

Contents

13.	Environmental Monitoring and Audit (EM&A) Requirements	1
13.1	Introduction	1
13.2	EM&A Manual	1
13.3	EM&A Programme	2

13. Environmental Monitoring and Audit (EM&A) Requirements

13.1 Introduction

13.1.1.1 This section summarizes the requirements on environmental monitoring and audits for the construction and operation of the Schedule 2 Designated Project (DP) items of the Project based on the assessment results of various environmental issues. Details of the Environmental Monitoring and Audit (EM&A) programme can be referred to the separate EM&A Manual.

13.2 EM&A Manual

13.2.1.1 EM&A is an important aspect in the EIA process which specifies the timeframe and responsibilities for the implementation of environmental mitigation measures. The requirements on environmental monitoring (including baseline and impact monitoring) are given in the EM&A Manual.

13.2.1.2 A project specific EM&A Manual to the Project has been prepared as part of the EIA deliverables based on the latest design information available and Environmental Protection Department (EPD)'s generic EM&A Manual. The project specific EM&A Manual highlights the following issues:

- Organisation, hierarchy and responsibilities of the Contractor, the Project Manager (PM) or Project Manager's Representative (PMR), Environmental Team (ET) and Independent Environmental Checker (IEC) with respect to the EM&A requirements during construction phase of the Project;
- Information on project organisation and programming of construction activities for the Project;
- Requirements with respect to the construction schedule and necessary EM&A programme to track the varying environmental impacts;
- Full details of methodologies to be adopted, including all field, laboratory and analytical procedures, and details on quality assurance;
- Procedure for undertaking on-site environmental audits;
- Definition of Action and Limit Levels;
- Establishment of Event and Action Plans;
- Requirements for reviewing pollution sources and working procedures required in the event of non-compliance of environmental criteria and complaints;
- Requirements for reviewing the implementation of mitigation measures, and effectiveness of environmental protection and pollution control measures adopted; and
- Presentation of requirements for EM&A data and appropriate reporting procedures.

13.2.1.3 The Contractor shall be requested to review and adhere to the mitigation measures and Environmental Mitigation Implementation Schedule (EMIS) with respect to the design developments and construction methodology. Any proposed changes to the mitigation measures shall be certified by the ET Leader and verified by the IEC as conforming to the relevant information and recommendations contained in the EIA Report.

13.3 EM&A Programme

13.3.1.1 The Contractor and Project Proponent will be requested to implement an environmental monitoring programme throughout the Project. In case exceedance is found, the Contractor, Project Proponent and ET should take immediate actions to implement remediation measures following the procedures specified in the EM&A Manual.

13.3.1.2 Detailed requirements of the EM&A programme have been described in the EM&A Manual. Measurements and activities that shall be conducted in accordance with the requirements in the EM&A Manual are summarised as follows:

- Baseline monitoring (noise, etc.);
- Impact monitoring (construction dust, noise, etc.);
- Remedial actions in accordance with the Event and Action Plans within the timeframe in case the specified criteria in the EM&A Manual were exceeded;
- Logging and keeping records of monitoring results; and
- Preparation and submission of Baseline, Monthly and Final EM&A Reports.

13.3.2 Air Quality

Construction Phase

13.3.2.1 With the implementation of the dust suppression measures and good site practices, no adverse construction dust impact is anticipated during the construction phase. However, construction dust monitoring should be conducted continuously at comprehensive monitoring locations throughout the construction phase, while regular site environmental inspections should be carried out at least once per week during construction phase to ensure that the dust level will comply with the relevant criterion and the recommended best practices as recommended in this EIA Report and the EM&A Manual are properly implemented by the Contractor.

Operation Phase

13.3.2.2 It is anticipated that there would be no adverse air quality impact during operational phases, and thus monitoring and audit are not required. However, the Tuen Mun Bypass (TMB)'s highway / tunnel operation and maintenance facilities (i.e., the northern ventilation building, satellite control building and operation area in Lam Tei, as well as maintenance compound and training ground and supporting area in Pillar Point) would partially fall within the potential exceedance zone at 1.5mAG. If there are any planned air sensitive uses within the satellite control building and operation area in Lam Tei, and maintenance compound and training ground and supporting area in Pillar Point, they will be properly designed such that any openings, openable windows, and/or FAIs will be located and avoided from the predicted exceedance zone at 1.5mAG. (e.g., by provision

of fixed glazed window or blank facades, and FAIs to be located away or proposed air sensitive uses outside the exceedance zone). Further review of the layout and design of these TMB highway / tunnel operation and maintenance facilities will be conducted in Detailed Design Stage to re-affirm compliance of the AQOs. For the proposed satellite control building and FAIs for maintenance compound located within the exceedance zone at 1.5mAG, installation of air filtering system is recommended. The air filtering system and NO₂ removal efficiency shall be further reviewed in Detailed Design Stage to re-affirm compliance of the AQOs. In addition, during the subsequent design stage and the operational stage, the ventilation engineer should conduct reviews on the ventilation scheme covering different periods of a day, taking into account the contemporary circumstance such as latest traffic forecast, traffic composition, update on the ambient air quality, etc., and then review and update the air quality assessment as necessary to re-affirm full compliance of the AQO. These reviews would allow the designer and operator to optimize the operation of the ventilation system without compromising the compliance of AQO.

13.3.3 Noise

Construction Phase

- 13.3.3.1 With proper implementation of noise control measures, adverse construction noise impact is unlikely. Nevertheless, noise monitoring is recommended as part of the EM&A programme for the construction phase of the Project to check compliance with the daytime construction noise criterion. The implementation of the recommended mitigation measures for daytime construction activities should also be audited as part of the EM&A programme, with reference to the latest implementation schedule in the Construction Noise Management Plan (CNMP) to be submitted and agreed with Director of Environmental Protection (DEP).

Operation Phase

- 13.3.3.2 Based on the assessment result, mitigation measures would not be required for road traffic noise. Therefore, EM&A for road traffic noise during operational phase is not required.
- 13.3.3.3 With proper implementation noise control measures, adverse fixed noise impact from the ventilation buildings, administrative building, satellite control building and maintenance compound is unlikely. Nevertheless, as part of the design process, monitoring of operational noise from the proposed fixed plants during the testing and commissioning stage would be recommended to verify the compliance of the EIAO-TM criteria. The specification and mitigation measures shall make reference to the latest implementation schedule in the Fixed Noise Source Management Plan (FNMP) to be submitted and agreed with DEP.

13.3.4 Water Quality

Construction Phase

- 13.3.4.1 With the implementation of good site practices, recommended mitigation measures and enhancement measures to control construction site runoff, no adverse water quality impact for land-based works is anticipated during the construction phase. Nevertheless, regular water quality impact monitoring for land-based works is required to ensure compliance

with criteria as stipulated in EIAO-TM. TBM tunnelling would be adopted for the section within Tuen Mun Typhoon Shelter which would be approximately 10 - 60m underneath seabed and within bedrock layer, hence marine water quality monitoring is considered not required.

- 13.3.4.2 Regular environmental site inspections at least once per week shall be carried out during construction phase to ensure that the recommended best management practices, mitigation measures and enhancement measures as recommended in this EIA Report and the EM&A Manual are properly implemented by the Contractor.

Operational Phase

- 13.3.4.3 Potential water quality impacts due to surface and tunnel run-off, sewage effluent from proposed satellite control building and administrative buildings and wastewater generated from washing and maintenance operations are likely. With proper connection to the public drainage and sewerage systems and the implementation of mitigation measures, no adverse impact is anticipated during the operational phase. Hence, no environmental monitoring and audit is required.

13.3.5 Waste Management Implication

Construction Phase

- 13.3.5.1 During the construction period, the Contractor shall ensure that all the waste produced during the construction of the Project are handled, stored and disposed of in accordance with good waste management practices, relevant legislation and waste management guidelines.
- 13.3.5.2 A Waste Management Plan (WMP), as part of the Environmental Management Plan should be prepared in accordance with ETWB TC(W) No.19/2005 and submitted to the Project Manager or Project Manager's Representative for approval. The recommended mitigation measures should form the basis of the WMP. The monitoring and auditing requirement stated in ETWB TC(W) No.19/2005 should be followed with regard to the management of C&D materials.
- 13.3.5.3 It is recommended that regular site inspections and audits (i.e., on a weekly basis) of the waste management practices would be carried out during the construction phase to determine if wastes are being managed in accordance with the recommended good site practices and WMP. The audits will investigate all aspects of waste management including waste generation, storage, handling, recycling, transportation and disposal. This measure ensures the proper disposal of waste. The Contractor would be responsible for the implementation of any mitigation measures to minimize waste or mitigate problems arisen from waste materials. Monitoring of the implementation of the trip ticket system for disposal of C&D materials in accordance with DEVB TC(W) No. 6/2010 is also recommended.

Operational Phase

- 13.3.5.4 It is expected that adverse environmental impacts would not be anticipated with the implementation of good waste management practices. Waste monitoring and audit programme for the operation phase of the Project is not required.

13.3.6 Land Contamination

- 13.3.6.1 The land contamination issues associated with the Project have been reviewed and assessed. Potential contaminated areas were identified, which would require land contamination assessment. However, all the potential contaminated areas are in operation and infeasible to conduct site investigation (SI) and sampling works at this EIA stage. Also, there could be changes in the operation or land use within the Project area, which may cause further contamination issues, before commencement of the construction. Detailed land contamination assessment could only be conducted when access is available.
- 13.3.6.2 Site re-appraisal for the whole project area would be recommended by the Project Proponent to assess the latest site situation and conduct subsequent land contamination assessment and remediation works if required prior to the commencement of the construction.

13.3.7 Hazard to Life

Construction Phase

- 13.3.7.1 The Project falls into consultation zone of a Potentially Hazardous Installations (PHI) (i.e. ExxonMobil LPG Storage Installation located at Tuen Mun Area 44. Nevertheless, the tunnel alignment of the Project is located at more than 30m under this PHI. Also, the tunnel alignment of the Project is located about 30m under the LPG storage installation at Sam Shing Estate. Tunnelling using Tunnelling Boring Machine (TBM) is adopted for constructing the tunnel section close to these LPG storage installations, such that at-grade construction activities and any blasting works in their vicinity have been avoided. In addition, with reference to monitoring of other similar project, no ground settlements would be expected for these two LPG storage installations. Hence, potential risk during construction phase is not envisaged.
- 13.3.7.2 With the implementation of good site practices and design measures for the overnight storage, transport and use of explosives, the requirements as stipulated in EIAO-TM could be complied. Nevertheless, the blasting related activities regarding overnight storage, transport and use of explosives shall be supervised and audited by competent site staff to ensure strict compliance with the blasting permit conditions. In addition, subject to the liaison of the three concurrent projects Route 11 (R11), TMB and Lam Tei Underground Quarrying (LTUQ), a Hazard Management Plan would be formulated with a view to aligning the understanding of the risk of the three projects so that all the working populations at Lam Tei Quarry area, which includes the workforce induced under the construction and operational stage of three projects, could be considered as on-site populations in the quantitative risk assessment for all the three projects. The measures stipulated in the Hazard Management Plan may include, but not limited to, the adjustment of the blasting schedules of the three projects to minimize the potential cumulative impact, provision of common trainings and drills to the workforce of all the three projects, etc. The Hazard Management Plan, which would be agreed among the three projects, would be submitted to EPD for agreement prior to the tender invitation of construction phases of R11, TMB and LTUQ, whichever is earlier.

Operational Phase

- 13.3.7.3 The Project falls into consultation zone of a Potentially Hazardous Installations (PHI) (i.e., ExxonMobil LPG Storage Installation located at Tuen Mun Area 44. Also, the Project is

located at some distance from the LPG storage installation at Sam Shing Estate. However, section of the Project in proximity of these LPG storage installations is in form of tunnel, the population induced from the tunnel is all located in a confined space underground and hence, would not be affected by the hazardous events from these LPG storage installations. Hence, potential risk during operational phase is not envisaged and thus monitoring and audit are not required.

13.3.8 Landfill Gas Hazard

Construction Phase

- 13.3.8.1 The construction works to be undertaken at the Project site will involve construction workers and others with risks resulting from contact with landfill gas. For example, when laying underground utilities or other situations, personnel may have to enter confined spaces. Precautionary measures to be adopted during construction at the Project Site are outlined in Paragraphs 8.3 to 8.49 of EPD's Guidance Note on Qualitative Landfill Gas Hazard Assessment (EPD/TR8/97) (Guidance Note). Monitoring will be undertaken when construction works are carried out in confined space within the Consultation Zone. The monitoring requirements and procedures specified in Paragraphs 8.23 to 8.28 of EPD's Guidance Note.

Operation Phase

- 13.3.8.2 All operation staffs and maintenance workers should be informed of the potential landfill gas hazards. Implementation of appropriate safety precautions are required all times when entering enclosed rooms or any service voids, manholes, chambers or culvert at the concerned area. All access to confined spaces should be restricted only to authorized personnel.
- 13.3.8.3 During operation, regular monitoring of landfill gas should be conducted at buildings and enclosures within the Consultation Zone to verify the effectiveness and to ensure the continued performance of the implemented protection measures. Should abnormality be observed, it should be reported to EPD and the PPVL operator.
- 13.3.8.4 Along with the detailed design of the landfill gas protection measure, the monitoring programme and detailed actions should be included in the detailed assessment during the designed design stage and submitted to EPD for approval.

13.3.9 Ecology (Terrestrial)

Construction Phase

- 13.3.9.1 Unacceptable construction phase impacts and operation phase impacts to terrestrial ecological resources would not be expected. The implementation of the ecological mitigation measures described in **Section 10.10** will be inspected and subjected to monthly site audit for all works under the Project, including Project Area near Tai lam Country Park, as part of the ecological monitoring programme during the construction period.

Transplantation of Flora Species of Conservation Importance

Two flora species of conservation importance, including one individual of *Diospyros vaccinioides* and a small patch of *Gnetum luofuense*, were recorded in mixed woodland

near Pillar Point and near Wah Fat Playground, respectively, within the Project Area (aboveground) during the ecological baseline survey. Detailed vegetation survey should be conducted by suitably qualified botanist/ecologist for the Project Area (aboveground) within mixed woodland and shrubland/grassland at Pillar Point and near Wah Fat Playground prior to the commencement of construction activities at the mentioned locations to confirm the presence of flora species of conservation interest. The curriculum vitae of the qualified botanist/ecologist should be submitted to the AFCD for approval and comments prior to the survey. If on-site preservation is not feasible, transplantation and/or mitigation measures would be recommended as far as possible to minimize the unavoidable direct loss of these species. Transplantation proposal for the affected individuals would be prepared if necessary. Potential recipient sites for the affected flora species were identified within close vicinity of its original location and indicated in **Figure 10.7**. A monitoring program should be prepared in the transplantation proposal by a suitably qualified botanist/ecologist prior to the transplantation works and monitor the health conditions of the transplanted individuals upon the completion of transplantation works at the recipient site.

Translocation of Freshwater Crab Species of Conservation Importance

- 13.3.9.2 Freshwater crab species of conservation importance, *Somanniathelphusa zanklon*, was recorded in affected watercourse section S2, within the Project Area (aboveground) during the ecological baseline survey. While *Somanniathelphusa zanklon*, *Cryptopotamon anacoluthon*, and *Nanhaipotamon hongkongense* were recorded at the lower watercourse section where S2 and S2A is connected. An update ecological survey shall be conducted by a qualified ecologist as part of the ET with focus to the presence of the freshwater crabs prior to the commencement of stream diversion works near Wah Fat Playground. An update ecological survey plan should be prepared by the qualified ecologist, whose curriculum vitae should be submitted together with the survey plan to AFCD for review and comments prior to the commencement of any survey to be conducted. Should freshwater crab species of conservation importance be found within the affected watercourse sections, a Freshwater Crab Translocation Plan should be prepared. Freshwater crab translocation should be conducted to move the individuals from the project area to suitable recipient site(s). The Freshwater Crab Translocation Plan should be prepared by the qualified ecologist as a part of the ET, certified by the IEC and submitted to AFCD within four months upon completion of the update aquatic survey to agree the detailed translocation procedures including the identified receptor site(s) and post-translocation monitoring programme. Approval from the Authority (e.g., AFCD and EPD) should be sought prior to conducting the translocation work. The freshwater crab translocation work should be conducted prior to the commencement of the stream diversion works near Wah Fat Playground, following the approved Freshwater Crab Translocation Plan. Upon the completion of the translocation work, post-translocation survey should be conducted at the recipient site to monitor the effectiveness of translocation.

Monitoring of Compensatory Woodland

- 13.3.9.3 Monitoring of the compensatory woodland should be performed on a regular basis after the first planting, to monitor the survival and establishment of trees and wildlife use. Survey in each compensatory woodland location will commence after the first planting. Randomly selected individuals of each planted species will be tagged and their survival rate will be computed. Supplementary planting will be recommended if deemed necessary. Wildlife use of the planted vegetation will also be monitored. Details of the

monitoring will be included in the Woodland Compensation Plan to be submitted in the detailed design stage and agreed with relevant authorities.

Monitoring on Mitigation Measures on Groundwater Infiltration

- 13.3.9.4 No significant impacts related to ground water infiltration is anticipated for the proposed tunnelling works including those within the Tai Lam Country Park with the implementation of suitable mitigation measures as discussed in **Section 5.7.2**. As an additional precautionary measure, surface water level monitoring at natural watercourses within Tai Lam Country Park, Lam Tei Irrigation Reservoir, and in the vicinity of the tunnelling works would be conducted during the construction and operation stages. Monthly monitoring should be conducted at the selected watercourses to monitor parameters (including water depth and water velocity) to record and evaluate if any abnormal significant decrease of the water level is arising from the Project. In case abnormalities is detected, the monitoring arrangement and remedial measures (if required) should be reported to EPD (who is the EIAO authority), AFCD and other relevant authorities. Details of the monitoring, including the monitoring locations, shall be agreed with AFCD during the detailed design stage prior to commencement of any construction activities.

Operational Phase

- 13.3.9.5 Potential groundwater drawdown is also anticipated to be insignificant with the majority of the tunnel section to be constructed with granite and sufficient depth below ground together with the good practices and mitigation measures adopted during construction phase. No significant impact on ecological resources is expected during operation phase of the Project, and thus, EM&A is not required.

13.3.10 Landscape and Visual

Construction Phase

- 13.3.10.1 Mitigation measures such as tree preservation, tree transplanting, landscape reinstatement, provision of site hoarding, optimization of construction area and lighting control should be adopted during the construction phase. Regular site environmental inspections should be undertaken during the construction period to ensure that the mitigation measures recommended in this EIA Report and EM&A Manual are properly implemented by the Contractor.

Operational Phase

- 13.3.10.2 Mitigation measures to be implemented, such as compensatory tree planting, post-planting monitoring, landscape integration and screen planting, architectural aesthetic design of built structures, and reinstatement of disturbed open space should be integrated into the detailed design and built as part of the construction works so that they would be in place during the operation of the Project.

13.3.11 Cultural Heritage

Construction Phase

- 13.3.11.1 For Archaeology, no adverse archaeological impact due to the proposed works is identified. As a precautionary measure, the project proponent and the contractor are

required to inform AMO immediately when any antiquities or supposed antiquities under the Antiquities and Monuments Ordinance (Cap. 53) are discovered during the course of works. Thus, EM&A is not required.

- 13.3.11.2 For built heritage, potential vibration impact and cumulative built heritage impact rising from concurrent project *Traffic Improvement Scheme in Tuen Mun – Widening and Addition of Slip roads at Lung Fu Road/ Tuen Mun Road/ Wong Chu Road/ Hoi Wing Road* may be a concern for the Shing Miu (Grade 2 historic building) (GB-02), special attention should be paid to avoid adverse physical impact arising from the construction works to the heritage site. Design proposal, method of works and choice of machinery should be targeted to minimize adverse impacts to the heritage site. Any vibration and building movement induced from the construction works should be strictly monitored to ensure no disturbance and physical damages made to the heritage site during the course of works. Vibration, building settlement and tilting monitoring proposal for the GB-02, including checkpoint locations, installation details, response actions for each of the Alert/ Alarm/ Action (3As) levels and frequency of monitoring should be submitted for AMO's consideration. As no adverse impact on the Hung Lau (Grade 1 historic building) (GB-01) is identified, no EM&A for GB-01 is required. Subject to detailed design of vibration generation activities at works areas near built heritage items BH-02 and BH-03, should potential vibration impact be unavoidable, vibration monitoring is recommended. Furthermore, for BH-03, appropriate protective and mitigation measures are to be recommended during detail design stage of the Project when the structural condition and assessment of BH-03 and the historical buildings/ structures/ features are verified during detailed design stage of the Project. The protective and mitigation measures should be agreed by AMO, and to be implemented to the satisfaction of AMO to safeguard against any potential adverse impact.
- 13.3.11.3 Excavation works in close vicinity to the heritage site should not jeopardize stability of the historic structures. It should not undermine or cause damage to foundation of the historic structures. Foundation information of the historic structures shall be verified on site if needed, sufficient lateral support should be provided and de-watering (if required) should be carried out with great cautions to control ground movement and change of ground water regime at the heritage site.
- 13.3.11.4 Installation of monitoring checkpoints shall be carried out in great care and adequate protection shall be provided so as to avoid unnecessary disturbance / damage to the historic fabrics. Photo records of monitoring checkpoints shall be submitted upon installation for AMO's records. Monitoring records should be submitted to AMO on regular basis and please alert AMO should the monitoring reach Alert/ Alarm/ Action levels.
- 13.3.11.5 Pre and post condition survey should be carried out to record conditions of the heritage site and survey reports should be submitted for AMO's record.

Operational Phase

- 13.3.11.6 No adverse impacts identified. Thus, EM&A is not required.