

11. ENVIRONMENTAL MONITORING AND AUDIT

11.1 Introduction

This section defines the key areas of impact that have been identified within the preceding chapters, and outlines the proposed EM&A requirements that should be implemented to ensure the efficacy of the recommended mitigation measures.

EM&A is recommended during the construction phase in order to monitor the efficacy of the measures recommended to mitigate the noise and air quality impacts, and during the operational phase to monitor the efficacy of measures proposed to mitigate the traffic noise impact during peak periods. The precise requirements are discussed later within this chapter.

11.2 Objectives of the Environmental Monitoring and Audit Programme

The objectives of carrying out EM&A for the Project include the following:

- to ensure that the areas of environmental concern identified during the EIA process are carried through to, and appropriately considered and incorporated into the detailed design and tender stages of the Project;
- to provide a database against which any short or long term environmental impacts of the Project can be determined;
- to provide an early indication should any of the environmental control measures or practices fail to achieve the acceptable standards;
- to monitor the performance of the Project and the effectiveness of mitigation measures;
- to verify the environmental impacts predicted in the EIA Study;
- to determine project compliance with regulatory requirements, standards and government policies;
- to take remedial action if unexpected problems or unacceptable impacts arise; and
- to provide data to enable an environmental audit to be performed.

The following sections summarise the recommended scope of the proposed EM&A requirements. The specific EM&A requirements that are to be implemented during the construction and operational phases of the EPIWs will be specified following the approval of the EIA Report as required by the Study Brief and the EIAO TM.

11.3 Scope of Environmental Management

In order to ensure the effective implementation of the recommended mitigation measures and to comply with the conditions of the Environmental Permit and the requirements of

all controlling legislation, it will be essential to develop robust environmental management mechanisms and procedures in the form of an Environmental Management System (EMS). This is in line with KCRC's corporate commitment to high standards of environmental performance and reflects formal systems already established within the operating East Rail Network.

The structure, focus and scope of the EMS is determined by the findings of the formal EIA process and by the Corporation's own environmental policy commitments. The EMS will seek to verify that the environmental performance commitments given in the EIA Report and in KCRC's corporate environmental policies are being upheld and that adverse environmental impacts are minimised.

11.4 Development of an Environmental Management System

An EMS can take many forms, however, they all basically involve the setting and agreement of performance targets and goals, the defining of mechanisms for achieving these targets, together with a means of reviewing and/or auditing the system to verify that the targets have been satisfactorily achieved, and also to identify any weaknesses in the overall EMS that can be improved.

To ensure compliance with the controlling principles defined in the Implementation Schedule, it is likely that these principles will be reproduced in contractual documentation and therefore become performance standards/targets for the consultants and contractors who undertake the detailed design or construction work for KCRC. In this way, the requirements of the Implementation Schedule will become formal requirements with which the various organisations involved in the construction and /or operation of the EPIWs must comply. If appropriate, it may also be necessary to set certain items from the Implementation Schedule as design standards that need to be met during the detailed design and operation of the railway.

To verify compliance with the Contractual requirements, it will be necessary to implement a system of compliance checking and auditing during both the detailed design and construction phases. This verification will be undertaken by either the Corporation, or by Independent Checkers employed by the Corporation who will undertake regular compliance audits, and, for the construction phase, environmental monitoring.

11.5 Environmental Management Plan

In addition to defining the environmental targets that must be achieved, it is envisaged that, for the construction phase, the contractual documentation will also require that the Contractors define mechanisms for achieving the environmental requirements in the form of an Environmental Management Plan (EMP).

The EMP should detail the means by which the Contractor (and all subcontractors working to the Contractor) will implement the recommended mitigation measures and achieve the environmental performance standards defined both in Hong Kong

environmental legislation and in the Implementation Schedule. A primary reason for adopting the EMP approach is to make sure that the Contractor is fully aware of his environmental responsibilities and to ensure his commitment to achieving the specified standards. The EMP approach is grounded on the principle that the Contractor shall define the means by which the environmental requirements of the EIA process, and the contractual documentation shall be met..

11.6 EM&A Manual

The Essential Public Infrastructure Works will be undertaken as part of the individual West Rail construction contracts for Tuen Mun, Tin Shui Wai, and Yuen Long. KCRC has stated its commitment to submit Contract specific EM&A Manuals for each contract and it is recommended that the EM&A provisions associated with the EPIWs be incorporated and integrated within these documents.

Each Contract specific EM&A Manual shall clearly demonstrate the effective integration of the EPIW EM&A requirements.

Once prepared, the EM&A Manual shall provide a description of the organisational arrangements and resources required for the EM&A programme based on the conclusions and recommendations of this EIA. The construction EM&A Manual shall stipulate details of the construction monitoring required, and actions that shall be taken in the event of exceedances of the environmental criteria. In effect, the EM&A Manuals will form handbooks for the on-going environmental management during the construction and, if required, operational phases.

The finalised EM&A Manual will need to comprise descriptions of the key elements of the EM&A programme including:

- appropriate background with references to relevant technical reports;
- organisational arrangements, hierarchy and responsibilities with regard to the management of environmental performance functions during the construction phase to include the EM&A team, the Contractor's team and the Corporation's representatives;
- a broad construction programme indicating those activities for which specific mitigation is required, as recommended in the EIA, and providing a schedule for their timely implementation;
- descriptions of the parameters to be monitored and criteria through which performance will be assessed including: monitoring frequency and methodology, monitoring locations (in the first instance, the location of sensitive receivers as listed in the EIA), monitoring equipment lists, event contingency plans for exceedances of established criteria and schedule of mitigation and best practice methods for minimising adverse environmental impacts;

- procedures for undertaking on-site environmental performance audits as a means of ensuring compliance with environmental criteria; and
- reporting procedures.

The EM&A manual will be a dynamic document which will undergo a series of revisions to accommodate the progression of the construction programme.

During the construction phase, it is envisaged that, in accordance with the mechanisms used for the West Rail Project, an Independent Environmental Checker (IEC) will be employed by KCRC to provide objective monitoring of the environmental management system. The Checker will typically have dual reporting responsibilities and will report directly to both the Engineer and to the EPD.

The IEC will be appointed by the Corporation as a competent independent organisation that can impartially assess the Contractor's environmental performance and ensure that they are implementing all the requirements of the EM&A Manual and the Contractor's own EMP. Compliance verification will be undertaken by means of independent environmental monitoring, and regular auditing of the Contractor's monitoring results, on-site practices and their EMS procedures. In the event of any problems or non-conformances being identified, the IEC will be empowered through the Contract, with powers to require the rectification of the problem.

11.7 Noise

11.7.1 Construction Phase

Noise produced during the construction phase would impact upon nearby NSRs as assessed in *Section 5.2*. The primary noise sources include the use of dump truck, asphalt paver, grader, excavator and breaker during various construction stages. The EIA O TM daytime construction noise criteria would be exceeded at most of the representative NSRs if no mitigation measures are imposed.

A set of broad mitigation measures, including good site practice, the use of quiet plant, installing temporary noise barriers, controlled usage of plant on site and substitution of noisy construction equipment has been recommended to reduce the identified impacts. The effectiveness of recommended measures will be checked by the EM&A procedures. It is anticipated that if the mitigation measures described could be successfully applied, the noise levels experienced by the affected receivers will be reduced.

Noise monitoring should be undertaken, as part of the EM&A programme during the construction period of the Project in Yuen Long, Tin Shui Wai and Tuen Mun Centre. *Table 11.7a* below shows the NSR locations for noise monitoring. Additional monitoring locations may be considered necessary in agreement with the EPD.

Table 11.7a Noise Monitoring Location

Location	NSR	Description
Yuen Long	6	Nam Pin Wai (east)
	10	Tai Wai Tsuen (west)
	17	Residential Development in Area 15 (north-west)
Tin Shui Wai	29	Tin Shing Court (east)
	33	QE School Old Student's Association Primary School
Tuen Mun Centre	61	Koon Hing Building
	65	Castle Peak Catholic Primary School (south façade)

The construction noise level shall be measured in terms of A-weighted equivalent continuous sound pressure level (L_{Aeq}). $L_{Aeq(30min)}$ shall be used as the monitoring parameter for the time period between 0700-1900 hours on normal weekdays. For all other time periods, $L_{Aeq(5min)}$ shall be employed for comparison with the NCO noise criteria. As supplementary information for data auditing, statistical results such as L_{A10} and L_{A90} shall also be obtained for reference.

11.7.1.1 Baseline Monitoring

Baseline noise monitoring should be carried out prior to the commencement of the construction works. The baseline monitoring should be carried out daily for a period of at least two weeks to set up the baseline noise condition.

There shall not be any construction activities in the vicinity of the stations during the baseline monitoring. Baseline monitoring measurements shall be evenly spread throughout the assessment period to be conducted at the same frequency and duration throughout the periods of the day for which works are anticipated to be constructed (e.g. daytime, evening and night-time).

11.7.1.2 Impact Monitoring

Noise monitoring should be carried out at all designated monitoring stations. The monitoring frequency should depend on the scale of the construction activities. As a initial guide, the frequency of monitoring should be undertaken once every six days at each monitoring station during the normal working hours (0700-1900 from Monday to Saturday) when noise generating activities are underway.

The monitoring is required to ensure the compliance with the EIA O TM noise standards in providing feedback to the contractor for the management of their operations. An EM&A programme should be established for impact monitoring during the construction phase.

In case of non-compliance with the construction noise criteria, more frequent monitoring 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.

11.7.2 Operational Phase

In the operational phase of the Project, traffic noise would impact on the nearby NSRs as assessed in *Section 5.3*. The traffic noise criteria for residential uses and schools would be exceeded given the insufficient buffer distance and the increase of traffic volume in the future. Traffic noise mitigation measures such as roadside barriers and low noise road surfacing have been proposed to protect the affected NSRs. Noise monitoring should be conducted during the operational phase so as to ensure the noise levels are comparable to the predicted results of the EIA Study.

Traffic noise levels shall be measured at representative locations in Yuen Long, Tin Shui Wai and Tuen Mun Centre as agreed with the EPD, within the first year of the road opening. Recommended monitoring locations are given in *Table 11.7a* above. Additional monitoring locations may be necessary in agreement with the EPD.

Measurements shall be made in terms of the A-weighted L_{A10} over a 1.5 hour period which includes the peak traffic hour. A traffic survey shall also be conducted during the measurement period and the average speed of vehicles estimated.

Baseline monitoring during the operational phase of the project is not required. For operational phase impact monitoring, two sets of measurements at all designated locations within the first year of the road opening are required as an initial guidance. The recorded traffic and speed data shall be put back in the project prediction model to provide noise level predictions. The generated noise levels will then be compared with the measured level. In case of noise levels exceeding those predicted in the EIA Study, more frequent monitoring shall be carried out.

11.8 Air Quality

The construction work will inevitably lead to dust emissions, mainly from excavation and material handling. Mitigation measures are presented in *Section 6.2.2* and recommended to limit the dust emission and dispersion. With proper dust control measures in accordance with *Air Pollution Control (Construction Dust) Regulations*, the dust levels at the nearby air sensitive receivers will comply with the dust criteria.

Dust monitoring should be undertaken, as part of the EM&A programme during the construction period of the Project in Yuen Long, Tin Shui Wai and Tuen Mun Centre to ensure the efficacy of the control measures. *Table 11.8a* below shows the ASR locations for dust monitoring. Additional monitoring locations may be considered necessary in agreement with the EPD.

Table 11.8a Dust Monitoring Location

Location	ASR	Description
Yuen Long	17	Residential Development in Area 15 (north-west)
Tin Shui Wai	36	Yiu Foo House (south) - Tin Yiu Estate
Tuen Mun Centre	65	Castle Peak Catholic Primary School (south façade)

11.8.1 Baseline Monitoring

Baseline monitoring should be carried out at all of the designated monitoring locations for at least 14 consecutive days prior to the commissioning of the construction works to obtain daily 24-hr dust samples.

11.8.2 Impact Monitoring

Impact monitoring should be carried out during the course of the construction works. For regular impact monitoring, the sampling frequency of at least once in every six-days, should be strictly observed at all the monitoring stations for 24-hr dust monitoring. For hourly dust monitoring, the sampling frequency of at least three times in every six-days should be undertaken when the highest dust impact occurs.

The monitoring is required to ensure compliance with the EIAO in providing feedback to the contractor for the management of their operations. An EM&A programme should be established for impact monitoring during construction phase.

11.9 Water Quality

Environmental monitoring for water quality is not required during the construction phase of the EPIWs.

11.10 Landscape and Visual

No specific landscape and visual environmental monitoring/ auditing is required during the construction phase of the EPIWs.

11.11 Waste Management

The effective management of waste arisings during the construction phase of EPIWs could be monitored through a well planned site audit programme. However, in view of the potential waste generation rate associated with the works, environmental monitoring and audit is not required.

11.12 Cultural Heritage

Although the works are more distant than West Rail Phase I construction activity, vibration monitoring will be required at the Pagoda in Tin Shui Wai to ensure the vibration limits are not exceeded. Should the West Rail Phase I monitoring be undertaken at the same time, data sharing will avoid the need for duplication in measurement.