for the provision, installation, operation, maintenance, dismantle of the monitoring equipment. They shall ensure that sufficient number of PM sensors are available for carrying out the regular impact monitoring and ad hoc monitoring.

4.5.1.2 General measurement procedures involved in the 1-hour and 24-hour average RSP, and 24-hour average FSP monitoring are summarised below. The exact measurement procedures will be subject to different brands of the PM sensor as described in the respective user manual.

- Mount the PM senor on a tripod or other solid structure at 1.5mAG;
- Ensure the PM sensor is properly connected to secured supply of electricity / batteries;
- Power up the PM sensor and connect the PM sensor to data management software via wired or wireless means;
- Check if the measurement data could be proper transferred to the data management software;
- Check if the measurement data could be properly stored; and
- Start the one-hour dust measurement with the site conditions and dust sources at the nearby area being properly recorded in a record sheet.

4.5.1.3 Wind data monitoring equipment shall also be provided and set up for several measurement locations (e.g. Lam Tei, Tai Lam / Siu Lam / So Kwun Wat, Tsing Lung Tau, North Lantau, etc.) for logging wind speed and wind direction near the dust monitoring locations. The equipment installation location shall be proposed by the ET and agreed with the IEC. For installation and operation of wind data monitoring equipment, the following points shall be observed:

- The wind sensors should be installed at an elevated level 10 meters above ground so that they are clear of obstructions or turbulence caused by buildings;
- The wind data should 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 should be re-calibrated at least once every six months; and
- Wind direction should be divided into 16 sectors of 22.5 degrees each.

4.5.1.4 On-site checking of the PM sensor shall be conducted by ET and agreed by IEC on the following approach :

- Prepare a transfer standard for PM monitoring, which has been calibrated against a PM reference monitor (i.e. the Federal Reference Methods (FRM) or Federal Equivalent Method (FEM) PM monitor);

- The inlets of the transfer standard and the monitoring equipment shall be collocated at the same height with a horizontal separation distance of less than 1 m;
- Warm-up the transfer standard on-site if necessary;
- Collocated monitoring shall be conducted in a continuous period to collect at least 20 valid 10-minute average measurements. The valid data rate shall be at least 80% during the collocation period; and
- The performance metrics and target values are shown in **Table 4.1**. If the performance of the monitoring equipment fails to meet the target values, the monitoring equipment needs to be re-calibrated or replaced.

Table 4.1 Recommended Performance Metrics and Target Values for On-site Verification of PM Monitoring Equipment

Performance Metric		**Target Value**
Tier 1		
Bias	Slope	1.00±0.25
Linearity	Coefficient of Determination (R^2)	>0.70
Tier 2 If Tier 1 criteria are not met due to narrow range of PM concentration (>30 µg/m^3 and >25 µg/m^3 as recommended span range for RSP and FSP, respectively) during the collocation period, Tier 2 will apply.		
Error	Root Mean Squared Error (RMSE)	<8 µg/m^3 for RSP <5 µg/m^3 for FSP

4.5.2 Calibration of PM Sensor

Transfer Standard (TS)

4.5.2.1 A TS is another PM monitor that is at least as capable as the sensor to be calibrated. Another sensor that has just been calibrated may serve the purpose provided its performance is known to be stable during the subsequent collocation period to be used as TS. Right before each on-site calibration, the TS itself needs to be calibrated e.g. collocating with an PM reference monitor, such as the FRM or FEM PM monitor at the accredited laboratories or research institutes, that has been calibrated against traceable standard. The TS/reference monitor collocation should last at least seven days.

On-site Calibration

4.5.2.2 The TS should be placed near (less than 1 m if practicable) the sensor to be calibrated so that both devices would be monitoring a similar environment. The TS is then turned on to warm-up for 30 to 60 minutes. The collocation period starts after the warm-up and TS is then left running with the sensor to be calibrated for at least three hours. The measurements from the sensor to be calibrated and the TS during the collocation period will be statistically analyzed.

Quality Control Criteria

4.5.2.3 The response of the sensor should be adjusted if its performance during on-site calibration does not meet the following evaluation criteria. For each device, data below its detection limit will be excluded.

Tier 1: Correlation

4.5.2.4 The minute average measurements from the two devices when subject to linear regression should have a coefficient of determination (R^2)>0.7. The regression line slope should be between 0.75 to 1.25. If these criteria are not met due to narrow range of PM concentration (more than 30 μg/m^3 and more than 25μg/m^3 as recommended span range for RSP and FSP, respectively) during the collocation period, Tier 2 will apply.

Tier 2: Root mean squared error

4.5.2.5 The root mean squared error of the sensor minute average measurements should be less than 8 μg/m^3 for RSP and less than 5 μg/m^3 for FSP.

Frequency

4.5.2.6 Each deployed sensor should be calibrated every month. If a sensor repeatedly failed in 2 or 3 consecutive calibrations, the sensor should be checked and maintained to improve its performance, or replaced.

4.5.2.7 It should be noted that this Quality Control Protocol may be subject to change.

4.6 Monitoring Location during Construction Phase

4.6.1.1 **Figure 4.1** shows the locations of the proposed construction dust monitoring stations. The status and location of ASRs may change after issuing this Manual. In such case, the ET shall propose updated monitoring locations and seek approval from the PMR and agreement from the IEC and EPD on the proposal. The locations of construction dust monitoring stations shall be reviewed and revised during detailed design on the basis of the latest information of the Project.

Table 4.2 Proposed Construction Dust Monitoring Locations and Monitoring Periods

Monitoring Station ID	ASR ID	Location	Construction Activity	Approximate Distance from Works Site Boundary (m)	Monitoring Period [1]
Existing ASRs					
Lam Tei Area					
DM1	A013	Tsoi Yuen Tsuen House 159	• Construction of elevated / at-grade roads • Construction of tunnel portal, ventilation building, administration building and associated facilities • Slope works • Stockpiling area • Construction of underground explosive magazine	20	Throughout the construction period of corresponding activity
DM2	A017	Tsoi Yuen Tsuen Village House		40	
DM3	A052	The Sherwood Podium		50	
DM4	A071	Fuk Hang Tsuen House 458		<10	
DM5	A073	Fuk Hang Tsuen Village House		<10	
DM6	A091	Tung Fuk Road Village House		50	
DM7	A099	Fuk Hang Tsuen Village House		<10	
DM8	A102	Chui Fuk Road Village House		<10	
DM9	A104	Fu Tei Ha Tsuen Village House		30	
So Kwun Wat, Siu Lam and Tai Lam Areas					
DM10	A202	So Kwun Wat Tsuen Village House	• Construction of elevated / at-grade roads • Construction of tunnel portals and ventilation buildings • Slope works • Stockpiling area • Construction of temporary explosive magazine	20	Throughout the construction period of corresponding activity
DM11	A205	Harrow International School		30	
DM12	A212	The Terrace Balcony Garden		20	
DM13	A239	Palm Beach Podium		10	
DM14	A249	Skypoint Royale Tower 6		<10	
DM15	A253	Crossroads Foundation Block 29		Within Boundary	
DM16	A255	So Kwun Wat Tsuen House 510		20	
DM17	A260	S.T.F.A. Lee Kam Primary School Playground		70	
DM18	A271	So Kwun Wat Tsuen Village House		Within Boundary	
DM19	A275	So Kwun Wat Tsuen Village House		10	
DM20	A279b	Avignon Tower 11		<10	
DM21	A291	Avignon Tower 5		<10	
DM22	A305	So Kwun Wat Tusen Village House 251		20	

Monitoring Station ID	ASR ID	Location	Construction Activity	Approximate Distance from Works Site Boundary (m)	Monitoring Period [1]
DM23	C005	A.D. & F.D. of Pok Oi Hospital Mrs Cheng Yam On Millennium School		90	
DM24	C009	Siu Sau Village House 39		20	
DM25	C010	Siu Sau Village House 91		<10	
DM26	C011	Siu Sau Village House 112		20	
DM27	C019	1005 Grandview Terrace		80	
DM28	C022	1002 Grandview Terrace		200	
DM29	A401	1001 Grandview Terrace		90	
DM30	A316	So Kwun Wat Tsuen Village House		140	
DM31	A318	So Kwun Wat Team-building Centre		<10	
DM32	C024	Peak Castle House 22		110	
DM33	A402	Siu Lam Village House		30	
DM34	A409	Siu Lam Village House		20	
DM35	A416	Siu Lam Village House		<10	
DM36	A420	Siu Lam Village House		<10	
DM37	A428	Tai Lam Dental Clinic		<10	
DM38	A431	Tai Lam Centre for Women		190	
DM39	A439	Tai Lam Chung Tsuen House 1-2		30	
DM40	A450	Tai Lam Chung Tsuen House 206		<10	
DM41	A452	Tai Lam Chung Tsuen House 261		<10	
DM55	C001	So Kwun Wat San Tsuen Village House		290	
DM56	A436	Luen On San Tsuen House 112		<10	
Tsing Lung Tau Area					
DM42	A508	Ka Loon Tsuen Village House	• Construction of elevated / at-grade roads • Construction of ventilation building	<10	Throughout the construction period of corresponding activity
DM43	A513	Vistacove 1		30	
DM44	A517	Choi Yuen Tsuen Village House		<10	

Monitoring Station ID	ASR ID	Location	Construction Activity	Approximate Distance from Works Site Boundary (m)	Monitoring Period [1]
DM45	A519	Choi Yuen Tsuen Village House	• Construction of Northern Anchorage for Tsing Lung Bridge • Slope works • Stockpiling area • Reclamation works • Construction of temporary barging point	<10	
DM46	A530	Choi Yuen Tsuen House 5B		<10	
DM47	A538	Hong Kong Garden - Estoril Heights		30	
DM57	A521	L'Aquatique Block 1		<10	
North Lantau Area					
DM48	A603	Tai Chuen House 10	• Construction of elevated / at-grade roads • Construction of administration building and associated facilities • Site formation works • Stockpiling area • Construction and operation of temporary barging point • Construction and operation of concrete batching plant	80	Throughout the construction period of corresponding activity
Planned / Committed ASRs					
Lam Tei Area					
DM49	P005b	Proposed Public Housing at Lam Tei North	• Construction of elevated / at-grade roads • Construction of tunnel portal, ventilation building, administration building and associated facilities • Slope works • Stockpiling area • Construction of underground explosive magazine	30	Upon the intake of the population and throughout the construction period of corresponding activity
DM50	P006	Proposed Temporary Place of Recreation, Sports or Culture (Indoor Recreation Centre)		40	
DM51	P015	Proposed Development of Elderly Home by Pok Oi Hospital		20	
DM52	P021	Proposed Comprehensive Development in D.D. 130 and Adjoining Government Land		20	

Monitoring Station ID	ASR ID	Location	Construction Activity	Approximate Distance from Works Site Boundary (m)	Monitoring Period [1]
So Kwun Wat, Siu Lam and Tai Lam Areas					
DM53	P207	Proposed Residential Development at Various Lots in D.D.374, Lawn Activity Area with Seating	• Construction of elevated / at-grade roads • Construction of tunnel portals and ventilation buildings • Slope works • Stockpiling area • Construction of temporary explosive magazine	60	Upon the intake of the population and throughout the construction period of corresponding activity
Tsing Lung Tau Area					
DM54	C201	Transitional Housing at 115 Castle Peak Road Tsing Lung Tau	• Construction of elevated / at-grade roads • Construction of ventilation building • Construction of Northern Anchorage for Tsing Lung Bridge • Slope works • Stockpiling area • Reclamation works • Construction of temporary barging point	Within Boundary	Upon the intake of the population and throughout the construction period of corresponding activity

Note:

[1] The monitoring period is subject to the construction programme of the relevant contracts in the construction phase.

4.6.1.2 When alternative monitoring locations are proposed, the proposed locations should, as far as practicable:

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

4.6.1.3 The ET shall agree with IEC on the position of the PM sensor. When positioning the sensor, the following points shall be noted:

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

4.6.1.4 The ET may, depending on site conditions and monitoring results, decide whether additional monitoring locations shall be included or any monitoring locations could be removed / relocated during any stage of the construction phase, upon the agreement from the IEC and EPD.

4.7 Impact Monitoring

4.7.1.1 The ET shall carry out impact monitoring during major construction activities for the Project as specified in **Table 4.2**. Continuous RSP and FSP monitoring should be undertaken throughout the construction stage.

4.7.1.2 The monthly schedule of the impact monitoring programme should be drawn up by the ET one month prior to the commencement of the scheduled construction period. Before commencing impact monitoring, the ET shall inform the IEC of the impact monitoring programme such that the IEC can conduct on-site audit.

4.8 Action and Limit Levels

4.8.1.1 The ET shall compare the impact monitoring results with air quality criteria set up for 1-hour and 24-hour average RSP, and 24-hour average FSP. **Table 4.3** shows the air quality criteria, namely Action and Limit Levels to be used. The Action and Limit Levels may be subject to the change based on the prevailing AQOs implemented at the time of the dust monitoring works.

Table 4.3 Action Level and Limit Level for Air Quality

Action Level	Limit Level
1-hour RSP level = 150 µg/m^3	24-hour RSP level (rolling average) = 100 µg/m^3 24-hour FSP level (rolling average) = 50 µg/m^3

4.8.1.2 The Event and Action Plan prescribes procedures and actions associated with the outcome of the comparison of air quality monitoring data recorded and the agreed Action and Limit levels. In the cases where exceedances of these Action and Limit levels occur, the ET, the IEC, the PMR and the Contractor should strictly observe the relevant actions of the respective Event and Action Plan listed in **Table 4.4**.

4.9 Event and Action Plan

4.9.1.1 Should non-compliance of the air quality criteria occur, actions in accordance with the Event and Action Plan in **Table 4.4** shall be carried out.

Table 4.4 Event and Action Plan for Air Quality

Event	Action			
	ET	**IEC**	**PMR**	**Contractor**
Action level exceedance for one sample	1. Notify IEC and PMR; 2. Check the monitoring data and error messages to confirm if the performance of the monitoring equipment is normal; 3. If exceedance is confirmed, identify source(s), investigate the causes of exceedance and propose remedial measures; and 4. Assess effectiveness of Contractor's remedial measures and keep IEC and PMR informed of the results until exceedance stops.	1. Check monitoring data submitted by ET; 2. Check Contractor's working method; 3. Discuss with ET, PMR and Contractor on possible remedial measures; 4. Advise PMR and ET on the effectiveness of the proposed remedial measures; and 5. Supervise implementation of remedial measures.	1. Confirm receipt of notification of exceedance in writing; 2. Notify Contractor; 3. In consultation with IEC and ET, agree with the Contractor on the remedial measures to be implemented; and 4. Ensure remedial measures are properly implemented.	1. Identify sources of exceedance and discuss with PMR, ET and IEC on possible remedial measures; 2. Implement remedial measures; and 3. Amend working methods if appropriate.
Action level exceedance for two or more consecutive samples	1. Notify IEC and PMR; 2. Check the monitoring data and the performance of the monitoring equipment (refer to **Section 4.5.1.4**); 3. If exceedance is confirmed, identify source(s), investigate the causes of exceedance and propose remedial measures; 4. Discuss with IEC and Contractor on possible remedial measures required; 5. Assess effectiveness of Contractor's remedial measures and keep IEC and PMR informed of the results until exceedance stops; and 6. Notify EPD if the exceedance is confirmed to be related to the Project.	1. Check monitoring data submitted by ET; 2. Check Contractor's working method and verify the performance of the monitoring equipment to be checked by ET (refer to **Section 4.5.1.4**); 3. Discuss with ET and Contractor on possible remedial measures; 4. Advise PMR and ET on the effectiveness of the proposed remedial measures; and 5. Supervise implementation of remedial measures.	1. Confirm receipt of notification of exceedance in writing; 2. Notify Contractor; 3. In consultation with IEC and ET, agree with the Contractor on the proposal for remedial measures to be implemented; and 4. Ensure the proposal for remedial measures are properly implemented.	1. Identify the sources and discuss with PMR, ET and IEC on possible remedial measures; 2. Submit a proposal for remedial measures to PMR, IEC and ET within 2 working days of notification of exceedance for agreement; 3. Implement the agreed proposal; and 4. Amend proposal if appropriate.

Event	Action			
	ET	**IEC**	**PMR**	**Contractor**
Limit level exceedance for one 24-hr rolling average RSP concentration record or/and one 24-hr rolling average FSP concentration record	1. Notify IEC, PMR, Contractor and EPD; 2. Check the monitoring data and the performance of the monitoring equipment (refer to **Section 4.5.1.4**); 3. If exceedance is confirmed, identify source(s), investigate the causes of exceedance and propose remedial measures; 4. Discuss with IEC, PMR and Contractor on possible remedial measures required; 5. Assess effectiveness of Contractor's remedial measures and keep IEC and PMR informed of the results until exceedance stops; and 6. Notify EPD if the exceedance is confirmed to be related to the Project.	1. Check monitoring data submitted by ET; 2. Check Contractor's working method and verify the performance of the monitoring equipment to be checked by ET (refer to **Section 4.5.1.4**); 3. Discuss with PMR, ET and Contractor on the possible remedial measures; 4. Advise PMR and ET on the effectiveness of the proposed remedial measures; 5. Review Contractor's remedial measures whenever necessary to assure their effectiveness and advise PMR and ET accordingly; and 6. Supervise the implementation of remedial measures.	1. Confirm receipt of notification of exceedance in writing; 2. Notify Contractor; 3. In consultation with the IEC and ET, agree with the Contractor on the proposal for remedial measures to be implemented; 4. Ensure the proposal for remedial measures are properly implemented; and 5. If exceedance continues, identify what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is abated.	1. Identify the sources and discuss with PMR, ET and IEC on possible remedial measures; 2. Take immediate action to avoid further exceedance; 3. Submit a proposal for remedial measures to PMR, IEC and ET within 2 working days of notification of exceedance for agreement; 4. Implement the agreed proposal; 5. Review and resubmit proposals if the problem is still not under control; and 6. Stop the relevant portion of works as determined by PMR until the exceedance is abated.

Notes:

ET – Environmental Team

IEC – Independent Environmental Checker

PMR – Project Manager's Representative

5 Noise Impact

5.1 Introduction

5.1.1.1 The EIA Report has considered the potential noise impacts associated with the construction and operation of the Project. Construction noise arising from the construction activities, would be the major potential noise impacts during the construction phase. With the implementation of mitigation measures, adverse airborne construction noise is not anticipated. Nevertheless, a Construction Noise Management Plan (CNMP) is required and will be submitted to the Director of Environmental Protection (DEP). During the operational phase, road traffic noise levels shall be monitored at representative NSRs, which are in the vicinity of the recommended direct mitigation measures, during the first year after road opening for ascertaining the effectiveness of mitigation measures. Adverse fixed noise impact from ventilation buildings and administration buildings is not anticipated with the proper implementation of noise control mitigation measures. Nevertheless, a Fixed Noise Source Management Plan (FNMP) is required and will be submitted to the DEP.

5.2 Mitigation Measures

5.2.1 Construction Phase

5.2.1.1 Adverse construction noise impact is not anticipated with the implementation of mitigation measures such as good site practices, use of quality powered mechanical equipment (QPME) and construction method, use of temporary noise barriers and noise enclosures to screen noise from relatively static PMEs, etc. All the recommended mitigation measures and good site practices are summarised in the EMIS given in **Appendix 4.1**.

5.2.1.2 The Contractor shall be required to prepare a CNMP with reference to Section 8 and Annex 21 of the EIAO-TM as well as Section 4.4.5 of the EIA Report and this EM&A Manual. CNMP shall contain the quantitative construction noise impact assessment, the adopted quieter construction method and equipment, noise mitigation measures and the construction noise impact monitoring and audit programme, with reference to the updated and identified noise mitigation measures once available and in any case before the tender and commencement of the project construction, and if there is any change to the construction noise mitigation measures recommended in the CNMP, an updated CNMP shall be submitted one month before the implementation of such change. It shall also include an implementation schedule clearly listing out the mitigation measures, the implementation party, location and timing of implementation.

5.2.2 Operation Phase

Road Traffic Noise

5.2.2.1 With the implementation of mitigation measures such as low noise road surfacing, noise semi-enclosure and noise barriers, adverse road traffic noise is not anticipated. In order to ascertain the effectiveness of mitigation measures in reducing the noise levels, road traffic noise shall be monitored in the vicinity of the representative NSRs of the direct mitigation measures during the first year after road opening.

Fixed Noise Sources

5.2.2.2 For the proposed fixed noise sources, adverse noise impact from the administration buildings and ventilation buildings is not anticipated with the properly selection of the equipment and installation of acoustic attenuators such as enclosure and silencer. All of the noise mitigation measures during operational phase are summarised in the EMIS given in **Appendix 4.1**.

5.2.2.3 The Contractor shall be required to prepare a FNMP with reference to Section 8 and Annex 21 of the EIAO-TM as well as Section 4.6.5 of the EIA Report and this EM&A Manual. The FNMP shall contain the quantitative fixed noise source impact assessment, noise mitigation measures and the fixed noise source impact monitoring and audit programme, with reference to the updated and identified inventories once available and in any case before the commencement of construction of the Project. If there is any change to the specifications of the planned fixed noise sources, layout design, operation modes mitigation measures, or any other factors that would have implications on the fixed noise sources impact as concluded in the FNMP, an updated FNMP shall be submitted to the EPD no later than one month before the implementation of any such change. It shall also include an implementation schedule clearly listing out the mitigation measures, the implementation party, location and timing of implementation.

5.3 Noise Monitoring Parameter

5.3.1 Construction Phase

5.3.1.1 Construction noise level shall be measured in terms of the A-weighted equivalent continuous sound pressure level (L_{eq}). $L_{eq\ (30min)}$ shall be used as the monitoring parameter for the time period between 0700 and 1900 hours on normal weekdays. 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. A sample data sheet is shown in **Appendix 5.1**. Supplementary information for data auditing and statistical results such as L_{10} and L_{90} should also be obtained for reference.

5.3.2 Operational Phase

Road Traffic Noise

5.3.2.1 Airborne noise sources are not anticipated, noise monitoring of airborne noise is not required. Road traffic noise shall be measured in terms of the A-weighted noise level exceeded for 10% of the time in 1 hour ($L_{10(1\ hour)}$) for comparison with the EIAO-TM.

Fixed Noise Sources

5.3.2.2 For the fixed noise sources from ventilation buildings and administration buildings shall be conducted for comparison with Technical Memorandum for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (IND-TM) for selecting appropriate Area Sensitive Ratings (ASRs).

5.4 Monitoring Equipment for Construction and Operational Phases

5.4.1.1 As referred to the Technical Memorandum (TM) issued under the NCO, sound level meters in compliance with the International Electrotechnical Commission Publications 651: 1979 (Type 1) and 804: 1985 (Type 1) specifications shall be used for carrying out the 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 may be accepted as valid only if the calibration level from before and after the noise measurement agrees to within 1.0 dB.

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

5.4.1.3 The ET is responsible for the provision, installation, operation, maintenance and dismantling of the monitoring equipment. He shall ensure that sufficient noise measurement 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.

5.5 Construction Noise Monitoring

5.5.1 Monitoring Locations and Methodology

Construction Noise

5.5.1.1 The locations of construction noise monitoring stations are summarised in **Table 5.1** and shown in **Figure 5.1**. The locations of construction noise monitoring stations shall be reviewed and revised during detailed design on the basis of the latest information of the Project.

Table 5.1 Proposed Construction Noise Monitoring Locations

Monitoring Station ID	NAP ID	Location	Construction Activity	Monitoring Period[1]
Existing NSRs				
Lam Tei Area				
NM1	TYT-11	Area at/near Tsoi Yuen Tsuen	• Construction of elevated / at-grade roads • Construction of tunnel portal, ventilation building, administration building and associated facilities • Slope works • Construction of underground explosive magazine	Throughout the construction period of corresponding activity
NM2	TYT-17	Area at/near Tsoi Yuen Tsuen		
NM3	FHT-05	Area at/near Fuk Hang Tsuen		
NM4	FHT-20	Area at/near Fuk Hang Tsuen		
NM5	FHT-34	Area at/near Fuk Hang Tsuen		
NM6	VH-07	Village Houses near Tung Fuk Road		
NM7	VH-12	Village Houses near Tung Fuk Road		
NM8	LFH-01	Area at/near Lo Fu Hang		
NM9	LFH-10	Area at/near Lo Fu Hang		

Monitoring Station ID	NAP ID	Location	Construction Activity	Monitoring Period[1]
So Kwun Wat, Siu Lam and Tai Lam Area				
NM10	SKW-03	Area at/near So Kwun Wat Tsuen	• Construction of elevated / at-grade roads • Construction of tunnel portals and ventilation buildings • Slope works • Construction of temporary explosive magazine	Throughout the construction period of corresponding activity
NM11	HIS-06	Harrow International School Hong Kong Staff Dormitory		
NM12	TER-04	The Bloomsway-The Terrace		
NM13	PAL-01a	Palm Beach		
NM14	ROY-02b	The Royale		
NM15	SKW-19	Area at/near So Kwun Wat Tsuen		
NM16	SKW-08	Area at/near So Kwun Wat Tsuen		
NM17	AVI-01	Avignon		
NM18	AVI-16	Avignon		
NM19	SKW-28	Area at/near So Kwun Wat Tsuen		
NM20	ePOH-01	A.D. & F.D. of Pok Oi Hospital Mrs Cheng Yam On Millennium School		
NM21	SST-01	Siu Sau Tsuen		
NM22	GRT-02	Grandview Terrace		
NM23	GRT-03	Grandview Terrace		
NM24	SKS-01	Area at/near So Kwun Wat San Tsuen		
NM25	SKS-03	Area at/near So Kwun Wat San Tsuen		
NM26	PEC-01	Peak Castle		
NM27	SIU-07	Area at/near Siu Lam		
NM28	SIU-11	Area at/near Siu Lam		
NM29	SIU-02	Area at/near Siu Lam		
NM30	TLC-01	Tai Lam Correctional Institution Dormitory		
NM31	TAI-03	Area at/near Tai Lam Chung Tsuen		
NM32	TAI-22	Area at/near Tai Lam Chung Tsuen		
NM33	TAI-23	Area at/near Tai Lam Chung Tsuen		
Tsing Lung Tau Area				
NM34	KLT-08	Area at/near Ka Loon Tsuen		Throughout the construction
NM35	VIS-03	Vistacove		

Monitoring Station ID	NAP ID	Location	Construction Activity	Monitoring Period[1]
NM36	CYT-02	Area at/near Choi Yuen Tsuen	• Construction of elevated / at-grade roads • Construction of ventilation building • Construction of Northern Anchorage for Tsing Lung Bridge • Slope works • Reclamation works • Construction of temporary barging point	period of corresponding activity
NM37	CYT-11	Area at/near Choi Yuen Tsuen		
NM38	CYT-01	Area at/near Choi Yuen Tsuen		
NM39	HKG-11b	Hong Kong Garden		
Committed / Planned NSRs				
Lam Tei Area				
NM40	p-LTN-05	Public housing development at Lam Tei North	• Construction of elevated / at-grade roads • Construction of tunnel portal, ventilation building, administration building and associated facilities • Slope works • Construction of underground explosive magazine	Upon the intake of the population and throughout the construction period of corresponding activity
NM41	pp-FHA-04	Comprehensive development area at Fuk Hang Tsuen Lane		
So Kwun Wat, Siu Lam and Tai Lam Area				
NM42	pp-SKW1-03	Residential Development under Planning Application No. Y/TM/29, Various Lots in D.D.374	• Construction of elevated / at-grade roads • Construction of tunnel portals and ventilation buildings • Slope works • Construction of temporary explosive magazine	Upon the intake of the population and throughout the construction period of corresponding activity
Tsing Lung Tau Area				
NM43	p-TRA-01	Transitional Housing at 115 Castle Peak Road Tsing Lung Tau	• Construction of elevated / at-grade roads • Construction of ventilation building • Construction of Northern Anchorage	Upon the intake of the population and throughout the construction period of corresponding activity

Monitoring Station ID	NAP ID	Location	Construction Activity	Monitoring Period[1]
			for Tsing Lung Bridge • Slope works • Reclamation works • Construction of temporary barging point	

Note:

[1] The monitoring period is subject to the construction programme of the relevant contracts in the construction phase.

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

- At locations close to the major site activities which are likely to have noise impacts;
- Close to the most affected existing noise sensitive receivers; 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.

5.5.1.3 The monitoring station shall normally be at a point 1m from the exterior of the sensitive receiver building facade and be at a position 1.2m 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. Once the positions for the monitoring stations are chosen, the baseline monitoring and the impact monitoring shall be carried out at the same positions.

5.5.1.4 The status and locations of the NSRs may change after issuing this Manual. In such case, the ET shall propose updated monitoring locations and seek approval from the PMR and agreement from the IEC and EPD on the proposal.

5.5.2 Baseline Monitoring

5.5.2.1 The ET shall carry out baseline noise monitoring in all identified monitoring stations prior to the commencement of the construction works. There shall not be any construction activities in the vicinity of the stations during the baseline monitoring. Continuous baseline noise monitoring for the A-weighted levels L_{eq}, L_{10} and L_{90} shall be carried out daily for a period of at least two weeks in a sample period of 30 minutes between 0700 and 1900, and 5 minutes between 1900 and 0700 as well as all time at general holidays including Sundays. A schedule on the baseline monitoring shall be submitted to the PMR and IEC for approval before the monitoring starts.

5.5.2.2 In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET shall liaise with the IEC and EPD to agree on an appropriate set of data to be used as a baseline reference.

5.5.3 Impact Monitoring

5.5.3.1 During normal construction working hours (0700 to 1900, Monday to Saturday),

monitoring of $L_{eq, (30min)}$ noise levels shall be carried out at the agreed monitoring locations once every week in accordance with the methodology in the TM issued under NCO.

5.5.3.2 In case of non-compliance with the construction noise criteria, more frequent monitoring, as specified in the Event and Action Plan, 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.

5.5.3.3 The monthly schedule of the impact monitoring programme should be drawn up by the ET at least 2 weeks prior to the commencement of the scheduled construction period. Before commencing impact monitoring, the ET shall inform the IEC of the impact monitoring programme such that the IEC can conduct on-site audit.

Action and Limit Levels

5.5.3.4 The ET shall compare the construction noise monitoring results with noise criteria. **Table 5.2** and **Table 5.3** show the noise criteria, namely Action and Limit Levels to be used.

Table 5.2 Action and Limit Levels for Construction Noise Noise for Daytime

Time Period	Land Use	Action Level	Limit Level
0700 - 1900 hours on normal weekdays	• All domestic premises; • Temporary housing accommodation. • Hostels; • Convalescent homes; and • Homes for the aged	When one documented complaint is received	75
	• Places of public worship; • Courts of law; and • Hospitals and medical clinics		70
	• Educational institutions (including kindergartens and nurseries)		70 65 (During Examination)

Table 5.3 Action and Limit Levels for Construction Noise during Restricted Hours

Time Period	Area Sensitivity Rating (ASR)	Action Level	Limit Level, dB(A) [1]
All weekdays during the evening (1900 to 2300 hours), and general holidays (including Sundays) during the day and evening (0700 to 2300 hours)	A	When one documented complaint is received	60 (45)
	B		65 (50)
	C		70 (55)
All days during the night-time (2300 to 0700 hours)	A		45 (30)
	B		50 (35)
	C		55 (40)

Note:

[1] Figures in brackets are ANLs for SPME construction work in designated areas.

5.5.4 Event and Action Plan

5.5.4.1 Should non-compliance of the noise criteria occur, actions in accordance with the Event and Action Plan in **Table 5.4** shall be carried out.

Table 5.4 Event and Action Plan for Construction Noise

Event	Action			
	ET	**IEC**	**PMR**	**Contractor**
Action Level Exceedance	1. Notify IEC, PMR and Contractor; 2. Identify source and carry out investigation; 3. Discuss with the Contractor and formulate remedial measures; and 4. Increase monitoring frequency to check mitigation effectiveness.	1. Review the analysed results submitted by the ET; 2. Review the proposed remedial measures by the Contractor and advise the PMR accordingly; and 3. Supervise the implementation of remedial measures.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Require Contractor to propose remedial measures for the analysed noise problem; and 4. Ensure remedial measures are properly implemented	1. Identify source, and carry out investigation and report the investigation to the ET, IEC and PMR; 2. Submit noise mitigation proposals to IEC and PMR; and 3. Implement noise mitigation proposals.
Limit Level Exceedance	1. Inform IEC, PMR, EPD and Contractor; 2. Repeat measurements to confirm findings; 3. Increase monitoring frequency; 4. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented; 5. Inform IEC, PMR and EPD the causes and actions taken for the exceedances; 6. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and PMR informed of the results; and 7. If exceedance stops, cease additional monitoring.	1. Check monitoring results and discuss amongst PMR, ET, and Contractor on the potential remedial actions; 2. Ensure remedial measures properly implemented; and 3. Review Contractors remedial actions whenever necessary to assure their effectiveness and advise the PMR accordingly.	1. Confirm receipt of notification of failure in writing; 2. Notify Contractor; 3. Require Contractor to propose remedial measures for the analysed 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.	1. Identify source and carry out investigation and report the investigation to the ET, IEC and PMR; 2. Take immediate action to avoid further exceedance; 3. Submit proposals for remedial actions to PMR, ET and IEC within 3 working days of notification; 4. Implement the agreed proposals; 5. Resubmit proposals if problem still not under control; and 6. Stop the relevant portion of works as determined by the PMR until the exceedance is abated.

Notes:

ET – Environmental Team

IEC – Independent Environmental Checker

PMR – Project Manager's Representative

5.6 Operational Noise Monitoring

5.6.1 Road Traffic Noise

Monitoring Location

5.6.1.1 The locations of road traffic noise monitoring stations are summarised in **Table 5.5** and shown in **Figure 5.2**. The locations of operational road traffic noise monitoring stations shall be reviewed and revised during detailed design on the basis of the latest information of the Project.

Table 5.5 Proposed Road Traffic Noise Monitoring Station

Monitoring Station ID	NSR	NAP	Location	Noise Mitigation Measures
Existing Noise Sensitive Receiver				
Lam Tei Area				
OM1	LT03	FHT-22	Area at/near Fuk Hang Tsuen	CB01, CB02, CB03
OM2	LT03	Te-02a	Church of Christian Faith Lam Tei Gospel Church	CB01, CB02, CB03
OM3	LT04	VH-12	Village Houses near Tung Fuk Road	VB01
OM4	LT06	SHE-08	The Sherwood	CB01, CB02, CB03
So Kwun Wat / Siu Lam / Tai Lam Area				
OM5	SKW01	SKW-03	Area at/near So Kwun Wat Tsuen	LNRS01, LNRS02, LNRS03, LNRS04, LNRS05, CB08
OM6	SKW19	AVI-01	Avignon	LNRS04, LNRS05
OM7	Not used			-
Tsing Lung Tau				
OM8	TLT04	CYT-03	Area at/near Choi Yuen Tsuen	VB02
OM9	TLT05	HKG-02b	Hong Kong Garden	CB04, CB05, CB06, CB07, SE01
OM10	TLT05	HKG-10b	Hong Kong Garden	CB04, CB06, CB07, SE01

5.6.1.2 The status and locations of NSRs may change after the approval of this Manual, when the ET proposes alternative monitoring locations, agreement from the IEC and EPD should be sought.

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

- At locations facing the road sections with various type of noise barriers upon commissioning of the Project;
- As close as possible 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.

5.6.1.4 The monitoring station shall normally be at a point 1m from the exterior of the sensitive receiver building facade and be at a position 1.2m 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 the commencement of monitoring.

Monitoring Plan and Measurement Report Submission

5.6.1.5 The ET should prepare and deposit to EPD, at least 6 months before the 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 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 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 deposit with EPD.

Impact Monitoring

5.6.1.6 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 vehicles shall be conducted for the Project Road and the existing road network in the vicinity of each measurement points;
- 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 shall be obtained within the first year of operation.

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

Event and Action Plan

5.6.1.8 For the 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.

5.6.2 Fixed Noise Sources Audit

5.6.2.1 The Contractor should also carry out a noise audit for all fixed noise sources before the operation of the Project, in order to ensure compliance of the noise levels with 5dB(A) below the appropriate Acceptable Noise Levels (ANLs) in the IND-TM or the prevailing background noise levels. The ANLs for different Area Sensitivity Ratings during different periods are summarised in the **Table 5.6**.

Table 5.6 ANLs for Fixed Noise Sources

Time Period	**ANL, dB(A)**		
	Area Sensitivity Rating A	**Area Sensitivity Rating B**	**Area Sensitivity Rating C**
Day (0700 to 1900 hours)	60	65	70
Evening (1900 to 2300 hours)	60	65	70
Night (2300 to 0700 hours)	50	55	60

6 Water Quality Impact

6.1 Introduction

6.1.1.1 The EIA Report has assessed the potential water quality impacts associated with the construction and operation of the Project. According to the EIA Report, adverse environmental impact is not anticipated during the construction and operational phases with proper implementation of the recommended mitigation measures and good site practices.

6.2 Mitigation Measures

6.2.1 Construction Phase

6.2.1.1 During the construction phase, recommended mitigation measures such as good site practices to control construction site runoff, provision of perimeter drains, on-site treatment of land-based works prior to discharge, etc., should be implemented. For marine-based construction works, silt curtain will be provided as an enhancement measures for the reclamation works. Other recommended practices for other potential sources of water quality impacts (including the construction of mud pit within the reclamation area and good management practice for marine works) should also be implemented. All the recommended mitigation measures are summarised in the EMIS in **Appendix 4.1**.

6.2.2 Operational Phase

6.2.2.1 With proper connection to the public stormwater drainage and sewerage systems and mitigation measure in place such as stormwater surface runoff discharged to the nearby government drainage system with provision of silt trap, standard oil interceptors and the practices outlined in ProPECC PN 5/93, adverse impact is not anticipated during the operational phase. Therefore, no water quality monitoring and site audit are required.

6.3 Water Monitoring Parameters

6.3.1.1 The monitoring shall normally be established by measuring the dissolved oxygen (DO), dissolved oxygen saturation (DO%), temperature, turbidity, salinity, pH and suspended solids (SS) in water bodies at all designated locations as specified in **Section 6.6**.

6.3.1.2 The measurements shall be taken at all designated monitoring stations 3 days per week during construction phase. The interval between two sampling surveys shall not be less than 36 hours.

6.3.1.3 Replicate in-situ measurements and samples collected from each independent sampling event shall be collected to ensure a robust statistically interpretable database. DO, DO%, pH, salinity, temperature and turbidity should be measured in-situ whereas other parameters should be determined by an accredited laboratory.

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

6.4 Monitoring Equipment

6.4.1 Dissolved Oxygen, Dissolved Oxygen Saturation and Temperature Measuring Equipment

6.4.1.1 The DO measuring instruments should be portable and weatherproof. The equipment should also complete with cable and sensor, and DC power source. It should be capable of measuring:

- A DO level in the range of 0 – 20 mg/L and 0 – 200% saturation; and
- A temperature of 0 – 45 degree Celsius.

6.4.1.2 The equipment should have a membrane electrode with automatic temperature compensation complete with a cable.

6.4.1.3 Should salinity compensation not be built-in to the DO equipment, in-situ salinity should be measured to calibrate the DO measuring instruments prior to each measurement.

6.4.2 Turbidity Measuring Equipment

6.4.2.1 The turbidity measuring instruments should be a portable and weatherproof with DC power source. It should have a photoelectric sensor capable of measuring turbidity level between 0 – 1000 NTU (e.g. Hach model 2100P or an approved similar instrument).

6.4.3 Salinity Measuring Equipment

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

6.4.4 pH Measuring Equipment

6.4.4.1 A portable pH meter capable of measuring a pH range between 0.0 and 14.0 shall be provided under the specified conditions (e.g. Orion Model 250A or an approved similar instrument).

6.4.5 Positioning Equipment

6.4.5.1 A hand-held or boat-fixed type digital Differential Global Positioning System (DGPS) with way point bearing indication and Radio Technical Commission for maritime (RTCM) Type 16 error message “screen pop-up” facilities (for real-time auto-display of error messages and DGPS corrections from the Hong Kong Hydrographic Office), or other equipment instrument of similar accuracy, should be provided and used during marine water monitoring to ensure the monitoring vessel is at the correct location before taking measurements.

6.4.6 Water Depth Detector

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

6.4.7 Water Sampling Equipment

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

6.4.8 Sample Containers and Storage

6.4.8.1 Water samples for SS should be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4°C without being frozen) and shipment to the testing laboratory. The samples shall be delivered to the laboratory within 24 hours of collection and be analysed as soon as possible after collection.

6.4.9 Calibration of In-Situ Instruments

6.4.9.1 The pH meter, DO meter and turbidimeter shall be checked and calibrated before use. DO meter and turbidimeter shall be certified by a laboratory accredited under HOKLAS or any other international accreditation scheme, and subsequently re-calibrated at quarterly basis throughout all stages of the water quality monitoring. Responses of sensors and electrodes should be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter shall be carried out before measurement at each monitoring station.

6.4.10 Back-up Equipment and Vessels

6.4.10.1 Sufficient stocks of spare parts shall be maintained for replacements when necessary. Backup monitoring equipment shall also be made available so that monitoring can proceed uninterrupted even when some equipment is under maintenance, calibration, malfunction, etc.

6.4.10.2 The water quality monitoring will involve 10 monitoring stations as specified in **Section 6.6** and measurements should be conducted within the prescribed tidal conditions in order to ensure the measurement / samples are representative. A multi-probe monitoring equipment set integrated with water sampler(s) is highly recommended to improve the monitoring efficiency. Depending on the actual operation, more than one field survey vessels might be required simultaneously to ensure the monitoring are conducted within the acceptable monitoring period. The ET shall also consider the use of unattended automatic sampling / monitoring devices at fixed stations where monitoring are required throughout the construction period. The use of such unattended automatic devices, however, shall be subject to the approval of the PMR, IEC and EPD.

6.5 Laboratory Measurement / Analysis

6.5.1.1 At least 3 replicate samples from each independent sampling event are required for the SS measurement which shall be carried in a HOKLAS or international accredited laboratory. Sufficient water samples shall be collected at the monitoring stations for carrying out the laboratory measurement and analysis. The laboratory determination work shall start within 24 hours after collection of the water samples. The analysis for suspended solids is presented in **Table 6.1**.

Table 6.1 Laboratory Analysis

Parameters	Analytical Method	Reporting Limit
Suspended Solid (SS)	APHA 22ed 2540 D & E	0.5mg/L

6.6 Monitoring Locations

6.6.1.1 Water quality monitoring will be carried out at 10 locations (WM1 to WM5 and C1 to C5) of the inland water and 5 locations (WM6 to WM9 and C6) of the marine water nearby the Project Site.

6.6.1.2 The proposed water quality monitoring locations are shown in **Figure 6.1** and listed in **Table 6.2**. The locations of water quality monitoring shall be reviewed and revised during detailed design on the basis of the latest information of the Project. The ET shall seek approval from IEC and EPD for any alternative monitoring locations.

Table 6.2 Locations of Proposed Water Quality Monitoring Stations

Monitoring Station ID	Description	Easting	Northing
WM1	Tuen Mun River	816734	830598
WM2	Stream near Tsing Ying Road	817392	826215
WM3	Stream near the So Kwun Wat Tsuen Road	819277	826719
WM4	Channel near the Siu Lam Road	819619	825667
WM5	Tai Lam Chung River	820286	825253
WM6	Marine waters near Tsing Lung Tau	821673	824110
WM7	Marine waters near Tsing Lung Tau	822424	824387
WM8	Marine waters near Tsing Lung Tau	822200	823995
WM9	Marine waters near Ma Wan	823677	823715
C1	Control Station of WM1	817065	830325
C2	Control Station of WM2	817195	826462
C3	Control Station of WM3	819507	826846
C4	Control Station of WM4	819728	825852
C5	Control Station of WM5	820335	825566
C6	Control Station of Marine Monitoring Stations	822398	823602

6.7 Baseline Monitoring

6.7.1.1 Baseline conditions for water quality shall be established and agreed with 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 construction works and to demonstrate the suitability of the proposed impact and control monitoring stations.

6.7.1.2 The baseline monitoring shall be conducted for at least 4 weeks prior to the commencement of construction works. The proposed water quality monitoring schedule shall be submitted to EPD by the ET at least 2 weeks before the first day of the monitoring month. The interval between two sets of monitoring shall not be less than 36 hours. EPD shall also be notified immediately for any changes in schedule.

6.7.1.3 In general, where the difference in value between the first and second in-situ measurement of DO or turbidity parameters is more than 25% of the value of the first reading, the reading shall be discarded and further readings should be taken.

6.7.1.4 There should be no construction work in the vicinity of the stations during the baseline monitoring. The baseline data will be used to establish the Action and Limit Levels. The determination of Action and Limit Levels will be discussed in **Section 6.9**.

6.7.1.5 **Table 6.3** below summarizes the proposed monitoring frequency and water quality parameters for baseline monitoring.

Table 6.3 Proposed Water Quality Monitoring Programme for Baseline Monitoring

Item	Baseline Monitoring
Monitoring Period	At least 4 weeks prior to the commencement of construction work
Monitoring Frequency	3 Days in a Week
Monitoring Locations	WM1 to WM9 and C1 to C6
Monitoring Parameters	Dissolved oxygen (DO), dissolved oxygen saturation (DO%), temperature, turbidity, salinity, pH and suspended solids (SS).
Intervals between 2 Sets of Monitoring	Not less than 36 hours

6.8 Impact Monitoring

6.8.1.1 The impact monitoring shall be conducted during construction period. The purpose of impact monitoring is to ensure the implementation of the recommended mitigation measures, provide effective control of any malpractices, and provide continuous improvements to the environmental conditions. The proposed water quality monitoring schedule shall be submitted to EPD by the ET at least 2 weeks before the first day of the monitoring month. The interval between two sets of monitoring shall not be less than 36 hours. EPD shall also be notified immediately for any changes in schedule.

6.8.1.2 In general, where the difference in value between the first and second in-situ measurement of DO or turbidity parameters is more than 25% of the value of the first reading, the reading shall be discarded and further readings should be taken.

6.8.1.3 In case of project-related exceedances of Action and/or Limit Levels, the impact monitoring frequency shall be increased according to the requirement of Event and Action Plan. The details of Event Action Plan will be discussed in **Section 6.10**.

6.8.1.4 **Table 6.4** below summarises the proposed monitoring frequency and water quality parameters for impact monitoring.

Table 6.4 Proposed Water Quality Monitoring Programme for Impact Monitoring

Item	Impact Monitoring
Monitoring Period	During entire construction period
Monitoring Frequency	3 Days in a Week

Item	Impact Monitoring
Monitoring Locations	WM1 to WM9 and C1 to C6
Monitoring Parameters	Dissolved oxygen (DO), dissolved oxygen saturation (DO%), temperature, turbidity, salinity, pH and suspended solids (SS)
Intervals between 2 Sets of Monitoring	Not less than 36 hours

6.9 Action and Limit Levels

6.9.1.1 The Action and Limit Levels for water quality are defined in **Table 6.5**.

Table 6.5 Action and Limit Levels for Water Quality

Parameters	Action Level	Limit Level
DO in mg/L (Surface, Middle & Bottom Marine Waters and Inland Waters)	Surface and Middle Marine Waters, Inland Waters 5 percentile of baseline data. [1] Bottom Marine Waters 5 percentile of baseline data	Surface and Middle Marine Waters, Inland Waters 4 mg/L or 1 percentile of baseline data. [1] Bottom Marine Waters 2 mg/L or 1 percentile of baseline data
SS in mg/L	95 percentile of baseline data or 120% of upstream control station. [2]	99 percentile of baseline data or 130% of upstream control station. [2]
Turbidity in NTU	95 percentile of baseline data or 120% of upstream control station. [2]	99 percentile of baseline data or 130% of upstream control station. [2]

Notes:

[1] For DO, non-compliance occurs when monitoring results is lower than the limits.

[2] For SS and turbidity, non-compliance occurs when monitoring results is larger than the limits.

6.10 Event and Action Plan

6.10.1.1 Should non-compliance of the criteria occur, action in accordance with the Action Plan in the **Table 6.6** below shall be carried out.

Table 6.6 Event and Action Plan for Water Quality

Event	Action			
	ET	**IEC**	**PMR**	**Contractor**
Action level exceedance for one sampling day	1. Inform IEC, Contractor and PMR; 2. Check monitoring data, all plant, equipment and Contractor's working methods; and 3. Discuss remedial measures with IEC and Contractor and PMR.	1. Discuss with ET, PMR and Contractor on the implemented mitigation measures; 2. Review proposals on remedial measures submitted by Contractor and advise the PMR accordingly; and 3. Review and advise the ET and PMR on the effectiveness of the implemented mitigation measures.	1. Discuss with IEC, ET and Contractor on the implemented mitigation measures; 2. Make agreement on the remedial measures to be implemented; and 3. Supervise the implementation of agreed remedial measures.	1. Identify source(s) of impact; 2. Inform the PMR and confirm notification of the non-compliance in writing; 3. Rectify unacceptable practice; 4. heck all plant and equipment; 5. Consider changes of working methods; 6. Discuss with PMR, ET and IEC and purpose remedial measures to IEC and PMR; and 7. Implement the agreed mitigation measures.
Action level exceedance for more than one consecutive sampling days	1. Repeat in-situ measurement on next day of exceedance to confirm findings; 2. Inform IEC, contractor and PMR; 3. Check monitoring data, all plant, equipment and Contractor's working methods; 4. Discuss remedial measures with IEC, contractor and PMR; and 5. Ensure remedial measures are implemented.	1. Discuss with ET, Contractor and PMR on the implemented mitigation measures; 2. Review the proposed remedial measures submitted by Contractor and advise the PMR accordingly; and 3. Review and advise the ET and PMR on the effectiveness of the implemented mitigation measures.	1. Discuss with ET, IEC and Contractor on the proposed mitigation measures; 2. Make agreement on the remedial measures to be implemented ; and 3. Discuss with ET, IEC and Contractor on the effectiveness of the implemented remedial measures.	1. Identify source(s) of impact; 2. Inform the PMR and confirm notification of the non-compliance in writing; 3. Rectify unacceptable practice; 4. Check all plant and equipment and consider changes of working methods; 5. Discuss with ET, IEC and PMR and submit proposal of remedial measures to PMR and IEC within 3 working days of notification; and 6. Implement the agreed mitigation measures.

Event	Action			
	ET	IEC	PMR	Contractor
Limit level exceedance for one sampling day	1. Repeat measurement on next day of exceedance to confirm findings; 2. Inform IEC, contractor and PMR; 3. Rectify unacceptable practice; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Consider changes of working methods; 6. Discuss mitigation measures with IEC, PMR and Contractor; and 7. Ensure the agreed remedial measures are implemented	1. Discuss with ET, Contractor and PMR on the implemented mitigation measures; 2. Review the proposed remedial measures submitted by Contractor and advise the PMR accordingly; and 3. Review and advise the ET and PMR on the effectiveness of the implemented mitigation measures.	1. Discuss with ET, IEC and Contractor on the implemented remedial measures; 2. Request Contractor to critically review the working methods; 3. Make agreement on the remedial measures to be implemented; and 4. Discuss with ET, IEC and Contractor on the effectiveness of the implemented remedial measures.	1. Identify source(s) of impact; 2. Inform the PMR and confirm notification of the non-compliance in writing; 3. Rectify unacceptable practice; 4. Check all plant and equipment and consider changes of working methods; 5. Discuss with ET, IEC and PMR and submit proposal of additional mitigation measures to PMR and IEC within 3 working days of notification; and 6. Implement the agreed remedial measures.
Limit level exceedance for more than one consecutive sampling days	1. Inform IEC, contractor and PMR; 2. Check monitoring data, all plant, equipment and Contractor's working methods; 3. Discuss mitigation measures with IEC, PMR and Contractor; 4. Ensure mitigation measures are implemented; and 5. Increase the monitoring frequency to daily until no	1. Discuss with ET, Contractor and PMR on the implemented mitigation measures; 2. Review the proposed remedial measures submitted by Contractor and advise the PMR accordingly; and 3. Review and advise the ET and PMR on the effectiveness of the implemented mitigation measures.	1. Discuss with ET, IEC and Contractor on the implemented remedial measures; 2. Request Contractor to critically review the working methods; 3. Make agreement on the remedial measures to be implemented; 4. Discuss with ET and IEC on the effectiveness of the implemented mitigation measures; and	1. Identify source(s) of impact; 2. Inform the PMR and confirm notification of the non-compliance in writing; 3. Rectify unacceptable practice; 4. Check all plant and equipment and consider changes of working methods; 5. Discuss with ET, IEC and PMR and submit proposal of additional mitigation measures to PMR and IEC within 3 working days of notification;

Event	Action			
	ET	IEC	PMR	Contractor
	exceedance of Limit Level for two consecutive days.		5. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the dredging activities until no exceedance of Limit level.	6. Implement the agreed remedial measures; and 7. As directed by the PMR, to slow down or stop all or part of the dredging activities until no exceedance of Limit level.

Notes:

ET – Environmental Team

IEC – Independent Environmental Checker

PMR – Project Manager's Representative

Each step of actions required shall be implemented within 1 working days unless otherwise specified or agreed with EPD.

7 Waste Management Implications

7.1 Introduction

7.1.1.1 The quantity and timing for the generation of waste during construction phase have been estimated in the EIA Report. Measures including the opportunity for on-site sorting, reusing Construction and Demolition (C&D) materials, etc. are devised in the construction methodology to minimise the surplus materials to be disposed. Chemical waste should be collected by licensed chemical waste collectors for proper disposal.

7.1.1.2 During the operational phase, the major types of waste to be generated are general refuse from the employees within mainly the administration buildings and partly from the ventilation buildings, chemical waste from the administration buildings and the ventilation buildings, maintenance of the tunnel, and floating refuse trapped/accumulated by the proposed artificial seawall for the reclamation at Tsing Lung Tau.

7.2 Mitigation Measures

7.2.1 Construction Phase

7.2.1.1 All the proposed mitigation measures during construction phase are stipulated in the EIA Report and summarised in **Appendix 4.1**.

7.2.1.2 Wastes will be handled in accordance with the relevant legislation and guidelines and with the implementation of the proposed mitigation measures, no adverse environmental impacts from waste management are anticipated. EM&A is required for waste management during the construction phase only and the effective management of waste arising during the construction phase will be monitored through the site audit programme. The aims of the waste audit are:

- To ensure the waste arising from the works are handled, stored, collected, transferred and disposed of in an environmental acceptable manner; and
- To encourage the reuse and recycling of material.

7.2.1.3 A trip-ticket system should be operated to monitor all movements of inert C&D materials for delivery to fill bank, non-inert C&D materials for disposal at landfill and chemical wastes which will be collected by licensed chemical waste collectors to licensed facilities for final treatment and disposal. Marine sediment will be handled, stored and disposed of in accordance with good waste management practices, relevant legislation and waste management guidelines. All dump trucks and vessels engaged on site for delivery of inert C&D materials, non-inert C&D materials and marine sediment from the site to the designated outlets should be equipped with GPS or equivalent system for tracking and monitoring of their travel routings and parking locations to prohibit illegal dumping and landfilling of C&D materials. Record and analysis of data collected by the mentioned GPS or equivalent system should be kept. Recommendations have been made in the EIA Report to ensure proper treatment and proper disposal of these wastes and summarised in **Appendix 4.1**.

7.2.2 Operational Phase

7.2.2.1 For the general refuse from the employees within mainly the administration

buildings and partly from the tunnel ventilation buildings, it should be separated from chemical waste by providing separated bins for storage to maximize the recyclable volume as far as practicable. A reputable waste collector should be employed to remove general refuse regularly to minimize odour, pest and litter impacts. Other than general refuse, opportunities for the reusing and recycling of chemical wastes should be explored where possible. As chemical waste is expected to be generated, a trip-ticket system should be operated in accordance with the Waste Disposal (Chemical Waste) (General) Regulation to monitor all movements of chemical wastes which will be collected by a licensed collector to a licensed facility for final treatment and disposal. For floating refuse, regular inspection and monitoring of floating refuse will be carried out by Marine Department's appointed contractor. With proper management, adverse waste management implications are not anticipated.

7.3 Environmental Monitoring and Site Audit Requirements

7.3.1 Construction Phase

7.3.1.1 The Contractor shall be required to pay attention to the environmental standards and guidelines, carry out appropriate waste management and obtain the relevant licenses/ permits for waste disposal. The ET shall ensure that the Contractor has obtained from the appropriate authorities the necessary waste disposal permits or licenses including:

- Chemical Waste Disposal License under the Waste Disposal Ordinance (Cap 354);
- Dumping at Sea Ordinance (DASO) (Cap. 466) if marine disposal of land-based sediment is unavoidable;
- Dumping License under the Land (Miscellaneous Provisions) Ordinance (Cap 28); and
- Water Pollution Control Ordinance License under the Water Pollution Control Ordinance (Cap.358).

7.3.1.2 The Contractor shall refer to EPD's Guidance Notes for license applications when applying for the license/ permit and the ET shall refer to these Guidance Notes for auditing purposes.

7.3.1.3 Regular audits and site inspections on a monthly basis should be carried out during the construction phase by the ET to ensure that the recommended good site practices and other mitigation measures recommended in the EIA Report and in **Appendix 4.1** 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, a Waste Management Plan (WMP) as part of the Environmental Management Plan (EMP) shall be prepared and submitted to the Project Manager for approval. Documents including licenses, permits, disposal and recycling records should be reviewed and audited for compliance with the legislation and contract requirements, and submitted to the Project Manager for approval.

7.3.1.4 The requirements of the environmental audit programme are set out in **Section 14** of this Manual. The audit programme will verify the implementation status and evaluate the effectiveness of the mitigation measures.

7.3.2 Operational Phase

7.3.2.1 As it is anticipated that there would not be any insurmountable impacts during the operational phase, monitoring and audit requirements are not required.

8 Land Contamination

8.1 Introduction

8.1.1.1 Based on the site surveys carried out in accordance with the approved Contamination Assessment Plan (CAP), a total of 15 potentially contaminated sites have been identified within the Project Site. However, nine of these sites were inaccessible for the site survey or limited to peripheral site inspections and were still in operation, and there may be changes in site activities and land uses within the Project Site prior to the construction works that could result in further contamination issues. Whilst further site re-appraisal is required for the whole Project Area, associated site investigation (SI) works and any necessary remediation works are required to conduct when assess is available to address any changes in operation or land use that may give rise to potential land contamination issues. The recommended further works, including a supplementary CAP, Contamination Assessment Report (CAR) and, where contamination has been identified, a Remediation Action Report (RAP) and Remediation Report (RR) shall be prepared and submitted to the EPD for approval prior to the commencement of any construction/ development works.

8.2 Mitigation Measures

8.2.1.1 Remediation work, if required, would be carried out after site operations have ceased and prior to the construction works at the potentially contaminated sites. Mitigation measures for the remediation works, if required, as recommended in the EIA Report. Appropriate remediation methods would be implemented during the remediation works in accordance with the RAP to be approved by EPD. EM&A should be carried out in the form of regular site inspection on a monthly basis to ensure that the recommended mitigation measures are properly implemented and the finding results of the audit should be reported in the EM&A reports.

8.3 Environmental Monitoring and Site Audit Requirements

8.3.1.1 As any contaminated soil/ groundwater would be identified and properly treated prior to the commencement of any construction/ development works, land contamination during the operational phase is not expected. Therefore, environmental monitoring and site auditing is not required for either construction or operational phases.

9 Hazard to Life

9.1 Introduction

9.1.1.1 The EIA Report concluded that with the implementation of proposed mitigation measures, no insurmountable potential risk arising from storage, transport and use of explosives is anticipated. Blasting activities regarding transport and use of explosives should be supervised and audited by the competent site staff to ensure strict compliance with the blasting permit conditions. The operation of the Project does not involve any use of explosives, potential risk during operational phase is not envisaged.

9.2 Mitigation Measures

9.2.1 Construction Phase

9.2.1.1 Recommendations have been made for implementation to meet the EIAO-TM requirements as listed out in **Appendix 4.1**. Other good site practices and design measures as listed out in **Appendix 4.1** are also proposed to further minimize the potential risk.

9.2.1.2 Subject to the liaison of the three concurrent projects Route 11 (R11), Tuen Mun Bypass (TMB) and Lam Tei Underground Quarrying (LTUQ), a Hazard Management Plan would be formulated with a view to aligning the understanding of the risk of the three projects so that all the working populations at Lam Tei Quarry area, which includes the workforce induced under the construction and operational stage of three projects, could be considered as on-site populations in the quantitative risk assessment for all the three projects. The measures stipulated in the Hazard Management Plan may include, but not limited to, the adjustment of the blasting schedules of the three projects to minimize the potential cumulative impact, provision of common trainings and drills to the workforce of all the three projects, etc. The Hazard Management Plan, which would be agreed among the three projects, would be submitted to EPD for agreement prior to the tender invitation of construction phases of R11, TMB and LTUQ, whichever is earlier.

9.2.2 Operational Phase

9.2.2.1 No specific mitigation measures are required as no potential risk during operational phase is envisaged.

9.3 Environmental Monitoring and Site Audit

9.3.1 Construction Phase

9.3.1.1 Blasting activities regarding transport and use of explosives should be supervised and audited by the competent site staff to ensure strict compliance with the blasting permit conditions. Therefore, additional environmental monitoring and site audit is not required.

9.3.2 Operational Phase

9.3.2.1 No specific mitigation measures are required as no potential risk during operational phase is envisaged. Hence, environmental monitoring and site audit are not required.

10 Ecology

10.1 Introduction

10.1.1.1 The EIA Report has evaluated the ecological impacts associated with the construction and operation of the Project and recommended ecological mitigation measures to avoid, minimise and compensate the impact arising from the Project.

10.1.1.2 The required mitigation measures to be adopted to avoid, minimize and mitigate for the ecological impacts arising from the Project were identified in Section 9 of the EIA Report and are described in the following sections. The proposed ecological mitigation measures should be checked as an element of the environmental audit programme under the Project.

10.2 Mitigation Measures

10.2.1 Construction Phase

10.2.1.1 The proposed mitigation measures for ecological impacts are summarized in the EMIS in **Appendix 4.1**. The environmental monitoring and auditing requirements are of stated in **Section 10.3** below.

10.2.1.2 The following key considerations throughout the entire project development and design have been duly considered to avoid/minimize the impacts (see Section 9.8 in EIA report for more detailed discussion).

Impact Avoidance

10.2.1.3 The Project has avoided direct impact on recognized sites of conservation importance (i.e. "Conservation Area", Siu Lang Shui Site of Special Scientific Interest and Tai Lam Country Park (TLCP), important habitats (i.e. Siu Lang Shui Butterfly Habitat, Ma Wan Egretry, Day Roost and Night Roost, and Fung Shui Woodlands) and roosting ground (i.e. bat roosts inside Tai Lam Chung (TLC) Catchwater Tunnels) as far as possible. Direct impacts on the aboveground habitats in TLCP are also fully avoided.

Impact Minimization

10.2.1.4 Aside from minimizing habitat loss via adopting tunnelling design, refinement/shifting the alignment to minimize slope cutting and maximization of haul road extent overlapping with the main alignment.

10.2.1.5 All aboveground works have been located away from TLCP as far as practicable to minimize potential disturbance impacts on TLCP during both the construction and operational phases. The Project has adopted modified design and/or construction methods to minimise indirect impacts to habitats inevitably influenced by the Project, including TLC Catchwater Tunnel No. 6 and No. 8, as well as the eastern patch of Ching Uk Tsuen Fung Shui Woodland.

10.2.1.6 The section of Lam Tei Tunnel near So Kwun Wat is located at about 115m from the western portal of TLC Catchwater Tunnel No. 8, which has been maximized under various constraints and consideration for alignment. Tai Lam Chung Tunnel would unavoidably pass underneath TLC Catchwater Tunnel No. 6 due to technical infeasibility and avoidance of TLC Tsuen and other key landscape features. Design has optimized the separation distance of TLC Catchwater Tunnel No. 6 and the

proposed tunnel to a vertical distance of 20 metres (see **Section 9.8** in EIA Report for more detailed discussion). During tunnel construction, the disturbance will also be minimized through controlled blasting technique in all tunnels. Alternative tunnel construction method using tunnel boring machine (TBM) has also been considered for construction of tunnels. However, TBMs of the size required for dual 3-lane or dual 4-lane tunnels for hard rock ground condition are not currently available on the market.

10.2.1.7 The Project has also sought to minimize habitat fragmentation, direct injury/mortality to species of conservation importance, water quality impact, indirect disturbance (including disturbance to the bat roosts), groundwater infiltration and site runoff.

Compensation

10.2.1.8 Compensation is provided for inevitable direct impacts, including diversion of watercourse, compensatory woodland planting, translocation of aquatic and water-dependent species of conservation importance, preservation, transplantation and/or compensatory planting of floral species of conservation importance, and detailed reconnaissance dive survey.

10.2.2 Operational Phase

10.2.2.1 All aboveground project elements including portals, administration and ventilation buildings, at-grade roads, slip roads and viaducts are outside TLCP to minimize potential disturbance impacts on TLCP during the operational phase. Both direct and indirect ecological impacts are considered minor or insignificant. The ground-borne vibration caused by vehicles (on inflated wheels) in tunnels would be far less than that due to blasting during the construction phase. Maintenance works may be required inside Lam Tei Tunnel, So Kwun Wat Link Road and Tai Lam Chung Tunnel during the operational phase. However, compared to the drill-and-blast for tunnelling works, the aforesaid maintenance works during the operational phase is also of much small scale. The resultant disturbance is considered insignificant. No specific ecological mitigation measure is required.

10.3 Environmental Monitoring and Site Audit Requirements

10.3.1 Monitoring on Preservation, Transplantation and/or Compensatory Planting of Floral Species of Conservation Importance

10.3.1.1 Five floral species of conservation importance were recorded within the aboveground works areas (*Aquilaria sinensis*, *Diospyros vaccinoides*, *Gnetum luofuense*, *Ixonanthes reticulata*, and *Nepenthes mirabilis*). A detailed vegetation survey within the latest aboveground works areas should be conducted prior to commencement of works by a qualified plant ecologist with at least 8 years of relevant experience to identify and update the condition of any flora species of conservation importance, including but not limited to the five species recorded in the EIA Report. The flora species of conservation importance to be affected will be preferably preserved in-situ where feasible. Relevant measures (e.g. setting up plant protection zone) should be implemented, and monthly monitoring of the condition of the plant species of conservation importance to be preserved and site audit of the recommended protection measures should be conducted. A Plant Preservation and Transplantation Proposal will be submitted to relevant authorities (e.g. Agriculture, Fisheries and Conservation Department (AFCD)) for comments.

10.3.1.2 In case of inevitable direct impact to flora species of conservation importance, transplantation or compensatory planting should be provided. A monitoring programme to review and monitor the health condition of the plant species of conservation importance to be transplanted and/or compensated at the recipient site should be provided in the transplantation proposal and conducted by a qualified plant ecologist with at least 8 years of relevant experience. Additional mitigation and remedial measures (such as provision and establishment of replacement plantings) should be recommended in consultation with relevant authorities and implemented where appropriate should any undesirable/unanticipated impact be identified during the monitoring and site audit. Details of monitoring programme, such as monitoring frequency and parameters, maintenance works and recommended remedial measures, will be reviewed and updated by a qualified plant ecologist with at least 8 years of relevant experience during the detailed design stage of the Project in consultation with relevant authorities (e.g. AFCD and EPD) prior to commencement of any construction works.

10.3.2 Monitoring of Directly Impacted Fauna Species of Conservation Importance

10.3.2.1 Direct impact on sections of watercourses within the aboveground works areas in So Kwun Wat (i.e. W4, W23 and W24) and Siu Lam (i.e. W22), and thus aquatic and water-dependent fauna species of conservation importance recorded in some sections of the watercourses during the ecological surveys (such as Hong Kong Cascade Frog in W4), is anticipated, and translocation exercise as mitigation is recommended. A pre-construction survey should be conducted by a qualified ecologist with at least 8 years of relevant experience to identify if aquatic and water-dependent species of conservation importance, including but not limited to Hong Kong Cascade Frog, are present within all sections of watercourses falling within the aboveground works areas. A Translocation Proposal should be prepared by the qualified ecologist and submitted to relevant authorities (e.g. AFCD) for comments and agreement. The Translocation Proposal should present the findings from the pre-construction survey and the abundance of aquatic and water-dependent fauna species of conservation importance (such as Hong Kong Cascade Frog) recorded, suitable recipient site(s) (e.g. Watercourse W7), proposed capture and translocation methodology, timing of the translocation, implementation programme, monitoring programme and other protection measures. The translocation exercise shall be implemented prior to site formation works to avoid potential direct impact on the amphibian species of conservation importance.

10.3.3 Monitoring for Bats Roosting inside Tai Lam Chung Catchwater Tunnel Nos. 1, 5, 6, 7 and 8

Monitoring Approach

10.3.3.1 Bat monitoring aims to 1) infer up to date information about roosting bats, confirm bat usage and record the variation in the diversity and number of roosting bats inside TLC Catchwater Tunnel Nos. 1, 5, 6, 7 and 8 during the pre-blasting, blasting, post-blasting and operational phases; 2) The information collected in 1) will be used to evaluate the impacts on the roosting bats inside TLC Catchwater Tunnel Nos. 1, 5, 6, 7 and 8, and provide grounded basis for adaptive review of the Alert, Action and Limit Levels of ground-borne vibration based on the monitoring data, including ground-borne vibration and bat monitoring data to be collected for TLC Catchwater Tunnel Nos. 6 and 8 during pre-blasting and blasting phases, which will take up to date information about bat roosts into account (Should TLC

Catchwater Tunnel No. 5 be found to be occupied by roosting bats during the pre-blasting and blasting phases, the monitoring results related to TLC Catchwater Tunnel No. 5 should also be taken into account when reviewing the Alert, Action and Limit Levels.); 3) ensure effectiveness of the proposed mitigation measures and to avoid impacts on the bats roosting catchwater tunnels during the construction and operational phases of the Project and 4) help formulate remedial actions in case of need. The bat roost monitoring shall be supported by qualified ecologist(s) with bat surveying experience to be agreed with relevant authorities (i.e. AFCD and EPD). A detailed bat survey methodology will be submitted to authorities.

10.3.3.2 A Detailed Bat Monitoring and Remedial Plan should be devised and submitted to relevant authorities for agreement before the commencement of the tunnelling works in TLCP to monitor the effectiveness of the proposed mitigation measures and to inform the adaptive review of the Alert, Action and Limit Levels of the ground-borne vibration and bat monitoring. Bat roost monitoring shall cover roosting bats inside TLC Catchwater Tunnel Nos. 1, 5, 6, 7 and 8, and include two major components: measurement of ground-borne vibration and ecological monitoring on the status of the bat roosts by means of 1) acoustics survey; 2) emergence survey, 3) bat roost survey, as well as other methods considered appropriate (e.g. bat activity monitoring or installing static passive bat detector). Bat roost survey aims at estimating the abundance of roosting bats inside TLC Catchwater Tunnel Nos. 1, 5, 6, 7 and 8 representatively. The abundance of each bat species will be recorded during the bat roost survey. Bat emergence and acoustics surveys, meanwhile, supplement the findings of bat roost survey and aims to record bat species not easily to be detected during bat roost survey (e.g. bats hiding in crevices). The bat species and number of each bat species emerging from tunnel portals will be recorded. The bat roost monitoring programme should cover different stages including prior to the commencement of tunnel blasting works, during the tunnel blasting works and after the tunnel blasting works has been completed. A Detailed Bat Monitoring and Remedial Plan should be prepared and submitted to relevant authorities (i.e. AFCD, EPD and Water Supplies Department (WSD)) for agreement/consent prior to the commencement of the monitoring.

10.3.3.3 The methodology of acoustics survey, emergence survey and bat roost survey should follow the survey methods adopted in the EIA stage (see **Section 9.3.2** of the EIA Report). Acoustics survey by bat detector and emergence survey should be conducted at or near the portals of TLC Catchwater Tunnel Nos. 1, 5, 6, 7 and 8 for at least 1.5 hours, starting at dusk. Bat roost survey should be performed inside TLC Catchwater Tunnel Nos. 1, 5, 6, 7 and 8 during daytime. These surveys should be performed by experienced ecologists with bat surveying experience. Other means of monitoring, such as activity of roosting bats by suitable devices (e.g. thermal camera or static passive bat detector), will be considered at later stages and subject to agreement with AFCD and WSD. The date and duration of these surveys to be performed, bat species diversity, the abundance of each bat species to be recorded and photographic records of the bat species to be observed, should be reported to relevant authorities (i.e. AFCD and EPD). Regular adaptive review on the Alert, Action and Limit Levels of ground-borne vibration will be conducted over the course of tunnelling works and submitted to AFCD and EPD for agreement.

10.3.3.4 The monitoring details of ground-borne vibration and roosting bats inside TLC

Catchwater Tunnel Nos. 1, 5, 6, 7 and 8 are described in sections below and summarized in **Table 10.1**.

Ground-borne Vibration Monitoring

10.3.3.5 Ground-borne vibration at suitable locations inside and/or near the portals of TLC Catchwater Tunnel Nos. 1, 5, 6, 7 and 8 will be measured by data logger. The exact installation locations will be agreed with WSD. Monitoring data should be reported to relevant authorities (e.g. AFCD and EPD).

10.3.3.6 The relationship between ground-borne vibration level, timing of blasting works and distance between the blasting source and TLC Catchwater Tunnel Nos. 1, 5, 6, 7 and 8 (if there are blasting works) should be suitably presented in the bat monitoring report. If the level of ground-borne vibration to be measured exceeds the Action or Limit Levels (i.e. >6mm/s and >10mm/s respectively), mitigation measures to reduce the magnitude of ground-borne vibration, such as reviewing the charge weight and tunnelling method, will be reviewed and adopted. Regular adaptive review on the Alert, Action and Limit Levels of ground-borne vibration will be conducted over the course of tunnelling works.

Baseline Monitoring on Roosting Bats

10.3.3.7 In advance of the commencement of any tunnel blasting works for Lam Tei Tunnel, So Kwun Wat Link Road and Tai Lam Chung Tunnel (South Section), baseline ground-borne vibration monitoring and baseline bat roost monitoring programme, including acoustics survey and emergence survey and bat roost survey, should be conducted for each of TLC Catchwater Tunnel Nos. 1, 5, 6, 7 and 8 by ecologists to update and determine the abundance and diversity of bat species therein for a period of at least 9 months, covering the overwintering season (usually mid-December to mid-March of the following year), breeding season (usually May to September) and the time gap between the overwintering and breeding seasons (i.e. late March to April and October to early December). Acoustics survey and emergence survey should be carried out at least monthly, while the interval of bat roost survey is quarterly tentatively, subject to agreement with AFCD in prior. Other means of monitoring, such as bat activity monitoring by suitable devices, will be subject to agreement with AFCD and WSD. A pre-blasting bat monitoring report will be submitted to relevant authorities (e.g. AFCD and EPD) for comments.

Blasting Phase: Monitoring on Roosting Bats and Ground-borne Vibration

10.3.3.8 Ground-borne vibration monitoring will be conducted continuously throughout the entire tunnelling works for Lam Tei Tunnel, So Kwun Wat Link Road and Tai Lam Chung Tunnel (South Section), including all blasting works.

10.3.3.9 Monitoring on roosting bats inside TLC Catchwater Tunnel Nos. 1, 5, 6, 7 and 8 will commence when the first blasting works is conducted at either end of the tunnel alignment (i.e. when the blasting works is farthest to TLC Catchwater Tunnel Nos. 6 and 8 and roosting bats therein), and the frequencies of bat roost monitoring will be adjusted with the ground-borne vibration data to be recorded (which also indicate the distance of blasting works). In the first stage of bat roost monitoring, monthly bat acoustics survey and emergence survey, should be carried out, while the interval of bat roost survey is quarterly tentatively, subject to agreement with AFCD in prior. Other monitoring, such as bat activity monitoring,

by suitable devices will be subject to agreement with AFCD and WSD. A bat monitoring report for blasting phase will be submitted to relevant authorities (e.g. AFCD and EPD) for comments and agreement prior to blasting.

Blasting Phase: Action Plan if Ground-borne Vibration Level Reaches or Exceeds the Alert Level but Falls below the Action Level

10.3.3.10 For TLC Catchwater Tunnel Nos. 6 and 8, when the level of ground-borne vibration reaches the Alert Level (2.5mm/s), weekly acoustics survey and emergence survey will be conducted at catchwater tunnel portals by qualified ecologists during blasting. The interval of bat roost survey at this stage is monthly tentatively, subject to agreement with AFCD in prior, and will also be conducted on an as-needed basis. For TLC Catchwater Tunnel No. 6, the monitoring frequency of acoustics and emergence surveys will be further increased to daily, comprising surveys to be conducted at dusk and during blasting when the tunnelling works fronts of Tai Lam Chung Tunnel underpass, and the monitoring data will be submitted to the ET, IEC, relevant authorities (e.g. AFCD and EPD) and the Project Proponent within 24 hours. The frequency and interval of bat roost survey during the underpass duration will be agreed with AFCD in prior. The frequency of acoustics survey and emergence survey could be relaxed to weekly when tunnelling works fronts advance and leave the underpass location and the level of ground-borne vibration is reduced to the Alert Level.

10.3.3.11 For TLC Catchwater Tunnels Nos. 6 and 8, the monitoring frequency will revert to monthly when the ground-borne vibration level is below the Alert Level.

10.3.3.12 From the kick-off of the blasting phase monitoring, ET will conduct an adaptive review, based on the monitoring results from both ground-borne vibration monitoring and monitoring on roosting bats to be collected for TLC Catchwater Tunnel Nos. 6 and 8 during pre-blasting and blasting phases, on the Alert, Action and Limit Levels on ground-borne vibration level every 3 months throughout the course of the tunnelling works, or on an as-needed basis. Should TLC Catchwater Tunnel No. 5 be found to be occupied by roosting bats during the pre-blasting and blasting phases, the monitoring results related to TLC Catchwater Tunnel No. 5 should also be taken into account when reviewing the Alert, Action and Limit Levels. Through adopting a conservative approach which will be well supported by data and observations, the adaptive review will recommend if any adjustments are needed based on the monitoring results, and shall be endorsed by IEC and submitted to the relevant authorities (e.g. AFCD and EPD) for agreement.

Blasting Phase: Action Plan if Ground-borne Vibration Level Reaches or Exceeds the Action Level but Falls below the Limit Level

10.3.3.13 If ground-borne vibration reaches or exceeds the Action Level, ET and the Contractor will investigate whether the exceedance is significantly caused by the blasting works and if affirmative, ET and the qualified ecologist will investigate on any adverse impact on bats roosting inside TLC Catchwater Tunnel Nos. 6 and/or 8, the frequency of acoustics survey and emergence survey, which will also include surveys to be conducted at dusk time and during blasting, to be conducted at the portals of TLC Catchwater Tunnel Nos. 6 and 8 will be increased to daily until the level of ground-borne vibration drops below the Action Level, and the frequency and interval of bat roost survey will be agreed with AFCD. Should any adverse impacts be identified, ET/the Contractor will propose practicable remedial

measures, including but not limited to adjustment/optimization of construction methodology, to minimize impacts for agreement with the relevant authorities (e.g. AFCD and EPD). The Contractor will implement the measures to be agreed. An adaptive review will be submitted by ET and endorsed by IEC within a period to be agreed with relevant authorities (e.g. AFCD and EPD).

Blasting Phase: Action Plan when Ground-borne Vibration Level Reaches or Is above the Limit Level

10.3.3.14 When ground-borne vibration level reaches or exceeds the Limit Level, blasting will be suspended and alternative tunnelling method will be proposed and adopted upon agreement with relevant authorities (e.g. AFCD and EPD). Acoustics survey and emergence survey will be conducted at the portals of TLC Catchwater Tunnel Nos. 6 and 8, covering both at dusk and at the time of implementing the alternative tunnelling method, will be performed daily until it is accepted by relevant authorities that the alternative tunnelling method is satisfactory and the level of ground-borne vibration falls below the Action Level.

Any Significant Bat Abnormality Observed during the Construction Phase

10.3.3.15 In case of any significant abnormality (e.g. unaccountable fatality of bats, emergence of a significant number of bats from TLC Catchwater Tunnel Nos. 6 and 8 during daytime, etc.) observed during the construction phase, even there is no exceedance on Action Level or Limit Level, blasting will be suspended, and ET and the qualified ecologists will investigate the cause of the abnormality and if it is related to with the construction works of the Project, including tunnel blasting works and other construction activities in the vicinity. The ET and the Contractor should recommend and implement remedial measures (e.g. further review charge weight or provide further mitigation for construction activities other than blasting), in consultation and agree with the relevant authorities (e.g. AFCD and EPD).

Site Audit and Inspection

10.3.3.16 Site audit and inspection will be undertaken during the construction phase to ensure that the mitigation measures are properly implemented and all aboveground works areas do not encroach on TLCP and all aboveground construction activities are confined within the works area boundaries.

Post-Blasting Phase Monitoring on Ground-borne Vibration and Roosting Bats

10.3.3.17 After all blasting works has been completed, post-blasting ground-borne vibration monitoring and bat roost monitoring will be conducted for TLC Catchwater Tunnel Nos. 1, 5, 6, 7 and 8 for at least 9 months. The method and frequency of the monitoring will follow that to be adopted during the baseline monitoring, covering the overwintering season (usually mid-December to mid-March of the following year), breeding season (usually May to September) and the time gap between the overwintering and breeding seasons (i.e. late March to April and October to early December). Acoustics survey and emergence survey should be carried out at least monthly, while the interval of bat roost survey is quarterly tentatively, subject to agreement with AFCD in prior. A bat monitoring report for post-blasting phase monitoring will be submitted to relevant authorities (e.g. AFCD and EPD) for comments.

Operational Phase Monitoring on Ground-borne Vibration and Roosting Bats

10.3.3.18 During the first year of the operational phase, both ground-borne vibration and bat roost monitoring will be conducted for TLC Catchwater Tunnel Nos. 1, 5, 6, 7 and 8 for at least 9 months. The method and frequency of the monitoring will follow that to be adopted during the baseline monitoring and the post-blasting monitoring, except bat roost survey to be subject to agreement in prior with AFCD. A bat monitoring report for operational phase monitoring will be submitted to relevant authorities (e.g. AFCD and EPD) for comments.

10.3.4 Monitoring of Compensation Woodland for Unavoidable Woodland Loss

10.3.4.1 The permanent loss of mixed woodland outside TLCP will be mitigated by compensatory woodland planting in Tuen Mun West, which is near the Pillar Point magazine site but falls outside the assessment area. Should reinstatement of the extent of mixed woodland to be temporarily affected be confirmed not feasible in the detailed design stage, the loss will also be compensated in the same compensatory woodland planting site in Tuen Mun West, the extent and area of which are subject to change. The planting list of tree species should include native tree species which will be directly impacted by the Project and/or those recorded within the assessment area. Upon completion of the compensatory woodland planting works, a maintenance and monitoring programme on the compensation woodland at the compensatory woodland planting site should be undertaken during establishment period which normally takes at least 9 years. Regular maintenance for the seedlings/saplings to be planted, including watering, weeding and pest control should be provided. Subject to the health condition and the survival of the planted trees, replanting works should be conducted to replace the dead or poor health individual with same species, where necessary. A monitoring programme would be provided in the Woodland Compensation Plan to be prepared by a qualified plant ecologist with at least 8 years relevant experience to monitor the health condition and survival of the seedlings/saplings to be planted. Details of monitoring programme such as monitoring frequency and parameters, and maintenance works would be recommended, reviewed and updated by a qualified plant ecologist at least 8 years of relevant experience during the detailed design phase of the Project in consultation with relevant authorities (e.g. AFCD and EPD) prior to commencement of any construction activity. A Woodland Compensation Plan will be submitted to relevant authorities (e.g. AFCD) for comments.

10.3.5 Monitoring of Mitigation Measures on Groundwater Infiltration

10.3.5.1 Although it is anticipated that the underground tunnelling works would not generate adverse groundwater infiltration impacts with proper implementation of groundwater infiltration minimization measures, surface water level monitoring at major natural watercourses within TLCP and in the vicinity of the tunnelling works will be conducted during the construction and operational phase. Monthly monitoring should be conducted at watercourses to be selected by ET to monitor water depth, water velocity and other relevant parameters, record and evaluate if any abnormal significant decrease in water level unlikely to be associated with changes in weather patterns, arises from the Project. In case of any abnormal and significant decrease in 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. AFCD).

10.3.5.2 Additional ecological mitigation measures, monitoring or site audit for groundwater infiltration are not required for both construction and operational phases.

10.3.6 Pre-construction Detailed Reconnaissance Dive Survey

10.3.6.1 Direct impact on the existing hard and soft coral species (i.e. *Oulastrea crispata*, ahermatypic cup coral *Balanophyllia* sp., and gorgonian *Guaiagorgia* sp.) is expected due to the reclamation and seawall construction works at TLT. Although the coverage and diversity of hard and soft coral recorded within the reclamation site is considered low, a detailed reconnaissance dive survey should be conducted prior to the construction phase, especially before the start of marine works. The detailed reconnaissance dive survey should be conducted by qualified SCUBA divers, who are experienced in SCUBA diving, possessed knowledge related to marine organisms and ability to identify both hard and soft coral species. The location of hard and soft coral should be indicated within the reclamation site at TLT. The presence of hard and/or soft coral species, other than *Oulastrea crispata*, ahermatypic cup coral *Balanophyllia* sp., and gorgonian *Guaiagorgia* sp. should also be inspected if any. The feasibility of coral translocation should be assessed when there is a need to conduct coral translocation, to minimize the loss of coral species. If coral translocation is confirmed necessary, a detailed coral translocation proposal should be submitted and approved by relevant government authorities (e.g. AFCD and EPD) prior to commencement of marine works and/or marine related constructions works.

Table 10.1 Event and Action Plan for Ground-borne Vibration and Bat Roost Monitoring during Pre-blasting, Blasting, Post-blasting and Operational Phases

Types of actions	Pre-Blasting	Blasting events					Post-Blasting Phase (After all blasting works has been completed) [1]	Operational Phase [1]
		Range of ground-borne vibration						
	Baseline (Prior to any blasting) [1]	**Below Alert Level (i.e. <2.5mm/s) upon commencement of blasting**	**At or above Alert Level but below Action Level (i.e. ≥2.5mm/s but <6mm/s)**	**When the tunnelling works fronts of Tai Lam Chung Tunnel (South Section) underpasses Tai Lam Chung Catchwater Tunnel No. 6**	**At or above Action Level but below Limit Level (i.e. ≥6mm/s but <10mm/s)**	**At or above Limit Level (i.e. ≥10mm/s)**		
Continuous ground-borne vibration monitoring to be agreed, inside and/or near the portals of catchwater tunnels	✓	✓	✓	✓	✓	✓	✓	✓
Bat emergence and acoustics survey at catchwater tunnel portals	Monthly at dusk	Monthly at dusk	Weekly (including surveys to be conducted at dusk and during blasting)	Daily when the tunnelling works fronts of Tai Lam Chung Tunnel (south section) underpass Tai Lam Chung Catchwater Tunnel No. 6 Could be relaxed to weekly when tunnelling works fronts advance and leave the underpass location and the level of ground-borne	Daily (including surveys to be conducted at dusk and during blasting) until the level of ground-borne vibration drops below the Action Level	Daily both at dusk and during the implementation of alternative tunnelling method until the level of ground-borne vibration drops back to Action Level	Monthly at dusk	Monthly at dusk

Types of actions	Pre-Blasting	Blasting events					Post-Blasting Phase (After all blasting works has been completed) [1]	Operational Phase [1]
		Range of ground-borne vibration						
	Baseline (Prior to any blasting) [1]	**Below Alert Level (i.e. <2.5mm/s) upon commencement of blasting**	**At or above Alert Level but below Action Level (i.e. ≥2.5mm/s but <6mm/s)**	**When the tunnelling works fronts of Tai Lam Chung Tunnel (South Section) underpasses Tai Lam Chung Catchwater Tunnel No. 6**	**At or above Action Level but below Limit Level (i.e. ≥6mm/s but <10mm/s)**	**At or above Limit Level (i.e. ≥10mm/s)**		
				vibration is reduced to the Alert Level (2.5mm/s)				
Bat roost survey	Quarterly tentatively, subject to agreement with AFCD	Quarterly tentatively, subject to agreement with AFCD	Monthly tentatively, subject to agreement with AFCD, and also on an as-needed basis	Intervals to be agreed with AFCD	Intervals to be agreed with AFCD	Intervals to be agreed with AFCD	Quarterly tentatively, subject to agreement with AFCD	Quarterly tentatively, subject to agreement with AFCD
Bat activity monitoring by suitable devices	Subject to agreement with AFCD and WSD	Subject to agreement with AFCD and WSD	Subject to agreement with AFCD and WSD	Subject to agreement with AFCD and WSD	Subject to agreement with AFCD and WSD	Subject to agreement with AFCD and WSD	Subject to agreement with AFCD and WSD	Subject to agreement with AFCD and WSD
Specific or Remedial actions	/	/	ET to conduct a review on Alert, Action and Limit Levels every 3 months or at as-needed basis. The adaptive review report shall be endorsed by IEC and submitted to relevant authorities for agreement. In case of any significant abnormality (e.g.	Monitoring data to be submitted to ET, IEC, relevant authorities (e.g. AFCD and EPD) and Project Proponent within 24 hours In case of any significant abnormality (e.g. unaccountable fatality of bats, emergence of a significant number of bats from the concerned catchwater tunnels during	1. Actions to be adopted at or above the Alert Level but below the Action Level (≥2.5mm/s but <6mm/s); 2. ET and the Contractor to investigate whether the	1. Suspend blasting 2. Propose and adopt alternative tunnelling method upon agreement with relevant authorities (e.g. AFCD and EPD)	/	/

Types of actions	Pre-Blasting	Blasting events					Post-Blasting Phase (After all blasting works has been completed) [1]	Operational Phase [1]
		Range of ground-borne vibration						
	Baseline (Prior to any blasting) [1]	Below Alert Level (i.e. <2.5mm/s) upon commencement of blasting	At or above Alert Level but below Action Level (i.e. ≥2.5mm/s but <6mm/s)	When the tunnelling works fronts of Tai Lam Chung Tunnel (South Section) underpasses Tai Lam Chung Catchwater Tunnel No. 6	At or above Action Level but below Limit Level (i.e. ≥6mm/s but <10mm/s)	At or above Limit Level (i.e. ≥10mm/s)		
			unaccountable fatality of bats, emergence of a significant number of bats from TLC Catchwater Tunnel Nos. 6 and/or 8 during daytime, etc.) observed during the construction phase, even there is no exceedance on Action Level or Limit Level, blasting will be suspended, and ET and the qualified ecologists will investigate the cause of the abnormality and if it is related to the construction works of the Project, including tunnel blasting works and other construction activities in the vicinity of the Project. The ET and the Contractor should recommend and	daytime, etc.) observed during the construction phase, even there is no exceedance on Action Level or Limit Level, blasting will be suspended, and ET and the qualified ecologists will investigate the cause of the abnormality and if it is related to the construction works of the Project, including tunnel blasting works and other construction activities in the vicinity of the Project. The ET and the Contractor should recommend and implement remedial measures agreed by relevant authorities (e.g. AFCD and EPD).	exceedance is significantly caused by the blasting works; 3. If affirmative, ET to investigate any adverse impacts on bats roosting inside TLC Catchwater Tunnel Nos. 6 and/or 8; 4. ET to prepare and submit an adaptive review within a period to be agreed with relevant authorities (e.g. AFCD			

Types of actions	Pre-Blasting	Blasting events					Post-Blasting Phase (After all blasting works has been completed) [1]	Operational Phase [1]
		Range of ground-borne vibration						
	Baseline (Prior to any blasting) [1]	Below Alert Level (i.e. <2.5mm/s) upon commencement of blasting	At or above Alert Level but below Action Level (i.e. ≥2.5mm/s but <6mm/s)	When the tunnelling works fronts of Tai Lam Chung Tunnel (South Section) underpasses Tai Lam Chung Catchwater Tunnel No. 6	At or above Action Level but below Limit Level (i.e. ≥6mm/s but <10mm/s)	At or above Limit Level (i.e. ≥10mm/s)		
			implement remedial measures to be agreed with relevant authorities (e.g. AFCD and EPD).		and EPD). The review shall be endorsed by IEC; 5. ET/ Contractor to propose practicable mitigation measures (including review of construction methodology) to minimize impacts for agreement with relevant authorities; and 6. Contractor to implement the measures to			

Types of actions	Pre-Blasting	Blasting events					Post-Blasting Phase (After all blasting works has been completed) [1]	Operational Phase [1]
		Range of ground-borne vibration						
	Baseline (Prior to any blasting) [1]	Below Alert Level (i.e. <2.5mm/s) upon commencement of blasting	At or above Alert Level but below Action Level (i.e. ≥2.5mm/s but <6mm/s)	When the tunnelling works fronts of Tai Lam Chung Tunnel (South Section) underpasses Tai Lam Chung Catchwater Tunnel No. 6	At or above Action Level but below Limit Level (i.e. ≥6mm/s but <10mm/s)	At or above Limit Level (i.e. ≥10mm/s)		
					be agreed with relevant authorities. In case of any significant abnormality (e.g. unaccountable fatality of bats, emergence of a significant number of bats from TLC Catchwater Tunnel Nos. 6 and/or 8 during daytime, etc.) observed during the construction phase, even there is no exceedance on Action Level or Limit Level, blasting will be suspended, and ET and the			

Types of actions	Pre-Blasting	Blasting events					Post-Blasting Phase (After all blasting works has been completed) [1]	Operational Phase [1]
		Range of ground-borne vibration						
	Baseline (Prior to any blasting) [1]	Below Alert Level (i.e. <2.5mm/s) upon commencement of blasting	At or above Alert Level but below Action Level (i.e. ≥2.5mm/s but <6mm/s)	When the tunnelling works fronts of Tai Lam Chung Tunnel (South Section) underpasses Tai Lam Chung Catchwater Tunnel No. 6	At or above Action Level but below Limit Level (i.e. ≥6mm/s but <10mm/s)	At or above Limit Level (i.e. ≥10mm/s)		
					qualified ecologists will investigate the cause of the abnormality and if it is related to with the construction works of the Project, including tunnel blasting works and other construction activities in the vicinity of the Project. The ET and the Contractor should recommend and implement remedial measures to be agreed with relevant authorities (e.g. AFCD and EPD).			

Notes:

[1] The pre-blasting baseline monitoring and post-blasting monitoring will be at least 9 months in duration.

[2] ET should be supported by qualified ecologists with bat surveying experience and to be agreed with relevant authorities (i.e. AFCD and EPD).

[3] Bat and ground-borne vibration monitoring plan is preliminary at this stage and an adaptive review on the Alert, Action and Limit Levels will be carried out during the course of the tunnelling works

11 Fisheries

11.1 Introduction

11.1.1.1 The EIA Report concluded that potential fisheries impacts due to construction and operation of the Project are considered minor. Specific mitigation measures for fisheries are not required. Nevertheless, potential fisheries resources would be affected by indirect water quality impact which would be controlled by construction site best practices. Hence, adverse fisheries impacts are not anticipated in both construction and operational phases.

11.2 Mitigation Measures

11.2.1.1 No fisheries-specific mitigation measures would be required during both construction and operational phases. Mitigation measures recommended in the water quality impact assessment will also minimise any adverse impacts on fisheries, including silt curtain will be provided during the construction phase at the reclamation site at Tsing Lung Tau. Also, other recommended practices for other potential sources of water quality impacts during the construction phase should also be implemented where applicable, as summarized in the EMIS in **Appendix 4.1**.

11.3 Environmental Monitoring and Site Audit Requirement

11.3.1.1 As no unacceptable adverse impacts have been predicted to occur during both the construction and operational phase of the Project, fisheries monitoring is not considered necessary. Site inspections with focus on water quality during construction phase should be carried out to monitor any malpractice leading to deterioration of water quality of the surrounding which may in turn affect the fisheries sensitive receivers (i.e. a monitoring and audit programme aims to ensure that the released suspended solid concentrations from reclamation filling and stockpiling activities, also acts as a protection against impacts to fisheries sensitive receivers). Also, a water quality monitoring location has been proposed for the Ma Wan Fish Culture Zone throughout the entire construction period, to monitor the water quality nearby. As there are no anticipated adverse fisheries impacts during operational phase, environmental monitoring and audit requirements are not required.

12 Landscape and Visual

12.1 Introduction

12.1.1.1 The EIA has recommended that EM&A for landscape and visual resources is undertaken during the design, construction and operational phases of the Project. The design, implementation and maintenance of landscape mitigation measures should be checked to ensure that any potential conflicts between the proposed landscape measures and any other works of the Project would be resolved at early as practical without affecting the implementation of the mitigation measures.

12.2 Mitigation Measures

12.2.1.1 The landscape and visual impact assessment of the EIA Report proposes a number of mitigation measures to ameliorate the landscape and visual impacts of the Project. These measures are listed in **Table 12.1** below and the implementation is summarised in the EMIS in **Appendix 4.1**.

Table 12.1 Mitigation Measures for the Construction and Operational Phases

Mitigation Measure Code	Summary Description	Mitigate Landscape Impacts	Mitigate Visual Impacts
Construction Phase			
CM01	Tree Protection and Preservation	Y	Y
CM02	Tree Transplanting	Y	Y
CM03	Works Area and Temporary Works Areas	Y	Y
CM04	Advance Implementation of Mitigation Planting	Y	Y
CM05	Decorative Screen Hoarding	-	Y
CM06	Control of Night-time Lighting	-	Y
Operational Phase			
OM01	Integrated Design Approach	Y	Y
OM02	Roadside Buffer Planting / Roadside Planting	Y	Y
OM03	Compensatory Planting Proposals	Y	Y
OM04	Post-Planting Monitoring	Y	Y
OM05	Greening Works on Slopes and associated Structure	Y	Y
OM06	Design of Tunnel Portals and Landscape Treatment	Y	Y
OM07	Design of an Elegant Bridge Structure and Approach Roads	-	Y

Mitigation Measure Code	Summary Description	Mitigate Landscape Impacts	Mitigate Visual Impacts
OM08	Provision of Visually Pleasing Aesthetic Treatment of Noise Mitigation Measures	-	Y
OM09	Provision of Green Roof	Y	Y

12.2.1.2 Mitigation measures to be implemented during construction should be adopted from the start of construction and be in place throughout the entire construction period. Mitigation measures to be implemented during operation should be integrated into the detailed design and built as part of the construction works so that they are in place on commissioning of the Project as far as practical.

12.3 Environmental Monitoring and Audit Requirement

12.3.1.1 Site audit should be undertaken during the construction phase of the Project to check that the proposed landscape and visual mitigation measures are properly implemented and maintained as per their intended objectives. Site inspections should be undertaken monthly by the tree specialist or a qualified arborist or endorsed by a registered landscape architect engaged by ET during the construction period.

13 Cultural Heritage

13.1 Introduction

13.1.1.1 No sites of archaeological interest would be affected by the Project and associated works. An archaeological field survey should be undertaken within an area of some archaeological potential identified at east of Area A at the lower slopes to the north of Lam Tei Quarry within the works area when access is available before the site formation and construction phase.

13.1.1.2 The identified built heritage sites are located separated from the proposed and associated works with the exception of Grade 3 Former Perowne Barracks, Gurkha Temple by some distances. The relevant works drawings and proposal shall be submitted to Antiquities and Monuments Office (AMO) for consideration. Mitigation measures required during and after the construction phase include a condition survey before and after the construction phase, ongoing vibration monitoring and any other monitoring identified in the condition survey and a buffer zone to provide physical separation between the heritage site from the works.

13.1.1.3 For marine archaeology, geophysical survey of Marine Archaeological Investigation (MAI) was conducted and anomalies were identified. However, due to safety issue to dive near the Ha Pang Fairway which is heavily utilized by marine vessels, marine diver survey of MAI could not be conducted without fencing off the diving area. Based on previous Marine Archaeological Investigation under "Route 10 – North Lantau to Tsing Lung Tau Section" project, of which its study area partially overlapped with the Study Area of the Project, there were no objects with marine archaeological value identified. Therefore, it is recommended to conduct the marine diver survey during detailed design stage when fencing off of the diving area can be safely implemented but prior to any reclamation works (see Section 12 in the EIA Report for more detailed discussion).

13.1.1.4 AMO should be informed immediately in case of discovery of antiquities / supposed antiquities, or buildings / structures both at-grade and underground with potential heritage value that would likely be affected by the development in the course of the project works in accordance for discussion of appropriate mitigation measures to be agreed by AMO before implementation by the project proponent to the satisfaction of AMO.

13.2 Mitigation Measures

13.2.1 Construction Phase

Terrestrial Archaeology

13.2.1.1 An archaeological field survey will be conducted at east of Area A at the lower slopes to the north of Lam Tei Quarry within the works area when access is available before the site formation and construction phase. Subject to the result(s) of the survey, mitigation measures, if necessary, will be proposed for AMO's agreement before implementing to the satisfaction of AMO.

Built Heritage

13.2.1.2 The Condition Survey Report for a Grade 3 structure (i.e. the Former Perowne Barracks, Gurkha Temple) should be undertaken by qualified building surveyor or engineer prior and after the construction phase. The Condition Survey Report should contain descriptions of the structure, identification of fragile elements, an appraisal of the condition and working methods for any proposed monitoring and precautionary measures that are recommended. The Condition Survey Report for the Graded Historic Building must be submitted to AMO for comment before commencement and after construction activities. The location of proposed monitoring points in the building should avoid damaging the historic fabric and agreed by the owner and AMO. The contractor should implement the approved monitoring and precautionary measures.

13.2.1.3 Any vibration and building movement induced from the construction works should be strictly monitored to ensure no disturbance and physical damages made to the heritage site during the course of works.

13.2.1.4 Monitoring proposal for the heritage sites, including checkpoint locations, installation details, response actions for each of the Alert/ Alarm/ Action (3As) levels and frequency of monitoring should be submitted for AMO's consideration. Recommended 3As levels for Grade 3 heritage site are as below:

Table 13.1 Recommended Alert / Alarm / Action Levels

Type of Monitoring for	Alert	Alarm	Action
Vibration (PPV)	5mm/s	6mm/s	7.5mm/s
Settlement	*6mm*	*8mm*	*10mm*
Tilting	*1/2000*	*1/1500*	*1/1000*

Note:
[1] Monitoring criteria would be subjected to review upon updates of grading status of heritage sites.

13.2.1.5 In addition, the monitoring schedule, location of monitoring equipment, frequency of monitoring, reporting requirements, and action plan should be included in the condition survey report.

13.2.1.6 A buffer zone should be provided to separate the Former Perowne Barracks, Gurkha Temple building from the construction works. The buffer zone should be clearly marked out by temporary fencing. The buffer zone should be made at least 5m from the proposed works or, if not possible, as large as the site restrictions allow. Special attention should be paid to avoid adverse physical impact arising from the construction of the Project. Design proposal, method of works and choice of machinery will be designed to minimize adverse impacts to the heritage site. Foundation information of the historic structure shall be verified on site if needed, sufficient lateral support should be provided and de-watering (if required) should be carried out with great cautions to control ground movement and change of ground water regime at the heritage site.

Marine Archaeology

13.2.1.7 Marine diver survey shall be conducted during the detailed design stage when fencing off can be implemented but prior to any reclamation works. The Contractor shall engage a qualified marine archaeologist to conduct the MAI. The "Licence to Excavate and Search for Antiquities" shall be obtained before the commencement of excavation and search for antiquities. Should there be any marine archaeological resources identified during the MAI, proper mitigation measures including but not limited to rescue excavation shall be proposed for agreement with AMO before the commencement of reclamation works.

13.2.1.8 In addition, for marine ground investigation (GI), which would be required prior to the reclamation works or the diver survey, it is recommended that the marine GI contractor shall be instructed to avoid all the anomalies identified by the geophysical survey conducted, by allowing sufficient setback distance (around 50m) from the anomalies.

13.2.1.9 However, in case antiquities or supposed antiquities are identified during the construction works, the works should be suspended, and the project proponent should notify AMO immediately.

13.2.2 Operational Phase

13.2.2.1 As no direct impact to archaeology and built heritage are anticipated, mitigation measures are not required for operational phase.

13.3 Environmental Monitoring and Site Audit Requirements

13.3.1 Construction Phase

13.3.1.1 Identified built heritages are located at the Project Site and hence mitigation measures and site audit are required for construction phase. Moreover, ongoing vibration monitoring, any other monitoring identified in the condition survey and a buffer zone to physical separate the heritage site from the works are required.

13.3.1.2 As no archaeological impact is expected during both construction and operational phases of the Project, monitoring and audit are considered not necessary.

12.1.1.1 As anomalies were identified from geophysical survey, marine diver survey shall be conducted in detailed design stage but prior to commencement of reclamation works. In addition, the marine GI Contractor shall avoid all anomalies identified by allowing sufficient setback distance (around 50m) from the anomalies. In case of discovery of any antiquities or supposed antiquities in the course of marine GI works, the project proponent is required to inform AMO immediately for discussion of appropriate mitigation measures to be agreed by AMO before implementation by the project proponent to the satisfaction of AMO. Besides, any marine GI works at the anomalies is required to be conducted after confirming their nature by MAI and seeking agreement with AMO. Site audit is required before the commencement of reclamation works.

13.3.2 Operational Phase

13.3.2.1 Environmental monitoring and site audit are not required during operational phase.

14 Site Environmental Audit

14.1 Site Inspection

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

14.1.1.2 The ET shall be responsible for formulating the environmental site inspection programme as well as the deficiency and action reporting system, and for carrying out the site inspections. The proposal for rectification, if any, should be prepared and submitted to the ET Leader and IEC by the Contractor.

14.1.1.3 Regular site inspections shall be carried out and led by the PMR and attended by the Contractor and ET at least once per week during the construction phase. The IEC shall undertake regular site audit at least once per month to assess the performance of the Contractor(s). 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 conditions of locations outside the works area which is likely to be affected, directly or indirectly, by the construction site activities of the Project. The ET shall make reference to the following information in conducting the inspection. During the inspection, the following information should be referred to:

(i) EIA Report and the Manual recommendations on environmental protection and pollution control mitigation measures;

(ii) Ongoing results of the EM&A programme;

(iii) Works progress and programme;

(iv) Individual works methodology proposals (which shall include the proposal on associated pollution control measures);

(v) Contract specifications on environmental protection;

(vi) Relevant environmental protection and pollution control legislations; and

(vii) Previous site inspection results undertaken by the ET and others.

14.1.1.4 The Contractor shall keep the PMR and ET Leader updated with all the relevant environmental related information on the construction contract necessary for him to carry out the site inspections. Site inspection results and associated recommendations for improvements to the environmental protection and pollution control efforts should be recorded and followed up by the Contractor in an agreed time-frame. The Contractor shall follow the procedures and time-frame as stipulated in the environmental site inspection, and the deficiency and action reporting system formulated by the ET, to report on any remedial measures subsequent to the site inspections.

14.1.1.5 The PMR, ET and the Contractor should also carry out ad-hoc site inspections if significant environmental problems are identified. Inspections may also be required subsequent to receipt of a valid environmental complaint, or as part of the investigation work, as specified in the Event and Action Plans for the EM&A programme.

14.2 Environmental Compliance

14.2.1.1 There are statutory requirements on environmental protection and pollution control requirements with which construction activities must comply.

14.2.1.2 In order to ensure the works would comply with statutory requirements, all method statements of works should be submitted by the Contractor to the PMR for approval and to the ET Leader to ensure sufficient environmental protection and pollution control measures have been included. EMIS is summarised in **Appendix 4.1**. Any proposed changes to the mitigation measures shall be certified by the ET Leader and verified by the IEC as conforming to the relevant information and recommendations contained in the EIA Report.

14.2.1.3 The PMR and ET shall also review the progress and programme of the works to check that relevant environmental legislation has not been violated, and that any foreseeable potential for violating laws can be prevented.

14.2.1.4 The Contractor should provide the update of the relevant documents to the ET Leader so that checking can be carried out. The document shall at least include the updated works progress reports, updated works programme, method statements, any application letters for different licenses / permits under the environmental protection laws, and copies of all valid licenses / permits. The site diary and environmental records shall also be available for inspection by the relevant parties.

14.2.1.5 After reviewing the document, the ET shall advise the IEC and the Contractor of any non-compliance with legislative requirements on environmental protection and pollution control so that they can timely take follow-up actions as appropriate. If the follow-up actions still result in potential violation of environmental protection and pollution control requirements, the PMR and ET should provide further advice to the Contractor to take remedial action to resolve the problem.

14.2.1.6 Upon receipt of the advice, the Contractor shall undertake immediate actions to correct the situation. The PMR and ET shall follow up to ensure that appropriate action has been taken in order to satisfy legal requirements.

14.3 Choice of Construction Method

14.3.1.1 At times during the construction phase, the Contractor may submit method statements for various aspects of construction. This state of affairs would only apply to those construction methods that the EIA has not imposed conditions while for construction methods that have been assessed in the EIA, the Contractor is bound to follow the requirements and recommendations in the EIA study. The Contractor's options for alternative construction methods may introduce adverse environmental impacts into the Project. It is the responsibility of the Contractor and ET, in accordance with established standards, guidelines and EIA study recommendations and requirements, to review and determine the adequacy of the environmental protection and pollution control measures in the Contractor's proposal in order to ensure no unacceptable impacts would result. To achieve this

end, the ET shall provide a copy of the Proactive Environmental Protection Proforma as shown in **Appendix 14.1** to the IEC for approval before commencement of work. The IEC should audit the review of the construction method and endorse the proposal on the basis of no adverse environmental impacts.

14.4 Environment Complaints

14.4.1.1 The following procedures should be undertaken upon receipt of any environmental complaint:

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

15 Reporting

15.1 General

15.1.1.1 Reports can be provided in an electronic medium upon agreeing the format with the PMR 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 shall also be submitted on diskettes or other approved medium. The formats for monitoring data to be submitted shall be separately agreed.

15.1.1.2 Types of reports that the ET shall prepare and submit include monthly EM&A report and final EM&A review report. In accordance with Annex 21 of the EIAO-TM, a copy of the monthly reports and final EM&A review report shall be made available to the Director of Environmental Protection.

15.2 Baseline Monitoring Report

15.2.1.1 The baseline monitoring report shall include at least 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) 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;
- Monitoring date, time, frequency and duration; and
- QA / QC results and detection limits.

(v) Details of 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 monitoring results.

(vi) Determination of the Action and Limit levels for each monitoring parameter and statistical analysis of the baseline data;

(vii) Revisions for inclusion in the Manual; and

(viii) Comments, recommendations and conclusions.

15.2.1.2 The ET should prepare and submit a baseline monitoring report at least two weeks before commencement of construction of the Project. Copies of the baseline monitoring report should be submitted to the IEC, the PMR and EPD. The ET should liaise with the relevant parties on the exact number of copies required.

15.3 Monthly Monitoring Reports

15.3.1.1 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 and endorsed by the IEC. The EM&A report shall be prepared and submitted to EPD within 10 working days of the end of each reporting month, with the first report within the month after major construction works commences. Copies of each monthly EM&A report shall be submitted to the following parties: the IEC, the PMR and EPD. Before submission of the first EM&A report, the ET shall liaise with the parties on the required number of copies and format of the monthly reports in both hard copy and electronic medium.

15.3.1.2 The ET 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.

15.3.2 First Monthly EM&A Report

15.3.2.1 The first monthly EM&A report shall include at least the following:

(i) Executive summary (1-2 pages):

- Breaches of Action and Limit levels;
- Compliant 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;
- Programme;
- Management structure; and
- The work undertaken during the month.

(iii) Environmental status:

- Advice on the status of statutory environmental compliance such as the status of compliance with the environmental permit (EP) conditions under the EIAO, submission status under the EP and implementation status of mitigation measures;
- Works undertaken during the month with illustrations (such as location of works, daily excavation rate, etc.); and
- Drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring stations (with co-ordinates of the monitoring locations).

(iv) A brief summary of EM&A requirements including:

- All monitoring parameters;

- Environmental quality performance limits (Action and Limit levels);
- Event and Action Plans;
- Environmental mitigation measures, as recommended in the EIA Report; and
- Environmental requirements in contract documents.

(v) Implementation status:

- Advice on the implementation status of environmental protection and pollution control / mitigation measures, as recommended in the EIA Report.

(vi) Monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology;
- Name of laboratory and types of equipment used and calibration details;
- Monitoring parameters;
- Monitoring locations;
- Monitoring date, time, frequency, and duration;
- Weather conditions during the period;
- Any other factors which might affect the monitoring results; and
- QA / QC results and detection limits.

(vii) Report on non-compliance, complaints, and notifications of summons and successful prosecutions:

- Record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- Record of all complaints received 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 legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary;
- Review of the reasons for and the implications of non-compliances, complaints, summons and prosecutions including review of pollution sources and working procedures; and
- Description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.

(viii) Others:

- An account of the future key issues as reviewed from the works programme and 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;
- Record of any project changes from the originally proposed as described in the EIA Report (e.g. construction methods, mitigation proposals, design changes, etc.); and
- Comments (for example, effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.

15.3.3 Subsequent Monthly EM&A Reports

15.3.3.1 Subsequent monthly EM&A reports shall include at least the following:

(i) Executive summary (1-2 pages):

- Breaches of Action and Limit levels;
- Compliant 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;
- Programme;
- Management structure;
- The work undertaken during the month; and
- Any updates as needed to the scope of works and construction methodologies.

(iii) Environmental status:

- Advice on the status of statutory environmental compliance such as the status of compliance with the EP conditions under the EIAO, submission status under the EP and implementation status of mitigation measures;
- Works undertaken during the month with illustrations (such as location of works, daily excavation rate, etc.); and
- Drawings showing the Project area, any environmental sensitive receivers and the locations of the monitoring stations (with co-ordinates of the monitoring locations).

(iv) Implementation status:

- Advice on the implementation status of environmental protection and pollution control / mitigation measures, as recommended in the EIA Report.

(v) Monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology;
- Name of laboratory and types of equipment used and calibration details;
- Monitoring parameters;
- Monitoring locations;
- Monitoring date, time, frequency, and duration;
- Weather conditions during the period;
- Any other factors which might affect the monitoring results; and
- QA / QC results and detection limits.

(vi) Report on non-compliance, complaints, and notifications of summons and successful prosecutions:

- Record of all non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- Record of all complaints received 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 legislation, including locations and nature of the breaches, investigation, follow-up actions taken, results and summary;
- Review of the reasons for and the implications of non-compliances, complaints, summons and prosecutions including review of pollution sources and working procedures; and
- Description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance.

(vii) 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;
- Record of any project changes from the originally proposed as described in the EIA (e.g. construction methods, mitigation proposals, design changes, etc.); and

- Comments (for example, effectiveness and efficiency of the mitigation measures), recommendations (for example, any improvement in the EM&A programme) and conclusions.

(viii) Appendices:

- Action and Limit levels;
- Graphical plots of trends of the monitoring parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following:
  - Major activities being carried out on site during the period;
  - Weather conditions during the period; and
  - 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; and
- Outstanding issues and deficiencies.

15.4 Final EM&A Review Report

15.4.1.1 The EM&A program should be terminated upon completion of the construction activities that have the potential to result in a significant environmental impact.

15.4.1.2 The proposed termination should only be implemented after the proposal has been endorsed by the IEC, the PMR and the Project Proponent followed by approval from the Director of Environmental Protection.

15.4.1.3 The final EM&A report should contain at least the following information:

(i) Executive summary (1-2 pages):
(ii) Drawings showing the Project area, any environmental sensitive receivers and locations of monitoring 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:

- Environmental mitigation measure, as recommended in the EIA Report;
- Environmental impact hypotheses tested;
- Environmental quality performance limits (Action and Limit levels);
- All monitoring parameters; and
- Event and Action Plans.

(v) A summary of the implementation status of environmental protection and pollution control / mitigation measures, as recommended in the project EIA Report, and summarised in the updated implementation schedule;

(vi) Monitoring results (in both hard and diskette copies) together with the following information:

- monitoring methodology;
- equipment used and calibration details;
- parameters monitored;
- monitoring locations (and depth); and
- monitoring date, time, frequency, and duration.

(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 for each media, liaison and consultation undertaken, actions and follow-up actions taken and results;

(xii) A review of the validity of EIA predictions and identification of shortcomings in EIA recommendations;

(xiii) A summary record of notification of summons, successful prosecutions for breaches of environmental protection/pollution control legislation, and actions taken to rectify such breaches;

(xiv) Comments (for example, a review of the effectiveness and efficiency of the mitigation measures and of the performance of the environmental management system, that is, of the overall EM&A programme); and

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

15.5 Data Keeping

15.5.1.1 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 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 on magnetic media form or other agreed media, and the software copy must be available upon request. All documents and data shall be kept for at least one year following completion of the construction contract.

15.6 Interim Notifications of Environmental Quality Limit Exceedances

15.6.1.1 With reference to the Event and Action Plans, when the environmental quality performance limits are exceeded and if they are proven to be valid, the ET should immediately notify the IEC and EPD, as appropriate. The notification should be followed up with advice to the 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 notification is presented in **Appendix 15.1**.