3 Technical Approach and Study Methodology

This chapter deals with technical approach and study methodology applied for evaluating the potential environmental impact of Stage III of the Shenzhen River Regulation Project (including channel, dyke, reprovisioning works and bridge reconstruction).

3.1 Technical Approach

The EIA follows the following technical approach:

(1) Invite experienced environmental experts to discuss and examine the major potential environmental impact and major environmental issues, in the light of project scheme and present environmental setting;

(2) Carry out baseline evaluation to identify the present environmental conditions in the Study Area, on the basis of available data, field investigation and monitoring;

(3) Predict the potential environmental impacts caused by the Project upon special study and simulation, incorporating expert's opinions;

(4) Evaluate the environmental impacts caused by the Project according to relevant laws, regulations, standards, and the predicted results;

(5) Put forward remedial measures, assess the residual impacts and evaluate whether it meets the relevant policies and standards in both Shenzhen and Hong Kong;

(6) Make environmental monitoring and audit working plan to evaluate the actual environmental impacts and the effectiveness of the remedial measures.

3.2 Examination of Major Environmental Issues

Many environmental issues that might be affected by the Project have been listed in the section of the EIA study Brief under "The Environmental Issues and Scope to be Considered". There are obvious differences among these environmental issues with respect to their importance, significance, and extent of impacts. Therefore, it is necessary to properly distinguish and to pay more attention to the major environmental issues.

Considering the Project's features, regional environmental characteristics, Project's constraints, special requirements, as well as the EIA's findings for Stage I, Stage II of the Project and other similar projects, experienced environmental experts have identified major environmental issues for the Project, which need special attention. These issues include the impact of spoil disposal and the impacts of the Project on ecology and water quality.

Besides the major environmental issues, other environmental impacts, such as air quality, noise, landscape and vision, cultural heritage etc., should also be assessed.

3.3 Review and Study of References

The EIA study for Stage I and Stage II of the Project has already been finished. Therefore some useful background information can be gained from them and associated agencies. Systematic collection of these data has been carried out at the early stage of this EIA process.

Information collection is focused on the area of the construction site and its vicinity. The main items include:

(1) Project data, such as scheme, design, and relevant investigation findings;

(2) Information about geology, topography, hydrology, meteorology, soil, vegetation, habitats and socio-economy in the Project affected area;

(3) EIA reports for Stage I and Stage II of the Project, findings from environmental monitoring and audit and relevant study, as well as EIA reports of other similar projects;

(4) Associated laws, regulations, ordinances, standards related to environmental protection in both Shenzhen and Hong Kong regions;

(5) Environmental quality reports, environmental protection plan, other relevant data and information of Shenzhen City.

(6) Data about historic relics and cultural heritages in both Shenzhen and Hong Kong.

After reviewing the above information collected, an online search for relevant infor-

mation at home and abroad has been made on the Internet concerning the major environmental issues of Stage III Project. The search focuses on the impacts of spoil disposal and impacts on ecology.

3.4 Environmental Baseline Survey

The objective of environmental baseline survey is to provide comprehensive information. It includes air, noise, water quality, sediment and bank soil, landscape and vision, cultural heritages, ecology and so on.

Survey methodology includes study of literature, field survey, photograph taking sampling and monitoring, and study of aerial photos.

3.5 Study

The studied subjects include the prototype of water quality monitoring, investigation on source of river pollution, elutriation test and so on. The study results will be described in the relevant chapters of the report.

3.6 Modeling and Prediction

Mathematical models are adopted for simulating and predicting the impacts on air, noise, hydraulics, sediment, and water quality in this study.

Fugitive Dust Model (FDM), which is extensively used by USEPA and endorsed by Hong Kong Environmental Protection Department, is adopted for assessing the potential impacts of Project's construction activities on air quality.

The Hong Kong *Technical Memorandum for Construction Noise Except for Pile Driving* is used for noise assessment and noise prediction for construction site. Items considered include noise from machines, vehicles and vessels in construction site. For calculation of traffic noise outside the construction sites, the "Traffic Noise Calculation Method" issued by the UK Department of Transport is applied.

One-dimensional non-steady flow model for open channel is used for modeling the river flow coupling with tide effect. Suspended load even sand unbalance sediment transport model is used for modeling of river sediment transportation and channel distortion. Inter-tidal weekly average one-dimensional estuary water quality model is ap-

plied for river water quality modeling.

Conceptual models have been set up for studying the relationships between propagation of fauna and flora and their habitats, as well as between fauna and flora. It enabled a close study on the regional ecosystem, and the potential impacts of Project construction on the ecosystem.

Considering the similarity between Stage III and Stage I and II of the Project, analogy method is used to predict the impacts of Stage III on birds and terrestrial fauna of the regional ecosystem.

In addition, GIS technology has been used to analyze habitat losses and impacts incurred due to the Project construction.

3.7 Impact Assessment

The potential impacts of Project on air, noise, water quality, riverbed substrate, and bank soil are evaluated through comparing the results of modeling and sampling analysis with the associated laws, regulations, and standards of Shenzhen and Hong Kong. Moreover, the potential environmental impacts from dredged silt disposal are further evaluated through elutriation test, Hakason potential ecological hazard index calculation, and other relevant study findings.

The potential impacts of project on ecology are evaluated for both on-site and off-site. As almost all potential ecological significant areas within the site are located in the territory of Hong Kong Special Administrative Region, the impact evaluation is specifically carried out based on the Hong Kong *Technical Memorandum on Environmental Impact Assessment Process*. Existing habitats, area of affected habitats, and degree of impact, are evaluated in detail. As for the off-site impact assessment, associated environmental laws, regulations and guidelines of the nation and Hong Kong Special Administrative Region are followed. Special attention is paid to evaluation of downstream impacts of potential water quality that may occur during construction, operation and maintenance of the Project.

The impacts on water and soil losses and on public sanitation are evaluated in the light of the national relevant laws, regulations, and standards. The impacts on landscape, visual, and cultural heritages are assessed according to associated environmental

laws, regulations and guidelines of the nation and Hong Kong Special Administrative Region.

Laws, regulations, and standards adopted in these evaluations are described in detail in relevant chapters or annexes.

Conclusion on project feasibility is made on the basis of the impacts on all aspects and the integration of all impacts. The conclusions is made based on the assumption that all mitigation measures will be taken, and no major modification of project design outlined in Chapter 2 .

3.8 Formulation of Mitigation Measures

Inevitably any project will bring some environmental impacts. One of the objectives of EIA is to formulate proper mitigation measures for the potential environmental impacts of the project.

Formulation of mitigation measures for Stage III Project is mainly on the basis of experiences of the consultant and available scientific technologies in environmental protection, and the implementation and effectiveness of the mitigation measures of Stage I and Stage II. The best combination of mitigation measures is put forward after comparison among various-alternatives.

3.9 Residual Impact Assessment

Residual impact assessment is mainly to evaluate the extent of residual environmental impact and its environmental acceptability after carrying out environmental mitigation measures. The methodology is the same as in Section 3.7.

3.10 Requirements for Environmental Monitoring and Audit

Environmental monitoring and audit is an important mechanism for evaluating the impact of construction activities on the environment, providing an early-warning on whether the environmental protection is being stressed and a mean to protect the habita and to minimize the adverse impacts environment as far as possible. The specific requirements for environmental monitoring and audit are formulated according to the technical guide of Hong Kong *Technical Memorandum on Environmental Impact*

Assessment Process and associated environmental standards and regulations of the nation.

Requirements for environmental monitoring and audit will be given separately in the *Environmental Monitoring and Audit Manual*.