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1. INTRODUCTION

1.1 Background

- 1.1.1 Surface water falling within the northern catchments of Hong Kong Island is intercepted by a series of existing drainage pipes and culverts running through the urban area that ultimately discharge at several locations into Victoria Harbour. The existing system is overloaded and flooding and hazardous overland water flows can occur in extreme conditions. However, much of the catchment¹ is outside the urban area and the objective of the drainage improvement scheme studied here is to intercept surface water before it enters the urban area and direct it to a discharge outlet on the west-side of Hong Kong Island. This will reduce the flows entering into lower catchment and reduce flooding frequency in the urban area.
- 1.1.2 The study under Agreement No. CE91/95 identified a tunnel alignment to intercept flows and direct them to the tunnel. Due to the proximity of the tunnel alignment to Country Parks it was determined that the project would be classified as a Designated Project (DP) falling under the requirements of the *Environmental Impact Assessment Ordinance* (EIAO). It has included the Environmental Impact Assessment (EIA) Study.
- 1.1.3 Black & Veatch Hong Kong Ltd. (B&V) was commissioned by the Drainage Services Department (DSD) in October 2002 under Agreement No. CE 25/2002 (DS) to undertake the Drainage Improvement in Northern Hong Kong Island - Hong Kong West and Lower Catchment Improvement - Investigation Study. The investigation includes a review of the extent and alignments of the drainage tunnels together with its associated drainage structures (e.g. the intake shafts and connecting adits between the shafts and tunnels). An Environmental Impact Assessment (EIA) Study has been undertaken to provide information on the nature and extent of environmental impacts arising from the construction and operation of the proposed DP project and related activities. From the EIA, the recommendations for monitoring contained herein, are made. Figure 1.1 shows the layout of the Project.
- 1.1.4 The proposed tunnel starts from a tunnel portal close to the site of the Haw Par Mansion in Tai Hang and follows a sinuous route beneath urban areas in Jardines Lookout and Mid Levels. A discharge portal at the west end of Hong Kong Island at Pokfulam, north of the Cyberport site is proposed. The tunnel is designed to convey the intercepted flood flows for a 200-year storm event occurring across the complete catchment. The internal diameter of the initial section of the tunnel, before the Aberdeen Vehicular Tunnel, is 6.25m, while the remaining tunnel section has an internal diameter of 7.25m. Thirty five intake locations have been identified within the project areas that are suitable for intercepting flood flows. The intakes structures are interconnected with the main tunnel by connecting adits which are 2.3m in diameter. Figure 1.1 shows the alignment of the proposed tunnel, adits and the locations of the intake structures.

1.2 Purpose of this Manual

- 1.2.1 The purpose of this Environmental Monitoring and Audit (EM&A) Manual is to guide the setup of an EM&A programme to ensure compliance with the recommendations in the EIA study, to assess the effectiveness of the recommended mitigation measures and to identify any further need for additional mitigation measures or remedial action.

1 The catchment is enclosed by the ridgelines running between Jardines Lookout in the east through Mount Butler, Mount Cameron, Mount Gough and the Peak.

- 1.2.2 This Manual outlines the monitoring and audit programme to be undertaken for the construction and operational phases of the proposed DP. It aims to provide systematic procedures for monitoring, auditing and minimising of the environmental impacts associated with the project.
- 1.2.3 Hong Kong environmental regulations for noise, air quality, water quality and waste, the *Hong Kong Planning Standards and Guidelines* (HKPSG), and recommendations in the EIA Report have served as environmental standards and guidelines in the preparation of this Manual.
- 1.2.4 For the purpose of this Manual, the "Engineer" should refer to the Engineer as defined in the Contract and the Engineer's Representative (ER), in cases where the Engineer's powers have been delegated to the ER, in accordance with the Contract. The Environmental Team (ET) leader, who should be responsible for and in charge of the ET, should refer to the person delegated the role of executing the environmental monitoring and audit requirements.
- 1.2.5 This Manual contains the following:
- Duties of the ET with respect to the environmental monitoring and audit requirements during construction;
 - Duties of the Independent Environmental Checker (IEC) with respect to the environmental monitoring and audit requirements during construction;
 - Information on project organisation and programming of construction activities for the project;
 - Requirements with respect to the construction schedule and the necessary environmental monitoring and audit programme to track the varying environmental impacts;
 - Definition of Action and Limit Levels;
 - Establishment of event and action plans;
 - Requirements of reviewing pollution sources and working procedures required in the event of non-compliance of the environmental criteria; and
 - Requirements of presentation of environmental monitoring and audit data and appropriate reporting procedures.

1.3 Environmental Monitoring and Audit Requirements

- 1.3.1 The construction and operation phase impacts of the DP have been assessed and presented in the EIA Report. The EIA Report has specified the recommended environmental mitigation measures to minimise the potential adverse environmental impacts identified. An implementation schedule of the recommended environmental mitigation measures is prepared as part of the EIA study and is contained in Appendix A of this Manual.
- 1.3.2 In order to ensure that the mitigation measures recommended in EIA Report are fully implemented and resulted in the expected effectiveness, this Manual defines the scope of EM&A requirements for the construction and operation of the DP to achieve satisfactory environmental performance. The EM&A requirements are prepared in accordance with the requirements stipulated in *Annex 21* of the *Technical Memorandum on Environmental Impact Assessment Process* (EIA-TM). The environmental monitoring to be undertaken for the DP are as follows:-
- *Baseline Monitoring* refers to the measurement of prevailing environmental parameters, including existing air quality and noise level, to determine the nature and ranges of natural variation and to establish, where appropriate, the nature of change. This information is useful for assessing the short and long term environmental impacts of the Project activities.
 - *Impact Monitoring* involves the measurement of environmental parameters during the Project activities in order to determine the impacts of the activities and the effectiveness of the proposed mitigation measures, and any further remedial measures which are needed.

-
- *Compliance Monitoring* involves periodic sampling and/or continuous measurement of environmental parameters and the determination of their compliance with regulatory requirements and standards.

1.3.3 The environmental monitoring programme shall also be subject to environmental audit. The aim is to determine whether satisfactory compliance with the legislative requirements has been met, and to ensure that no annoyance is caused to sensitive receivers or else the remedial action plan will be initiated, if required. This will require information on the standards for parameters of concern and monitoring data. Each audit will consist of a review of the monitoring data and comparison with the relevant legislative requirements and environmental performance standards specified in the Contract Document.

1.3.4 In order to ensure that the mitigation measures recommended in the EIA study are implemented fully and resulted in the expected effectiveness, this Manual defines the scope of EM&A requirements for the construction of the proposed DP to achieve satisfactory environmental performance. The EM&A requirements for the DP shall be as follows:-

- Pre-Construction Phase – including all baseline monitoring prior to any project activity occurring on site.
- Construction Phase – including impact/compliance monitoring and audit during all construction activities.
- Operation Phase – including ground water level monitoring and audit at selected intakes/drop shafts locations.

1.4 Project Organization

1.4.1 The proposed EM&A organization is shown in Figure 1.2 of this Manual. The responsibilities of respective parties for the EM&A programme during the pre-construction and construction are listed in forthcoming Clauses.

Environmental Team

1.4.2 The ET Leader and the ET should not be in any way an associated body of the Contractor. The ET should be led and managed by the ET Leader. The ET Leader shall be the person who has at least 7 years' experience in EM&A or environmental management.

1.4.3 Suitably qualified staff should be included in the ET, and resources for the implementation of the EM&A programme should be allocated in time under the Contract, to enable fulfillment of the project's EM&A requirements as specified in the EM&A Manual during construction. The project proponent should be responsible for the EM&A requirements as specified in this EM&A manual during operation phase of the proposed project.

1.4.4 The ET Leader and the ET are employed to implement the EM&A programme and ensure the Contractor's compliance with the project's environmental performance requirements during construction. The duties are:

- (a) sampling, analysis and statistical evaluation of monitoring parameters as required in the EM&A Manual;
- (b) carry out environmental site surveillance;
- (c) audit of compliance with environmental protection, and pollution prevention and control regulations;
- (d) monitor the implementation of environmental mitigation measures;

-
- (e) monitor the compliance with Conditions in the relevant Environmental Permit (EP) and compliance with Specifications in the Contract;
 - (f) review the construction programme and comment as necessary;
 - (g) review the construction methodology and comment as necessary; preparation and updating of EM&A works schedule with reference to the best available detailed construction programme;
 - (h) investigation of non-compliant events, evaluation and identification of corrective measures;
 - (i) liaison with IEC on all environmental performance matters, and timely submission of all relevant EM&A proforma for the approval by IEC;
 - (j) advice to the Contractor on environment improvement, awareness, enhancement matters, etc., on site and
 - (k) timely submission of the EM&A report to the project proponent and the DEP.

1.4.5 Site inspections should be carried out by the ET at least once per week during construction. Ad hoc site inspections should also be carried out if significant environmental problems are identified.

Independent Environmental Checker

1.4.6 The IEC should advise the ER on environmental issues related to the project. The role of the IEC should be independent from the management of construction works, but the IEC should be empowered to audit the environmental performance of construction.

1.4.7 The IEC should be employed prior to commencement of construction of the project. The IEC should have at least 7 years experience in EM&A or environmental management. The appointment of the IEC is subject to the approval of the Engineer.

1.4.8 The IEC should audit the overall EM&A programme including the implementation of all environmental mitigation measures, submissions relating to EM&A, and any other submission required under this Manual. In addition, the IEC should be responsible for verifying the environmental acceptability of permanent and temporary works, and relevant design plans and submissions under this Manual.

1.4.9 The IEC should arrange and conduct at least monthly general site inspections of the project during the construction periods. Ad hoc site inspection should also be carried out if significant environmental problems are identified.

1.4.10 The IEC should ensure the impact monitoring is conducted according to the prescribed schedule at the correct locations.

1.4.11 The IEC should report the findings of the site inspections and other environmental performance reviews to DSD and Engineer/ER.

1.4.12 Appropriate resources should also be allocated under the Contract for the IEC to fulfill their duties specified in this Manual.

1.4.13 The main duty of the IEC is to carry out environmental audit of the construction of the project; this should include, inter alia, the followings:

- (a) review and audit all aspects of the EM&A programme;
- (b) advise on proactive actions;
- (c) validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and locations of sensitive receivers;
- (d) carry out random sample check and audit on monitoring data and sampling procedures, etc.;

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- (e) conduct random site inspection;
 - (f) audit the recommendations and requirements in EIA Report against the status of implementation of environmental protection measures on site;
 - (g) review the effectiveness of environmental mitigation measures and project environmental performance;
 - (h) on a needs basis, audit the Contractor's construction methodology and agree the least impact alternative in consultation with the ET Leader and the Contractor;
 - (i) investigate complaint cases and check the effectiveness of corrective measures;
 - (j) review accuracy of environmental monitoring section of EM&A reports;
 - (k) verify EM&A report submitted by the ET Leader;
 - (l) feedback audit results to ET by signing off relevant EM&A proformas.

Contractors

1.4.14 The term "Contractors" should be taken to mean all construction contractors and sub-contractors, working on site at any one time. Besides reporting to the Engineer, the Contractors should:

- (a) provide assistance to ET in carrying out monitoring;
- (b) work within the scope of the relevant contract and conditions;
- (c) participate in the site inspections undertaken by the ET, as required, and undertake any correction actions instructed by the Engineer;
- (d) provide information/advice to the ET regarding works activities which may contribute, or be continuing to the generation of adverse environmental conditions;
- (e) implement measures to reduce impact whenever Action and Limit Levels are exceeded;
- (f) take responsibility and strictly adhere to the guidelines of the EM&A programme and complementary protocols developed by their project staff; and
- (g) adhere to the procedures for carrying out complaint investigation in accordance with EM&A manual

Engineer or Engineer's Representative (ER)

1.4.15 The term Engineer, or Engineer's Representative, refers to the organization responsible for overseeing the construction works of the project and 'monitoring' the works undertaken by the various Contractors, and for ensuring that they are undertaken by the Contractors in accordance with the specification and contractual requirements. The ER should:

- (a) monitor the Contractors' compliance with contract specifications, including the implementation and operation of environmental mitigation measures and ensure their effectiveness, and other aspects of the EM&A programme;
- (b) inform the Contractor when action is required to reduce impacts in accordance with the Event and Action Plan;
- (c) provide assistance to the ET as necessary in the implementation of the environmental monitoring and auditing programme;
- (d) adhere to the procedures for carrying out complaint investigation in accordance with EM&A manual; and
- (e) instruct the Contractors to follow the agreed protocols or those in the Contract Specifications in the event of exceedances of Action and Limit levels;

1.5 Construction Programme

- 1.5.1 The major construction activities of the Project are tunneling works, drilling & blasting works, excavation and concreting works for the intakes structure, stilling basins and tunnel portals.
- 1.5.2 During the operation stage, the major site activities are the maintenance work of the main drainage tunnel, adits, intake structures and the ancillary facilities.
- 1.5.3 The construction of the Project is scheduled for commencement in mid 2007 for completion in end 2011. A tentative construction programme is provided in Appendix F. The ET and IEC shall make reference to the Contractor's actual works progress and works programme during the construction stage to schedule the EM&A works, and the Contractor shall provide the respective information to the ET Leader and the IEC for formulating the EM&A schedule.

2. AIR QUALITY

2.1 Air Quality Monitoring Parameters

- 2.1.1 The construction of the Project is scheduled for commencement in mid 2007 for completion in end 2011. A tentative construction programme is provided in Appendix F. The ET and IEC shall make reference to the Contractor's actual works progress and works programme during the construction stage to schedule the EM&A works, and the Contractor shall provide the respective information to the ET Leader and the IEC for formulating the EM&A schedule.
- 2.1.2 Monitoring and audit of the Total Suspended Particulates (TSP) levels shall be carried out by the ET to ensure that any deteriorating air quality could be readily detected and timely action taken to rectify the situation.
- 2.1.3 1-hour and 24-hour TSP levels shall be measured to indicate the impacts of construction dust on air quality. The TSP levels shall be measured by following the standard high volume sampling method as set out in the *Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50)*, Appendix B. Upon approval by the ER, 1-hour TSP levels can be measured by direct reading methods which are capable of producing comparable results as that by the high volume sampling method, to indicate short event impacts.
- 2.1.4 All relevant data including temperature, pressure, weather conditions, elapsed-time meter reading for the start and stop of the sampler, identification and weight of the filter paper, and other special phenomena and work progress of the concerned site etc. shall be recorded down in details. A sample field log sheet is shown in Appendix B to this Manual.

2.2 Monitoring Equipment

- 2.2.1 High Volume Sampler (HVS) in compliance with the following specifications shall be used for carrying out the 1-hour and 24-hour TSP monitoring:
- 0.6-1.7m³/min (20-60 SCFM) adjustable flow range;
 - equipped with a timing/control device with +/- 5 minutes accuracy for 24 hours operation;
 - installed with elapsed-time meter with +/- 2 minutes accuracy for 24 hours operation;
 - capable of providing a minimum exposed area of 406 cm² (63in²);
 - flow control accuracy: +/- 2.5% deviation over 24-hour sampling period;
 - equipped with a shelter to protect the filter and sampler;
 - incorporated with an electronic mass flow rate controller or other equivalent devices;
 - equipped with a flow recorder for continuous monitoring;
 - provided with a peaked roof inlet;
 - incorporated with a manometer;
 - able to hold and seal the filter paper to the sampler housing at horizontal position;
 - easy to change the filter; and
 - capable of operating continuously for 24-hour period.
- 2.2.2 The ET Leader shall be responsible for provision of the monitoring equipment and associated accessories and power supply. He shall ensure that sufficient numbers of HVSs with an appropriate calibration kit are available for carrying out the regular impact monitoring and ad hoc monitoring. The HVSs shall be equipped with an electronic mass flow controller and be calibrated against a traceable standard at regular intervals. All the equipment, calibration kit, filter papers, etc. shall be clearly labeled. The ET Leader shall also liaise with the concerned parties for gaining access to the monitoring stations for the installation of the monitoring equipment and carrying out monitoring.

- 2.2.3 Initial calibration of dust monitoring equipment shall be conducted upon installation and thereafter at bi-monthly intervals. The transfer standard shall be traceable to the internationally recognized primary standard and be calibrated annually. The calibration data shall be properly documented for future reference by the concerned parties such as IEC. All the data should be converted into standard temperature and pressure condition.
- 2.2.4 The flow-rate of the sampler before and after the sampling exercise with the filter in position shall be verified to be constant and be recorded in the field log sheet mentioned in Section 2.3.
- 2.2.5 If the ET Leader proposes to use a direct reading dust meter to measure 1-hour TSP levels, he shall submit sufficient information to the IEC to prove that the instrument is capable of achieving a comparable result as that the HVS and may be used for the 1-hour sampling. The instrument shall also be calibrated regularly, and the 1-hour sampling shall be determined periodically by HVS to check the validity and accuracy of the results measured by direct reading method.
- 2.2.6 Wind data monitoring equipment shall also be provided and set up at conspicuous locations for logging wind speed and wind direction near to the dust monitoring locations. The equipment installation location shall be proposed by the ET Leader and agreed with the ER in consultation with the IEC. For installation and operation of wind data monitoring equipment, the following points shall be observed:-
- the wind sensors should be installed on masts at an elevated level 10m above ground so that they are clear of obstructions of turbulence caused by the buildings;
 - the wind data should be captured by a data logger and to be downloaded for processing 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.
- 2.2.7 In exceptional situations, the ET Leader may propose alternative methods to obtain representative wind data. The alternative methods shall be agreed by ER in consultation with the IEC.

2.3 Laboratory Measurement/Analysis

- 2.3.1 The ET Leader shall carry out laboratory measurements/analyses for the dust samples collected.
- 2.3.2 A clean laboratory with constant temperature and humidity control, and equipped with necessary measuring and conditioning instruments, to handle the dust samples collected, shall be available for sample analysis, and equipment calibration and maintenance. The laboratory shall be *Hong Kong Laboratory Accreditation Scheme* (HOKLAS) accredited.
- 2.3.3 If a site laboratory is set up or a non-HOKLAS accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment shall be approved by the ER and the measurement procedures shall be witnessed by the ER. The ET Leader shall provide the ER with one copy of the *Title 40 of the Code of Federal Regulations, Chapter 1 (Part 50)*, Appendix B for his reference.
- 2.3.4 Filter paper of size 8"×10" shall be labeled before sampling. It shall be a clean filter paper with no pin holes, and shall be conditioned in a humidity controlled chamber for over 24-hour and be pre-weighed before use for the sampling.
- 2.3.5 After sampling, the filter paper loaded with dust shall be kept in a clean and tightly sealed plastic bag. The filter paper is then returned to the laboratory for reconditioning in the humidity controlled chamber followed by accurate weighing by an electronic balance with a readout down to 0.1 mg. The balance shall be regularly calibrated against a traceable standard.

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

2.4 Monitoring Locations

2.4.1 Two designated monitoring stations, AQ1 and AQ2 are selected for dust impact monitoring as they are the representative air sensitive receivers very close to the construction works areas. Table 2.1 describes the air quality monitoring locations, which are also depicted in Figures 2.1 and 2.2.

Table 2.1 Locations for Air Quality Monitoring Stations

| Monitoring Stations | Figure no. | Location |
|---------------------|------------|---------------------------------------|
| AQ1 | 2.1 | True Light Middle School of Hong Kong |
| AQ2 | 2.2 | Aegean Terrace |

2.4.2 The status and locations of dust sensitive receivers may change after issuing this Manual. If such cases exist, the ET Leader shall propose updated monitoring locations, which shall be approved by the ER and agreed with IEC.

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

- at the site boundary or such locations close to the major dust emission source;
- close to the sensitive receptors; and
- take into account the prevailing meteorological conditions.

2.4.4 The ET Leader shall agree with the ER on the position of the High Volume Sampler for installation of the monitoring equipment. When positioning the samplers, the following points shall be noted:

- a horizontal platform should be provided with appropriate support to secure the samplers against gusty wind;
- no two samplers should be placed less than 2 meters 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 sampler;
- a minimum of 2 meters separation from walls, parapets and penthouses is required for rooftop samples;
- a minimum of 2 meters separation from any supporting structure, measured horizontally is required;
- no furnaces or incineration flues or building vents are nearby;
- airflow around the sampler is unrestricted;
- the sampler is more than 20 meters from the drip line;
- any wire fence and gate, to protect the sampler, should not cause any obstruction during monitoring;
- permission must be obtained to set up the samplers and to obtain access to the monitoring stations; and
- a secured supply of electricity is needed to operate the samplers.

2.5 Baseline Monitoring

2.5.1 Baseline monitoring shall be carried out at all the designated monitoring locations for at least 14 consecutive days prior to the commissioning of the construction works to obtain daily 24-hour TSP samples. 1-hour TSP sampling shall also be done at least 3 times per day while highest dust impact is expected. Before commencing the baseline monitoring, the ET leader shall inform the IEC of the

baseline monitoring programme such that the IEC can conduct on-site audit to ensure accuracy of the baseline monitoring results.

- 2.5.2 During the baseline monitoring, there should not be any construction or dust generation activities in the vicinity of the monitoring stations.
- 2.5.3 In case the baseline monitoring cannot be carried out at the designated monitoring locations during the baseline monitoring period, monitoring shall be carried out at alternative locations which can effectively represent the baseline conditions at the impact monitoring locations. The alternative baseline monitoring locations shall be approved by the ER and agreed with IEC.
- 2.5.4 In exceptional case, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with IEC to agree on an appropriate set of data to be used as a baseline reference and submit to ER for approval.
- 2.5.5 Ambient conditions may vary seasonally and shall be reviewed at three monthly intervals. If the ET Leader considers that the ambient conditions have been changed and repeat of the baseline monitoring is required to be carried out for obtaining the updated baseline levels, the monitoring should be conducted at times when the Contractor's activities are not generating dust, at least in the proximity of the monitoring stations. Should changes in ambient conditions be determined, the baseline levels and, in turn, the air quality criteria, should be revised. The revised baseline levels and air quality criteria should be agreed with IEC and EPD.

2.6 Impact Monitoring

- 2.6.1 The ET Leader shall carry out impact monitoring during the course of the Project activities under the Contract. For regular impact monitoring, the sampling frequency of at least once in every six-day, shall be strictly observed at all the monitoring stations for 24-hour TSP monitoring. For 1-hour TSP monitoring, the sampling frequency of at least three times in every six-day should be undertaken when the highest dust impact occurs.
- 2.6.2 The specific time to start and stop the 24-hr TSP monitoring shall be clearly defined for each location and be strictly followed by the operator.
- 2.6.3 In case of non-compliance with the air quality criteria, more frequent monitoring exercise, as specified in the Event/Action Plan in Section 2.7 shall be conducted within 24 hours after the result is obtained. This additional monitoring shall be continued until the excessive dust emission or the deterioration in air quality is rectified.

2.7 Event and Action Plan for Air Quality

- 2.7.1 The baseline monitoring results form the basis for determining the air quality criteria for the impact monitoring. The ET Leader shall compare the impact monitoring results with air quality criteria set up for 24-hour TSP and 1-hour TSP. Table 2.2 below shows the air quality criteria, namely Action and Limit levels to be used. Should non-compliance of the air quality criteria occur, actions in accordance with the Event/Action Plan in Table 2.3 shall be carried out.

Table 2.2 Action and Limit Levels for Air Quality

| Parameters | Action | Limit |
|--|--|--------------|
| 24 Hour TSP Level in $\mu\text{g}/\text{m}^3$ | For baseline level $\leq 200 \mu\text{g}/\text{m}^3$, Action level = (Baseline level * 1.3 + Limit level)/2 For baseline level $> 200 \mu\text{g}/\text{m}^3$, Action level = Limit level | 260 |
| 1 Hour TSP Level in $\mu\text{g}/\text{m}^3$ | For baseline level $\leq 384 \mu\text{g}/\text{m}^3$, Action level = (Baseline level * 1.3 + Limit level)/2 For baseline level $> 384 \mu\text{g}/\text{m}^3$, Action level = Limit level | 500 |

Table 2.3 Event/Action Plan for Air Quality

| EVENT | ACTION | | | |
|--|---|---|---|---|
| | ET | IEC | ER | CONTRACTOR |
| ACTION LEVEL | | | | |
| 1.Exceedance for one sample | 1. Identify the source and investigate the causes and propose remedial measures 2. Inform ER & IEC 3. Repeat measurement to confirm finding 4. Increase monitoring frequency to daily | 1. Check monitoring data submitted by ET 2.Check Contractor's working methods | 1.Notify Contractor | 1.Rectify any unacceptable practice 2.Amend working methods if appropriate |
| 2.Exceedance for two or more consecutive samples | 1. Identify the source 2. Inform ER & IEC 3. Repeat measurements to confirm findings 4. Increase monitoring frequency to daily 5. Discuss with ER & IEC for remedial actions required 6. If exceedance continues, arrange meeting with ER & IEC 7. If exceedance stops, cease additional monitoring | 1.Checking monitoring data submitted by ET 2. Check Contractor's working methods 3. Discuss with ET, IEC and Contractor on proposed remedial actions 4. Advise the ER & ET on the effectiveness of the proposed remedial measures 5.Supervise the implementation of the remedial measures | 1.Confirm receipt of notification of failure in writing 2.Notify Contractor 3.Ensure remedial actions properly implemented | 1.Submit proposals for remedial actions to ER within 3 working days of notification 2.Implement the agreed proposals 3.Amend proposal if appropriate |
| LIMIT LEVEL | | | | |
| 1.Exceedance for one sample | 1. Identify source,,investigate the causes and propose remedial measures 2. Inform ER & IEC and EPD 3. Repeat measurement to confirm finding 4. Increase monitoring frequency to daily 5. Assess effectiveness of Contractor's remedial actions and keep EPD and ER & IEC informed of the results | 1.Check monitoring data submitted by ET 2. Check Contractor's working methods 3. Discuss with ET and Contractor on proposed remedial actions 4. Advise the ER on the effectiveness of the proposed remedial measures 5.Supervise the implementation of the remedial measures | 1.Confirm receipt of notification of failure in writing 2.Notify Contractor 3.Ensure remedial actions properly implemented | 1.Take immediate action to avoid further exceedance 2.Submit proposals for remedial actions to ER within 3 working days of notification 3.Implement the agreed proposals 4.Amend proposal if appropriate |
| 2.Exceedance for two or more consecutive samples | 1. Identify source 2. Inform ER, IEC and EPD the causes & actions taken for the exceedances 3. Repeat measurement to confirm findings 4. Increase monitoring frequency to daily 5. Investigate the causes of exceedance 6. Arrange meeting with & IEC and ER to discuss the remedial actions to be taken 7. Assess effectiveness of Contractor's remedial actions and keep ER, IEC and EPD informed of the results 8. If exceedance stops, cease additional monitoring | 1.Discuss amongst ER, ET and Contractor on the potential remedial actions 2.Review Contractor's remedial actions to assure their effectiveness and advise the ER accordingly 3.Supervise the implementation of the remedial measures | 1.Confirm receipt of notification of failure in writing 2.Notify Contractor 3.In consultation with the IEC, agree with the Contractor on the remedial measures to be implemented 4.Ensure remedial measure are properly implemented 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. Take immediate action to avoid further exceedance 2. Submit proposals for remedial actions to ER within 3 working days of notification 3. Implement the agreed proposals 4. Resubmit proposals if problem still not under control 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated |

3. NOISE

3.1 Noise Monitoring Parameters

3.1.1 The construction noise levels shall be measured in terms of the A-weighted equivalent continuous sound pressure level (Leq). Leq(30 min) shall be used as the monitoring parameter for the time period between 0700-1900 hours on normal weekdays. A supplementary information for data auditing, statistical results such as L₁₀ and L₉₀ shall also be obtained for reference. For all other time periods, Leq(5 min) shall be employed for comparison with the *Noise Control Ordinance* (NCO) criteria.

3.2 Monitoring Equipment

3.2.1 As referred to in 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 levels from before and after the noise measurement agree to within 1.0dB.

3.2.2 Noise measurements shall not be made in the presence of fog, rain, wind with a steady speed exceeding 5ms⁻¹ or wind with gusts exceeding 10ms⁻¹. The wind speed shall be checked with a portable wind speed meter capable of measuring the wind speed in m/s. Sample noise field data sheet is shown in Appendix C to this Manual for reference.

3.2.3 The ET Leader shall be responsible for the provision of the monitoring equipment and associated accessories and power supply. He shall ensure that sufficient noise measuring equipment and associated instrumentation are available for carrying out the regular impact monitoring and ad hoc monitoring. All the equipment and associated instrumentation shall be clearly labelled. The ET Leader shall also liaise with the concerned parties for gaining access to the monitoring stations for the installation of the monitoring equipment and carrying out monitoring.

3.3 Monitoring Locations for Airborne Construction Noise

3.3.1 Twenty-one designated monitoring stations, NC1 to NC21 are selected for construction noise monitoring. Table 3.1 describes the construction noise monitoring locations, which are also depicted in Figures 2.1, 2.2 and 3.1-3.16. The status and locations of noise sensitive receivers may change after issuing this manual. If such cases exist, the ET Leader shall propose updated monitoring locations and seek approval from ER and agreement from the IEC of the proposal.

Table 3.1 Locations for Airborne Construction Noise Monitoring Stations

| Location | Fig. no. | Monitoring Stations | Descriptions | Status |
|----------------|----------|---------------------|---------------------------------------|-------------------|
| Eastern Portal | 2.1 | NC1 | True Light Middle School of Hong Kong | School |
| Eastern Portal | 2.1 | NC2 | The Legend (Future development) | Domestic Premises |
| Western Portal | 2.2 | NC3 | Aegean Terrance | Domestic Premises |
| Intakes BR6(P) | 3.1 | NC4 | Man Yuen Garden | Domestic Premises |
| Intakes BR7(P) | 3.1 | NC5 | 16 Caronia | Domestic Premises |
| Intake DG1(P) | 3.2 | NC6 | Blk C Villa Monte Rosa | Domestic Premises |

| Location | Fig. no. | Monitoring Stations | Descriptions | Status |
|---------------------------|----------|---------------------|---|-------------------|
| Intake DG1 | 3.3 | NC7 | Rosaryhill School | School |
| Intake E5(A)(P) | 3.3 | NC8 | Buddist Li Ka Shing Care & Attention Home for the Elderly | Domestic Premises |
| Intake E7(P) | 3.4 | NC9 | Marymount Secondary School | School |
| Intake E7(P) | 3.4 | NC10 | 117 Blue Pool Road | Domestic Premises |
| Intakes MA13(P) & MA14(P) | 3.5 | NC11 | The Harbour View | Domestic Premises |
| Intake P5(P) | 3.6 | NC12 | 24 Po Shan Road | Domestic Premises |
| Intake PFLR1(P) | 3.7 | NC13 | Honey Court | Domestic Premises |
| Intake RR1(P) | 3.8 | NC14 | Ying Wa Girl's School | School |
| Intake RR1(P) | 3.8 | NC15 | Peaksville Court | Domestic Premises |
| Intake THR2(P) | 3.9 | NC16 | Hong Kong Japanese School | School |
| Intake W0(P) | 3.12 | NC17 | Sir Ellis Kadoorie Secondary School | School |
| Intake W5(P) | 3.13 | NC18 | Raimondi College | School |
| Intake W8 | 3.14 | NC19 | Hong Kong Institute of Technology | School |
| Intake W8 | 3.14 | NC20 | Blk A, 80 Robinson Road | Domestic Premises |
| Intake W12(P) | 3.15 | NC21 | 92A-92C Sylvanbrook | Domestic Premises |

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

- (a) at locations close to the major site activities which are likely to have noise impacts;
- (b) close to the noise sensitive receivers. For the purposes of this section, any domestic premises, hotel, hostel, temporary housing accommodation, hospital, medical clinic, educational institution, place of public worship, library, court of law, performing art centre should be considered as noise sensitive receiver; and
- (c) for monitoring locations located in the vicinity of the sensitive receivers, care should be taken to cause minimal disturbance to the occupants during monitoring.

3.3.3 The monitoring station shall normally be at a point 1m from the exterior of the sensitive receivers 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 +3dB(A) shall be made to the free field measurements. The ET Leader 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.

3.4 Baseline Monitoring

3.4.1 The ET Leader shall carry out baseline monitoring prior to the commencement of the construction works. The baseline monitoring shall be carried out daily for a period of at least 14 consecutive days. A schedule on the baseline monitoring for construction noise prior to the commencement of the construction works shall be submitted to the ER for approval and IEC agreement before the monitoring starts.

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

-
- 3.4.3 There shall not be any construction activities in the vicinity during the baseline monitoring. In exceptional cases, when insufficient baseline monitoring data or questionable results are obtained, the ET Leader shall liaise with IEC to agree on an appropriate set of data to be used as a baseline reference.
- 3.4.4 Noise monitoring shall be carried out at all the designated monitoring stations. The monitoring frequency shall depend on the scale of the construction activities. The following is an initial guide on the regular monitoring frequency for each station on a per week basis when noise generating activities are underway:-
- (a) one set of measurements between 0700-1900 hours on normal weekdays;
 - (b) one set of measurements between 1900-2300 hours;
 - (c) one set of measurements between 2300-0700 hours of next day; and
 - (d) one set of measurements between 0700-1900 hours on holidays.
- 3.4.5 For the measurements (b), (c) and (d) above, one set of measurements shall at least include 3 consecutive Leq (5 min) results.

3.5 Impact Monitoring

- 3.5.1 Noise monitoring shall be carried out at all the designated monitoring stations. The monitoring frequency shall depend on the scale of the construction activities. The following is an initial guide on the regular monitoring frequency for each station once every week in accordance with the methodology in the TM when noise generating activities are underway:-
- one set of measurements between 0700-1900 hours on normal weekdays;
- 3.5.2 If a school exists near the construction activity, noise monitoring shall be carried out at the monitoring stations for the school during the school examination periods. The ET Leader shall liaise with the school's personnel and the Examination Authority to ascertain the exact dates and times of all examination periods during the course of the construction.
- 3.5.3 In case of non-compliance with the construction noise criteria, more frequent monitoring as specified in the Event/Action Plan in Section 3.6 of this Manual 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.

3.6 Event and Action Plan for Construction Noise

- 3.6.1 The Action and Limit levels for construction noise are defined in Table 3.2. Should non-compliance of the criteria occur, action in accordance with the Event/Action Plan in Table 3.3, shall be carried out. As residual impacts are predicted at some NSRs according to the air borne noise construction noise assessment presented in the EIA report, the Event/Action Plan and the construction stage noise EM&A work shall be strictly implemented to facilitate identification of practicable measures to minimize the residual noise impacts.

Table 3.2 Action and Limit Levels for Construction Noise

| Time Period | Action | Limit |
|--|---|------------------|
| 0700-1900 hrs on normal weekdays | When one documented complaint is received | 75* dB(A) |
| 0700-2300 hrs on holidays; and 1900-2300 hrs on all other days | | 60/65/70** dB(A) |
| 2300-0700 hrs of next day | | 45/50/55** dB(A) |

* reduce to 70 dB(A) for schools and 65 dB(A) during school examination periods.

** to be selected based on Area Sensitivity Rating.

3.7 Residual Impact

Public Relationship Strategy

3.7.1 Having a good public relation with the local communities during the construction stage of the works is indispensable for smooth implementation of the Project. Prior to commencement of the construction, visits to the possibly affected local communities including the District Councils, nearby residents, schools and property owners will be carried out. The purpose of the visits is to advise the public the following information in relation to the Project:

- the implementation programme of the works;
- the planned construction activities that will be involved;
- the possible impacts to the affected communities;
- the measures to avoid or mitigate any adverse impacts;
- the monitoring programme to check the efficiency of the measures; and
- the communication channels between the local communities and the project office for better understanding the efficiency of the measures taken and the necessity for enhancement of the measures.

3.7.2 To maintain a better communication link with the local communities, it will specify under the contract to establish a 24-hour hot line manned by the Contractor such that all the received enquiries or complaints could be logged immediately and forwarded to the relevant project officers to follow up. Under the establishment of the project site office, liaison officers will also be nominated who are responsible for regular contacts with the local communities advising them the current progress of works, the efficiency of the environmental mitigation measures and any follow-up action that have been taken in responses to any non-compliances or complaints received from the local communities. It is considered that such a close relation between the local communities and the project site office could ensure speedy resolution of any environmental non-compliance and maintain an environmental standard acceptable to the communities during construction.

Table 3.3 Event/Action Plan for Construction Noise

| EVENT | ACTION | | | |
|--------------|---|---|--|--|
| | ET | IEC | ER | Contractor |
| Action Level | <ol style="list-style-type: none"> 1. Notify IEC, ER and Contractor 2. carry out investigation by reviewing all the relevant monitoring data and the corresponding construction activities. Exceedances should also be confirmed by immediate verification in the field as far as practical. 3. Report the results of investigation to the IEC, ER and Contractor 4. Discuss with the Contractor and formulate remedial measures 5. increase monitoring frequency to check mitigation effectiveness | <ol style="list-style-type: none"> 1. Review the analysed results submitted by the ET 2. Review the proposed remedial measures by the Contractor and advise the ER & ET accordingly 3. Supervise the implementation of remedial measures | <ol style="list-style-type: none"> 1. Confirm receipt of notification of complaint in writing 2. Notify Contractor 3. require Contractor to proposed remedial measures for analyzed noise problem 4. Ensure remedial measures are properly implemented | <ol style="list-style-type: none"> 1. Identify practicable measures to minimize the noise impact. Submit noise mitigation proposals to ET, IEC and ET. 2. Implement noise mitigation proposals |
| Limit Level | <ol style="list-style-type: none"> 1. Notify IEC, ER, EPD and Contractor 2. Identify the source(s) of impact by reviewing all the relevant monitoring data and the corresponding construction activities. Exceedances should also be confirmed by immediate verification in the field as far as practical. 3. Repeat measurement to confirm findings 4. Increase monitoring frequency 5. Carry out analysis of Contractor's working procedures to determine possible mitigation to be implemented. 6. inform IEC, ER and EPD the cause & actions taken for the exceedances 7. Assess effectiveness of Contractor's remedial actions and keep IEC, EPD and ER informed of the results 8. If exceedance stops, cease additional monitoring. | <ol style="list-style-type: none"> 1. Discuss amongst ER, ET, and Contractor on the potential remedial actions 2. Review Contractor's remedial actions to assure their effectiveness and advise the ER & ET accordingly 3. Supervise the implementation of the remedial measures | <ol style="list-style-type: none"> 1. Confirm receipt of notification of exceedance in writing 2. Notify Contractor 3. Require Contractor to propose remedial measures for the analyzed noise problem 4. Ensure remedial measures are properly implemented 5. If exceedance continuous, consider what portion of the work is responsible and instruct the Contractor to stop that portion of work until the exceedance is aborted | <ol style="list-style-type: none"> 1. Take immediate action to avoid further exceedance 2. Identify practicable measures to minimize the noise impact. Submit proposals for remedial actions to ER within three working days of notification 3. Implement the agreed proposals 4. Resubmit proposal if problem still not under control 5. Stop the relevant portion of works as determined by the ER until the exceedance is abated |

3.8 Ground Borne Construction Noise Monitoring

3.8.1 Based on the recommendations of the EIA study, it is required to carry out ground borne noise monitoring to ensure that proper control of groundborne noise is executed by the contractor. The monitoring frequency shall be the same as stated in Section 3.5.

3.9 Monitoring Locations for Groundborne Construction Noise

3.9.1 Prediction of construction groundborne noise indicates the criteria will be achieved at all NSRs during day-time.

3.9.2 Eight designated monitoring stations (GNC1 to GNC8) are selected for construction groundborne noise monitoring to check for compliance. Table 3.4 describes the construction groundborne noise monitoring locations, which are also depicted in Figures 2.1, 2.2 and 3.16-3.18. The status and locations of noise sensitive receivers may change after issuing this manual. If such cases exist, the ET Leader shall propose updated monitoring locations and seek approval from ER and agreement from the IEC of the proposal.

3.9.3 The monitoring locations are selected at sensitive receivers (e.g. schools or domestic premises). The Legend (GNC2) near Eastern Portal, Aegean Terrace (GNC3) near Western Portal, Carriana Sasson (GNC4) near Western Portal, Green Villa (GNC7) near the alignment of adit with vertical shaft W3 are residential buildings. True Night Middle School (GNC1), Hong Kong University Educational Institute (GNC5), French International School (GNC6) and Raimondi College (GNC8) are for educational purposes.

Table 3.4 Locations for Ground borne Construction Noise Monitoring Stations

| Location | Fig. no. | Monitoring Stations | Descriptions | Status |
|--------------------------|----------|---------------------|--|-------------------|
| Near Eastern Portal | 2.1 | GNC1 | True Night Middle School | School |
| Near Eastern Portal | 2.1 | GNC2 | The Legend (Future development) | Domestic Premises |
| Near Western Portal | 2.2 | GNC3 | Aegean Terrace | Domestic Premises |
| Near Western Portal | 2.2 | GNC4 | Carriana Sasson | Domestic Premises |
| Near Western Portal | 2.2 | GNC5 | Hong Kong University Educational Institute | School |
| Tunnel chainage CH+ 1950 | 3.16 | GNC6 | French International School | School |
| Near Intake W3(P) | 3.17 | GNC7 | Hong Villa | Domestic Premises |
| Near Intake W5(P) | 3.18 | GNC8 | Raimondi College | School |

3.9.4 The criterion include TM for the Assessment of Noise from Places other than Domestic Premises, Public Places or Construction Sites (TM-Places) under the NCO stipulates that noise transmitted primarily through the structural elements of building, or buildings shall be 10dB(A) less than the relevant ANLs.

3.9.5 Table 3.5 indicates the noise criteria which apply for the groundborne noise assessment. The ground borne noise criteria during restricted hours (daytime during holidays, all evening and nighttime) presented in Tables 3.5, 3.6a and 3.6b which only refer to areas with ASR “B” for demonstration purpose. There are some factors affecting the assessment results of a CNP application, such as the assigning of Area Sensitivity Rating. As the situations/conditions around the sites may change from time to time, the Noise Control Authority would decide at the time of assessment of such an

application based on the contemporary situations/conditions. Notwithstanding the above, the use of PME (including TBM) for carrying out of construction work during the restricted hours will require a CNP.

Table 3.5 Construction Ground Borne Noise Standards

| Uses | Ground Borne Noise Criteria, dB(A) (Leq, 30 mins) | | |
|---|---|--|---------------------------------|
| | Daytime (except General Holidays and Sundays)* | Daytime during general holidays and Sundays and all days during Evening (1900 to 2300 hrs)** | Night time (2300 to 0700 hrs)** |
| Domestic Premises | 65 | 55 | 40 |
| Educational Institutions (normal periods) | 60 | 55 | [1] |
| Educational Institutions (during examination periods) | 55 | 55 | [1] |

* 10 dB(A) below the noise criteria stipulated in EIAO-TM

** 10 dB(A) below the noise criteria stipulated in GW-TM

[1] No sensitive uses usually present during these periods

3.9.6 If the ground borne level exceeds in the defined limit measured during TBM operation, TBM construction work and the associated works should be restricted during the all days evening / all days night-time / day time including general holidays and Sundays. Tables 3.6a and 3.6b show the follow up actions for ground borne noise monitoring if exceedance is found at representative monitoring locations. The noise level should be measured on the ground floor inside the nearest building during the TBM construction work in the evening and early morning.

Table 3.6a TBM Working Hours - Sensitive Receiver (Domestic Premise)

| Scenario | Monitoring Time | Monitoring Result | Working hours of TBM or associated work operation |
|----------------|-----------------|--|--|
| A | Day time | $55 \text{ dB(A)} < x \leq 65 \text{ dB(A)}$ | Day time (Except general holidays and Sundays) (0700 – 1900 hrs) only |
| B [§] | Day time | $40 \text{ dB(A)} < x \leq 55 \text{ dB(A)}$ | Day time including general holidays and Sundays and all days during evening (0700-2300 hrs) only |
| C [§] | Day time | $\leq 40 \text{ dB (A)}$ | No restriction |

Table 3.6b TBM Working Hours - Sensitive Receiver (Education Institution)

| Scenario | Monitoring Time | Monitoring Result | Working hours of TBM or associated work operation |
|----------------|-----------------|--|---|
| D | Day time | $55 \text{ dB(A)} < x \leq 60 \text{ dB(A)}$ | Day time (Except general holidays and Sundays) (0700 – 1900 hrs) only |
| E [§] | Day time | $x \leq 55 \text{ dB(A)}$ | No restriction |

Remarks:

§ - For scenarios B, C and E, they reflect the working hours are subject to CNP application.

4. WATER QUALITY

4.1 Water Quality Parameters

- 4.1.1 An assessment of potential impacts to water quality due to the construction and operation of Drainage Improvement in Northern Hong Kong Island – Hong Kong West Drainage Tunnel has been carried out and identified in the EIA Report. The water quality assessment in the EIA identified that the key impacts may arise from the intakes and tunnel excavation works, construction of temporary berthing point, outlet structure and stilling basin at western portal. To minimise the potential impacts arising from the construction on the water quality in the vicinity of water sensitive receivers, proper construction methods with good site practices are required. The measures include installation of proper drainage system to collect site runoff and silt curtain in the waters around the temporary berthing point to prevent dispersion of suspended particle. Groundwater level monitoring would also be carried out at those construction works areas near to the natural streams during the first year of operation phase (maintenance period) to assess effect of tunnel construction to the existing ground water regime.
- 4.1.2 Water quality monitoring and audit for the project are required to ensure compliance with the water quality criteria and the effectiveness of the proposed mitigation measures. Marine water quality monitoring and audit shall be carried out during the construction period for the works at the Western Portal. The related construction activities includes construction of temporary berthing facility, outlet structure, stilling basin, tunnel boring at western portal. If proper measures are not taken, it may have short term impacts on the marine water quality.
- 4.1.3 It was considered that site inspections should also be required to ensure that the recommended water pollution mitigation measures would be properly implemented, functioned and maintained during construction phase of the DP. The requirements of site inspections are detailed in Section 10.

4.2 Water Quality Parameters

- 4.2.1 The following water quality parameters will be included in the monitoring programme during construction phase.

Table 4.1 Water Quality Parameters

| Phase | Water Quality Parameters |
|--------------|---|
| Construction | <ul style="list-style-type: none">• Temperature (°C)• pH (pH unit)• turbidity (NTU)• water depth (m)• salinity (mg/L)• dissolved oxygen (DO) (mg/L and % of saturation)• suspended solids (SS) (mg/L) |

4.3 Monitoring Equipment

4.3.1 For water quality monitoring, the following equipments will be supplied by the ET and approved by the ER.

Dissolved Oxygen (DO) and Temperature Measuring Equipment

4.3.2 The instrument for measuring dissolved oxygen and temperature will be portable and weatherproof completed with cable, sensor, comprehensive operation manuals and use DC power source. It will be capable of measuring:

- a dissolved oxygen level in the range of 0-20 mg/L and 0-200% saturation; and
- a temperature of 0-45 degree Celsius.

4.3.3 It will have a membrane electrode with automatic compensation completed with a cable. Sufficient stocks of spare electrodes and cables will be available for replacement where necessary (e.g. YSI model 59 meter, YSI 5739 probe, YSI 5795A submersible stirrer with reel and cable or an approved similar instrument).

4.3.4 In situ salinity will be measured to calibrate the DO equipment prior to each DO measurement if salinity compensation is not built-in in the DO equipment.

Turbidity

4.3.5 Turbidity will be measured in situ by the nephelometric method. The instrument will be portable and weatherproof using a DC power source complete with cable, sensor and comprehensive operation manuals. The equipment will be capable of measuring turbidity between 0-1000 NTU. The probe cable will not be less than 25m in length. The meter will be calibrated in order to establish the relationship between NTU units and the levels of SS.

Suspended Solids (SS)

4.3.6 A water sampler, consisting of a transparent PVC or glass cylinder of a capacity of not less than two litres which can be effectively sealed with cups at both ends will be used (Kahlsico Water Sampler 13SWB203 or an approved similar instrument). The water sampler will 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.

4.3.7 Water samples for SS will be collected in high density polythene bottles, packed in ice and delivered to HOKLAS accredited laboratory for analysis as soon as possible after collection.

Water Depth Detector

4.3.8 A portable, battery-operated echo sounder (Seafarer 700 or a similar approved instrument) will be used for the determination of water depth at each designated monitoring station. This unit can either be hand held or affixed to the underside of the survey boat, if the same vessel is to be used throughout the monitoring programme.

Salinity

- 4.3.9 A portable salinometer capable of recording within the range of 0-40 ppt will be used for salinity measurements.

Water Sampling for Laboratory Analysis

- 4.3.10 A water sampler as detailed in Section 4.3.6 will be used to collect samples for laboratory analysis.

Position System

- 4.3.11 A portable salinometer capable of recording within the range of 0-40 ppt will be used for salinity measurements.
- 4.3.12 A hand held or boat fixed type Digital Global Positioning System (DGPS) will be used to ensure that the correction location has been selected prior to sample collection. Coordinates checking should be carried out with a DGPS. The DGPS should be calibrated at appropriate checkpoint (e.g. Quarry Bay Survey Nail at Easting 840683.49, Northing 816709.55) to ensure the monitoring station is at the correct position before taking measurement and water samples.

Sample Container and Storage

- 4.3.13 Following collection, water samples for SS analysis will be stored in high density polythene bottles with no preservative added, packed in ice (cooled to 4°C without being frozen), delivered to the laboratory and analysed as soon as possible.

Calibration of In Situ Instruments

- 4.3.14 All in situ monitoring instruments will be checked, calibrated and certified by a laboratory accredited under HOKLAS or other international accreditation scheme before use, and subsequently re-calibrated at 3 monthly intervals throughout all stages of the water quality monitoring.
- 4.3.15 For the on site calibration of field equipment, the BS 1427:1993, "Guide to Field and on-site test methods for the analysis of waters" will be observed.
- 4.3.16 Sufficient stocks of spare parts will be maintained for replacements when necessary. Backup monitoring equipment will also be made available so that monitoring can proceed uninterrupted even when some equipment is under maintenance, calibration, etc.

Laboratory Analytical Methods

- 4.3.17 Analysis of SS will be carried out in a HOKLAS or other international accredited laboratory. The following table shows the standard test methods of the proposed determinants for laboratory analysis.

Table 4.2 Methods for Laboratory Analysis for Water Samples

| Parameters (Unit) | Suggested Method | Detection Limit |
|-------------------|------------------|-----------------|
| SS (mg/L) | APHA 2540 D | ≤ 0.1 mg/L |

Notes:

APHA= American Public Health Association: Standard Methods for the Examination of Water and Wastewater Ed

- 4.3.18 The testing laboratory will be HOKLAS accredited (or if not, approved by the ER) and comprehensive quality assurance and control procedures in place in order to ensure quality and consistency in results.
- 4.3.19 If a site laboratory is set up or a non-HOKLAS and non-international accredited laboratory is hired for carrying out the laboratory analysis, the laboratory equipment, analytical procedures, and quality control will be approved by ER. All the analysis will be witnessed by the ER.
- 4.3.20 The ET will provide the ER with one copy of the relevant chapters of the "Standard Methods for the Examination of Water and Wastewater" updated edition and any other relevant document for his reference.
- 4.3.21 For the testing methods of other parameters as recommended by EPD, detailed testing methods, pre-treatment procedures, instrument use, quality assurance/quality control (QA/QC) details (such as blank, spike recovery, number of duplicate samples per batch, etc.), detection limits and accuracy will be submitted to EPD for approval prior to the commencement of monitoring programme. The QA/QC will be in accordance with the requirement of HOKLAS or international accredited scheme. The QA/QC results will be reported. EPD may also request the laboratory to carry out analysis of know standards provided by EPD for quality assurance. Additional duplicate samples may be required by EPD for inter laboratory calibration. Remaining samples after analysis will be kept by the laboratory for 3 months in case repeat analysis is required. If in-house or nonstandard methods are proposed, details of the method verification may also be required for submission to EPD. In any circumstance, the sample testing will have comprehensive quality assurance and quality control programmes. The laboratory will prepare to demonstrate the programmes to EPD.

4.4 Monitoring Locations

- 4.4.1 The marine water quality monitoring locations are shown in Figure 4.1 and ground water level (borehole with piezometer) monitoring locations are shown in Figures 2.1, 3.7, 3.9, 3.10, 3.11 and 3.15. Prior to the commencement of the EM&A programme, the ET leader shall agree with ER and EPD the locations of the monitoring stations. As no intake and dropshaft structures are within Country Parks, no underground water level within Country Parks are required.

Table 4.3 Methods for Laboratory Analysis for Water Samples

| Monitoring station | Fig. no. | Description | Easting | Northing | Monitoring Parameters |
|--------------------------|----------|-------------------------|---------|----------|--|
| Underground water | | | | | |
| UC1 | 2.1 | Eastern Portal | (i) | (i) | Underground water level is the monitoring parameter to be measured at each ground water monitoring stations. |
| UC2 | 3.7 | PFLR1(P) | (i) | (i) | |
| UC3 | 3.9 | THR2(P) | (i) | (i) | |
| UC4 | 3.10 | TP5(P) | (i) | (i) | |
| UC5 | 3.11 | TP789(P) | (i) | (i) | |
| UC6 | 3.15 | W12(P) | (i) | (i) | |
| Marine Water | | | | | |
| CE | 4.1 | Control station (Ebb) | 830026 | 814956 | Marine water quality parameters to be monitored include temperature, pH, turbidity, water depth, salinity, dissolved |
| CF | 4.1 | Control station (Flood) | 831778 | 812420 | |
| I1 | 4.1 | Impact Station | 831088 | 813654 | |
| I2 | 4.1 | Impact Station | 831105 | 813582 | |

| Monitoring station | Fig. no. | Description | Easting | Northing | Monitoring Parameters |
|--------------------|----------|--|---------|----------|--|
| Intake A | 4.1 | Impact Station (Cyberport intake) | 831603 | 813044 | oxygen (DO) and suspended solids (SS). |
| Intake B | 4.1 | Impact Station (Queen Mary Hospital/Shaw Wan Drive intake) | 830606 | 814583 | |

Note : (i) The location of ground water monitoring stations shall be determined on site to suit the actual conditions

- 4.4.2 The final locations and number of the monitoring points shall be agreed with EPD at least 2 weeks before undertaking any works. The status and locations of water quality sensitive receivers may change after issuing this manual. If such cases exist, the ET leader shall propose updated monitoring locations and seek approval from the IEC and DEP.
- 4.4.3 When alternative monitoring locations are proposed, they shall be chosen based on the following criteria:
- at locations close to and preferably at the boundary of the mixing zone of the major site activities as indicated in the EIA final report, which are likely to have water quality impacts;
 - close to the sensitive receptors which are directly or likely to be affected;
 - for monitoring locations located in the vicinity of the sensitive receptors, care shall be taken to cause minimal disturbance during monitoring;
- 4.4.4 Control stations are necessary to compare the water quality from potentially impacted sites with the ambient water quality. Control stations shall be located within the same body of water as the impact monitoring stations but shall be outside the area of influence of the works and, as far as practicable, not affected by any other works. For underground water monitoring, the measured ground water levels should be compared with the pre-construction monitoring data carried out by the project office.
- 4.4.5 Replicates in-situ measurements and sample (except ground water monitoring) collected from each independent sampling event are required for all parameters to ensure a robust statistically interpretable dataset.

4.5 Baseline Monitoring

Marine Water

- 4.5.1 Baseline conditions for water quality will be established and agreed upon with ER and EPD prior to the commencement of works. The purpose of the baseline monitoring is to establish ambient conditions prior to the commencement of the works and to demonstrate the suitability of the proposed impact, control and reference monitoring stations.
- 4.5.2 The baseline conditions will normally be established by measuring all the water quality parameters for the construction phase monitoring as illustrated in Figure 4.1. The measurements will be taken at all designated monitoring stations 3 days per week, at mid-flood and mid-ebb tides, at three depth locations (i.e. 1 m below surface, mid-depth and 1m from bed), for a period of 4 weeks prior to the commencement of marine works. The interval between two sets of monitoring will not be less than 36 hours and the baseline monitoring schedule will be submitted to ER and EPD at least 2 week prior to the commencement of the baseline monitoring. Flow rates and sample depth will be also recorded, where appropriate. Also, all seasonal variations such as rainfall, tidal flow, typhoons and shipping activities will be assessed. For the selection of tide for water quality monitoring, tidal range of less than 0.5m should be avoided for both flood and ebb tides.

- 4.5.3 Measurements will be taken at 3 water depths, namely, 1m below water surface, mid-depth and 1m above sea bed, except where the water depth less than 6 m, the mid-depth station may be omitted. Will the water depth be less than 3 m, only the mid-depth station will be monitored. The ET will seek approval from EPD on all the monitoring stations.
- 4.5.4 There will not be any marine construction activities in the vicinity of the stations during the baseline monitoring.
- 4.5.5 In exceptional cases when insufficient baseline monitoring data or questionable results are obtained, the ET Leader will seek approval from EPD on an appropriate set of data to be used as baseline reference.

Underground water level

- 4.5.6 In order to ensure the water levels at those intakes near to the natural stream courses and thus on the surrounding habitats will not be significantly affected, the groundwater levels will be measured throughout the construction and the first year of tunnel operation period. A one-year ground water level monitoring program has been started since November 2004 for those ground water stations in the vicinity of the relevant intake structure. The data set will form the basis to assess the baseline line conditions. These data will be submitted to IEC prior to the commencement of construction works.

4.6 Impact Monitoring

Marine Water

- 4.6.1 During the course of the marine works, monitoring will be undertaken three days per week, at mid-flood and mid-ebb tides, with sampling/measurement at the designated monitoring stations. The interval between two sets of monitoring will not be less than 36 hours except where there are exceedances of Action and/or Limit levels, in which case the monitoring frequency will be increased.
- 4.6.2 Measurements will be taken at 3 water depths, namely, 1m below water surface, mid-depth and 1 m above sea bed, except where the water depth less than 6 m, the mid-depth station may be omitted. Will the water depth be less than 3 m, only the mid-depth station will be monitored.
- 4.6.3 Proposed water quality monitoring schedule shall be sent to ER and EPD at least one week prior to commencement of the monitoring work, ER and EPD shall be notified immediately of any change in monitoring schedule by fax.
- 4.6.4 The Action/Limit levels will be agreed with ER and EPD following the completion of the baseline monitoring. The Action/Limit levels will be calculated as outlined in Table 4.4.
- 4.6.5 Upon completion of all marine activities, a post project monitoring exercise on water quality shall be carried out four weeks in the same manner as the impact monitoring.

Table 4.4 Action /Limit Levels for Marine Water Quality

| Parameter (unit) | Action | Limit |
|--|---|---|
| Dissolved Oxygen (mg/L) (surface, middle, bottom) | <i>Surface and middle</i> 5%-ile of baseline for surface and middle layers | <i>Surface and middle</i> 4 mg/L or 1%-ile of baseline for surface and middle layers |
| | <i>Bottom</i> 5%-ile of baseline for bottom layer | <i>Bottom</i> 2 mg/L or 1%-ile of baseline for bottom |

| Parameter (unit) | Action | Limit |
|------------------------------------|--|--|
| | | layer |
| SS (mg/L) Depth average | 95%-ile of baseline data or 120% of upstream control station's SS at the same tide of the same day | 99%-ile of baseline or 130% of SS readings at the upstream control station at the same tide of same day and specific sensitive receiver water quality requirements |
| Turbidity (NTU) (depth average) | 95%-ile of baseline data or 120 % of upstream control station's turbidity at the same tide of the same day | 99%-ile of baseline or 130% of turbidity at the upstream control station at the same tide of same day |

Notes:

- For DO, non-compliance of the water quality limit occurs when monitoring result is lower than the limit.
- For SS & turbidity non-compliance of the water quality limits occur when monitoring result is higher than the limits.
- All the figures given in the table are used for reference only and the EPD may amend the figures whenever it is considered as necessary

Underground water level

- 4.6.6 It is proposed to measure the groundwater levels once per month during the construction and in the first year of operation and the monitoring program will be subject to review. Monitoring data will be submitted to EPD for record purposes.
- 4.6.7 Proposed ground water monitoring schedule shall be sent to EPD on or before the first day of the monitoring month. If there is any change in the monitoring schedule, EPD shall be notified immediately of the change.

4.7 Event and Action Plan for Water Quality

Marine Water

- 4.7.1 When the monitoring results of the water quality parameters at any designated monitoring stations exceed the water quality criteria, the actions in accordance with the Action Plan in Table 4.5 will be carried out.

Groundwater Level at Sensitive Intake Sites

- 4.7.2 It has been identified the intake sites at Eastern Portal, PFLR1(P), THR2(P), TP5, TP789 and W12 have sensitive ecological features. Monitoring of groundwater levels at these sites is proposed to ensure that construction and operation of the intake and drop shaft structures do not adversely impact on the local groundwater levels. Subject to review, the monitoring will be carried out monthly during the construction of the intakes and drop shafts and for the first year of the operation of the intakes which coincides with the maintenance period of the construction contract.
- 4.7.3 Data will be recorded from the monitoring stations and regularly analysed. Indicators highlight possible induced changes in groundwater levels may include –
- A sudden lowering of the groundwater level within a day;
 - No change or a lowering in groundwater level during periods of substantial rainfall;
 - A sustained lowering of the groundwater level over a longer period with rainfall;
- 4.7.4 When one of the criteria listed above is met the structures will be examined for signs of significant infiltration. If no infiltration is observed it is unlikely that the structures are causing the change in

— groundwater levels. If infiltration is observed then remedial action will be taken immediately that may include taking measures to stop the infiltration.

Table 4.5 Event and Action Plan for Water Quality

| EVENT | ACTION | | | |
|--|--|---|---|--|
| | ET | IEC | ER | CONTRACTOR |
| ACTION LEVEL | | | | |
| Action level being exceeded by one sampling day | <ol style="list-style-type: none"> Repeat in situ measurement to confirm findings; Identify source(s) of impact; Inform IEC, contractor and ER; Check monitoring data, all plant, equipment and Contractor's working methods. Discuss mitigation measures with IEC and Contractor Repeat measurement on next day of exceedance. | <ol style="list-style-type: none"> Discuss with ET and Contractor on the mitigation measures. Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; and Assess the effectiveness of the implemented mitigation measures. | <ol style="list-style-type: none"> Discuss with IEC on the proposed mitigation measures; and Make agreement on the mitigation measures to be implemented. | <ol style="list-style-type: none"> Inform the ER and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment; Consider changes of working methods; Discuss with ET and IEC and propose mitigation measures to IEC and ER; Implement the agreed mitigation measures. |
| Action level being exceeded by more than one consecutive sampling days | <ol style="list-style-type: none"> Repeat in-situ measurement to confirm findings; Identify source(s) of impact; Inform IEC, contractor; Check monitoring data, all plant, equipment and Contractor's working methods; Discuss mitigation measures with IEC, ER and Contractor; Ensure mitigation measures are implemented; Prepare to increase the monitoring frequency to daily; Repeat measurement on next day of exceedance. | <ol style="list-style-type: none"> Discuss with ET and Contractor on the mitigation measures. Review proposals on mitigation measures submitted by Contractor and advise the ER accordingly; and Assess the effectiveness of the implemented mitigation measures. | <ol style="list-style-type: none"> Discuss with IEC on the proposed mitigation measures; and Make agreement on the mitigation measures to be implemented. Assess the effectiveness of the implemented mitigation measures. | <ol style="list-style-type: none"> Inform the Engineer and confirm notification of the non-compliance in writing; Rectify unacceptable practice; Check all plant and equipment and Consider changes of working methods; Discuss with ET and IEC and propose mitigation measures to IEC and ER within 3 working days; Implement the agreed mitigation measures. |

| EVENT | ACTION | | | |
|---|---|--|--|---|
| | ET | IEC | ER | CONTRACTOR |
| LIMIT LEVEL | | | | |
| Limit level being exceeded by one sampling day | <ol style="list-style-type: none"> 1. Repeat measurement on next of exceedance to confirm findings; 2. Identify source(s) of impact; 3. Inform IEC, contractor, ER and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, ER and Contractor; | <ol style="list-style-type: none"> 1. Check monitoring data submitted by ET and Contractor's working methods. 2. Discuss with ET and Contractor on possible mitigation measures; 3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly; | <ol style="list-style-type: none"> 1. Confirm receipt of notification of failure in writing 2. Discuss with IEC, ET and Contractor on the proposed mitigation. 3. Request Contractor to view the working methods. 4. Ensure mitigation measures are properly implemented. | <ol style="list-style-type: none"> 1. Inform the ER and confirm notification of the non-compliance in writing; 2. Rectify unacceptable practice; 3 Check all plant and equipment and consider changes of working methods; 4. Discuss with ET, IEC and ER and propose mitigation measures to ER and IEC within 3 working days; 5. Implement the agreed mitigation measures. |
| Limit level being exceeded by more than one consecutive sampling days | <ol style="list-style-type: none"> 1. Repeat measurement on next of exceedance to confirm findings; 2. Identify source(s) of impact; 3. Inform IEC, contractor, ER and EPD; 4. Check monitoring data, all plant, equipment and Contractor's working methods; 5. Discuss mitigation measures with IEC, ER and Contractor; 6. Ensure mitigation measures are implemented; 7. Increase the monitoring frequency to daily until no exceedance of Limit level for two consecutive days; | <ol style="list-style-type: none"> 1. Check monitoring data submitted by ET and Contractor's working methods. 2. Discuss with ET and Contractor on possible mitigation measures; 3. Review the proposed mitigation measures submitted by Contractor and advise the ER accordingly; 4. Supervise the implementation of mitigation measures. | <ol style="list-style-type: none"> 1. Discuss with IEC, ET and Contractor on the proposed mitigation measures; 2. Request Contractor to critically review the working methods; 3. Make agreement on the mitigation measures to be implemented; 4. Ensure mitigation measures are properly implemented; 5. Consider and instruct, if necessary, the Contractor to slow down or to stop all or part of the construction activities until no exceedance of Limit level | <ol style="list-style-type: none"> 1. Take immediate action to avoid further exceedance 2. Discuss with ET, IEC and ER and propose mitigation measures to ER and IEC within 3 working days; 3. Implement the agreed mitigation measures; 4. Resubmit proposals of mitigation measures if problem still not under control; 5. As directed by the Engineer, to slow down or to stop all or part of the construction activities until no exceedance of Limit level. |

5. WASTE MANAGEMENT

5.1 General

- 5.1.1 The Contractor is responsible for the management of materials and wastes arising during construction. This includes control of wastes on site, removal of the waste materials from the site and the implementation of any mitigation measures to minimize waste or redress any problems that arise from waste associated with the works. In addition to C&D waste and general refuse, this material may include sewage, waste water or any other site discharges on to adjacent land, sewers, or water course.
- 5.1.2 This section sets out the measures to be adopted to avoid or minimize potential adverse impacts associated with waste arising from the works under the headings of each waste type. The Contractor should incorporate these recommendations into a comprehensive on-site waste management plan (WMP). If, for any reason, the recommendations cannot be implemented, full justification should be given in the WMP.
- 5.1.3 The WMP should be prepared in accordance with ETWB Technical Circular No. 15/2003 – Waste Management on Construction Sites and submitted for approval by the Engineer’s Representative prior any construction activities. During the construction period the WMP should be used as a working document to detail the on-going management procedures and to record waste arising and import of fill throughout the Contract. The WMP shall be subject to audit by IEC.
- 5.1.4 The WMP should include at least the following information:
- the types and quantities of waste,
 - timing and activities of waste generation,
 - locations for temporary storage,
 - considerations for recycle,
 - reuse and destinations for final disposal
- 5.1.5 According to the assessment, the excavation of the vertical intake shafts will mainly be carried out from the tunnel upwards (raise boring method) and therefore, those excavated spoil will be transported (drop down) via the intake shafts and then to either ends of drainage tunnel. Approximate negligible amount of excavated material (1,000 m³) will require transport on the ground surface from six (W8, W5, RR1, THR(2), WO and HR1) intake shafts only and disposed by trucks. Estimated total quantity of spoil generated during construction at both portals will be approximately 522,000 m³ for granite and volcanic rock (including 1,500 m³ for soil).
- 5.1.6 As most the majority of excavated material will be comprised of rocks, no re-use on site is identified and it will require off-site disposal either at suitable public fill areas or designated landfills or for re-use on other construction projects where good quality fill material is required. Estimated quantity will be about 185,100 m³ at Eastern portal (Table 5.1a) which will be transported by trucks and about 337,000 m³ at Western portal (Table 5.1b) which will be transported by barge respectively.

Table 5.1a

Estimated Spoil Generated Breakdown from Eastern Portal for 24 hours TBM operation regime

| Eastern Portal | Construction Period & Duration | Total volume, m ³ | m ³ /month | m ³ / day by truck |
|---|--|------------------------------|-----------------------|-------------------------------|
| Bored tunnel (Tai Hang Road to Aberdeen Tunnel) (Granite & Volcanic Rock) | Early June 2008 to End July 2010 (26 months) | 167,707 | 6,450 | 215 |
| Adits (Granite & Volcanic Rock) | Mid September 2008 to End April 2011 (31.5 months) | 13,741 | 436 | 15 |
| Adits (Soil) | | - | - | - |
| Intake Shafts & Ventilation Pipes (Granite & Volcanic Rock) | End August 2008 to Mid May 2011 (33.5 months) | 3,165 | 95 | 3 |
| Intake Shafts & Ventilation Pipes (Soils) | | 460 | 14 | 0.5 |
| Total | | 185,073 | 6,995 | 233.5 |

Table 5.1b

Estimated Spoil Generated Breakdown from Western Portal for 24 hours TBM operation regime

| Eastern Portal | Construction Period & Duration | Total volume, m ³ | m ³ /month | m ³ / day by barge |
|--|--|------------------------------|-----------------------|-------------------------------|
| Bored tunnel (Aberdeen Tunnel to Pok Fu Lam) (Granite & Volcanic Rock) | Early June 2008 to Mid August 2010 (26.5 months) | 308,674 | 11,648 | 388 |
| Adits (Granite & Volcanic Rock) | Mid September 2008 to Mid April 2011 (31 months) | 17,636 | 569 | 19 |
| Adits (Soil) | | - | - | - |
| Intake Shafts & Ventilation Pipes (Granite & Volcanic Rock) | End August 2008 to Early June 2011 (34 months) | 9,625 | 283 | 10 |
| Intake Shafts & Ventilation Pipes (Soils) | | 1,032 | 30 | 1 |
| Total | | 336,967 | 12,530 | 418 |

6. ECOLOGICAL IMPACTS

- 6.1 EIA report indicates that no unacceptable residual impact due to the construction and operation of the tunnel and intake structures is expected after the implementation of the proposed mitigation measures. The design has been developed based on avoidance, minimisation and compensation to reduce the ecological impact. There is no special requirement about EM&A programme for the ecological impact. Nevertheless, the following mitigation measures as recommended in EIA report are required to minimise the impact. The measures should be audited to ensure the effective implementation of mitigation measures.

Mitigation Measures for Terrestrial Ecology

- 6.2 During the detailed design stage, the following issues should be taken into account to further minimise the impacts:
- Refinement of site limit to minimise temporary loss of natural stream habitat during construction;
 - Refinement of site limit of temporary works area to minimise loss of woodland habitat, in particular for temporary works area at Eastern Portal;
 - Minimizing felling of large trees; and
 - Transplanting of trees of rare species or high amenity values if it is found in the path of the permanent works (e.g. the *Artocarpus hypargyreus* at intake shaft HKU1).
- 6.3 Good site practice including the following, should be enforced to minimise the disturbance to the surroundings:
- Treat any damage that may occur to individual major trees in the adjacent area using material and method appropriate for tree surgery;
 - Reinstatement of work sites/disturbed areas immediately after completion of the construction works, in particular, through on-site tree/shrub planting along the woodland and shrubland section within the temporary works area. Tree/shrub species used should be the same as the surrounding area; and
 - Regularly check the work site boundaries to ensure that they are not exceeded and that no damage occurs to surrounding areas.
- 6.4 Impact of permanent loss of 0.16ha of woodland by site formation and temporary loss of 0.53 ha of woodland within the works area would be mitigated by on site compensatory planting at various intake points and the Western Portal area. A total of 1.02 ha of area would be replanted with woodland species, reaching almost a 1.5:1 ratio for compensatory planting. Tree/shrub species used for compensatory planting should be based on those in the surrounding area.
- 6.5 Measures are needed to maintain the flow of the affected streams/nullahs during the construction stages. Temporary bypass should be provided if the stream/nullah flows will be cut off by the construction works. After the construction works are finished, sections of temporary loss should be reinstated. Measures should also be taken to avoid runoff to streams and marine habitats. Streams/channels that could potentially be affected during construction should be prevented from sedimentation by erection of sediment barriers. Site runoff should be desilted by siltation traps in streams/channels or diverted, to reduce the potential for suspended sediments, organics and other contaminants to enter the local stream environment.
- 6.6 The majority of the permanent stream habitat loss would come from the modification of a section of stream channel (54 m) immediately upstream from the Eastern Portal. Mitigation measures include introduction of low flow channel within the channelised section to maintain a deeper water depth, in

- particular during dry season. And there would be a basin at the end of the channelised section. Both structures could provide living space for aquatic life within the channelised section. Furthermore, step chute in the form of a series of descending water pools would be constructed between the low flow channel and the undisturbed stream course. There would also be openings for aquatic fauna between each chute step (pool). These could work like a “ladder” to help avoid isolating the aquatic fauna in the channelised section from natural habitats.
- 6.7 Surveys of amphibians at E4(P), PFLR1(P), W12(P), MB16, E5(B)(P), TP789(P) and P5(P) prior to commencement of construction is recommended. Frogs (including Hong Kong Cascade Frog and Lesser Spiny Frog) and tadpoles found at work areas of these proposed intake points will be collected and translocated to nearby streams that will not be affected by the project. These procedures should be performed by experienced herpetologists. A detailed translocation proposal will be submitted during the detailed design stage.

Mitigation Measures for Marine Ecology

- 6.8 According to the EIA report, the potential impacts on marine ecology due to the Project is limited and would be controlled by the water quality mitigation measures and monitoring programme outlined in Section 4 of this Manual. The programme would ensure that no unforeseen water quality impacts occur to the ecological receivers, and hence no additional monitoring measures are proposed specifically for ecological receivers.
- 6.9 Potential sources of marine water quality impact during construction phase include:
- Site runoff;
 - Suspended solid during the construction and demolition of the berthing point; and
 - Construction of the stilling basin.
- 6.10 Silt curtain will be deployed during the construction and demolition of the temporary berthing point. With the deployment of silt curtains around the berthing point area, adverse water quality impact would not be anticipated. No significant ecological impact is anticipated.
- 6.11 The stilling basin will be constructed by the side of shoreline. Its invert will be at -5.4 mPD which is below the sea level. A cofferdam in the form of pipe-pile wall is to be erected outside the stilling basin prior to the construction of basin. The cofferdam will be dewatered to provide a working space for the construction of stilling basin and prevent mitigation of suspended particles from the work site to the sea.
- 6.12 A speed limit of 10 knots should be strictly enforced in particular in the waters between the outfall location at Western Portal and the navigation channel in East Lamma channel to avoid causing injury to cetacean.

7. FISHERIES

7.1 The construction and operation of the Project will not give rise to significant impacts to fisheries as there is no predicated adverse impact to water quality and only insignificant loss of fishing ground. The impacts of the Project on fisheries resources could be monitored indirectly through the water quality EM&A programme. The recommended mitigation measures for protecting fisheries resources are outlined as follows.

Mitigation Measures for Fisheries

7.2 Potential sources of impact during construction phase include:

- Site runoff;
- Suspended solid during the construction and demolition of the berthing point; and
- Construction of the stilling basin.

7.3 Site runoff will be controlled by general site practices during the construction.

7.4 Silt curtain will be deployed during the construction and demolition of the temporary berthing point. With the deployment of silt curtains around the berthing point area, adverse water quality impact would not be anticipated. No significant fisheries impact is anticipated.

7.5 The stilling basin will be constructed by the side of the shoreline. Its invert is at about -5.4 mPD which is below the sea level. A cofferdam in the form of pipe-pipe wall is to be erected outside the stilling basin prior to the construction of basin. The cofferdam will be dewatered to provide a working space for the construction of stilling basin and prevent mitigation of suspended particle from the work site to the sea.

8. LANDSCAPE AND VISUAL IMPACTS

8.1 General

8.1.1 Preservation of existing landscape/visual resources are the primary considerations in the design of this project. Losses of landscape/visual resources are unavoidable for construction of the proposed structure but all of these shall be limited to an absolute minimum to minimize the landscape and visual impact.

8.1.2 The EIA has recommended mitigation measures for landscape and visual resources during both the construction and operational phases of the Project. The implementation and maintenance of the landscape compensatory planting measures is a key aspect which should be checked to ensure that the proposals are fully realised.

8.2 Mitigation Measures for Landscape and Visual during Construction

8.2.1 The EIA has recommended mitigation measures for landscape and visual resources during both the construction and operation phases of the Project. The implementation and maintenance of the landscape compensatory planting measures is a key aspect which should be checked to ensure that the proposals are fully realised.

8.2.2 Major source of visual impact during the construction phase of the project are due to the permanent loss of existing vegetation and temporary construction works. After implementation of following mitigation measures, the residual visual impacts during the construction phase are considered acceptable with mitigation measures:

- Topsoil, where identified, should be stripped and stored for re-use in the construction of the soft landscape works, where practical.
- Existing trees to be retained on site should be carefully protected during construction.
- Trees unavoidably affected by the works should be transplanted where practical.
- Compensatory tree planting should be provided to compensate for felled trees.
- The extent of disturbance on the existing stream course should be minimized.
- Control of night-time lighting
- Erection of decorative screen hoarding.
- The landscape/reinstatement works at site area should be completed as early as possible.

8.3 Mitigation Measures for Landscape and Visual during Operation

8.3.1 Major source of visual impact during the operation phase of the project are due to the change in existing visual quality due to the permanent alienation of landscape areas for the Eastern Tunnel Portal, Western Tunnel Portal and the intake structures and permanent erection of the above ground structures for the Eastern and Western Tunnel Portals. After implementation of following mitigation measures, the residual visual impacts during the operation phase are considered acceptable with mitigation measures.

- Aesthetic design of above ground structures with the finishes and color matching with the surrounding environment.
- Toe planter with tall tree and shrub planting shall be provided to screen the Eastern Portal Tunnel and the retaining wall for access road.
- Buffer tree and shrub planting shall be provided to screen above ground structures and blend in the structures with the surrounding landscape setting.
- Existing hard and soft landscape areas to be affected by temporary works shall be reinstated.

- The proposed intake structure that are within existing playground/sitting out areas shall be designed to be accommodated underground except the ventilation column and the necessary facilities. Upon completion of the construction, the areas will be reinstated to match with the surrounding landscaping settings for the enjoyment of the public.

9. CULTURAL HERITAGE IMPACTS

9.1 General

- 9.1.1 The works associated with proposed drainage tunnel will have no impact on terrestrial or marine archaeological resources, cultural or historical landscapes or historical graves. Archaeological monitoring work during the construction and operation phases of the project is, therefore, not required.
- Four built heritage resources have been identified in the EIA study as falling within the 50m Study Area of the DP. Two of these resources, i.e. the Catholic Cathedral of the Immaculate Conception on Caine Road and the Hop Yat Church on Bonham Road, have been found to be located at sufficient distance from the works that no adverse impacts would result from the project during the construction or operational phases. Two other resources (located within close proximity to works areas) will require mitigation during the construction phase to mitigate against the identified adverse impacts. These are the Haw Par Mansion site and the Former Explosive Magazine of the Victoria Barracks.

9.2 Mitigation Measures for Cultural Heritage

Haw Par Mansion

- 9.2.1 A condition survey must be undertaken prior to the commencement of construction works, to assess the structural integrity of the building, (with special attention paid to any fragile architectural features) and to determine if vibration monitoring and/or other protective measures will be necessary during the construction phase. Implementation of the survey and any recommended protective measures will be the responsibility of the contractor.

Boundary Wall and Gate of Haw Par Mansion Site

- 9.2.2 A condition survey must be undertaken prior to the commencement of construction works, to assess the structural integrity of the wall and gate and to determine if vibration monitoring and/or any other protective measures will be necessary during the construction phase. Implementation of the survey and any recommended protective measures will be the responsibility of the contractor.
- 9.2.3 The contractor will also be responsible for ensuring that a 3 metre buffer zone (clearly demarcated by a temporary fence) is maintained between the boundary wall and gate and the works area (during construction works for both the tunnel portal and the permanent vehicle access ramp), to enable access for routine maintenance to the wall. In addition, the buffer zone could protect the wall not being damaged by machinery operation during construction phases.

Former Explosive Magazine of the former Victoria Barracks

- 9.2.4 A condition survey must be undertaken prior to the commencement of construction works, to assess the structural integrity of the wall and the extent of damage from cracks and vegetation growth, to determine if vibration monitoring and/or any other protective measures will be necessary during the construction phase. Implementation of the survey and any recommended protective measures will be the responsibility of the contractor.
- 9.2.5 The contractor will also be responsible for ensuring that a 3 meter buffer zone (clearly demarcated by a temporary fence) will be maintained between the retaining wall and the works area.
- 9.2.6 The condition surveys as described in Sections 9.2.1, 9.2.2 and 9.2.4 must be carried out in advance of works and report(s) must be compiled, containing description of the types of construction, identification of fragile elements, an appraisal of the condition and working methods for any proposed

- monitoring and precautionary measures that are recommended. The report(s) must be submitted to AMO for approval at least one month before construction activities commence. Upon approval the contractor shall implement the approved monitoring and precautionary measures.
- 9.2.7 The condition surveys should be conducted by a registered structural engineer or a conservation architect, who should be agreed by the AMO before the condition surveys take place. The contractor should inform AMO the time schedule of the condition surveys and notify AMO well in advance prior to the commencement of the condition surveys so as to allow AMO to arrange the on-site monitoring, if necessary. The ET team leader should check whether a registered structural engineer or a conservation architect has been employed by the Contractor to conduct the condition surveys. The survey methodology and locations should be checked against with the requirements agreed between the registered structural engineer or conservation architect and AMO. Any recommended mitigation measures should be agreed with and to the satisfaction of the AMO.

10. SITE ENVIRONMENTAL AUDIT

10.1 Site Inspections/Audits

10.1.1 Site Inspections/Audits provide a direct means to trigger and enforce the specified environmental protection and pollution control measures. They shall be undertaken routinely to inspect the construction activities in order to ensure that appropriate environmental protection and pollution control mitigation measures are properly implemented. With well defined pollution control and mitigation specifications and a well established site inspection, deficiency and action reporting system, the site inspection is one of the most effective tools to enforce the environmental protection requirements on the construction site.

10.1.2 The ET Leader is responsible for formulation of the environmental site inspection, deficiency and action reporting system, and for carrying out the site inspection works. He shall submit a proposal on the site inspection, deficiency and action reporting procedures within 21 days of the commencement of Contract to the Contractor for agreement and to the ER and the IEC for approval.

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

- (a) the EIA recommendations on environmental protection and pollution control mitigation measures;
- (b) works progress and programme;
- (c) individual works methodology proposals (which shall include proposal on associated pollution control measures);
- (d) the contract specifications on environmental protection;
- (e) the relevant environmental protection and pollution control laws; and
- (f) previous site inspection results.

10.1.4 The ET Leader shall liaise with the Contractor to update all relevant information of Contract for him to carry out the site inspections / audits. The inspection results and the associated recommendations on improvements to the environmental protection and pollution control works shall be submitted to the ER, the IEC and the Contractor within 24 hours, for reference and for taking immediate action. The Contractor shall follow the procedures and time-frame as stipulated in the environmental site inspection, deficiency and action reporting system formulated by the ET Leader to report on any remedial measures subsequent to the site inspections / audits.

10.1.5 The ET Leader shall carry out ad hoc site inspections / audits if significant environmental problems are identified. He shall also carry out any inspections/ audits required subsequent to receipt of an environmental complaint, or as part of the investigation work, as specified in the Action Plan for environmental monitoring and audit.

10.2 Compliance with Legal and Contractual Requirements

10.2.1 There are contractual environmental protection and pollution control requirements as well as environmental protection and pollution control laws in Hong Kong which the construction activities shall comply with.

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- 10.2.2 In order that the works are in compliance with the contractual requirements, all the works method statements submitted by the Contractor to the ER for approval shall also be sent to the ET Leader and the IEC for vetting to see whether sufficient environmental protection and pollution control measures have been included.
- 10.2.3 The ET Leader shall also be responsible for certifying the environmental acceptability of permanent and temporary works, and the environmental acceptability of relevant design plans and submissions.
- 10.2.4 The ET Leader shall also review the progress and programme of the works to check that relevant environmental laws have not been violated, and that any foreseeable potential for violating the laws can be prevented.
- 10.2.5 The Contractor shall regularly copy relevant documents to the ET Leader and the IEC so that the checking work can be carried out. The document shall at least include the updated Work Progress Reports, the updated Works Programme, the application letters for different license/permits under the environmental protection laws, and all valid licenses/permits. The site diary shall also be available for the ET Leader's inspection upon his request.
- 10.2.6 After reviewing the document, the ET Leader shall advise the ER and the Contractor of any non-compliance with the contractual and legislative requirements on environmental protection and pollution control for them to take follow-up actions. If the ET Leader's review concludes that the current status on licence/permit application and any environmental protection and pollution control preparation works may not cope with the works programme or may result in potential violation of environmental protection and pollution control requirements by the works in due course, he shall also advise the Contractor and the ER accordingly.
- 10.2.7 Upon receipt of the advice, the Contractor shall undertake immediate action to remedy the situation. The ER shall follow up to ensure that appropriate action has been taken by the Contractor in order that the environmental protection and pollution control requirements are fulfilled.

10.3 Environmental Complaints

- 10.3.1 Complaints shall be referred to the ET Leader for carrying out complaint investigation procedures. The ET Leader shall undertake the following procedures upon receipt of the complaints:
- (a) log complaint and date of receipt onto the complaint database;
 - (b) investigate the complaint to determine its validity, and to assess whether the source of the problem is due to works activities;
 - (c) if a complaint is valid and due to works, identify mitigation measures;
 - (d) if mitigation measures are required, advise the Contractor accordingly;
 - (e) review the Contractor's response on the identified mitigation measures, and the updated situation;
 - (f) if the complaint is transferred from EPD, submit interim report to EPD on status of the complaint investigation and follow-up action within the time frame assigned by EPD;
 - (g) undertake additional monitoring and audit to verify the situation if necessary, and review that any valid reason for complaint does not recur;
 - (h) report the investigation results and the subsequent actions to the source of complaint for responding to complainant (If the source of complaint is EPD, the results should be reported within the time frame assigned by EPD); and
 - (i) record the complaint, investigation, the subsequent actions and the results in the monthly EM&A reports.

- 10.3.2 During the complaint investigation work, the Contractor and ER shall cooperate with the ET Leader and the IEC in providing all the necessary information and assistance for completion of the investigation. If mitigation measures are identified in the investigation, the Contractor shall promptly carry out the mitigation measures. The ER shall ensure that the measures have been carried out by the Contractor. A flow chart of the complaint response procedures is shown in Figure 10.1. A sample of the complaint log sheet is provided in Appendix E.

11. REPORTING

11.1 General

11.1.1 The ET Leader shall prepare and certify the EM&A Reports in accordance with following reporting requirements. The following reporting requirements are based upon a paper documented approach. However, the same information can be provided in an electronic medium upon agreeing the format with the ER. This would enable a transition from a paper/historic and reactive approach to an electronic/real time proactive approach.

11.2 Baseline Monitoring Report

11.2.1 The ET Leader shall prepare and submit a Baseline Environmental Monitoring Report within 2 weeks of completion of the baseline monitoring. Copies of the Baseline Environmental Monitoring Report shall be submitted to each of the four parties: the Contractor, the ER, the IEC and the EPD. The ET Leader shall liaise with the relevant parties on the exact number of copies they want. The format of the report and the format of the baseline monitoring data in magnetic media to be submitted to EPD.

11.2.2 The baseline monitoring report shall include at least the following:-

- (a) Up to half a page executive summary;
- (b) Brief project background information;
- (c) drawings showing locations of the baseline monitoring stations;
- (d) an updated construction programme with milestones of environmental protection/mitigation activities annotated;
- (e) monitoring results (in both hard and diskette copies) together with the following information:
 - monitoring methodology;
 - name of laboratory and types of equipment used and calibration details;
 - parameters monitored;
 - monitoring locations (and depth); and
 - monitoring date, time, frequency and duration;
 - QA/QC results and detection limits.
- (f) details on influencing factors, including:
 - major activities, if any, being carried out on the site during the period;
 - weather conditions during the period; and
 - other factors which might affect the results.
- (g) determination of the Action and Limit Levels for each monitoring parameter and statistical analysis of the baseline data, the analysis shall conclude if there is any significant different between control and impact stations for the parameters monitored;
- (h) revisions for inclusion in the Updated EM&A Manual, and
- (i) comments and conclusions.

11.3 Monthly EM&A Reports

11.3.1 The results and findings of all EM&A work required in this EM&A Manual shall be recorded in the monthly EM&A reports certified by the ET Leader and verified by the IEC. The EM&A report shall be prepared and submitted within 2 weeks of the end of each reporting month, with the first report due in the month after construction commences. Six hard copies of each monthly EM&A report shall be submitted to each of the five parties: the Employer, the Contractor, the ER, the IEC and EPD (2 hard copies), and an electronic copy as described in Section 11.14 shall be submitted to each of the ER and

EPD. Before submission of the first EM&A report, the ET Leader shall liaise with the parties on format of the monthly reports in both hard copy and electronic medium requirement.

11.3.2 The ET Leader shall review the number and location of monitoring stations and parameters to be monitored for every 6 months or on as needed basis in order to cater for the changes in surrounding environment and nature of works in progress.

First Monthly EM&A Report

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

- (a) 1-2 pages executive summary;
 - breaches of Action/Limit levels;
 - Complaint Log;
 - Notifications of any summons and successful prosecutions;
 - Reporting Changes;
 - Future key issues.
- (b) Basic project information;
 - Project organization including key personnel, contact names and telephone numbers;
 - Construction Programme with fine tuning of construction activities showing the inter-relationship with environmental protection/mitigation measures for the month;
 - Management structure; and
 - Works undertaken during the month;
- (c) Environmental Status
 - Works undertaken during the month with illustrations (such as location of works, daily dredging/filling rates, percentage fines in the fill material used) and;
 - Drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations.
- (d) Summary of EM&A requirements including:
 - all monitoring parameters;
 - environmental quality performance limits (Action and Limit levels);
 - Event-Action Plans;
 - environmental mitigation measures, as recommended in the EIA report;
 - environmental requirements in contract documents;
- (e) Implementation Status
 - advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the EIA report, summarized in the updated implementation schedule;
- (f) Monitoring results (in both hard and diskette copies) together with the following information;
 - monitoring methodology
 - name of laboratory and types of equipment used and calibration details
 - parameters monitored
 - monitoring locations (and depth)
 - monitoring date, time, frequency, and duration;
 - weather conditions during the period;

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- graphical plots of the monitored parameters in the month annotated against;
 - the major activities being carried out on site during the period;
 - weather conditions that may affect the results;
 - any other factors which might affect the monitoring results;
 - QA/QC results and detection limits.
- (g) Report on non-compliance, complaints, 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 (written or verbal) for each media, including locations and nature of complaints, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
 - record of all notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, including locations and nature of the breaches, investigation, follow-up action taken, results and summary;
 - review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
 - description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance
- (h) 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; and
 - submission of implementation status proforma, proactive environmental protection proforma, regulatory compliance proforma, site inspection proforma, data recovery schedule and complaint log summarizing the EM&A of the period.

Subsequent Monthly EM&A Reports

11.3.4 The subsequent monthly EM&A reports shall include the following:

- (a) Executive Summary (1-2 pages)
- Breaches of Action and Limit levels
 - Complaint Log
 - Notifications of any summons and successful prosecution
 - Reporting Changes
 - Future key issues
- (b) Environmental Status
- Construction Programme with fine tuning of construction activities showing the inter-relationship with environmental protection/mitigation measures for the month;
 - Works undertaken during the month with illustration including key personnel contact names and telephone numbers; and
 - Drawing showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations
- (c) Implementation Status
- Advice on the implementation status of environmental protection and pollution control/mitigation measures including measures for ecological and visual impacts, as recommended in the project EIA study report, summarized in the updated implementation schedule.

(d) Monitoring Results

To provide monitoring results (in both hard and diskette copies) together with the following information:

- Monitoring methodology
- Name of laboratory and types of equipment used and calibration details
- Parameters monitored
- Monitoring locations (and depth)
- Monitoring date, time, frequency, and duration;
- Weather conditions during the period;
- Graphical plots of the monitored parameters in the month annotated against;
- The major activities being carried out on site during the period;
- Weather conditions that may affect the results;
- Any other factors which might affect the monitoring results;
- QA/QC results and detection limits.

(e) Report on non-compliance, complaints, 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 (written or verbal) for each media, including locations and nature of complaints, liaison and consultation undertaken, actions and follow-up procedures taken, results and summary;
- Record of all notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, including locations and nature of the breaches, investigation, follow-up action taken, results and summary;
- Review of the reasons for and the implications of non-compliance, complaints, summons and prosecutions including review of pollution sources and working procedures; and
- A description of the actions taken in the event of non-compliance and deficiency reporting and any follow-up procedures related to earlier non-compliance

(f) 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.

(g) Appendix

- Action and Limit levels
- Graphical plots of trends of monitored parameters at key stations over the past four reporting periods for representative monitoring stations annotated against the following:
 - i) major activities being carried out on site during the period;
 - ii) weather conditions during the period; and
 - iii) any other factors which might affect the monitoring results
 - Monitoring schedule for the present and next reporting period
 - Cumulative complaints statistics
 - Details of complaints, outstanding issues and deficiencies

11.4 Quarterly EM&A Summary Reports

11.4.1 The quarterly EM&A summary report which should generally be around 5 pages (including about 3 of text and tables and 2 of figures) should contain at least the following information. Apart from these,

the first quarterly summary report should also confirm that the monitoring work is proving effective and that it is generating data with the necessary statistical power to categorically identify or confirm the absence of impact attributable to the works:

- (a) up to half a page executive summary;
- (b) basic project information including a synopsis of the project organization, programme, contacts of key management, and a synopsis of work undertaken during the quarter;
- (c) a brief summary of EM&A requirements including:
 - monitoring parameters;
 - environmental quality performance limits (Action and Limit levels); and
 - environmental mitigation measures, as recommended in the EIA report;
- (d) advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the EIA report, summarized in the updated implementation schedule;
- (e) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
- (f) graphical plots of the trends of monitored parameters over the past 4 months (the last month of the previous quarter and the present quarter) for representative monitoring stations annotated against:
 - the major activities being carried out on site during the period;
 - weather conditions during the period; and
 - any other factors which might affect the monitoring results;
- (g) advice on the solid and liquid waste management status;
- (h) a summary of non-compliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
- (i) a brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;
- (j) a quarterly assessment of construction impacts on water quality at the project site, including, but not limited to, a comparison of the difference between the quarterly mean and 1.3 times of the ambient mean, which is defined as 30% increase of the baseline data or EPD data, of the related parameters by using appropriate statistical procedures. Suggestion of appropriate mitigation measures if the quarterly assessment analytical results demonstrate that the quarterly mean is significantly higher than the 1.3 on water quality times of the ambient mean ($p < 0.05$);
- (k) a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;
- (l) a summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;

- (m) a summary record of notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, locations and nature of the breaches, investigation, follow-up actions taken and results;
- (n) comments (e.g. effectiveness and efficiency of the mitigation measures), recommendations (e.g. any improvement in the EM&A programme) and conclusions for the quarter; and
- (o) the Employer's contacts and any hotline telephone number the public to make enquiries.

11.5 Final EM&A Summary Report

11.5.1 The termination of EM&A programme shall be determined on the following basis:

- (a) completion of construction activities and insignificant environmental impacts of the remaining outstanding construction works;
- (b) trends analysis to demonstrate the narrow down of monitoring exceedances due to construction activities and the return of ambient environmental conditions in comparison with baseline data; and
- (c) no environmental complaint and prosecution involved.

11.5.2 The proposed termination may require to consult relevant local community such as village representative/committee and/or District Councils and the proposal should be endorsed by the IEC, ER and the project proponent prior to final approval from the Director of Environmental Protection.

11.5.3 The final EM&A summary report shall include, inter alia, the following:

- (a) an executive summary;
- (b) basic project information including a synopsis of the project organization, programme, contacts of key management, and a synopsis of work undertaken during the entire construction period;
- (c) a brief summary of EM&A requirements including:
 - all monitoring parameters;
 - environmental quality performance limits (Action and Limit levels);
 - Event-Action Plans; and
 - environmental mitigation measures, as recommended in the project EIA study final report;
- (d) advice on the implementation status of environmental protection and pollution control/mitigation measures, as recommended in the project EIA study reports, summarized in the updated implementation status proformas;
- (e) drawings showing the project area, any environmental sensitive receivers and the locations of the monitoring and control stations;
- (f) graphical plots of the trends of monitored parameters over the construction period for representative monitoring stations annotated against:
 - the major activities being carried out on Site during the period;
 - weather conditions during the period;
 - any other factors which might affect the monitoring results; and
 - the return of ambient environmental conditions in comparison with baseline data;

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- (g) compare and contrast the EM&A data with the EIA predictions and annotate with explanation for any discrepancies;
 - (h) provide clear-cut decisions on the environmental acceptability of the project with reference to the specific impact hypothesis;
 - (i) advice on the solid and liquid waste management status;
 - (j) a summary of noncompliance (exceedances) of the environmental quality performance limits (Action and Limit levels);
 - (k) a brief review of the reasons for and the implications of non-compliance including review of pollution sources and working procedures;
 - (l) a summary description of the actions taken in the event of non-compliance and any follow-up procedures related to earlier non-compliance;
 - (m) a summary record of all complaints received (written or verbal) for each media, liaison and consultation undertaken, actions and follow-up procedures taken;
 - (n) review the monitoring methodology adopted and with the benefit of hindsight, comment on its effectiveness (including cost effectiveness);
 - (o) a summary record of notifications of summons and successful prosecutions for breaches of the current environmental protection/pollution control legislations, locations and nature of the breaches, investigation, follow-up actions taken and results;
 - (p) review the practicality and effectiveness of the EIA process and EM&A programme (e.g. effectiveness and efficiency of the mitigation measures), recommend any improvement in the EM&A programme ; and
 - (q) a conclusion to state the return of ambient and/or the predicted scenario as per EIA findings.

11.6 Data Keeping

11.6.1 The site document such as the monitoring field records, laboratory analysis records, site inspection forms, etc. are not required to be included in the monthly EM&A reports for submission. However, the document shall be well kept by the ET Leader and be ready for inspection upon request. All relevant information shall be clearly and systematically recorded in the document. The monitoring data shall also be recorded in magnetic media form, and the software copy can be available upon request. All the documents and data shall be kept for at least one year after completion of the Contract.

11.7 Interim Notifications of Environmental Quality Limit Exceedances

11.7.1 The site document such as the monitoring field records, laboratory analysis records, site inspection forms, etc. are not required to be included in the monthly EM&A reports for submission. However, the document shall be well kept by the ET Leader and be ready for inspection upon request. All relevant information shall be clearly and systematically recorded in the document. The monitoring data shall also be recorded in magnetic media form, and the software copy can be available upon

request. All the documents and data shall be kept for at least one year after completion of the Contract.

11.7.2 With reference to Event/Action Plans in Tables 2.3, 3.3 and 4.5, when the environmental quality limits are exceeded, the ET Leader shall immediately notify the ER, the IEC, and EPD, as appropriate. The notification shall be followed up with advice to EPD on the results of the investigation, proposed action and success of the action taken, with any necessary follow-up proposals. A sample template for the interim notifications is shown in Appendix D.

11.8 Electronic Reporting of EM&A Information

11.8.1 To facilitate public inspection of the monthly EM&A Reports via the EIAO Internet Website and at the EIAO Register Office, electronic copies of these Reports shall be prepared in Hyper Text Markup Language (HTML) (version 4.0 or later) and in Portable Document Format (PDF version 4.0 or later) unless otherwise agreed by EPD and submitted to the ER and to EPD at the same time as the hard copies. For the HTML version, a content page capable of providing hyperlink to each section and sub-section of these Reports shall be included in the beginning of the document. Hyperlinks to all figures, drawings and tables in these Reports shall be provided in the main text from where the respective references are made. All graphics in these Reports shall be in interlaced GIF format unless otherwise agreed by EPD. The content of the electronic copies of these Reports must be the same as the hard copies.

11.8.2 The Contractor shall establish a website and the environmental monitoring data on air, noise and water quality shall be made available to the public via internet access in the form of a website, in the shortest possible time and in no event later than 2 weeks after the relevant environmental monitoring data are collected or become available, unless otherwise agreed with EPD. The ET shall inform EPD in writing within 6 weeks after the commencement of the Project the internet address where the environmental monitoring data are to be placed. The internet address and the environmental monitoring data shall be made available to the public via the EIAO Internet Website and the EIAO Register Office.

11.8.3 The internet website as described in Section 11.8 above shall enable user-friendly public access to the monitoring data with features capable of:

- (a) providing access to all environmental monitoring data collected since the commencement of works;
- (b) searching by date;
- (c) searching by types of monitoring data (air quality and noise);
- (d) searching by monitoring stations; and
- (e) providing hyperlinks to relevant monitoring data after searching,

or otherwise as agreed by EPD.

11.8.4 The ET shall incorporate the Baseline Monitoring Report in the internet website described in Section 11.8 above.