Shenzhen River Regulation Office of Shenzhen Municipal Government
Drainage Services Department of Hong Kong Government

ENVIRONMENTAL IMPACT ASSESSMENT STUDY ON SHENZHEN RIVER REGULATION PROJECT

EXECUTIVE SUMMARY FOR STUDY REPORT FOR STAGE I WORKS

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S1 INTRODUCTION

This Section provides a summary of the key findings of the EIA on Stage 1 works of the Shenzhen River Regulation Project. The approach to the assessment, the baseline conditions, and the potential impacts of the Project are summarized, and mitigation measures and audit and monitoring requirements are recommended. The study area is considered to comprise any areas within the catchment of Deep Bay potentially affected by the Stage 1 works of the Shenzhen River Regulation Project.

S2 STUDY AREA AND THE PROJECT

S2.1 Shenzhen River

The Shenzhen River forms the border between the Shenzhen Special Economic Zone (SEZ) within the People's Republic of China (PRC) and Hong Kong.

The ecosystem of Shenzhen River, its estuary, and Deep Bay is a wetland ecosystem of international importance. Its core is the Mai Po Marshes and Neilingding-Futian National Nature Reserve, along with the adjacent Sites of Special Scientific Interest (SSSI). This area provides a habitat for numerous rare and endangered species, in particular waterfowl and migratory birds including a number of species under threat on a global scale.

Flow of Shenzhen River at flood peak is high. The river channel downstream is narrow and bending. The river embankment is low and narrow. Combined with tidal pressure, the river's safety flood-discharge capacity corresponds to a 1 in 2 year storm capacity, and results in frequent flooding.

Shenzhen River is heavily polluted due to untreated discharge of pollutants from industry, agriculture, poultry and livestock farming, and human sewage.

S2.2 The Shenzhen River Regulation Project

The Shenzhen and Hong Kong Authorities have developed the Shenzhen River Regulation Scheme. The full Project consists of a three stage scheme. Stage 1 involves relatively localized works to truncate two existing meanders of the river at Liu Pok and Lok Ma Chau. Stage 2 involves more extensive dredging works downstream of Lo Wu to increase the depth and width of the channel, and construction of flood protection works along both banks of the widened stream. Stage 3 involves dredging works upstream of Lo Wu.

The programme for the Stage 1 works is planned to take approximately 28 months. The programme includes the erection of the site fence, construction of the haul road, excavation of the Lok Ma Chau Bend, excavation of the Liu Pok Bend, and the excavation of the Seung Ma Lei Yue Hill. Material from the Seung Ma Lei Yue Hill is expected to be used for embankment construction. Upon completion of Stage I works, the length of the section of the river trained in Stage 1 will be reduced from 6.2 km to 3.2 km.

The meander at Lok Ma Chau will be eliminated during the Stage 1 work and the realigned

channel will be located at the north of the bends in the old river channel. The area was farm land before being converted to fish ponds in anticipation of designation as a disposal area of the Project. The 70 ha commercial fish pond area was created for temporary use while waiting for the Project to begin. During the Stage 1 work of the Project, these fish ponds will be filled up by spoil. In the river section between Liu Pok and Yumin Village, the new river channel following Stage 1 work will cut through the eastern portion of Seung Ma Lei Yue Hill. At Liu Pok Bend, material will be disposed of in the existing river channel.

Small suction dredger will be used for dredging. A large portion of the excavation will be carried out in isolation from the main river. The quantity of dredged material from the river channel excavation for Stage I works has been estimated at approximately 1.7 Mm^3. Approximately 10% of dredged material will be dredged from the existing channel, of which 56,000 m^3 or so will be contaminated mud.

S2.3 The Environmental Impact Assessment on the Project

Both the Shenzhen and Hong Kong governments have recognised that the Project may affect the internationally important Mai Po and Futian Nature Reserves at the mouth of the river. The Project also presents other potential environmental problems. The environmental impact assessment (EIA) is thus jointly funded by the Shenzhen and Hong Kong Authorities to ensure that these environmental concerns are addressed. The EIA of the first two stages of the Project started on Dec.16, 1993 and will be finished by the middle of March, 1995. The EIA report on the first stage of the Project is to be submitted by middle of June, 1994 to enable decision on this part of the Project. This has therefore been structured to address this issue for the EIA of Stage 1 Works. The purpose of this Stage 1 Works EIA is to provide information to assist in a decision on the acceptability of the Stage 1 works and to recommend specific requirements for environmental protection which should be included in the detailed design of Stage 1. The study area is shown in Figure S-1.

S2.4 Key Environmental Issues

Due to the localized nature of the Stage 1 works, the direct losses of wetland habitat will be limited to areas at Liu Pok and Lok Ma Chau bends. Potential impacts to terrestrial ecosystems will be limited for the most part to works on the upper portion of Seung Ma Lei Yue Hill.

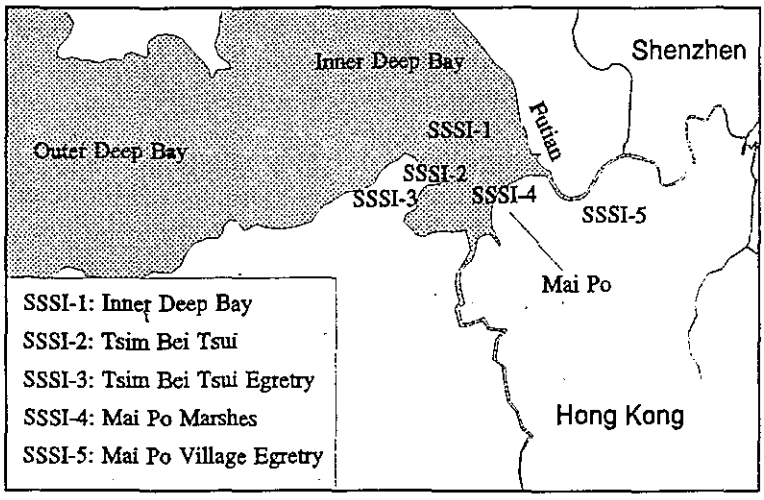

Figure 3-1 Study Area

Stage I of the Project may effect hydrodynamics, sediment flux, and release rates of nutrients and pollutants from sediments in Shenzhen River estuary area, resulting in alteration in erosion, sedimentation and water quality.

The extent and nature of the impact caused by disposed mud will be determined by the quantity of the spoil and the degree of contamination of the mud.

Dust and noise from construction and traffic may be produced during the construction period.

S3 ASSESSMENT APPROACH

To assess potential impacts, the consultants' technical approach focused on the use of existing information, supplemented by a baseline monitoring programme and special investigations. Baseline monitoring included air quality, noise, water quality, sediment and soil quality, ecology and socioeconomy. The purpose of baseline monitoring was to provide a better understanding of the existing environment. Special investigations were designed to provide specific input to some of the assessment tasks or to investigate specific issues. These included 50-hr continuous hydrographic surveys, elutriate tests, and mangrove survival studies.

Air quality baseline monitoring focused on dust. Parameters monitored include dust fall, total suspended particulates (TSP), and respirable suspended particulates (RSP). For baseline monitoring on water quality, over 20 parameters, including dissolved oxygen (DO), 5-day biochemical oxygen demand (BOD_5), chemical oxygen demand (COD), nutrients, heavy metals, and *E. coli.*, were measured. Sediment and bank soil samples were also collected for determination of a number of parameters including heavy metals.

A 50-hr monitoring exercise was undertaken to provide hydrographic data for hydrodynamic, sediment transport, and water quality modelling. Information was also collected on pollution sources, including water quality data of main tributaries on both sides of Shenzhen River and Deep Bay.

Potential release of oxygen-consuming organics, nutrients, and metals from the suspended sediment in river and marine waters during dredging was estimated using the elutriate test.

The ecological survey aimed to build on the existing data base by providing additional information required to better understand the ecosystem and allow for impact evaluation. The surveys were directed at consideration of the ecosystem as a whole. Major elements of the ecological survey included terrestrial ecology (mainly the Seung Ma Lei Yue Hill), mangroves, mud flat and mangrove invertebrates, and birds.

Data gathered through these studies were then used for determining potential impacts on air quality, noise, water quality, sediment quality, hydrodynamics, sediment transport, ecology and socioeconomy. Where appropriate, modelling techniques were used for prediction of impacts. The Fugitive Dust Model (FDM) was used to examine potential dust impacts during construction. Noise modelling was based on various Technical Memoranda (TM) published by the Environmental Protection Department in Hong Kong on construction noise. For hydrodynamics, sediment transport and water quality modelling, a mathematical model of unsteady flow and sediment transport was used. The model regarded Shenzhen River (downstream from Sanchahe), estuary, and Deep Bay as a whole system with smooth transition between a one dimensional (1-D) model and a two dimensional (2-D) model for the estuary and Deep Bay. Details of the above models are provided in the relevant sections in this report. A flow diagram showing trophic linkages between major components of the Deep Bay ecosystem was developed.

S4 EXISTING CONDITIONS

S4.1 AIR QUALITY

Baseline TSP and RSP levels in the vicinity of the Stage 1 works area complied with both Shenzhen and Hong Kong air quality standards. Total dust fall in spring however exceeded the Shenzhen standard. Compared to the control station upstream of the study area, strong and unpleasant odour was detected from all monitoring locations along the river. The Project is not intended to reduce the odour of Shenzhen River.

S4.2 NOISE

Noise levels at Lok Ma Chau Bend and Hekou were comparatively lower than those at other stations and were within PRC and Hong Kong standards. Both day and night time noise levels at the other stations generally exceeded the applicable noise standards of both sides, especially at night. Major night time noise sources included construction work, loading and unloading operations at the piers, and land and marine based traffic.

S4.3 WATER AND SEDIMENT QUALITY

The existing water quality of middle and downstream sections of Shenzhen River was severely polluted and nitrogen and phosphorus were the principle pollutants. The river failed nearly all standards applied by both the Hong Kong and Shenzhen Authorities. Water quality deteriorated downstream as pollutant load increased due to industrial and sewage discharges. The most polluted section was near Zhuanmatou.

Water quality in Deep Bay was polluted referring to PRC, Hong Kong, or Joint Guangdong Hong Kong standards. The dominant pollutants were nitrogen and phosphorus. As the pollutants mainly washed from Shenzhen River, the most severely polluted area was in the estuary region.

Shenzhen River had not been dredged for many years, nor had pollution discharge been controlled. Therefore, there were thick deposits of sediment which were severely polluted by all kinds of pollutants including heavy metals. The concentration of most pollutants in Deep Bay was much lower than that in the river. The majority of pollutants accumulated in the bay sediments were from Shenzhen River.

Soils along the river were not polluted.

S4.4 ECOLOGY

The intertidal flats of Inner Deep Bay and surrounding wetlands comprised an area of international importance. The population of wintering and migrant waterfowl had been increasing over the past decade. The mangroves of Inner Deep Bay appeared to be in a satisfactory state.

The benthic assemblage in the Inner Deep Bay tidal flats was dominated by a few species which can tolerate high organic loadings. These species often occurred in very high densities. There appeared to be some gradient in species abundance, diversity and biomass in parallel with the pollution gradient away from the mouth of Shenzhen River. Current levels of sedimentation

within the Inner Bay were not thought to adversely affect the existing benthos.

The habitats to be directly affected by the Stage 1 works include hillside, fish ponds, freshwater marsh and the river itself.

Five habitats were delineated on the Seung Ma Lei Yue Hill. The habitat of greatest extent is shrub/ grassland. Pine woodland occurred on the north and southeast slopes of the hill and broadleaf woodland habitat was riparian and confined to small areas at the base of the hill on the southeast slope and at the northern point. Open pine woodland occurred on the ridge on the north slope of the hill. Abandoned paddy habitat was located adjacent to the north slope of the hill.

The Seung Ma Lei Yue Hill supported a relatively rich fauna. The avifauna of the hill was found to be locally and regionally important. In addition to those species relatively common in Hong Kong on an annual or seasonal basis, Imperial eagles, Bonelli's eagles, and Black kites were also observed.

There has been a significant loss of fish ponds on both sides of Shenzhen River in the past 20 years due to large-scale infilling for planned developments, as well as extensive unauthorised and illegal filling for open storage. The 65 ha of fish ponds on Lok Ma Chau Bend which will be filled during the Stage 1 works were created after being designated as a disposal area while waiting for the Project to begin. The net loss of fish pond as a result of the Project, therefore, will be 19 ha on Liu Pok Bend, equivalent to about 2% of the estimated fish pond area on the Hong Kong side of Deep Bay.

The existing river banks upstream of Lok Ma Chau were generally steep with little emergent vegetation other than grasses and a small number of mangroves. The north bank of the river had been largely reclaimed and offered no habitat of conservation value. No benthic organisms were observed in bottom sediments upstream of the River mouth.

S5 POTENTIAL IMPACTS

S5.1 AIR QUALITY

Modelling results showed that under worst-case meteorological conditions during Stage 1 Works period, 24-hr average total suspended particulate (TSP) levels wold exceed PRC limits at Shenzhen sensitive receivers (Shenzhen City, Yumin Village, and Yunong Village) and Hong Kong AQO at Hong Kong sensitive receivers (Lo Wu, Liu Pok Village, Lok Ma Chau, and Ha Wan Village).

Adverse impact at the sensitive receivers caused by odour from disturbance of the river system and the discharge of dredged spoil is expected.

There will be no significant air quality impacts during the operational and maintenance period of the Stage 1 works.

S5.2 NOISE

Daytime Hong Kong construction noise standards should not be difficult to meet. Assuming that

the proposed list of equipment, or a combination of equipment which produces a total sound power level of less than 123 dB(A) is used, the non-stationary limit of 75 dB(A) at Villages on Hong Kong side would not be exceeded. PRC daytime standards will be more difficult to meet, since they stipulate noise at the construction site boundary. The use of items of PME near the boundary will thus be constrained.

More stringent evening and night-time noise standards require lower night time noise levels. Concurrent use of the equipment for a single activity would generally not be possible in the evening and at night under either the PRC or Hong Kong standards unless quietened or shielded items are used.

The noise from haul road use is expected to remain within acceptable limits at all but the very nearest distances. Restrictions during the night-time may be necessary to meet PRC standards.

There will be no significant noise impacts during the operational and maintenance period.

S5.3 HYDRODYNAMICS AND SEDIMENTATION

According to the modelling results, no significant changes in hydrodynamics of the River and the Bay are expected after the Stage 1 works. The water surface curve in the longitudinal direction of the river would fall slightly after the Stage 1 works. Flow fields in both the River and the Bay would not be significantly changed. There would be a minor increase in the tidal exchange volume (and hence flushing) and flume storage owing to the Stage I works.

A slight increase in sediment flux from the Shenzhen River and a moderate change in sedimentation rate on the mudflat would be expected during the construction operation of the Stage 1 works. The maximum annual increase in sedimentation depth due to the Stage 1 works would be 1.8mm and 2.0mm for Futian and Mi Po respectively. Therefore, the mud flat at the head of the Bay would not be affected significantly by sedimentation during and after the Stage 1 works of the Project.

It was also shown by modelling that the largest increase in sedimentation would occur at high tide and high water level.

S5.4 WATER QUALITY

The effect of the increase in tidal exchange volume on water quality of the Shenzhen River would be a minor improvement due to greater flushing and dilution by the relatively cleaner water from Deep Bay.

The dredging operation in the existing river course would give rise to an unavoidable increase in the concentrations of suspended materials in the lower river, the estuary and Deep Bay receiving waters. Release of pollutants from resuspended solids would not cause a serious problem to water quality of Shenzhen River.

Estimated increase in SS content during the dredging operation of the Stage 1 works would not exceed 40mg/l (10mg/l on average), less than 20% of the total concentration of the SS content at the head of the Bay.

The elutriate tests showed that no more than 5% increase in all pollutant concentrations is expected at a SS increase of 40mg/l. Since the value of 40mg/l is a conservative estimation of a worse case, it can be concluded that no significant impact on water quality at the head of the Bay will be caused by the release of pollutants from the re-suspended solids due to the Stage 1 works.

Potential effects on water quality from the operation of Stage 1 may result from the re-settlement of re-suspended sediments after transportation in downstream reaches and changes in hydrodynamics and sedimentation. Based on the modelling predictions, only moderate changes are expected, which will not have significant impacts on hydrodynamics, sedimentation, or water quality.

S5.5 DISPOSED SPOIL

The contaminated dredged spoils (organics and heavy metals) to be disposed of during the Stage 1 works will total 56,000 m^3, constituting 3-4% of the total amount of dredged spoils. According to the dredged spoil classification standards of Hong Kong polluted spoils from Stage 1 works are class "C" materials. Based on the Hakanson method, however, the potential comprehensive ecological toxicity of the contaminated spoil is slight.

Since the dredged spoils will be disposed of in the Stage 1 working area, the issue of contaminated spoil transport will not become a problem. Because the spoils disposal area will not be used for agriculture, adequate care taken during disposal and prevention of potential for erosion by surface runoff, the disposal of contaminated spoil will not cause ecological damage.

The spoil disposal area is near Shenzhen River channel, the hydrological connection between these sediments and ground waters will not be changed by the dredging and disposal. Pond mud and underlying marine deposits have also been found to be practically impermeable. Therefore, storage sites for contaminated spoils will not cause pollution of ground waters.

S5.6 ECOLOGY

Stage 1 works will result in direct loss of habitats, including fishponds and part of the hill at Seung Ma Lei Yue. Total areas of habitats which will be directly lost are relatively small in a regional context, and are mitigated through provision of replacement habitats and revegetation.

The 65 ha of fish pond on Lok Ma Chau Bend which will be filled during the Stage 1 works was created after being designed as disposal area while waiting for the Project to begin. The net loss of fish pond as a result of the Project, therefore, is 19 ha on Liu Pok Bend, equivalent to about 2% of the estimated fish pond area on the Hong Kong side of Deep Bay. The loss of the fish ponds of 19 ha as a net result of the Stage 1 works is not of itself likely to be a significant effect on the overall ecological system although certain species will be adversely affected.

Portions of all five habitat types found on the hill will be lost due to the proposed earthworks. The loss of the shrub/grass habitat and the open pine woodland habitat would not result in significant ecological impact. Loss of an estimated 2.0 ha of pine woodland would potentially result in adverse impacts on roosting and/or nesting birds of prey. Loss of broadleaf woodland would eliminate some preferred eagle perch sites at the northern foot of the hill. Approximately

0.6 ha of the abandoned paddy adjacent to the north foot of the hill would also be lost due to excavation for the new river channel.

Changes in air quality, noise, hydrodynamics, sedimentation, and water quality, as well as human disturbance, caused by the Stage 1 works would result in indirect impacts. The dust effect of the Stage 1 works on ecology will not be significant. It is not expected that noise generated as a result of either the construction or operation of the Project will significantly impact birds.

The moderate changes in hydrodynamics, sediment flux, and sedimentation rate resulting from the Stage 1 works are considered to pose no threat to ecological resources in Shenzhen River estuary area. Changes in water quality resulting from the Stage 1 works would not affect waterfowl, benthic fauna, mangroves, or commercial species of the area.

S6 MITIGATION MEASURES

AIR QUALITY

- Fifteen measures were proposed to avoid or mitigate air quality impacts included standard works practices such as watering haul roads, washing haul trucks, and sprinkling loading areas;
- Enclosed systems for materials handling and storage were also proposed as were speed limits on haul trucks;
- Heavily contaminated spoil should be segregated and disposed to separate spoil storage sites with capping to reduce potential odour problems;
- In view of the conservatism of the model and with the implementation of the proposed mitigation measures, dust problems during construction are unlikely to be insurmountable and can possibly be mitigated to acceptable levels.

NOISE

- It is desirable to avoid concentrating large numbers of PME at one location at same time. PME and activities should be sited as far from sensitive areas as possible. Whenever possible, stored materials on site may also act as noise barriers;
- A second effective way of mitigating construction noise is to control it at source, either through use of silenced equipment or through the use of mufflers, silencers or acoustic barriers.

WATER QUALITY

- The use of a works method which isolates the main excavation works from the river channel is fundamental to the environmental performance of the Stage 1 works;
- The use of suction dredgers is thus strongly supported;
- The worse case of resuspension of sediments during dredging can be easily avoided if the construction is programmed in dry season;
- Opening the channel during a period of low river flow and low tides will greatly reduce sedimentation risks.

DISPOSAL OF SPOIL

- The contaminated spoil from the existing river course should be disposed separately in isolated locations without mixing with uncontaminated spoil;
- The contaminated spoil disposal area should be capped with uncontaminated spoil to prevent erosion of contaminated sediments.

ECOLOGY

- Potential impacts to water birds due to loss of 19 ha of fish ponds could be mitigated by retention of the old Shenzhen River channel at Lok Ma Chau Bend. The restoration plan will be included in the Environmental Monitoring and Audit Manual;
- Impacts due to loss of upland habitats on Seung Ma Lei Yue Hill can be mitigated by successful restoration of vegetation on the proposed cut slope and adjacent slopes of the Hill. Further impact mitigation can be achieved by habitat creation on materials storage areas;
- Fire control methods should be specified;
- Rock drilling and blasting should be minimized during the nesting season of birds;
- Ecological impacts from Stage 1 works can possibly be mitigated or compensated to acceptable levels.

S7 MONITORING AND AUDIT REQUIREMENTS

AIR QUALITY

- Setup of two monitoring stations consisting of a TSP dust monitor and a weather station at each of the works areas;
- Baseline information provided by this studies;
- Measurement of 24-hour average TSP level once every 6 days during construction period;

NOISE

- Set up of two stations on each side of the River at Lok Ma Chau and Liu Pok, respectively;
- Baseline information provided by this study;
- Weekly monitoring during the construction period;
- Additional monitoring during restricted hours.

WATER QUALITY

- Set up of three monitoring stations for Lok Ma Chau and three for Liu Pok (control, 500m and 2,000m downstream);
- Baseline information provided by this studies;
- Daily measurement of SS during the wet dredging within the existing river course. The frequency can be reduced to once a month if the condition remain stable;
- Measurement of COD, TP, TN, and Cu only when unexpected amount of SS is observed;
- Routine monitoring will provide information during operation and maintenance periods.

ECOLOGY

- Baseline information provide by current studies;
- Survey of birds every month between the Lok Ma Chau and Lo Wu bridge during the works period, and every 2 months thereafter for 1 years;
- Survey of mudflat after the construction;
- Survey of mangroves, benthos, and waterbirds is necessary only significant change in mudflat is observed;
- Monthly survey of old River channel at Lok Ma Chau before conservation management works commence and seasonally for a period of 3 years following completion of the works.

S8 CONCLUSION

The purpose of the Stage 1 EIA was to provide information to assist in decisions on the environmental acceptability of the Stage 1 works and to recommend on any specific environmental protection measures which should be included in the detailed design of the Stage 1 works.

The major conclusions of the study which should influence decisions on the Stage 1 works are summarised below.

The scale of the Stage 1 works would be comparatively small. Upon implementation of the proposed mitigation measures, the construction works would not create any unacceptable air, noise or other nuisance which should influence major decisions on the acceptability of the Stage 1 works.

The Stage 1 works would have minimal effect on the down stream ecological resources. Predicted changes in sedimentation and water quality would be unlikely to have any noticeable effect on ecological resources in the estuary or Inner Deep Bay.

There would be potential for release of contaminants from sediments due to the dredging works. With effective control and close monitoring programme, this increase, however, would not have any detrimental effect on the habitats in the estuary or Deep Bay.

The Stage 1 works would result in direct loss of habitat, 19ha of fish ponds at Liu Pok and parts of the Seung Ma Lei Yue Hill. Recommendations were made by the consultants on various measures which would compensate the loss of the habitats.

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香港政府渠務署

深港治理深圳河工程環境影響評估研究

一期工程評價報告摘要

總諮詢公司 北京大學

分諮詢公司 匯亞環保顧問公司
環境科學顧問（亞洲）有限公司

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世界自然（香港）基金會

一九九四年七月

第一部分 摘要

S1 引言

此部分概述了一期工程环境影响评估的主要结果，摘要说明了评价方法、环境和生态基线状况、一期工程的潜在影响、建议的纾缓措施以及监察审核要求。本项研究范围包括可能受深圳河治理一期工程影响的深圳湾集水区的一切区域。

S2 研究区域和工程概况

S2.1 深圳河

深圳河是中华人民共和国深圳经济特区与香港间界河。

深圳河－深圳河口－深圳湾的生态系统是华南地区具有国际意义的最重要湿地生态系统之一。其核心部分是米埔沼泽、内伶仃－福田国家级红树林自然保护区以及附近具有特别科学价值的地点。该区域为许多珍稀和濒危生物种提供了栖息地，尤其是以水鸟和候鸟为主的鸟类。

深圳河洪峰流量大，而下游河道弯曲狭窄，河堤低矮单薄，加上潮水顶托，河道安全泄洪量很小，大约相当于两年一遇的洪水流量，以致经常造成洪水泛滥成灾。

由于大量工业、农业、养畜养禽业和生活废水排入河中，深圳河河水已遭受严重污染。

S2.2 深圳河治理工程

深港双方政府共同制定了深圳河治理工程规划。工程将分为三期进行。其中第一阶段为料坐和落马洲附近两个曲流的裁弯取直。第二阶段包括罗湖桥以下河道疏浚、加深与拓宽，并在拓宽河段两岸修筑防洪堤。第三期工程包括向罗湖桥上游进行拓宽和疏浚。

一期工程施工计划约需 2 年半完成。施工计划包修建工地境围栏，修筑运料公路，开掘落马洲河曲、料坐河曲和双孖鲤鱼山。从双孖鲤鱼山挖掘的物料将用以修筑堤坝。工程竣工后已整治河段的长度将从 6.2km 缩短到 3.2km。

落马洲河曲旧河道将被裁直，新河道自其北部通过。深圳境内的落马洲河曲约占地 100 公顷，过去全部是农田。自被征用为深圳河治理一期工程弃土区后，在等待工程开工期间其中 70 公顷暂被改为鱼塘。一期工程开工后，这些鱼塘将作为落马洲施工段弃土区被再次填平。料坐河段裁弯取直后

的新河道将穿过双孖鲤鱼山东侧山体，其大部分在香港境内。料坐河曲挖掘的物料将堆放在现有河道中。

将采用小型抽吸式挖泥机开挖新河道。大部分新河道开挖在与主流隔断的条件下施工。一期工程河道挖掘的物料数量估计近 170 万 m^3，将从现河道中开挖出大约 30 万 m^3 的物料，其中约 5.6 万 m^3 为受污染的沉积物。

S2.3 深圳河治理工程环境影响评估

考虑到此项工程可能对深圳河口具有国际意义的米埔沼泽和福田自然保护区产生影响以及可能出现的其他环境问题，深港政府共同组织了治理工程的环境影响评估。本项环评自 1993 年 12 月 16 日开始，预计在 1995 年 3 月 15 日结束，研究范围仅限于前两期工程。其中关于一期工程的环评应于 1994 年 6 月中完成，本文件即为针对一期工程环境影响的评估报告。本报告的目的即在于为一期工程的可行性决策提供必要的信息，并就一期工程详细设计中的有关环境保护的要求提出具体意见。研究区如图 S－1 所示。

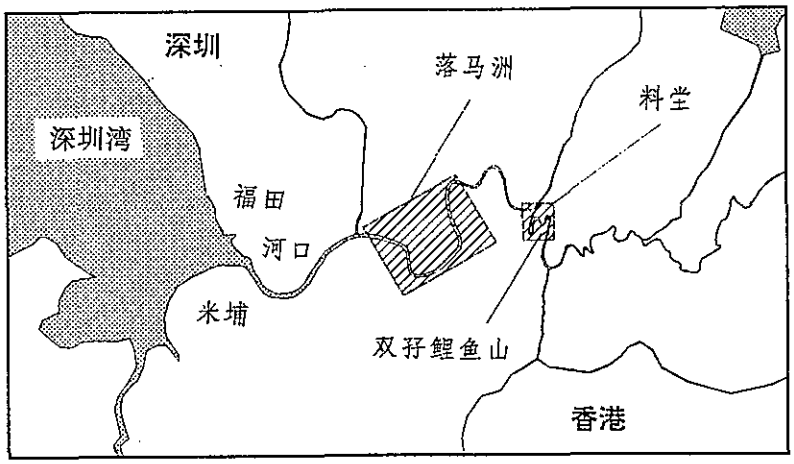

图 S－1　研究地区

S2.4 关键的环境问题

鉴于一期工程施工的局部性特点，其可能造成的湿地生境的直接损失有限。对陆地生态系统的潜在影响局限于双孖鲤鱼山土方工程。

一期工程施工期间还可能造成深圳湾河口区水动力学条件、沉积物通量以及营养物和污染物释放量的改变。从而影响侵蚀/沉积速率和水质。

疏浚淤泥的环境影响取决于污泥数量和污染程度。

在施工期间可能会产生灰尘及施工、交通噪声。

S3 评价方法

为评估本项目的潜在影响，顾问公司采用的技术路线重视利用现有资料，辅以基线监测与专项研究。基线监测对象包括大气质量、水质、沉积物与土壤、生态和社会经济等方面，旨在增进对环境的了解。专门试验的目的是为评估工作或特别问题提供专门信息，包括50小时连续水文观测、底泥污染物释放实验和红树林调查等。

大气质量基线监测参数包括降尘量、总悬浮颗粒物(TSP)和可吸入颗粒物(RSP)。二十余种水质监测项目中包括DO、BOD_5、COD、营养盐、重金属和大肠杆菌。研究中还采集了沉积物和土壤样品，测定了其中的重金属和其他污染物含量。

除一般基线调查外，还在深圳河和深圳湾进行了50小时连续监测，并分别收集和调查了深圳河中下游及深圳湾深港两侧主要污染源资料，以便为水力学、泥沙运移和水质模型提供基础资料。

设计了专门的释放实验，籍以探讨再悬浮沉积物中耗氧有机物、营养盐和金属的释放量。

生态学调查的目的是在现有资料的基础上，为更好地理解生态系统而提供必要的补充信息，以便进行影响评价。调查的指导思想是将生态系统作为一个整体来考虑，其要素包括陆生生态(主要是双孖鲤鱼山)、红树林、泥滩、红树林底栖无脊椎动物和鸟类等。

由此收集的数据随后用以确定工程对大气质量、噪声、水质、沉积物、水动力学、泥沙运移、生态和社会经济等方面的影响。并尽可能用模型技术定量预测这些影响。建设期降尘影响利用飘尘模型(FMD)进行预测。采用以香港环保署发布的各种技术备忘录为依据的噪声模型进行噪声影响评价。水动力学模型采用河流一维、海湾二维不稳定流模型；泥沙输移模型采用河流一维、海湾二维非平衡输送模型；水质模型采用一维稳态河口水质模型。深圳湾生态系统内主要组分之间的营养联系则用生态流程图表述。

S4 环境现状

S4.1 大气质量

深圳河沿岸的大气环境质量基本符合中港双方的有关标准，唯旱季降尘超标。除上游对照点外，沿河各监测点均为强臭。

S4.2 噪声

落马洲河曲和河口是全河段比较安静的地区。两处基本满足深港双方标准。其余河段昼夜实测等效声级普遍超过双方标准。超标现象在夜间尤为严重，建筑施工、交通运输和码头装卸作业是沿河

主要污染声源。

S4.3 水质和沉积物质量

深圳河目前都已受到严重污染，不论采用中方还是港方标准进行评价，多数水质指标严重超标，其中又以氮、磷污染最甚。随着沿河污染物排入河道，污染程度向下游逐渐增强，污染最严重的河段集中在砖码头附近。

无论以中方标准、港方标准还是粤港深圳湾水质指标进行评价，深圳湾水质目前都已受到一定程度污染。最主要的污染物为氮和磷。污染程度在湾内不同区域不同，由于污染物主要来自深圳河，近深圳河口地区最为严重。

深圳河已多年未疏浚，加上未经处置废水的排入，河底沉积了大量受包括重金属在内的污染物严重污染的淤泥。海湾沉积物中大多数污染物浓度明显低于深圳河沉积物。多数污染物在深圳河口沉积物中的浓度高于在湾中部及湾口沉积物中浓度，显示污染物可能更多地来自深圳河。

深圳河岸边土壤基本未受污染。

S4.4 生态

深圳湾潮间带泥滩是一处有国际性重要意义的湿地。在过去 10 年里，冬季候鸟和迁徙水鸟种群的数量持续增加。深圳湾红树林的状况较好。

深圳湾潮间带泥滩的底栖动物落群以少数几种能够忍耐高有机负荷的种类为优势种。这些种类经常呈现出较高的种群密度。从河口向外部延伸，随着污染程度下降，底栖动物种类的丰度、多样性和生物量逐渐减少。深圳湾目前的沉积水平不会对底栖动物产生任何不利影响。

受一期工程直接影响生境包括山地、鱼塘、淡水沼泽和河流本身。

双孖鲤鱼山有五种不同生境。其中占地最大的是灌丛和草地。针叶林出现在北坡和东南坡。阔叶林地只在东南坡和北部个别小区域内存在。开阔的针叶林地主要出现在山地的北坡。弃耕的稻田则位于北坡附近。

双孖鲤鱼山栖息着比较丰富的动物区系。这里的鸟类区系具有局部的乃至区域的重要性。除大多数在香港可全年或季节性见到的鸟类外，在该山上还发现三种较少见的物种，即白肩雕、白腹山雕和燕隼。

过去 20 年内因各种开发计划或未获批准的非法填埋，深圳河两侧损失了大量的鱼塘。落马洲地区在一期工程期间将被用来堆填弃方的 65 公顷鱼塘是在为深圳河治理工程征用的土地上临时开挖并专门留作弃土场的。一期工程将造成料坐河曲 19 公顷鱼塘的净损失，约相当于香港一侧鱼塘总

面积的 2%。

落马洲以上河段的岸坡较陡，除了几种草本植物和少量红树植物外，基本无其它植物种类存在。河北岸大部分地段已被开发，因此不具有任何生境保护价值。调查表明，施工段至河口河道底泥中根本没有底栖生物存在。

S5 潜在影响

S5.1 大气质量

模型计算结果表明，一期工程期间，若遇最不利气象条件，可能在深圳一侧敏感受体（深圳市、渔民村和渔农村）处超过中方标准，在香港一侧敏感受体（罗湖、料坐、落马洲和河湾村）处超过香港大气质量目标。

除降尘外，现河道疏浚及疏浚污泥堆放过程散发的恶臭可能对周围居民产生一些不利影响。

一期工程运行与维护期间对大气质量无显著影响。

S5.2 噪声

施工噪声白天将基本符合香港标准。如果使用假设的设备或产生相当于 123dB(A)声功水平的其他设备，港方不会超过 75dB(A)的非固定源标准。由于深方标准规定以施工场地边界噪声为准，靠近边界处应限制动力机械设备的使用。

晚上和夜间比白天更严格的噪声标准要求施工活动产生较低的噪声，从而限制了在同一活动中同时使用多种机动设备（除非采用消声装置）。

除非在非常近的距离以内，运输道路噪声均在可接受水平之下。为满足深方标准，可能有必要在夜间采取一定限制措施。

一期工程运行及维护期间将无明显噪声影响。

S5.3 水动力学条件与泥沙沉积

据模型计算结果可知，一期工程不会对河流和海湾的水动力学条件造成明显影响。工程完工后河道水面线略有下降，河流与海湾的流场则无明显变化。纳潮量和槽蓄量在一期工程后有所增加，但增加幅度不大。

施工过程中，深圳河泥沙输出通量有所增加，但河口湿地泥滩上泥沙淤积量变化很小。据非洪水期

模型计算结果估算，由于一期工程施工造成的在福田和米埔泥滩泥沙淤积增量分别为 1.8mm 和 2.0mm，其影响可以忽略不计。由此可见，一期工程施工期和运行期间，河口附近的泥滩不会受到施工的影响。

模型计算结果还说明，对深圳湾泥沙冲淤影响最大的时期是大潮与洪水期。

S5.4 水质

一期工程完工后，由于纳潮量增加，相对清洁海水的交换量有所增大，可使下游河流水质略有改善。

在现河道中进行疏浚作业可能造成大量含高浓度污染物的悬浮物被带往下游、河口和深圳湾。悬浮物中释放出来的污染物不会对深圳河水质产生显著影响。

一期工程在现河道疏浚期间造成的湾口地区泥沙浓度增加量不会超过 40mg/l，相当于该地区海水悬浮物总量的 20%以下。

根据释放实验结果，40mg/l 悬浮固体造成的释放量远低于水相原含量的 5%。由于这一估计基于最坏条件，可以认为，再悬浮沉积物中污染物释放不会对河口水质造成显著影响。

一期工程运行期对水质可能的影响主要起因于河流水动力学和沉积特征变化后沉积物迁移所造成的再分配和重悬浮。据模型计算结果，这样的变化不会很大，因此不可能导致对水动力学条件、泥沙沉积和水质的显著影响。

S5.5 废弃疏浚物

一期工程需弃置受有机物和重金属污染的淤泥约 5.7 万 m^3，占总挖方量的 3－4%。这些污泥属港方弃置标准中的"C"类。据 Hakanson 推荐的底质评价方法，这些污泥仅具有轻微的潜在生态危害。

一期工程两处工地的疏浚物将就地弃置，故不存在污染污泥运输问题。由于弃置场不会成为农业用地，只要弃置时加以注意，切实防止暴雨径流冲刷，受污染污泥的弃置就不会造成潜在生态危害。

由于污泥弃置地点距现深圳河河道很近，并没有从根本上改变这些沉积物与地下水之间的水力学联系，加上鱼塘底泥和其下的海相沉积物基本不透水，故不会造成地下水污染问题。

S5.6 生态

一期工程在深圳河两岸造成的直接生境损失主要包括鱼塘和双孖鲤鱼山的一部分。从区域角度看，直接生境损失的总面积很小。

落马洲地区在一期工程期间将被用来堆填弃方的 65 公顷鱼塘，是在深圳河疏浚工程开始设计之前

就保留下来专门作为工程弃方场的。因此，一期工程鱼塘的净损失仅是料坐河曲附近的19公顷，大约相当于深圳湾香港一侧估计鱼塘总面积的2%。这一损失虽然会对某些生物种类产生不利影响，但不会对整个生态系统产生显著影响。

双孖鲤鱼山现有五种生境类型的一些部分将因为计划中的土方工程而损失。其中灌丛草地和针叶疏林生境的损失均不会产生显著生态影响。预计损失的2.0公顷针叶林地可能会对捕食性鸟类的栖息地和巢域产生不利影响。阔叶林地的损失将减少北部山脚下鹰类的栖息地。此外，北坡山脚附近0.6公顷弃耕稻田也将损失掉。

大气质量、噪声、水动力学条件、泥沙、水质等变化以及施工活动中的人为扰动可能产生间接影响。本项工程中，降尘对生态系统没有显著影响。施工期和运行期产生的噪声均不会对鸟类产生显著影响。一期工程引起的水动力学条件、沉积物通量和海湾沉积速率变化都不大，不会对深圳河口地区生态资源产生威胁。

一期工程引起的河流水质变化将不会对水鸟、深圳河底栖、深圳湾红树林、底栖以及经济物种产生不利影响。

S6 纾缓措施

大 气 质 量
• 提出的十五措施包括采取标准化措施进行道路洒水、冲洗车辆和在料场喷水等； • 采用封闭车辆和装置运输和储存物料并限制车速； • 将严重污染的污泥与其他污泥分开堆放并用未污染土方覆盖，将有利于减少恶臭影响； • 因模型假设偏保守如采取必要的纾缓措施，可将灰尘降至可接受水平。

噪 声
• 避免将大量机动装备集中在一处。尽量将动力机械及施工活动安排在远离敏感区的地方。尽可能利用料堆作为天然噪声屏障。 • 另一有效的纾缓措施是控制声源。这种措施可以通过选择低噪声设备或者使用消声器、消声设备或声障板实现。

疏浚污泥

- 挖自现河道的污染污泥应与未污染挖方分开弃置；
- 污染淤泥弃置场应用清洁土覆盖。

水质

- 新河道开挖时应与现有河道隔开，以避免施工的影响；
- 抽吸式挖泥机是理想的疏浚设备；
- 选择旱季施工可以有效地避免人为影响和天然影响在泥沙释放量上造成的极端情形，从而大大减小一期工程对水质的不利影响；
- 选择低潮和低流量时机打通新河道与现河道也有利于降低沉积物释放量。

生态

- 由于损失19公顷鱼塘而对水鸟产生的潜在影响可以通过保留落马洲河曲深圳河旧河道加以补偿。详细的恢复方案将在《监察审核手册》中介绍；
- 双孖鲤鱼山陆生生境损失的潜在影响可通过切割边坡和附近山坡的植树造林来弥补。在料坐弃土区植树可进一步对此进行纾缓；
- 采取必要的防火措施；
- 尽量减少在鸟类筑巢季节进行钻岩和爆破作业。
- 一期工程造成的生态影响可以采取纾缓措施使之降低到可接受程度。

S7 监察审核要求

大气质量

- 每一工区设立2个TSP和有关气象条件监测站位；
- 根据目前研究取得基线数据；
- 施工期每周测定24小时TSP平均含量。

噪声

- 分别在落马洲和料坐两处深港两侧设立监测站；
- 根据目前研究取得基线数据；
- 施工期每周监测一次；
- 非假日晚上和夜间增加监测次数。

水　　质
• 落马洲和料坐工地各设 3 处监测站(上游控制、下游 500 米和 2,000 米)； • 根据目前研究获得基线资料； • 在现河道疏浚期间每日一次测定 SS 含量,待水质变化趋势稳定后减少至每周一次； • SS 含量异常时增测 COD、TP、TN 和 Cu 含量； • 运行与维护期利用常规监测资料。

生　　态
• 根据目前研究获得基线资料； • 施工期在落马洲与罗湖之间每月观鸟一次,其后一年内每两月观鸟一次； • 完工后进行河口泥滩调查,若发生明显变化,需进行红树林、底栖动物和鸟类调查； • 完工前每月观察落马洲旧河道,完工后三年内每季进行观察。

S8 结论

一期工程环评报告的目的是提供信息以帮助确定一期工程的环境可接受性,并且推荐可能包含在一期工程详细设计中的环境保护措施。

以下为本研究的主要结论：

一期工程施工范围较小，只要采取必要的纾缓措施,施工作业不会产生任何不可接受的大气、噪声或其他环境影响,故不至于影响对一期工程可接受性的决策。

一期工程对河流下游生态资源的影响很小。沉积作用和水质的预期变化不会对河口生态资源或深圳湾内湾产生任何显著影响。

疏浚作业可能导致沉积物中污染物的释放。在采取有效的控制和监察手段后,这种释放不会对深圳湾或河口生境产生任何有害影响。

一期工程造成的直接生境损失包括料坐河曲的 19 公顷鱼塘和双孖鲤鱼山的部分林地。顾问公司提出了弥补这些损失的具体措施。