

12. ONGOING ENVIRONMENTAL MANAGEMENT

12.1 Introduction

This EIA Study has focused on the prediction and mitigation of impacts arising from the construction and operation of the new railway. The primary outputs have been a series of recommendations on the range of measures to be undertaken to eliminate or mitigate predicted impacts to levels that comply with the standards, criteria and requirements of the Hong Kong Government. The findings and recommendations of this EIA will form the basis on which KCRC's environmental performance will be judged during the detailed design, construction and operational phases of the Project.

In order to ensure that the mitigation measures defined in this EIA are appropriately and effectively implemented, it is necessary to develop Environmental Monitoring and Audit (EM&A) procedures and means by which the Implementation Schedule (see *Annex B*) may be tracked and its effectiveness assessed. This chapter discusses the mechanisms for implementing the EM&A requirements, summaries the measures that have been recommended within the preceding technical assessment sections and outlines an Environmental Management System within which the Corporation's ongoing environmental obligations will be managed.

12.1.1 Implementation of EIA Findings and Recommendations

As stated above, the preceding technical assessment sections have, where appropriate, identified and recommended the implementation of mitigation measures and practices in order to minimise the impact of the construction and operation of the MOS Extension. These findings and recommendations, summarised in the form of the Implementation Schedule, in effect form the primary deliverable from the whole EIA process, and, once the EIA is endorsed by the Government, they will form an agreement between the Corporation and the Government as to the measures and standards that are to be achieved on site. It is therefore essential that mechanisms are put in place to ensure that each of the mitigation measures prescribed in the Implementation Schedule are fully and effectively implemented during construction and operation.

The required format for the Implementation Schedule is specified in the MOS Extension Study Brief. The format requires that details are specified concerning the persons responsible for implementing each of the requirements together with details of the required timing and duration for each of the specified mitigation measures, and if appropriate the location on site where it is to be implemented. In addition, the related legislation or guidelines are also defined.

It should be noted that, in addition to the mitigation measures stated in the Implementation Schedule as a result of the findings of the EIA, there is also scope for other requirements to be included within the finalised Implementation Schedule. Prior to the issue of an Environmental Permit, there is an EIA Determination Period. During this

period the EIA Report is reviewed and commented upon by both the public and professional bodies. Where recommendations are made and accepted by either the Advisory Council on the Environment (ACE) or its subcommittee these measures will, if appropriate, be included within the Implementation Schedule.

12.1.2 Statutory Requirements

As the MOS Extension is classed as a designated project under the *EIAO*, an Environmental Permit must be obtained before construction or operation of the development can commence.

Upon approval of the EIA, the applicant, in this case KCRC, can apply for an Environmental Permit. If the application is successful and an Environmental Permit is issued it will, in most circumstances, have conditions attached to it which must be complied with.

As well as complying with the requirements of the *EIAO* and the Environmental Permit, KCRC and its Contractors, must also comply with all other controlling environmental legislation and guidelines during the construction and operation of the MOS Extension.

The requirements of the controlling legislation and guidelines are discussed within the specific technical sections of this report, however, the key legislation is highlighted below for each discipline:

Air Quality:

- Air Pollution Control Ordinance
- Air Quality Objectives
- Air Pollution Control (Construction Dust) Regulation

Noise:

- Noise Control Ordinance
- Technical Memorandum on Noise From Construction Work Other Than Percussive Piling
- Technical Memorandum on Noise From Construction Work in Designated Areas
- Technical Memorandum on Noise From Percussive Piling

Water:

- Water Pollution Control Ordinance
- Technical Memorandum for Effluents discharged into Drainage and Sewerage Systems, Inland and Coastal Waters
- Practical Note for Professional Persons on Construction Site Drainage

Waste and Contaminated Land:

- Waste Disposal Ordinance
- Waste Disposal (Chemical Waste) (General) Regulation
- Land (Miscellaneous Provisions) Ordinance
- Public Health and Municipal Services Ordinance - Public Cleansing and Prevention of Nuisances (Urban Council) and (Regional Council) By-laws
- Waste Disposal (Chemical Waste) (General) Regulation
- Code of Practice on the Packaging, Labelling and Storage of Chemical Wastes

Ecology:

- Forests and Countryside Ordinance
- Wild Animals Protection Ordinance
- Animals and Plants (Protection of Endangered Species) Ordinance
- Town Planning Ordinance
- Hong Kong Planning Standards and Guidelines.

Cultural and Heritage:

- Antiquities and Monuments Ordinance

Failure to comply with the above legislative requirements could lead to prosecution under the various Pollution Control Ordinances, and, could potentially, result in project delays during the construction works.

12.2 Scope of the Ongoing 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.

12.2.1 Development of an Environmental Management System

An EMS can take many forms, however, it is envisaged that the MOS Extension EMS system will be based on that adopted for West Rail. As with all systems, this 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.

For the MOS Extension the controlling principles and targets will be derived from the agreed content of the Implementation Schedule. As a means of ensuring that these principles become performance standards/targets for the consultants and contractors who undertake the detailed design or construction work for KCRC, it is envisaged that, where appropriate, the requirements stated in the Implementation Schedule will be reproduced in their contractual documentation. 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 MOS Extension 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.

As a means of ensuring the implementation of the contractual requirements, there may be scope for implementing an Environmental Liability Scheme which establishes a link between the Contractor's environmental performance, as judged by monitoring results and the outcome of contract compliance audits, to environmental payments; a similar approach is routinely employed in safety compliance auditing.

12.2.2 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. This will most likely be achieved by requiring that the Contractors produce and implement an Environmental Management Plan (EMP).

EMP's are similar in nature to safety or quality plans and will provide details of 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. In the first instance, each Tenderer shall be required to produce a skeletal EMP for submission as part of the tendering process; the skeletal EMP will demonstrate the determination and commitment of the organisation and indicate how the environmental performance requirements laid out in the available EIA documentation will be met and, where appropriate, exceeded. It is recommended that this aspect be included as a specific criterion in the assessment of tender documents; this will act as a clear indication to all Tenderers of the Corporation's commitment to the minimisation and management of environmental impacts. Upon Contract Award, the successful tenderer shall be required to submit a draft and final version of the EMP for the approval of the Engineer prior to the commencement of the works.

12.2.3 EM&A Manual

The Environmental Protection Department (EPD) requires the submittal for approval of an EM&A Manual prior to the commencement of construction. For the MOS Extension, it is envisaged that separate EM&A Manuals for both the construction and operational phases will be produced and agreed with the EPD prior to the commencement of either phase. Both Manuals will have the same purpose of defining the mechanisms for implementing the EM&A requirements specific to each phase of the work.

Once prepared, the EM&A Manuals 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, whilst the operational EM&A shall address the requirements that need to be implemented during the operational phase. In effect, the EM&A Manuals will form handbooks for the on-going environmental management during the construction and operational phases.

This EIA has identified the need for EM&A measures relating to air quality and noise, to be implemented during the construction and operational phases of the project respectively. Whilst the preparation of an EM&A Manual, specifying the precise details of the required monitoring and auditing activities is outside of the scope of this study, this report does set out details of the recommended environmental monitoring and auditing requirements that should be implemented to monitor compliance with the EIA findings and ensure compliance with environmental legislation. This information will form the basis of a future EM&A Manual, however, it will need to be expanded upon to specify the precise mechanisms for implementing the EM&A requirements and to provide precise site/contract specific details of the works packages to which it relates, together with further information on the contractual roles and responsibilities of the organisations and individuals involved in the process, and the mechanisms to be implemented in the event of any identified non-conformances or breaches of a specified environmental limits or criteria.

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

- appropriate background information on the construction and operational phases of the railway 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 the Engineer, the Environmental Manager, 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.

12.2.4 Objectives of Environmental Monitoring & Audit

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

- 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.

12.2.5 EM&A Programme

The previous chapters of this report have identified where the unmitigated impacts from either the construction or operation of the MOS Extension are predicted to exceed the required environmental criteria. In such instances, appropriate mitigation measures have been proposed to ensure that all the various aspects of the Project meet the relevant criteria. In order to verify that the proposed mitigation measures are effective, and to fulfil the other objectives listed above, it is recommended that an EM&A programme is implemented. This Section of the Report provides an overview of the environmental monitoring requirements for air and noise that have arisen from the EIA Report. In addition, it sets out the audit recommendations for the noise, air, water, landscape and visual, ecological, waste, and land contamination issues and the mechanisms for implementing the mitigation measures defined in the EIA.

12.3 Air Quality

12.3.1 Background

Along the proposed alignment of the MOS Extension, the area is predominantly urban with the majority of land uses in the vicinity of the work sites being residential, recreational and institutional. The main sources of pollutants are the traffic on existing roads and highways.

12.3.2 Air Sensitive Receivers

In accordance with the EIAO TM, domestic premises, hotels, hostels, hospitals, clinics, nurseries, temporary housing accommodation, schools, educational institutions, offices, factories, shops, shopping centres, place of public worship, libraries, courts of law, sports stadium or performing arts centres are considered as Air Sensitive Receivers (ASRs). Air Sensitive Receivers (ASRs) identified within the Study Area (500m either side and along

the full stretch of the proposed MOS Extension) are summarised in *Table 3.3a* in Annex A1 of *Volume 2 - Technical Annexes* while *Figures 3.3a-r* in Annex A2 of *Volume 2 - Technical Annexes* show their locations.

The air quality assessment that has been undertaken identified that construction dust would result in the main air quality impact. Construction dust impacts were identified at a number of sensitive receivers since the buffer distance stipulated in the HKPSG could not be satisfied between receivers and the work site boundary. Dust monitoring requirements for the construction phase have therefore been recommended in this EIA in order to ensure the efficacy of the proposed control measures.

It is recommended that dust monitoring be carried out as part of the EM&A programme during the construction period at the locations presented in *Table 12.3a* below. The locations of the proposed monitoring sites are shown in *Figures 12.3a-g* in Annex I of *Volume 2 - Technical Annexes*. The Environmental Protection Department's (EPD's) agreement to the proposed monitoring locations and any other additionally proposed sites will be required.

No operational air quality impacts have been predicted, therefore, EM&A requirements relating to air quality have not been proposed for the operational phase.

Table 12.3a Location of Air Monitoring Station

Area	Air Monitoring Station	Location
Tai Wai to Sha Tin Tau	AM1	Grandway Garden, Block 2
Sha Tin Tau to Sha Kok Street	AM2	Chun Shek Estate, Shek Fai House
	AM3	Pok Hong Estate, Pok Yat House
City One Sha Tin to Shek Mun	AM4	Yau Kam Yuen Prevocational School
Shek Mun to Chevalier Garden	AM5	Siu Lek Yuen Road Playground
Chevalier Garden to Heng On	AM6	Kam Tai Court Block J (WIP)
	AM7	Chinese YMCA College
Heng On to Ma On Shan	AM8	Ma On Shan Centre Block 1
Lee On Station	AM9	Rest Garden at Lee On Estate

12.3.3 Air Quality Monitoring

Baseline Monitoring

Baseline monitoring should be carried out at all of the designated monitoring locations for at least 14 consecutive days prior to the commencing the construction works to ascertain the existing daily 24hr Total Suspended Particulate (TSP) concentrations. 1hr sampling is

also recommended to be undertaken at least 3 times per day during the times when the highest dust impact is predicted to occur.

The baseline monitoring results form the basis for determining the air quality criteria for the impact monitoring. *Table 12.3b* shows the air quality criteria, namely Action and Limit Levels for Air Quality (Construction Dust). Should monitored TSP levels exceed Action Level during construction, appropriate control measures will need to be employed to restore the dust level to acceptable levels.

Table 12.3b Action and Limit Levels for Air Quality

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

Impact Monitoring

The impact of fugitive dust on ambient air pollution depends on the quantity, as well as the drift potential of the dust particles injected into the atmosphere. Large dust particles will settle out near the source and particles that are 30-100 μm in diameter are likely to undergo impeded settling. These particles, depending on the extent of atmospheric turbulence, would settle within a distance of 100 m from the source. The main dust impact will arise from fine particles of a diameter less than 30 μm , measured as TSP, dispersed over greater distances from the sources. TSP levels should, therefore, be monitored to evaluate the dust impact during the construction works.

24-hour TSP concentrations should be measured by the *High Volume Method for Total Suspended Particulates, Part 50 Chapter 1 Appendix B, Title 40 of the Code of Federal Regulations of the USEPA*. It is considered that this impact monitoring should be undertaken at each of the proposed monitoring locations once every 6 days.

TSP is sampled by drawing air through a conditioned, pre-weighed filter paper inside a High Volume Air Sampler (HVAS) at a controlled rate. After sampling, the filter paper with retained particles is collected and returned to the laboratory for drying in a desiccator followed by accurate weighing. TSP levels are calculated from the ratio of the mass of particulates retained on the filter paper to the total volume of air sampled over the time period. The drying and analysis of HVS samples normally takes about two days to complete.

Due to the lengthy delay between sampling time and result availability for 24-hour sampling, 1-hour TSP sampling should also be conducted. 1-hour TSP levels, while assessed under different criteria, are considered to be indicative of forthcoming 24-hour results conducted on the same day. In this way expedient remedial actions, should they be required, may be undertaken based on the 1-hour data, before the 24-hour results become available.

1-hour sampling, providing real time airborne particulate measurement, can be undertaken using a direct reading dust meter. Despite the advantages of using a real time monitor to measure particulate concentrations such as in response to dust complaints, results are not comparable with 24-hour HVS data. Therefore, if the use of a direct reading monitor is agreed for 1-hour TSP sampling both baseline and impact monitoring must be carried out by the direct reading method.

No comparisons between direct reading and physically measured (HVS) data shall be attempted except that, where the direct reading method for 1-hour TSP sampling is used, the measured TSP concentrations shall be regarded as indicative of the 24-hour TSP results and the actions specified in the following section shall be implemented.

Specific dust control measures should be considered as part of Contractor contracts and regular compliance checking by the EM&A Consultant and the Engineer at site and as well as at the Sensitive Receivers should be conducted.

12.4 Construction Noise

Noise sensitive receivers (NSRs) within the Study Area (300 m either side and along the full stretch of the proposed MOS Extension) have been identified based on the guidelines in the NCO and EIAO TM. The NSRs are detailed in *Table 4.3b* in *Annex B1* of *Volume 2 - Technical Annexes* while *Figures 4.5a-r* in *Annex B* of *Volume 2 - Technical Annexes* show their locations. Representative NSRs, which are likely to be worst affected during the construction phase, have also been identified for the assessment purposes and these have been summarised in *Table 4.3a* of this report.

The construction noise assessment that has been undertaken has identified that unmitigated construction noise would give rise to impacts along much of the alignment. As a consequence, a package of noise mitigation measures has been specified to mitigate these predicted impacts. Noise monitoring requirements are recommended during the construction phase in order to ensure the efficacy of the proposed control measures.

It is recommended that noise monitoring be carried out as part of the EM&A programme during the construction period at the locations presented in *Table 12.4a* below. The locations of the proposed monitoring sites are shown in *Figures 12.3a-g* in *Annex I* of *Volume 2 - Technical Annexes*. The Environmental Protection Department's (EPD's) agreement to the proposed monitoring locations and any other additionally proposed sites will be required.

Table 12.4a Location of Recommended Construction Noise Monitoring Station

Noise Monitoring Station	Location
NM1	Christian Alliance School
NM2	Sha Tin Tsung Tsin Secondary School & Ng Yuk Sec. School
NM3	Lei Uk Tsuen No. 11-15
NM4	Shek Yuk House, Chun Shek Estate
NM5	Tin Ka Ping Salvation Army Primary School
NM6	Pok Tai House, Pok Hong Estate
NM7	Caritus H.W.Lee Care & Attention Centre
NM8	Yue Kwan House, Yue Tin Court
NM9	Lam Kau Mow Secondary School
NM10	Ma On Shan Tsung Tsin Secondary School
NM11	Proposed Residential Development on Area 90B
NM12	Chinese YMCA College
NM13	St. Francis Church
NM14	Sun Shine City Block M
NM15	Bayshore Towers Block 3
NM16	Caritas Ma On Shan Practical School
NM17	Lee Wing House, Lee On Estate

12.4.1 Noise Monitoring

Baseline Monitoring

To obtain fully satisfactory baseline results, a waterproof sound level meter and noise logger should be used at each of the aforementioned locations. At each location, baseline noise levels should be measured over a consecutive 7-day calendar week at a minimum logging interval of 15 minutes. The quantities L_{Aeq} , L_{10} and L_{90} should be recorded at the specified interval. The survey period should be selected prior to the commencement of construction activities in order to avoid other atypical noise sources. The proper functioning of the logger shall be ensured during the monitoring period, and as a minimum, the equipment shall be inspected for a period of not less than one hour every two days to ensure its continued operation and to detail specific noise sources audible at the monitoring location. The calibration of the logger kit shall be as recommended by the manufacturer. Measurements shall be recorded to the nearest 0.1 dB.

At locations where it is not feasible to leave the equipment unattended for the required period, or where other factors such as access to the monitoring location make the use of the above method of determining the baseline noise level unfeasible, then an appropriate alternative noise "sampling" methodology may be used. It should be acknowledged at the outset that the accuracy of this method lies in the total number of samples taken and the spread of the samples taken throughout the noise period. An appropriate minimum standard is considered to be the taking of five $L_{Aeq, 5 \text{ minute}}$ samples during each noise period (daytime, evening and night-time) over a five day period which is to include one Sunday. Additional samples may be requested based on the results and convergence of previous baseline monitoring efforts. Similar to the previous methodology, L_{Aeq} , L_{10} and L_{90} shall be recorded at the specified intervals and the survey period shall be selected prior to the commencement of construction activities, so as to avoid other atypical noise sources.

In order to confirm that typical conditions prevail throughout the survey period, observations of noise sources and weather conditions shall be made and reported on all monitoring occasions or at the minimum specified interval.

Checking for changes in the baseline noise levels shall be carried out by taking "sample" noise measurements every six months when no noisy construction activities are in progress.

Impact Monitoring

During normal construction working hours (0700-1900 Monday to Saturday), monitoring of $L_{Aeq, 30\text{min}}$ noise levels (as six consecutive $L_{Aeq, 5 \text{ min}}$ readings) shall be carried out at the agreed monitoring locations once every six days in accordance with the methodology in the TM. If restricted hours works are undertaken, monitoring of $L_{Aeq, 15\text{min}}$ noise levels (as three consecutive $L_{Aeq, 5 \text{ min}}$ readings) shall be carried out at the agreed monitoring stations at the same frequency as specified for normal working hours.

In relation to the monitored noise levels, other noise sources such as road traffic may make a significant contribution to the overall noise environment. Therefore, the results of noise monitoring activities will take into account such influencing factors which were not present during the baseline monitoring period. All measurements shall be recorded to the nearest 0.1 dB.

In order to ascertain the significance of any impact that the construction works may impose upon the local population, it is necessary to set out a framework for the interpretation of monitoring results. As an Area Sensitivity Rating has been assigned to individual affected NSRs, it is proposed that the interpretation of monitoring results is undertaken through checking of them against the Action and Limit (A/L) Levels defined in *Table 12.4b*.

Table 12.4b Action and Limit Levels for Construction Noise dB(A)

Time Period	Action	Limit
0700-1900 on normal weekdays;	When one documented complaint is received	75 dB(A) ⁽¹⁾
1900-2300 on any day and 0700-2300 on Sundays and general holidays; for use of SPME and carrying out of PCW	When one documented complaint is received	45/50/55 dB(A) ⁽²⁾
2300-0700 on any day for use of SPME and carrying out of PCW	When one documented complaint is received	30/35/40 dB(A)
1900-2300 on any day and 0700-2300 on Sundays and general holidays for the use of PME other than those specified in TM3	When one documented complaint is received	60/65/70 dB(A)
2300-0700 on any day for the use of PME other than those specified in TM3	When one documented complaint is received	45/50/55 dB(A)

⁽¹⁾ For educational establishments the limit level shall be 70 dB(A), reduced to 65 dB(A) during examination periods.

⁽²⁾ Acceptable Noise Levels for Area Sensitivity Rating of A/B/C.

12.5 Operational Noise

Monitoring of rolling stock emissions will be required to determine maintenance requirements for vehicles. This will comprise a permanent monitoring location close to the Depot so that noise levels can be attributed to specific rolling stock. As soon as an exceedance of a reference noise level given in *Table 12.5a* is detected, the fault will be diagnosed for remedial action. This may include routine wheel profiling and checking of mechanical sources and their silencing equipment.

Table 12.5a Maximum Permissible Free Field Rolling Stock Noise Levels (L_{max} dB)

Rolling Stock	Distance (m)	Speed (kph)	Noise Limit
EMU on Ballasted Track	25	100	82.1 ⁽¹⁾
Locomotive on Ballasted Track	25	50	71 ⁽¹⁾
Flatbed Wagons on Ballasted Track	25	50	78.1 ⁽¹⁾
EMU Air-conditioning Unit	15	0	57 ⁽²⁾

⁽¹⁾ Noise levels measured in a free-field condition on flat ground at a height of 1.5m and in the absence of any screening objects and reflective surfaces. In the absence of a suitable monitoring location representative of the reference conditions, alternative procedures may be adopted to good acoustical principles.

⁽²⁾ Noise levels measured in a free-field condition in the vertical axis above the train and in the absence of any screening objects and reflective surfaces. In the absence of a suitable permanent monitoring location, alternative procedures may be adopted to good acoustical principles as defined in Section 4.5.4.

Periodic inspection of the track for wear and the presence of corrugation will be undertaken by KCRC track maintenance personnel. In particular, where corrugation is detected, rail grinding will be carried out by the KCRC. It should be noted that it is in the KCRC's best interests to ensure the early removal of corrugation since long term build up

will permanently alter the material structure of the rail head. The frequency for grinding will be dependant on the actual operational characteristics of the permanent way system and rolling stock. This will be determined together with the need to maintain rail head profiles for the minimisation of wear.

12.6 Water Quality Monitoring

12.6.1 Introduction

The construction of crossings over the Shing Mun River Channel, and the Siu Lek Yuen and Tai Shui Hang Nullahs may involve dredging of riverine deposits that may be contaminated by heavy metals and organic pollutants. As such, it is recommended that water quality monitoring is undertaken to assess the efficacy of the proposed mitigation measures. This section outlines the methodology, equipment and monitoring locations for the proposed water quality monitoring.

12.6.2 Methodology and Criteria

It is recommended that water quality monitoring be carried out as part of the EM&A programme during the course of any riverine works in order to ensure that any deteriorating water quality is readily detected and timely action is taken to rectify the situation. At each of the river water quality monitoring locations, the following parameters shall be measured:

- Dissolved oxygen (DO) (in mg l-1 and % saturation);
- Biochemical Oxygen Demand (BOD);
- Chemical Oxygen Demand (COD);
- Temperature (oC);
- pH value;
- Flow rate;
- Suspended solids (SS) (mg l-1);
- Turbidity (NTU); and
- Water depth (m).

With the exception of SS, which requires laboratory analysis, all of the above parameters shall be measured *in situ*.

In addition to the water quality parameters defined above, other relevant data shall also be recorded, such as monitoring location, time, weather conditions, tidal stage (where appropriate), special phenomena and work activities at the construction site.

12.6.3 Monitoring Equipment

The following equipment shall be used following approved from the Engineer.

Dissolved Oxygen and Temperature Measuring Equipment

The instrument shall be a portable, weatherproof dissolved oxygen measuring instrument complete with cable, sensor, comprehensive operation manuals, and shall be operable from a DC power source. It shall be capable of measuring:

- Dissolved oxygen levels in the range of 0 - 20 mg l⁻¹ and 0 - 200% saturation; and
- A temperature of 0-45 degrees Celsius.

It shall have a membrane electrode with automatic temperature compensation complete with a cable of not less than 25 m in length. Sufficient stocks of spare electrodes and cables shall be available for replacement where necessary.

Turbidity Measurement Equipment

Turbidity within the water shall be measured in-situ by the nephelometric method. The instrument shall be a portable, weatherproof turbidity-measuring unit complete with cable, sensor and comprehensive operation manuals. The equipment shall be operated from a DC power source, it shall have a photoelectric sensor capable of measuring turbidity between 0 - 1000 NTU and shall be complete with a cable with at least 25 m in length (Hach 2100P or an approved similar instrument).

The turbidity meter shall be calibrated to establish the relationship between turbidity readings (in NTU) and levels of suspended solids (in mg l⁻¹). After calibration, turbidity measurements shall be taken as a true representation of levels of suspended solids only before laboratory test results for suspended solids are known.

Suspended Solids

A water sample shall be taken at the same time as the turbidity results are obtained using a Niskin Water Sampler (or a similar approved instrument) of at least 2.5 litre capacity with messenger and a 10 m line. Gravimetric suspended solid concentrations in each sample shall be determined in the laboratory according to Method No. 2540 D in APHA *Standard Methods for the Examination of Water and Wastewater, 19th edition*.

Water samples for SS measurements shall be collected in high density polythene bottles, packed in ice (cooled to 4 °C without being frozen), and delivered to a HOKLAS laboratory as soon as possible after collection.

Flow Rate Meter

A portable, battery operated flow meter (General Oceanics Mechanical Flowmeter Model 2030 or Flow Probe Hand Held Flowmeter) shall be used to determine river flow rate at each designated monitoring station. This unit should either be hand held or fitted to the bottom of the survey boat. Flow rate shall be measured in cubic meters per second.

Water Sampling Equipment

A water sampler, consisting of a transparent PVC or glass cylinder of not less than two litres which can be effectively sealed with cups at both ends, shall be used (Kahlsico Water Sampler 13SWB203 or an approved similar instrument). The water sampler shall have a positive latching system to keep it open and prevent premature closure until released by a messenger when the sampler is at the selected water depth.

All *in situ* monitoring instruments shall be checked, calibrated and certified by a laboratory accredited under HOKLAS or any other international accreditation scheme before use, and subsequently re-calibrated at bi-monthly intervals throughout all stages of the water quality monitoring. Responses of sensors and electrodes shall be checked with certified standard solutions before each use. Wet bulb calibration for a DO meter shall be carried out before measurement at each monitoring location.

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* shall be observed.

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

Laboratory Analysis

All laboratory work shall be carried out in a HOKLAS accredited laboratory. Water samples of about 1,000 ml shall be collected at the monitoring stations for carrying out the laboratory SS determination. The SS determination work shall start within 24 hours after collection of the water samples. The analyses of SS and sulphides shall follow the

standards described in APHA *Standard Methods for the Examination of Water and Wastewater*, 19th edition.

SS : 2540D standard method

Sulphides : 4500-S²⁻ D

In any circumstance, the sample testing shall have comprehensive quality assurance and quality control programmes.

12.6.4 Monitoring Locations

The proposed monitoring stations are presented in *Table 12.6a* and depicted in *Figure 12.6a*.

Table 12.6a Water Quality Control and Monitoring Stations

River	Ebb Tide		Flood Tide	
	Control Station	Monitoring Station	Control Station	Monitoring Station
Shing Mun River*	SM1	SM2	SM1	SM2
Siu Lek Yuen Nullah	SLY1	SLY2	SLY2	SLY1
Tai Shui Hang Nullah	TSH1	TSH2	TSH2	TSH1

* The Shing Mun River has no appreciable tidal flow at at the proposed monitoring locations therefore the monitoring and control stations remain the same for the ebb and flood tides.

Prior to the commencement of the EM&A programme, the proposed water monitoring stations shall be discussed and agreed with the EPD.

12.6.5 Baseline Monitoring

Baseline conditions for water quality shall be established and agreed with the EPD prior to the commencement of any riverine works. The purposes 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 and control monitoring stations. The baseline conditions shall be established by measuring the water quality parameters specified above. The measurements shall be taken at all designated impact monitoring stations, at mid-flood and mid-ebb tides (where appropriate) on the sampling day.

Prior to the commencement of construction works, a period of 4 consecutive weeks of baseline monitoring is recommended which should comprise three sampling days per week. The baseline monitoring will provide a database of water quality data which shall be used as the reference for subsequent impact monitoring during the construction phase of the MOS Extension.

All measurements shall be carried out at three water depths, namely, 1 m below the water surface, mid-water depth, and 1 m above river bed (where appropriate). Water samples for suspended solids analysis shall be taken at the same three depths. If the water depth is less than 6 m, the mid-depth measurement may be omitted subject to the approval of the Engineer. If the depth is less than 3 m, only the mid-depth measurement needs to be taken subject to the approval of the Engineer. There shall not be any construction activities in the vicinity of the stations during the baseline monitoring.

All parameters should be measured at the control stations on each monitoring day.

12.6.6 Impact Monitoring

During the course of the riverine works, impact monitoring shall be undertaken on three working days per week. Monitoring at each station shall be undertaken at both mid-ebb and mid-flood tides (for tidal sections) on the same day. The interval between two sets of monitoring shall not be less than 36 hours. Two consecutive measurements of DO, dissolved oxygen saturation at each depth of each station shall be taken. The probes shall be retrieved out of water after the first measurement and then redeployed for the second measurement. Where the difference in value between the first and second readings of each set is more than 25% of the value of the first reading, the reading shall be discarded and further readings shall be taken. One sample for suspended solids measurement shall be taken at each depth at each water quality monitoring/control station.

Should the monitoring record levels of turbidity, suspended solids, temperature or dissolved oxygen that exceed the statutory standards of the *Water Pollution Control Ordinance*, increased monitoring shall be required.

12.6.7 Compliance Assessment

Monitoring data collected during the period of the construction works shall be assessed against the Action and Limit Levels proposed by Contractor, and ultimately agreed with the EPD, following the completion of the baseline monitoring.

12.6.8 Further Environmental Management

The EIA Report has concluded that, with the effective implementation of the specified management measures, there will be no insurmountable residual water quality impacts from either the construction or operation of the MOS Extension. Water quality monitoring, as defined above, is recommended during the course of the riverine works, however, in order to ensure that the recommended mitigation measures and on-site management practices are appropriately and strictly implemented during the construction and operational phases (thereby minimising and controlling the potential sources of impact) it is also recommended that the mitigation measures defined in this Report are incorporated into the Contract documents, and that there is also a contractual requirement for the Contractor to undertake regular site inspections to ensure compliance with these



LOCATIONS OF PROPOSED RIVER WATER QUALITY MONITORING STATIONS

FIGURE 12.60

requirements. In addition, the IEC should also audit the Contractor's activities and site inspection findings to ensure compliance with the requirements, and to, if appropriate, make recommendation for improvements in the Contractor's works activities.

12.7 Management of Other Environmental Issues

Environmental monitoring requirements have been identified for construction dust, water, and construction and operational noise impacts. However, in order to ensure that the potential impacts from other sources are adequately assessed and thereby controlled, it is recommended that regular environmental auditing is undertaken throughout the construction and operational phases of the MOS Extension in order to ensure that the mitigation measures recommended in this EIA Report are appropriately implemented. The proposed auditing requirements are set out below.

12.7.1 Waste

It is recommended that auditing of each waste stream should be carried out periodically by the Independent Environmental Checker to determine if wastes are being managed in accordance with approved procedures and the site waste management plan and to assess whether waste reduction could be enhanced.

The audits shall investigate all aspects of waste management including waste generation, storage, recycling, transport, and disposal.

12.7.2 Ecology

As no impacts of concern to terrestrial ecological resources are predicted to occur, the development and implementation of a monitoring and audit programme specifically designed to assess the effects of the construction activities on terrestrial ecological resources is not considered necessary.

12.7.3 Landscape and Visual

No specific EM&A requirements are considered necessary to monitor the efficacy of the mitigation measures recommended for minimising for the landscape and visual impacts of the construction works. However, it is recommended that the Contractor undertakes regular site inspections to monitor the condition of the site, and the level of general 'house-keeping'. It is considered that that these general inspections should be sufficient to identify any issues related to landscape and visual impacts and that they will also form an appropriate mechanism for ensuring that the issue is appropriately highlighted and rectified.

12.7.4 Heritage

A number of areas of archaeological potential have been identified during the EIA process, and it is recommended that field excavation is undertaken prior to the

commencement of any construction works. Until the findings of the field excavation are known, precise archaeological EM&A requirements, if any, cannot be specified.

12.7.5 Contaminated Land

No specific EM&A requirements are considered necessary for contaminated land issues. However, the Contractor should develop procedures for reacting to and assessing any suspect areas that are identified during the groundworks.