

# 1 Introduction

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## 1.1 Project Background

Before the training of Shenzhen River, the Lok Ma Chau Loop (LMC Loop) was within the administrative boundary of Shenzhen Municipal Government. It is now lies within the administrative boundary of the Hong Kong special Administrative Region (HKSAR).

In the Chief Executive's 2007 Policy Address, the development at LMC Loop is one of the ten major infrastructure projects for economic growth of the Hong Kong Special Administrative Region (HKSAR). The HKSAR Government would work with the Shenzhen authorities to tap the land resources of the LMC Loop to meet future development needs and consolidate the strategic position of both cities in the Pan-Pearl River Delta region.

Subsequent to the signing of the "Co-operation Agreement on Recently Initiated Major Infrastructural Projects" at the Hong Kong-Shenzhen Co-operation Meeting on 18.12.2007, a "Hong Kong-Shenzhen Joint Task Force on Boundary District Development" (Joint Task Force), co-chaired by the Secretary for Development of the HKSAR Government and the Executive Vice Mayor of Shenzhen Municipal Government, was set up to coordinate and steer research and studies in relation to planning and development of land in the boundary district, including, inter alia, the LMC Loop.

At its first meeting on 10.3.2008, the Joint Task Force agreed that Hong Kong and Shenzhen would conduct a joint study on planning, environmental, and engineering feasibility for the development of the LMC Loop. Public engagement exercise on the possible future land uses of the LMC Loop was then carried out concurrently in Hong Kong and Shenzhen between June and July 2008. In the meanwhile, the Shenzhen Municipal Environmental Protection Bureau (SZMEPB) had appointed consultants to carry out terrestrial ecological investigation, marine/aquatic ecological baseline study and soil contamination testing works for the LMC Loop in 2008. Among the proposed land uses, higher education, research and development of new high technology and cultural and creative industries received wide support from both sides.

At the Hong Kong-Shenzhen Cooperation Meeting on 13.11.2008, a co-operation agreement was signed on the undertaking of a comprehensive study for the development of the LMC Loop. The meeting initially considered that higher education might be developed as the leading land use in the LMC Loop, complemented with some elements of high-tech research and development (R&D) facilities as well as cultural and creative (C&C) industries. This would provide impetus for human resources development in the South China region and enhance the competitiveness of the Pearl River Delta (PRD), as well as benefit the long-term economic development of the two cities. In 2009, the "Planning and Engineering Study on the Development of Lok Ma Chau Loop – Investigation" (P&E Study) was jointly commissioned by the Hong Kong Planning Department (PlanD) and Civil Engineering and Development Department (CEDD) with participation from Shenzhen. The findings of the baseline survey by SZMEPB were provided for reference under the P&E Study. In parallel, a separate study for

the adjoining area on Shenzhen side was commissioned by the Shenzhen government with participation from Hong Kong.

Stage 1 Public Engagement (PE) was conducted in Hong Kong and Shenzhen between November 2010 and January 2011 to seek public views on the Preliminary Outline Development Plan (PODP)(**Appendix 1-1**) for the LMC Loop. Based on the public views on the PODP and engineering assessment, the draft Recommended Outline Development Plan (RODP)(**Appendix 1-1**) was formulated and put forward to collect public views in the Stage 2 PE between May and July 2012. A Preliminary Layout Plan was then developed taking into account the public views, planning and engineering considerations (Details are discussed in **Section 2**).

The Study Area comprises Area A, Area B and Added Area B as shown in **Figure 1.1**. Area A is the LMC Loop site in which the buildings, landscape, infrastructures and internal roads will be located. Supporting infrastructures and external transport connections are planned in Area B. Linkage of the external transport connections to the nearby regional primary road network is located in the Added Area B. It should be noted that no new land uses / development would be proposed in Area B and Added Area B under the Project.

## 1.2 Designated Project

The LMC Loop Development is a designated project (DP) under Item 1 Schedule 3 of EIAO - Engineering feasibility study of urban development projects with a study area covering more than 20 ha or involving a total population of more than 100,000.

In addition, the following individual project components associated with the LMC Loop Development also fall under various Schedule 2 DP categories as listed below:

- Ecological Area (DP1)
- Western Connection Road (including LMC Road Connection to Fanling / San Tin Highway) (DP2)
- Direct Link to MTR LMC Station (DP3)
- Drainage System under Internal Transport Networks (DP4)
- Sewage Treatment Works (DP5)
- Eastern Connection Road (DP6)
- Flushing Water Service Reservoir (DP7)

## 1.3 Objectives of the Manual

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

- Guide the set up of an EM&A programme to ensure compliance with the EIA recommendations;
- Specify the requirements for monitoring equipments;

- Propose environmental monitoring points (which were selected according to the findings of EIA, most affected receivers, most representative control point and receiver, etc), monitoring frequency etc;
- Propose Action / Limit Level; and
- Propose Event / Action Plan.

This EM&A Manual outlines the monitoring and audit programme for the construction and operation of the LMC Loop Development and provide systematic procedures for monitoring, auditing and minimizing environmental impacts.

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

This Manual contains the following information:

- Responsibilities of the Contractor, the Engineer or Engineer's Representative (ER), Environmental Team (ET), and the Independent Environmental Checker (IEC) under the context of EM&A;
- Project organization for the EM&A works;
- The basis for, and description of the broad approach underlying the EM&A programme;
- Details of the methodologies to be adopted, including all laboratories and analytical procedures, and details on quality assurance and quality control programme;
- The rationale on which the environmental monitoring data will be evaluated and interpreted;
- Definition of Action and Limit levels;
- Establishment of Event and Action plans;
- Requirements for reviewing pollution sources and working procedures required in the event of non-compliance with the environmental criteria and complaints; and
- Requirements for presentation of environmental monitoring and audit data and appropriate reporting procedures.

This EM&A Manual is a dynamic document that should be reviewed regularly and updated as necessary during the construction and operation of the Project including those updates noted in the EIA.

For the purpose of this manual, the ER shall refer to the Engineer / Supervising Officer as defined in the Construction Contract, in cases where the Engineer's / Supervising Officer's powers have been delegated to the ER / Supervising Officer's Representative, in accordance with the Construction Contract. The ET leader, who shall be responsible for and in charge of the ET, shall refer to the

person delegated the role of executing the environmental monitoring and audit requirements.

## 1.4 Summary of EM&A Programme

The summary of EM&A programme is presented in Table 1.1 and the monitoring detail requirements are presented in the following chapters.

**Table 1.1 Summary of EM&A Programme**

Parameters	Stages		
	Pre-construction	Construction	Operation
Dust (TSP)	Baseline monitoring	Impact monitoring	-
Odour (AVS / Redox potential)	Baseline monitoring	Impact monitoring	
Construction noise	Baseline monitoring	Impact monitoring	-
Traffic noise	Baseline monitoring	-	Impact monitoring
Water quality	Baseline monitoring	Impact monitoring	12 months after construction
Survey for birds, mammals, herpetofauna, dragonflies, butterflies, aquatic fauna, flora and any others considered relevant	Baseline monitoring (at ECR only)	Impact monitoring of fauna at Pond 12 and of the stream containing Rose Bitterling (during WCR works only)	Monitoring of mammal use of underpasses and the overpass forming part of the ECR
Transect counts of herpetofauna	-	Impact monitoring (during ECR works only)	
Flight line survey	-	Impact monitoring (Until 12 months after construction completion )	-

## 2 Project Description

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### 2.1 General Description of the Project

The Project is to develop LMC Loop with higher education as the leading land use, complemented by high-tech R&D and C&C industries. The estimated total population for LMC Loop will be about 53,000, based on a Gross Floor Area (GFA) of 1,200,000m<sup>2</sup> and overall plot ratio of and 1.37. The development plan, the associated infrastructures provisions, the major activities in the project scope are outlined below.

The Project comprises the development and infrastructure of LMC Loop (about 87.7ha) according to the Recommended Outline Development Plan (RODP) and associated supporting infrastructure / works outside the LMC Loop (**Figure 2.1a**). Through the P&E Study, a reference Revised Preliminary Layout Plan (Revised PLP) (**Figure 2.1b**) for the development of the LMC Loop has been developed. The proposed key infrastructure include to roads within the Loop, external connection roads such as Western Connection Road, Eastern Connection Road and the Direct Link to MTR LMC Station, sewage treatment works, flushing water service reservoir, district cooling systems (provisional), fire station cum ambulance depot, electricity substations, drainage and sewage systems, water supply network and public utilities. Mitigation measures such as offsite compensation of wetland area and bioremediation works at Shenzhen River are also proposed along with this EIA Study (**Figures 2.1c to 2.1d**).

Other project components that are related to the implementation of Development of LMC Loop but under separate EIA studies includes Kwu Tung North Fresh Water Service Reservoir and upgrading of Shek Wu Hui Sewage Treatment Works for off-site compensation to comply with the “No net increase in pollution load requirement in Deep Bay”. The EIA of these project components were included in the North East New Territories New Development Areas (NENT NDAs) Planning and Engineering Study.

Project components that fall under various Schedule 2 DP categories are briefly described in the following sections.

### 2.2 Key Infrastructures

#### 2.2.1 Ecological Area (DP1)

A 12.8 ha of Ecological Area (EA) will be established in the south of LMC Loop (i.e. Area A in **Figure 1.1**) prior to reed marsh removal. The EA serves a side function as a flood storage pond to temporarily retain part of the storm water from the LMC Loop before conveyed to Shenzhen River through the new proposed outfalls. **Figure 2.2** and **2.3** shows the proposed preliminary onsite drainage arrangement. The profile of EA should follow the recommendations of Drainage Impact Assessment.

## 2.2.2 Western Connection Road (DP2)

The main purpose of Western Connection Road (WCR) is to provide a direct linkage between LMC Loop with the external road and highway network at the southern end of the connection road, i.e. San Tin Highway and Castle Peak Road (**Figure 2.4a to 2.4c, 2.5 to 2.10**).

The design of and major associated works for WCR are summarised below:

- Site formation works
- Linkage from LMC Loop to external road and highway network in San Tin Highway/Castle Peak Road formed by widening of existing Ha Wan Tsuen Road and Lok Ma Chau Road (at-grade) (**Figures 2.5 to 2.10**) plus a new slip road to San Tin Interchange (**Figures 2.4a to 2.4c**)
- 2-lane single carriageway
- About 1.3 km (main road) and 480m (slip roads) in length

Other components under this DP: construction haul roads, utilities, noise barriers and cycle tracks

## 2.2.3 Direct Link to Lok Ma Chau Station (DP3)

The purpose of Direct Link to Lok Ma Chau Station is to transport local Loop users to MTR LMC Station and the cross-boundary Loop users to LMC Spurline Boundary Control Point (**Figures 2.11a to 2.11e**).

The design of and major associated works for the Direct Link is summarised below:

- Site formation works
- Linkage from LMC Loop to LMC Station
- Road-based 2-lane single viaduct
- Elevation: at grade in the junction at WCR and up to 17.6 mPD
- About 770m in length

Other components under this DP: construction haul roads, utilities, noise barriers and barriers/parapets

## 2.2.4 Drainage System under Internal Transport Networks (DP4)

According to the preliminary design, the drainage network will include 900mm to 2250mm drainage pipes, 3000x2500mm and 3500x2750mm box culverts (**Figure 2.3**). The alignment of the drainage system generally follows the internal transport network. The works for drainage system include the follows:

- Site formation works
- Drainage system within LMC Loop

Other components under this DP: utilities

## 2.2.5 Sewage Treatment Works (DP5)

An on-site sewage treatment work (STW) with design Average Dry Weather Flow of 18,000 m<sup>3</sup>/day (with at least 4,000m<sup>3</sup>/day of Treated Sewage Effluent reuse) will be provided in ultimate scenario. The location of on-site STW is shown in **Figure 2.1b** and the detailed layout is shown in **Figures 2.26a to 2.26c**. The treatment method will be Membrane Bioreactor (MBR) System. Under the policy of “No Net Increase in Pollution Load” in Deep Bay, off-site compensation will be made by upgrading the existing Shek Wu Hui Sewage Treatment Works under a separate project.

The TSE will be reused for non-potable use (**Section 2.2.7**). This not only reduces water consumptions but also minimizes the amount of effluent discharge. The treatment of TSE up to the proposed reuse quality will be located within the on-site STW, including the chlorine contact tank, chemical storage, TSE storage and distribution pumps connecting to the service reservoir and supply pipe network.

## 2.2.6 Eastern Connection Road (DP6)

The Eastern Connection Road (ECR) is designed as a single 2-way carriageway configuration with footpath and cycle track of standard widths at the eastern side of the LMC Loop, linking it with the proposed road network of the future Kwu Tung North New Development Area (KTN NDA). Layout of ECR is shown in **Figures 2.12 to 2.19**, while the schematic longitudinal section of the shallow underpass is shown in **Figures 2.20 and 2.21**. The proposed cross-sectional arrangements of the shallow underpass and depressed road are presented in **Figures 2.22 and 2.23e**.

The design of and major associated works for ECR are summarised below:

- Site formation works
- Linkage from LMC Loop to North East New Territories New Development Areas (NENT NDAs) via Ma Tso Lung involving widening part of existing Border Road and new road near Ma Tso Lung
- 2-lane single at-grade carriageway plus depressed road/underpass crossing the Meander and minor viaducts across streams
- About 610m (depressed road), 200m (underpass), 50m (viaduct), 1350m (at-grade road) in length

Other components under this DP: construction haul roads, utilities, noise barriers and cycle tracks

## 2.2.7 Flushing Water Service Reservoir (DP7)

Being one of the green initiatives and subject to further study, TSE is proposed to be reused for non-potable purposes such as toilet flushing, landscape irrigation and make-up water for district cooling system (DCS). TSE from the STW will be diverted to a flushing water service reservoir (**Figure 2.23f and 2.26c**) and supplied to the development for non-potable use via pipelines. The estimated amount of effluent to be reused within LMC Loop development is 10,460 m<sup>3</sup>/day. The water quality for TSE reuse for various non-potable reuses are formulated with reference to the prevailing water supply guidelines or on-going TSE reuse

projects for the intended non-potable water uses, balancing with practicality and anticipated end-user satisfaction.

The design of and major associated works for Flushing Water Service Reservoir are summarised below:

- Site formation and slope works
- Construction of flushing water service reservoir with footprint of about 1,350m<sup>2</sup>, associated pipelines and ancillary facilities
- Other components under this DP: construction haul roads and utilities

## 2.3 Implementation Programme

According to the tentative implementation programme (**Appendix 2-1**), the LMC Loop will be commissioned in phases. The implementation programme is summarised in **Table 2.3**.

**Table 2.3** Summary of tentative implementation programme

Phasing	Description of Work	Time Line
Advance Works	Fishpond compensation	Late 2013/Early
	Land de-contaminations	2014 – 2015
	Establishment of Ecological Area (DP1)	
Phase 1 Infrastructures	Site formations works	2015 – 2020
	Land reserve of boundary crossing facilities	
	Western Connection Road including the connections between LMC Road and Fanling/San Tin Highway (DP2)	
	Direct Link to Lok Ma Chau Station (DP3)	
	Drainage System under Internal Transport Networks (DP4)	
	Sewage Treatment Works (DP5)	
	District Cooling System (Western)	
	Bio-remediation	
	Landscaping Works at Open Spaces	
Phase 1 Buildings	Construction and operation of Phase 1 Buildings	Construction: 2016 to 2020 / Operation: 2020
	Construction and operation of fire station cum ambulance depot	
Phase 2 Infrastructures	District Cooling System (Eastern)	2021 - 2027
	Eastern Connection Road (DP6)	
	Flush Water Service Reservoir (DP7)	
	Landscaping Works at Open Spaces	
Phase 2 Buildings (Full Operation)	Construction and operation of Phase 2 Buildings	Construction: 2024 to 2027 / Operation: 2027



## 2.4 Project Implementation Schedule

Detailed EIA assessments have been conducted and presented in the EIA report. Mitigation measures have also been identified and recommended. The Project Implementation Schedule (PIS) is given in **Appendix 2-2**. It specifies the extent, locations, time frame and responsibilities for the implementation of the environmental mitigation measures identified.

### 3 Project Organization

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The proposed project organization and lines of communication with respect to environmental protection works are shown in **Appendix 3-1**.

Sufficient and suitably qualified professional and technical staff shall be employed by the respective parties to ensure full compliance with their duties and responsibilities, as required under the EM&A programme for the duration of the Project.

The responsibilities of respective parties are:

#### **The Contractor**

The Contractor should report to the Engineer / Supervising Officer. The duties and responsibilities of the Contractor are:

- Implement the EIA recommendations and requirements;
- Employ an ET to undertake monitoring, laboratory analysis and reporting of environmental monitoring and audit;
- Provide assistance to ET in carrying out monitoring and auditing;
- Submit proposals on mitigation measures in case of exceedances of Action and Limit levels in accordance with the Event and Action Plans;
- Implement measures to reduce impact where Action and Limit levels are exceeded; and
- Adhere to the agreed procedures for carrying out compliant investigation.

#### **Environmental Team (ET)**

The Environmental Team should be led and managed by the ET leader. The ET leader shall be an independent party from the Contractor and has relevant professional qualifications, or have sufficient relevant EM&A experience subject to approval of the ER and EPD. The ET Leader shall have at least 7 years of experience in conducting EM&A for infrastructure projects. His / Her qualification shall be vetted by the ER. The ET should monitor the mitigation measures implemented by the Contractor on regular basis to ensure the compliance with the intended aims of the measures. The duties and responsibilities of the ET are:

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

control and environmental mitigation, and take proactive actions to pre-empt problems;

- Liaison with IEC on all environmental performance matters, and timely submission of all relevant EM&A proforma for IEC's approval;
- Prepare reports on the environmental monitoring data and site environmental conditions;
- Report on the environmental monitoring and audit results to the IEC, Contractor, the ER, Project Proponent and EPD;
- Recommend suitable mitigation measures to the Contractor in the case of exceedance of Action and Limit levels in accordance with the Event and Action Plans;
- Give advice to the Contractor on environmental improvement, awareness, enhancement matters, etc. on site;
- Undertake regular on-site audits / inspections and report to the Contractor, the ER and IEC of any potential non-compliance;
- Follow up and close out non-compliance actions; and
- Adhere to the procedures for carrying out environmental complaint investigation.

#### **Engineer / Supervising Officer or Engineer's / Supervising Officer's Representative (ER)**

The Engineer / Supervising Officer is responsible for overseeing the construction works and for ensuring that the works undertaken by the Contractor in accordance with the specification and contractual requirements. The duties and responsibilities of the ER with respect to the EM&A may include:

- Supervise the Contractor's activities and ensure that the requirements in the EM&A Manual are fully complied with;
- Inform the Contractor when action is required to reduce impacts in accordance with the Event and Action Plans;
- Assist the Project Proponent in employing an IEC to audit the results of the EM&A works carried out by the ET;
- Participate in joint site inspection undertaken by the ET;
- Comply with the agreed Event Contingency Plan in the event of any exceedance;
- Adhere to the procedures for carrying out complaint investigations.

#### **Independent Environmental Checker (IEC)**

The Independent Environmental Checker should advise the ER on environmental issues related to the project. The IEC should possess at least 7 years experience in EM&A. The duties and responsibilities of the IEC are:

- Review in an independent, objective and professional manner the EM&A works performed by the ET (at not less than monthly intervals);

- Audit the monitoring activities and results (at not less than monthly intervals);
- Validate and confirm the accuracy of monitoring results, monitoring equipment, monitoring locations, monitoring procedures and location of sensitive receivers;
- Report the audit results to the ER, the Project Proponent and EPD in parallel;
- Review the EM&A reports (monthly summary reports) submitted by the ET;
- Check and review the proposed mitigation measures submitted by the Contractor in accordance with the Event and Action Plans;
- Check and review the effectiveness of the mitigation measures that have been recommended in the EIA and this Manual, and ensure they are properly implemented in a timely manner, when necessary; and
- Report the findings of site inspections and other environmental performance reviews to ER, Project Proponent and EPD.
- Coordinate the monitoring and auditing works for all the on-going contracts in the area in order to identify possible sources / causes of exceedances and recommend suitable remedial actions where appropriate;
- Coordinate the assessment and response to complaints / enquires from locals, green groups, district councils or the public at large;
- On as-needed basis, verify and certify the environmental acceptability of the Contractor's construction methodology (both temporary and permanent works), relevant design plans and submissions under the EP; and
- Verify investigation results of environmental complaint cases and the effectiveness of corrective measures.

## Figures

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## Figure 1-1 Description

## **Appendix 1-1**

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## **Appendix 1-3**

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